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H. WHITTAKER ETAL

3,376,698

PRODUCTION OF STRETCH OR BULKED TEXTILE YARNS

Filed Aug. 2, 1965

2 Sheets-Sheet 1

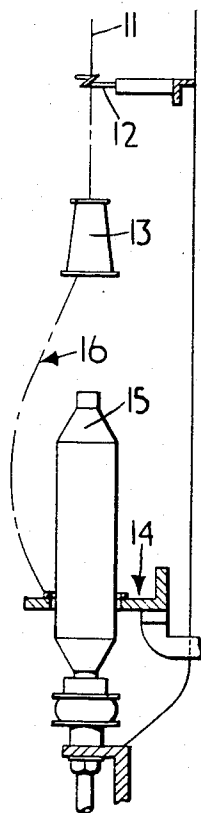


FIG. 1

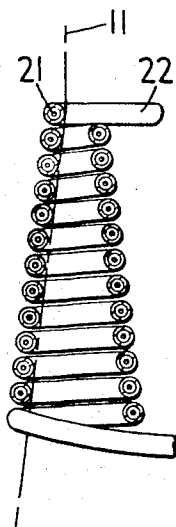


FIG. 3

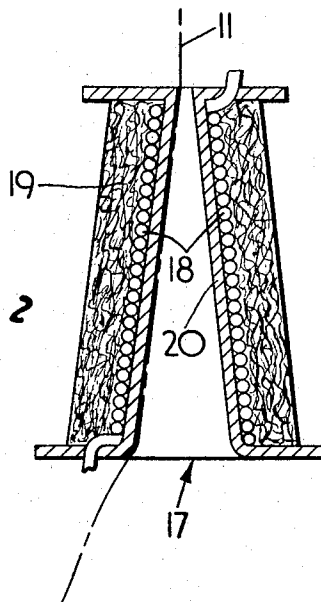


FIG. 2

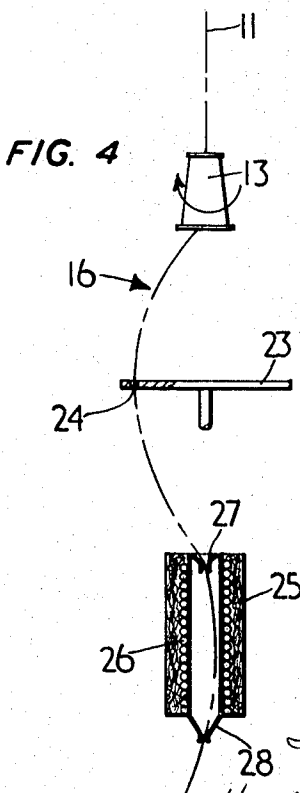


FIG. 4

Inventors
Harold Whittaker
and
Anthony James Booth
By: *noel & noel*
attorneys

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H. WHITTAKER ETAL

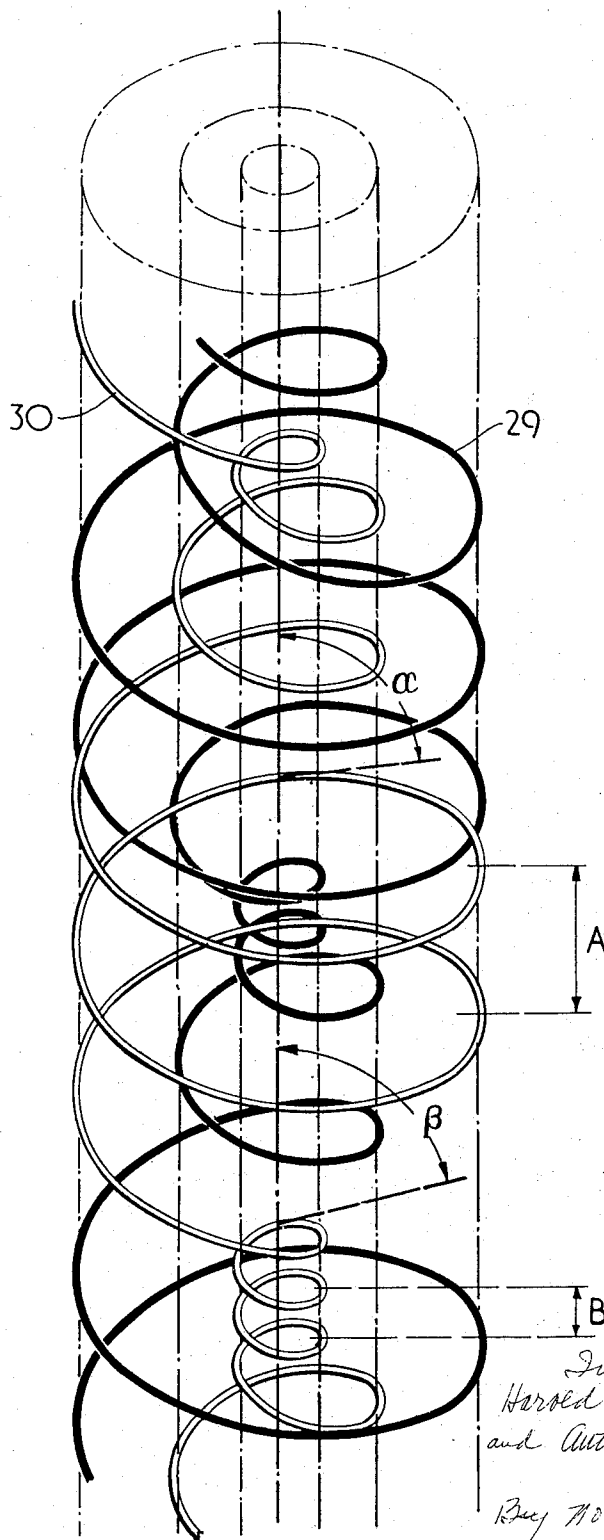
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FIG. 5



Inventors
Harold Whittaker
and Anthony James
Booth
By Mcete & Mcete
Attorneys

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3,376,698 PRODUCTION OF STRETCH OR BULKED TEXTILE YARNS

Harold Whittaker, Alkington, Middleton, and Anthony James Booth, Helmshore, Rossendale, England, assignors to T. M. M. (Research) Limited, Oldham, Lancashire, England, a British company
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ABSTRACT OF THE DISCLOSURE

The present invention includes a method for producing bulk yarn and includes the steps of continuously forming material into a balloon, causing the balloon to contact a yarn contacting surface and by relative displacement between the ballooning material and the surface to ride across the surface while the material making up the balloon is being advanced, heating the material to bring same in contact with the surface to an elevated temperature and withdrawing the yarn from the balloon.

The invention has reference to the production of the so-called "stretch" or "bulked" textile yarns from synthetic thermo-plastic filaments, such as have heretofore been produced, for example, by compression in a stuffer box, by passage between the teeth of intermeshing gear type wheels, or by successive twisting, heat-setting and untwisting operations. The object of the invention is to provide an improved method of and apparatus for producing such yarns.

According to a first aspect of the present invention there is provided a method of producing bulked yarn comprising the steps of continuously forming the material into a balloon, heating the material to an elevated temperature as it balloons, causing the balloon to contact a stationary or moving surface, and withdrawing the yarn from the balloon.

According to a second aspect of the present invention there is provided apparatus for producing bulked yarn comprising means for forming the material into a balloon and for subsequently drawing the yarn therefrom, and means for applying heat to the material either prior to, or at, or after its entry into the balloon, the arrangement being such that the material in the balloon, upon heating or after heating is caused to contact a stationary or moving surface. The stationary or rotating surface with which the ballooning material makes contact may also serve as a heating member, and said surface may be such as to provide either continuous contact with the material or discontinuous contact therewith.

The balloon may be formed by any means such as are conventionally used for the purpose, i.e. by a ring and traveller take-up package-forming apparatus, by a false-twisting device, or by passing the yarn from a rotary supply package to winding means, as in the uptwister machine.

According to a third aspect of the present invention, there is provided a multifilament yarn made from a synthetic resin material, the component filaments of which are formed as helices with varying coil pitch or helix angle in random manner. Preferably, the helix angle or coil pitch in one section is at least twice that in another section.

Some embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

FIG. 1 is a schematic side elevation of a part of a draw-twister according to the invention,

FIG. 2 is an enlarged sectional view of the heater employed in the arrangement shown in FIG. 1,

FIG. 3 is a cross-sectional view of an alternative form of heater for use in the arrangement shown in FIG. 1, and

FIG. 4 is a schematic part-sectional side elevation of an alternative arrangement according to the present invention, and

FIG. 5 is schematic perspective view illustrating two component filaments of a multifilament yarn according to the invention.

Referring first to FIG. 1, synthetic filamentary material 11 is taken from a supply package (not shown) subjected to drawing and then passed by delivery rollers to a lappet guide 12 from which it passes to a heater 13. From the heater 13 the material 11 is fed to the traveller of a ring and traveller take-up unit 14 where it is wound on to a package 15. As indicated at 16, the material forms a balloon between the heater 13 and the traveller of the ring and traveller unit 14.

Referring now to FIG. 2, the heater 13 comprises a spool 17 on which is wound a heating element 18 fed with electrical current from a remote electrical supply. The element 18 is encased in a thermally insulating material 19 formed on the spool. The body of the spool 17 is of hollow frusto-conical form and the material 11 passes therethrough maintaining continuous contact with the inner surface 20.

In operation, electrical current is supplied to the element 18 and the spool 17 brought to the required temperature. The material 11 passes through the spool 17 and becomes heated thereby and upon leaving the spool forms a balloon before being taken up by the ring and traveller 14. In this arrangement the material 11 is heated at its entry into the balloon and the stationary surface with which the ballooning material is required to make contact is the inner surface 20 of the spool 17.

Referring now to FIG. 3 this shows an alternative form of the heater 13, in which an electrically heated element 21 enclosed in a protective tube 22 is wound into an expanding helix to produce a frusto-conical body through which the material 11 is caused to pass. It will be seen that in this arrangement the material 11 passes over a discontinuous surface within the heater.

In another embodiment of the invention illustrated in FIG. 4, the material 11 is passed through the heater 13 and is formed into a balloon 16 by a rotating disc 23 provided with a hole 24 in the region of its periphery through which the material 11 passes. A supplementary heater 25 heated by an electrically heated element 26 is employed to heat the material 11 on leaving the balloon and the material is arranged to pass through constricting elements 27 and 28 before passing to a ring and traveller or other take-up package winding unit.

In an alternative arrangement to that shown in FIG. 1, the heater 13 is arranged to take the place of the lappet guide 12, material being fed to the heater direct from the delivery rollers.

In an alternative arrangement to that shown in FIG. 3 the element 21 and tube 22 are replaced by an electrically insulated metallic strip wound as an expanding helix and heated by current supplied thereto.

Other shapes than conical may be used for the heating member, and the latter may include internal constrictions or other forms of barrier tending to retard the passage of the material.

A variety of products having different characteristics of bulking, and/or crimp, and/or stretch, may be made by varying the processing conditions in the use of apparatus such as that described.

In an arrangement according to FIG. 1 yarn of a drawn denier of approximately 40 has been passed through the heater 13 at a speed of 1200 ft./min. and wound up by a conventional ring and traveller take-up unit. It has been

found that with a heater about 3 inches long and with the inner surface of the heater maintained at a temperature of 450° C. the momentary contact of the ballooning yarn with the very hot surface produces a condition in which parts of the yarn surface are given a thermal shock. On relaxing the yarn so treated, bulkiness is exhibited due to differential shrinkage properties and the latent torque induced by the treatment is allowed to develop. By controlling the rubbing tension and the time of contact, yarns can be obtained which exhibit moderate bulk and a soft handling quality.

The method of producing bulked yarn according to the invention has been found to produce a multifilament yarn in which the component filaments are formed as helices with varying coil pitch or helix angle. In particular, using the apparatus described with reference to FIGS. 1 and 2, a multifilament yarn is produced, the component filaments of which take the form illustrated in FIG. 5 of the drawings. Referring to FIG. 5, two component filaments 29 and 30 are shown and it will be seen that each of the filaments follows a spiral path with a varying pitch and helix angle. As will be seen, the component filament 30 has a pitch which varies from a maximum indicated by the dimension A to a minimum indicated by the dimension B. Clearly, in FIG. 5 $A > 2B$. It will also be seen that the helix angle of the component filament 30 varies along the length of the filament, the helix angle α at one point of the filament being greater than the helix angle β at another point of the filament. It will furthermore be seen that the filaments 29 and 30 form coils of varying diameters and it will be appreciated that although the filaments have been drawn in FIG. 5 as coils following three generating cylinders, in the multifilament yarn actually produced the component filaments form coils with randomly varying diameters.

We claim as our invention and desire to secure by Letters Patent is:

1. A method of producing bulked yarn comprising the steps of continuously forming the material into a balloon, heating the material to an elevated temperature as it balloons, causing the balloon to contact an elongated yarn contacting surface, and withdrawing the yarn from the balloon.

2. A method according to claim 1, including the further step of retarding the yarn in its passage through the heating zone.

3. A method according to claim 1, wherein the yarn leaving the balloon is subjected to a supplementary heating treatment before passage to a yarn take-up unit.

4. A method for producing bulked yarn comprising the steps of continuously forming the material into a balloon, causing the balloon to contact an elongated yarn contacting surface and by relative displacement between the ballooning material and the surface to ride across the said surface while the material in the balloon is being advanced, heating the material to bring the material contacting the said surface to an elevated temperature, and withdrawing the yarn from the balloon.

5. A method of producing a multi-filament yarn made from a synthetic resin material, the component filaments of which are formed as helices with varying coil pitch or helix angle in random manner, comprising the steps of continuously forming the material into a balloon, causing the balloon to contact an elongated yarn-contacting surface and by relative displacement between the ballooning material and the surface to ride across the said surface while the material in the balloon is being ad-

vanced, heating the material to bring the material contacting the said surface to an elevated temperature, and withdrawing the yarn from the balloon.

6. Apparatus for producing bulked yarn comprising means for forming the material into a balloon and for subsequently drawing the yarn therefrom, an elongated yarn contacting surface, heating the material to bring the material contacting said surface to an elevated temperature.

7. Apparatus according to claim 6, wherein said means for heating the material comprises a heating surface over which the material passes in continuous contact therewith.

8. Apparatus according to claim 6, wherein the means for heating the material comprises a heater having a hollow conical passage through which the yarn is caused to pass, the yarn making continuous contact with the conical heating surface of the passage.

9. Apparatus according to claim 6, wherein said means for heating the material comprises a heating surface over which the material passes in discontinuous contact therewith.

10. Apparatus according to claim 9, wherein the means for heating the material comprises a heater formed by a tube wound as an expanding helix, the yarn passing there-through in discontinuous contact with the heating surface of the helix.

11. Apparatus according to claim 9, wherein the means for heating the material comprises a heater formed by a strip wound as an expanding helix, the yarn passing there-through in discontinuous contact with the heating surface of the helix.

12. Apparatus according to claim 6, wherein said yarn-contacting surface is constituted by said heating surface.

13. Apparatus according to claim 6, wherein said surface is a rotating surface.

14. Apparatus according to claim 13, wherein said means for heating the material is located at the commencement of the balloon, and wherein the balloon is generated by a rotating disc having an aperture offset from the centre of the disc through which the yarn passes.

15. Apparatus according to claim 6, comprising a supplementary heating means for heating the yarn leaving the balloon.

16. Apparatus for producing bulked yarn comprising means for forming the material into a balloon and for subsequently withdrawing a yarn therefrom, an elongated yarn contacting surface arranged such that the balloon contacts said surface and by relative displacement between the balloon and the surface rides across said surface while the material in the balloon is being advanced, and means for heating the material to bring the material contacting said surface to an elevated temperature.

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FRANK J. COHEN, *Primary Examiner*.

W. H. SCHROEDER, *Assistant Examiner*.