United States Patent [19]

Northup et al.

[11] **3,899,867**

[45] **Aug. 19, 1975**

[54] **METHOD AND APPARATUS FOR FORMING HELICALLY WRAPPED YARNS**

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[22] Filed: **July 15, 1974**

[21] Appl. No.: **488,810**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 279,944, Aug. 11, 1972, Pat. No. 3,831,369.

[52] **U.S. Cl.** **57/18;** 57/106; 57/160

[51] **Int. Cl.** **D02g 3/28;** D01h 7/18

[58] **Field of Search** ..... 57/3, 6, 18, 19, 34 R, 57/52, 54, 58.52, 59, 78, 88, 89, 91, 106, 108, 156, 160

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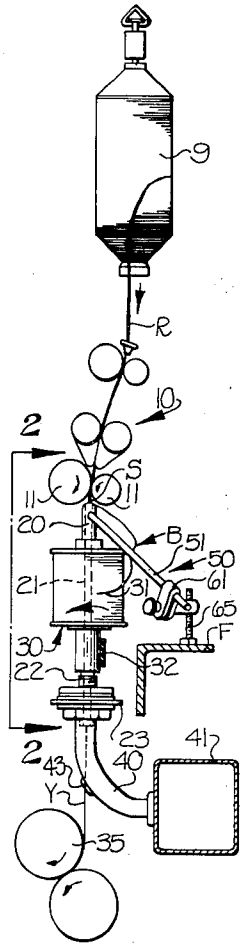
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[57] **ABSTRACT**

A method and apparatus for obtaining a higher quality wrapped yarn during a wrapping operation wherein a binder strand, carried by a package mounted for rotation on a hollow spindle, is wrapped around a core strand moving through the hollow spindle during which the binder strand inherently balloons outwardly in its path of travel from the package to the core strand being wrapped, and wherein the normal path of travel of the ballooning strand is intermittently and repeatedly interrupted so as to partially collapse and impart an undulating movement to the ballooning binder strand to effect a whip-like action thereto causing fiber waste picked up by the binder strand to be cast off the same. Also, any picked-up fiber waste still adhering to the ballooning binder strand is attenuated and moved along the binder strand toward the core strand so that the attenuated picked-up fiber waste will be less discernible in the wrapped yarn. Suction means communicates with the hollow spindle for facilitating the passage of the wrapped yarn therethrough.

20 Claims, 5 Drawing Figures



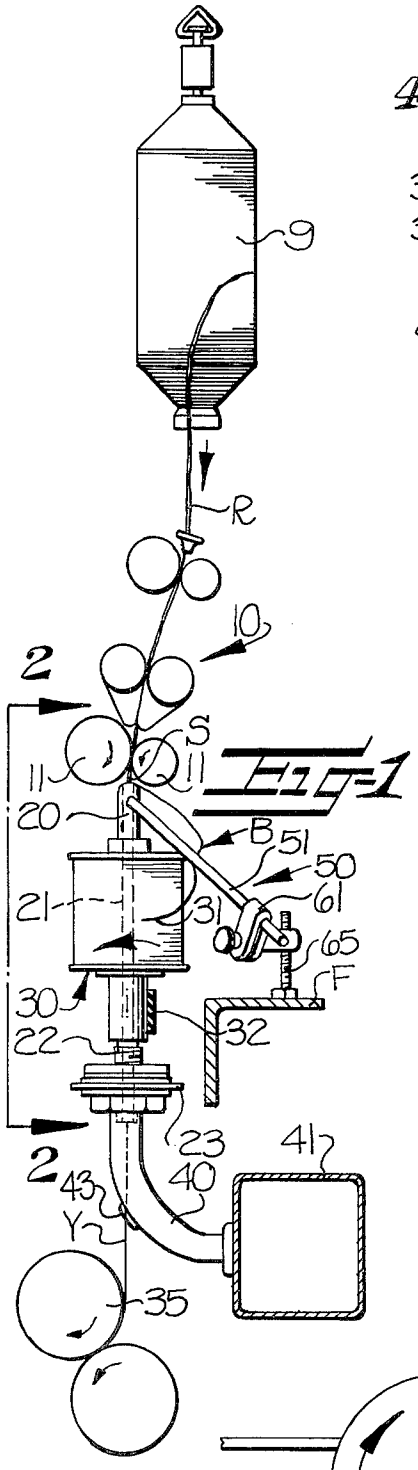


Fig-1

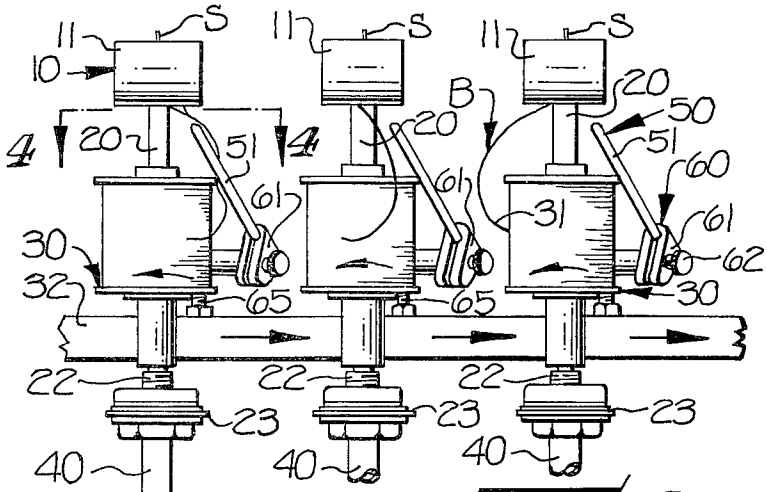


Fig-2

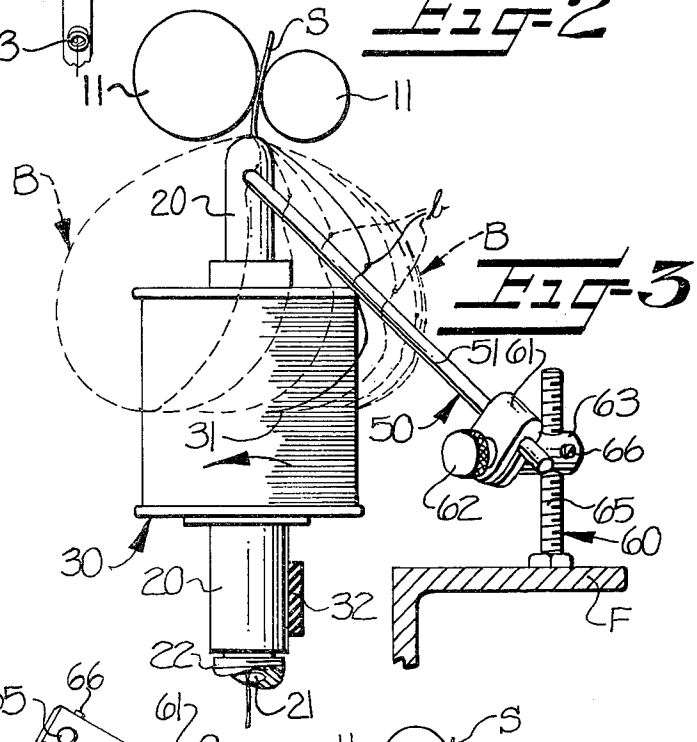


Fig-3

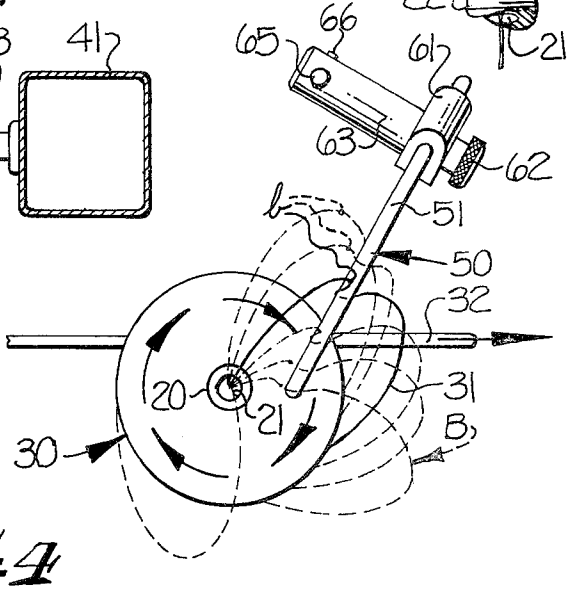


Fig-4

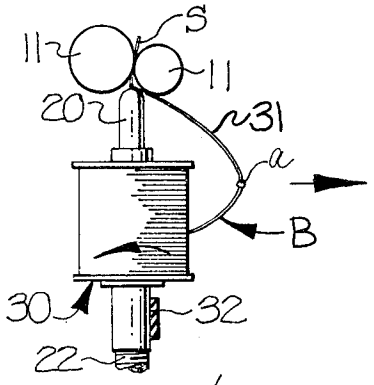


Fig-5

METHOD AND APPARATUS FOR FORMING HELICALLY WRAPPED YARNS

This application is a continuation-in-part of our copending application Ser. No. 279,944, filed Aug. 11, 1972, now U.S. Pat. No. 3,831,369, and entitled YARN STRUCTURE AND METHOD OF MAKING SAME.

This invention relates to the art of producing wrapped yarns in which a cover strand or binder strand is helically wrapped around a core strand or strands to form each wrapped yarn, and it is the primary object of the invention to provide an improved method and apparatus for obtaining higher quality wrapped yarns while substantially reducing or eliminating ends-down conditions generally attendant to the ballooning of a binder strand picking up airborne fiber waste thereon during rotation of the ballooning binder strand being wrapped around a core strand.

Most wrapped or covered yarns are formed by directing a core strand through a hollow spindle as a ballooning binder strand is being withdrawn from a rotating package on the spindle and is being wrapped around the core strand. In some instances, it is particularly desirable, if not necessary, that the wrapping of the core strand is effected closely adjacent that end of the hollow spindle into which the core strand is being directed, since the hollow spindle then aids in better controlling the wrapping of the binder strand on the core strand and in guiding the core strand during the wrapping process. This is particularly the case in the forming of a wrapped yarn having a core strand formed of drafted untwisted staple fibers about which a binder strand is being wrapped.

A wrapped yarn formed in the manner last described is disclosed in our said copending application Ser. No. 279,944, and wherein a drafted core strand of substantially parallel untwisted staple fibers is directed from a pair of delivery rolls into one end of and through a hollow spindle having a rotating package of a binder strand wound thereon. The binder strand is withdrawn from the package and wrapped around the core strand adjacent said one end of the hollow spindle to form the wrapped yarn, and such end of the spindle is so positioned adjacent the delivery rolls that the staple fibers of the core strand are engaged by and extend from the delivery rolls while their leading ends are being wrapped by the binder strand. Thus, the binder strand cooperates with the delivery rolls to maintain the integrity of the untwisted drafted core strand of staple fibers as it is being wrapped by the binder strand adjacent the ingress end of the hollow spindle.

As is well known, substantial amounts of fiber waste in the form of fine airborne waste fibers, known as "fly," are generated by textile machines which process staple fibers and form textile strands therefom. It can be appreciated, therefore, that substantial amounts of fiber waste generally are present in the ambient air adjacent machines for wrapping binder strands about core strands formed of untwisted staple fibers. It is also well known that, during the forming of a wrapped yarn in the manner indicated above, the binder strand inherently balloons outwardly in its path of travel from the package to the core strand being wrapped; i.e., a rapidly rotating ballooning binder strand is present between each binder strand package and the end of the respective spindle adjacent which the binder strand is being wrapped around the respective core strand. Such rapidly rotating ballooning binder strand picks up fiber waste from the ambient air during rotation thereof, and while some of the picked up fiber waste is quickly thrown off of the ballooning binder strand by centrifugal force, much of the fiber waste adheres to the rotating ballooning binder strand.

Heretofore, in many instances, the fiber waste picked up by the rotating ballooning binder strands has adhered thereto and other fibers have accumulated on the fiber waste so that substantial masses or wads of fiber waste were formed on the binder strands. In some instances, such wads of fiber waste were continuously being "skinned" back along the binder strand to reside in the ballooning area of the binder strand and would ultimately break loose from the ballooning binder strand and be thrown into adjacent ballooning binder strands, resulting in rupture thereof. However, some of such wads of accumulated fiber waste would eventually cling to the binder strand and no longer be "skinned" back and thus would be carried along with the binder strand to be wrapped about the core strand, thus resulting in objectionable slubs or enlarged places in the wrapped yarn being formed. Such defects would, of course, reduce the quality of the wrapped yarn. Also, such defects oftentimes would cause breakage of the wrapped yarn in subsequent processes, such as during passage of the wrapped yarn through yarn guides and needles of knitting machinery or through stop motions, heddles and reeds of weaving machinery.

It has also been determined that one of the causes for ends-down conditions on yarn wrapping machines of the character described resides in the fact that picked-up fiber waste accumulated on the ballooning binder strand would increase to such a mass and weight that centrifugal forces acting thereon would increase the width or diameter of the ballooning binder strand to such an extent that it would strike and become entangled with the ballooning binder strand of an adjacent yarn forming unit of the wrapping machine, resulting in breaking of both of the binder strands. More frequently, such wads of fiber waste accumulated on the ballooning binder strand would be carried into the hollow spindle and would frequently choke the spindle to such extent as to prevent the binder strand and the core strand from being drawn through the hollow spindle by the usual associated yarn take-up means, with the result that the binder strand and/or the core strand would become ruptured. The problem of such ends-down conditions is particularly serious in the forming of wrapped yarns in accordance with our aforementioned copending application because, in the event of parting of the binder strand, with the attendant failure of the binder strand to be wrapped about the drafted core strand, since the core strand cannot then sustain its own integrity, it moves away from the delivery rolls toward the hollow spindle in the form of an uncontrolled mass of opened fibers. Such uncontrolled fibers quickly disseminate in the ambient air currents and oftentimes will settle on other yarns being processed on the machine, thus resulting in such other yarns being of inferior quality or causing such other yarns to break and thereby further aggravating the ends-down problem.

According to the present invention, we have discovered that the adverse affects of the airborne fiber waste picked up by the ballooning binder strands is sustantially nullified by insuring that most airborne fiber

waste picked up by the ballooning binder strands will be cast off the same, that no large masses of accumulated fiber waste will be formed on the ballooning binder strands, and that any fiber waste which still adheres to the binder strand as it is being wrapped around the core strand will be of such small size as to be less discernible and not adversely affect the quality of the wrapped yarn being produced. Further, since the binder strand is free of any wads of fiber waste, the passage of the wrapped yarn through the hollow spindle will no longer be encumbered thereby.

Accordingly, it is a more specific object of this invention to prove a method and apparatus for obtaining a higher quality wrapped yarn wherein the normal path of travel of a ballooning binder strand in its course from a package to a core strand being wrapped is intermittently and repeatedly partially collapsed by intermittently and repeatedly interrupting the normal path of travel of the ballooning binder strand so as to impart an undulating movement thereto to cause most fiber waste picked up by the binder strand to be cast off the same.

It is still another object of this invention to provide a method and apparatus of the character described wherein the intermittent and repeated interrupting of the normal path of travel of the ballooning binder strand is effected in such a manner that any picked-up fiber waste still adhering to the ballooning binder strand during its undulating movement will be attenuated along the binder strand so that when the attenuated picked-up fiber waste is wrapped around the core strand with the binder strand, such attenuated picked-up fiber waste will be less discernible in the wrapped yarn.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which

FIG. 1 is a schematic substantially vertical sectional view of a yarn forming unit of a yarn wrapping machine and including a drafting unit, a hollow spindle and a yarn take-up means, and illustrating a preferred embodiment of apparatus in association therewith for intermittently and repeatedly interrupting the path of travel of a ballooning binder strand from a binder strand package to a core strand so as to collapse and impart a whip-like action to the ballooning binder strand in accordance with the invention;

FIG. 2 is a view looking at the left-hand side of FIG. 1 substantially along line 2—2, but illustrating three of the yarn forming units of the machine;

FIG. 3 is an enlarged elevation of the central portion of FIG. 1 and particularly illustrating, in broken lines, various positions occupied by a ballooning binder strand during each revolution thereof;

FIG. 4 is an enlarged fragmentary plan view looking down substantially along line 4—4 in FIG. 2; and

FIG. 5 is a fragmentary view similar to the central portion of FIG. 1, but omitting the means for interrupting the path of travel of the ballooning binder strand so as to illustrate how a mass or wad of airborne fiber waste would accumulate on the binder strand upon failure to cause picked-up fiber waste to be cast off the binder strand in accordance with the invention.

Referring more specifically to the drawings, suitable apparatus for forming wrapped yarns is best shown in FIG. 1 as being of the general type disclosed in our said copending application Ser. No. 279,944. One of the yarn forming units of a yarn wrapping machine is illustrated in FIG. 1, and three such units are partially illustrated in FIG. 2. As shown in FIG. 1 a strand of staple fibers, such as a roving R, is taken from a package or other suitable source 9. The roving R is directed into and drafted through a suitable drafting unit 10 shown extending in a generally vertical position and provided with a pair of delivery rolls 11 for delivering the thus drafted core strand S formed of roving R to the yarn covering or wrapping station.

The yarn covering or wrapping station is located adjacent the ingress end of a hollow wrapping spindle 20 which may be of conventional or other desired construction capable of rotatably supporting thereon a removable spool 30 or other suitable package of a binder strand 31 wound on the spool 30. Binder strand 31 preferably is continuous and may be in the form of a continuous multifilament synthetic strand, such as nylon. As preferred, each spool 30 is shown as having flanges on opposite ends thereof.

The machine is equipped with a suitable spindle driving member or belt 32 engaged by spindles 20 so as to rotate each spool 30 during the forming of the respective wrapped yarn Y. The binder strand 31 extends upwardly from each spool 30 and, due to high-speed rotation of spool 30, centrifugal force causes the binder strand 31 to form a rapidly rotating balloon B in its travel from spool 30 to the wrapping station adjacent the free upper end of spindle 20 as the binder strand is being wrapped about the drafted core strand S.

As the binder strand 31 is being wrapped about the core strand S, it forms spaced-apart helices on the core strand S as the core strand, in untwisted condition, passese from the delivery rolls 11, downwardly along an axial yarn passageway 21 (FIG. 1) through the respective hollow spindle 20 and to take-up rolls or any other suitable take-up means 35. As preferred, the hollow spindle 20 is so constructed that it includes the usual tubular body 22, only the lower portion of which is shown in FIGS. 1 and 2, and which is suitably mounted in a bracket 23 carried by the frame F of the wrapping machine.

The lower end portion of the tubular body 22 of each spindle 20 extends through the portion of the bracket 23 shown in FIGS. 1 and 2 and has a suitable means connected thereto and defining an airflow passageway. As shown, the airflow passageway is defined by a respective airflow suction tube or conduit 40 having one end communicatively connected to passageway 21 in spindle body 22. The suction tubes 40 from all of the spindle bodies 22 of FIG. 2 extend to a suitable suction and collection device shown schematically at 41 in FIG. 1.

Thus, a continuous suction airflow is induced along the axial passageways of the hollow spindles 20 in the direction of movement of the wrapped yarn therethrough to prevent waste material, such as lint, from accumulating in the hollow spindles and interfering with passage of the wrapped yarn therethrough. The suction airflow also aids in directing the fibers of the drafted strand S into the upper end of each spindle 20 during the wrapping of the binder strands about the core strands. It will be observed in FIG. 1 that the lower portion of the wall of the suction tube 40 there shown is provided with a suitable eyelet or egress opening 43 therethrough for passage of the helically wrapped yarn

Y from the lower end of spindle **20** through the suction tube **40** to take-up means **35.**

As indicated in said copending application, it is advantageous to form the yarn Y by wrapping a continuous filament binder strand about a core strand of substantially parallel, untwisted stapple fibers, because such a yarn may be produced efficiently at substantially higher speeds than is the case with respect to spun yarns produced on ring spinning machines having rings and travelers for effecting the spinning operation, it being well known that the production rate is limited by the mechanical limitations of the speed of a ring traveler in its movement around the respective spinning ring. On the other hand, as explained earlier herein, because of the drafted core strand S being of staple fibers in untwisted condition, it is preferred that the free or upper end of spindle **20** is so positioned adjacent delivery rolls **11** that the staple fibers of the drafted strand S are engaged by and extend from the delivery rolls **11** of drafting unit **10** while their leading ends are being wrapped by binder strand **31** adjacent the ingress end of the respective hollow spindle **20.**

Also, because of the drafted strand being of staple fibers in untwisted condition, in the event of an ends-down condition in which the binder strand **31** becomes exhausted or is parted, with attendant failure of the binder strand to be wrapped about the drafted core strand S, the core strand cannot sustain its own integrity and, thus, it would then move away from delivery rolls **11** as an uncontrolled mass of opened fibers. As stated earlier herein, such uncontrolled fibers quickly disseminate in ambient air currents and oftentimes will settle on other yarns being processed through the adjacent spindles **20,** thus resulting in others of the yarns being formed of inferior quality or causing such other yarns to rupture and thereby further aggravating the ends-down problem.

As further stated earlier herein, substantial amounts of fiber waste in the form of fine airborne waste fibers, known as "fly," are generated by textile machines which process staple fibers and form textile strands therefrom. Consequently, as represented in FIG. **5,** in the absence of any means for intermittently and repeatedly partially collapsing and imparting an undulating movement to the ballooning binder strand in accordance with this invention, the airborne fiber waste picked up by and adhering to the rapidly rotating binder strand balloon frequently would continue to pick up and accumulate large masses of fiber waste thereon to form wads such as that indicated at *a* in FIG. **5.**

As indicated by the arrow in the right-hand central portion of FIG. **5,** the wad *a* increases the outward or centrifugal force acting on the ballooning binder strand so that, if the wad *a* does not break away from the binder strand and is continuously "skinned" back along the binder strand, the wad *a* continues to increase in size and results in rupture of the binder strand or adjacent binder strands as explained heretofore. Also, if such wads of fiber waste adhere to and are caused to move upwardly along the binder strand, such wads are wrapped around the binder strand to form objectionable slubs in the wrapped yarn being formed. Also, such wads *a* being formed on and then being carried upwardly along the rotating ballooning binder strand frequently would choke the hollow spindle **20** to such an extent as to bind and cause rupture of the binder strand **31** and/or the core strand S within the hollow spindle.

According to the invention, in order to obtain a higher quality of wrapped yarn and to reduce ends-down conditions, there is provided an improved method and apparatus for insuring that most of the airborne fiber waste picked up by each ballooning binder strand is cast off the same and that any picked up fiber waste which is not cast off the ballooning binder strand and is still adhering to the same will be attenuated so that it will be less discernible in the wrapped yarn being formed. Since the still adhering fiber waste is attenuated, no wads of fiber waste will be formed on the binder strand or in the wrapped yarn. As indicated above, the picked-up fiber waste is largely cast off each binder strand balloon B by intermittently and repeatedly collapsing the ballooning of the binder strand to effect a whip-like action thereto by intermittently and repeatedly interrupting the normal path of travel of the ballooning binder strand.

To this end, during each revolution of each binder strand balloon B, the binder strand balloon wipingly engages an elongate balloon-interrupting obstruction, broadly designated at **50,** positioned in the path of travel of the ballooning binder strand being so constructed and arranged as to collapse the ballooning of the binder strand while imparting an undulating movement thereto to cause fiber waste picked up by the binder strand to be cast off the same.

Each elongate balloon-interrupting obstruction **50** is shown in FIGS. **1–4** in the form of an elongate rod **51** which preferably is round in cross-section and is of relatively small cross-sectional area as compared to the size of the balloon B of the binder strand **31.**

Each rod **51** is positioned to extend upwardly at an incline from outwardly below the outermost portion of the binder strand balloon B and has a free upper end terminating adjacent the free upper end of the hollow spindle **20,** but below the same and offset to one side of the hollow spindle, so that the ballooning binder strand will initially engage the rod **51** at a location below the widest portion of the ballooning binder strand and will be wipingly engaged by the elongate rod **51** as the ballooning binder strand moves upwardly along and then around and past the free end of the rod **51** between the spool **30** and the hollow spindle **20.** The offset relation of the free upper end of the rod **51** to one side of the hollow spindle **20** is best illustrated in FIG. **4** wherein it will be observed that the free end of the rod **51** is so positioned that the rod extends tangentially to an imaginary circle generated about the axis of the hollow spindle **20,** with such imaginary circle having a diameter greater than that of the free upper end of the spindle **20** but preferably substantially less than that of the flanged upper end of the respective spool **30.**

As will be observed in FIG. **4,** desirably the free upper end of the elongate rod **51** terminates inwardly of the normal path of the balloon B defined by the ballooning binder strand to effect an enhanced collapsing and undulation of the binder strand balloon **50** during each revolution thereof. To also insure that the binder strands will not become entangled with and ruptured by the respective rods **51,** it is to be noted that the direction of rotation of the spool **30** (FIG. **4**) is such that the portion of the spool over which the elongate balloon-interrupting rod **51** extends is moving in a direction

generally toward that direction toward which the free end of the rod **51** is facing. Thus, the ballooning binder strand will not move over or past the outer side of the rod **51** but will always pass inwardly of the rod **51** as shown in FIG. **4.**

To further insure that the balloon-obstructing rods **51** will not damage or rupture the respective binder strand **31** as the balloons B thereof repeatedly strike and are distorted by the obstruction rods **51,** it is preferred that each rod **51** is provided with a substantially smooth peripheral surface having a relatively low coefficient of friction. Accordingly, it is preferred that each rod **51** is formed of a synthetic plastic material, such as Teflon (trademark). Any suitable means may be provided for adjustably supporting each rod **51** in a predetermined inclined position relative to the respective spindle **20** during the operation of the machine.

To this end, it will be observed in FIGS. **1–4** that the lower portion of each rod **51,** remote from its free end, is mounted on a supporting means, broadly designated at **60,** positioned outwardly of the respective spool **30.** As shown, each rod **51** is clampingly secured, for longitudinal adjustment toward and away from the upper portion of spindle **20,** in an inverted substantially U-shaped clamping block **61** through which one end portion of the respective rod **51** extends. Each clamping block **61** is suitably adjustably secured, as by a suitable clamping or adjustment screw **62,** to a lateral bracket **63.** Adjustment screw **62** is arranged to permit pivotal or angular adjustment of the clamping block **61** and the respective rod **51** about a substantially horizontal axis relative to bracket **63.** Bracket **63** is mounted for adjustment about a substantially vertical axis on a threaded post **65** to which the respective bracket **63** is adjustably secured, as by means of an adjustment screw **66.** It should be noted that each bracket **63** also may be vertically adjusted on post **65** substantially parallel to the axis of the respective spindle **20.**

Each post **65** has its lower portion suitably secured to a fixed part of the frame F as best shown in FIGS. **1** and **3.** From the foregoing description, it is apparent that each rod **51** may be adjusted to extend at any predetermined angle, preferably an acute angle, with respect to the axis of the respective spindle **20,** simply by adjusting each respective clamping block **61** about the substantially horizontal axis of screw **62.** It is also apparent that each rod **51** may be adjusted inwardly and outwardly toward and away from the axis of the respective spindle **20** so as to overlie the upper end flange of the respective spool **30.** Such inward and outward adjustment of each rod **51** may be effected by adjusting bracket **63** about the supporting post **65** and by adjusting each rod **51** longitudinally in the respective block **61.** Additionally, each rod **51** may be adjusted parallel to the axis of the respective spindle **20** by adjusting bracket **63** along the respective post **65.** It is thus seen that each supporting means **60** provides for universal adjustment of the respective rod **51** relative to the frame F and, thus, relative to the respective spindle **20** and delivery rolls **11.**

As indicated above, as shown in FIG. **4,** it is preferred that each elongate rod **51** is positioned so that it extends at an acute angle or incline past and closely adjacent the upper flange of the respective spool **30,** with the rod **51** extending upwardly beyond the latter flange and generally toward the free upper end of the respective spindle **20.** Thus, the ballooning binder strand **31** will slide along the upwardly inclined rod **51** so that any picked-up fiber waste still adhering to the binder strand will be progressively attenuated while moving toward the core strand S, as indicated by the path of the adhering fiber waste *b* in FIG. **3,** during the undulating movement of the ballooning binder strand. It is to be noted that centrifugal force tends to throw the fiber waste outwardly toward the widest portion of each binder strand balloon B, but the respective rod **51** is arranged so as to progressively and gradually cam the adhering fiber waste *b* upwardly even though the adhering fiber waste may slide past the rod **51** in the course of each of several successive revolutions of the ballooning binder strand. Such sliding of the adhering fiber waste past rod **51** aids in the attenuation of the fiber waste, and if the adhering fiber waste is not cast off the ballooning binder strand, it ultimately will reach the uppermost portion of the balloon B so as to be wrapped about the core strand along with the binder strand. It is believed that the intermittent and repeated interrupting of the normal path of travel of the ballooning binder strands and the undulation and partial collapsing thereof, as effected by the respective rods **51,** causes turbulence in the ambient air adjacent the binder strand balloons B so as to repel much of the airborne fiber waste from being attracted to such balloons, thus lessening the problem of fiber waste adhering to the ballooning strands.

It is desirable that each rod **51** be positioned so that the respective balloon B will strike the rod **51** and then will be so deflected and partially collapsed as to wrap at least about halfway around the respective rod **51** as indicated in the central portion of FIG. **4.** The rod **51** then applies a wiping action to the respective balloon in one direction along the binder strand until the binder strand passes beyond and is released by the respective rod **51,** thus effecting a whip-like action to the ballooning binder strand.

The partial collapsing and subsequent whip-like action of the ballooning binder strand during each revolution thereof causes the binder strand balloon B to cast off most of the fiber waste intercepted and picked up by the balloon B of the corresponding binder strand **31,** thus substantially improving the quality of the wrapped yarn being produced. Although some airborne fiber waste is not cast off the balloon B and remains adhering to the binder strand, such adhering fiber waste will be smoothed out and attenuated by the wiping action applied to the respective binder strand balloon B by rod **51,** in the manner heretofore described, so as to be less discernible, if at all, when wrapped about the core strand with the binder strand.

Since the suction tubes **40** and the source of suction **41** induce an airflow along each of the hollow spindles **20** in the direction of movement of the wrapped yarn Y therethrough, it can be appreciated that the airflow not only aids in directing the fibers of the core strand S into the upper end of the respective spindle **20,** but it also aids in directing into the hollow spindle **20** any attenuated fiber waste which has been carried to the upper end of the balloon B by the binder strand **31** during the wrapping of the corresponding binder strand around the core strand. This not only aids in effecting the wrapping of the core strand S by the attenuated picked-up fiber waste along with the respective binder strand **31,** but it also aids in directing such attenuated

picked-up fiber waste into the hollow spindle during the wrapping operation.

It is thus seen that we have provided an improved method and apparatus for obtaining a higher quality wrapped yarn during a wrapping operation and wherein the normal path of travel of the ballooning binder strand is intermittently and repeatedly interrupted so as to collapse the same and impart an undulating movement thereto as the binder strand is being wrapped about a core strand so as to cause the fiber waste picked up by the binder strand to be cast off the same to thus improve the quality of the wrapped yarn. It is seen further that the partial collapsing and undulating movement is effected in the ballooning binder strand by wipingly engaging the binder strand against an elongate obstruction positioned in the path of travel of the ballooning binder strand. It is seen further that the elongate obstruction effects the progressive attenuation, and movement along the binder strand toward the core strand, of any picked-up fiber waste still adhering to the ballooning binder strand during its collapsing or undulating movement so that the thus attenuated picked-up fiber waste will be less discernible in the wrapped yarn. It can also be seen that we have provided means defining an airflow passageway for communicatively connecting the hollow spindle to a source of suction to induce an airflow along the spindle in the direction of movement of the wrapped yarn therethrough for aiding in directing the core strand into the hollow spindle while preventing waste material, such as lint, from accumulating in the hollow spindle and interfering with the passage of the wrapped yarn therethrough. Additionally, any airborne fiber waste which remains adhering to the binder strand and is thus attenuated and carried up to the core strand by the binder strand will be aided in entering the free upper end of the hollow spindle by the airflow therethrough.

In the drawings and specification, there has been set forth a preferred embodiment of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation.

That which is claimed is:

1. A method of obtaining a higher quality wrapped yarn during a wrapping operation wherein a binder strand carried by a package mounted for rotation on a hollow spindle is wrapping a core strand moving through the hollow spindle and wherein the binder strand inherently balloons outwardly in its path of travel from the package to the core strand being wrapped, said method comprising intermittently and repeatedly interrupting the normal path of travel of the ballooning binder strand so as to impart an undulating movement thereto to cause fiber waste picked up by the binder strand to be cast off the same and to thus improve the quality of the wrapped yarn.

2. A method according to claim 1 which includes inducing an airflow into the spindle and along the same in the direction of movement of the wrapped yarn therethrough to prevent waste material, such as lint, from accumulating in the spindle and interfering with passage of the wrapped yarn therethrough.

3. A method of obtaining a higher quality wrapped yarn during a wrapping operation wherein a binder strand carried by a package mounted for rotation on a hollow spindle is wrapping a core strand moving through the hollow spindle and wherein the binder strand inherently balloons outwardly in its path of travel from the package to the core strand being wrapped, said method comprising intermittently and repeatedly partially collapsing the ballooning of the binder strand to effect a whip-like action thereto to cause fiber waste picked up by the binder strand to be cast off the binder strand and thus improve the quality of the wrapped yarn.

4. A method according to claim 3 wherein the step of intermittently and repeatedly partially collapsing the ballooning of the binder strand comprises wipingly engaging the binder strand against an elongate obstruction positioned in the path of travel of the ballooning binder strand.

5. A method according to claim 3 wherein the step of intermittently and repeatedly partially collapsing the ballooning of the binder strand is effected by positioning an elongate obstruction to extend from outwardly of the package of binder strand upwardly above the end of the package and adjacent the upper end of the hollow spindle for engaging the ballooning binder strand in its path of travel to and into the upper end of the hollow spindle.

6. A method of obtaining a higher quality wrapped yarn during a wrapping operation wherein a binder strand carried by a package mounted for rotation on a hollow spindle is wrapping a core strand moving through the hollow spindle and wherein the binder strand inherently balloons outwardly in its path of travel from the package to the core strand being wrapped, said method comprising intermittently and repeatedly interrupting the normal path of travel of the ballooning binder strand so as to impart an undulating movement thereto to cause fiber waste picked up by the binder strand to be cast off the same while progressively attenuating and moving along the binder strand toward the core strand any picked-up fiber waste still adhering to the ballooning binder strand during its undulating movement so the thus attenuated picked-up fiber waste will be less discernible in the wrapped yarn.

7. A method according to claim 6 which includes inducing an airflow along the hollow spindle in the direction of movement of the wrapped yarn therethrough for aiding in directing the attenuated picked-up fiber waste into the hollow spindle during the wrapping thereof around the core strand with the binder strand.

8. A method of obtaining a higher quality wrapped yarn during a wrapping operation wherein a binder strand carried by a package mounted for rotation on a hollow spindle is wrapping a core strand moving through the hollow spindle and wherein the binder strand inherently balloons outwardly in its path of travel upwardly from the package to the core strand being wrapped, said method comprising intermittently and repeatedly interrupting the normal path of travel of the ballooning binder strand by positioning an elongate obstruction to extend from outwardly of the package of binder strand upwardly above the upper end of the package and adjacent the upper end of the hollow spindle so as to impart an undulating movement to the ballooning binder strand to cause fiber waste picked up by the binder strand to be cast off the same while repeatedly wiping the ballooning binder strand along the elongate obstruction so as to progressively move in the direction of travel of the binder strand any picked-up fiber waste still adhering to the ballooning binder strand during its undulating movement to thereby pre-

vent the adhering fiber waste from remaining in the ballooning binder strand but along the binder strand and be wrapped around the core strand with the binder strand.

9. A method of obtaining a higher quality wrapped yarn during a wrapping operation wherein a binder strand carried by a package mounted for rotation on a substantially vertically positioned hollow spindle is wrapping a core strand moving downwardly through the hollow spindle and wherein the binder strand inherently balloons outwardly in its path of travel upwardly from the package to the core strand being wrapped, said method comprising intermittently and repeatedly partially collapsing the ballooning of the binder strand by wipingly engaging the binder strand against an elongate obstruction below the widest portion of the ballooning thereof and progressively thereafter in an upward direction toward the upper end of the spindle during each of a plurality of successive revolutions of the ballooning binder strand to cause fiber waste picked up by the binder strand to be cast off the same while causing any fiber waste still adhering to the ballooning binder strand to be attenuated along the binder strand so as to be wrapped around the core strand with the binder strand but to be less discernible in the wrapped yarn.

10. In a machine for making a higher quality wrapped yarn from a core strand and a binder strand, said machine comprising a hollow spindle having a package of binder strand mounted for rotation thereon and adapted to be wrapped around the core strand as the core strand is moving into one end of and through the hollow spindle and wherein the binder strand inherently balloons outwardly in its path of travel from the package to the core strand being wrapped, the combination therewith of means positioned in the path of travel of the ballooning binder strand for intermittently and repeatedly interrupting the path of travel of the ballooning binder strand and imparting an undulating movement thereto to cause fiber waste picked up by the binder strand to be cast off the same and to thus improve the quality of the wrapped yarn being formed.

11. Apparatus according to claim **10** including means defining an airflow passageway communicatively connecting said hollow spindle to a source of suction and arranged to induce an airflow along the hollow spindle in the direction of movement of the wrapped yarn therethrough for aiding in directing any fiber waste which may still be adhering to the binder strand into and through the hollow spindle during the wrapping of the binder strand around the core strand.

12. Apparatus according to claim **10** wherein said means for intermittently and repeatedly interrupting the ballooning of the binder strand comprises an elongate rod extending from a position outwardly of the package of binder strand and at an angle toward said one end of the hollow spindle and terminating in a free end adjacent to but in spaced relation from said one end of the hollow spindle to thus be disposed at an angle to the ballooning binder strand, supporting means supporting said elongate rod remote from said free end thereof and outwardly of the package of binder strand, and said supporting means including means adjustably mounting said rod for adjustment substantially parallel to its longitudinal axis and for angular adjustment toward and away from said one end of the hollow spindle.

13. Apparatus according to claim **10** wherein said means for intermittently and repeatedly interrupting the ballooning of the binder strand comprises an elongate obstruction positioned in the path of travel of the ballooning binder strand.

14. Apparatus according to claim **13** wherein said hollow spindle is vertically disposed and has a free upper end extending upwardly above the package of binder strand mounted for rotation thereon, and wherein said elongate obstruction extends from outwardly of the package of binder strand upwardly above the upper end of the package and has a free end terminating adjacent to but in spaced relation from the upper end of the hollow spindle to thus be angularly disposed at an incline to the ballooning binder strand.

15. Apparatus according to claim **13** wherein said hollow spindle is vertically disposed and has a free upper end extending upwardly above the package of binder strand mounted for rotation thereon, and wherein said elongate obstruction is positioned to extend upwardly at an incline from outwardly below the outermost portion of the ballooning binder strand and has a free end terminating adjacent the upper end of the hollow spindle but below the same and offset to one side of said hollow spindle so that the ballooning strand will initially engage the elongate obstruction at a location below the widest portion of the ballooning strand and will be wipingly engaged by the elongate obstruction as the ballooning strand moves upwardly along and then past the free end of the elongate obstruction between the package and the hollow spindle.

16. Apparatus according to claim **13** wherein said hollow spindle is vertically disposed and has a free upper end extending upwardly above the package of binder strand mounted for rotation thereon, and wherein said elongate obstruction comprises a round rod extending upwardly at an incline from a position outwardly alongside the package and having a free upper end terminating to one side of and adjacent said upper end of the hollow spindle, the free upper end of the rod being so positioned relative to the hollow spindle that the rod extends tangentially to an imaginary circle generated about the axis of said hollow spindle.

17. In a machine for making a higher quality wrapped yarn from a core strand and a binder strand, said machine comprising a substantially vertically disposed hollow spindle having a package of binder strand mounted for rotation thereon and adapted to be wrapped around the core strand as the core strand is moving downwardly into a free upper end of and through the hollow spindle and wherein the binder strand inherently balloons outwardly in its path of travel from the package upwardly to the core strand being wrapped, the combination therewith of an elongate rod extending upwardly at an incline from a position outwardly of and spaced below the level of the upper end of the package, said elongate rod having a free upper end terminating to one side of, adjacent to and below the level of said free upper end of said hollow spindle, and said free upper end of said rod being so positioned relative to said hollow spindle that said rod extends tangentially of an imaginary circle generated about the axis of said hollow spindle so as to intermittently and repeatedly interrupt the path of travel of the ballooning binder strand and to impart an undulating movement thereto to cause fiber waste picked up by the binder strand to be cast off the same and to thus

improve the quality of the wrapped yarn being formed.

18. Apparatus according to claim **17** including means defining an airflow passageway communicatively connecting said hollow spindle to a source of suction and arranged to induce an airflow along the spindle in the direction of movement of the wrapped yarn therethrough to prevent waste material, such as lint, from accumulating in said hollow spindle and interfering with passage of the wrapped yarn therethrough and to also aid in directing into said spindle any fiber waste which may still be adhering to the binder strand as it is wrapping around the core strand.

19. Apparatus according to claim **17** wherein said free end of said elongate rod terminates inwardly of the normal path of the balloon defined by the ballooning binder strand.

20. Apparatus according to claim **17** including means adjustably supporting a lower portion of said elongate rod remote from said free upper end thereof, and said supporting means including means mounting said elongate rod for longitudinal adjustment parallel to the axis thereof and for angular adjustment about a horizontal axis for adjustably varying the incline of said elongate rod with respect to said substantially vertically disposed hollow spindle and the package of binder strand mounted thereon.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,899,867
DATED : August 19, 1975
INVENTOR(S) : Francis B. Northup and Donald R. Hart

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 34,"passese" should be --passes--

Column 5, line 6, "stapple" should be --staple--

Column 11, line 2, after "but" the words --to move-- were omitted

Signed and Sealed this

twenty-first Day of *October 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks