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TWISTING FILM STRIPS TO YARN

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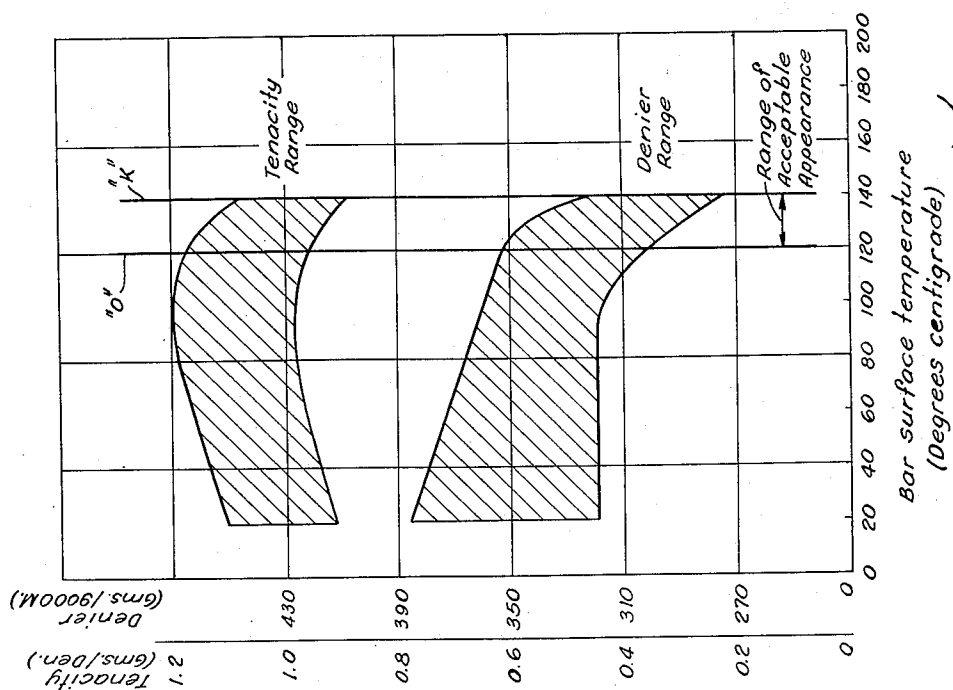


Fig. 2

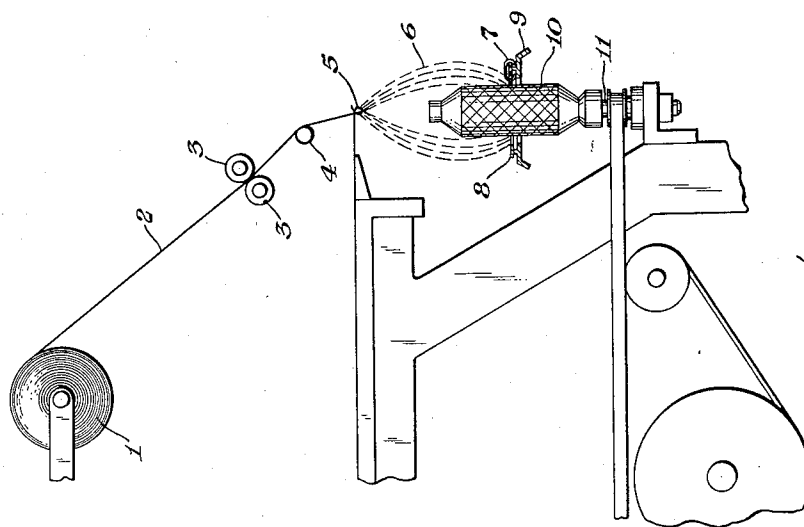


Fig. 1

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TWISTING FILM STRIPS TO YARN

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This invention relates to an improved and satisfactory process for twisting ribbon or generally tape-like strips of flat, normally crystalline, saran polymer films into relatively cylindrical and commercially acceptable yarn-like monofilamentary products.

It has heretofore been difficult to satisfactorily twist flat film strips of normally crystalline saran polymers, particularly copolymers of vinylidene chloride and acrylonitrile that contain in the polymer molecule from about 90 to 98 percent by weight of vinylidene chloride, into suitable, yarn-like, monofilamentary products. The ordinary twisting processes that are employed for such purpose (including the twisting of flat ribbon-like strips that may actually have folded, rolled or curled over edges or be comprised of greater than single film layers, or both) oftentimes fail to provide a product having an acceptable appearance. Frequently, these usual techniques require so much twist to be inserted in the film strip that a resilient, relatively lively twisted, crepe-like article is obtained having an excessive and undesirable tendency to unwind and coil upon itself. Furthermore, flat film strips of normally crystalline saran polymers that have been twisted by the ordinary and conventional Z- or S-twisting procedures are not especially well suited as yarn-like, monofilamentary products to be constructed into good quality textile cloth and fabric materials.

The object of the present invention is to provide an effective and efficient process for twisting flat film strips of normally crystalline saran polymers, particularly those of the specified variety, that would have excellent appearance, good twist retention at moderate levels of twisting and would be excellently adapted to provide and serve as good-quality, yarn-like, monofilamentary textile products free from the indicated drawbacks and disadvantages and capable of furnishing highly advantageous and beneficial textile cloth and fabric constructions.

Accordingly, flat film strips of normally crystalline saran polymers, especially those of the specified copolymeric type, may most advantageously be twisted into substantially cylindrical, yarn-like, monofilamentary textile products and the foregoing objectives and desiderata readily secured by a process which comprises, in its most essential form, subjecting a flat film strip of the normally crystalline saran polymer to heat at a temperature between about 120 and 145° C., preferably between about 125° C. and 140° C., and advantageously by flat contact of the ribbon-like film strip upon a heated surface for a practically instantaneous period of time between about 0.003 and 0.05 second; then immediately thereafter spirally Z- or S-twisting said film strip into a yarn-like, monofilamentary product, conveniently and advantageously while taking-up said twisted product in a collecting package therefor as in and with a conventional textile twist-imposing apparatus such as a ring or cap-twisting device that is adapted to impose at least one turn per inch in the strip. The precise heating period that is involved may vary, of course, with the particular feed

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rate as well as with such other variables as the amount of twist being effected; the take-up speed during twisting and the traversing action of the collection apparatus during winding.

The yarn-like monofilamentary products that are provided by and obtained in the process of the present invention have excellent appearance and properties. The twist is uniformly inserted in the material and is substantially permanently set therein, even at relatively low or moderate levels of twisting, such as twists in the neighborhood of three to six turns per inch. Their appearance is most attractive. They may easily and readily be converted into a wide variety of textile cloth and fabric constructions. Any of the several techniques that are available may be utilized for such purpose, using conventional yarn handling procedures for and upon the twisted film strip product.

Further features of the invention are apparent in the following description and specification, taken in connection with the accompanying drawing, wherein:

Figure 1, on a completely schematic basis of representation, illustrates one embodiment of the present invention; and

Figure 2 graphically portrays some of the benefits of its practice.

In Figure 1 there is shown a down-twisting assembly using a conventional ring twister device for converting the flat film strip to the twisted, yarn-like monofilamentary product. In this connection, it is generally more convenient to employ the conventional down-twisting variety of apparatus in the practice of the invention. The flat film strip 2 is withdrawn from a suitable supply package 1 on which it is wound through a set of feed or nip rolls 3 which form a bight upon the strip and forward it at a suitable rate to the twisting apparatus. Of course, equivalent feed and strip advancing means may be employed for forwarding the strip. The normally crystalline saran polymer film strip may be obtained in the conventional manner by casting the polymer from solution or aqueous latex-like emulsion into a film structure that is dried, fused and formed into continuous strips by any suitable means. Advantageously, the film strip 2 that is twisted has a thickness between about one-half ($\frac{1}{2}$) and two (2) mils and a width between about one-fiftieth ($\frac{1}{50}$) and one-quarter ($\frac{1}{4}$) of an inch. From the forwarding feed rolls, the film strip 2 is passed over a heated surface 4 which, preferably, is a steam or electrically heated cylinder, pipe or bar that has been raised to the indicated temperature level. It is beneficial for the heated surface or bar 4 to have a diameter between about one-half ($\frac{1}{2}$) and two (2) inches and for the flat film strip to flatly contact between about one-eighth ($\frac{1}{8}$) to one-quarter ($\frac{1}{4}$) or thereabout of its peripheral surface in its transverse passage thereover. Under such conditions, excellent results may be obtained when the linear feed rate of the film strip 2 to the twister is between about fifty (50) and seven-hundred-fifty (750) feet per minute with the heated surface 4 being maintained in the desired temperature range.

From the heated surface 4, the flat film strip 2 is immediately passed through a stationary guide 5 to be twisted, while passing through the usual balloon 6, in an ordinary ring twister operated in the ordinary manner consisting of the take up package 10 mounted on the spindle 11 about which the twisted yarn-like filamentary product is laid through the traveler 7 moving on the ring 8 on the ring rail 9. Any degree of Z or S twist may be imposed in the film strip to provide the monofilamentary product. It is usually desirable for between about two (2) and thirty (30) turns per inch to be imparted to the film strip to obtain yarn-like monofilaments that are in a denier range between about fifty (50) and two-thousand

(2,000) in twist multiplier relationships of from about one-half (0.5) to eight (8). Of course, in the usual manner, heavier yarns are ordinarily suitably twisted with less actual twist being inserted per unit of length.

In Figure 2 there is graphically depicted certain of the physical properties of products made both within and without the scope of the present process using about a one-half mil by one-eighth inch flat film strip of a copolymer of vinylidene chloride and acrylonitrile which was fused from a latex coagulum and that contained in the polymer molecule about 97 percent by weight of the former which was S twisted about six turns per inch in the above described manner using a one inch diameter steam heated stainless steel tube as the heated surface that was contacted for about one-eighth of its periphery by the strip at a feed rate of about seventy-two feet per minute to the ring twister. Only when the heated surface was maintained between about 120 and less than about 150° C. did the yarn-like products have suitable appearance with respect to its generally round cross-section and satisfactory processing characteristics upon subsequent conversion to cloth and fabric. The properties of such acceptable goods fell in the shaded portions of the graph between the lines "O" and "K" that are set forth therein and denoted as encompassing the range of acceptable product appearance.

Other yarn-like monofilamentary products prepared in the process of the invention were made by twisting similar normally crystalline saran film strips having the mentioned advantageous physical dimensions to products having characteristics of twist in the indicated ranges. The products were obtained with various deniers in the tenacity range from about one-half to about three and one-half grams per denier and had excellent elongations of from ten to twenty-five percent at break with practically perfect cylindrical configurations and literally permanent retention of imposed twist, without displaying noticeable tendency to unwind or coil when permitted to relax. When temperatures much below about 120° C. were employed at rates much greater than seven-hundred-fifty

feet per minute (using the same one inch hot bar), little beneficial effect was obtained in converting the strips to desired product. Temperatures much greater than about 145° C., especially at feed rates to the ring twister much slower than twenty-five feet per minute, frequently disrupted the process by melting the film and generally caused great physical harm to the product. The products obtained by practice of the present process were used with very good results to provide and prepare various textile articles in such operations as plying, winding or coning, warping, quilling and weaving.

What is claimed is:

1. Process for converting flat film strips of normally crystalline saran polymers into yarn-like, monofilamentary textile products which comprises subjecting a flat film strip of the indicated variety having a thickness between about 0.5 and 2 mils. and a width between about 0.02 and 0.25 inch to heat at a temperature of from about 120 to 150° C. for a period of time between 0.003 and 0.05 second by passing said strip in flat contact at a rate of from about 50 to 750 linear feet per minute over from $\frac{1}{8}$ to $\frac{1}{4}$ of the periphery of a hot cylindrical surface heated to a temperature within said range, and immediately thereafter spirally twisting the strip at least one turn per inch so as to have a twist multiplier therein between about 0.5 and 8.

2. The process of claim 1, wherein said flat film strip is subject to heat at a temperature of between about 125 and 145° C.

3. The process of claim 1, wherein said film strip is a copolymer of vinylidene chloride and acrylonitrile that contains in the polymer molecule from about 90 to 98 percent by weight of vinylidene chloride.

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