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[54] **METHOD OF LAYING PROTRUDING FIBRES, AND INCREASING ABRASION RESISTANCE OF TEXTILE YARNS**

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[52] **U.S. Cl.** **57/12,** 57/36, 57/160

[51] **Int. Cl.** **D01h**

[58] **Field of Search** 57/12, 36, 160, 3

[56] **References Cited**

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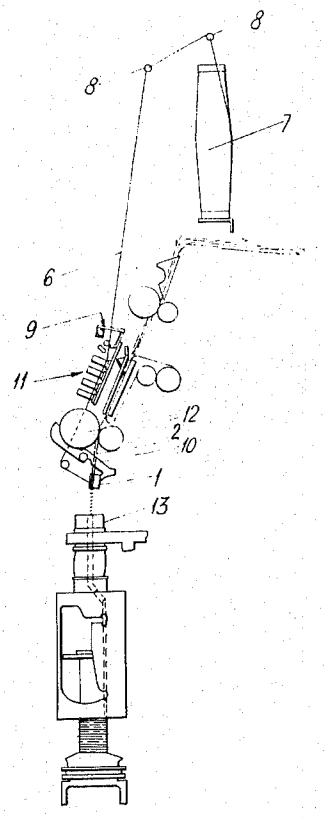
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[57] **ABSTRACT**

Textile yarn spun from natural or man-made staple fibres and of the kind, such for example, as jute, from which fibres usually protrude at random so that the yarn has an appearance of hairiness, has a fine wrapping material, for example nylon yarn or film in tape form, extending helically and externally thereof, by which fibres which would otherwise protrude from the yarn are laid along and anchored to the body of the latter, the abrasion resistance of the yarn is increasd and fibre loss in subsequent processing is decreased. The wrapping material is fed to the yarn during spinning in a spinning frame, as the yarn passes, while twisting, from the drawing rollers to the eye of the wharve of a spindle of the frame, so that the wrapping material becomes helically wrapped around the yarn externally.

12 Claims, 2 Drawing Figures



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SHEET 1 OF 2

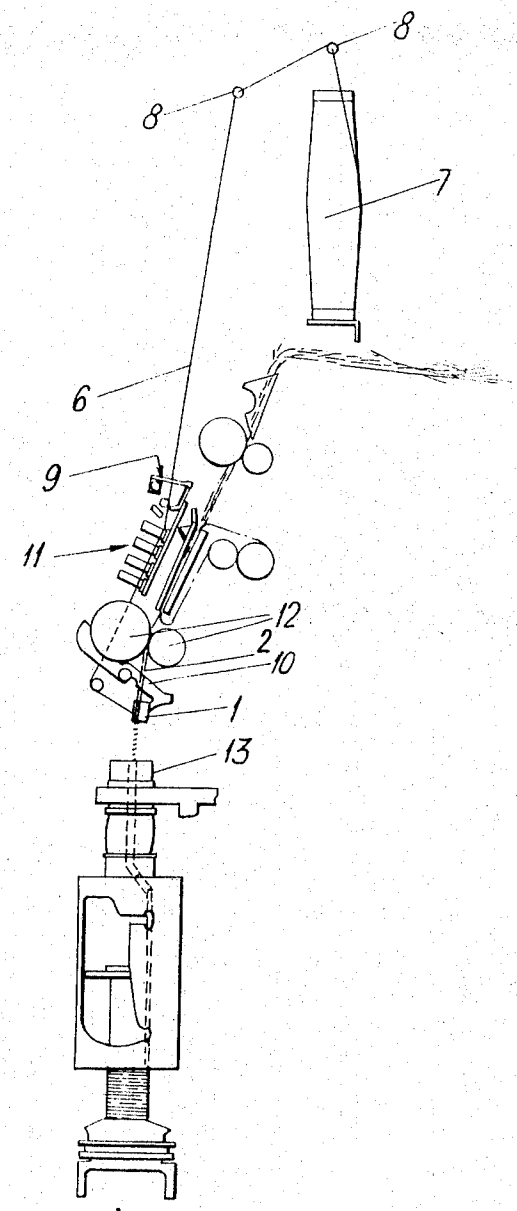


Fig. 1.

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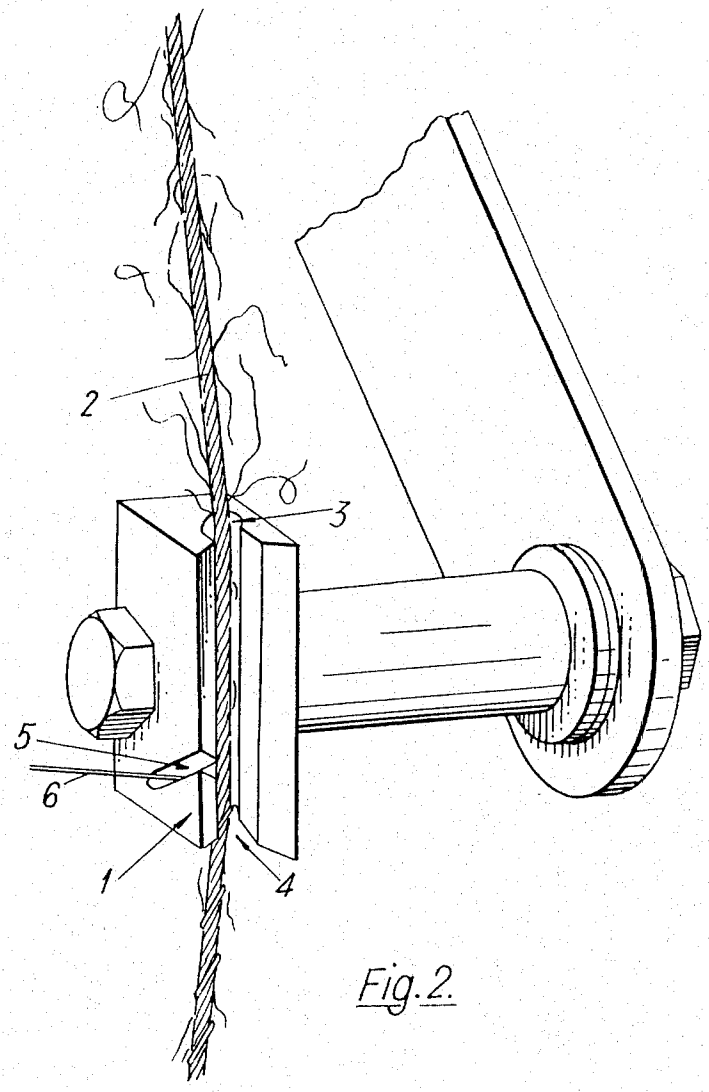


Fig. 2.

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METHOD OF LAYING PROTRUDING FIBRES, AND INCREASING ABRASION RESISTANCE OF TEXTILE YARNS

This invention relates to a method of and apparatus for use in laying the protruding fibres of textile yarns spun from natural or man made-staple fibres, and an object of the invention is to provide such a method and apparatus by which the abrasion resistance of the yarn is increased, the increased abrasion resistance being apparent not only in conventional yarn abrasion tests but also in the reduction in "caddis" or "fly" associated with processes subsequent to spinning, and in which there is no loss of desirable textile yarn characteristics - handle, elasticity, pliability, and ability to retain size or coating material.

Fibre protrusion or hairiness can be advantageous in certain applications as, for example, in the manufacture of jute fabrics that are to be employed as reinforcing media for plaster board, in which case the protruding fibres increase the adhesion of the yarn to the plaster. However, in most applications of textile yarns, hairiness is objectionable on several grounds. For example, the protruding fibres adversely affect the appearance of the yarn and do not contribute to its strength. They may also become detached and form accummulations of "fly" or "caddis" during subsequent processes, e.g. winding and weaving. Similarly if the jute yarns used in traditional carpets are too hairy or shed fibres too readily occasional jute fibres may appear in the pile. Hairy jute yarns or loose fibre accummulations can also interfere with operations such as back sizing or latexing.

Several methods are known by which hairiness can be reduced. Thus, it is well known that the use of a high degree of twist in the yarn is of some advantage, but there are accompanying disadvantages, such as reduced tensile strength and a lower output from the spinning frame. It is also known that a plied yarn produced by twisting together two or more single yarns is usually less hairy than a single yarn of the same total weight per unit length but this has the disadvantage that the cost of the plied yarn is considerably greater. It is also known that the surface hairs of a yarn may be caused to lie substantially along the yarn and to adhere to the remainder of the fibres by subjecing the yarn to a sizing process after spinning. In such a process, the yarn is impregnated with or coated with an adhesive preparation, for example, a gel of starch and water, the water being then removed by drying the yarn with hot air or by passage over heated surfaces. Sizing processes are commonly used to prepare warp yarns for weaving, and the cost is not prohibitive because, often, the sizing operation can be combined with the necessary operation of amalgamating a number of warpers beams to form a weavers beam. However, to produce yarn with the protruding fibres laid by sizing prior to sale, has disadvantages in that a sizing process would be a completely additional operation involving time and labour and space considerations. If it were combined with the winding operation that follows spinning, there would arise the difficult probelm of drying the yarn at the high speeds used in winding. Further, sizing normally increases yarn stiffness which may be a disadvantage if the yarn is to be used as weft.

A further object of the present invention is to provide a method of and apparatus for use in laying protruding

fibres on yarn, by which the disadvantages above mentioned are obviated or mitigated.

According to the present invention we provide textile yarn spun from natural or man-made staple fibres and of the kind such for example as jute, from which fibres usually protrude at random so that the yarn has an appearance of hairiness; in which the yarn has a fine wrapping material extending helically and externally thereof, by which fibres which would otherwise protrude from the yarn are laid along and are anchored to the body of the latter, the abrasion resistance of the yarn is increased, and fibre loss in subsequent processing is decreased.

The wrapping may be a non-hairy yarn, or a monofilament, or film in tape form which are fine compared with the staple fibre yarn to be wrapped.

Further, according to the present invention we provide a method of producing yarn as aforesaid comprising feeding wrapping material to the yarn during spinning in a spinning frame, as the yarn passes, while twisting, from the drawing rollers to the eye of the wharve of a spindle of the frame, so that the wrapping material becomes helically wrapped around the yarn externally.

Preferably, the yarn passes through a fibre laying guide which lays fibres protruding from the yarn, until they are enwrapped by the wrapping material.

Still further, according to the present invention we provide, in a spinning frame, apparatus for use in carrying out the method aforesaid, said apparatus comprising means for mounting a bobbin or spool of wrapping material, adjustable wrapping material tenstioning means, and guide means comprising a guide for guiding the wrapping material during a spinning operation, into engagement with the yarn at a point between the drawing rollers and the eye of the wharve of a spindle of the frame, which the yarn passes while twisting, so that the wrapping material becomes helically wrapped around the yarn externally.

Preferably, said guide means includes a fibre-laying guide for the yarn co-operating with the guide for the wrapping material.

Preferably also, said guide means comprises an upstanding block having a cylindrical hole from top to bottom forming said guide for the yarn, and a laterally directed slot opening into said hole adjacent the bottom of the block and forming the guide for the wrapping material.

Preferably also, the diameter of the cylindrical guide hole is such, for yarn of a predetermined thickness, as to cause protruding fibres on the yarn to be laid as the latter passes through the hole.

When synthetic tape is used as wrapping material, the tape, after being wrapped around the yarn, may be heated so as to increase its plasticity and to cause shrinkage so that the tape beds down on to the surface of the yarn more smoothly and uniformly.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying diagrammatic drawings, in which:

FIG. 1 is a side view of a spinning frame showing apparatus and the method according to the present invention in operation, and

FIG. 2 is a perspective view showing a detail to a larger scale.

A fibre-laying guide 1, best shown in FIG. 2, progressively smooths protruding fibres on to the surface of yarn 2 as it passes through the guide 1. The fibre-laying

guide **1** consists of a block having a cylindrical hole **3** of about five sixty-fourths inch dia, and three-fourths inch long, and made of abrasion-resistant material, and having an entrance slot **4** parallel to the hole **3** so that the yarn can be placed in the hole **3** without recourse to threading.

In FIGS. **1** and **2**, the path of the yarn **2** is shown deflected by about 10° by the fibre-laying guide **1** so that the pressure of the yarn against the guide helps to smooth fibres down on to the yarn surface. A slight improvement in uniformity of pressure of the yarn **2** against the guide may be obtained if the hole **3** is slightly convex from top to bottom towards the yarn.

Satisfactory results can also be obtained if the yarn **2** runs straight through the guide, in which case the cylindrical wall of the hole **3** brings the protruding fibres very close to the body of the yarn.

The diameter of the hole is made as small as possible, provided thicker parts of the yarn can pass through. The guide is not intended to act as a slub-catcher. In practice, the diameter of the hole therefore depends upon the range of counts being spun and the yarn irregularity. Thus, a diameter of five sixty-fourths inch should cover a range of good quality carpet yarns from 10 to 20 lbs/spyndle, a spyndle being a unit of length equal to 14,400 yards, and corresponding with a yarn linear density range of 344.5 to 689 tex. Slightly better results can be obtained on the finer yarns in this range by using smaller diameters.

If nothing further were done to the yarn after it had passed through the fibre-laying guide **1**, the smoothed fibres would largely spring back into their original protruding positions upon emergence from the guide. However, the guide **1** has a laterally directed guide slot **5** adjacent its lower end and opening into the hole **3**. The slot **5** guides wrapping material in the form of a fine non-hairy yarn **6** or film in tape form so as to meet and wrap round the twisting yarn **2** and its sheath of smoothed fibres shortly before, as in the present embodiment, or immediately after they emerge from the fibre-laying guide hole **3**. The wrapping material, for example, may be:

a. a monofilament or multifilament yarn or a film in tape form made from substantially linear or cross-linked linear polymers, including regenerated cellulose. Such polymers include those capable of being softened by water, e.g. polyvinyl alcohol, by heat — e.g. melt adhesives, or by organic solvents; or

b. a fine non-hairy yarn made from natural or man-made staple fibres, including linear polymeric material as in (a).

The fibre-laying and wrapping material guides may form a composite unit as shown in FIGS. **1** and **2**, mounted on the broken-yarn detector **10**, or may be independently mounted. Alternatively, the hole **3** and the slot **5** may be provided in separate members carried by the broken-yarn detector or be independently mounted.

In a modification, no fibre-laying guide is provided, and only the wrapping material guide is used. In this case, the wrapping material guide may either be carried by the broken-yarn detector or be independently mounted.

If a still higher degree of hair-lay is required, two or more wrapping yarns and wrapping yarn guides can be used. To ensure that the multiple wrapping yarns are evenly spaced on the yarn **2**, the separation of the corresponding guides, in the direction of the yarn path, should be:

Inches per turn of staple fibre divided by number of wrapping yarns.

The freedom of choice for the positions in which single wrapping yarn guides can be mounted is also applicable to the multiple guides.

Referring to FIG. **1**, the fine wrapping yarn **6** or film in tape form is carried by a bobbin or spool **7** from which it passes, usually overend, successively through suitable guides **8**, a wrapping yarn stop-motion **9** linked to a broken-yarn detector **10**, an adjustable tensioning device **11** and the wrapping yarn guide **1**, to be wrapped helically round the staple fibre yarn **2**. Thus, the wrapping-yarn **6** is drawn from its bobbin or spool **7** by the yarn **2** to be wrapped as the latter passes from the nip of the drawing rollers **12** to the eye of the spindle wharve **13**.

The tension in the wrapping yarn **6** should be high enough to ensure a close and uniform wrap with negligible distortion of the essentially cylindrical form of the staple fibre yarn **2** being wrapped. Thus, when the wrapped yarn is under tension, the axis of the relatively heavy staple fibre yarn constituent is a straight line, and that of the fine wrapping yarn is a helix.

EXAMPLE 1

In this, the following were used:

	Lbs/spyndle	Tex
Staple fibre yarn — Jute 12 lbs/spyndle	12.0	413
Wrapping yarn - Nylon 70 denier 34 filaments	0.23	7.8

The wrapped yarn had a resultant count of about 12.4 lbs/spyndle, corresponding to a yarn linear density of 427 tex, and markedly less protruding fibre than the initial unwrapped yarn.

In an accelerated abrasion test in which the yarn, under tension, was pulled back and forth with a 90° wrap round a piano wire of 0.035 inch dia., an average of 83 back and forth motions (rubs) was required to break the wrapped yarn compared with an average of 53 for the corresponding unwrapped yarn of the same resultant count. This 57 percent improvement in abrasion resistance is probably near the minimum improvement obtained. Some other tests showed a nearly doubled abrasion resistance due to the wrapping.

There were striking reductions in "caddis" or "fly" accummulations during subsequent winding and weaving operations and in the hairiness of the staple fibre yarn when woven into cloth and carpet.

Thus, the method of wrapping not only gives a "hair-laid" jute yarn, but also, by vastly increasing the number of binding points at which surface fibres are held, produces a new type of staple fibre yarn with greatly enhanced abrasion resistance and fibre-retaining properties. The fine wrapping yarn, being partly hidden by the jute fibres, is unobtrusive and in no way detracts from the desirable textile characteristics of the yarn — handle, elasticity, pliability and size-retaining properties.

The method may produce similar advantages with other bast fibres, e.g. Hibiscus, hemp, dry spun flax, and with leaf fibres such as sisal and manila tow and line fibre, or even mineral fibres, notably asbestos.

Using a warp of wrapped yarn, it may be possible to omit the usual warp dressing operation, which gives protection against the abrasive action of the loom.

EXAMPLE II

		Tex
Staple fibre yarn — Jute 12 lbs/spyndle		413
Wrapping — Slit film of polyethylene ⅛ inch wide	1.75 lbs/ spyndle	60

The method was carrid out as described with reference to FIGS. 1 and 2, except that the wrapping was film in tape form instead of multifilament nylon. The resultant count of the wrapped yarn was about 14 lbs/spyndle, which corresponds with a yarn linear density of 482 tex.

The film-wrapped yarn was later unwound from the spinning bobbin, and passed over a heating element at 130°C on to a precision-wound spool of the type used by the carpet trade. Heating of the polyethylene film increased its plasticity and caused slight shrinkage, the combined effect of which was to bed the wrapping down on to the surface of the jute yarn more smoothly and uniformly.

The film-wrapped yarn was found to be virtually free from protruding hairs — more so that the nylon wrapped yarn. In an accelerated abrasion test, the jute component broke after an average of 168 rubs compared with 64 for the unwrapped jute yarn.

Thus, this film-wrapped yarn is superior to the nylon wrapped yarn for hair-lay and abrasion resistance. On the other hand, the plastic film by reducing the friction of the yarn against itself or against other yarns, makes satisfactory spool formation more difficult and may also make the yarn less suitable for use as tuft-retaining threads in carpets. The efficiency of carpet backsizing may also be reduced if film-wrapped yarns are used in the backing.

The invention is also applicable to the production of non-hairy plied yarns and twines. In this case, the singles can first be wrapped and then plied, or plied yarn or twine can be made from unwrapped singles and be wrapped during plying.

We claim:

1. In a method of spinning relatively coarse yarn from staple fibre and of the kind such as jute, from which fibres usually protrude at random so that the yarn has an appearance of hairiness, the steps comprising guiding a relatively fine non-hairy yarn from a spool into contact with the coarse yarn during spinning of the latter in a spinning frame, during passage of the coarse yarn, while twisting, from drawing rollers to the eye of the wharve of a spindle of the frame, entraining the fine yarn by the coarse yarn by virtue of its said twisting, and drawing the fine yarn from the spool by virtue of its entrainment with the coarse yarn and the said passage of the latter, whereby the fine yarn becomes helically wrapped externally around the coarse yarn at the same number of turns per inch as the number of turns per inch in the coarse yarn, fibres on the coarse yarn which would otherwise protrude are laid and anchored to the coarse yarn by the fine yarn, the abrasion resistance of the yarn is increased, fibre loss in subsequent processing is decreased, and there is substantially no loss in the yarn of handle, elasticity, pliability, and the ability to retain size or coating material.

2. In a method of spinning relatively coarse yarn in the range of 10 to 20 pounds per spyndle from staple fibre and of the kind, such as jute, from which fibres usually protrude at random so that the yarn has an appearance of hairiness, the steps comprising guiding a relatively fine non-hairy yarn of about 0.23 pounds per spyndle from a spool to the coarse yarn during spinning of the latter in a spinning frame, during passage of the coarse yarn while twisting, from drawing rollers to the eye of the wharve of a spindle of the frame, entraining the fine yarn by the coarse yarn by virtue of its said twisting, and drawing the fine yarn from the spool by virtue of its entrainment with the coarse yarn and the said passage of the latter, whereby the fine yarn becomes helically wrapped externally around the coarse yarn at the same number of turns per inch as the number of turns per inch in the coarse yarn, fibres on the coarse yarn which would otherwise protrude are laid and anchored to the coarse yarn by the fine yarn, the abrasion resistance of the yarn is increased, fibre loss in subsequent processing is decreased, and there is substantially no loss in the yarn of handle, elasticity, pliability, and the ability to retain size or coating material.

3. The method claimed in claim 1 in which the yarn passes through a guide which lays fibres protruding from the yarn, until they are enwrapped by said wrapping material.

4. The method claimed in claim 1, in which said wrapping material is a monofilament or multifilament yarn, made from substantially linear or cross-linked linear polymers including regenerated cellulose.

5. The method claimed in claim 1, in which said wrapping material is a fine non-hairy yarn made from natural staple fibre or from staple fibre man-made from substantially linear or cross-linked linear polymers including regenerated cellulose.

6. In a spinning frame, apparatus for use in carrying out the method claimed in claim 1 said apparatus comprising means for mounting a bobbin or spool or wrapping material, an adjustable wrapping thread tensioning means, drawing rollers, a spindle wharve of the frame and a guide means comprising a guide for guiding the wrapping material during a spinning operation, into engagement with the yarn at a point between the drawing rollers and the eye of the said spindle wharve through which the yarn passes, while twisting, so that the wrapping material become helically wrapped around the yarn externally.

7. Apparatus as claimed in claim 6, in which said guide means includes a fibre-laying guide for the yarn co-operating with the guide for the wrapping material.

8. Apparatus as claimed in claim 7, in which said guide means comprises an upstanding block having a cylindrical hole from top to bottom forming said guide for the yarn, and a laterally directed slot opening into said hole adjacent the bottom of the block and forming the guide for the wrapping material.

9. Apparatus as claimed in claim 8, in which the diameter of the cylindrical guide hole is such, for yarn of a predetermined thickness, as to cause protruding fibres on the yarn to be laid as the latter passes through the hole.

10. Apparatus as claimed in claim 9, in which the guide block is so arranged that it deflects the yarn so that pressure of the latter against the wall of the guide hole facilitates laying of protruding fibres.

11. Apparatus as claimed in claim 10, in which said guide hole is convexly curved from top to bottom towards the yarn so that uniform pressure of the yarn on the wall of the hole may be attained substantially throughout the length of the hole.

12. Apparatus as claimed in claim 8, in which the guide block has a slot leading to and extending throughout the length of the hole to facilitate entrance of the yarn into the hole.

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