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YARN CRIMPING APPARATUS

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This invention relates to apparatus for crimping yarn by compression so that it assumes a sinuous or zig-zag formation and particularly for crimping yarns formed from organic synthetic material including polyamides, polyesters, and material sold under the trade name "nylon" and "Perlon" and under the registered trademark "Terylene" and which apparatus is of the kind comprising a wheel having its periphery so formed that the yarn will cling to it and a part of which periphery projects into a groove in a member so as to leave a space between those parts, means for heating the yarn whilst in said groove or before reaching the groove, or after reaching the groove or for heating the yarn at any of these locations, feed rollers arranged to force the yarn into one end of said space, means for driving said wheel at such a speed in relation to the feed rollers that the yarn is compressed in said space and so that the resulting plug of compressed yarn travels round with said wheel and means for withdrawing said yarn at a controlled rate from the head of the plug and for winding it into a package. Two forms of such apparatus are described in my prior patent applications Serial No. 240,551, filed November 11, 1962, and Serial No. 270,448, now U.S. Patent No. 3,174,206, filed April 3, 1963.

An object of the invention is to enable the extent of crimp to be varied along the length of the yarn whereby an article formed from the yarn has a non-uniform appearance over the area thereof.

The invention is particularly applicable to yarn of large denier and which is subsequently cut into lengths forming tufts in carpets. By the use of the invention the yarn in different tufts may have different degrees of crimping or the tufts may be made up of lengths of yarn having different crimping according to the appearance of the carpet which is required.

According to this invention an apparatus of the kind referred to in the above referenced applications is modified in that means are provided for periodically varying the rate of travel of the yarn through the space in which it is compressed in relation to the rate of feed of the yarn and/or in relation to the rate of withdrawal of the yarn from said space.

In one form of improved apparatus means may be provided for periodically varying the rate of rotation of the feed rollers whereas the rate of rotation of said wheel and the rate of driving of said withdrawing means remain substantially constant.

Alternatively the rate of rotation of the feed rollers and the rate of drive of the withdrawing means may be maintained substantially constant and said wheel is so driven that its rate of rotation is periodically varied.

In yet another alternative arrangement in which the yarn is subjected to heating and cooling steps after being withdrawn from said wheels, the rate of rotation of the feed rollers and of said wheel are maintained substantially constant and the rate of withdrawal of the yarn from said plug on the wheel is periodically varied.

In any of the arrangements referred to above instead of the speed of the various parts being periodically varied they may be arranged so that they are constantly varying at a predetermined periodicity.

In the case where the speed is periodically varied cer-

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tain stretches of the yarn will have a uniform crimp of one predetermined extent and other stretches of uniform crimp of another extent whereas when the speed is continually changing the extent of crimp will vary continuously along the length of the yarn.

In any of the arrangements where the speed of drive is to be varied this may be effected by change speed gear having automatically actuated controlling mechanism.

In yet another alternative arrangement the rate of drive of said feed rollers, and of said wheel and of the withdrawing means may be maintained substantially constant and the periphery of said wheel is so formed as to have varying yarn clinging properties around its periphery.

For example, in the case where the wheel is provided with teeth around its periphery certain portions of the periphery may be left clear of the teeth so that when this part of the wheel is opposite the compressed yarn it traverses it at a lesser rate than when the toothed part of the wheel is opposite the yarn.

Alternatively certain portions of the periphery may have different toothed forms.

Yet again certain portions of the periphery may have different height of teeth than others. For example, the tips of the teeth may lie on the same circumference whereas the base portions of the teeth may be disposed on circumferences of different diameters.

In yet another arrangement portions of the periphery wheel may be polished whereas other parts of the periphery may be roughened.

The invention includes within its scope a yarn in which the extent of crimping varied in an ordered and predetermined manner along the length thereof.

Other objects and arrangements of the invention will become apparent and the invention will be fully understood from the following description and drawings in which:

FIG. 1 is a schematic view partially in cross section of a composite embodiment of the invention;

FIG. 2 is a fragmentary view of an alternate embodiment of feed wheel;

FIG. 3 is a view similar to FIG. 2 showing a further embodiment of feed wheel;

FIG. 4 is a view similar to FIG. 2 showing still another embodiment of feed wheel; and

FIG. 5 is a view similar to FIG. 2 showing still another embodiment of feed wheel.

Referring to the drawings, and in particular to FIG. 1, the invention as embodied includes a "stuffing box" crimper in substantial accordance with applicant's prior application Serial No. 240,551. The specific construction details and functioning of the elements designated 10, 12, 14, 16, 18, 19, 21, 24a and 72 need not be specifically elaborated on herein as these conform to applicant's prior aforementioned application and are fully disclosed therein in connection with the description of the figures and particularly FIG. 4 of that application. However, the present invention includes a novel combination of programmed variable speed control means 100 for altering the speed of the means 102 for driving the yarn input feed wheels 19, 19; the feed wheel 14; and/or yarn withdrawal and take up means which may be operated in accordance with the preceding description to produce a yarn having varying degrees of crimp therein. As will be readily apparent to those skilled in the art, when the relative speeds of the respective drive means shown in FIG. 1, are maintained constant, a uniformly crimped product will result. In the practice of the invention herein disclosed, a product having varying degrees of crimp may readily be obtained by the programmed speed variation, either gradually, periodically or abruptly of one or more of the drive means.

In FIG. 2, an alternate form of toothed feed wheel designated 14a is disclosed. The peripheral portion des-

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ignated 50 is void of teeth, which will alter the clinging properties of the yarn plug in this portion of the wheel, thereby altering the crimping conditions at the bight of the feed rollers 19, 19, during its passage across the end of the crimping chamber 21.

The alternate feed wheel designated 14b of FIG. 3 includes a plurality of teeth 52 of rounded or otherwise different form from the remainder of the teeth upon the wheel to accomplish similar results as those obtained from the wheel of FIG. 2.

Likewise, the wheel designated 14c in FIG. 4 includes a peripheral portion having shallow root teeth designated 54, 54, which also in relationship to the adjacent teeth alter the crimping conditions at the bight of the feed rollers 19.

FIG. 5 is yet a further extension of FIGS. 2-4 and includes a feed wheel designated 14d having a roughened peripheral portion designated A adjacent a polished peripheral portion designated B. Again, as in the previous figures, the different co-efficient of friction between the various peripheral portions of feed wheels 14a to 14d is effective to periodically alter the crimping characteristics to thereby produce a non-uniformly crimped yarn. While it will be understood that a non-uniformly crimped yarn may be obtained by the use of the feed wheels of FIG. 2 to FIG. 5 inclusive, without the use of the programmed variable speed control means of FIG. 1, it should be appreciated that the present invention contemplates the individual use as well as the combined use of any one of the disclosed condition varying means to obtain the desired crimped yarn product.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What I claim is:

1. Apparatus for crimping yarn comprising feed means having a bight on the discharge side thereof, confining means of short length having stationary wall portions adjacent said bight, enclosure means having an inlet and an outlet, said inlet communicating with the discharge end of said confining means, said enclosure means extending transversely away from said bight, and driven conveyor means having projections extending into said enclosure means, whereby the mass of crimped yarn formed in said confining means is positively engaged at the discharge end of said confining means and conveyed through said enclosure means to said outlet, and means for periodically varying the speed of said conveyor means to produce a yarn of non-uniform crimp.

2. Apparatus for crimping yarn comprising feed means having a bight on the discharge side thereof, confining means of short length having stationary wall portions adjacent said bight, enclosure means having an inlet and an outlet, said inlet communicating with the discharge end of said confining means, said enclosure means extending transversely away from said bight, and driven conveyor means having projections extending into said enclosure means, whereby the mass of crimped yarn formed in said confining means is positively engaged at the discharge end of said confining means and conveyed through said enclosure means to said outlet, and means for periodically varying the speed of said feed means to produce a yarn of non-uniform crimp.

3. Apparatus for crimping yarn comprising feed means

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having a bight on the discharge side thereof, confining means having stationary wall portions adjacent said bight, enclosure means having an inlet and an outlet, said inlet communicating with the discharge end of said confining means, and driven conveyor means having projections extending into said enclosure means, whereby the mass of crimped yarn clings to said conveyor means and is positively engaged at the discharge end of said confining means and conveyed through said enclosure means to said outlet, and means for varying the speed of said conveyor means and said feed means relative to each other to produce a yarn of non-uniform crimp.

4. Apparatus according to claim 3, wherein said driven conveyor means includes the periphery of a wheel, said wheel having a first peripheral portion, a second peripheral portion, said first and second peripheral portions comprising means for varying the yarn clinging properties of said conveyor means.

5. Apparatus for crimping yarn comprising feed means having a bight on the discharge side thereof, confining means having stationary wall portions adjacent said bight, enclosure means having an inlet and an outlet, said inlet communicating with the discharge end of said confining means, and driven conveyor means having projections extending into said enclosure means, whereby the mass of crimped yarn clings to said conveyor means and is positively engaged at the discharge end of said confining means, and conveyed through said enclosure means to said outlet, said driven conveyor means comprising the periphery of a wheel, said wheel having a first peripheral portion, a second peripheral portion, said first and second peripheral portions comprising means for varying the yarn clinging properties of said conveyor means, whereby the rate of withdrawal of said mass of crimped yarn from said confining means is varied to produce a yarn of non-uniform crimp.

6. Apparatus for crimping yarn according to claim 5, wherein said conveyor means comprise a toothed wheel having at least one peripheral portion void of teeth at predetermined dispositions.

7. Apparatus for crimping yarn according to claim 5, wherein said conveyor means comprise a toothed wheel having at least one peripheral portion with a plurality of rounded teeth.

8. Apparatus for crimping yarn according to claim 5, wherein said conveyor means comprise a toothed wheel having at least one peripheral portion with a plurality of teeth of lesser depth than the teeth of other portions of said wheel.

9. Apparatus for crimping yarn according to claim 5, wherein said conveyor means comprise a wheel having at least one roughened peripheral portion and at least one smooth peripheral portion.

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