United States Patent

Schiffli

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[54] **LINT FREE SPINDLE DRIVE BELT**

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[52] **U.S. Cl.**.....**74/231 S,** 156/137

[51] **Int. Cl.**.....**F16g 1/00,** B29d 29/00

[58] **Field of Search**.....74/231 S, 231 R; 156/137

[56] **References Cited**

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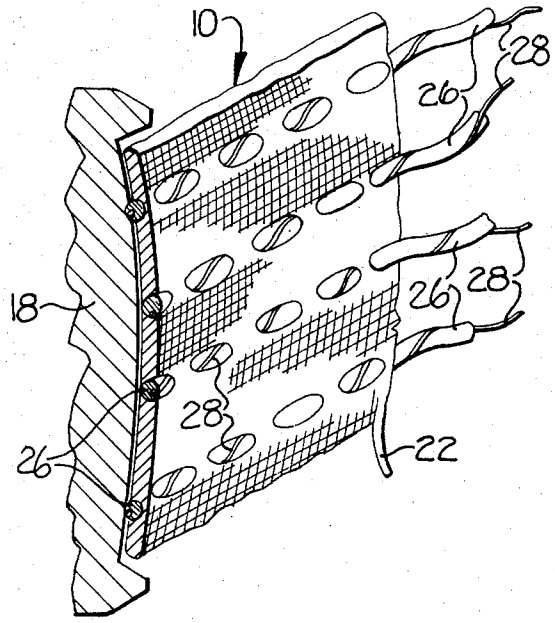
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[57] **ABSTRACT**

A drive belt for use on a yarn spinning frame or the like, and which is adapted to run substantially lint free. The belt comprises interwoven cotton and nylon yarns, with at least several of the yarns including an electrically conductive component in either continuous or staple filament form blended therewith to facilitate discharge of static electricity. Also, a cured resin substantially fills the interstices of the woven material to prevent lint or yarn fly from lodging therein.

14 Claims, 4 Drawing Figures



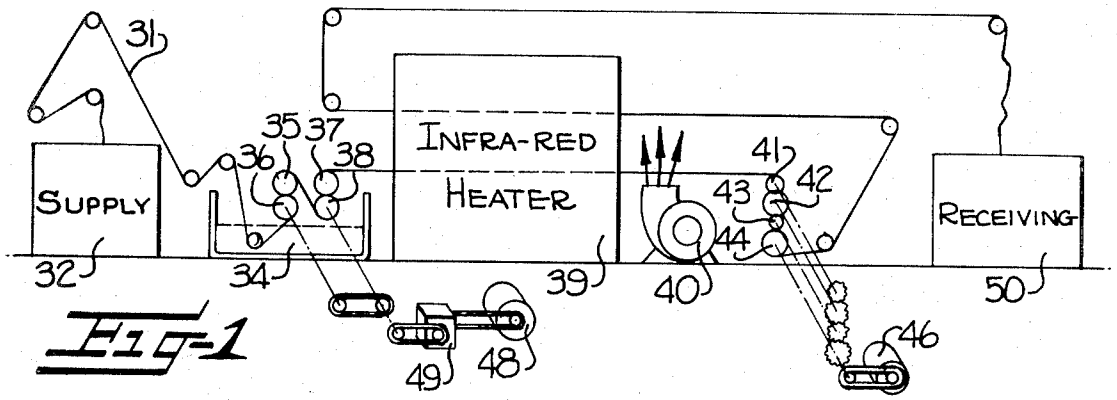


Fig-1

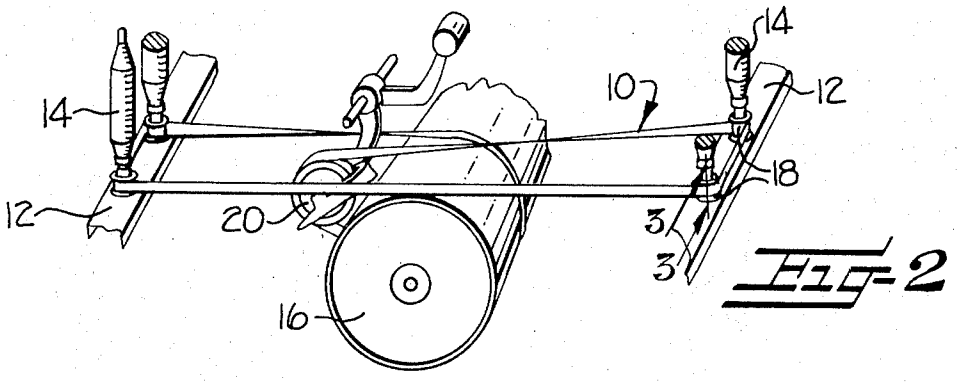


Fig-2

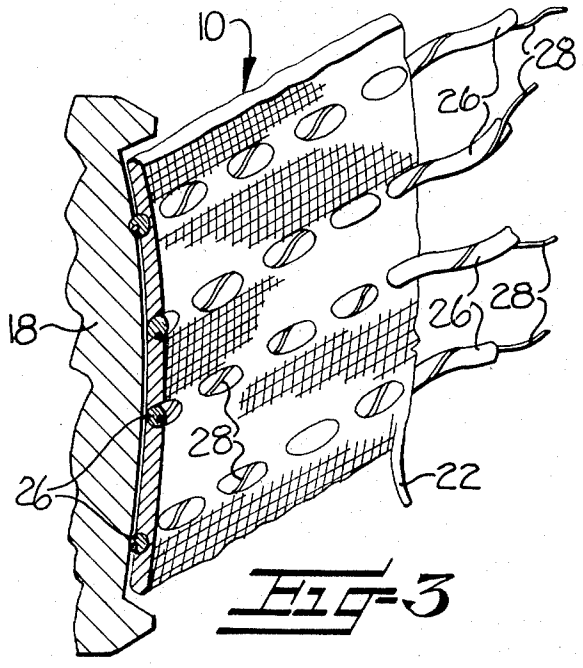


Fig-3

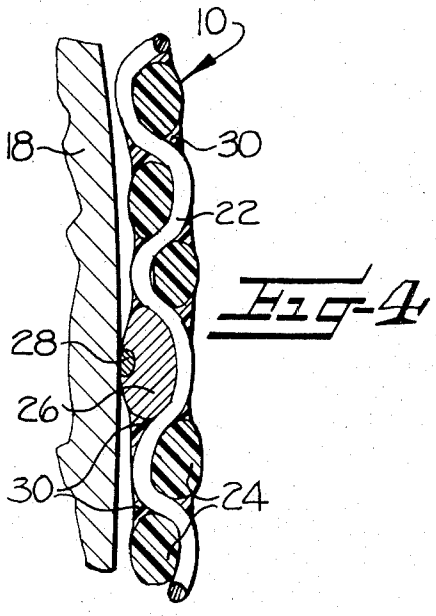


Fig-4

LINT FREE SPINDLE DRIVE BELT

The present invention relates to an improved spindle drive belt of the type commonly used on yarn spinning frames and other yarn processing equipment. More particularly, the invention relates to an endless spindle drive belt which does not accumulate lint or yarn fly during use, and which possesses substantial strength, long life, and does not significantly stretch during use.

Endless spindle belts for use in the textile industry have conventionally been fabricated from woven cotton tapes, although some use has been made of synthetic materials such as nylon. In use, such belts extend around a driving member such as a pulley or drum roller, with each belt then extending around the whorl of a spindle to rotate the same at speeds up to about 25,000 rpm or higher. It is well understood by those skilled in the art that the rapid flexing of the belts at these high speeds tends to quickly wear and stretch the belts, necessitating their replacement after perhaps only a few weeks operation.

A further problem in the use of conventional spindle belts resides in the fact that during operation of the yarn processing machinery, lint collects on the spindle belt and this accumulation results in variations in the speed of spindle rotation due to slippage or loss of traction between the lint coated belt and the whorls about which it passes. Such variations in the speed of rotation of the spindle are extremely undesirable since it has a direct effect on the amount of twist inserted in the yarn. In addition, the lint which has accumulated on the belt may be thrown therefrom and contaminate the yarn by causing "slubs" which must be removed before the yarn is processed into the finished product.

The build-up of lint on the spindle belt appears to result from a combination of factors. First, it is believed that the movement of the belt and the relative movement of its internal filaments during flexing produces static electricity which tends to attract the small lint particles to the belt, particularly under certain atmospheric and temperature conditions. In addition, it is thought that the belt creates a vacuum as it moves about the spindles at high speed, with the vacuum tending to draw the lint particles into contact with the belt. When these lint particles are struck by the rapidly moving belt, they tend to enter and become lodged in the interstices of the woven fabric to produce a build-up of lint which rapidly covers the outer surface.

It is accordingly an object of the present invention to provide a spindle belt which effectively overcomes the above noted problems associated with conventional belts.

It is more specific object of the present invention to provide a high strength spindle belt having a long service life, and which is adapted to run substantially lint free on the whorl of a yarn spinning frame or the like.

It is a further object of the present invention to provide a substantially non-stretching drive belt which may be inexpensively produced.

These and other objects and advantages of the present invention are achieved in the embodiment illustrated herein by the provision of a tape which includes interwoven cotton and nylon yarns, with at least several of the yarns including an electrically conductive component blended therewith which is adapted to contact the spindle whorl to discharge any static electricity. Also, a cured resin finish substantially fills the interstices of the woven tape to prevent the lint from collecting on the tape by entering the interstices.

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

FIG. 1 is a schematic illustration of the process for treating a woven textile tape to produce a spindle drive belt according to the present invention;

FIG. 2 is a fragmentary isometric view of a portion of the drive system for a yarn spinning frame, and showing two pairs of spindles on opposite sides of the frame and the associated drive belt;

FIG. 3 is a fragmentary sectional and partially schematic view of the drive belt and spindle whorl taken substantially along the line 3—3 of FIG. 2; and

FIG. 4 is a fragmentary enlarged sectional view of the whorl and drive belt also taken substantially along the line 3—3 of FIG. 2.

Referring more specifically to the drawings, there is shown in FIG. 2 a spindle drive belt **10** incorporating the features of the present invention. The belt **10** is shown disposed on a portion of a spinning frame which includes a pair of rails **12** extending along opposite sides thereof for supporting the spindles **14**, and a rotatable driving member or drum **16** positioned intermediate the rails. The belt **10** passes around the drum **16** and extends outwardly in one direction and around the whorls **18** of one pair of spindles **14**, and then across the frame above the drum and around the whorls of the opposite pair of spindles. A counter-balanced idler roller **20** is shown positioned adjacent the drum to maintain a proper degree of tension in the belt.

In the embodiment of the invention shown in FIGS. **3** and **4**, the drive belt **10** comprises a woven tape comprising cotton filling yarns **22**, a plurality of nylon warp yarns **24**, and four cotton warp yarns **26** spaced along the width of the belt. The cotton warp yarns **26** include an electrically conductive component **28** in either continuous or staple filament form blended therein, and will be seen to have a linear density (or cross-sectional area) substantially greater than tee linear density of the cotton filling yarns **22** or the nylon warp yarns **24**. By this arrangement, portions of the cotton warp yarns **26** will be seen to extend above the surface of the tape, and the electrically conductive filaments **28** similarly extend above the surface of the tape as seen in FIG. **3** to facilitate contact with an adjacent surface, such as the whorls **18**, to discharge any static electricity in the belt.

As a further aspect of the tape shown in FIGS. **3** and **4**, there is provided a cured resin **30** which substantially fills the interstices of the material. By filling these interstices, the yarn fly is prevented from becoming lodged therein to produce a build-up of lint on the tape surface. Also, it will be appreciated that the resin **30** preferably does not completely coat the tape surface since a coating could interfere with the desired contact of the filaments **28** with an adjacent surface.

In fabricating the belt **10**, a continuous length of tape **31** is initially woven in a conventional weave pattern having selvage edges, such as a herringbone with a small gros grain. The tape may then be impregnated with a suitable resin, cured, and heat stabilized by the process illustrated schematically in FIG. **1**. Specifically,

the tape **31** is initially withdrawn from a supply container **32** and passed through a resin bath **34**. Next, the tape is passed through two pairs of squeeze rollers **35**, **36** and **37**, **38**, which are operated under controlled compression, through the infrared drying oven **39**, and past the drying blower **40**. The tape, which is only partially cured and dried at this point, then passes through the four vertically arranged squeeze rollers **41**, **42**, **43** and **44** which are also maintained under a controlled compression. The rollers **41–44** are driven at a constant speed by the drive motor **46**, while the rollers **35–38** are driven at a variable rate by the motor **48** and variable speed control **49** to maintain a predetermined tension in the tape as it passes through the drying oven. More particularly, the tension in the tape is monitored by a conventional control arrangement (not shown) which acts through the speed control **49** to maintain a preselected tension in the belt. After leaving the roller **44**, the tape **31** is directed through the oven a second time to obtain complete curing of the resin, and then into a suitable receiving container **50**. During this second pass through the oven, the tape is under no significant tension. The tape is then adapted to be cut into suitable lengths and fabricated into endless belts **10** by securing the ends of the tape together by stitching, heat bonding, or other conventional means.

When synthetic or polymeric warp yarns are employed in the tape, the above procedure of curing the resin under conditions of controlled tension further serves to heat stabilize the synthetic yarns and thereby reduce the stretch in the finished belt. Typically, the tape **31** is tensioned to a point which closely approaches its breaking strength as it passes through the oven **39** to accomplish this propose. Also, it is believed that the stretching procedure serves to slightly open the interstices of the fabric to facilitate penetration of the resin therein.

As noted above, the rollers **35–38** and **41–44** are maintained under controlled compression such that the tape is squeezed therebetween and the resin is forced inwardly into the fabric. Thus the tendency of the resin to entirely coat the outer surface of the tape is minimized.

The tape of the present invention is preferably fabricated from interwoven cotton and nylon yarns as described above, since the nylon yarns provide the desired strength, and the cotton yarns serve to insulate against the build up of heat in the belt during use. Spun nylon yarns have been found to be somewhat preferably to continuous nylon yarns since belts using spun nylon yarns are longer lasting and the ends thereof are somewhat easier to bond by conventional heat bonding techniques.

Obviously, the electrically conductive filaments **28** of the present invention could be fabricated from a wide variety of materials. For example, a conductive metal or alloy such as stainless steel or aluminum could be employed, or a non-metallic material such as a conductive glass or synthetic polymer could be used. For cost reasons, only a sufficient amount of the conductive filament should be employed which assures an adequate discharge of the static electricity, and in the case of four blended warp yarns comprising cotton and stainless steel, it has been found that the stainless steel should comprise at least about 1 percent of the blended yarns. In addition, it will be appreciated that the conductive filaments could be positioned in the filling as well as the warp yarns. While either continuous or staple stainless steel filaments could be employed with the present invention, staple filaments are somewhat preferred since they are easier to blend in the cotton spinning system.

The resin **30** employed with the present invention may similarly comprise any of a number of suitable polymeric materials, such as nylon or polyurethane. Typically the resin will comprise between about 10–20 percent of the total weight of the finished tape.

To describe the present invention with reference to a specific example, a ⅝ inch wide continuous tape was woven in a conventional herringbone pattern with a small gros grain and with selvage edges using 20*s*/3 long staple cotton filling yarn having 32–36 picks per inch, 48 ends of 21*s*/3 spun nylon warp yarn and four ends of 8*s*/2 cotton warp yarn having staple stainless steel filaments blended therein. The cotton in the four cotton warp yarns had staple length of 1 1/32 inch, and the stainless steel filaments were 8 microns in diameter and had a staple length about the same as the cotton. One strand of the two ply cotton warp yarns contained about 2 percent stainless steel, while the other strand was all cotton. Thus the net weight of the stainless steel in these yarns was about 1 percent thereof. The four cotton warp yarns were substantially evenly spaced along the width of the tape.

The above tape was impregnated in a polyurethane resin solution, formed by dissolving about 15 percent by weight of flaked polyurethane in liquid tetrahydrafuran. The tape was then squeezed between two pairs of compression rollers, and subjected to a tension of approximately 400 pounds (which is only lightly below its breaking strength) as it was passed through the infrared drying oven and blower. The oven was maintained at a temperature of approximately 550°F, and the time for passage through the oven and blower was approximately six to eight seconds. The tape was slightly tacky as it left the blower. After passing through the four secondary squeeze rollers, the tape was again passed through the oven, after which it was substantially dry to the touch.

The above tape was cut into a suitable length, and the two ends joined by a conventional heat bonding technique to form an endless drive belt. When used on a yarn spinning frame, the resulting belt was found to have a long useful life, it did not appreciably stretch, and it ran substantially lint free.

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 strong, substantially non-stretching drive belt characterized as being adapted to run substantially lint free on the whorl of a yarn spinning frame or the like and comprising

a tape including interwoven cotton and nylon yarns, at least several of said yarns including an electrically conducive component blended therewith, and a cured resin substantially filling the interstices of the tape.

2. The drive belt as defined in claim 1 wherein said nylon yarns are heat stabilized.

3. The drive belt as defined in claim 1 wherein said several yarns including a conductive component are of a linear density substantially greater than the linear density of the remaining cotton and nylon yarns whereby portions of the conductive component extend above the surface of the tape to facilitate contact with a spindle whorl or the like for discharging static electricity.

4. The drive belt as defined in claim 1 wherein said electrically conductive component comprises staple filaments of stainless steel.

5. The drive belt as defined in claim 1 wherein said resin comprises polyurethane.

6. A strong, substantially non-stretching drive belt characterized as being adapted to run substantially lint free on the whorl of a yarn spinning frame or the like and comprising

a tape comprising interwoven filling and warp yarns, said filling yarns comprising cotton, and said warp yarns comprising nylon yarns and cotton yarns, said cotton warp yarns including an electrically conductive component blended therein and having a linear density substantially greater than the linear density of said cotton filling yarns and nylon warp yarns whereby portions of said conductive component extend above the surface of the tape to facilitate discharge of static electricity onto an adjacent surface, and a cured resin substantially filling the interstices of the tape to thereby prevent yarn fly from collecting on the tape by entering the interstices.

7. The drive belt as defined in claim 6 wherein said conductive component is stainless steel and comprises at least about 1 percent of the weight of said cotton warp yarns.

8. The drive belt as defined in claim 6 wherein said resin is polyurethane.

9. The drive belt as defined in claim 6 wherein said cotton filling yarns and said cotton warp yarns comprise long staple cotton filaments and said nylon warp yarns comprise spun nylon filaments.

10. The process for fabricating a strong substantially non-stretching drive belt adapted to run substantially lint free on yarn spinning and processing machinery, comprising the steps of

impregnating a woven tape comprising cotton, nylon and electrically conductive components in a resin bath,

tensioning the impregnated tape to approach its breaking point,

calendaring the impregnated tape while maintain-ing the same under tension to cause the resin to thoroughly penetrate and fill the interstices of the tape, and

heating the tape while maintaining the same under tension to heat stabilize the nylon filaments and to cure the resin.

11. The process as defined in claim 10 wherein the step of heating the tape includes subjecting the same to infrared radiation.

12. A drive belt characterized as being adapted to run substantially lint free on the whorl of a yarn spinning frame or the like and comprising

a tape including interwoven yarns, at least several of said yarns having a linear density substantially greater than the linear density of the remaining yarns and including an electrically conductive component blended therewith, whereby portions of the conductive component extend above the surface of the tape to facilitate contact with a spindle whorl or the like for discharging static electricity.

13. The drive belt as defined in claim 12 wherein said tape further comprises a cured resin substantially filling the interstices of the tape to thereby prevent lint or the like from becoming lodged therein.

14. A drive belt characterized as being adapted to run substantially lint free on the whorl of a yarn spinning frame or the like and comprising

a tape including interwoven cotton and polymeric yarns, at least several of said cotton yarns having a linear density substantially greater than the linear density of the remaining cotton and polymeric yarns and including staple filaments of stainless steel blended therewith, whereby portions of the stainless steel filaments extend above the surface of the tape to facilitate contact with a spindle whorl or the like for discharging static electricity.

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