Oct. 1, 1940. C. C. SORENSEN 2,216,377

METHOD OF MAKING YARN

Filed May 17, 1939 2 Sheets-Sheet 1

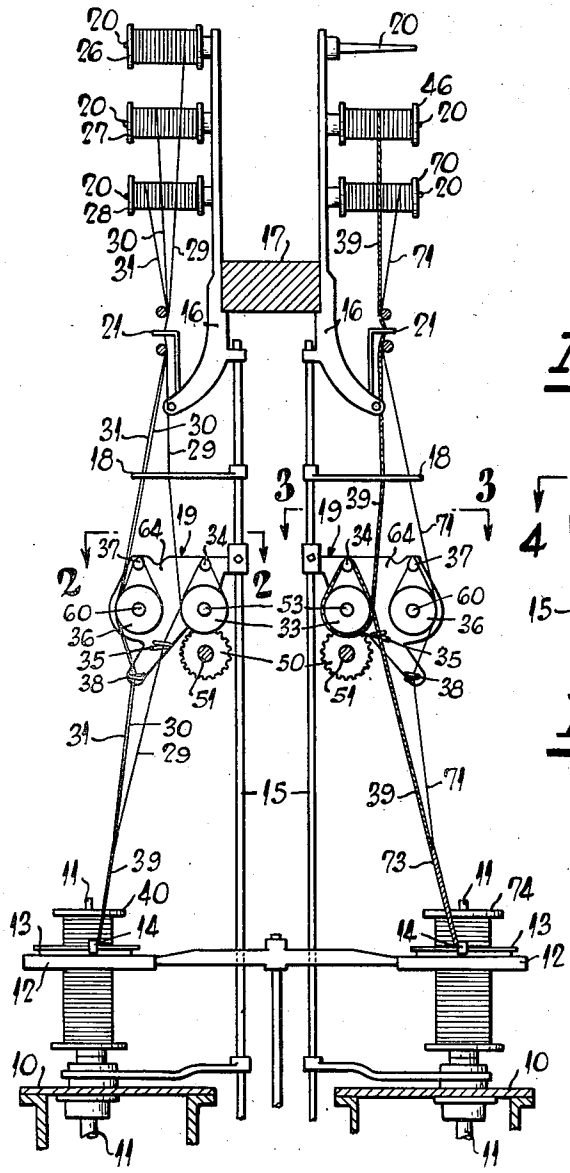


Fig. 1

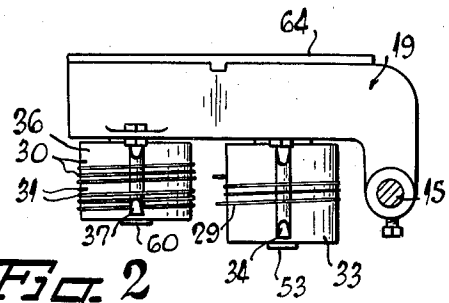


Fig. 2

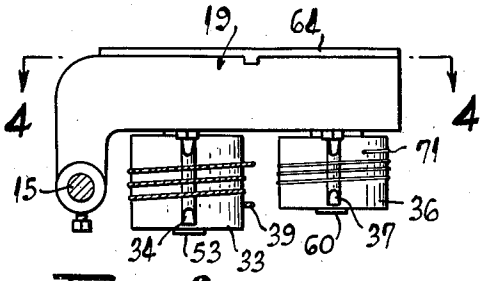


Fig. 3

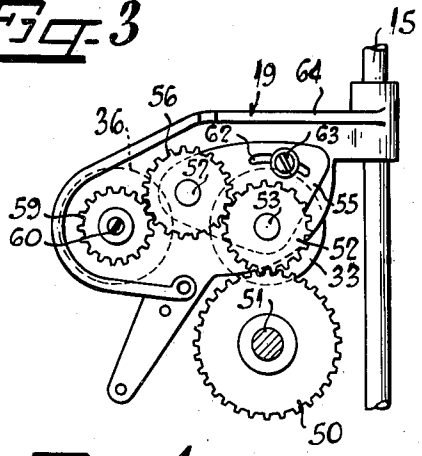


Fig. 4

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METHOD OF MAKING YARN

Filed May 17, 1939 2 Sheets-Sheet 2

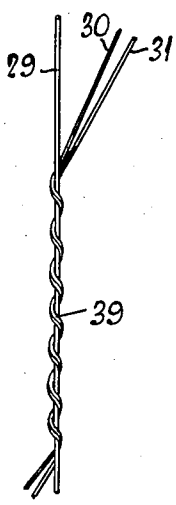


Fig. 7

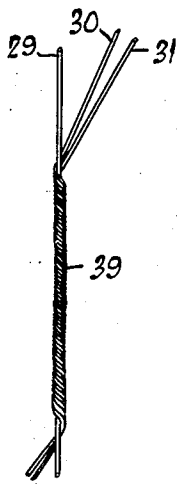


Fig. 8

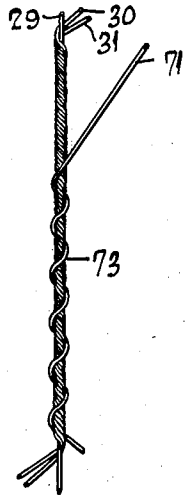


Fig. 9

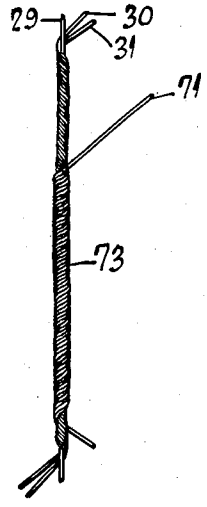


Fig. 10

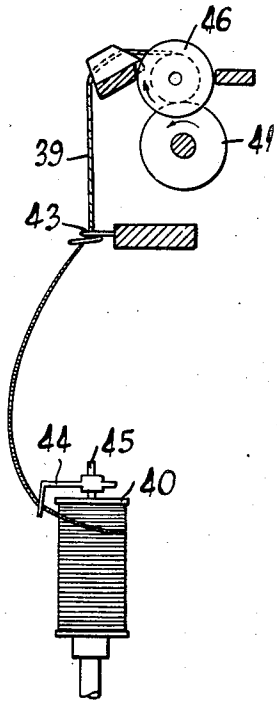


Fig. 5

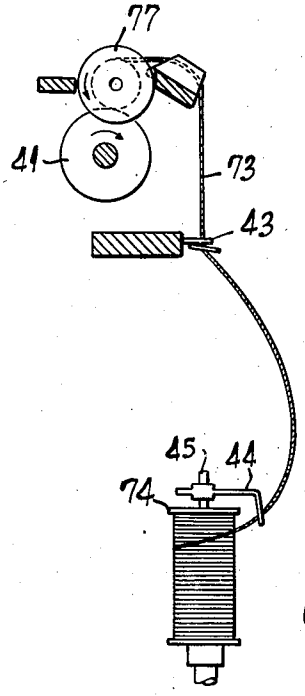


Fig. 6

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METHOD OF MAKING YARN

Carl C. Sorensen, Westwood, Mass.

Application May 17, 1939, Serial No. 274,187

11 Claims. (Cl. 57—156)

This invention relates to a yarn and a method of making the same and more especially to a yarn which is to be subsequently used in the manufacture of knit products, especially hosiery. Heretofore, one of the greatest obstacles encountered in knit products such as ladies' hosiery, is that of elimination of runs. This obstacle is especially apparent where the fabric has been knitted from a silk yarn, the qualities of which being such that a very little resistance to relative movement will be offered when one strand is brought into contact with an adjacent strand. As a result, when one loop in a fabric, such as a stocking, knitted from an ordinary silk strand has been broken the entire wale in the fabric will soon become affected. There is also a great demand for sheer silk stockings, but usually the sheerer the stocking the weaker the structure and more susceptible to runs. Therefore, the goal to which hosiery manufacturers are working is sheerness combined with maximum strength.

It is, therefore, an object of this invention to provide a strand of yarn comprising a plurality of filament strands plied and twisted together in one direction, said plied and twisted strands being subsequently plied and twisted in another direction with an additional filament strand. During the manufacture of a strand of this type, some of the strands are fed faster than the others thereby causing one strand to be wrapped around the other. This will leave the natural strength in the silk when ready for knitting. By providing a yarn of this type, it is evident that more frictional resistance will be offered to runs when it is knitted. It is a well known fact that when filament silk has been knitted into a stocking that the periphery of the strand is sleek, thereby making it easy for the yarn to slip. This combination of strands into a consolidated yarn produces a strand of maximum strength, which, when knitted into a stocking, will produce a very sheer effect and also a very strong stocking from the structural point of view.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which—

Figure 1 is a vertical, sectional view through a doubling and twisting machine, showing one type of apparatus which may be employed in the manufacture of my improved yarn;

Figure 2 is a sectional plan view taken along the line 2—2 in Figure 1, showing the strands positioned on the feed rolls during the first step in the manufacture of the improved yarn;

Figure 3 is a sectional plan view taken along line 3—3 in Figure 1, showing the strands of yarn as they are fed during the third step in the manufacture of the yarn, the second step being described later;

Figure 4 is an elevation taken along the line 4—4 in Figure 3 showing the gearing arrangement whereby one feed roll is driven at a faster rate than the other;

Figure 5 is a sectional view through a portion of an up-spinner, showing the strand of yarn as it undergoes the second step in its manufacture;

Figure 6 is a sectional view through a portion of an up-spinner showing the strand of yarn as it undergoes the fourth and final step in its manufacture;

Figure 7 is an enlarged detail view of the strand of yarn after the first step of plying and twisting has been performed by the apparatus in the left-hand portion of Figure 1;

Figure 8 is an enlarged view of this same strand after the second step has been performed by the apparatus shown in Figure 5;

Figure 9 is an enlarged view of the strand of yarn after the third step has been performed by the mechanism shown in the right hand portion of Figure 1;

Figure 10 is an elevation of this strand after the fourth and final step has been performed by the mechanism shown in Figure 6.

The manufacture of this improved type of yarn is more effectively carried out by a suitable machine such as shown in my prior Patent No. 2,096,654 of October 19, 1937, with which may be associated a suitable up-spinning apparatus. Therefore, I have shown a substantial portion of the structure disclosed in this previously issued patent in conjunction with the strands which are processed by this device for forming a perfected strand.

The numerals 10 indicate suitable housings of a doubling and twisting machine in which are rotatably mounted spindles 11. The spindles 11 are adapted to carry suitable spools which will be presently described upon which the plied and twisted yarns have been wound. Surrounding the upper portion of each spindle is a suitable ring rail 12 having rings 13 mounted therein upon which travellers 14 are adapted to rotate and carry a strand along with it. This doubling and twisting machine is also provided with suitable vertically disposed rods 15 which have their upper ends mounted in brackets 16, said brackets being secured to longitudinally disposed member 17. Each rod 15 carries thread guiding means

18 and a feeding assembly 19 which will be presently described.

As disclosed in my former patent, the silk strand is fed downwardly from spools on suitable spindles, such as indicated by the reference character 20, downwardly through a stop motion 21, through thread guide 18, feed roll assembly 19 and to the traveller 14 from when it is wound around a suitable spool disposed upon the upper portion of spindle 11. This is conventional process in plying and twisting machines.

The first step in the manufacture of my improved strand of yarn is to place a plurality of spools of yarn such as indicated by reference characters 26, 27 and 28 upon spindles 20, which are disposed on the left-hand bracket 16 in Figure 1. From these spools suitable filament strands 29, 30 and 31, respectively are drawn downwardly through stop motion 21 and thread support 18. At the thread support the strand 29 is directed downwardly beneath back feed roll 33 and then upwardly over a horizontally disposed supporting member 34 which is located directly above the center line of the feed roll. This strand is wrapped several times around members 33 and 34 as shown in Figure 2, and then this strand is directed downwardly through an eyelet 35.

The strands 30 and 31 after leaving the thread supporting means 18, are directed downwardly over front feed roll 36 and then around a horizontally disposed supporting member 37 directly above the feed roll. These strands are likewise wrapped around the members 36 and 37 several times, from whence they are directed downwardly through an eyelet 38. After leaving the eyelet 38, the strands 30 and 31 are twisted together to form a strand 39.

Due to the structure in the feeding assembly 19, the front roll 36 is caused to rotate at a faster rate than the rear roll 33; consequently the strands 30 and 31 will be fed at a faster rate than strand 29. Therefore, when it is twisted, the strands 30 and 31 will be wrapped around the strand 29 in the manner shown in Figure 7. The combined strand 39 is drawn downwardly beneath the traveller 14 and onto a spool 40.

As a general rule, the strand 39 has only two to four turns per inch therein when it leaves the doubling and twisting machine and it is necessary to add additional twists or turns before it is ready for use. In such cases, it is preferable to place the spool 40 in a textile machine commonly known as an up-spinner to place these additional turns in the yarn at a very rapid rate. Figure 5 shows a sectional view through a portion of an up-spinner which is illustrated in a diagrammatic fashion. The spool 40 is placed upon a spindle 45 and the yarn 39 is passed through a flyer 44, then upwardly through a centering eyelet 43 and onto a take-up spool 46, said take-up spool being rotated by friction drive roller 41. The take-up spool speed is regulated for the number of turns without changing the spindle speed. The slower the spool 40 rotates the greater number of turns per inch will be imparted to the yarn. In this manner, an additional twist between 10 and 70 turns per inch will be added to the strand 39. I have found that from 20 to 35 turns per inch gives the desired yarn for knitting hosiery. This operation completes the second step.

It is to be expressely noted that the number of turns may vary from three to seventy per inch, in this type of yarn, depending of course upon the effect desired to be produced in the fabric in which this yarn is knitted.

Since it is very important that the strands 30 and 31 be fed at a faster rate than the strand 29, it is thought to be to an advantage to describe briefly the mechanism which is used to produce this variation in the rates of feed of the strands. Figure 4 shows the rear side of the feeding assembly 19. A gear 50 on drive shaft 51 is employed for driving a pinion 52, said pinion 52 being secured around a shaft 53. The shaft 53 has rear roll 33 also mounted thereon as well as a plate 55 which plate supports an intermediate pinion 56 as at 57. The pinion 56 meshes with the pinion 52 and also with a change gear 59 on stud shaft 60, said stud shaft being adapted to support the front feed roll 36. Due to the fact that the gear 59 is smaller than the pinion 52, the rate of rotation of this pinion will be correspondingly greater than the rate of rotation of pinion 52. Therefore the front roll 36 will rotate at a faster rate than the rear roll 33, and thereby feed strands 30 and 31 at a faster rate than strand 29.

Plate 55 has a slot 62 therein which is penetrated by a set screw 63, said set screw having its end embedded in housing 64. When it is desired to vary the rate of rotation of the front roll 36, the change gear 59 is removed and another is inserted in its stead, thereby necessitating the readjustment of the position of intermediate pinion 56, so that this intermediate pinion will mesh with both gear 52 and the gear which is inserted upon the shaft 60 instead of the removed gear 59.

After the second step in the manufacture of the yarn has been performed (Figures 5 and 8), the spool 46, together with the twisted yarn 39, is inserted upon spindles 20 disposed on the right hand side of Figure 1. The strand 39 is drawn downwardly from the spools 46 through stop motion 21 and around the rear feed roll 33. This strand of yarn is wrapped around the feed roll 33 and member 34 several times in the manner shown in Figure 3, after which it passes downwardly through eyelet 35. An additional spool 70 of filament yarn 71 is inserted upon one of the pins 20 alongside the spool 46. The strand 71 is drawn downwardly through tension device 21 and thread guide 18. From the thread guide, the strand 71 is wrapped around the front roll 36 and horizontally supporting member 37 several times in the manner shown in Figure 3 and then the yarn passes downwardly through eyelet 38. After the strands 39 and 71 leave eyelets 35 and 38, respectively, they are twisted together into a common strand 73. It is most economical to place from 2 to 4 turns per inch in this operation and then transfer the product to an up-spinner for the additional twist. It will be noted that the strand 39 in the present instance, is a left-hand twist; whereas the strand 71 is twisted around the strand 39 in a reverse manner. In other words, the combination of the strands 39 and 71 are twisted together in a right-hand manner. The strand 73 passes beneath traveller 14 and around a spool 74.

If it is desired to place additional turns in the strand 73, the spool 74 is removed from the spindle 11 and placed in an up-spinner in the manner shown in Figure 6. In this machine the strand 73 will be drawn from the spool 74 through flier 44, centering eye 43 and onto take-up spool 77. By employing the up-spinner, a right hand twist will be placed in the yarn at a very rapid rate. Likewise, in the final steps of the manufacture of the yarn, the number of turns may be varied

from three turns per inch to seventy-five turns per inch, depending upon the type of yarn desired and the use to which it is to be placed, by varying the revolutions per minute of the spool 11.

This type of twisting and knitting gives two main effects in the stocking. The first is that of sheerness. It has been found that a four-thread stocking made from this type of yarn has the appearance of a two thread stocking made from other types of yarn. This makes the stocking two numbers better in wearing as users get the wear of a four thread hose but have the appearance of a two thread hose. Secondly, the stocking made from this type of yarn is practically free from runs. While it might be called no-run, it is very evident that since the periphery of each strand has a frictional resistance to the adjacent strand, that runs are harder to produce for when a strand is parted, only a few loops in a wale will be affected. Although I have shown three plied ends in the first steps of the manufacture of this yarn, and two plied ends in the final steps, it is to be understood that this invention is not limited to any number of ends. The number of ends used, and the direction of twisting of the yarn and the number of turns can be varied to suit the type of yarn desired. However, it is essential that the first yarns be twisted in one direction in the first two steps, whereas the last two steps should twist the yarn in the opposite direction.

Summarizing, one filament strand is placed around one roller and two filament strands are placed around another roller which is rotating at a greater rate of speed than the first roller, and these two stands are plied and twisted together in the neighborhood of three left turns per inch and it is preferable to then transfer these wound bobbins to an up-spinner and impart an appreciably greater number of left-turns per inch somewhere between 10 and 75 turns per inch depending upon the type of yarn desired, and the purpose for which it is to be used. I have found that a very good yarn is obtained in this step, by applying between twenty-five and thirty left turns per inch. This additional twisting can be accomplished in the first machine employing the front and back rolls without the necessity of transferring it to an up-spinner but of course it is realized that it would be a slow operation and the transfer to the up-spinning machine is for the sake of economy. So it is seen that the two ends running over one roller and the single end running over the other roller are plied and twisted from three to seventy-five turns per inch.

The product thus described is then placed in the machine employing the two rollers and is wound around the slow roll, and a single untwisted strand is wound around the faster roll, and is wound at a faster rate and this combination is likewise plied and twisted about three right turns per inch and then the product is transferred to an up-spinner where it is twisted anywhere from ten to seventy-five right turns per inch, but I have found that approximately from thirty-five to fifty-five turns per inch gives the desired product for the knitting of hosiery. In this step it is likewise clear that the up-spinning step could be eliminated and the desired number of left-turns per inch could be given the yarn in the original machine employing the slow and fast rolls, but for the sake of economy, the transfer to the up-spinning machine is desirable. I have described the first operation being a left turn and the second operation as being a right turn. It is evident that these two operations can be reversed as to the direction of twisting, the only requirement being that in the second operation, the direction of twist be opposed to the direction of twist employed in the first operation.

Although I have stressed the twisting for example of two filament strands at a high rate with one filament strand at a low rate in the formation of the first resultant twisted strand, it is evident that this process could be reversed and two filament strands fed at low rate could be twisted with one or more filament strands fed at a righ rate in producing the first resultant strand. It is also evident that in producing the finished yarn where the first resultant twisted strand is twisted with a single filament strand being fed at a higher rate of speed than the resultant twisted strand, two or more filament strands could be fed along with the resultant twisted strand in the filament twisting operation without departing from the spirit of the invention. It is quite evident that the number of strands used can be varied depending upon the desired type of yarn to be produced and the number of thread yarn desired. The invention resides in twisting a plurality of filament strands together with some of the strands being fed at a faster rate than the other to produce a preliminary resultant strand and then twisting this preliminary resultant strand fed at one rate with one or more filament strands fed at another rate in a reverse direction.

I have found that the number of turns per inch imparted to the finished yarn has a distinct bearing on the lustre of the yarn and consequently on the lustre present in the stocking made from the yarn. The greater the number of turns per inch in the finished yarn, the less lustre appears in the finished stocking. In other words, the turns per inch can be regulated between the minimum turns recited to give the desired lustre in the finished stocking.

In Figures 7 and 9 the schematic repetition is supposed to show about three turns per inch. On account of the size of the yarn being greatly magnified, the number of turns per inch is not drawn according to scale, a true representation of the yarn does not appear, but it is thought that anyone skilled in the art will be able to visualize the appearance of such yarn. In Figures 8 and 10, the number of turns per inch shown are likewise only by way of illustration, because it is apparent that in Figure 8 it is impossible to show graphically the exact number of turns per inch on account of having to illustrate the filaments on a much larger scale than they naturally appear. As to Figure 10 this likewise is by way of illustration only as the strand would not be shown as completely wrapped around and covering the inner strand on account of the fact that the twisting in the last operation in Figures 9 and 10 is reversed in the composite strand composed of strands 29, 30 and 31, will open up and the wrapping yarn locks into the strand around which it is twisted in opposite direction.

In the drawings and specification there has been set forth a preferred embodiment of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the appended claims.

I claim:

1. That method of forming a stocking yarn from filament strands such as silk, which comprises feeding a plurality of filament strands to a spinning couple, feeding some of said strands at

a faster rate to the spinning couple than the others and twisting the combined filaments between 3 and 75 turns per inch in one direction, to form a twisted strand, then feeding the twisted strand to a spinning couple and also feeding a filament strand to the spinning couple along with the twisted strand and imparting between 3 and 75 turns reverse twist to the twisted strand and the last-named filament strand.

2. The method of forming a silk stocking yarn from filament strands which comprises twisting a plurality of filament strands together while feeding some of the filament strands at a faster rate than the others, then twisting the resultant twisted strand in the opposite direction with a filament strand feed at a faster rate than the resultant twisted strand.

3. The method of forming silk stocking yarn from filament strands which comprises twisting a plurality of filament strands with another filament strand fed at a faster rate than the plurality of strands, then twisting the resultant strand in a reverse direction with a filament strand fed at a faster rate than the resultant twisted strand.

4. The method of forming a silk stocking yarn from filament strands which comprises twisting a plurality of filament strands together at a rate of between 3 and 75 turns per inch with another filament strand fed at a slower rate than the other filament strands, then twisting the resultant twisted strand in the opposite direction for about 3 to 75 turns per inch with a filament strand fed at a faster rate than the resultant twisted strand.

5. The method of forming silk stocking yarn from filament strands which comprises twisting a plurality of filament strands for about 3 to 75 turns per inch with another filament strand fed at a faster rate than the plurality of filament strands, then twisting the resultant twisted strand for about 3 to 75 turns per inch in the opposite direction with a filament strand fed at a faster rate than the resultant twisted strand.

6. The method of forming a silk stocking yarn from filament strands which comprises twisting a plurality of filament strands together at a rate of between 20 and 35 turns per inch with another filament strand fed at a slower rate than the other filament strands, then twisting the resultant twisted strand in the opposite direction for about 50 to 65 turns per inch with a filament strand fed at a faster rate than the resultant twisted strand.

7. The method of forming silk stocking yarn from filament strands which comprises twisting a plurality of filament strands for about 20 to 35 turns per inch with another filament strand fed at a faster rate than the plurality of filament strands, then twisting the resultant twisted strand for about 35 to 55 turns per inch in the opposite direction with a filament strand fed at a faster rate than the resultant twisted strand.

8. That method of making a silk stocking yarn from filament strands which comprises twisting two filament strands together under different tensions for about 3 to 75 turns per inch, then twisting the resultant strand under relatively high tension for about 3 to 75 turns per inch with a filament strand under relatively low tension in a direction opposed to the direction of twist imparted to said resultant strand.

9. That method of forming a silk stocking yarn from filament strands which comprises feeding a plurality of filament strands at a given rate of delivery and feeding a single filament strand at a rate slower than the rate of feed imparted to the plurality of strands, twisting the plurality of strands and the single strand together for about 3 to 75 turns per inch in one direction, then feeding the resultant twisted strand under a given tension and feeding a filament strand at a faster rate than the twisted strand, twisting the twisted strand and the filament strand together for about 3 to 75 turns per inch in a direction opposite to that imparted to the said twisted strand.

10. That method of forming a silk stocking yarn from filament strands which comprises feeding a plurality of filament strands to a twisting apparatus with the rate of feed of some of the strands being faster than others of the strands, then feeding the resultant strand along with the filament strand to a reverse twisting apparatus while feeding the last-named filament strand under less tension than the tension imparted to the resultant twisted strand.

11. That method of making a twisted stocking yarn from filament strands which comprises feeding a plurality of filament strands at a given rate and also feeding a filament strand at a slower rate than the plurality of strands are fed and imparting to all of the strands a twist of about 2 to 10 turns per inch in one direction, then passing the resultant twisted strand through an upspinner and imparting between 10 and 75 additional turns per inch in the same direction, then feeding the resultant up-spun strand through a twisting apparatus at a given rate and at the same time passing a filament strand through the twisting apparatus at a faster rate than the twisted strand and imparting thereto between 2 and 10 turns per inch, in a direction opposite to the twist imparted in the upspinning operation, then up-spinning the last-named resultant strand with a twist of about 10 and 75 turns per inch in the same direction last-mentioned.

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