TAKE DOWN APPARATUS FOR CIRCULAR SEAMLESS HOSE
KNITTING MACHINES

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ABSTRACT

An anti-twist device for preventing twisting of hose as knitted on a circular seamless hose knitting machine of the kind including a stationary take-down tube along which a hose is pulled under suction. The device includes a rotary cylindrical dust shield arranged co-axially with respect to the take-down tube and driven at at least the same rotational speed as that of the needle cylinder of the machine. Fingers, pivotally mounted on the dust shield, are movable about fulcrum points to operative positions in which they interrupt the passage of a knitted hose downwardly through the shield and the take-down tube and to inoperative positions in which they release the pressed-off hose for free passage through the dust shield and the take-down tube. The dust shield is driven from an independent electric motor located exteriorly thereof.

11 Claims, 4 Drawing Figures
This invention relates to take down apparatus for circular seamless hose knitting machines, and is applicable exclusively to such a machine of the kind equipped with a take-down unit including a mainly vertical take-down or take-away tube down which the tubular fabric produced on the machine is pulled pushwise as to hold it under tension. In a machine of this kind the tubularly knitted fabric as produced turns with the revolving needle cylinder, whereas the mainly vertical take-down tube is stationary.

The invention is primarily applicable to, and the following further description will for convenience be concentrated upon, a suction take-down unit in which the tubular fabric is pulled down the take-down tube under suction. There is, however, no absolute limitation in this respect since, in appropriate circumstances, the invention could be applied to a brush take down.

The knitting head, including the rotary needle cylinder, of a modern circular seamless hose knitting machine is usually situated approximately 4 feet above floor level. As a consequence, the take-down tube at the bottom of the machine requires to turn through 90° and again through another 90° in order that suction can be constant throughout the knitting cycle. Now circularly knitted stockings and tights, i.e., hose, are made of stretch yarn to enable them to fit all sizes of legs. It follows that such hose are extended to considerable lengths under full suction. To quote one example: the leg of a stretch tight is often extended to as much as 6 feet or more. Accordingly, since the knitting head rotates whereas the take-down tube is stationary, the said tube comes into contact with the revolving tubular fabric, as the result of which the latter twists up. When a knitting cycle is completed, a hose is automatically "pressed-off" the knitting head and sucked away into a storage bag or other container at the side of the machine. Such a hose, were it not to be passed through an anti-twist device, would normally contain anything up to 20 twists in its length. To untwist the articles manually is an expensive operation.

With the aim of obviating the necessity for a manual untwisting operation, it has previously been proposed to provide, within the take-down suction tube of a circular seamless hose knitting machine of the kind herein referred to an anti-twist device of a form designed to turn the tubular fabric at the same rotational speed as, or even faster than, that of the revolving needle cylinder, with the results that during the hose knitting cycle, the revolving tubular fabric does not have any twists imparted by any static or stationary portion of the take-down tube, and that after the hose knitting cycle is completed, the hose is in the unstwisted state.

According to one prior proposal of which we are aware, an anti-twist device of this general form comprises a rotary perforated tube which is located below and is geared in conjunction with, and thus driven directly with the needle cylinder. During the knitting cycle the suction, instead of being effective vertically downwards, is so diverted as to pass horizontally through the perforated tube (mounted for rotation co-axially within the take-down tube). Thus, when the circularly knitted article reaches the perforated tube it is forced into the interior surface thereof and consequently rotates together therewith so that any twisting of the fabric is prevented. Upon completion of the knitting cycle, the suction direction is changed back again so that the pressed-off hose is sucked vertically downwards through the lower end of the rotating perforated tube into a storage bag. However, in so far as the suction direction has to be changed, and the perforated tube is geared directly with the knitting head, this particular previously proposed device is expensive to construct, fit and operate. Moreover, the perforated tube collects waste yarn and requires to be frequently cleaned to obviate clogging up of the perforations.

Another previously proposed anti-twist device of the general form concerned consists simply of a slotted disc which is mounted within the take-down tube and is adapted to be driven by a miniature electric motor combined with it, at a rotational speed either the same as, or faster than, that of the needle cylinder. During the knitting cycle, the circularly knitted hose is drawn down by means of a rotating disc and, in turning together with the latter, is prevented from twisting up. When, however, the cycle is complete, the disc and its independent motor are either swivelled or displaced laterally, by means of levers or linkages, out of the take-down tube into a housing mounted on the side of the said tube. Accordingly, whereas when the disc is in its operative position within the take-down tube, it provides not only an obstruction to the free passage of the tubular fabric being produced but also a support upon which this fabric can temporarily accumulate, the removal of the obstruction by swivelling or laterally displacing the disc and its motor into the housing provided permits the pressed-off article to be sucked away downwardly. Thus, whilst with this second prior device in use, the suction can remain always in the same direction, nevertheless the levers or linkages effecting the swivelling or lateral displacement of the disc are complex and unattractive and the disc itself tends to collect fibers some of which, in the normal course of knitting, are prone to pass through the take-down tube. In addition, the independent electric motor, being necessarily very small, is not reliable and also being in the center of the take-down tube, will itself tend to collect fibers which have passed down the knitting head.

According to a development of the second described prior device of which we are aware, the direction of the suction is changed so as to suck the pressed-off circularly knitted hose out of the side of the take-down tube at a location above the rotary disc. But while this development avoids the necessity to move the disc and its motor out of the way, the problems associated with the disc and the motor still remain.

The object of the present invention is to provide, in or for a circular seamless hose knitting machine of the kind herein referred to, a generally improved anti-twist device designed to overcome the disadvantages of previously proposed devices.

Broadly considered the anti-twist device according to this invention comprises a rotary component which is disposed, or adapted to be disposed, co-axially with respect to the relatively stationary take-down tube and is driveable at a rotational speed either the same as or in excess of that of the needle cylinder of the seamless hose machine, and a set of fingers which are pivotally mounted on the said rotary component and are movable about their pivots or fulcrum points to operative positions in which they interrupt the passage of a circularly knitted hose downwardly through the said component and the co-axial take-down tube and to operative positions in which they release the pressed-off hose for free passage along the rotary component and the take-down tube, e.g., into a storage container.

The rotation of the component carrying the fingers must be in the same sense as the needle cylinder and other rotatable parts of the knitting machine head.

The arrangement of the pivoted fingers may advantageously be such that when they are swung into the aforesaid operative positions they extend radially inwards with respect to the rotary component with their inner extremities approaching a common point coincident with the axis both of the rotary component and also of the take-down tube co-axial therewith. Thus, in such positions the pivoted fingers completely block the passage of a hose being produced so that the hose collects, or at least initially collects, above the fingers. When the knitting cycle is completed, the fingers are permitted to turn on their pivots or fulcrum points to operative positions in which the inner extremities of the fingers are spaced apart to such an extent as to open up a free passage for the released hose.

Since, therefore, the pivoted fingers support the circularly knitted fabric during the knitting cycle, and the component upon which the fingers are mounted rotates at the same speed as or faster than the needle cylinder, the hose being produced
is prevented from becoming twisted, since it does not reach the 90° bend at the bottom of the machine. The rotary component is adapted to the driven from an independent electric motor located exteriorly of the component and hence also of the take-down tube, e.g., through the medium of intermeshed toothed gearing or a belt and pulley drive.

The improved anti-twist device may, of course, be built into a new circular seamless hose machine of the kind concerned so as to permit to form an integral part of the take-down apparatus of the machine. It is, however, primarily the intention that the said device shall be in the form of an independently saleable unit adapted for incorporation into such a take-down apparatus.

Means of any suitable character, such, for instance, as electrical means, electromagnetic means, pneumatic means or mechanical means, under any appropriate control, are provided for actuating the fingers.

In order that the invention may be more clearly understood and readily carried into practical effect, one specific constructional example of the improved anti-twist unit will now be described with reference to the accompanying drawings, wherein:

FIG. 1 is a purely diagrammatic elevational view of so much of a circular seamless hose knitting machine of the kind concerned as is necessary to illustrate the suction take-down apparatus and the application thereto of the improved anti-twist unit.

FIG. 2 is a vertical cross-section of the anti-twist unit per se, FIG. 3 is a horizontal cross-section of the same taken on the line III—III of FIG. 2, and FIG. 4 is a detail vertical sectional view corresponding to a portion of FIG. 2, but showing the fingers in their inoperative position.

In FIG. 1, the rotary needle cylinder forming part of the knitting head of the circular seamless hose knitting machine is indicated at 10. The stationary take-down tube of the suction take-down apparatus is generally designated 11. At the bottom of the machine the take-down tube 11, which is co-axial with respect to the cylinder 10, turns via a first bend 11a through 90° and again, via a second bend 11b, through another 90°. At 12 is diagrammatically depicted a form of storage receptacle into which pressed-off hose are deposited after having been drawn by suction along the length of the tube 11 and through a conventional transparent trap T complete with hose-release flap. The storage receptacle may, of course, logically consist of a bag.

The improved anti-twist unit, provided in accordance with this invention, is generally designated ATU. The unit is of an independently produced form and in FIG. 1 is shown incorporated into an existing take-down apparatus of a circular seamless hose machine the casing of which is represented in chain lines. A vertical portion of the tube 11, between the rotary needle cylinder 10 and the first right-angular bend 11a is omitted or cut away to receive the anti-twist unit ATU. In fact, the bend 11a, in the form of an elbow component, may form an actual part of the unit as manufactured for sale.

As will be seen more clearly in FIG. 2, the unit ATU includes a rotary component in the form of a cylindrical dust shield 13, this component being vertically disposed in co-axial alignment with the relevant portions of the take-down tube 11. The dust shield 13 may conveniently be made of an opaque plastics material.

A plurality of relatively thin blade-like fingers 14, e.g., eight as shown, are pivotally mounted upon the cylindrical dust shield 13 and are movable about fulcrum points 15 to their operative positions, shown in FIGS. 2 and 3, in which they intertwine vertically with a circularly contoured portion of the take-down tube 11 and through the tube 11 and the said shield, and to their inoperative positions, shown in FIG. 4, in which they release the pressed-off hose for free passage along the take-down tube 11 into the storage container 12.

The rotatable cylindrical dust shield 13 is encased and revolves within a stationary outer casing 16, also cylindrical, which is carried by a framework F furnished with legs such as 17 and 18 arranged to stand on the floor. The framework F comprises a bottom cover 19 and an upper lid-like cover 20, the two being spaced apart, with the outer casing 16 interposed between them and rigidly connected together by vertical tie rods 21.

Thus, the top surface of the bottom cover 19 is recessed at 20a not only to receive and close the lower end of the outer casing 16 but also to locate the lower race 22 of a ball bearing BB1 provided between the rotary dust shield 13 and the fixed outer casing 16. The upper race 22 of this ball bearing embraces and is rigidly secured to the lower end of the shield 13. On the underside of the bottom cover 19 is formed a cylindrical hollow boss 19a adapted to be inserted and secured within a socket portion of the first bend 11a of the take-down tube 11. Similarly, the underside of the upper lid-like cover 20 is recessed at 20a not only to receive and close the upper end of the outer casing 16 but also to locate the upper race 23 of another ball bearing BB2. The lower race 24 of this further ball bearing is combined with a peripherally grooved pulley 25 which is rigidly secured to the upper end of the rotary dust shield 13 and through the medium of which the latter is driven. On the top side of the lid-like cover 20 of the framework is formed a cylindrical hollow boss 20a adapted to be engaged in and secured within a portion 11c of the take-down tube 11.

Anti-friction bearings of any other suitable type may, if desired, be provided between the rotary dust shield and the fixed outer casing 16.

In the illustrated example, an independent electric motor 26 is provided for driving the rotary dust shield 13 at a speed either the same as or in excess of that of the needle cylinder 10. It is, however, to be clearly understood that rotary shield 13 may, if desired, be mechanically driven, through drive-transmitting means of any suitable character from the knitting machine drive. As will be seen in FIG. 2, the motor 26 is suspended at 27 from an upper portion of the framework: in the illustrated example this upper portion is, in fact, constituted by a lateral extension 20c of the upper lid-like cover 20. A drive belt 28 is passed both around the pulley 25 secured to the dust shield and also a smaller grooved pulley 29 rigid with the motor spindle 30. An opening or openings in or are formed in the outer casing 16 at 31 to permit of the passage therethrough of the runs of the drive belt 28.

When swung into their operative positions the fingers 14 extend radially inwards with their inner extremities approaching a common point coincident with the axis a. But when the said fingers are permitted to swing down about the fulcrum points 25 their inoperative positions, the aforementioned inner extremities of the fingers are directed downwards (see FIG. 4) so as to open up a free passage for a released hose.

Each of the fingers 14 extends through an opening 32 formed in the wall of the revolvable cylindrical dust shield 13, the lower edge of the said opening being smoothly rounded to provide the fulcrum 15 about which the finger can turn. Angular tails 14a provided on the outer ends of the fingers 14 are located exteriorly of the dust shield 13. A retaining ring 33 is fitted and secured within the cylindrical dust shield at a location immediately above the fingers 14.

A ring or collar 34 through which the said shield 13 is slidably axially up and down is located exteriorly of the dust shield 13. A retaining ring 33 is fitted and secured within the cylindrical dust shield at a location immediately above the fingers 14.

A ring or collar 34 is formed to provide a downwardly facing socket 34a a vertical depression in which is lined with a small portion of cushioning material. This lined socket 34a, when the ring or collar 34 is in its lowest position, as shown in FIG. 2, embraces and accommodates vertical portions 14b of the tails 14c of the fingers 14; moreover, the horizontal base of the
socket 34a engages the upper ends of the tails 14a suchwise as to lock the fingers 14 in their operative positions. With the fingers in these hose-obstructing positions, the inner surfaces of their tails 14a rest against the outer surface of the rotary dust shield 13. In this way the inwardly projected fingers are maintained downwardly inclined so as to define a hose-collecting space S of inverted conical shape immediately above them. When a hose, in the course of being knitted, piles up on the closed fingers 14, the increasing weight of the hose plus the downward pull of the suction in the take-down tube 11 would, were it not for the locking action of the ring or collar 34 upon the tails 14a, eventually be sufficient to press the fingers down thereby removing the obstruction. But, as will be appreciated, the fingers must not be permitted so to move downwardly until such time as the hose has been pressed-off the needles of the machine and is consequently ready for release into the storage container 12. As will, therefore, be appreciated, release of the fingers 14 at the appropriate instant of time to enable them to swing down to their inoperative positions in contact with the inner surface of the rotary dust shield 13, as shown in FIG. 4, is effected by an upward movement of the ring or collar 34 to a position in which its socket 34a is well clear of the tails 14a of the fingers. As will be seen in FIG. 4, when the fingers are in their inoperative positions to open up the tube 11 and so enable a pressed-off hose to be sucked away into the storage container 12, the upper corners of the angular tails 14a are tilted upwardly and inwardly. When next the ring or collar 34 is lowered, the horizontal base of the socket 34a acts upon and presses down the upwardly and inwardly directed corners of the tails 14a, with a camming action, to restore the fingers 14 into, and again lock them in, their operative hose-obstructing positions.

Means of any suitable character such, for instance, as electrical means, electro-magnetic means, pneumatic means or wholly mechanical means, under any appropriate control, are provided for raising and releasing the ring or collar 34 at the relevant times. Wholly mechanical means are shown in the drawings. Thus, as will be seen, the said ring or collar is formed with an annular flange 36 beneath which is provided an inwardly directed arm 37a of a generally U-shaped member 37 which is arranged to be lifted and lowered under control. This member 37 is slidable up and down one of the vertical tie rods 21 which extends between and is secured at its upper and lower ends in the framework F. A helical compression spring 39 surrounding the said rod 21 is interposed between the top side of the upper limb 37b of the member 37 and the underside of one of the tie rods 20 employed to secure in position the upper end of the relevant tie rod 21. The arrangement is accordingly such that the member 37 is spring-biased downwardly and is adapted to be raised against this bias. The member 37 is connected to one end of a Bowden cable 41 the opposite end of which is connected to a lever 42 which is actuated and controlled by a cam 43 on a control drum 44. The automatically controlled member 37 accordingly cooperates with the annular flange 36 to raise and permit lowering of the ring or collar 34.

At 45 is depicted a micro-switch for switching the independent electric motor 26 off and on, this switch being arranged to be operated automatically as a consequence of the ring or collar 34 being moved up or down. For this purpose, a cam 46 suitably associated with the member 37 is provided for depressing and releasing the operating button 45a of the micro-switch. The cam 46, e.g., of nylon, is threaded on to the relevant tie rod 21 and is held up against the underside of the upper limb 37b of the member 37 by means of a relatively short compression spring 47 arranged on the said rod as shown.

As shown in FIGS. 2 and 4, the set of fingers 14 is located at the lower end of the rotary dust shield 13 — immediately above the first 90° bend 11a in the take-down tube 11. In any event, the pivoted fingers 14 can be so designed as to be self-cleaning, and the electric motor 26, being outside the take-down tube 11, can be large enough to have sufficient power and longevity to satisfy the user. Moreover, in the event of a needle or, indeed, a spanner or any other tool being inadvertently dropped down the take-down tube, no damage will be sustained by the fingers. Equally important, use of the improved anti-twist device of this invention does not necessitate any switching of the direction of the suction.

I claim:

1. For a circular seamless hose knitting machine of the kind having a rotary needle cylinder and equipped with a stationary take-down tube for tubularly knitted hose as produced, a hose in the tube being held under tension whilst being knitted but, when pressed-off needles in the cylinder, being conveyed away along the tube, an anti-twist unit of a form which is adapted to be combined with the take-down tube and comprises a hose-obstructing and supporting means designed to turn the hose together with the revolving needle cylinder, the anti-twist unit being characterized in that it also comprises a rotary tubular component disposable co-axially with respect to the take-down tube; means for driving said component at least the rotational speed of a needle cylinder of a machine of the kind concerned, said hose-obstructing and supporting means comprising a set of fingers pivotally mounted upon the said rotary tubular component and movable about fulcrum points both to operative positions in which they extend radially inwards across the rotary components to block a free passage therethrough of a hose being produced and provide a support upon which the hose can temporarily accumulate and to inoperative positions in which they open up the said component to provide such a free passage to permit a pressed-off hose to be freely conveyed therethrough; and means not only for moving the fingers to and locking them in their operative positions but also for releasing the said fingers movement to their inoperative positions.

2. An anti-twist unit according to claim 1, wherein an independent electric motor mounted upon a framework within which the rotary tubular component is located is the means provided for driving the said component.

3. An anti-twist unit according to claim 1, wherein the rotary component is cylindrical and designed to function as a dust shield.

4. An anti-twist unit according to claim 1, which is adapted to be accommodated in a space provided by omitting a section of a take-down tube, between a needle cylinder and a first 90° bend in said tube.

5. An anti-twist unit according to claim 4, wherein the rotary component is in the form of a cylindrical dust shield which is encased and rotatable within a stationary outer casing, the latter being carried by a framework supported on legs adapted to stand on the floor, and anti-friction bearings being provided between the dust shield and the said outer casing.

6. An anti-twist unit according to claim 5, wherein an independent electric motor is suspended from a part of the framework extending laterally from the top of the outer casing, and the cylindrical dust shield has secured to it a pulley, a drive belt being passed both around this pulley and another pulley associated with the motor spindle, at least one opening being formed in the outer casing to permit of the passage therethrough of the runs of the drive belt.

7. An anti-twist unit according to claim 3, wherein each of the fingers extends through an opening formed in the wall of the cylindrical dust shield, the lower edge of the opening providing the fulcrum about which the finger can turn.

8. An anti-twist unit according to claim 3, wherein the finger moving and locking means comprises a collar which embraces and is slidable axially up and down the rotary dust shield, a lower part of this collar being formed for engagement, upon a downward movement of the latter, with tail ends of the pivoted fingers for the purpose of moving the fingers into and locking them in their inwardly directed operative positions, and an upward movement of the collar releasing the fingers and so permitting them to swing down into their inoperative position.
9. An anti-twist unit according to claim 8, wherein the said collar is formed with an annular flange beneath which is provided a member arranged to be lifted and lowered under control.

10. An anti-twist unit according to claim 9, wherein the said member is spring-biassed in one direction and positively movable in the opposite direction against the bias.

11. An anti-twist unit according to claim 9, wherein the rotary dust shield is driven by an independent electric motor mounted upon a framework of the unit, and an electrical switch for switching the said motor off and on is arranged to be automatically operated and controlled by a cam associated with the member whereby the collar is moved up and down.