SPECIFICATION

Method and Apparatus for Making a Join in a Bound Yarn

It is known to produce a bound or wrapped yarn by guiding a sliver or roving, arriving from the pair of delivery rollers of a drafting unit, and a binding thread running off a package, through a rotating hollow spindle (British Patent Specifications 1159510 and 1423484; U.S.A. Patent 4018042). The binding thread is laid helically round the sliver, as a result of which a yarn is produced having the strength which is required for its further processing and which is subsequently pulled through the hollow spindle by a pair of draw-off rollers, and is wound up on to a bobbin.

In this way yarn can be produced at a high speed and in a particularly economic way; however, difficulties are experienced when,—for example after a thread breakage,—a thread join has to be made. The operator is then faced with the problem of recombining three components, viz. the sliver, the binding thread, and the free end of the bound yarn which has already been produced.

It has already been proposed, for making a join in a bound yarn, to use a compressed-air pistol with a suction tube by means of which a reduced pressure or partial vacuum is created in the tube or hollow spindle lying in the centre of the binding thread bobbin; the sliver and the binding thread, drawn off the rotating package, is sucked through the hollow spindle (U.S.A. Patent 4018042).

The silver or roving is strengthened to such a degree that the thread arriving from the hollow spindle can be guided through the pair of draw-off rollers and placed on the package. It is a drawback associated with this method of effecting a thread join that only two components are combined with one another, and no connection is established between the end of the bound yarn already formed and the thread end arriving from the hollow spindle, so that a thread breakage is presupposed during further processing. Further, circumstances may be such that the speed of the air sucked into the pistol is so high that the sliver will not be tied by the rotating binding thread, or may be such that the reduced pressure is so pronounced that the binding thread will not be drawn off the package.

Underlying this invention is the object of providing a method and apparatus which enable a join to be made, in a simple and reliable way, in a bound yarn, all three components being joined to one another without the supply of sliver from the pair of delivery rollers being interrupted after a thread breakage has occurred.

According to the invention the sliver, which continues to arrive from the pair of delivery rollers on the occasion of a thread breakage, is deflected from its path of travel by a suction air current; after the hollow spindle and the package bearing the bound yarn have been stopped, the end of the bound yarn is brought back, through the hollow spindle, to a point between the hollow spindle and the delivery rollers, and is there combined with the end of the binding thread, whereupon the two thread ends are twisted with the sliver by bringing the hollow spindle back into operation, so that production of bound yarn is continued.

Conveniently, the sliver may be deflected, by a first suction air current, from its direction of travel towards the hollow spindles, the binding thread and the bound yarn being brought together in a second suction air current, whereupon the sliver is transferred into the second suction air current, and is twisted with the binding thread and the bound yarn by bringing the hollow spindle back into operation. In this way it is ensured that the fibres introduced into the suction air current will not form fibre tufts at the free ends of the binding thread and of the bound yarn.

The suctioning force can be reduced by bringing the binding thread and the bound yarn together in the suction air stream which deflects the sliver, this binding thread and bound yarn being twisted with the sliver by bringing the hollow spindle back into operation.

The invention also relates to an apparatus for performing the method and which is characterised by: a belt lift-off device and a lift-off device for a package which contains the produced bound yarn, these two lift-off devices being actuatable by way of switching devices; and at least one suction tube which is disposed between the pair of delivery rollers and the hollow spindle and whose suction opening is in the vicinity of the path of travel of the sliver.

The invention is hereinafter explained by way of example with reference to the accompanying drawings of different embodiments of binding apparatus and in which:—

Figure 1 illustrates, in side elevation, a binding apparatus with two stationary suction tubes for effecting a thread join, and with switching means;

Figure 2 illustrates, again in side elevation, a modification of the apparatus shown in Figure 1, with one suction tube; whilst

Figure 3 shows, in side elevation, a binding apparatus with one stationary and one movable suction tube for effecting thread joins.

As shown in Figure 1, a hollow spindle 3 is arranged after a drafting unit, of which only the pair of delivery rollers 1, 2 is shown. The hollow spindle 3 is rotatably mounted in a frame 31 and is continuously driven, for example by a tangential contact belt 32. On the hollow spindle 1 is a package 4, which contains the binding thread B. This binding thread B may be in the form of a filament, a yarn, or a twine. In this embodiment the package 4 is fixed with the hollow spindle 3, so that the former also rotates. However, the bobbin of package 4 may also be rotatably mounted on the hollow spindle 3 and be prevented from rotation during continuous operation.

Following, and situated at a distance from the hollow spindle 3 is a pair of draw-off rollers 5, 6 namely a driven roller 5 and a presser roller 6. The

presser roller 6 is rotatably mounted on an arm 60, which is pivotable about an axis 61, the presser roller 6 being pressed, by a tension spring 62 which engages the arm 60, against the roller 5. Located after the pair 5, 6 of draw-off rollers is a take-up device with a drive drum 7, which is for example a grooved drum, and which frictionally drives the package SP which is held in a package holder 70 and is pressed by a spring 71 against the drive drum 7.

Bound yarn is produced by the sliver S, which arrives from the pair of delivery rollers 1, 2, and the binding thread B passing through the rotating hollow spindle 3, the binding thread B being helically placed around the sliver S. The sliver S, arriving from the pair of delivery rollers 1, 2, may remain untwisted, or a false twist may be imparted to it through (for example) its being brought into frictional contact with the hollow spindle 3. The bound yarn G which is produced is drawn out of the hollow spindle 3 by the pair of draw-off rollers 5, 6 and is taken up onto the package SP by means of the grooved drive drum 7.

As is also clear from Figure 1, the hollow spindle 3 and the package 4 containing the binding thread B are surrounded by a stationarily arranged housing 40, which completely encloses them. If required, the housing 40 can be opened, for example by removing a cover 41. The housing 40 has air inlet openings 44 through which air from outside can be sucked into the inside of the housing 40, as will be explained below. The cover 41 has an opening 42 which lies concentrically of the longitudinal axis of the hollow spindle 3 and through which there passes the sliver S arriving from the pair of delivery rollers 1, 2. The cover 41 also has an eccentric bore 43 into which there opens a suction tube 80, which communicates with a suction device 8. The suction tube 80 may advantageously have a resilient intermediate member, so that it can be removed from the bore 43 or, when the cover 43 is being lifted off, can be removed with this cover 41. The tube may be replaced by a resilient suction hose. A second suction tube 81 is also connected to the suction device 8 and extends to the region of the path of travel of the sliver between the pair of delivery rollers 1, 2 and the housing 40 which surrounds the package 4.

Associated with the suction tube 81 is a closure or cut-off member, for example a slider 82, which is brought, against the biasing force of a spring 83, into a closure or cut-off position by an electromagnet E_2. This electromagnet E_2 can be connected to a current-conducting line L by way of a switch S_{12} of a switching device SE. The suction tube 80 is preferably also equipped with a cut-off member 85, which holds the suction tube 80 in its cut-off condition during the binding process. The closure member 85 is manually actuated. Naturally, however, this closure member 85 can move automatically, similar to the automatic movements of the slider 82 of the suction tube 80.

Associated with the tangential belt 32 driving the hollow spindle 3 is a belt lift-off device 33 to which a braking jaw 34 is attached. The belt lift-off device 33 is caused to move, with the braking jaw 34, in the direction of the tangential belt 32 by an electromagnet E_1 and the return movement is caused by a spring 35. By virtue of a corresponding connection the belt lift-off device 33 with the braking jaw 34 can open and close the contact of a switch S_2. The flow of current from the conductor L to the electromagnet E_1 is by way of a switch S_{11} of the switching device SE, and a switch S_3. The switch S_3 is actuated by a thread-monitoring unit 9 arranged between the hollow spindle 3 and the pair of draw-off rollers 5, 6 this monitoring unit 9 being pivotable about an axis 90 and pressing, by its free end, against the bound yarn G.

An electromagnet E_3 is connected to the free end of the arm 60 carrying the draw-off roller 6, while another electromagnet E_4 is intended to press, in opposition to the force of a spring 73, a plunger 72, which serves as a liftoff device for the package SP, against the package SP, so that the latter is lifted away from the drive drum 7 in opposition to the biasing force of the spring 71. The electromagnets E_3 and E_4 can be connected to the current conductors L by way of the switch S_2.

Figure 1 shows the apparatus during the process whereby the thread is spun or bound. The switch S_{11} is closed, while switches S_{12}, S_2 and S_3 are opened, so that all the electromagnets E_1, E_2, E_3, and E_4 are de-energised, and the corresponding springs are effective. The spring 83 holds the slider 82 of the suction duct 81 in its open position, so that air is sucked from the outside and flows through the suction duct 81. The belt lift-off device 33 with the braking jaw 34 is held in its retracted position by the spring 35, and the plunger 72 associated with the package SP is held in its retracted position by the spring 73. The presser roller 6 is urged by the spring 62 against the driven draw-off roller 5, so that bound yarn G is drawn out of the hollow spindle 3 by these two rollers.

When a thread breakage occurs—in particular in the area between the pair of delivery rollers 1, 2 and the inlet into the hollow spindle 3—the sliver S, which continues to arrive unobstructedly from the pair of delivery rollers 1, 2, is gripped by the air suctioned into the suction tube 81, (this current is described as the first suction air current), and is deflected from its direction of travel towards the hollow spindle 3 by being drawn into the suction tube 81. At the same time the thread-monitoring unit 9, due to the decreased thread tension, pivots about the axis 90, and in this way closes the contact of the switch S_3. This decrease in the tension of the thread by an amount such that the thread-monitoring unit 9 pivots about the axis 90, takes place on each occasion, for example when only the sliver S, and not the binding thread B, is broken. Because the contact of the switch S_3 is closed, a current flow path is established between the conductor L and

the electromagnet E_1. The electromagnet E_1 presses the belt lift-off device 33 against the tangential belt 32, which is lifted away from the hollow spindle 3, and the braking jaw 34 now abuts against the wall of the hollow spindle 3 and stops the latter. Due to the movement of the belt lift-off device 33 with the braking jaw 34 in the direction of the hollow spindle 3, the contact of the switch S_2 is also closed, and current then flows through this switch S_2 to the electromagnets E_3 and E_4. The electromagnet E_3 acts in opposition to the force of the spring 62, so that the arm 60 pivots about the swivel pin 61 and lifts the presser roller 5 away from the driven draw-off roller 6. At the same time the electromagnet E_4 presses the plunger 72 against the package SP and lifts the latter away from the drive drum 7 in opposition to the force of spring 71. Thus, the process whereby thread is drawn off and taken up is interrupted. If the binder thread B has not been ruptured, it is cut off between hollow spindle and the pair of draw-off rollers.

The process of effecting a thread join is performed by arranging for the end of the bound yarn G, present on the package SP or for example in a storage means (not shown) lying upstream of the package SP, to be initially returned from this package SP to a point between the pair of delivery rollers 1, 2, and the hollow spindle 3, this point being defined, in the present embodiment, by the inlet opening of the suction tube 80. For this purpose a length of the bound yarn G, which substantially corresponds to the distance between the package SP (or another yarn-storage point lying in front of the package SP), and the suction tube is removed from the package SP, so that only a limited length of bound yarn G subsequently passes into the suction tube 80. The end of the bound yarn G is introduced, passing between the presser roller 5 and the driven draw-off roller 6, into the hollow spindle 3. The cut-off member 85 of this suction tube 80 is opened, with the result that air from the outside is sucked through the opening 42, the air inlet openings 44 of the housings 40 and also the hollow spindle 3, a condition of reduced pressure being created inside the housing 40. This suction air current, to be described as the "second suction air current", then draws the bound yarn G through the hollow spindle 3 in the direction of the delivery rollers 1, 2 and into the suction tube 80.

The process whereby the binding thread B is located on the bobbin 4, and removed from the latter, is automically performed by an air eddy inside the housing 40, this eddy being produced by the air which flows through the air inlet openings 44. This air eddy may possibly be reinforced by compressed air twist nozzles. A certain length of the binding thread is then also sucked into the suction tube 80. If the binding thread B has not been ruptured, and still lies in the hollow spindle 3, it passes into the suction tube 80 together with the bound yarn G.

The two components, namely bound yarn G and binding thread B, are in this way combined, along a certain distance in the second suction air current, and are held subject to tension by the condition of reduced pressure in the suction tube 80, while the sliver S is continuously deflected in its direction of travel to the hollow spindle 3 and drawn by the first air suction current through the suction tube 81. After this first stage of effecting the thread join, the second and last phase is initiated by closing the switch S_{12} of the switching device SE and opening the switch S_{11}. In this way a connection is established between the current-conducting line L and the electromagnet E_2, as a result of which the electromagnet E_2 moves the slider 82, in opposition to the force of spring 83, into the cut-off position, and interrupts the flow of suction air in the suction tube 81. At the same time, due to opening of the switch S_{11} the electromagnet E_1 is de-energised, so that the spring 35 becomes effective, and moves the belt lift-off device 33 (together with the braking jaw 34) away from the tangential belt 32 and hollow spindle 3 respectively. The hollow spindle 3, driven by the tangential belt 32, now starts to rotate again.

Due to the belt lift-off device 33 (together with the braking jaw 34 which is arranged upon it) being moved away from the hollow spindle 3, the switch S_2 is opened. Simultaneously with the recommencement of rotation of the hollow spindle 3, or after this recommencement if correspondingly installed delay members (not shown) are provided, the electromagnets E_3 and E_4 are de-energised, and the spring 62 engaging the arm 60 of the presser roller 6, and also the spring 73, associated with the plunger 72, become effective. These springs respectively press the presser roller 6 against the driven roller 5, and the package SP, which takes up the bound yarn G, against the drive drum 7.

Due to the hollow spindle 3 and also the parts of the apparatus lying downstream of this spindle 3 being brought into operation in the above-described manner, the bound yarn G present in the suction tube 80, and the binding thread B, are drawn out of this suction tube 80 and form a thread balloon. Also, the sliver S is released from the suction tube 81 by reason of the first suction air current being discontinued in the tube 81, and is gripped by the second air current flowing through the opening 42 to the inside of the housing, and is drawn into the latter. The sliver S then present in the second suction air current, is gripped by the thread balloon formed by the binding thread B and the bound yarn G, and is twisted together with these two components. Meanwhile, due to the tension of the travelling thread, the thread-monitoring unit 9 is pivoted about its axis 90, thereby opening the switch S3. After, in the above-described manner, the thread joining process has ended, the switch S_{12} is opened by the operator, and switch S_{11} is closed. When the switch S_{12} is opened the electromagnet E_2 is de-energised, and the slider 82 associated with the suction 81 is opened, so that suction air starts again to flow through the suction tube 81

and becomes available for deflecting the sliver S from its path of travel to the hollow spindle 3 on the occasion of a later thread breakage. Also, the cut-off member 85 of the suction tube 80 is closed.

Means are shown in Figure 2 for effecting a join of the three components, namely sliver S, binding thread B, and bound yarn G, with only one suction tube 80. As all the other apparatus parts correspond to similar parts shown in Figure 1, the structural details are not repeated in the drawing, and the description is restricted to the modification which the embodiment of Figure 2 respresents over the embodiment shown in Figure 1. This modification resides in the fact that, when a thread breakage occurs, the sliver S which continues to arrive from the pair 1, 2 of delivery rollers is deflected from its direction of travel by the suction air current flowing into the suction tube 80, this sliver S being conveyed, through the opening 42 in the housing 40, into the suction tube 80. As is illustrated in Figure 1, the bound yarn G and the binding thread B are then combined in this suction air stream of the suction tube 80, which suction air stream deflects the sliver S. Accordingly, all three components, namely sliver S, bound yarn G and binding thread B are combined in a single suction air stream. However, it has to be ensured that the inlet end of the hollow spindle 3 lies a sufficient distance from the cover 41 to ensure that the sliver S will not be gripped by this end of the hollow spindle 3 and thrown outwards or coiled round the hollow spindle 3. Due to the hollow spindle 3, and the apparatus parts lying downstream of it, being brought into operation in the above-described way, the three components to be joined are twisted together in the suction air stream of the suction tube 80. As a relatively large fibre tuft can form the three components are joined in this way in the suction tube 80, the thread assembly is severed, at an appropriate time, in the suction tube 81. This is done by a cutting device 84, which is actuated by an electromagnet similarly to the way in which the slider 82 is actuated by means of an associated electromagnet (Figure 1). In other respects the process of effecting thread joins is similar to that described with reference to Figure 1.

The process whereby the bound yarn G is returned to a point situated between the delivery rollers 1, 2 and the inlet end of the hollow spindle 3—and whereby this yarn G is combined with the binding thread B at this point, and whereby these two components G and B are twisted, with the sliver S, by bringing the hollow spindle 3 into operation—can also be performed with a binding apparatus, whose hollow spindle 3 and the package 4 with the binding thread are not closed by the housing 40 shown in Figures 1 and 2. This embodiment is illustrated in Figure 3. In this embodiment use is made of a suction tube 86, which is movable between the inlet end of the hollow spindle 3 and the delivery rollers 1, 2, for producing a second air suction current, instead of the suction tube 80 which opens out, into the housing 40, eccentrically of the hollow spindle 3. This suction tube 86 is connected, or is connectable, to the suction device 8 and is manipulated by the operator. Conveniently, the suction tube 86 will have a choke valve 87.

After a thread breakage has been detected by the thread-monitoring unit 9, in the above-described manner, the sliver S arriving from the pair of delivery rollers 1, 2 is deflected from its direction of travel by the first suction air stream of the suction tube 81, the hollow spindle 3 is stopped, the presser roller is lifted away from the driven draw-off roller 5 and the package SP is lifted away from the drive drum 7. The end of the bound yarn G unwound from the package SP is then introduced into the hollow spindle, possibly together with the binding thread B which is still present in the hollow spindle 3, is drawn through this spindle 3 in the direction of the delivery rollers 1, 2, and is pulled into the suction tube 86 by bringing the mouth of the suction tube 86 (the choke valve 87 being opened) into the vicinity of the inlet opening of the hollow spindle 3. If the binding thread B has been broken, its end is manually sought on a package 4, and it also is introduced into the suction tube 86. The thread length unwound from the package SP and the package 4 are each so controlled that a specific length of the bound yarn G and of the binding thread B will be present in the suction tube 86. Thus, the binding thread B and the bound thread G are combined in the suction air current of the suction tube 86, and are held under tension by this suction air current.

The suction tube 86 is then brought into a position, between the inlet opening of the hollow spindle 3 and the pair of delivery rollers 1, 2, such that, when the slider 82 of the suction tube 81 then closes, the sliver from the first suction air stream of the suction tube 81 jumps into the second suction air current of the suction tube 86. The slider 82 is conveniently closed shortly before or at the same time as the hollow spindle 3, and the components of the apparatus which lie downstream of this spindle 3, are brought into operation. The three components, namely binding yarn B, bound yarn G, and sliver S, which are then combined in the suction air current of the suction tube 86 are twisted together by the rotation of the ends of the binding yarn B and bound yarn G leaving the suction tube 86, drawn off by the pair of draw-off rollers 5, 6 and taken up by the package SP. For facilitating the twisting process, particularly in the case of fine yarns, the choke valve 87 is actuated. After the thread join has been completed, the slider 82 of the suction tube 81 is re-opened. The suction tube 86 can then be used for effecting thread joins at other spinning stations.

The method according to the invention for effecting a thread join has been described by use of a binding device with a driven hollow spindle. However, this method may also be implemented by use of a binding apparatus including a

stationary hollow spindle and a driven binding thread package. Modifications can also be made to the devices described for performing the method, that is to say to the mechanisms for moving the lift-off devices. For example, electromagnets can be replaced by pneumatic or hydraulic actuating means for the lift-off devices; alternatively, the lift-off devices may be manually actuated. Also, the switching means may be modified, for example the presser roller of the pair of draw-off rollers may be lifted off by way of a manually-actuated switch instead of by way of a switch which is actuated by the belt lift-off device. As another example of this, the package which receives the binding yarn may be lifted away by means of a switch actuated manually instead of by means of a switch actuated by the belt lift-off device.

Also, the procedure whereby the presser roller 5 of the pair of draw-off rollers is lifted away from the driven roller 5 may be dispensed with if, when the thread-monitoring unit 9 responds, a thread gripping device 63 (Figure 2), arranged between the hollow spindle 3 and the pair 5, 6 of draw-off rollers, prevents any possible further draw-off of the binding thread B from its package 4, and if, during the following process carried out for effecting the join and as described above, the bound yarn G arriving from the hollow spindle 3 only arrives between the draw-off rollers 5, 6 after the package SP has been juxtaposed to the drive drum 7.

Claims

1. A method for making a joint in a bound yarn, which has been produced, by means of a hollow spindle, from a sliver delivered by a pair of delivery rollers and from a binding thread running off a package, the produced yarn being drawn out of the hollow spindle and wound up on a package, characterised in that the sliver which continues to leave the pair of delivery rollers after a thread breakage is deflected from its path of travel by a suction air stream and, after the hollow spindle and the package with the bound yarn have been stopped, the end of the bound yarn is returned, through the hollow spindle, to a point between the hollow spindle and the pair of delivery rollers, and is there combined with the end of the binding thread, whereupon the two thread ends are twisted with the sliver by bringing the hollow spindle back into operation, and the production of the bound yarn is continued.

2. A method according to Claim 1, characterised in that the sliver is deflected from its path of travel to the hollow spindle by a first suction air stream, and the binding thread and the bound yarn are combined in a second suction air stream, whereupon the sliver is transferred into the second suction air stream, and is twisted with the binding thread and the bound yarn by bringing the hollow spindle back into operation.

3. A method according to Claim 1, characterised in that the binding thread and the bound yarn are combined in the suction air stream, which deflects the sliver, and are twisted with the sliver by bringing the hollow spindle back into operation.

4. Apparatus for performing the method according to any of Claims 1 to 3, with a pair of delivery rollers for delivering a sliver, downstream of which are a package (with binding thread) arranged on a belt-driven hollow spindle, a pair of draw-off rollers, and a take-up device, characterised by: a belt lift-off device, and a lift-off device for a package which contains the produced bound yarn, which lift-off devices are actuatable by way of switching devices; and at least one suction tube which is disposed between the pair of delivery rollers and the hollow spindle and whose suction opening is in the vicinity of the path of travel of the sliver.

5. Apparatus according to claim 4, characterised in that the hollow spindle, with the package arranged on it, is surrounded by a stationary housing having a through opening for through travel of the sliver, the suction tube opening out eccentrically of the hollow spindle into the housing.

6. Apparatus according to claim 5, characterised in that the housing has air inlet openings.

7. Apparatus according to claim 5, characterised in that a second, stationary suction tube is associated with the suction tube which opens into the housing, the suction opening of which tube lies in the vicinity of the nip of the pair of delivery rollers.

8. Apparatus according to claim 4, characterised in that there is provided a stationary suction tube, which opens out close to the nip of the pair of delivery rollers, and a suction tube which is movable between the inlet opening of the hollow spindle and the pair of delivery rollers.

9. Apparatus according to claim 7 or claim 8, characterised in that a respective cut-off or closure member is associated with the suction tube which opens out into the housing and the suction tube which opens out in the vicinity of the nip of the pair of delivery rollers.

10. Apparatus according to claim 8, characterised in that the movable suction tube has a choke valve.

11. Apparatus according to claim 9, characterised in that the cut-off member of the suction tube, which opens out in the vicinity of the nip of the pair of delivery rollers, can be brought into the cut-off position by an electromagnet which is actuatable by way of a switching device.

12. Apparatus according to any of claims 4 to 11, characterised in that the lift-off device for the package is movable in the direction of the package by way of a switch which is actuatable by the belt lift-off device.

13. Apparatus according to any of claims 4 to 12, characterised by a lift-off device for the presser roller of the pair of draw-off rollers, which device is actuatable by way of switching devices.

14. Apparatus according to any of claims 4 to

stationary hollow spindle and a driven binding thread package. Modifications can also be made to the devices described for performing the method, that is to say to the mechanisms for moving the lift-off devices. For example, electromagnets can be replaced by pneumatic or hydraulic actuating means for the lift-off devices; alternatively, the lift-off devices may be manually actuated. Also, the switching means may be modified, for example the presser roller of the pair of draw-off rollers may be lifted off by way of a manually-actuated switch instead of by way of a switch which is actuated by the belt lift-off device. As another example of this, the package which receives the binding yarn may be lifted away by means of a switch actuated manually instead of by means of a switch actuated by the belt lift-off device.

Also, the procedure whereby the presser roller 5 of the pair of draw-off rollers is lifted away from the driven roller 5 may be dispensed with if, when the thread-monitoring unit 9 responds, a thread gripping device 63 (Figure 2), arranged between the hollow spindle 3 and the pair 5, 6 of draw-off rollers, prevents any possible further draw-off of the binding thread B from its package 4, and if, during the following process carried out for effecting the join and as described above, the bound yarn G arriving from the hollow spindle 3 only arrives between the draw-off rollers 5, 6 after the package SP has been juxtaposed to the drive drum 7.

Claims

1. A method for making a joint in a bound yarn, which has been produced, by means of a hollow spindle, from a sliver delivered by a pair of delivery rollers and from a binding thread running off a package, the produced yarn being drawn out of the hollow spindle and wound up on a package, characterised in that the sliver which continues to leave the pair of delivery rollers after a thread breakage is deflected from its path of travel by a suction air stream and, after the hollow spindle and the package with the bound yarn have been stopped, the end of the bound yarn is returned, through the hollow spindle, to a point between the hollow spindle and the pair of delivery rollers, and is there combined with the end of the binding thread, whereupon the two thread ends are twisted with the sliver by bringing the hollow spindle back into operation, and the production of the bound yarn is continued.

2. A method according to Claim 1, characterised in that the sliver is deflected from its path of travel to the hollow spindle by a first suction air stream, and the binding thread and the bound yarn are combined in a second suction air stream, whereupon the sliver is transferred into the second suction air stream, and is twisted with the binding thread and the bound yarn by bringing the hollow spindle back into operation.

3. A method according to Claim 1, characterised in that the binding thread and the bound yarn are combined in the suction air stream, which deflects the sliver, and are twisted with the sliver by bringing the hollow spindle back into operation.

4. Apparatus for performing the method according to any of Claims 1 to 3, with a pair of delivery rollers for delivering a sliver, downstream of which are a package (with binding thread) arranged on a belt-driven hollow spindle, a pair of draw-off rollers, and a take-up device, characterised by: a belt lift-off device, and a lift-off device for a package which contains the produced bound yarn, which lift-off devices are actuatable by way of switching devices; and at least one suction tube which is disposed between the pair of delivery rollers and the hollow spindle and whose suction opening is in the vicinity of the path of travel of the sliver.

5. Apparatus according to claim 4, characterised in that the hollow spindle, with the package arranged on it, is surrounded by a stationary housing having a through opening for through travel of the sliver, the suction tube opening out eccentrically of the hollow spindle into the housing.

6. Apparatus according to claim 5, characterised in that the housing has air inlet openings.

7. Apparatus according to claim 5, characterised in that a second, stationary suction tube is associated with the suction tube which opens into the housing, the suction opening of which tube lies in the vicinity of the nip of the pair of delivery rollers.

8. Apparatus according to claim 4, characterised in that there is provided a stationary suction tube, which opens out close to the nip of the pair of delivery rollers, and a suction tube which is movable between the inlet opening of the hollow spindle and the pair of delivery rollers.

9. Apparatus according to claim 7 or claim 8, characterised in that a respective cut-off or closure member is associated with the suction tube which opens out into the housing and the suction tube which opens out in the vicinity of the nip of the pair of delivery rollers.

10. Apparatus according to claim 8, characterised in that the movable suction tube has a choke valve.

11. Apparatus according to claim 9, characterised in that the cut-off member of the suction tube, which opens out in the vicinity of the nip of the pair of delivery rollers, can be brought into the cut-off position by an electromagnet which is actuatable by way of a switching device.

12. Apparatus according to any of claims 4 to 11, characterised in that the lift-off device for the package is movable in the direction of the package by way of a switch which is actuatable by the belt lift-off device.

13. Apparatus according to any of claims 4 to 12, characterised by a lift-off device for the presser roller of the pair of draw-off rollers, which device is actuatable by way of switching devices.

14. Apparatus according to any of claims 4 to

12, characterised in that a thread gripping device is arranged between the hollow spindle and the pair of draw-off rollers.

15. A method of producing a bound yarn substantially as hereinbefore described.

16. Apparatus for producing a bound yarn and constructed substantially as hereinbefore described with reference to, and as shown in, any of Figures 1 to 3 of the accompanying drawings.

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