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METHOD OF TREATING YARN

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Fig. 1.

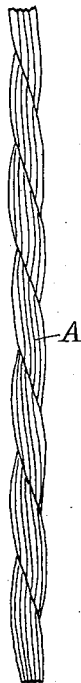


Fig. 2.



Fig. 3.



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METHOD OF TREATING YARN

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This invention relates to the softening of yarn, and while it will be described in the connection with the formation and treatment of cotton yarn, it is understood that the invention is not limited thereby, but will apply to yarns other than cotton yarns.

In the manufacture of cotton yarn, raw cotton is carded and spun into strands. The fibres of the strands are bound together by the spinning, so that they become twisted together, each fibre aligning closely with its neighbors.

This single strand, as twisted in the spinning, is sometimes used as yarn in the formation of finely woven or knitted materials, while in other instances, a plurality of these strands are twisted together to produce a multiple strand yarn.

The raw cotton yarn, either in a single strand or composed of a plurality of strands, is usually bleached, mercerized and dyed, or may be treated with a combination of any of these steps in order to produce the finished article.

In any or all of these treating steps, the yarn may be held under tension.

It has been found by experimentation that yarns are stiffened or made harder by any of these treatments and, consequently, are less adaptable to the knitting machine than would be the case if softer. And this hardness is not only present in the yarn itself, but is carried on into the knitted goods so that they are harder or stiffer than goods manufactured with yarn treated in accordance with this invention.

Various processes have been advanced for the treatment of finished yarn in order to soften the same and render it more adaptable to the knitting machine and, consequently, to the production of better knitted goods.

These processes, however, usually consist of treating the yarn with conditioning oils or emulsions, and may be said to be chemical processes, as distinguished from mechanical processes.

In one instance, however, it has been suggested that the yarn could be beaten or flayed with tom toms or the like, in order to take out the stiffness or hardness.

While all of these processes are helpful in varying degrees, none of them are capable of producing a soft yarn or a perfect yarn for the purpose specified.

The object of this invention is to provide a process of mechanical treatment for softening yarn.

According to the invention, the yarn, after treatment, is untwisted to separate the fibres and cause them to take up new relations with their neighbors.

It is a well-known fact that the processing of yarns, as by mercerization, puts them into a more or less plastic condition before drying. Then when they are dried, particularly if run over drying cylinders where the yarn is under some tension and is pressed tightly against the cylinder surfaces, the fibres are set rather firmly in new positions. The result is that ordinary mercerized yarns, for example, have finer and smoother appearance than the untreated yarn, due to a closer packing of the fibres.

Such yarns do not knit as well because the fibres cannot slip over one another as readily as before this packing or sticking together and, therefore, do not accommodate themselves as readily to the formation of loops in the knitting machine.

With mercerization, even aside from the drying influence, the tension on the yarn while it is wet tends to make a harder—more compact structure.

The ordinary methods of softening employ materials like soaps, oils or fatty substances. These materials may exert some softening effect on the individual fibres, but it seems more likely that they act through a lubricating effect. There is no evidence that they soften yarn through any influence on the "set" of the fibres.

It is common experience that such softening usually does not add much to the knitting quality of yarns.

The basis of this invention is the attack of this problem in a more fundamental manner by breaking the "set" in the processed yarn. It is quite probable that during the process of untwisting or of untwisting and retwisting, every fibre in the yarn moves a little

with respect to its neighbors and, probably, never comes back to its original position.

The well-known twist relations of two-ply yarns such as cotton of ordinary mercerizing twist, appears to establish this as a fact. It is established beyond all doubt that when a single strand yarn is made at any twist, and then doubled into two-ply yarn by twisting in the opposite direction, an amount of twist comes out of the singles equal to that put into the two-ply; for example, if the single strand yarns are made at 15 twists per inch, and they are then doubled at 15 twists, the twist in the singles will practically all come out and the single yarns will contain almost no twist as they lie in the two-ply.

This general behavior has been verified in the laboratory of the Mellon Institute of Industrial Research, a department of the University of Pittsburgh, and is also covered in a very recent issue of Textile World (see Textile World of February 21, 1931, page 38).

The reverse is also true. The untwisting of a two-ply yarn puts twist back into the singles. This is readily demonstrated by the regular test for twist. The twist is first taken out of the two-ply, then one strand is cut away, and the original twist is found in the remaining single strand yarns. Even though the single yarns were practically without twist while in the two-ply, the full twist goes back into them on untwisting the two-ply.

With this twist behavior in mind, it can be readily seen that when a two-ply yarn is untwisted, even to a very slight extent, there is a corresponding input of twist into the single yarns from which it is made. This means that all of the fibres are moved more or less and change their positions, as shown by new twist angles.

At this stage, the single strand yarns are temporarily tightened but the separate fibres are in new positions.

On retwisting the twist comes out of the single strand yarns and back into the two-ply, but the tightening and loosening have been sufficient to break up the fibre "set" and soften the yarn. An observed increase in loose fibre ends confirms this general slight loosening of structure which has released them.

Although the effect produced in an ordinary yarn is scarcely visible, it is sufficient to make a very definite difference in knitting quality. In knittings made with this specially treated yarn, it has been found that they show about 5% less width than with knittings made with the same yarn untreated by this process. This indicates a better knitting quality, as commonly judged by the trade, and from the knitting point of view, is a very real difference.

A very slight unpacking of the fibres or release of any sticking together would make

the yarn more flexible and less stiff. While there is rather small visible difference in the knittings, their preference by the knitter and the general appearance and feel of the fabrics is highly persuasive.

There are two general methods by which this process may be carried out. Let us consider the first from the standpoint of untwisting and retwisting. Let us consider that a single strand of yarn is twisted about 15 times to the inch. This is its condition when mercerized and treated. This strand is then untwisted so as to leave about 4 or 5 twists to the inch and is then retwisted to add about 7 twists so as to bring it back to a little less than the former number of twists, or even bring it back to the original number of twists. In any instance, the fibres have been pulled apart and the fibres will each assume new relations upon the retwisting of the yarn.

This is practically the same case which will result in the case of multiple twist yarn, except that the relation of the single strand twists and the doubling twist will produce a somewhat different effect.

In the accompanying drawing, I have endeavored to diagrammatically illustrate this phenomenon of the twists of multiple strand yarn by exaggerating the size thereof.

In the drawing the fine lines show the directions of the single fibres or the twist angles.

In the original yarn, Figure 1, there is practically no twist angle as the fibres A tend to follow the axis of the single strand yarns. Let us assume that in this yarn of Figure 1 the doubling twist is about 14 twists to the inch and the single strand twist was 15.

In Figure 2 the doubling twist is reduced from 14 to 5 twists per inch and the fibres A show a distinct twist angle in the singles, because they have taken on twists with the untwisting of the two-ply.

In Figure 3 a part of the doubling twist has been put back and a corresponding amount of single twists have been taken out automatically by that same operation. The fibres in the yarn of Figure 3 are now at a smaller angle with the single strands of yarn than in Figure 2, and are intermediate between the conditions shown in Figures 1 and 2.

These views have been prepared from magnified yarn count 45/2 and they are not exaggerated.

Anyone can easily convince himself, by a few minutes experimenting with a two-ply yarn of usual mercerizing twist, that the twist will run into or out of the singles with changes in the doubling. If a short length of the two-ply is held by its ends, and one of the single strands removed, without disturbing the other, the one remaining will be found to be almost without twist and very weak.

If, however, a piece of the two-ply is held at the end, as with knots, and untwisted with only the natural disturbance of the single strands, the single yarns will now be found to be twisted as well as stronger, and also inclined to kink, showing that the twist has gone into them.

This untwisting of the multiple ply yarn and the retwisting involves two operations on twisting machinery. A second or alternative method is proposed to eliminate one of these operations.

When the yarn is manufactured, it can have the usual amount of twist in the singles, but they can be put together with a higher twist than usual.

If the yarn is mercerized or otherwise processed, the excess of twist in the doubling can be taken out, leaving the usual doubling twist. This step will, at the same time, bring the yarn down to the usual singles twist.

Since the doubling and singles twist will have both been changed by this one untwisting operation, the yarn will have been softened in accordance with the explanation above and the final yarn will have the usual structure.

A slightly different modification will yield a still softer yarn.

The yarn is so designed that the untwisting will untwist both the singles and the two-ply at the same time, leaving the whole yarn structure slightly loosened but at approximately the usual commercial twist or at any desired special twist.

To illustrate this last modification the single strand yarn could be made at 14 twists and then doubled in the two-ply with 18 twists. This doubling would take all the twist out of the singles and put in 4 twists in the reverse direction to the original. If, after processing, the yarn is desired to have 14 twists of doubling twist, the 4 twists excess can be taken out and at the same time 4 reverse twists in the singles will also come out, thus the singles and the two-ply can both be slightly untwisted at the same time, a condition most favorable to maximum softening. In this case, the result will be a balanced yarn with 14 twists in the doubling and 14 in the original singles.

Since the untwisting is done after the processing, it is obvious from the general twist relations already stated that these yarns will not be merely equivalent to softer twisted yarns. The special manipulation also undoes some of the harmful effects of treating yarn by tension, drying and other operations, and this, as already explained, is the main point of the invention.

It must be understood that the special twist processes which involve a permanent taking out of twist will not produce results equivalent to merely using yarns of less twist in the first place. In this invention, the

untwisting is only done after the yarns have been hardened by other processes, hence its phenomenal results.

While the invention has been explained in connection with certain yarns and certain twists, it must be understood that these are for illustrative purposes only, and the description of these particular yarns and the steps in the process may be modified and changed in various ways without departing from the invention herein set forth and hereafter claimed.

The invention is hereby claimed as follows:

The herein described process of softening treated twisted yarns, comprising the steps of putting a number of twists in excess of the desired final twist into the yarn before treatment, and then partially untwisting the same after treatment.

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

JOSEPH P. HOLT.