United States Patent

[11] 3,593,514

[72] Inventor **Robert K. Stanley**
Media, Pa.

[21] Appl. No. **772,468**
[22] Filed **Oct. 22, 1968**
[45] Patented **July 20, 1971**
[73] Assignee **Techniservice Corporation**
Kennett Square, Pa.
Continuation-in-part of application Ser. No. 620,873, Mar. 6, 1967, now abandoned.

[54] **STRAND TREATMENT**
4 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **57/157,** 28/72.11
[51] **Int. Cl.** **D02g 1/02**
[50] **Field of Search** 28/1.2, 1.3, 1.4, 1.6, 72.1, 72.11, 72.12, 72.14; 57/34, 140, 157, 51, 77.3; 264/168, 282

[56] **References Cited**

UNITED STATES PATENTS

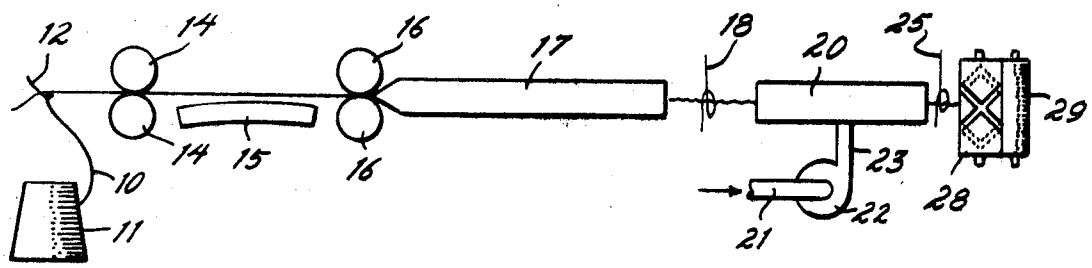
2,655,781	10/1953	Heberlein et al.	57/77.3
2,972,798	2/1961	Stanley et al.	28/72.11
3,147,533	9/1964	Baer	28/72.11 X
2,869,967	1/1959	Breen	57/140
3,079,745	3/1963	Breen et al.	57/34
3,110,151	11/1963	Bunting et al.	57/157

FOREIGN PATENTS

658,465	5/1965	Belgium	28/1.3
1,064,765	4/1967	Great Britain	28/72.12

Primary Examiner—Louis K. Rimrodt
Attorney—McClure, Weiser & Millman

ABSTRACT: The interfilament spacing of stuffer-crimped textile strands is increased by application of fluid circumferentially thereto in a temporarily confining region, such as when the strand travels from the stuffer-crimping region to windup. The strand is false twisted in such processing, the initial direction of twisting being opposite to the direction of any substantial twist in the untreated strand.



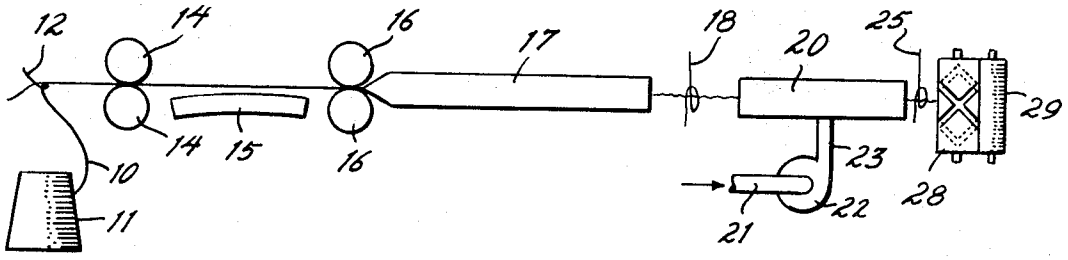


Fig. 1.

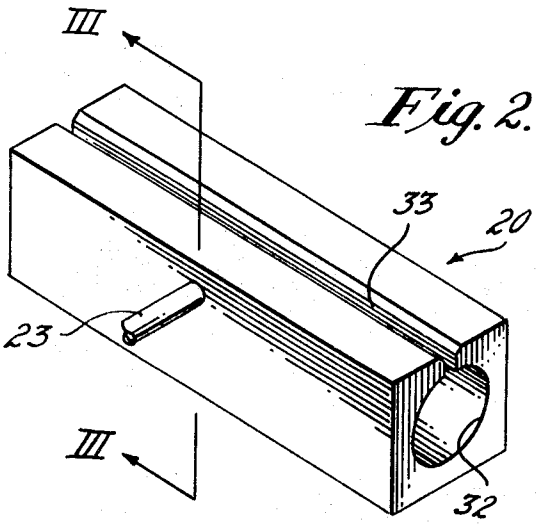


Fig. 2.

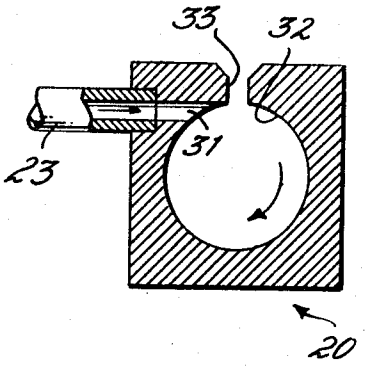


Fig. 3.

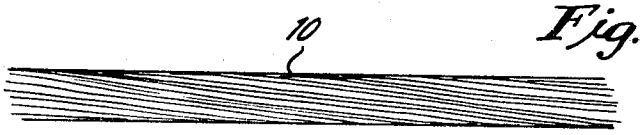


Fig. 4.

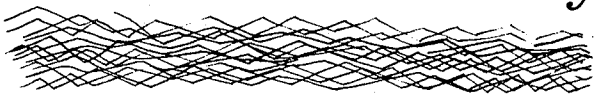


Fig. 5.



Fig. 6.

INVENTOR.
ROBERT K. STANLEY
BY McClure & Weiser
ATTORNEYS

STRAND TREATMENT

This is a continuation-in-part of my copending patent application, Ser. No. 620,873 filed Mar. 6, 1967 and since abandoned.

This invention relates to treatment of textile strands, especially after treatment of stuffer-crimped multifilament strands.

Multifilament textile strands usually have at least a small amount of twist therein, whether in a right-hand or Z-direction, or in a left-hand or S-dirction Bulking or crimping processes, such as stuffer crimping, may not alter the twist appreciably although it may be largely obliterated by other configurational changes. Indeed an appreciable amount of twist, i.e., more than about a turn per inch, although desirable to maintain strand integrity, may be a deterrent to development of a desired degree of bulk or interfilament spacing in the strand. Reference to twisted strands herein is meant to exclude strands having less twist than is defined above as being appreciable.

A primary object of the present invention is improved bulking or crimping of multifilament textile strands having appreciable twist therein.

Another object is improved after treatment of stuffer-crimped textile strands.

A further object is provision of apparatus for accomplishing the foregoing.

Other objects of this invention, together with means and methods for attaining the various objects, will be apparent from the description herein and the accompanying diagrams of a preferred apparatus embodiment.

FIG. 1 is a side elevation, partly schematic, of apparatus for practicing the present invention, indicating the passage of strand therethrough;

FIG. 2 is a perspective view, on an enlarged scale, of part of the apparatus of the preceding view;

FIG. 3 is a transverse section through the apparatus of FIG. 2, taken at III–III thereon;

FIG. 4 is a side elevation of untreated strand, partially stylized;

FIG. 5 is a side elevation of the strand after being subjected to stuffer crimping, also partially stylized; and

FIG. 6 is a similarly partially stylized strand produced according to this invention.

In general, the objects of the present invention are accomplished through false twisting of stuffer-crimped multifilament textile strand to increase the multifilament spacing therein, especially by application of fluid circumferentially thereto. Such treatment is performed in a temporarily confining chamber, open at its opposite ends, through which the strand passes on the run, as from the exit end of a stuffer crimper. The inphase regularity of stuffer-crimped configuration imparted to adjacent filament portions therein is greatly reduced, i.e., the filaments are dephased.

FIG. 1 shows frustoconical package **11** of multifilament textile strand **10**, which passes from the package through pigtail guide **12** and between the nip of pair of withdrawal rolls **14**. After passing over preheater **15**, the strand passes between the nip of pair of feed rolls **16** and into the entrance end of stuffing chamber **17**. From the exit end of the stuffing chamber the strand passes through pigtail guide **25** and overgrooved self-traversing drive roll **28** and onto windup package **29**. Fluid treatment chamber **20**, which is open at its opposite ends to admit and emit the strand, has fluid inlet tube **23** extending transversely therefrom midway of its ends, and the tube has attached to it pump **22**, which has intake **21** joined thereto.

FIGS. 2 and 3 show fluid treatment chamber **20** in perspective and transverse section, respectively. Fluid inlet tube **23** intercommunicates with longitudinal cylindrical bore **32**, which extends from one end to the opposite open end of the chamber, by way of small transverse bore **31**, which intersects longitudinal bore **32** tangentially at the top. Extending along the top from end to end is slot **33**, which interconnects longitudinal bore **32** with the exterior along the entire length of the chamber. The slot flares at its outer edges to facilitate introduction of the strand therethrough during stringup. Air or other fluid entering the chamber through fluid inlet tube **23** and interconnecting transverse bore **31** swirls circumferentially in longitudinal bore **32**, as suggested by the curved arrow, eddying somewhat because of aspiration induced at the edge of slot **33**, and exits from the opposite ends of bore **32** and more remote portions of slot **33**.

The fluid is not applied to the strand so directly or forcibly as to entangle or interlace it, which would be contrary to the desired action. The described arrangement of chamber and fluid supply readily operates as desired.

FIGS. **4**, **5**, and **6** indicate, in somewhat stylized manner rather than photographically, the appearance of a strand viewed from the side before, at an intermediate stage, and after being processed according to this invention. As shown in FIG. **4** the untreated strand consists essentially of straight filaments having an appreciable right-hand or Z-twist. FIG. **5** shows the strand as it appears between the stuffer-crimping chamber and the fluid treatment chamber, such as in the vicinity of guide **18**; the strand has expanded laterally because of numerous sawtooth or zigzag deviations from the original rectilinearity. In FIG. **6**, which shows the product after fluid treatment according to this invention the strand has expanded even more laterally, as the sawtooth or zigzag character has been somewhat modified by curved instead of exclusively angular deviations from rectilinearity, and the previous inphase relationship of adjacent filament portions has been largely eliminated. The beneficial effects of imparting such bulkiness to the strand, especially in apparel fabrics composed thereof, are apparent.

The fluid applied to the strand in the fluid treatment chamber swirls it circumferentially in a single rotational direction only, thereby false twisting it, i.e., rotating it to twist it in opposite directions from about midway of the chamber toward the opposite ends. As arranged, the strand is twisted first in a left-hand direction and then in a right-hand direction as it passes through the chamber, the imparted twist running outward to the flanking guides, which function in part as twist stops. The tension on the strand should be low enough to preclude undesirable reduction in the degree of crimp imparted to the strand but high enough to preclude undesirable entanglement or loop formation in the strand during the fluid treatment. The force at which the fluid is applied to the strand is controlled by regulating the fluid supply pressure, which correlates positively with the strand tension.

If desired, the applied fluid may be cooler than the strand so as to set the crimp therein by reducing molecular mobility and, therefore, "freezing" the crimped configuration. Alternatively, the fluid may be hotter than the strand so as to stress relieve it and thereby set the crimp by stabilizing the molecular arrangement. Air alone can suffice as the treating fluid. Steam or a spray of droplets of solvent or plasticizer for the strand composition may be injected or aspirated into the air or other fluid, usually at relatively high temperature, but in some instances effective at lower temperature than that at which the strand composition softens. Softening or plasticization is useful especially where considerable alleviation of the stuffer-crimped configurational angularity is desired.

The invention is useful not only on conventionally extruded filamentary strands of ordinary fiber-forming compositions, such as nylon, but also upon strands composed of filamentary structures produced by slitting of sheets or films (preferably fibrillated), such as of polypropylene for example. While strands of all thermoplastic fiber-forming compositions are especially suited to practice of this invention, strands that are not thermoplastic, at least not under the conditions employed, may also be processed hereby more advantageously than heretofore, as to increase their bulk or loftiness.

The practice of this invention is most beneficial with multifilament textile strands having relatively high twist, such as about two or more turns per inch, but is useful whenever the twist is appreciable, such as more than about one turn per

inch. While it may be of some benefit to strands having as little as a half turn, or even less, per inch, such low-twist or zero-twist strands are more likely to benefit from an entanglement or interlacing type of treatment, such as can be accomplished by jetting fluid directly thereonto sufficiently forcibly to produce multiple vortices or other turbulent conditions not within the contemplation or scope of this invention.

Although a preferred embodiment of the apparatus of this invention has been illustrated and described, it is contemplated that modifications may be made therein, as by adding, combining, or subdividing parts, while retaining all or some of the advantages of the invention, which is defined in the following claims.

I claim:

1. In treatment of a twisted multifilament textile strand wherein it has been stuffer-crimped in a treating region, the improvement comprising post treatment the crimped strand on the run upon withdrawal from the treating region including the steps of passing the crimped strand lengthwise into and through a laterally confining region and applying fluid circumferentially to the strand while in the laterally confining region and thereby rotating the strand so as to false twist it without significantly entangling or interlacing the component filaments thereof.

2. The improvement in strand treatment according to claim 1 wherein the fluid is cooler than the strand and including the step of cooling the strand therewith.

3. The improvement in strand treatment according to claim 1 wherein the fluid is substantially saturated with moisture and including the step of softening the strand therewith.

4. The improvement in strand treatment according to claim 1, wherein the fluid is at a higher temperature than the strand and including the step of stress relieving the strand therewith.