

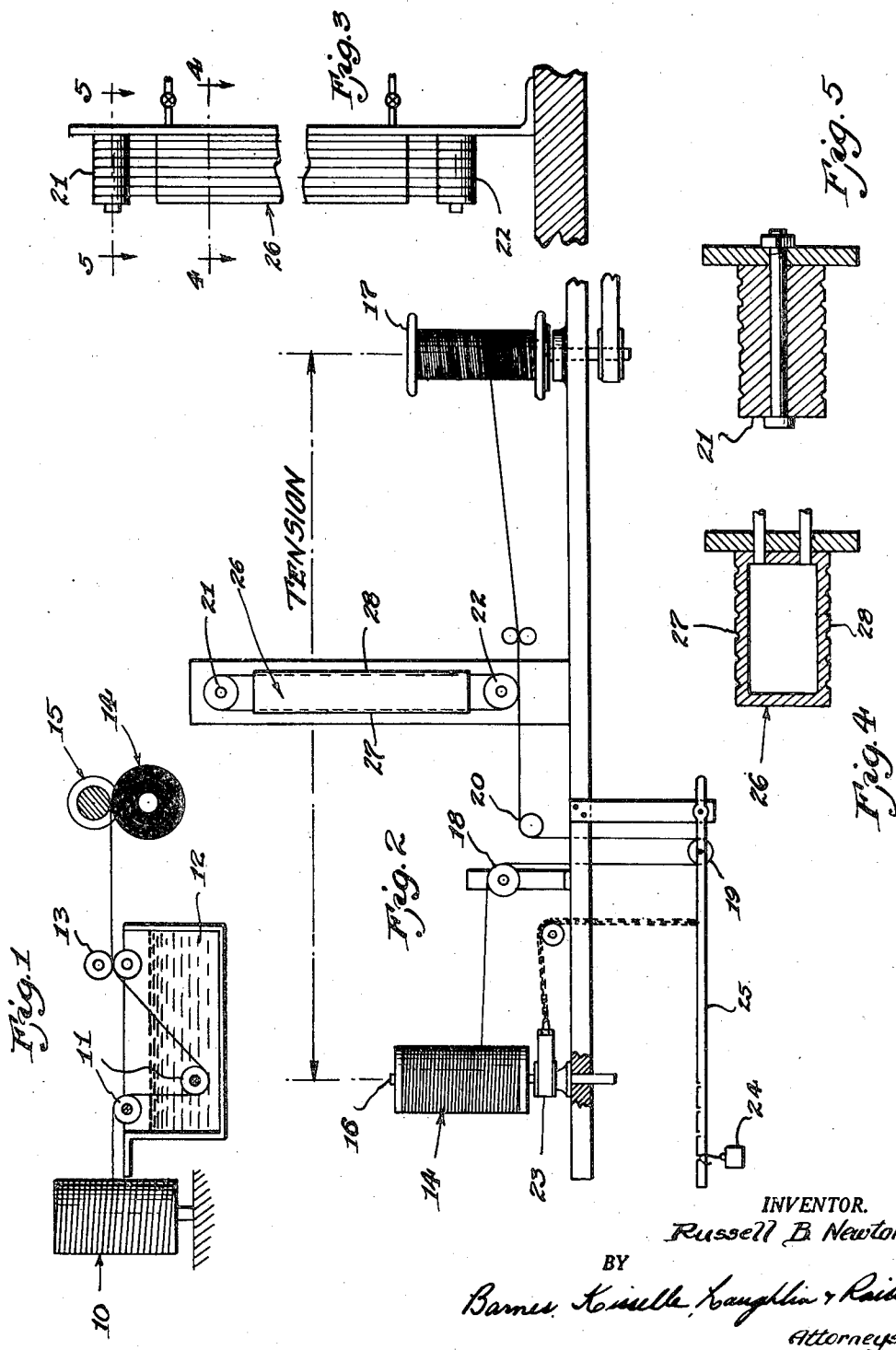
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TENSIONED ROVING AND METHOD OF FORMING SAME

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TENSIONED ROVING AND METHOD OF FORMING SAME

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3 Claims. (Cl. 28—75)

1

The present invention is applicable to rovings formed of fibrous filaments of all kinds, mixed and otherwise, but more particularly to rovings formed of cotton fibers, and has as its principal object the parallel arranging of the discrete fibers of a length of roving and the condensing of the parallel arranged fibers into as small a space as possible to form a new product comparable in tensile strength and reduced stretch to plied yarns, but having even greater resistance to breaking than comparable plied yarns because of its inherent uniform fiber arrangement and the elimination of the shearing action of the plies themselves.

During recent years attempts have been made to increase the tensile strength and reduce the stretch of standard yarns, threads, cords and the like, by stretching the standard formed cord to substantially its breaking point, and setting the individual fibers and strands of the cord while so stretched. Yarns and cords so treated have proven very successful commercially and examples of such treatment are set forth in the patents to Jennings 2,220,958 and Gwaltney et al. 2,103,218. However, while the tensioning and setting of the discrete fibers in yarns, cords and the like has proven commercially successful in greatly increasing the tensile strength of such cords and the like, nevertheless, the final tensioned product has been relatively expensive because in the fabricating of the yarn or cord itself, preparatory to giving it a tensioning treatment, a large number of drawing, spinning and twisting operations has been required.

I have discovered that it is possible to form a tensioned textile element, in fact, a new textile article of manufacture, which has the beneficial advantages of a tensioned yarn or cord such as described in the above Jennings and Gwaltney et al. patents, plus additional advantages, by processing and treating rovings directly as drawn and in some cases processing and treating the sliver itself.

While it is true that other attempts have been made to treat roving as distinguished from plied yarn, such as set forth in the patents to LeJeune No. 1,959,723 and Harrison No. 2,125,633, these attempts have been limited to the treating of the roving without materially twisting and without tensioning and compacting, but so far as is known, such treated roving without tensioning and/or compacting has never been commercially produced and in tests made in treating such roving in accordance with the teachings of said patents to Harrison and LeJeune, very little increase in strength was obtained.

More specifically the present invention contemplates the taking of the roving or sliver wherein the discrete fibers have been given some treatment so that they are generally parallel and

2

eliminating all the standard drafting and twisting operations and directly spin or twist the initial roving, or sliver. In other words, the operation I prefer to give the initial roving or sliver is comparable to the spinning operation usually given the standard yarns after the usual drawing and twisting steps. The relatively tightly twisted roving is then treated with a bonding material and compacted and tensioned and the tensioned, compressed fibers then fixed in position by setting the bonding material. Preferably the compressing should be just short of damaging and the tensioning just short of the breaking point. The direct result of this processing and mechanical treatment of a roving is the production of a linear textile element of high density and tensile strength comparable in every way to tensioned plied yarns of the same diameter but eliminating the wear producing plies.

Another important feature of the invention is that regardless of the amount of twist given to the initial roving or sliver to permit the same to be placed under sufficient tension for proper handling in my process, it is possible to, because the element being stretched is a roving instead of a plied yarn, obtain a more uniform tensioning and parallel arranging of the discrete fibers in a single roving unit than in a multi-ply yarn, because more drafting creates more irregularity and therefore the fibers in the roving are more uniformly arranged than where the rovings have been drawn down and combined into a multi-ply yarn.

Other features of the invention have to do with various detailed steps of processing and mechanical treatment and with the manner of applying treating material to the roving, as will be more clearly brought out in the specification and claims.

In the drawings:

Fig. 1 is a diagrammatic flow chart illustrating one method of treating the roving with the bonding agent.

Fig. 2 is a diagrammatic flow chart illustrating the simultaneous tensioning, compacting and setting the bonding material on the roving.

Fig. 3 is an enlarged detail view of one type of heating element which I may use in setting the parallel fibers of the roving.

Fig. 4 is a sectional view taken on line 4—4 of Fig. 3 showing the formation of a steam heating unit.

Fig. 5 is a sectional view taken on line 5—5 of Fig. 3 showing in detail one of the bearing units for supporting and guiding the roving as it passes over and through the heating unit.

In the manufacture of my new product I utilize either the sliver or roving as delivered. This roving may vary in size but I prefer to use from 1/4 hank to 4 hank size. Normally such rovings

are without twist and merely comprise a continuous strand of parallelly arranged fibers.

An important feature of the present invention is that the sliver or roving is given a twist preliminary to processing and this twist is preferably just sufficient to obtain the tensile strength required for mechanical handling. The twist is placed in the initial sliver, or roving as it comes from the drawing frame, and is wound up on a standard spool. Various types and sizes of rovings will require different amounts of twist and the amount of tension to produce uniform tensioning and parallel arranging of the fibers will vary with the amount of twist.

It is well known that a single individual cotton fiber, for instance, has relatively great strength, and it is the object of the present invention to bring the parallelly arranged fibers of a sliver or roving down to as small a diameter as possible and bonding them under tension and/or compression to approximate as nearly as possible a single strand.

The processing and mechanical steps of producing my new product may be best understood by following through the steps as illustrated in the flow charts of Figs. 1 and 2. While the sliver or roving may be formed of any parallelly arranged fibrous filaments, I prefer to illustrate the invention in connection with a sliver or roving formed of cotton fibers. Assuming that the roving or sliver has been given a relatively high twist sufficient for treatment and wound upon a spool, this spool which is generally designated 10, in Fig. 1, may be suitably mounted. The sliver or roving is passed over suitable rollers 11 so as to impregnate the roving with a treating solution 12 carrying some form of a bonding agent. The impregnated roving can be passed through squeeze rolls 13 and on to a spool 14 which is driven by a floating drive member 15; so as to impart a constant speed to the roving passing through the treating bath.

To insure very thorough penetration of the treating material, the treated roving as wound up on the spool 14 is preferably allowed to age, which ageing time will vary with the kind of treating material used. After the roving has aged sufficiently, the spool 14 is placed on the spindle 16 and the final product is wound up on a driven spool, generally designated 17. It will be understood that various methods may be utilized for placing the treated roving under tension and compression, but the main point is that after the tensioning and/or compressing of the roving is obtained, a certain length of the continuous moving roving is maintained under such tension and compression while the bonding material on the discrete fibers is set to bond the fibers firmly together.

In the arrangement shown in Fig. 2, the thoroughly treated roving on spool 14 is mounted on the spindle 16, threaded over pulleys 18, 19 and 20 and around the multi-grooved guides 21 and 22 and then on to the driven spool 17. Predetermined tension is placed upon the roving by means of a friction brake 23, the amount of friction being predetermined by adjusting the weight 24 at the end of the lever arm 25.

The particular heating element shown in the flow chart of Fig. 2 consists of a steam jacketed portion 26, the outer two sides 27 and 28 of which are grooved to receive and assist in compacting the roving. The roller members 21 and 22 are also grooved, as best shown in Fig. 5, so as to guide the roving over the grooved surfaces of

the steam heated element 26. In threading the unit, the roving is progressively fitted into each one of the grooves in the rollers 21 and 22 and taken off the last groove in the bottom roller 22 and fed to the driven element 17. As the roving moves along the grooves in the side walls 27, 28 of the unit 26, it is subjected to considerable heat and the carrying agent for the bonding material evaporated and the bonding material set around the discrete fibers while the roving between the spindles 16 and 17 is under tension.

Inasmuch as the fibers of the roving are part of a single strand as compared to multi-ply yarn, the individual fibers are given a more uniform tensioning and parallel arranging than if the tension were placed on multi-ply yarn. The tension applied to the roving during the heating step is preferably such as to closely approach the breaking strength of the twisted treated roving and, of course, this will vary in accordance with the number of turns initially given the roving and its hank size and its fiber content or composition. This tensioning of the roving, in addition to moving the roving along the specially shaped grooves in the heating element 26 and over the grooves in the rollers 21 and 22, will effect a compacting of the roving; this compacting of the roving while the tension is placed thereon is just short of damaging or crushing the roving. With such tensioning and compressing of the roving as it passes over the heating element 26, it will be seen that the maximum number of fibers, parallelly arranged and under equal tension, are held in as small a cross sectional shape as possible by the said bonding agent, whereby the strength of the new product approaches as much as possible the theoretical strength of a single fiber of the same diameter.

It will be understood that most any artificial integument or bonding material may be used in treating the discrete fibers of the sliver or roving. This material may be placed in the form of emulsion, solution or any standard manner of getting a bonding agent into and around the individual fibers. The following examples of treating solutions are adapted for use as a bonding material in my process:

Example 1

Water dispersion

15% by weight hydrogenated rosin glycol ester emulsion (approximately 40% solids)
5% by weight emulsified congo gum (approximately 40% solids)
1% sulphonated oil
79% water

Example 2

Organic formulation

10 parts by weight urea formaldehyde resin (50% solids—organic solution)
5 parts rosin ester (the glycerol ester of abietic acid)
3 parts alkyl resin
75 parts carbon tetrachloride

The particular resins used in this formulation are urea formaldehyde, Reichhold P 305 Beckamine, #1111 ester gum (a combination of abietic acid and mixed glycerides), and 24-B alkyl resin (a phthalic glycerol resin modified with castor oil).

Example 3

Water dispersed treating material

10% solids—water soluble urea formaldehyde resin in water solution

An acceptable resin for this Formula 3 is Reichhold P-246 water soluble urea formaldehyde.

In using any of the above bonding solutions, as thin a solution as possible is used as long as sufficient bonding action is obtained to hold the respective discrete fibers in their relatively stretched and compacted positions. In using some solutions on relatively thick slivers or rovings, it may be that the stretching and compacting of the roving would be such as to force outwardly a small portion of the bonding solution, but there will be sufficient solution left in the greater part of the cross sectional area of the roving that a majority of the parallel fibers will be bonded together.

In tests made on roving treated in accordance with the treating solution of Example 1, and with the roving tensioned to within approximately 15% of its breaking point, and with corresponding relatively great compacting of the roving, and with initial twist on the roving varying from two to eight turns per inch, an increase in tensile strength was obtained of 100% to 200% and the residual stretch was reduced to 2% to 3% at the breaking point, or 1% under a ten pound load.

On tests made on yarn treated with the treating solution of Example 2, and with the same variation in the twist of the roving of from two to eight turns per inch, the increase of tensile strength was 75% to 150% and the decrease in stretch was substantially identical with the tests made with the treating solution of Example 1. It was also found in connection with tests made under the treating solution of Example 2, that a colored yarn could be produced from the formula of Example 1 by merely adding one part of Monastral Blue pigment (copper phthalocyanine), first dispersed in the alkyd resin. A further unexpected result was obtained in tests on roving treated with the solution of Example 2 in that a much tougher final product was obtained than when using the treating solution of Example 1; the over all tensile strength was not as good under identical conditions, but it will be understood that in some uses of roving treated in accordance with the present process that toughness may be desirable even at some sacrifice to increase in tensile strength.

In tests made with the roving treated with the treating material of Example 3, substantially the same results were obtained as to increase in tensile strength and decrease in stretch as were obtained in connection with the treating solution of Example 2.

It will thus be seen that by imparting a relatively high twist to a sliver or roving coming directly from the drawing frame and then treating the twisted roving and subjecting the same to tension and compression in proportion to the amount of twist, and then setting the bonding agent, I am able to obtain a new product in the form of a linear textile filament the tensile strength of which is greater than or equivalent

to conventional yarns of the same size and gage. All the normal subsequent operations in transforming sliver or roving into multi-ply yarns are eliminated and since my new product is a homogeneous linear element all the cutting and wearing action resulting in the use of multi-ply yarns is eliminated so that even if my new product only equals multi-ply yarns of equivalent size and gage in tensile strength, it will wear much better in that the overlapping plies are eliminated.

If desired the new product formed from the sliver or roving may be coated with latex, resins or waxes to give a smoother surface and to permit of freer action in some types of weaving.

What I claim is:

1. The method of bonding fibers to form a filament like linear element of high density and tensile strength, which comprises impregnating roving with material to act as a bonding agent, stretching said roving to substantially its breaking point, setting said material while said roving is so stretched to form a final product without spinning, and coating the final product with a material such as latex and the like to form a smooth surface.

2. The method of bonding fibers to form a filament-like linear element of high density and tensile strength, which comprises twisting roving from two to eight turns per inch, impregnating the twisted roving with a bonding material by a dipping and squeezing action and then without change in the treated roving stretching it to substantially its breaking point, and setting said bonding material while said roving is so stretched to form a final product without spinning, said roving being stretched to such a point and so set that the result is an increase in tensile strength of at least 50%, and the reduction in residual stretch is less than 3% under a 10-pound load.

3. As a new article of manufacture a homogeneous linear element formed from a single length of roving, the individual discrete fibers being held in substantially parallel uniformly tensioned relationship by a hardened bonding agent, the external surface having a smooth coating of latex and the like to permit free action in weaving and the like, said bonded roving having a tensile strength at least 50% higher and a substantially lower stretch and diameter than identical roving which has not been bonded.

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REFERENCES CITED

The following references are of record in the file of this patent:

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2,220,958	Jennings	Nov. 12, 1940

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