Aug. 1, 1961 E. WEBER 2,994,491

MEANS FOR UNWINDING THE YARN OF CONICAL-LAYER COILS

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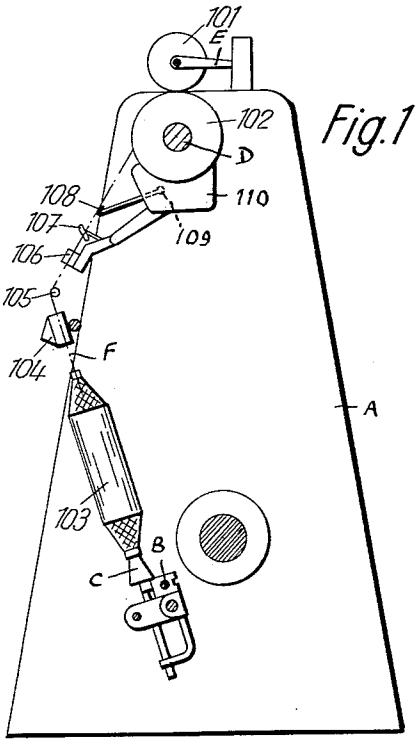


Fig.1

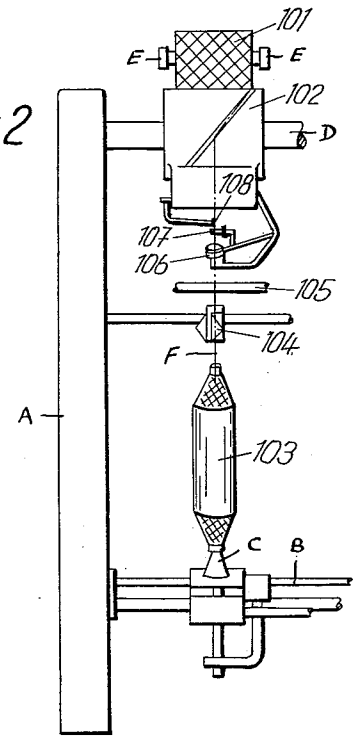


Fig.2

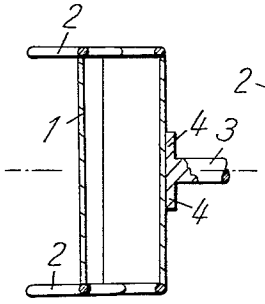


Fig.3

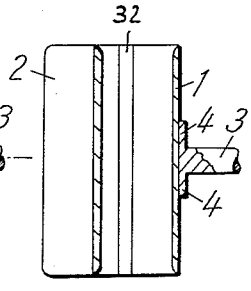


Fig.4

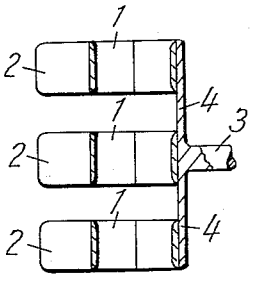


Fig.5

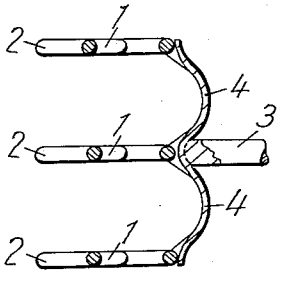


Fig.6

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Fig. 7

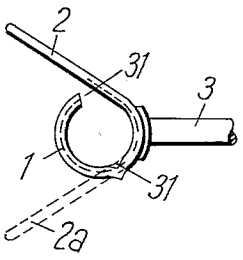


Fig. 8

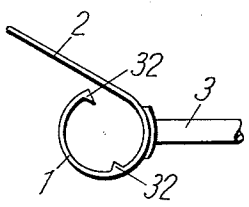


Fig. 9

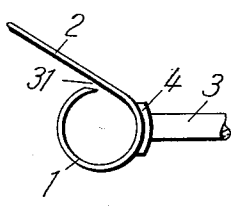
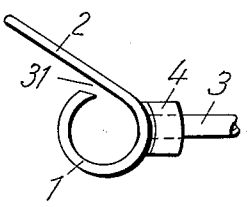


Fig. 10



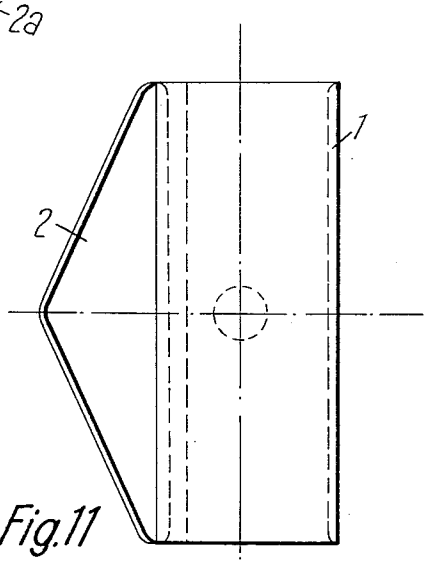


Fig. 11

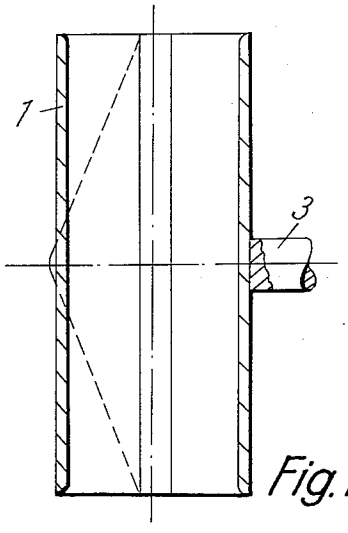


Fig. 12

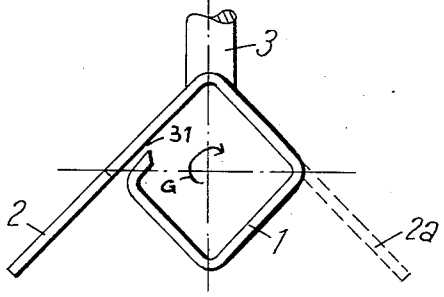


Fig. 13

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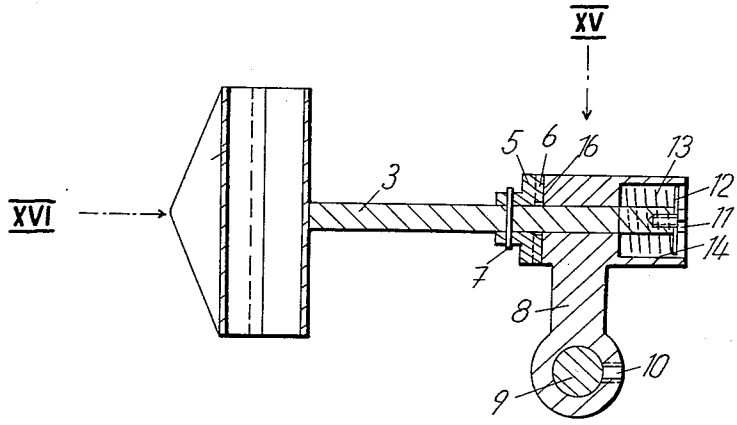


Fig. 14

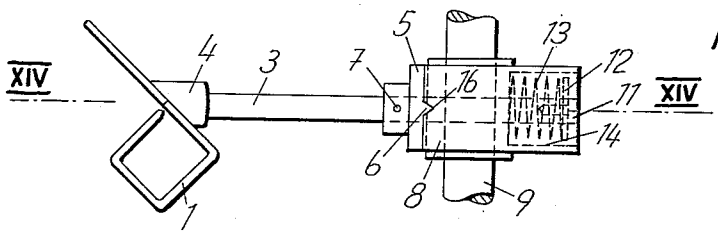


Fig. 15

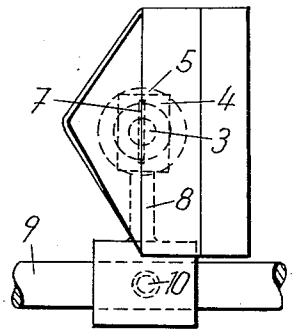


Fig. 16

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United States Patent Office 2,994,491 Patented Aug. 1, 1961

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MEANS FOR UNWINDING THE YARN OF CONICAL-LAYER COILS

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8 Claims. (Cl. 242—128)

My invention relates to a method and means for unwinding the yarn from cops or other coils of the conical-layer type. The individual layers of yarn in such a coil have conical shape and are coaxially nested in each other, the coil thus being built up in the axial direction. In one of its more particular aspects, the invention relates to the unwinding of such coils in machines that serve for re-winding the yarn into a yarn package of a desired size or shape, such as a cross-wound package also called "cheese." However, the invention is also applicable in other textile fabricating machines, such as in weaving looms, where a conical-layer coil is to be unwound for supplying the shuttle yarn, or in beaming machines for winding the yarn from a creel of cops onto a warp beam.

When unwinding the yarn from a cop, the cop itself is kept stationary and the yarn is pulled over the tip so that only the yarn portion being removed from the yarn body of the cop must rotate about the cop axis. At high unwinding speeds, namely those above 800 meters per minute, the rotating speed of the yarn about the axis of the stationary cop becomes so large as to produce enough centrifugal force to impose appreciable tension upon the yarn running off. As a result, the uppermost yarn layers become constricted. This may cause the formation of loops that may interfere with proper unwinding, and it also causes the yarn to frictionally rub against the coil body thus further increasing the yarn tension.

The rotating yarn portion, when thus being pulled off the body of the cop, bulges outwardly and forms the so-called "balloon" located outside of a geometrical, conical surface whose apex lies at the first stationary yarn-guiding member reached by the yarn being pulled off, and whose basis is located at the largest diameter of the particular yarn layer being pulled off at a time.

It has been proposed to impose a limiting action upon the yarn during its unwinding travel so that a balloon cannot form at all. Such complete suppression of balloon formation has the advantage that the yarn will run off more uniformly, but it also entails the disadvantage of still subjecting the yarn tension to appreciable variation.

It is an object of my invention to minimize such tensional variations and to secure a more quiescent run of the yarn than heretofore obtainable.

According to my invention, I disturb the balloon formation of the yarn only to a partial extent so that a residual balloon of limited diameter is formed during the unwinding operation; however, I limit the width of the residual balloon on the entire periphery about the axis of the yarn coil. As a result, the yarn is forced to dissipate much of its momentum, for example by friction. It will run more uniformly and is subjected to smaller fluctuations in tension because, due to the limitation of the ballooning width, only a greatly reduced centrifugal force can be built up.

By virtue of such a combination of balloon disturbance and a peripherally and axially limited formation of a residual balloon, the unwinding speed can be greatly increased, for example from approximately 1200 to 1500 meters per minute, thus affording a considerable increase in overall operating speed.

The above-mentioned reduction of tension variations

is further improved if the yarn is forced during each rotation to vary its distance from the coil axis in several planes perpendicular to that axis at respectively different heights, or at least in one such plane. In other words, according to a preferred feature of my invention, the width of the residual balloon during each rotation is continuously varied so that there also occurs a continuous change of the centrifugal force acting upon the rotating yarn. As a consequence of the repetitive disturbance thus imparted to the yarn by forcing it to vary its spacing from the balloon axis, a free balloon of circular cross section cannot be formed but only a constrained balloon shape whose cross section resembles that of the disturbing or limiting member which is frictionally engaged by the rotating yarn portion while that yarn portion travels away from the coil. Consequently, no counter-tension which may exert itself as yarn tension is built up by centrifugal force.

The device for performing the above-described method according to the invention is preferably provided with a sleeve structure located in concentric relation to the upward extension of the geometric cop axis between the tip of the cop and the first guiding member reached by the yarn as it runs off the cop, this first guiding member being in most cases provided for changing the direction of the yarn path. The sleeve structure surrounds the yarn during its unwinding travel and has its diameter so dimensioned that the yarn does not touch the sleeve structure when the unwinding travel is very slow so that no ballooning takes place. However, the sleeve diameter is sufficiently small to be touched by the yarn when at higher unwinding speed the yarn being pulled off rotates about the cop axis and forms a balloon. Then the yarn glides frictionally along the inner wall of the sleeve and dissipates part of its energy. That is, the sleeve structure now acts as a brake and prevents the formation of a free balloon. The inner side of the sleeve structure is provided with one or more disturbance means. These may consist of projections or recesses. That is, the sleeve is given an inner cross section which departs from circular shape and forces the yarn, while contacting the inner side during its rotating movement, to continuously vary its radial spacing from the geometric axis of the coil.

A particularly simple design of the above-mentioned sleeve structure is constituted by a tubular member of substantially square inner cross section whose axis approximately coincides with the extension of the geometric coil axis. The corners of such a tubular sleeve member are spaced from the axis a distance approximately 50% larger than the spacing at the centers of the inner surface portions closest to the axis.

According to another feature of my invention, the sleeve structure is preferably provided with a longitudinal slot for inserting the yarn, the slot being so located that it interferes as little as possible with the rotation of the traveling yarn about the coil axis. The sleeve structure may be so mounted that it can be turned about an angle of 180°. This has the advantage that the same machine may be employed for unwinding coils of yarn having right-hand or left-hand pitch.

By providing the sleeve structure, according to another feature of my invention, with one or more catch noses or projections on the sleeve side corresponding to the winding direction of the yarn on the cop, the threading of the yarn into the sleeve structure is further facilitated. In order to take advantage of this convenience for coils having right-hand or left-hand turns, the sleeve structure is preferably mounted on a holder rotatable on a pivot that permits turning the sleeve 180°.

The cross section of the sleeve may be rounded, but when using a round sleeve at least one disturbance mem-

ber should be located on the inside wall of the sleeve. I have found that sleeves of polygonal cross section, particularly square cross section, permit a particularly great unwinding speed of the yarn and produce uniformly low yarn tension.

The foregoing and other objects, advantages and features of my invention will be apparent from, and will be mentioned in, the following with reference to the drawings in which embodiments of devices according to the invention are illustrated by way of example. On the drawing;

FIGS. 1 and 2 are a front view and a side view respectively of a winding station in a coil-winding machine equipped with a device according to the invention.

FIGS. 3 to 6 illustrate in section four different embodiments of a sleeve structure applicable in a machine according to FIGS. 1 and 2; and

FIGS. 7 to 10 are respective plan views of the same sleeve structures as shown in FIGS. 3 to 6 respectively.

FIGS. 11, 12 and 13 show a particularly advantageous design of the sleeve structure in front view, sectional side view, and top view respectively.

FIGS. 14 to 16 show the same device as FIGS. 11 to 13 attached to a rotatable holder, in sectional side view, top view, and front view respectively.

The same reference characters are used in FIGS. 3 to 16 for respectively similar elements.

Referring first to FIGS. 1 and 2, the illustrated coil winding machine serves for producing a yarn package of a desired type, shape and size from a number of spinning cops which are successively placed into the machine each after depletion of the cop precedingly used. The machine has a stationary frame structure A on which a transverse pivot rod B is mounted. The rod carries a coil holder assembly C which occupies the illustrated position during the unwinding operation. The coil holder accommodates a cop **103** to be unwound by pulling the yarn over the tip of the cop. When the cop is depleted, the holder structure C can be turned counter-clockwise (FIG. 1) about the axis of pivot rod B into a position where the depleted cop is doffed and a new cop is donned. The starting end of the new cop is then tied together with the yarn coming from the take-up spool and the unwinding operation is continued, these details being not further described herein because they are generally known and customary and are not essential to the invention proper.

Journalled in the stationary frame structure A is a shaft D on which a yarn-guiding drum **102** is mounted so as to rotate together with shaft D during the above-mentioned unwinding operation. A frame E is pivotally mounted on the machine structure A and serves as a holder for the take-up spool or yarn package **101** to be produced, this package being illustrated as a cross-wound coil. During rotation of shaft D and drum **102** the take-up spool or package **101** rests against the drum **102** and is frictionally entrained thereby so as to rotate at constant peripheral speed. During such rotation the yarn F coming from cop **103** passes through an endless guiding groove of the drum **102** as it is being wound up on spool **101**, thus producing the desired cross-wound package.

The yarn F coming from the cop **103**, passes first through a tubular member **104** of substantially square inner cross section, thence over a yarn-guiding rod **105** which is mounted in fixed relation to the machine frame structure A and changes the traveling direction of the yarn. From rod **105** the yarn passes through a yarn brake **106** acting as a tensioner, thence through an eye or comb-shaped yarn cleaner **107** and then past a yarn guard **108** onto the guiding drum **102** from which it is wound onto the take-up spool **101** as described above. The yarn guard **108** is essentially a feeler which is pivoted at **109** on a stationary mounting structure **110** to which the parts **107** and **106** are also attached. The feeler **108** is spring-biased into contact with the yarn F and turns clockwise in the event the yarn becomes exhausted or torn, thus initiating a control which stops the machine until a new cop is inserted or the yarn breakage eliminated. Since such fault-responsive controls are conventional in the art and do not form part of my invention, they are not further described herein.

The sleeve member **104** is made of sheet material and has an essentially square cross section. The axial length of the sleeve member **104** is preferably about 60 to 100 mm. in the direction of yarn travel, the spacing between two opposite inner faces of the sleeve being approximately 15 to 30 mm. The axis of the sleeve member approximately coincides with the extended geometric axis of the cop **103**. The spacing between the lower edge of the sleeve member **104** and the tip of the cop is preferably between about 15 and about 30 mm.

Design details of the sleeve structure **104** according to FIGS. 1 and 2 are apparent from FIGS. 11 to 16; and modified forms of such sleeve structure are shown in FIGS. 3 to 10.

The sleeve member in all embodiments comprises a sleeve structure **1** proper. This sleeve structure may be subdivided in the axial direction in accordance with the modification shown in FIGS. 5 and 9, or it may be composed of individual rings as is the case in the embodiment shown in FIGS. 6 and 10. In each case, the structure **1** is provided with one or more noses **2** for catching the yarn, these noses being located on one side of a longitudinal slot **31** through which the yarn can be inserted into the sleeve structure. The sleeve structure further comprises a connecting piece **4** and a holder rod **3** which is rotatably and axially displaceable relative to the fixed frame structure of the machine.

As shown in FIGS. 14 to 16, the holder rod **3** is fastened to a coupling disc **5** by means of a cotter pin **7**. The disc **5** has two axially projecting noses **6** which are 180° displaced from each other and and are engageable with corresponding notches **16** of a support **8**. The support **8** can be arrested on a carrier rod **9** by means of a set screw **10** in the desired angular position. The support **8** has a recess **14** in which a helical pressure spring **13** is located. The spring **13** abuts against the bottom of the recess **14** and against a disc **12** firmly joined with the holder rod **3** by a bolt **11**. Due to the pressure of spring **13**, the disc **12** and the holder rod **3** are pressed against the support **8** so that the noses **6** catch into the grooves **16** and retain the sleeve body **1** in one of two available positions displaced 180° from each other.

While, as explained above, the four longitudinal edges of the square sleeve according to FIGS. 1, 2 and 11 to 13 operate as disturbance means for periodically varying the ballooning width, a sleeve structure with a perfectly circular inner cross section does not inherently provide the desired disturbance feature. However, in the embodiment illustrated in FIGS. 5 and 9, as well as the embodiment illustrated in FIGS. 6 and 10, the longitudinal yarn-entrance slot **31** constitutes a disturbance location. In the embodiment according to FIGS. 3 and 7, a longitudinal recess **31'** is provided opposite the yarn-entrance slot **31** so that this embodiment possesses two disturbance means. In the embodiment according to FIGS. 4 and 8, the sleeve structure is provided with two inward ridges **32** which extend axially along the inner surface and constitute two disturbance means.

In the embodiment according to FIGS. 5 and 9, as well as in the embodiment of FIGS. 6 and 10, the sleeve structure is interrupted in the axial direction so as to be composed of a plurality of ring-shaped components.

The operation of the device in all of its illustrated and above-described modifications is essentially as set forth hereinabove. That is, when the yarn is being pulled over the tip of the stationary cop or other conical-layer coil, the formation of a balloon is not entirely suppressed but is subdued so as to form a residual balloon

of small radius which enters into contact engagement with the inner surface of the sleeve member and, during its upward travel and simultaneous rotating motion about the cop axis, is also subjected to a variation of the ballooning diameter during each individual rotation of the reduced balloon.

As a result, the invention affords increasing the unwinding speed and the reliability of operation without involving an appreciable change in the design of the machine in which the the device is employed, thus affording a considerable reduction of the cost involved in the manufacture of textile materials. The device is applicable not only in new machines but can also be added to existing machines of various types.

As mentioned above, the device can readily be given such a mounting that it is applicable in one and the same machine for coils of right-hand or left-hand winding sense. For example, when the sleeve structure is set as shown in FIG. 13, it is applicable for cops whose yarn turns will unwind themselves in the clockwise sense indicated by an arrow G. The same device is made suitable for the rerevse rotation of the yarn by merely turning the shaft 3 about 180°, thus placing the catch nose 2 into the broken-line position 2*a*.

I claim:

1. Device for unwinding a conical yarn-layer coil, comprising a normally stationary coil holder for accommodating the coil to be unwound, said holder defining a coil axis, pull means axially spaced from said holder for pulling the yarn over the coil tip whereby the pulled-off portion of yarn rotates about the coil axis and tends to form a balloon, a stationary yarn guide located between said pull means and said holder in axially spaced relation to said holder, a sleeve structure mounted between said holder and said guide in spaced relation to said holder and forming a yarn passage generally of axially elongated shape to be traversed by the yarn, said passage being frictionally engageable by the ballooning yarn so as to limit the ballooning diameter, and said sleeve structure forming a longitudinal slot for threading the yarn into said structure, said sleeve structure having yarn-catching means protruding away from the sleeve axis at one side of said slot, said sleeve structure comprising a shaft member, and a support on which said shaft member is pivotally mounted to permit turning said sleeve structure to selectively adapt it to right-hand and left-hand winding sense of the coil to be unwound.

2. Device for unwinding a conical yarn-layer coil, comprising a normally stationary coil holder for accommodating the coil to be unwound, said holder defining a coil axis, pull means axially spaced from said holder for pulling the yarn over the coil tip whereby the pulled-off portion of yarn rotates about the coil axis and tends to form a balloon, a stationary yarn guide located between said pull means and said holder in axially spaced relation to said holder, a sleeve structure mounted between said holder and said guide in spaced relation to said holder and forming a yarn passage generally of axially elongated shape to be traversed by the yarn, said passage being frictionally engageable by the ballooning yarn so as to limit the ballooning diameter, and said sleeve structure forming a longitudinal slot for threading the yarn

into said structure, said sleeve structure having yarn-catching means protruding away from the sleeve axis at one side of said slot, said sleeve structure comprising a shaft member, and a support on which said shaft member is pivotally mounted to permit turning said sleeve structure to selectively adapt it to right-hand and left-hand winding sense of the coil to be unwound, said support and said sleeve structure being latchingly engageable with each other in two respective angular positions 180° displaced from each other, said shaft member being axially displaceable in said support to permit unlatching and angularly displacing said sleeve member, and spring means mounted on said support for urging said structure and support into latching engagement.

3. In a device according to claim 1, said yarn passage of said sleeve structure having a polygonal cross section.

4. In a device according to claim 1, said yarn passage of said sleeve structure having a substantially square cross section.

5. In a device according to claim 1, said yarn passage of said sleeve structure having a rounded cross section and having radially projecting disturbance means for periodically varying the ballooning diameter of the yarn being unwound from the coil.

6. In a device according to claim 1, said sleeve structure consisting of an elongated tubular member of sheet material.

7. In a device according to claim 1, said sleeve structure comprising a plurality of annular members axially spaced from each other.

8. Device for unwinding a conical yarn-layer coil, comprising a coil holder for accommodating the coil to be unwound, said holder defining a stationary coil axis, pull means axially spaced from said holder for pulling the yarn over the coil tip whereby the pulled-off portion of yarn rotates about the coil axis and tends to form a balloon, a normally stationary structure of generally annular shape mounted substantially on said axis between said pull means and said holder to form a passage for the yarn, said structure being elongated in the direction of said axis and having an inner opening departing from the annular cross-sectional shape and frictionally engageable by the ballooning yarn so as to limit the ballooning diameter while varying said diameter during each rotation of said yarn portion, said structure being provided with a shaft member, and a support on which said shaft member is pivotally mounted to permit turning said structure to selectively adapt it to right-hand and left-hand winding sense of the coil to be unwound.

References Cited in the file of this patent

UNITED STATES PATENTS

306,348	Pettengill	Oct. 7, 1884
1,965,471	Schaaff	July 3, 1934
2,099,215	Moore	Nov. 16, 1937
2,286,189	Abbott	June 16, 1942
2,585,962	Perry	Feb. 19, 1952

FOREIGN PATENTS

1,146,746	France	May 27, 1957
316,367	Switzerland	Nov. 30, 1956