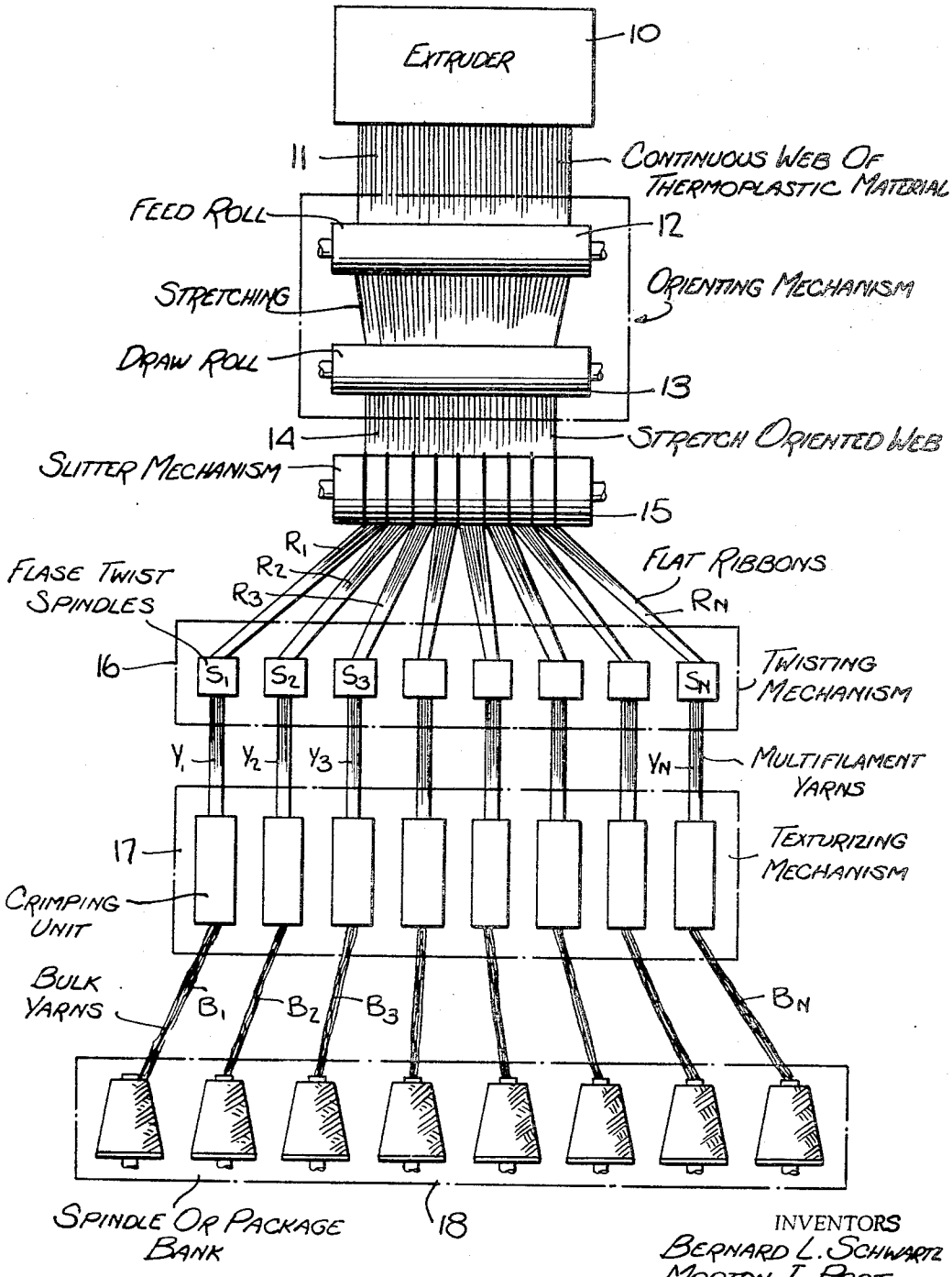
Aug. 20, 1968 M. I. PORT ET AL 3,398,220

PROCESS FOR CONVERTING A WEB OF SYNTHETIC MATERIAL INTO BULK YARNS

Filed June 26, 1964



INVENTORS
BERNARD L. SCHWARTZ
MORTON I. PORT

Michael Ebert
ATTORNEY

United States Patent Office 3,398,220
Patented Aug. 20, 1968

3,398,220

PROCESS FOR CONVERTING A WEB OF SYNTHETIC MATERIAL INTO BULK YARNS

Morton I. Port, West End, N.J., and Bernard L. Schwartz, Scarsdale, N.Y., assignors to Parker, Pace Corporation, a corporation of New York

Filed June 26, 1964, Ser. No. 378,179
8 Claims. (Cl. 264—147)

ABSTRACT OF THE DISCLOSURE

A process for converting synthetic polymeric material into a plurality of bulk yarn packages in which the material is first extruded into a film-like broad web which is then stretched to an orientation point at which filamentization is possible, the oriented web being thereafter slit into a plurality of individual monofilament ribbons which are then stressed to cause the ribbons to form into multi-filament yarns, each yarn then being texturized to form a bulked yarn which is wound into a package.

This invention relates generally to the manufacture of bulk yarns, and more particularly to a method for converting a web of thermoplastic polymeric material into multi-filament yarns which are then modified to impart bulk thereto.

The term "bulk yarns" is generally applied to continuous, multi-filament yarns that have been processed to give greatly increased mass or bulk per unit length. There are three distinct types of bulk yarn, each type depending on the method and conditions used to texturize the filaments. The crimped type, such as Textralized and Spunized yarn, is produced by stuffer-box or gear crimping techniques, and is characterized by the fact that individual fibers, when fully contracted, show very small random undulations along their length.

In the looped type, as for example Taslan yarn, produced by air texturizing techniques, the individual fibers exhibit many complete loops. In the crinkle-type, produced by a knit-heat set and unravel technique, the bulk yarn has a wavy configuration.

The end uses of bulk yarns depend on their inherent characteristics, and while crimp-type yarns in heavy deniers are used in rugs, carpets and for upholstery and industrial fabrics of various types, the loop type is more widely used in apparel items, such as sport jackets, ties and scarves, whereas the crinkle type finds its uses in ladies' seamless hosiery and sweaters. Each type of bulk yarn has a particular appearance, hand and texture, as well as moisture adsorption characteristics, and these properties are taken into account in the selection of a bulk yarn for a specific purpose.

The technique by which the continuous filaments are converted into bulk yarns is known as "texturizing." This technique depends on the ability of thermoplastic filaments to be deformed, heat-set and developed, and it acts permanently to introduce crimps, coils, loops, or crinkles into otherwise continuous filaments. Not only does texturizing make it possible with synthetic yarns to simulate the characteristics of spun yarns, but it provides bulk yarns having improved pill resistance, greater durability, as well as stretch and wash-and-wear qualities.

Conventionally, in making bulk yarns, one begins with a continuous, multi-filament yarn produced by standard fiber-making techniques. The raw material in molten form, which may be, for example, a polyamide, a polyester or an acrylic, is extruded through a pattern of fine holes in a spinneret to yield a multiplicity of fine continuous fiilaments which are then wound upon a spin bobbin. Thereafter the multi-filament yarn is unwound and stretch-oriented by a drawing process to improve the tensile strength thereof, the multi-filament yarn being again wound on a bobbin. To texturize this yarn, it is again unwound, this time the yarn passing through an appropriate stuffer-box or other form of texturizing mechanism.

Thus the conventional technique for making bulk yarns involves a series of distinct, discontinuous steps, the yarn being unwound at the beginning and rewound at the end of each step. Accordingly, it is the main object of the present invention to provide a novel process for making bulk yarn in a rapid, uninterrupted, sequential operation for transforming molten raw material into bulk yarn.

More specifically, it is an object of this invention to provide a continuous method for manufacturing bulk yarns, wherein the molten thermoplastic, synthetic material is extruded into a film-like web which is first oriented and then slit into a series of flat monofilament ribbons, each ribbon then being filamentized to form a multi-filament yarn which is then texturized, the various steps being interrelated and uninterrupted.

Among the advantages of the present invention are manufacturing efficiency and economy, the technique making use of low-cost processing equipment. It also enables the manufacture of bulk yarns from lower-grade resins and materials which otherwise do not lend themselves to or justify texturizing.

For a better understanding of the invention, as well as other objects and further features thereof, reference is made to the following detailed description to be read in conjunction with the accompanying drawing, wherein the single figure illustrates schematically a system in accordance with the invention, for making bulk yarns.

Referring now to the drawing, the raw material for forming the bulk yarn is rendered molten and extruded through a suitable extruder **10** to form a film-like sheet or web **11**. The raw material may be of any known form of molecularly orientable, thermoplastic polymeric material, such as polyethylene, polypropylene, polyamide, polyester, or any other suitable resin having a cross-linked molecular structure. Polymers are synthetic substances composed of large molecules that have been formed by the union of a group of single molecules with one another. The manner in which the raw material is converted into web form is entirely conventional, and any standard equipment may be used for this purpose.

Web **11** is pulled from extruder **10** by feed roll **12**, the web being cooled before it reaches the roll so that it is below its softening point. Longitudinal orientation is then effected by the process of drawing to irreversibly stretch the web and thereby increase its tensile strength considerably. This is accomplished by a cooled draw roll **13** whose peripheral speed is greater than that of a heated roll **12**, the ratio between the two rolls being termed the draw ratio. The draw ratio is preferably in excess of 5 to 1, so that the material will have a definite tendency to filamentize longitudinally when later stressed or worked.

The stretch-oriented web **14** emerging from draw roll **13** is conveyed into a slitter mechanism **15** where it is divided into a plurality of individual flat ribbons R_1, R_2, R_3 . . . R_n, the ribbons having a width appropriate to the final denier of the yarn.

In order to convert the ribbons into multi-filament yarns, each ribbon is then subjected to a working operation which serves to rupture the cross or lateral bonding of the polymeric ribbon and thereby to separate the longitudinally-oriented chain molecules into individual fibers or filaments. This may be accomplished by a swaging operation involving the use of repeated hammer blows or by means of a creping blade.

Preferably it is carried out by false twisting operations in device **16** making use of false-twist spindles S_1, S_2 to S_n, one for each multi-filament yarn. With the false-twist

spindle rotating continuously, but with the ribbon passing therethrough, the twist is restricted to the ribbon entering the false-twist spindle. This twisting action stresses or works the highly-oriented ribbon and causes it to filamentize into a multi-filament yarn Y_1 to Y_n. Because of the false-twist, the multi-filament yarn leaves the spindle twist-free.

Each multi-filament yarn Y then enters a texturizing mechanism in a bank **17** thereof. Any standard form of texturizing device may be used for this purpose for converting the straight, continuous multi-filament yarns into bulk yarns B_1 to B_n. Thus crimping may be effected by heated crimping gears or by stuffer-box techniques, known commercially as Spunized, Textralized and Tiffanized. The straight yarns may also be modified by the stress-curled or Agilon method, or twist-curled by the Chadalon or Helanca method.

Texturizing may also be carried out by the air jet or Taslan process, or by the crinkle process, and any other commercially available technique. The resultant bulk yarns B_1 to B_n are then wound on individual spindles in a bank **18** thereof. In practice, the bulk yarns may be wound on a beam for warp yarns or onto suitable packages for use as filling yarns.

Thus the process for producing bulk yarns involves the production of a theromplastic web by extrusion, followed by stretch-drawing to form an oriented web of smaller width which is slit into a series of flat ribbons of a width appropriate to the denier of the final yarn, the ribbons being individually worked to effect filamentization thereof, thereby producing multi-filament yarns which are texturized into bulk yarns. The process entails an uninterrupted sequence of steps effecting a considerable economy in processing equipment and manufacturing costs.

While there has been shown and described a preferred process for converting web of synthetic material into bulk yarns in accordance with the invention, it will be appreciated that many changes and modifications may be made therein without, however, departing from the essential spirit of the invention as defined in the annexed claims.

What we claim is:

1. A process for continuously producing a plurality of packages of bulk yarns from polymeric material capable of being molecularly oriented, said process comprising the sequential and continuous steps of:

(A) extruding the polymeric material into a relatively broad film-like web,

(B) longitudinally drawing said web to irreversibly stretch same to an orientation point at which filamentization by stressing is possible,

(C) slitting said stretch-oriented web into a plurality of individual monofilament flat ribbons,

(D) false-twisting each of said ribbons to filamentize the structure thereof to form a yarn composed of twist-free continuous filaments,

(E) texturizing each of said yarns to form a bulk yarn; and

(F) winding each of said bulk yarns into a package to produce said plurality of packages.

2. A process as set forth in claim **1**, wherein said polymeric material is polytheylene.

3. A process as set forth in claim **1**, wherein said polymeric material is polypropylene.

4. A process as set forth in claim **1**, wherein said polymeric material is a polyamide.

5. A process as set forth in claim **1**, wherein said polymeric material is a polyester.

6. The method as set forth in claim **1**, wherein said texturizing is carried out by crimping the multi-filament yarns.

7. The method as set forth in claim **1**, wherein said texturizing is carried out by crinking the multi-filament yarns.

8. The method as set forth in claim **1**, wherein said texturizing is carried out by looping the multi-filament yarns.

References Cited

UNITED STATES PATENTS

3,153,272	10/1964	Mattingly.	
3,186,155	1/1965	Breen et al.	
2,531,234	11/1950	Seckel.	
2,853,741	9/1958	Costa et al.	
2,954,587	10/1960	Rasmussen.	
3,003,304	10/1961	Rasmussen.	
3,137,911	6/1964	Bromley	264—168 X
3,177,557	4/1965	White.	

FOREIGN PATENTS

864,695	4/1961	Great Britain.

ROBERT F. WHITE, *Primary Examiner.*

S. I. LANDSMAN, *Assistant Examiner.*