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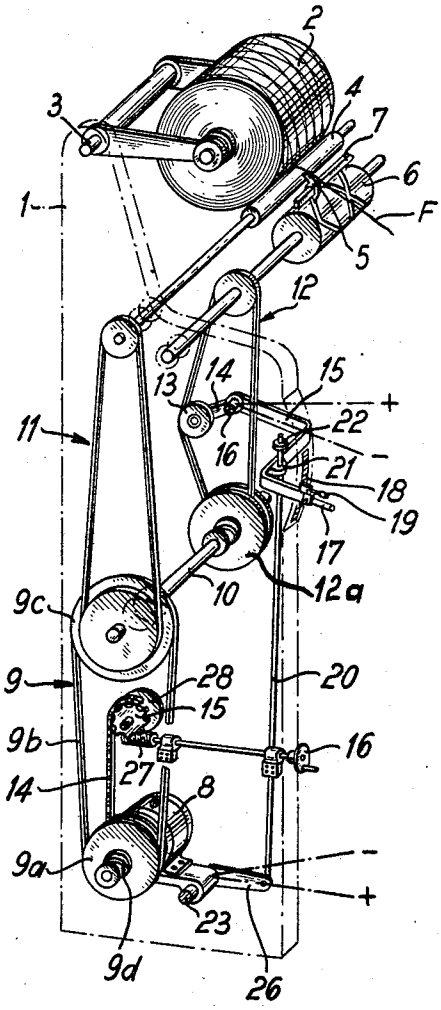

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COIL WINDING MACHINE WITH RECIPROCATING YARN GUIDE

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ABSTRACT OF THE DISCLOSURE

Yarn coil winding machine includes means for rotating a coil being wound in the machine, yarn guide means located adjacent the coil, means for driving the yarn guide means so as to reciprocate oncoming yarn along the coil; transmission means for the yarn guide means operatively connecting the coil rotating means and the yarn guide driving means for varying the speed ratio between the rotating coil and the yarn guide means; means operatively connected to the transmission means for automatically varying the transmission ratio of the transmission means in relation to the rotary speed of the coil, and including means for limiting the maximum speed of the yarn guide means irrespective of the increase of rotary speed of the coil beyond a given value.

My invention relates to a yarn coil winding machine having means for rotating a take-up coil, such as a cross-wound coil or cheese, being wound in the machine, yarn guide means located adjacent to the coil as well as means for driving the yarn guide means so as to reciprocate oncoming yarn along the coil, and variable transmission means operatively connecting the coil rotating means and the yarn guide driving means for varying the speed ratio between the rotating coil and the yarn guide means.

Variable transmission means of the aforementioned type have been known for a decade and serve for permitting a change in the pitch or angle of slope of the yarn turns as the yarn is wound on a coil. Only one of many possible forms of such transmission means is disclosed for example in German Patent 141,616.

A great disadvantage of yarn winding machines having reciprocating yarn guides is that the speed of the yarn guide is limited to a specific maximum value because allowance must be made for inertial forces produced at the reversing nodes of the reciprocating movements. If the speed of the yarn guide should exceed this maximum limit, it could cause damage to the machine within a short time. With the heretofore known yarn winding machines of this type, the originally set ratio between the rotary speed of the take-up coil and the speed of the yarn guide is maintained for any variation in the speed of the take-up coil. In order to prevent the maximum permissible speed of the yarn guide from being exceeded for high rotary speeds of the take-up coil, the maximum rotary speed of the take-up coil has therefore been accordingly limited. The result thereof is that only a relatively low rotary speed of the take-up coil is available even for small intersecting angles of the yarn wound on the cross-wound take-up coil, although in such a case, in view of the yarn guide speed, higher rotary speeds of the take-up coil would be permissible. In such a case, therefore, relatively

poor use is made of the machine and the efficiency thereof is consequently reduced.

It is accordingly an object of my invention to provide a yarn coil winding machine having a reciprocating yarn guide with variable transmission means that will avoid the aforementioned disadvantages of the heretofore known yarn winding machines.

With the foregoing and other objects in view, I accordingly provide a yarn coil winding machine with means operatively connected to the transmission means for automatically varying the transmission ratio of the transmission means in relation to the rotary speed of the coil, and means for limiting the maximum speed of the yarn guide means irrespective of the increase of the rotary speed of the coil beyond a given value. It is thereby possible to operate with relatively high rotary speeds of the take-up coil within the range of relatively smaller intersecting angles or pitches of the yarn laid down on the coil, to increase the pitch of the yarn winding without unduly raising the high speed of the yarn guide.

In accordance with further features of the invention, for varying the transmission ratio of the transmission means, the rotary speed of the coil is ascertained or determined in a great many different ways, for example, by revolution counters, and the measured value is referred to for suitably adjusting the transmission ratio. A particularly simple and advantageous embodiment in accordance with the invention comprises a control device for varying the rotary speed of the coil, and a control member forming part of the yarn guide transmission means connected to the control device. Thereby, for each operation of the control device to vary the rotary speed of the coil, the control member for the speed of the yarn guide is actuated to prevent the permissible maximum speed of the yarn guide from being exceeded.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as yarn winding machine having reciprocating yarn guide, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalence of the claims.

The construction and method of operation of the invention, however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying single figure of the drawing schematically showing part of a winding machine constructed in accordance with the invention.

Referring now to the drawing, there is shown the winding machine frame **1** in dot-dash lines, a wind-up coil or yarn package **2** such as a cross wound coil or cheese, is pivotally mounted on a shaft **3** supported in the frame **1**. The take-up coil **2** is driven by a driving roller **4**. A yarn guide **5** serves for laying down the oncoming yarn F on the drive roller **4** and thereby transferring it to the cheese or take-up coil **2**. The yarn guide **5** has an end which is received in an endless guiding groove formed in a guiding drum **6** and is accordingly displaceable along a slide rail **7**, suitably mounted in the machine, as the guiding drum **6** is rotated, whereby the yarn F carried at the upper end of the yarn guide **5**, as seen in the drawing, is reciprocated along the coil **2**. Consequently, the

speed of the reciprocating yarn guide **5** depends upon the rotary speed of the guide drum **6**.

The yarn coil winding machine is driven by a motor **8** which rotates the shaft **10** through a variable transmission **9**. The variable transmission **9** is formed of a driving pulley *9a* which is mounted on the shaft of the motor **8**, and V-shaped transmission means *9b*, such as a V-belt, chain or the like, which connects the driving pulley *9a* with a driven pulley *9c*. The pulley *9a* is formed of two discs or wheels which are wedge shaped, one of which is displaceable toward the other under the biasing force of a spring *9d* responsive to the tension in the V-belt *9b*. A pulley mounted coaxially with the pulley *9c* on shaft **10** drives the driving roller **4** through a transmission belt or chain **11** to rotate the take-up spool **2**. Similarly, a variable pulley *12a* constructed substantially like the pulley *9a* is mounted on the shaft **10** for variably transmitting rotation over a transmission belt for rotating the guide drum **6**, the transmission means **12** for rotating the guide drum **6** being substantially similar to the aforedescribed transmission means **9**.

The motor **8** is pivotally mounted on shaft **23** in order to vary the rotary speed of the take-up spool **2** which is proportional to the speed of the shaft **10**. The motor **8** is accordingly hung or supported on a chain **14'** secured at the upper end thereof as shown in the figure to a wheel **15**. The angular position of the wheel **15** is adjustable by manual rotation of the crank **16**, which advances a worm drive **27** that meshes in a gear **28** mounted coaxially with the wheel **15**, so as to thereby turn the wheel **15** to alternately raise and lower the chain **14'** and the motor **8** suspended thereby. When the wheel **15** is turned counter-clockwise, as viewed in the drawing, the length of the chain portion that is vertically suspended is increased, and the motor **8** accordingly pivots by inertia counter-clockwise about the shaft **23**. Thereby, the transmission belt *9b* of the variable transmission **9** adjusts one of the wedge shaped discs of the driving pulleys *9a* against the biasing action of the spring *9d* so that the belt *9b* is located on a portion of the conical peripheral surface of the pulley *9a* having a reduced diameter, and the rotary speed of the take-up spool **2** is thereby reduced.

As noted hereinbefore, a variable transmission means **12** is connected between the drive mechanism for the take-up spool **2** and the drive mechanism for the yarn guide **5** by means of which the pitch or angle of intersection of the yarn running up on the coil **2** can be established. The adjustment of the transmission means **12** is effected in a similar manner to the adjustment of the transmission means **9** by the fact that the transmission belt of the transmission means **12** is guided by a roller **13** which is more or less pivotable to increase or decrease the tension in the transmission belt so that the transmission belt is located on a platform of the periphery of the driving pulley having a relatively smaller or larged diameter, as the case may be. The roller **13** is mounted on one arm of a double armed lever **14**, **15** and is pivotable about a fixed axis **16** by means of a handle **17**. An adjustment in a direction toward the dot-dash line represented by the plus sign indicates an increase in the speed of the yarn guide. The handle **17** can accordingly swing in front of a scale **18** and can be stopped in any suitable manner such as for example by means of a clamping screw **19**. The pitch of intersecting angle of the yarn which is laid down on the coil **2** is then readable from the scale **18**.

In order to prevent the permissible maximum speed of the yarn guide **5** from being exceeded at very high velocities of the coil, the transmission means **12** is automatically variable in relation to or in dependence on the rotary speed of the coil **2**. In the illustrated embodiment this is effected due to the connection of the control device for varying the rotary speed of the coil **2** with the control member **17** of the transmission means **12** for the yarn guide. For this purpose a lever arm **26**, which is pivotable about a shaft **23** is connected to the motor **8**. If, for example, the rotary speed of the coil **2** is reduced, the lever arm **26** and the motor **8** therewith is swung in a direction from the dot-dash line represented by the plus sign to the dot-dash line represented by the minus sign. The lever arm **26** is connected with a push-rod **20** which passes through a guiding eye **21** secured to the lever arm **15** and is provided on the upper end thereof as shown in the drawing with a limiting disc **22**. The limiting disc **22** prevents, in cooperation with the guiding eye **21**, the raising of the control member **17** above a predetermined height as shown in the figure of the drawing. On the other hand, the limiting disc **22** has the effect that the control member **17** is automatically controlled or adjusted in the sense of a reduction in the speed of the yarn guide when the rotary speed of the coil is increased. This control or adjustment can be effected for example against the frictional force applied by the screw **19**.

It is, of course, believed to be quite obvious that the embodiment shown in the figure is employed solely for explaning the basic concept of the invention of the instant application. This basic concept is, however, applicable both with various types of winding machines as well as also various different embodiments falling within the scope of the invention. Thus, for example, it is noted that a variable motor, i.e. a motor having a variable rotary speed can be used for changing the rotary speed of the coil **2**, and a control member for changing the rotary speed of the motor can be connected with the control member **17** of the transmission means **12** for the yarn guide.

I claim:

1. Yarn coil winding machine comprising means for rotating a coil being wound in the machine, yarn guide means located adjacent the coil, means for driving the yarn guide means so as to reciprocate oncoming yarn along the coil; transmission means for the yarn guide means operatively connecting said coil rotating means and said yarn guide driving means for varying the speed ratio between the rotating coil and said yarn guide means; means operatively connected to said transmission means for automatically varying the transmission ratio of said transmission means in relation to the rotary speed of the coil, and including means for limiting the maximum speed of said yarn guide means irrespective of the increase of the rotary speed of the coil beyond a given value.

2. Winding machine according to claim **1** including means operatively connected to said coil rotating means for controlling the rotary speed of the coil.

3. Winding machine according to claim **1** including control means operatively connected to said yarn guide transmission means for controlling the reciprocating speed of said yarn guide means.

4. Winding machine according to claim **3** including control means operatively connected to said coil rotating means for controlling the rotary speed of the coil, and means interconnecting both of said control means for conjointly varying the reciprocatory speed of said yarn guide means with the rotary speed of the coil.

5. Winding machine according to claim **4** wherein said means for limiting the maximum speed of said yarn guide means forms part of said interconnecting means.

6. Winding machine according to claim **5** wherein said control means for controlling the rotary speed of the coil includes a lever arm displaceable in relation to a variation in the rotary speed of the coil, said control means for controlling the reciprocating speed of said yarn guide means includes a lever arm displaceable in relation to a variation in the reciprocating speed of said yarn guide means, said interconnecting means comprises a push-rod connected at opposite ends to the respective lever arms, and said limiting means comprises an abutment located at the end of said push-rod arjacent the lever arm of said yarn guide control means, said abutment cooperating with

a guide carried by said last-mentioned lever arm for slidably guiding said push-rod therein so as to limit the displacement of said last-mentioned lever arm in a given direction irrespective of the increase in the displacement of the first mentioned lever arm.

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