United States Patent

Newton

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[54] YARN TEXTURING

[72] Inventor: **Richard C. Newton**, Greenville, S.C.

[73] Assignee: **Phillips Petroleum Company**

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[52] **U.S. Cl.**.....**28/1.6**, 28/72.14

[51] **Int. Cl.**.....**D02g 11/12**

[58] **Field of Search**.....28/1.2, 1.3, 1.4, 1.6, 1.7, 28/72.11, 72.12, 72.14

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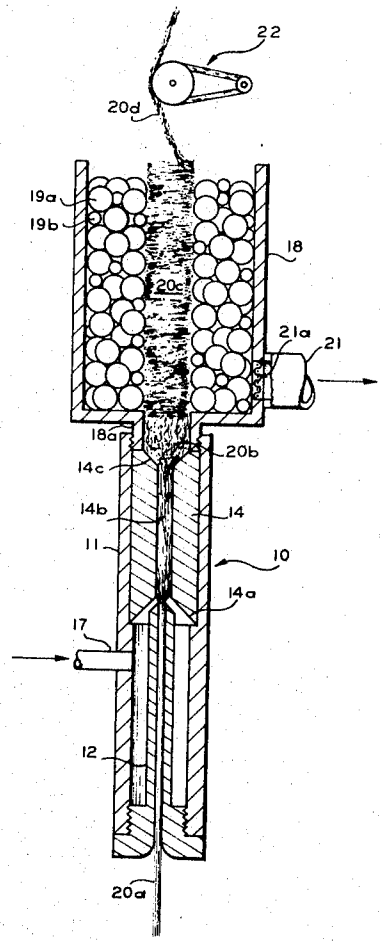
Primary Examiner—Louis K. Rimrodt

Attorney—Young and Quigg

[57] **ABSTRACT**

Yarn is textured by passage at an elevated temperature into a zone of turbulence. The resulting textured yarn is passed through a chamber which contains a plurality of stacked members, such as balls or rods. These members exert a force on the yarn to produce a confined wad. Fluid employed to produce the turbulence zone is separated from the textured yarn in the chamber.

15 Claims, 2 Drawing Figures



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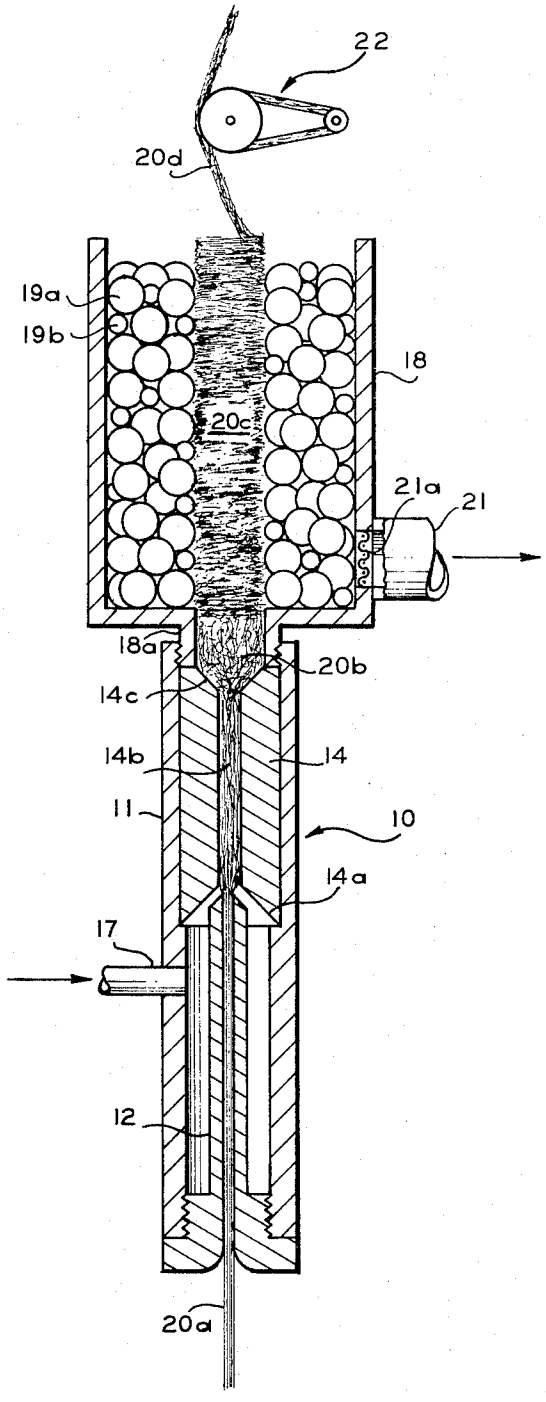

FIG. 1

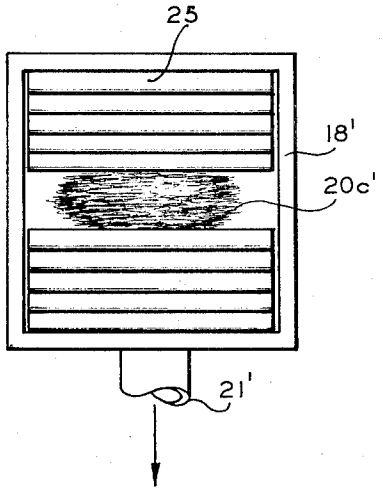

FIG. 2

INVENTOR.
R. C. NEWTON
BY Young & Quigg
ATTORNEYS

YARN TEXTURING

Synthetic fibers are commonly produced by extruding molten polymer through a spinneret. In order to produce yarns which have properties approximating those of wool or other natural materials, it is common practice to subject the extrudate from the spinneret to a texturing process. This can be accomplished by a variety of procedures known in the art, such as stuffer-box crimping, false twisting, and fluid jet texturing. One particularly effective procedure involves contacting the fiber with a high velocity fluid stream in a turbulent zone at an elevated temperature. The turbulence imparted to the fiber produces crimps which give the fiber a textured appearance. While such a procedure is effective in imparting crimp to the fiber, problems are often encountered in removing the material from the turbulent zone and removing the fluid from the textured fiber. Although various types of removal equipment are known, a need still exists for a more efficient method of removing yarn from a fluid texturing zone.

In accordance with this invention, the textured yarn from a fluid crimping zone is passed through an elongated chamber which contains a plurality of discrete members, such as balls or rods. The textured yarn forms an elongated yarn wad which is surrounded by the stacked members. These members exert a force on the sides of the wad to confine the wad in a generally cylindrical or oval configuration. The fluid introduced into the turbulent zone is permitted to escape through the voids between the individual members. The resulting textured yarn can easily be removed from the top of the wad as it emerges from the removal chamber.

In the accompanying drawing,

FIG. 1 illustrates a first embodiment of the apparatus of this invention which is employed to texture yarn.

FIG. 2 is a top view of a second embodiment of the apparatus.

Referring now to the drawing in detail and to FIG. 1 in particular, there is shown fluid texturing apparatus generally designed by reference numeral **10**. This apparatus comprises an elongated sleeve **11** which has a hollow needle **12** positioned in the inlet section thereof. An elongated plug **14** is disposed in the outlet section of sleeve **11**. Plug **14** has a central opening **14*b*** therethrough. The inlet of opening **14*b*** is tapered to provide a seat **14*a*** adjacent the tip of needle **12**. The outlet of central opening **14*b*** constitutes a flared section **14*c*** of increasing diameter. A conduit **17** communicates with sleeve **11** adjacent needle **12** to introduce a fluid, such as steam or air, at an elevated temperature.

A hollow chamber **18** having an inlet tube **18*a*** is mounted immediately above sleeve **11** to receive yarn which is crimped in apparatus **10**. A large number of relatively small balls **19*a*** and **19*b*** are disposed within chamber **18**. Chamber **18** can be provided with an outlet conduit **21** which is connected to a drain or to a source of reduced pressure, not shown. A screen **21*a*** is positioned across conduit **21** to retain balls **19*a*** and **19*b*** within chamber **18**.

In the operation of the illustrated apparatus, one or more filaments **20*a*** are inserted through needle **12** into the central passage of plug **14**. These filaments can be delivered to the apparatus by any suitable feed means, not shown. In the normal start-up operation, the filaments are threaded completely through the apparatus. Fluid is introduced through conduit **17** and flows upwardly through plug **14** into chamber **18**. The fluid so introduced surrounds needle **12** to elevate the temperature of the incoming filaments. The velocity of the introduced fluid is sufficiently high to produce a zone of substantial turbulence in the flared outlet region **14*c*** of plug **14**. This turbulence imparts crimp to the filaments to produce textured yarn **20*b***. The yarn passes upwardly to form an elongated generally cylindrical wad **20*c*** in the center of chamber **18**. This wad is surrounded and confined by balls **19*a*** and **19*b***. The yarn is cooled in passing through chamber **18** so that permanent crimps are imparted. The resulting textured yarn **20*d*** is removed through a take-up device **22** and passed to a storage zone, not shown.

As previously mentioned, the velocity and temperature of the fluid introduced through conduit **17** are such as to impart the desired degree of crimp in the yarn in the flared outlet section of plug **14** and in tube **18*a***. If desired, an external heater can be employed to assist in elevating the temperature of the crimping apparatus **10**. The texturing fluid passes upwardly and escapes from the open top of chamber **18**. When steam is employed as the texturing fluid, it may be desirable to provide vent conduit **21** to remove any condensate which may be formed. Balls **19*a*** and **19*b*** provide sufficient force to retain the yarn wad in a confined central region of chamber **18** for a period of time sufficient to allow the yarn to be cooled to retain a permanent crimp. These balls can be formed of metal, glass or any other material which is inert to the yarn at the temperatures encountered. The balls are advantageously of spherical configuration, but this is not essential to the operation of the invention. As illustrated, balls **19*a*** are larger than balls **19*b*** to provide better packing. However, the balls can all be the same size. The height of the balls in chamber **18** should be sufficient to permit the yarn to be cooled before removal from the chamber.

Any type of synthetic fiber which can be textured by the application of external forces at elevated temperatures can be treated by the process of this invention. Typical fibers which can be so treated are polyolefins, nylons and polyesters, for example.

In one specific example of this invention as illustrated in FIG. 1, needle **12** has an internal diameter of about 0.06 inch. The end of needle **12** is tapered at an angle of about 45°, as is flared inlet **14*a*** of plug **14**. The central passage **14*b*** is about 1¼ inches in length and has an internal diameter of about 0.125 inch. The flared outlet **14*c*** is about one-quarter inch in length and has an outlet diameter of about one-half inch. Balls **19*a*** have a diameter of about one-quarter inch; and balls **19*b*** have a diameter of about one-eighth inch. Approximately 70 percent of the total number of balls in chamber **18** are balls **19*a***. Chamber **18** has an internal diameter of about 3 inches, with the depth of balls being about 6 inches.

In one specific mode of operation, a bundle of 126 polypropylene filaments having a denier of about 1,800 (approximately 14 denier per filament) is introduced at a velocity of about 750 meters per minute. Steam at 100 psig is introduced at a rate of about 20 pounds per hour. The textured yarn is removed at a velocity of about 500 meters per minute.

In the embodiment of this invention illustrated in FIG. 2, a plurality of generally cylindrical rods **25** are disposed in chamber **18'** in place of the balls. These rods are stacked in the chamber in the same manner as are the balls of FIG. 1. The resulting yarn wad **20*c'*** tends to be of oval cross-section. The rods can be solid or hollow, and need not be of circular cross-section. The individual rods can be the same or of different sizes. The stack of rods exerts a force on the yarn wad in substantially the same manner as does the stack of walls in FIG. 1. Thus, the chamber above apparatus **10** can contain individual members of various configurations having generally convex outer surfaces to facilitate stacking and exerting a confining force on the yarn wad.

While this invention has been described in conjunction with a presently preferred embodiment, it obviously is not limited thereto.

What is claimed is:

1. A method of texturing yarn which comprises:

passing yarn to be textured through a first passage into an enlarged zone which has a greater cross-sectional area than said passage;

passing a fluid through said first passage into said enlarged zone, the volume and the velocity of the fluid passed into said enlarged zone being such as to establish a high degree of turbulence in said enlarged zone;

maintaining the yarn in said enlarged zone at a temperature sufficiently high that the turbulence of the yarn in said enlarged zone crimps the yarn;

passing the yarn from said enlarged zone into a cooling zone which contains a plurality of individual stacked members which are free to be displaced by a yarn wad, said cooling zone having a cross-sectional area greater than the cross-sectional area of said enlarged zone so that an elongated wad of yarn is formed which extends through said cooling zone, thereby displacing the surrounding stacked members outwardly so that the elongated wad is surrounded by the stacked members, and the stacked members exert a retaining force on the sides of the wad; and

removing textured yarn from the cooling zone.

2. The method of claim 1 wherein the fluid is supplied at a temperature sufficiently high to maintain the yarn in said enlarged zone at said temperature to crimp the yarn.

3. The method of claim 2, further comprising passing the yarn through a confined zone prior to introduction into said first passage, and passing said fluid in indirect heat exchange relationship with the yarn in said confined zone to elevate the temperature of the yarn.

4. The method of claim 1 wherein the fluid is steam.

5. The method of claim 1 wherein the fluid is air.

6. The method of claim 1 wherein the stacked members comprise balls.

7. The method of claim 5 wherein the balls include balls of different sizes.

8. Apparatus for texturing yarn comprising:

means forming a first passage through which yarn to be textured can be directed, said first passage having an inlet and an outlet for the yarn;

means forming a second passage of greater cross-sectional area at the outlet thereof than at the inlet, the inlet of said second passage being connected to the outlet of said first passage;

conduit means communicating with the inlet of said first passage to introduce a fluid;

a chamber of cross-sectional area greater than the cross-sectional area at the outlet of said second passage, said chamber having an inlet and an outlet, the inlet of said chamber being connected to the outlet of said second passage; and

a plurality of individual stacked members disposed in said chamber, said members being free to move in said chamber so as to be displaced outwardly by an elongated wad of yarn which is formed in said chamber when the yarn and fluid are passed through said first and second passages into said chamber, whereby the members exert pressure on the sides of such a yarn wad extending from the inlet to the outlet of said chamber.

9. The apparatus of claim 8 wherein said stacked members comprise balls.

10. The apparatus of claim 9 wherein said balls include balls of different sizes.

11. The apparatus of claim 8 wherein said stacked members comprise rods which are stacked on one another and which extend in generally horizontal directions when said apparatus is positioned so that said chamber is located vertically above said second passage.

12. The apparatus of claim 8, further comprising textured yarn take-up means spaced from the outlet of said chamber to remove textured yarn from a wad of yarn formed in said chamber.

13. The apparatus of claim 8 wherein said first passage is cylindrical and said second passage is of truncated conical configuration.

14. The apparatus of claim 8, further comprising means forming a third passage spaced from the inlet of said first passage so that yarn directed through said third passage enters the inlet of said first passage, and said conduit means communicates with a region exterior of said third passage so that fluid introduced through said conduit means passes in heat exchange relationship with said third passage prior to being introduced into said first passage.

15. The apparatus of claim 8, further comprising a vent communicating with said chamber to remove condensate formed within said chamber.

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