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HOLLOW SPINDLE YARN PLYING MACHINE

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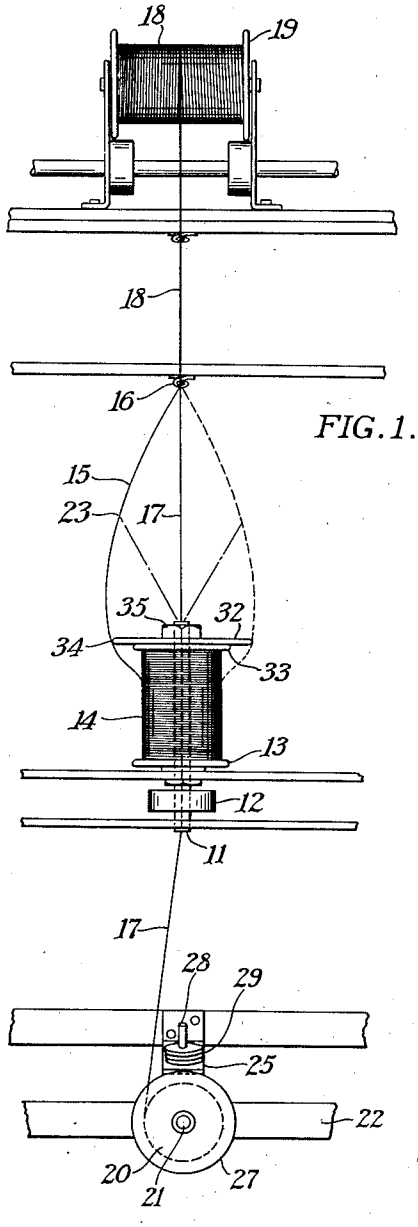


FIG. 1.

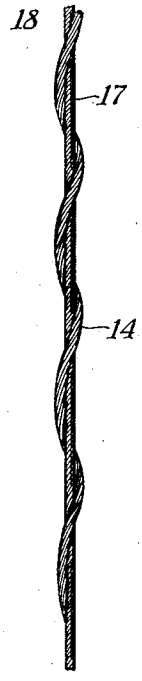


FIG. 3.

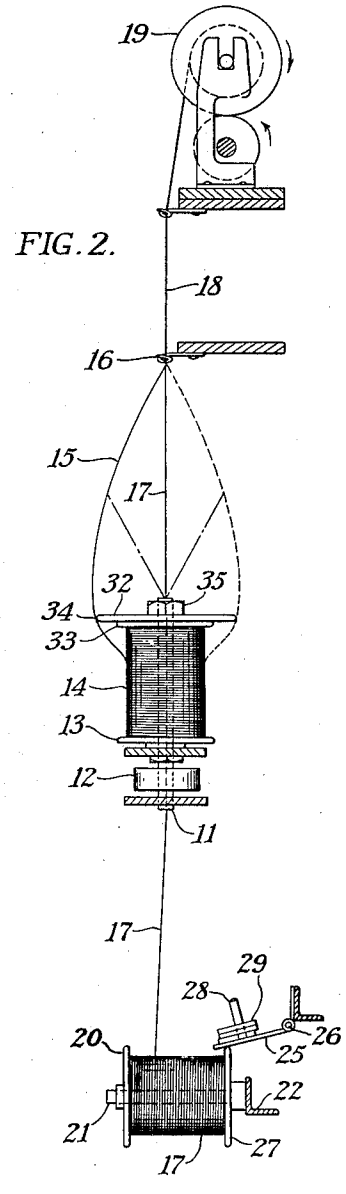


FIG. 2.

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HOLLOW SPINDLE YARN PLYING MACHINE

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2 Claims. (Cl. 57—18)

The present invention relates to the twisting, plying, or doubling of yarn, and more particularly to certain mechanical features utilized in wrapping two or more yarns together by the hollow spindle principle.

In wrapping or plying yarns on a hollow spindle machine, the core yarn or thread is unwound from a supply spool and is passed upwardly through a vertically rotating hollow spindle to a thread guide positioned above and in axial alignment with the spindle. The covering or wrapping yarn or thread is drawn from a supply spool mounted on and rotated by the spindle. For best results, the tension on the two threads should be properly controlled so that the core thread remains straight and forms a true core on which the covering thread is wound in spiral relation to form the final plied yarn. In prior hollow spindle machines, proper control of the thread tensions was difficult to achieve, with the result that an inferior non-uniform compound or plied yarn was formed.

The features forming the subject matter of the present invention are found to result in a uniformity of the plied yarn hitherto unattainable by prior construction, and to permit a positive control of the characteristics of the resulting plied, double, or compound yarn. The present invention secures these desirable features by proper control of the tensions of the various yarn components.

The present invention has, therefore, as its principal object, the provision of an arrangement for accurately and positively controlling the tensions on the various yarn components to form a compound or plied yarn.

A further object of the invention is the provision of tensioning means which may be altered to secure the desired yarn characteristics.

Yet another object of the invention is the provision of separate thread tensioning mechanisms which will enable large quantities of plied yarn of unvarying uniformity to be effectively produced.

To these and other ends, the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawing:

Fig. 1 is a front view of a hollow-spindle yarn plying machine, showing the relation of the various parts thereof, and the devices for applying the tensions to the different yarn components;

Fig. 2 is a side elevation view of the machine shown in Fig. 1; and

Fig. 3 is an enlarged or magnified view of the plied yarn formed on the hollow spindle machine shown in Figs. 1 and 2.

In order to be able to alter, in the desired manner, the double, compound or plied yarn characteristics; and, having chosen a set of characteristics desirable for a certain type of fabric, to be able to effectively produce large quantities of yarn with unvarying uniformity, requires a study and knowledge of all the factors (such as thread tensions) which influences these things. Only after a recognition of these factors can means be applied for their control.

The most common type of double or plied yarn, used in romaine and other fabrics, consists of an end of a highly twisted crepe yarn or thread and an end of a low twist yarn or thread. These yarns are twisted together with a common twist of five to twenty turns per inch. When this doubling is performed on the ordinary down draft type of twister, an additional five to twenty turns plying twist is also imparted to both of the components, as is well known to those in the art.

In the hollow spindle process of the present invention, a highly twisted crepe core yarn or thread passes upwardly through the hollow center of a rapidly turning spindle. Mounted coaxially on and driven by the spindle is a supply spool of a low twist or "raw" yarn. A distinguished feature of yarn plied on this principle rather than on a usual down draft principle is that the crepe or core yarn receives no further twist as it passes from the supply spool upwardly through the hollow spindle to the point of union with the raw yarn. Rather, the crepe yarn serves as a true straight core on which the "raw" or low twist yarn is wrapped in spiral form, as shown in Fig. 3.

The hollow spindle ply machine is a well-known device in the textile art, and does not per se constitute a part of the present invention so that a detailed description thereof is not deemed necessary. A portion of such a machine is, however, shown in Figs. 1 and 2 and comprises broadly, a hollow spindle 11 which is driven by a whorl 12 or other suitable means. A supply spool 13 is mounted on and driven by the spindle 11 and carries a supply of "raw" low-twist yarn 14 which constitutes one component of the final plied or compound yarn. The "raw" yarn is withdrawn from the spool 13, and passes over a tension device, to be later described, and after moving along

the balloon path 15 passes through a thread guide 16 positioned above and in axial alignment with the hollow spindle 11, as clearly shown in Figs. 1 and 2. At the guide 16, the low twist "raw" yarn 14 meets and is wrapped in a spiral form around a highly twisted crepe core yarn 17 to form the final plied or compound yarn 18 which is finally wound up on the spool or bobbin 19. This crepe core yarn 17 is carried by a supply spool 20 mounted on a shaft 21 carried by a support 22. This core yarn 17 after being unwound from the spool 20 passes, without twist, through the hollow spindle 11 to the thread guide 16, as clearly shown in Figs. 1 and 2.

In adapting such a hollow spindle machine to commercial production of plied textile yarns with outstanding evenness of twist and evenness of character, it has been found that certain novel adjuncts are necessary. For example, it has been found that the control of the tension on each of the component ends of the combination or compound yarn is highly important in determining which component will appear on the surface of the compound yarn, and to what extent. Furthermore, the matter of tension application, is important, for the evenness of plying depends on the maintenance of tension with small deviation from the mean value.

It has been found that the character of the plied or compound yarn is effected by the relative value of the tensions of the core yarn or thread and the wrapping yarn or thread at the moment of joining together. The tension in the core (crepe) yarn must be above a certain minimum value if it is to act as a true core with the "raw" or low twist yarn spiraling around it. If the crepe or core yarn tension is allowed to fall below this value, the low twist yarn appears to be the straight center thread with the core yarn acting apparently as a wrapper. Actually in such a case, the core yarn has not been further twisted, but due to the high "raw" yarn tension, the core yarn is bent at each plying turn and is forced to lie on the surface of the composite thread. If on the other hand, the core yarn tension has been brought up to a proper value, but the "raw" yarn tension is too low, the "raw" yarn is too loosely wrapped around the crepe or core yarn in a sort of an outside shell which will easily slip along the core. Poor methods of tension application may also produce plied yarn with irregular twisting. All of these disadvantages are overcome by the simple yet effective yarn tensioning devices of the present invention to be later described.

The appearance of the thread balloon 15 depends on the final form of plied yarn being produced, and is thus connected directly with the yarn tension. If the tension of the core yarn 17 is above the minimum necessary to hold it as a true core of the final plied yarn, the point of combination of the two yarns components 14 and 17 is at the thread guide 16; the "raw" or low twist yarn 14 passing to the guide 16 through the balloon 15, and the core yarn 17 passing straight to the guide from the hollow spindle 11, as shown in full and dotted lines in Figs. 1 and 2. If, however, the core yarn 17 has a tension below this minimum, the junction point of the two yarns 14 and 17 is no longer at the guide 16, but somewhere below on the balloon 15 such as at 23, the exact point of junction depending on the relative tensions of the two yarn components.

It is apparent that the "raw" yarn tension, as well as the crepe or core yarn tension, must be properly controlled to effect the desired results. Furthermore, the means of regulating these tensions must be such that not only can the characteristics of the yarn be determined, but also the manner of tension regulation must not allow deviation from the proper value.

Coming now to the actual yarn tension device of the present invention, it may be mentioned that a large number of guide systems were tried on which the core yarn made frictional contact. None of these methods were successful, possibly because of the inherent rough surface of the highly twisted crepe yarn as compared with the low twist yarn. It is necessary to wind the core yarn on a well-centered spool or bobbin which can run smoothly on a shaft, and to apply tension to the yarn indirectly.

This tension means of the core yarn 17 comprises in the preferred embodiment of the invention, a brake shoe 25 which is pivotally connected at 26 to the support 22 of the machine and is adapted to frictionally engage a flange 27 of the spool or bobbin 20, as best shown in Fig. 2. This brake shoe rides on the flange 27 and provides a drag or retarding force for the spool 20 to properly tension the crepe or core yarn 17 drawn therefrom. The brake shoe 25 is formed with an upstanding pin 28 adapted to receive removable washers 29 by which the braking or retarding effect of the shoe 25 may be varied or adjusted, as is apparent from an inspection of Fig. 2. Other means for adjusting the pressure of the brake 25 on the flange 27, such as an adjustable spring, will readily suggest themselves to those in the art. The important thing is that the pressure of the brake shoe 25, on the flange 27 be adjustable to secure the desired degree of tension of the crepe or core yarn 17. While the present embodiment has shown the brake shoe applied to the flange 27 of the spool 20 which pivotally rotates on a shaft 21, it is contemplated that the bobbin or spool 20 may be secured to the shaft 21 so as to rotate as a unit therewith. With such an arrangement, the brake shoe 25 may obviously be applied either to the flange 27 or to the shaft 21. By means of such a retarding device, the proper tension is imparted to the core yarn 17 to retain the latter in a straight line and without twist during its passing through the hollow spindle 11 to the yarn guide 16 so as to provide a straight true core on which the wrapping yarn may be applied.

The tension of the low-twist yarn 14 is determined by a number of factors which are; spindle speed, yarn denier, balloon height, size of bobbin, and mode of take-off from the bobbin or spool. A thorough study was made of the way in which proper tension may be applied to the low-twist yarn in this type of hollow spindle doubler. Traveler devices have been tried, including ball-bearing travellers fitted to the top of the spindle 11. The height of the balloon has been varied, and surfaces have been used to enclose the balloon to confine it. The low-twist yarn has been variously treated to change its frictional and flexural properties. None of these methods have, however, yielded a yarn of the desired uniform twist.

It has been found, however, after extensive tests, that the desired low-twist yarn tension may be obtained by means of a thin flat flange or disk 32 secured to the top of the spindle 11 and engaging the top flange 33 of the low twist yarn or thread spool 13. As the yarn 14 is unwound from the spool 13, it passes over a well-polished outer edge 34 of the flange 32 and thence along

the balloon 15 to the guide 16 at which point it joins and is wrapped around the core yarn 17.

It is apparent that the diameter of the flange 32 necessary to produce a given tension will be related to spindle speed. The flange 32 functions in two ways as a guide to the low twist yarn tension; (1) regulation of the diameter of the balloon 15, and hence the centrifugal force on the low twist yarn; (2) setting up a frictional drag on the yarn 14 as it passes over the polished flange edge 34. It is essential that for proper results, the diameter of the flange 32 be larger than the diameter of the spool flange 33 by at least 25 per cent, with a maximum of three times the diameter of the spool flange 33. Otherwise, when the raw yarn spool 13 is full, the effect of any flange 32 is lost, while as the yarn 14 is removed, the top flange 33 of the spool 13 itself begins to act as a flange. This produces a variation throughout the course of the yarn. It is thus apparent that the same beneficial results could be obtained by using the top flange 33 of the bobbin 13 (providing it is of sufficient diameter and evenness) as a tension regulating flange on the raw yarn, and taking care not to fill the spool 13 to more than about three-quarters of the maximum diameter. Thus, by use of (1) a bobbin whose upper end or flange is of a larger diameter than the lower end and (2) an incompletely filled spool of proper head diameter, the same desirable results are obtained as with the detachable flange 32. It is preferred, however, to use the separate detachable flange 32 so as to allow the use of the ordinary supply spools as they are received by the mill. When a detachable flange 32 is used, the latter is held in place on the spindle 11 and against the upper flange 33 of the spool 11 by means of a nut 35 which threadably engages the upper end of the hollow spindle 11. Various diameter flanges 32 may be used to secure the tension desired. The flange 32 and the spool 13 constitute a unitary structure so that the flange may be broadly considered as formed on or as a part of the spool 13.

It is thus apparent from the above description that the tension of the two yarn components 14 and 17 may be normally adjusted, controlled, and accurately maintained. However, if for any reason, a change of tension is desired, this change can be readily and easily secured merely by replacement of the flange 32 with another flange of the proper diameter, and/or by varying the pressure of the brake shoe 25 on the flange 27 by the addition or removal of some of the washers 29. The marked effect of variable tension in one or both of the yarn components can be put to useful application by producing novelty yarns in which the twist density is purposely varied on the combination yarn. The adjustable tension control of the crepe yarn offers a convenient means of obtaining this result, and this effect may be obtained by periodically altering the pressure on the brake shoe 25.

It is thus apparent from the above description that the present invention provides an arrangement for separately controlling the tensions of the yarn components. These tensions may be normally maintained constant or may be suitably varied if and when desired. The tension devices insure a yarn with a straight core component on which the other yarn is wound in a spiral form to provide a covering for the core.

While one embodiment of the invention has been disclosed, it is to be understood that the inventive idea may be carried out in a number of ways. This application is, therefore, not to be limited to the precise details described, but is intended to cover all variations and modifications thereof falling within the scope of the appended claims.

We claim:

1. In a yarn plying machine, the combination with a rotating hollow spindle, a spool carrying a core thread arranged to pass through said spindle, a supply of low-twist thread mounted on and rotated by said spindle, means for uniting said threads to form a plied yarn, of an adjustable brake shoe arranged to engage said spool to tension said core thread, and means for controlling the tension of said low-twist thread comprising a flange associated with said spindle and having a diameter at least 25% greater than the diameter of the low-twist thread supply at its fullest size.

2. In a yarn plying machine, the combination with a rotating hollow spindle, a spool carrying a supply of core thread arranged to pass through said spindle, a spool of low-twist thread mounted coaxially on and adapted to be rotated by said spindle, means for uniting said threads to form a plied yarn, of a brake shoe arranged to apply a retarding force to said first spool to tension said core thread, means for adjusting said brake shoe for varying the tension of said core thread, and a tension control for said low-twist thread comprising a flange carried by said spindle and over which said low-twist yarn moves to said uniting means, said flange having a diameter at least 25% greater than the maximum diameter of the supply of said low-twist thread on said second spool.

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