

[54] APPARATUS TO PRODUCE YARN  
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[52] U.S. Cl..... 57/90, 19/65 T, 57/36,  
 57/106

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[58] Field of Search..... 57/1, 3, 5, 12, 24,  
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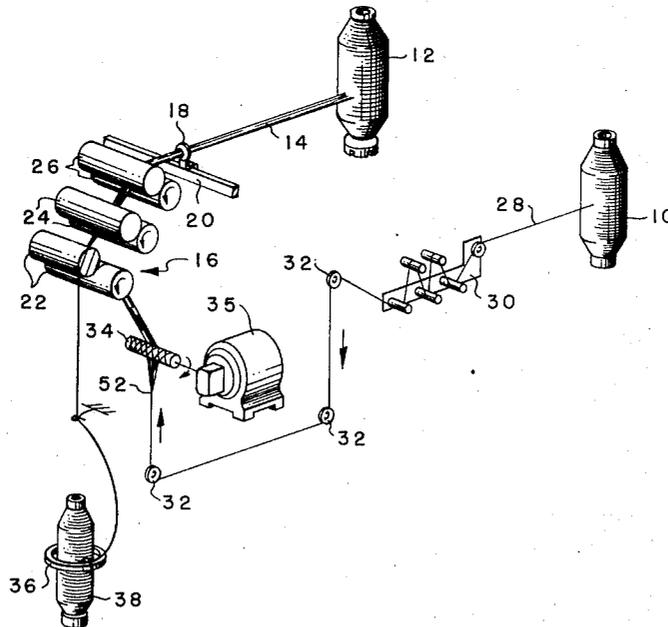
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[57] **ABSTRACT**

A double threaded spreader roll to separate the filaments of a continuous multifilament yarn to allow staple yarn to be placed among the separated filaments and the yarns to be twisted together to form a yarn having the strength of filament yarn and the appearance of spun staple yarn.

4 Claims, 4 Drawing Figures



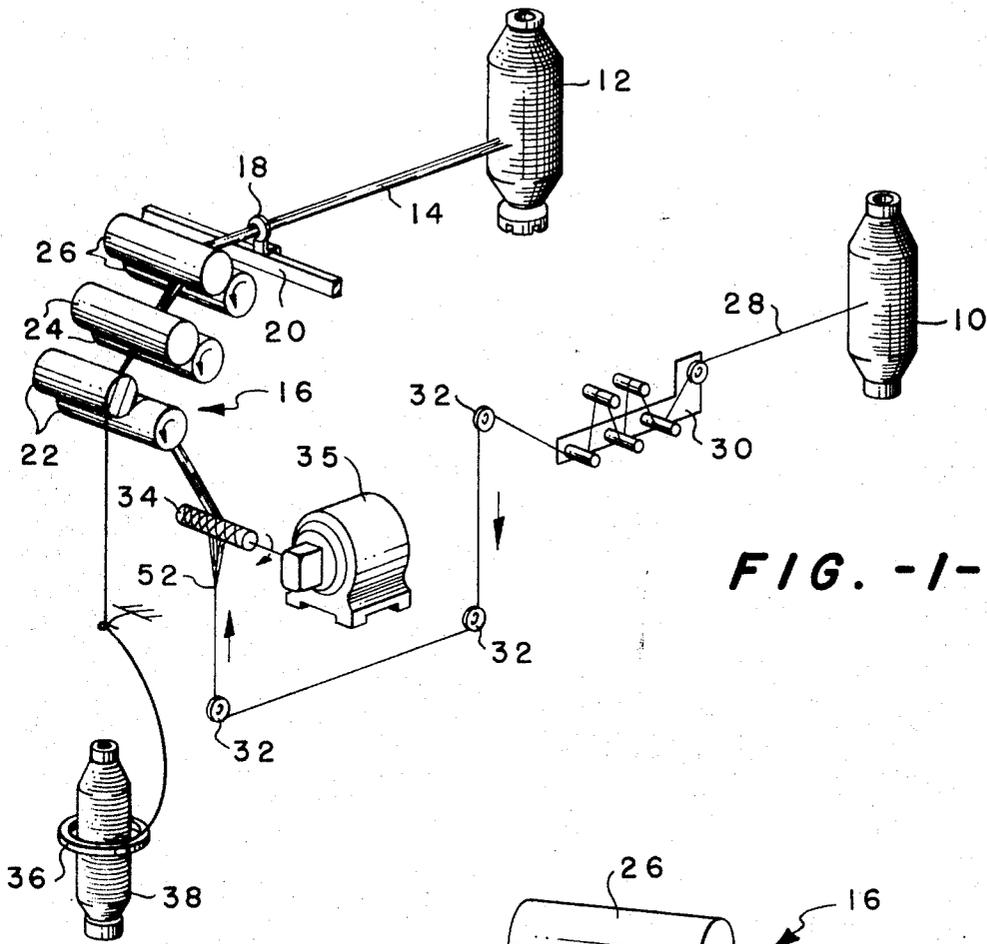
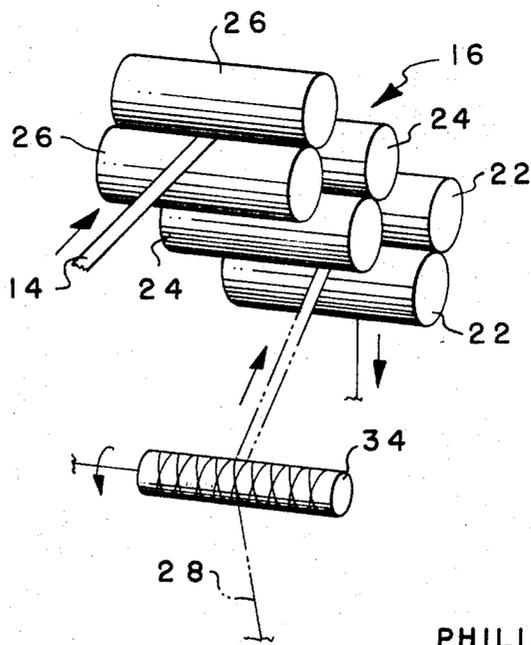


FIG. -1-

FIG.-2-



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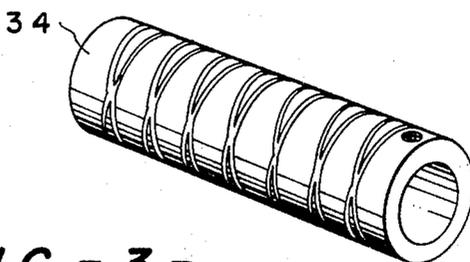


FIG. - 3 -

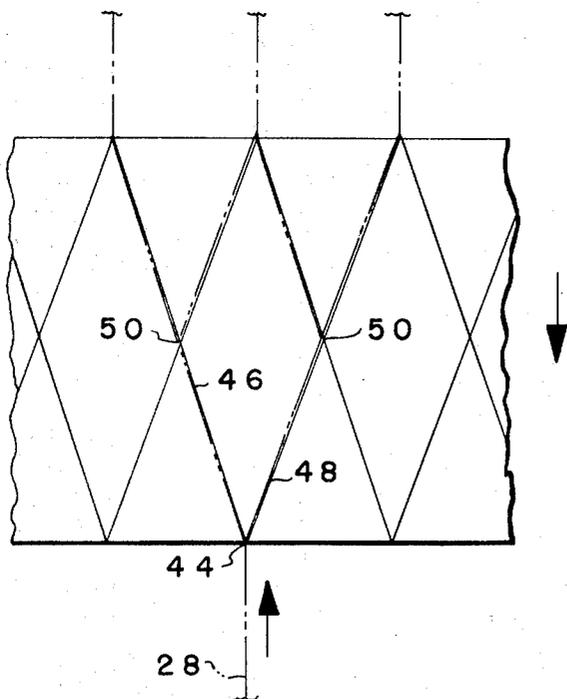


FIG. - 4 -

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## APPARATUS TO PRODUCE YARN

Most yarns used today can be classified either as spun or as filament yarns. The spun yarns are generally employed for suitings, dress goods and the like and have the advantage of resulting in fabrics which have a high insulating value and which provide excellent cover. They have, as a general rule, the disadvantage of a relatively low tensile strength and in addition have disadvantages which are characteristic of the type of fiber or fibers employed in their formation. The filament yarns are generally employed in the manufacture of sheer hosiery or other sheer dress goods and have the primary advantage of a high tensile strength as compared to that of the spun yarns. They have the disadvantages of resulting in fabrics which provide poor cover and which have a low heat insulating value. For many years attempts have been made to combine staple fiber materials and filamentary materials to thereby obtain in a single yarn the advantages of both the spun yarns and the filament yarns but previous to this invention, such combination yarns have not been completely satisfactory in all respects.

Therefore, it is an object of this invention to provide apparatus to efficiently produce a yarn which has the appearance of a spun yarn and the strength of a filament yarn.

The yarn produced by this invention is preferably prepared by bringing together a drafted ribbon or the like or fibrous material and a ribbon of separated filaments and thereafter twisting the two together into a unitary strand. The ribbon or fibrous material can readily be prepared by passing sliver or roving between a plurality of pairs of drafting rollers rotating at different peripheral velocities, such as is done in the conventional spinning of staple fiber yarns. The filamentary ribbon can be formed by separating the component filaments of a multifilament yarn, having little or no twist, and thereafter placing the yarn under a very low tension so that the filaments are free to separate. The ribbon of drawn fibers and the ribbon of filamentary material are best brought together by passing the two in superimposed relationship between a pair of driven rolls, such as illustrated by the delivery rolls of a drafting frame. The two ribbons are then twisted together, at the point where they are delivered from between the driven rolls, by any suitable conventional means such as, for example, a ring and traveler spinning array.

Other objects and advantages of the invention will become readily apparent as the specification proceeds to describe the invention with reference to the accompanying drawings, in which:

FIG. 1 is a schematic view in perspective of apparatus suitable for producing the desired yarn;

FIG. 2 is a blown-up view of the yarn combining portion of the apparatus shown in FIG. 1;

FIG. 3 is an enlarged view of the multifilament yarn spreader roll; and

FIG. 4 is the spreader roll cut in half and spread out flat to illustrate the operation of spreading the filaments of a multifilament yarn.

Looking now to the drawings and especially to FIG. 1, the reference numeral 10 represents a yarn supply package of multifilament yarn, such as Dacron, and the reference number 12 represents a sliver or roving package such as wool. The roving 14 from the package 12 is supplied to the drafting system 16 through a trumpet 18 mounted on the traverse bar 20. The drafting system

16 is conventional in that it consists of three sets of drafting rolls 22, 24 and 26. Each of the three sets of rolls have an upper and lower roll in nip forming relationship with the front rolls 22 being driven faster than the middle rolls 24 and the middle rolls 24 being driven faster than the rear rolls 26 to draft the roving 14 being supplied thereto.

The multifilament yarn 28 from the package 10 is delivered through conventional tension device 30 and over a series of guides 32 to the spreader roll 34 driven by motor 35. The multifilament yarn, in a manner hereinafter explained, is separated into a plurality of its individual filaments and is delivered into the back of the nip of front rolls 22. The separated multifilament yarn 28 is delivered under the roving 14 in the nip of the front rolls so that the roving will lie essentially in the center of the separated multifilament. From the nip of the rolls 22 the multifilament yarn 28 and the drafted roving 14 are twisted together by the conventional ring and traveler 36 and taken up on a bobbin 38. The yarn thus produced will be a composite yarn having the strength of a filament yarn, imparted by the Dacron, and the appearance of a spun staple yarn due to the wool yarn. The yarn will take on an appearance very similar to that shown in FIG. 3 of U. S. Pat. No. 2,964,900.

The spreader roll 34 is preferably made from metal and has a right hand thread 40 and a left hand thread 42 formed therein by any suitable method. Since these threads are formed in an opposite direction, a plurality of cross-over points are formed in the spreader roll 34.

Looking now to FIG. 4, assume that a single strand of substantially O-twist continuous multifilament yarn 28 is delivered to the roll 34. This strand has a certain preselected number of individual filaments therein. At the first cross-over point 44 the multifilament yarn will divide and a portion of the individual filaments will follow the groove 46 and the rest will follow the groove 48. Then at the next cross-over point 50 the portion of the strands in the grooves 46 and 48 will divide once again. In practice, as shown in FIG. 1, the separation of the individual strands will back down the yarn to a certain point 52.

Preferably, in operation the spreader roll 34 is driven in a direction opposite to the direction of travel of the yarn 28 to enhance the spreading of the individual filaments. Other factors, such as the number of grooves per inch in the roll, roll speed, yarn speed, denier of the yarn and tension also contribute to the spreading of the individual filaments.

The filamentary component of the yarn of this invention can comprise natural fibers, such as silk, as well as synthetics such as viscose rayon, acetate, rayon, nylon, polyester filaments such as those formed from a product produced by the reaction of terephthalic acid and ethylene glycol and sold under the trade mark Dacron, acrylic fibers such as those formed from a product produced by the polymerization of acrylonitrile or by the copolymerization of acrylonitrile and a minor amount of another polymerizable monomer and sold under the trade marks of Orlon and Acrilan, or any other type of filamentary material commercially available. For special applications, glass or metal filaments may even be employed. Likewise, the staple fiber material may be of natural origin and may comprise cotton, wool or flax, or it may be of synthetic origin. For example, staple fibers formed by cutting filamentary material of any of

the above-described types into staple length may be suitably used in the formation of the new yarn of this invention. The particular choice of filamentary material and of staple fiber material depends entirely upon the combination of properties desired in the finished yarn. For example, if one desires a fabric similar to conventional cotton fabrics but having greater strength and crease resistance, one can employ cotton fibers in combination with polyester or nylon filaments. Likewise, if one desires a fabric having an appearance and utility similar to that of conventional woollens one can employ a mixture of wool fibers and polyester or acrylic filaments.

The length of the fibers in the fibrous material is an important consideration since if the mean length of the fibers is too short, a ribbon of the same cannot readily be formed by drawing and, in addition, the resulting composite yarn may have a marked tendency to shed or lose the sample material. As a general rule, fibrous material having an average length of at least about  $\frac{1}{2}$  inch should be utilized and the average length of the fibers is preferably at least about  $\frac{3}{4}$  of an inch. There is no upper limit as to the length of the fibrous material employed. Even when the fibrous material is to be distributed continuously along the length of the filamentary strand, it is not generally advantageous to employ fibrous material having an average length greater than about 3 to 6 inches since longer lengths of staple material may result in yarns devoid, to some extent, of an appearance characteristic of spun yarns.

While it is only necessary that the yarn used in this invention contain a plurality of filaments between which the staple fiber material is entwined, the filamentary strand from which the yarns are prepared should preferably contain at least about 5 to 10 filaments since if the number of filaments is below this figure, the staple material may not be adequately secured in position. Another advantage of employing filamentary strands containing at least about 5 to 10 filaments is that they are more readily available and generally are less expensive than strands with a smaller number of filaments. There is no upper limit as to the number of filaments that the filamentary strand may contain except that imposed by availability.

In some instances two readily available strands of lower denier than desired may be run together to give a single strand and thereby increase the total number of filaments and, in fact, this procedure has the additional advantage, for preparing yarns with staple distributed as evenly and as continuously as possible along the length thereof, that any turns of incidental twist originally present in one of the lower denier strands or twist resulting from the strand being withdrawn from the package, will generally not coincide with the incidental twist in the second lower denier strand so that it is possible to prepare a more uniform yarn.

The ratio of fibrous material to filamentary material may vary within wide limits and depends to some extent upon the intended use of the yarn. If one is not interested in producing yarns which have the general appearance of spun yarns and is interested only in obtaining a novel appearance such as can be obtained with slubbed yarns, the percentage of fibrous material may be as low as a fraction of one percent, but if it is desired that the yarn have the general appearance of a spun yarn, best results are generally obtained from combinations wherein the staple fibers constitute from about 30

to 80 percent by weight of the yarn. The appearance of yarn according to this invention, wherein the staple fiber material is evenly distributed and wherein the staple constitutes about 40 percent or more of the total weight, is almost identical to that of a spun yarn except that it is generally more uniform and the long fiber protrusion or fuzziness is generally somewhat less. In most instances it is not advantageous to employ the staple material in percentages greater than about 80 percent since this requires the insertion of a greater amount of twist and since the yarns begin to lose some of the advantageous characteristics imparted by the filamentary strands. There are exceptions, however, and one instance when it may be desirable to exceed this figure is in the preparation of yarns for very lightweight summer materials wherein the filamentary material, even though present in very small percentages, can serve to increase appreciably the minimum breaking strength. This makes possible the production of extremely lightweight fabrics and one can, for example, weave a fabric which approximates in appearances and strength a good tropical woollen but which has only about one-half the weight.

The amount of twist that should be inserted in the filamentary strand, following its contact with a suitable source of staple fibers, to adequately secure the fibrous material in position, should be at least about 5 turns per inch and preferably at least about 10 turns per inch. This additional twist forces the filaments of the strand together and thus secures the fibers firmly in position so that they are not readily dislodged. There is no upper limit as to the amount of twist that can be inserted, as far as the operativeness of the new process is concerned, since the greater the amount of twist, the more rigid the securement of the fibers; however, excessive twist in the new yarns of this invention will, as in any other yarn, result in bad handling characteristics.

Although I have described the specific apparatus of my invention, I contemplate that changes may be made without departing from the scope or spirit of my invention and I desire to be limited only by the scope of the claims.

That which is claimed is:

1. In an apparatus having a pair of driven delivery rolls and means for guiding first and second bodies of material into contact with the other in the area at the nip of said rolls, one of said bodies of material being a continuous multifilament yarn, the improvement comprising a roll rotatably mounted in the path of travel of the continuous multifilament yarn, said roll having a right hand thread and a left hand thread therein to spread the individual filaments of the multifilament yarn and means to rotate said roll, said right hand threads crossing said left hand threads at a plurality of points across the length of said roll.

2. The apparatus of claim 1 wherein said roll is rotated in a direction opposite to the path of travel of the multifilament yarn.

3. Apparatus to produce a composite yarn of continuous fibers and staple fibers comprising a pair of driven delivery rolls, means to supply staple fibers into the nip of said delivery rolls, means to separate a continuous multifilament yarn into a plurality of continuous filaments, means to supply said separated filaments into the nip of said delivery rolls and means to twist said staple fibers and said filaments, said means to separate a continuous multifilament yarn being a roll member ro-

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tatably supported in the path of travel of the multifila-  
ment yarn to the nip of said delivery rolls and having  
a left hand thread and a right hand thread and means  
to rotate said roll, said right hand threads crossing said  
left hand threads at a plurality of points across the

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length of said roll.

4. The apparatus of claim 3 wherein said threaded  
roll member is driven in a direction opposite to the path  
of travel of said multifilament yarn.

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