ABSTRACT

A thread storage and supply device for a textile machine including a winding body upon which a thread can be wound in a circumferential direction to form two or more layers of stored thread windings, and from which the threads can be removed, such as in the axial direction thereof. A storage surface is associated with the winding body and is movable relative thereto in the circumferential direction thereof. A thread guide device is provided for conducting the thread to the storage surface, which guide device is disposed inside the space defined by the layers of stored thread windings such that the issued thread penetrates between the storage surface and the innermost layer of thread windings.

22 Claims, 4 Drawing Figures
FIG. 1
This invention relates to a threaded storage and supply device for textile machines, comprising a winding body upon which the thread can be wound in circumferential direction in two or more layers of thread windings and from which the thread can be removed particularly an axial direction.

While in the case of thread storage and supply devices great importance was originally placed on the fact that the thread was wound up in only one layer thus preventing any irregularities in tension from being produced during removal or unwinding of the thread, a device of the class cited at the outset has recently become known (German published patent application DT-PS 1,903,133), in which the thread forms an irregular skein of thread in which two or more layers lie on top of one another. It is surprising that the thread can be drawn out of this skein with an extensively constant tension. Storing the thread in several layers has the advantage that a greater amount of thread can be stored in a device having a given structural size. In the case of the cited device, the thread windings formed by the thread winding up on the winding body tangentially is displaced in the axial direction by a suitable thread transport element. In so doing, the last formed windings are shoved underneath the previously formed one thereby causing the quoted irregular skein of thread to be formed. The size of the skein of thread produced in this manner is limited in that the resistance to displacement in the skein constantly increases so that the passive thread transport element is no longer able to press the newly formed windings underneath the old one and, at the same time, to displace the entire thread storage in axial direction on the winding body.

The invention is based on the object of designing a thread storage and supply device of the class cited at the outset such that a large thread storage can be produced on the winding body while ensuring substantially regular configuration of the layers of thread windings on the winding body. This object is accomplished in accordance with the invention in that a storage surface is associated with the winding body and can be moved in the circumferential direction thereof and that a thread guide member conducting the thread to the storage surface is arranged stationary relative to the storage surface and inside the space defined by the stored thread windings such that the issued thread penetrates between the storage surface and the lowermost thread layer.

Unlike all known thread storage and supply devices in which the thread storage is exclusively produced by axial movement of the thread windings, the thread storage in the inventive device also increases in a radial direction. In so doing, the newly formed thread windings are placed on the inside of the previous windings so that the latter are pressed outwardly. This has the great advantage that the thread is always removed from the outermost layer of thread. The thread windings of the outermost thread layer are not covered or crossed by thread windings previously formed, thereby permitting the thread to be drawn off without producing any irregularities in tension. Since the thread storage is not displaced in the axial direction of the winding body, the resistance to displacement thereof does not limit the size of the thread storage. On the contrary due to the elasticity of the thread, numerous thread layers can be formed above one another when new thread layers are issued from the inside, thus permitting a larger thread supply to be created on the winding body within a small space.

In an expedient embodiment of the invention, it is provided that the winding body has several rollers disposed in angular spacing distributed over the circumference thereof which can be set in rotation about their axes and whose surface face regions respectively encompassed externally by the thread windings mutually form the storage surface and that the thread guide member is arranged within the enveloping surface externally tangent to the rollers. The storage surface which causes the newly wound thread to be pushed under the existing thread windings can be easily formed by means of rotating rollers disposed in a closed path in a distributed fashion.

It is even more favorable if a belt which can be driven in the circumferential direction of the winding body is conducted about the cylindrical rollers and the outer surface thereof forms the storage surface, the belt being conducted inwardly between two proximate rollers and about a guide member to form a belt loop which opens outwardly and the thread guide member is disposed in the space defined by the belt loop. The thread windings are supported on the inside by the belt across the substantial portion of the winding body circumference, thereby preventing any undesirable deformation of the thread storage. The belt also transmits frictional forces to the newly wound thread across practically the entire winding body circumference so that the thread is reliably pulled under the already existing thread layers.

Advantageously, the guide member consists of a cylindrical roller arranged in the center of the winding body and driven in rotation while the remaining rollers are pulled along with the belt. The guide member has, in addition to its task of ensuring that the belt loop is drawn inwardly, the additional function of driving the belt and the other rollers over this belt, thereby permitting the device to be constructed in a simple manner.

In accordance with a variation of the invention, the rollers are rotatably journaled in a stationary framework. The device is then especially simple in structure and operation.

Another variation provides that the winding body comprising the thread guide member having a thread guide coaxial relative to the winding body can be set in rotation in its entirety and the storage surface can be driven relative to the winding body at a negative speed corresponding to the circumferential speed of said body so that the storage surface remains stationary relative to the environment. This variation of the embodiment has the advantage that the thread storage remains stationary, thereby preventing any and all loop formation in the thread.

It is advantageously provided that the thread guide member be periodically reciprocal in the axial direction of the winding body. In this manner, the thread storage is distributed over the storage surface in axial direction of the winding body, thereby enabling a greater thread storage to be formed.

Preferably, the winding body is associated with a winding element which rotates in the same direction as
the storage surface relative to the winding body at a circumferential speed corresponding to or exceeding the storage surface. The thread is unwound neatly in this way. The unwinding element prevents a balloon from forming in the unwinding section of the thread.

 Expediently, the unwinding element has an annular surface journal concentrically to the winding body, over which the thread can be removed in an axial direction as well as having a brake ring which is supported on a shoulder of the annular surface, which is known per se and which elastically hinders the passage of the thread about the annular surface. In this development of the invention, the unwinding element unites in itself the functions of unwinding and braking the unwinding thread.

 Preferably, the winding body is associated with a monitoring device which keeps the size of the stored amount of thread inside predetermined limits and which has a tactile member which is movably disposed in the belt loop radial to the winding body and which makes contact with the lowermost layer of thread from the inside and which is connected to a switch which controls the winding drive. The tactile member responds to the radial tension varying in accordance with the thickness of the thread storage. When the thread storage has attained the desired maximum amount, the tactile member is pressed inwardly by this radial tension to such an extent that it disconnects the winding drive. Vice-versa, the tactile member moves outwardly when the thread storage becomes smaller and consequently causes the radial tension to decrease. In so doing, the tactile member switches the winding drive on again. This permits reliable monitoring of the size of the thread storage.

 BRIEF DESCRIPTION OF THE DRAWINGS

 Embodiments of the invention are illustrated in the drawings in which:

 FIG. 1 is a longitudinal section through a first embodiment of a thread storage and supply device in accordance with the invention.

 FIG. 2 is a schematic cross section through the device in accordance with FIG. 1.

 FIG. 3 is a longitudinal section through a second embodiment of a thread storage and supply device in accordance with the invention and including a stationary storage surface.

 FIG. 4 is a schematic cross section through the device according to FIG. 3.

 DETAILED DESCRIPTION

 In the device according to FIGS. 1 and 2, a plurality (here six) of cylindrical rollers 2 have their axles 3 rotatably journaled in a stationary framework 1. The rollers 2 are disposed in a circle with equal angular spacing. A belt 4 externally encircles the rollers 2.

 As is especially obvious from FIG. 2, the belt 4 is drawn inwardly between two proximate rollers 2 such that the belt forms a loop 4a which opens outwardly.

 The belt loop encircles a central roller 5 in the center of the circle in which the rollers 2 lie, said central roller 5 being mounted on an axle 5b which is also rotatably journaled in the framework 1. Rollers 2 and the belt 4 together form at least part of a body generally designated W in the drawing for winding up a thread F issuing from a storage spool (not shown). The outer surface 4b of the belt forms a storage surface for the thread F.

 The thread is conducted through a tubular thread guide member 6 whose mouth 6a is disposed in the interior of the belt loop 4a. The thread guide member 6 is mounted in the framework 1 so as to be longitudinally slidable and is held in position by means of a spindle nut 7 mounted on a screw 8 which has intersecting threads merging together at the end and which is also rotatable in the framework 1, whereby rotation of screw 8 causes reciprocation of nut 7 and member 6.

 An electromotor 9 which is rigidly secured to the framework serves as the driving means and drives the screw 8 via a first pinion 10 and intermediate gears 11 and 12. Motor 9 also drives the central roller 5 via a second pinion 13 and a gear 14 rigidly connected to the roller 5. The central roller 5 serves to drive the belt 4. The belt pulls along the rollers 2 and thereby rotates these about their axes 3.

 In the interior of the belt loop 4a, in particular in the area where it opens externally, there is disposed a roller 15 having a small diameter which is rotatably journaled in the framework 1. The roller 15 is pivotally mounted at one end thereof on the frame so that the roller is normally urged radially outwardly toward the surrounding layers of thread for sensing and controlling the size of the existing thread storage V. For this purpose, the roller 15 is urged outwardly by a compression spring 16 and cooperates with a switch 17 positioned in the control line 17a of the drive motor 9.

 A disc 18 which can be set in rotation by the drive motor 9 via the first pinion 10 and the intermediate gear 11 in the same direction as the belt 4 is fixedly positioned on the axle 60 of the central roller 5. The transmission ratios are selected such that the circumferential speed of the disc 18 is at least as high as that of the belt 4. The disc 18 forms a conically expanding annular surface 18a on its circumference. A brake ring 19, which consists of a base ring 19a surrounding the annular surface 18a in spaced relation and flexible fingers 19b extending inwardly in a conical fashion and inclined from the base ring 19a in the direction of circumference, is supported on a shoulder 18b formed by a bend in the annular surface 18a. The brake ring 19 is described in full detail in German published patent application (DT-AS) 1,900,619.

 The device described above functions in the following way: When the drive motor 9 is switched on, the central roller 5 rotates in the direction indicated by the arrow P1 as seen in FIG. 2. This causes the belt 4 to rotate in the sense of arrow P2 and pulls along with it the rollers 2 which rotate in the direction indicated by arrow P3. The thread F is conducted in the direction of arrow P1 (FIG. 1) through the tubular thread guide member 6 and emerges from the mouth 6a of the thread guide member in the direction of arrow P5. In so doing, the thread comes to abut on the outer surface of the belt 4 and is pulled along thereby while forming thread windings about the winding body W. The successive thread windings are offset mutually in the axial direction of said winding body W, since the thread guide member 6 executes a reciprocating movement as indicated by the double arrow P6 in FIG. 1 by virtue of the rotation of screw 8. This causes a thread storage V to be formed on the storage surface 4b defined by the external surface of the belt 4. This thread storage V in-
corporates several layers of thread lying one above the other in radial direction relative to the winding body W. During this process, the new layers of thread are always formed in radial direction within (i.e., beneath) the old thread layers because the belt pulls the newly issued thread F between the existing thread storage V and the storage surface 4b formed by the outer surface of the belt.

The thread F is removed from the thread storage V in the axial direction of the winding body W, as indicated by the arrow P1 in FIG. 1. The thread is conducted over the annular surface 18a which rotates at the same or a higher speed than the belt and in the same direction of rotation. In so doing, the thread F is conducted over the annular surface 18a relative thereto and is elastically decelerated by the brake ring 19 in a known manner. The brake ring 19 prevents a balloon from forming in the section of thread which is removed.

In the region where the belt loop 4a is open, the roller 15 forming a tactile device abuts on the inside of the thread storage V which is not supported by the belt 4. When the thread storage V has reached the desired maximum size, its radial contraction is so great that it pivots the roller 15 inwardly against the action of the spring 16, thereby opening the switch 17 and switching off the drive motor 9.

If the thread storage has become so small by removal of the thread that the spring 16 can pivot the roller 15 outwardly in radial direction again, switch 17 is again closed, thus causing the winding operation to begin once again.

In a modification of the afore-described embodiment, the belt 4 can be omitted. The rollers 2 must then be rotated synchronously via a gearbox. The inserted thread is then conducted by the surface of the rollers and is stored thereupon. In this case, the areas of the rollers which are encompassed by the thread windings themselves form the storage surface. Furthermore, it is possible, of course, to drive one or more of the rollers 2 instead of the central roller 5 thus producing the belt movement. The rollers 2 can also be replaced by a stationary, cylindrical guide member about which the belt 5 passes. In order to reduce friction, the belt is supported in this case only on rib- or roller-shaped projections of the guide member. The pendulum movement of the thread guide member 6 may also be attained, of course, by using means other than the screw 9 with intersecting threads. For instance, a curve control could be provided for this purpose. In stead of the tubular thread guide member 6, a bobbin roller with crossed grooves for guiding the thread could also be used. Driving could be accomplished by a belt driving several winding bodies instead of by a special electromotor 9; this would entail arranging a clutch which is actuable by the monitoring device 15, 17 between the driving belt and the driven parts of the winding body. The monitor itself could also be constructed differently. For example, the thickness of the thread storage could be measured photoelectrically and the drive means could be controlled accordingly. Pneumatic scanning of the thickness of the thread storage is also feasible. The thread F does not necessarily have to be drawn off from the winding body W in a radial direction. A reversing device would also be present which effects a tangential thread removal and thus a positive thread supply if desired.

In the embodiment according to FIGS. 3 and 4, a stationary framework 1' is again provided. The cylindrical rollers 2' are, however, not journelled with their axes 3' in the framework, but rather in a plate 20 which is integrally constructed or rigidly joined to a central shaft 21. The shaft 21 can be driven by the drive motor 9' via a belt drive 22 which includes a belt 22a and pulleys 22b and 22c. The tubular thread guide member 6' is arranged coaxial in the shaft 21 such that it can be slid in its longitudinal direction, but still be pulled along (i.e., rotated) during rotation of the shaft 21. Member 6' has a laterally bent mouth 6'a. This extends into a belt loop 4'a which the belt 4' encompassing the rollers 2' forms about an inner roller 5' which is somewhat displaced from the center. The inner roller 5' is also journaled in the support disc 20 so as to be freely rotatable.

The axles 3' of a few or all rollers 2' bear a pinion 23 at their free ends which engages with the stationary internal gear 24 of the framework 1'. The transmission ratios are selected such that, during rotation of the support disc 20, the rollers 2' execute a circumferential movement on the outer circumference of the rollers 2' which is opposite to the rotation of the support disc 20 due to the engagement of the pinion 23 in the internal gear 24 and which has such a linear speed that the belt encompassing the rollers 2', 5' remains stationary at least in the circumferential direction of the winding body with respect to the framework 1'.

A tactile arm 25 which is pivotally hinged to the support surface 20 is biased outwardly by a spring (not shown) and acts on a microswitch 17' which in turn switches the motor 9' on and off via slip rings 26'.

The tubular thread guide member 6' has a control arm 27 which abuts on a stationary eccentric cam 28. During rotation of the shaft 21 and the guide member 6', which also causes rotation of the disc 20 supporting thereon the rollers 2' and 5', the tubular thread guide member 6' is thus reciprocated in its longitudinal direction. The abutment of the arm 27 on the eccentric cam 28 is guaranteed by a compression spring 29 which acts on a flange 30 on the thread guide member 6'.

The thread F' passes through the central thread guide member 6' and through the laterally bent mouth 6'a thereof to the outer surface of the belt 4' and there forms a thread storage V' from the inside to the outside. The thread storage V' is thus located in this case on a storage surface 4'b which is stationary relative to the environment and which is formed by the outer surface of the belt 4'.

The thread F' is removed from the winding body W', the external supporting surface of which is stationary in this case, in an axial direction as indicated by the arrow P1' over a disc 18' and under a brake ring 19'.

The disc 18' must be stationary during operation. This can be accomplished by magnetic force, by an eccentrically positioned weight or by means of a pin 31 secured to the machine frame 1' and holding the brake ring 19'. Friction between the brake ring 19' and the rotatably journelled disc 18' is sufficient to keep this in a stationary position.

What we claim is:

1. A thread storage and supply device for a textile machine, comprising winding body means upon which a thread can be wound in a circumferential direction to form two or more layers of stored thread windings and from which the thread can be removed, a storage sur-
face associated with said winding body means and movable relative thereto in the circumferential direction thereof, and thread guide means for conducting the thread to the storage surface, said guide means being disposed inside the space defined by the layers of stored thread windings such that the issued thread penetrates between the storage surface and the innermost layer of thread windings.

2. A device according to claim 1, wherein the winding body means includes a plurality of rollers disposed in angular spaced relationship around the circumference thereof, said rollers being rotatable about their respective axes, and said rollers having surface regions respectively externally encompassed by the thread windings, and said thread guide means being positioned within an enveloping surface which is externally tangent to the rollers.

3. A device according to claim 2, including an endless belt conducted about the rollers, the outer surface of said belt forming said storage surface, a belt guide element positioned inwardly from said rollers, said belt being conducted inwardly between two adjacent rollers and about said guide element to form a belt loop which opens outwardly, and said thread guide means being disposed in the space defined by the belt loop.

4. A device according to claim 3, including means for periodically reciprocating the thread guide means in the axial direction of the winding body means.

5. A device according to claim 3, including a monitoring device associated with the winding body means for maintaining the size of the stored amount of thread within predetermined limits, said monitoring device having a sensing member disposed in said belt loop and movable radially relative to the winding body means for contacting the innermost layer of thread from the inside, a winding drive associated with said winding body means for causing rotation of said rollers relative to a supporting frame, and switch means operationally activated by said sensing member for controlling said winding drive.

6. A device according to claim 5, wherein said sensing member comprises a roller disposed between said two adjacent rollers.

7. A device according to claim 3, wherein the guide element comprises a cylindrical roller arranged in the interior of the winding body means, and drive means connected to said guide element for rotating same, whereby said guide element drives the belt which in turn drives said plurality of rollers.

8. A device according to claim 7, wherein the rollers are rotatably journaled in a stationary frame.

9. A device according to claim 1, including means for periodically reciprocating the thread guide means in the axial direction of the winding body means.

10. A device according to claim 1, including an unwinding element associated with the winding body means and rotatable relative thereto in the same direction as the storage surface, and means for causing said unwinding element to rotate at a circumferential speed relative to the winding body means corresponding to or exceeding the circumferential speed of said storage surface.

11. A device according to claim 10, wherein the unwinding element has an annular surface journaled concentrically to the winding body and over which the thread can be removed in axial direction, and a brake ring supported on a shoulder formed on the annular surface, said brake ring elastically hindering the passage of the thread about the annular surface.

12. A device according to claim 1, further including means for supporting said winding body means for rotation in one direction at a first circumferential speed, and means coacting with said support surface for rotating same in a circumferential direction relative to said winding body means at a second circumferential speed which is substantially the same as said first circumferential speed but in the opposite direction so that the storage surface remains substantially circumferentially stationary relative to a fixed frame.

13. A thread storage and supply device for a textile machine, comprising:

- body means having a longitudinal axis;
- thread support means movably mounted on said body means for defining an axially elongated, shell-like cylindrical region in surrounding relationship to said body means, said region being substantially concentric with said axis;
- said thread support means having thread support surface means defining at least part of the inner boundary of said region, said surface means having at least one opening in the circumferentially extending direction thereof;
- thread guide means for supplying thread to said region to cause a plurality of thread windings to be wound around said support means and supported on said surface means, said guide means including a guide member positioned within the interior of said cylindrical region for supplying a thread radially outwardly through said opening into said region; and
- drive means for causing movement of said surface means in said circumferential direction relative to said guide member for causing the thread to be wound around said surface means.

14. A device according to claim 13, wherein said support means includes a plurality of cylindrical rollers rotatably supported on said body means and disposed in a circular pattern in surrounding relationship to said axis, said roller means being substantially equally angularly spaced from one another, and said thread guide member having a discharge end positioned within the interior of the circular pattern defined by said plurality of rollers for discharging a thread radially outwardly between an opening defined between a pair of adjacent rollers.

15. A device according to claim 14, wherein said body means is stationary, said drive means being drivingly interconnected to at least one of said rollers for rotating same, and said thread guide member being nonrotatable relative to said body means.

16. A device according to claim 14, wherein said body means is mounted for rotation about said axis, said drive means being drivingly interconnected to said body means for causing rotation thereof in one direction, and means coacting with said rollers for causing rotation of said rollers about their respective axes in the opposite direction in response to rotation of said body means in said one direction, and said thread guide member being mounted for rotation with said body means.

17. A device according to claim 13, wherein said surface means is defined by an endless belt extending circumferentially around said body means in substantially concentric relationship to said axis, a belt guide ele-
ment positioned in the interior of said region spaced radially inwardly from said inner boundary, said belt having a loop formed therein which extends radially inwardly from said inner boundary and around said belt guide element whereby said loop opens outwardly and defines said opening, and said thread guide member having the discharge end thereof disposed in the space defined by said belt loop.

18. A device according to claim 17, wherein said support means includes a plurality of cylindrical rollers rotatably supported on said body means, said rollers being disposed within a circular pattern in surrounding relationship to said axis, said belt being supported on said rollers, and said belt loop extending radially inwardly between an adjacent pair of said rollers.

19. A device according to claim 17, wherein said body means is stationary, and wherein said drive means is drivingly connected to said belt for causing rotation thereof in the circumferential direction of said body means.

20. A device according to claim 17, wherein said drive means is drivingly connected to said body means for causing rotation thereof in one direction about said axis, and means cooperating with said belt for causing rotation thereof in said circumferential direction relative to said body means in the opposite rotational direction.

21. A device according to claim 17, further including means drivingly connected to said thread guide member for causing same to reciprocate in a direction substantially parallel to said axis simultaneous with the relative rotation between said belt and said body means.

22. A device according to claim 13, further including means for causing reciprocation of said thread guide means in a direction substantially parallel to said axis simultaneous with the relative circumferential rotation between said body means and said surface means.

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