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AUBREY E. MEYER, OF PARIS, FRANCE

METHOD OF PREPARING TEXTILE YARN

No Drawing. Original application filed September 30, 1924, Serial No. 740,841, and in Great Britain October 21, 1924. Divided and this application filed November 30, 1929. Serial No. 410,888.

The invention relates to method of preparing textile yarn, and more particularly to an improved method of producing the kind of yarn set forth in my United States Letters Patent No. 1,295,821, granted February 25, 1919, for textile yarn and method of making the same. The yarn referred to is one from which the twist of the fibres has been partially or wholly removed by gumming and untwisting.

The general character of the yarn and fabric to which the invention relates and the advantages of the untwisted yarn and resulting fabric, are fully set forth in my said Letters Patent and need not be repeated here.

The object of this invention is to improve the quality of the untwisted yarn and fabrics woven or knitted therefrom, by improving the uniformity of the yarn structure—i. e., twist or detwist, and/or its tensile strength. The invention consists in the novel method of preparing the yarn which is hereinafter set forth according to the preferred manner of practicing the same. The invention will be more particularly pointed out in the appended claims.

As pointed out in my aforesaid patent specification, heretofore I have produced gummed untwisted yarn in the following manner: I took the yarn after it had been spun in the usual manner, from sliver, roving, etc., and wound upon suitable bobbins or cops, and having the necessary twist for being so handled and for permitting it to be gummed, and I then gummed it in any suitable manner, as for example by passing it over gumming rolls or through a suitable basin containing the adhesive, and after it had been gummed, I brushed it, if desired, as it left the rolls or basin, and then dried it as it left the brushes, if used, so that the gum would bind the fibres together. I then took out a substantial amount or substantially all of the twist, as may be desired in the particular case, depending upon the gum wholly or in part to hold the fibres together so as to give the yarn its necessary strength for use in forming fabrics of the interlaced strand type. The twist was taken out in any way desired as by placing the cop in a twisting frame and rotating it in a direction to untwist the yarn. It was further pointed out in said specification that instead of taking the spun yarn that had already been copped, and gumming, untwisting and recopping it, the yarn could be gummed during the spinning operation, i. e., after the twist has been put in it by the spinning of the yarn, and then after drying it could be wound upon the cop or pirn; after which the twist could be taken out as described.

I have found in practice in producing such yarn, that some of the fibres or groups of fibres are caused to separate from other fibres or groups of fibres due to the detwisting operation, the dried gum being somewhat ruptured along the length of the yarn by the detwisting, permitting some of the fibres to thus somewhat separate, in the same general manner as roughly illustrated by the loosening, bulging or separating of fibres or groups of fibres in the untwisting of a string or rope when one takes hold of the same and holds it at one point while turning it at another point in a direction to take out the twist. This somewhat separation of fibres or groups of fibres one from another tends to reduce the tensile strength of the gummed untwisted yarn from what it would be if the fibres in their untwisted condition could be held and cemented together in close contact one with another.

I have also found that the detwisting does not occur uniformly along the length of the yarn. For example, if a yarn has 17 twists to the inch, and after it is gummed and dried, it is twisted in the reverse direction, say 12 times to leave only 5 twists per inch; it may be that due to heavier gumming at some portions, or other factors causing the fibres of the yarn to be bound together more firmly at one portion than at another, the resulting yarn may actually have a few twists in one direction for a short length, and no twist or even a reverse twist in another adjacent short length. This is not objectionable in some fabrics, but it is objectionable in other fabrics, such for example as where a smooth, soft uniform surface hav-

ing a high sheen is desirable. Fabrics woven from the improved yarn have the desired more uniform surface and sheen.

I have found that untwisted fibres can be kept or brought into close contact, as the case may be, and be cemented or bonded together in that position if the gum is sufficiently wet or moist, either at the time of the detwisting or after the detwisting and before the use of the yarn, so as to have the gum sticky or tacky enough to cause the fibres to be held down in this position or to be brought back into this position and cemented there, as the case may be. This may be accomplished by detwisting the gummed yarn while the gum is yet wet or tacky. But this method of procedure is rather undesirable or troublesome due to difficulties in carrying out the same, among which I might mention slow operation, added expense, and the fact that I have found that when the detwisting is carried out with the gum in a condition tacky to the touch, the yarn collects lint in the "traveler" through which it passes in the detwisting operation. It is therefore, perhaps in many cases, preferable in accomplishing the desired end, to detwist the yarn with the gum dry and thereafter wet or moisten the gummed yarn to make the gum sufficiently sticky or tacky to cause the untwisted fibres to be drawn or flattened down in close contact, in which position they are recemented by the tacky gum.

It might be attempted to allow the gum to sufficiently dry before the detwisting so that it is not tacky to the touch or contact and thus avoid the traveler difficulties above mentioned in detwisting the yarn while the gum is tacky to this extent, and yet not allow the drying to progress to a point where the gum will be sufficiently dry to cause it to crack and allow the fibres to separate during the detwisting; but while this may be successfully accomplished under certain conditions where the entire process can be carefully watched and the detwisting carried on at exactly the desired stage of dryness of the gum, yet in general practice it is troublesome, uneconomical and inadvisable to try and handle the matter in this way because if the yarn should be detwisted with the gum too wet the foregoing difficulties will be encountered, and if it should have dried too much the resulting lack of tensile strength might not be noted until the yarn had been shipped and was put to use in weaving where it would be too late to rectify the trouble without serious cost. Furthermore, it may well be that in the actual use of the yarns the yarn may be gummed at one time or at one place and then be detwisted at a much later date, or even at an entirely different place and under such circumstances it may be impossible to carry on the detwisting before the gum became too dry. Therefore, in order to insure the desired tensile strength without incurring the difficulties above mentioned it is important to moisten the gum as above stated, after the detwisting has taken place, so as to insure recementing of the fibres.

The detwisted gummed yarn may be moistened or wetted while on the bobbins, such for example by steaming the bobbins or by sprinkling the bobbins or by soaking them in cold water, or by soaking and steaming, in each case allowing the gum to dry before use; or the gummed untwisted yarn may be suitably wetted or moistened while it is being run from bobbin to bobbin, etc. The wetting or moistening of the gum may be carried out in any manner so long as the gum is made sufficiently sticky or tacky to insure the recementing of the somewhat separated fibres or groups of fibres, and preferably to insure the flattening down of the fibres or groups of fibres in close contact one with another and the recementing of the fibres in this flattened down close contact position. On the other hand, if the wetting is to be done while the yarn is running from bobbin to bobbin or in any other manner than while the yarn is at rest on a bobbin, the wetting should not be carried to such an extent that the gum will become so soft as to let the fibres pull apart while the yarn is being manipulated. If the yarn is moistened while wound on the bobbin the moistening or wetting may be carried to a considerable extent without danger of hurting the yarn, because there is little or no strain on the yarn as may be the case in running it from bobbin to bobbin, but of course the gum should be allowed to dry to proper consistency before the yarn is used in a manner requiring substantial tensile strength, such as for weaving, etc.

I have found that the yarn when thus produced, prepared or treated,—i. e., having the gum moist or tacky at the time of or subsequent to the detwisting, has its tensile strength considerably improved.

But to insure uniformity in the degree of twist or detwist along the yarn as hereinabove pointed out, it is also desirable to subject the detwisted gummed yarn to a certain degree of tension while the gum is in the moist or tacky condition, because by doing this the adjacent unequally twisted sections of the yarn are permitted to, and are assisted in, their natural tendency to equalize their twist, so as to make the twist substantially uniform along the length of the yarn. Since the gum on the yarn is in a tacky condition this unequal twist in different sections of the yarn will be readily equalized. The advantages of putting the yarn under tension for this purpose might be explained by the following rough or general analogy: For example, if one takes two or three yarns

or threads and twists them together say for twenty turns for a 6 inch length, and then grips the yarn at the end of this 6 inch length to prevent any interference with the twisted 6 inches, and then twists the adjacent 6 inches for say five turns, and then grips the end of this 6 inches having 5 twists, and puts a reverse twist in the next adjacent 6 inches, and allows the resulting 18 inches of yarn to be slack, there may be some neutralization in the twist along the three adjacent sections of 6 inches each, but the neutralization of the twists will not be nearly so complete as if the 18 inches of yarn is drawn out taut. The tensioning of the yarn will assist the natural tendency of these sections to neutralize their respective twists so as to bring the twist throughout the 18 inches substantially uniform or much more uniform. This is a mere rough analogy of what takes place. Also, by tensioning the yarn when the gum is moist or sufficiently tacky, the fibres of the yarn are brought together or caused to lay upon each other with closer contact for a firmer or closer binding together by the moist yarn. The result is therefore a stronger more uniform yarn, and fabrics woven from such yarn are of better, more uniform texture, with a smoother surface giving a more pleasing softer appearance and better sheen in fabrics having this characteristic.

The operation may be carried out in various ways and by various kinds of apparatus, but I have found the following method of handling the gummed detwisted yarn, to put it under tension while the gum is moist or tacky, to give good results—i. e., the bobbins are mounted so as to have the yarn drawn therefrom, and the strands of yarn are then drawn off of the bobbins, passed through a suitable moistening device, such as over a roller running in water, from which roller the yarn is passed through a drying zone to partially dry out the yarn, but not beyond the tacky stage, for the purpose of increasing the tensile strength of the yarn so that it may be put under the desired tension, and from this drying zone the yarn is run between a set of rollers and thence to another set of rollers, the peripheral velocity of the second pair of rollers being slightly in excess of that of the first pair, so as to put the yarn under the desired tensile stress, and from this second set of rollers the yarn may again be wound upon bobbins. The drying of the yarn as it passes through what I have termed the heated zone, may be accomplished, for example, by winding the yarn back and forth between two revolving rollers, as is well understood in the art, so that as the yarn passes along from the wetting roll it goes back and forth over these two rolls in the drying zone before it goes to the tensioning rolls, and beneath the rolls between which the yarn is wound a suitable heating device may be arranged such as a set of gas burners. By this arrangement, the various elements of which are well known in the art for other uses, the yarn may be first well wetted to insure the desired degree of thorough softening of the gum throughout, and then the excess moisture will be taken out by the drying, so as to increase the tensile strength of the gummed yarn sufficiently for it to stand the tensioning operation. I merely mention this apparatus as one means of producing the desired yarn.

This application is a division of my copending application Serial No. 740,841, filed September 30, 1924, for method of preparing textile yarn, and resulting products, which application in turn is in the nature of a continuation in part of an application filed by me November 12, 1923, Serial No. 674,257, for method of preparing textile yarn. In this application I claim that specie of my invention wherein the process is carried out by detwisting the gummed yarn while the gum is moist or soft, whereas in my said copending application I claim the invention generically as to process and resulting products, and also that specie of my invention, described herein as the preferred procedure, wherein the process is carried out by detwisting the yarn while the gum is dry beyond the stage where it is tacky to the touch, and after it has been thus detwisted, moistening or wetting it.

In the foregoing description and the claims I make use of the terms "gum" and "gumming" merely for brevity and convenience, and I do not wish to be understood as limiting myself to a gum in the strict sense of the word as distinguished from any other form of suitable adhesive, but wish to be understood as including the use of any suitable form of adhesive, the important thing being that a suitable adhesive is present in the yarn when the same is untwisted, so as to bind the fibres together. Any suitable adhesive may be used that can be readily dissolved from the fabric, such for example as glue, fish glue, gelatin, starch, gum arabic, rosin, solvent rubber, etc., admixed or not with suitable additional matters. Of these gumming agents perhaps starch is the most generally used and best known adhesive in the textile industry, and since it is inexpensive and its characteristics and working properties are well known in the trade it is perhaps the most satisfactory adhesive agent to be used for gumming yarn. The solvent will be chosen in accordance with the character of the adhesive, as will be understood in the art.

The following compositions of adhesives have been found suitable in practice:

(*a*) 1 kg. joiners' glue dissolved in 10 liters of water, and

(*b*) 25 grams of gum arabic and 91 grams of starch dissolved in 5½ liters of water.

As pointed out in my above-mentioned patent, the interlocking or the interlacing of the yarn or threads of the fabric (made from the yarn) one on or with the other, gives the fabric the necessary strength after the adhesive has been dissolved from the yarn or threads.

Where in the specification or claims I use the word "untwisted" or "untwisting" or "detwisted" or "detwisting" referring to the yarn, I use it in its ordinary meaning, namely, as referring to yarn having a partially or wholly removed previous twist, and do not mean by such words to refer to yarn which has either not been twisted at all, or has been slightly twisted and remains in that condition. Also, where I refer to increasing the tensile strength, or to a yarn of increased tensile strength, it will be understood that I have reference to a comparison of the yarn made or prepared according to this invention with a yarn of the same size and character as heretofore made by me under my said patent, i. e., a yarn made of the same kind and length of fibre and of the same size.

While I have described my invention in detail according to the preferred manner of carrying out the same, it will be obvious to those skilled in the art, after understanding my invention, that changes and modifications may be made therein without departing from the spirit or scope of the invention, and I do not wish to be limited other than as indicated in the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. Method of producing gummed untwisted textile yarn, which comprises gumming a twisted yarn and then detwisting the yarn while the gum on the yarn is sufficiently soft to facilitate a better detwisting of the fibres and the flattening down of the detwisted fibres.

2. Method of producing gummed untwisted textile yarn, which comprises gumming a twisted yarn and then detwisting and tensioning the yarn while the gum on the yarn is sufficiently wet to facilitate a better detwisting of the fibres and the flattening down of the detwisted fibres.

3. Method of producing gummed untwisted textile yarn, which comprises gumming a twisted yarn and then detwisting the yarn while the gum on the yarn is sufficiently soft to facilitate a better detwisting of the fibres and the flattening down of the detwisted fibres, and then permitting the gum to dry on the yarn.

4. Method of producing gummed untwisted textile yarn, which comprises gumming a twisted yarn, drying the gum on the yarn, wetting the gum on the yarn sufficient to facilitate a better detwisting of the fibres and the flattening down of the detwisted fibres, and then detwisting the yarn while the gum is thus wet.

5. Method of producing gummed untwisted textile yarn, which comprises gumming a twisted yarn, drying the gum on the yarn, wetting the gum on the yarn sufficient to facilitate a better detwisting of the fibres and the flattening down of the detwisted fibres, and then detwisting and tensioning the yarn while the gum is wet, to cause the detwisted fibres to lie more closely together and to equalize the detwist along the yarn, and then permitting the yarn to dry.

In testimony whereof I have signed my name to this specification.

AUBREY E. MEYER.