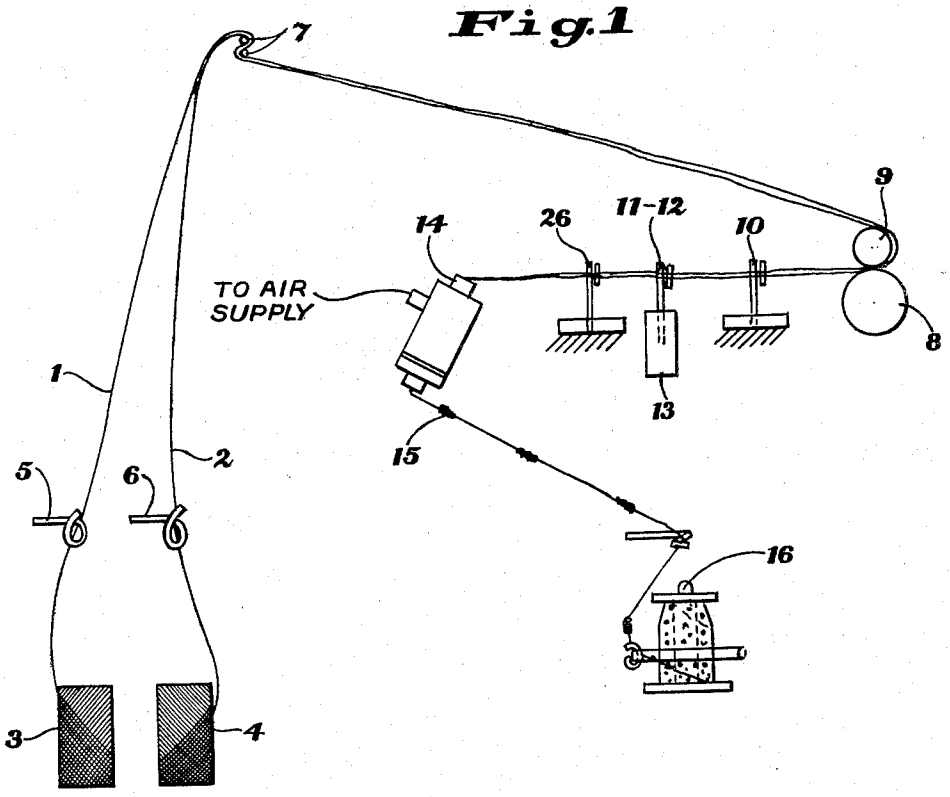
Dec. 10, 1963 H. JACOBS ETAL 3,113,413

APPARATUS AND METHOD FOR PRODUCING VOLUMIZED SLUB YARN

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Fig. 1



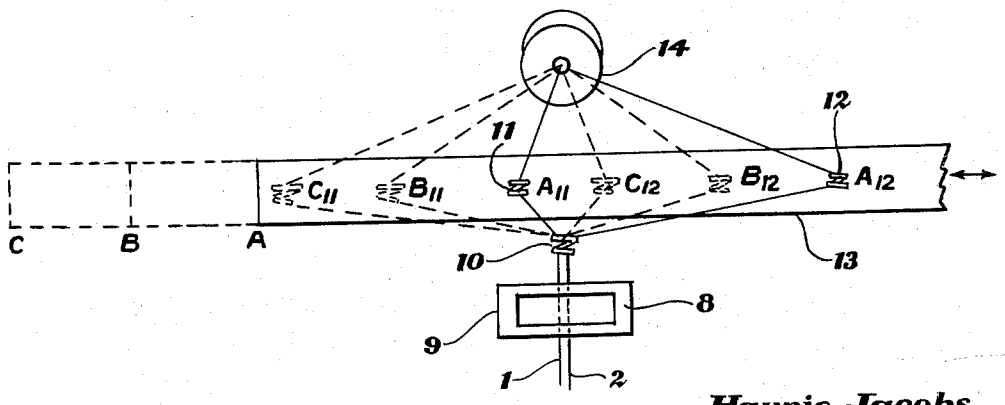


Fig. 2

Haynie Jacobs
Angus Morehead
INVENTORS

BY R. Frank Smith
Harold N. Powell
ATTORNEYS

Dec. 10, 1963 H. JACOBS ETAL 3,113,413

APPARATUS AND METHOD FOR PRODUCING VOLUMIZED SLUB YARN

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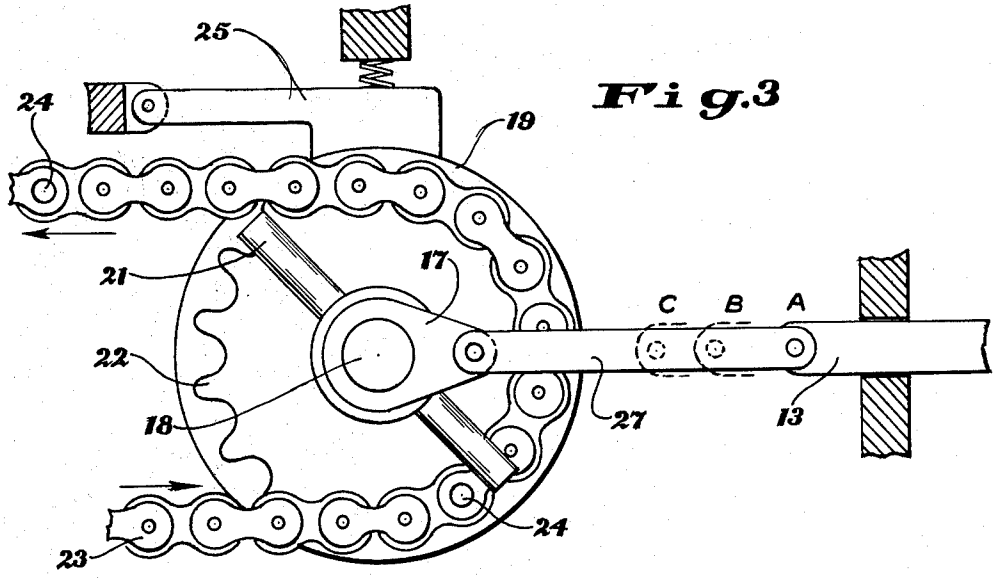


Fig.3

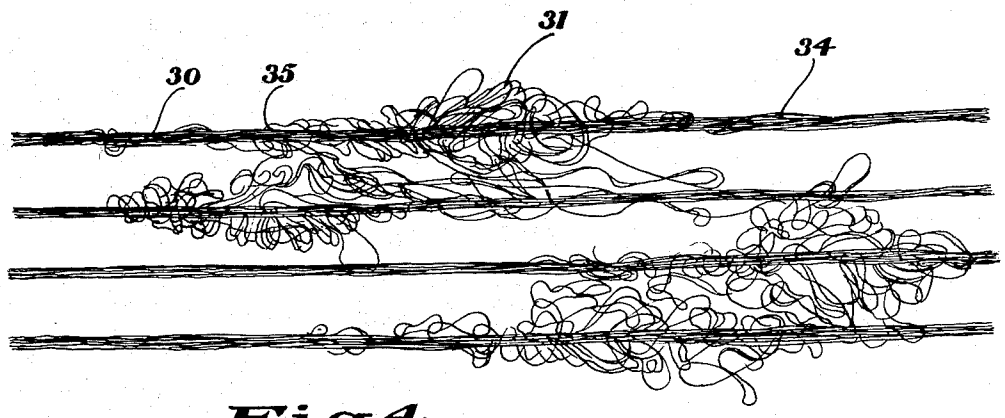


Fig.4

Haynie Jacobs
Angus Morehead
INVENTORS

BY R. Frank Smith
Harold N. Powell
ATTORNEYS

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APPARATUS AND METHOD FOR PRODUCING VOLUMIZED SLUB YARN

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Fig. 5

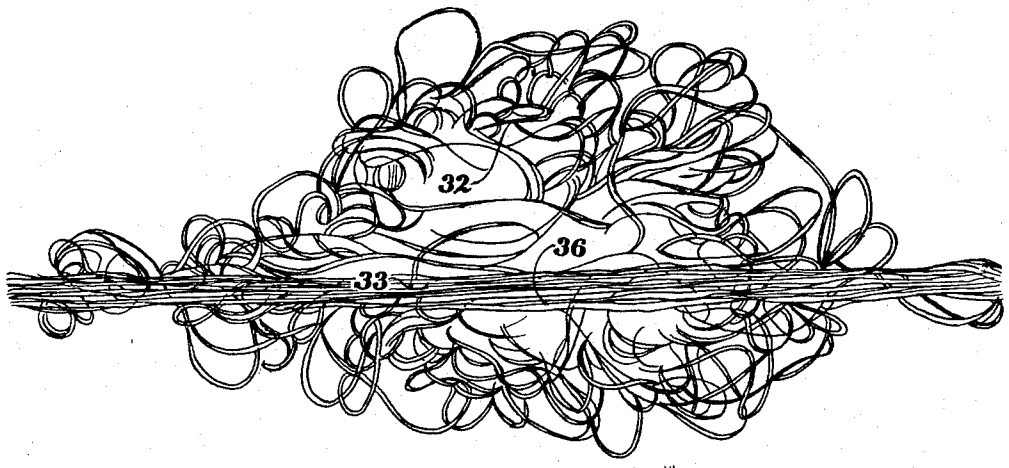


Fig. 6

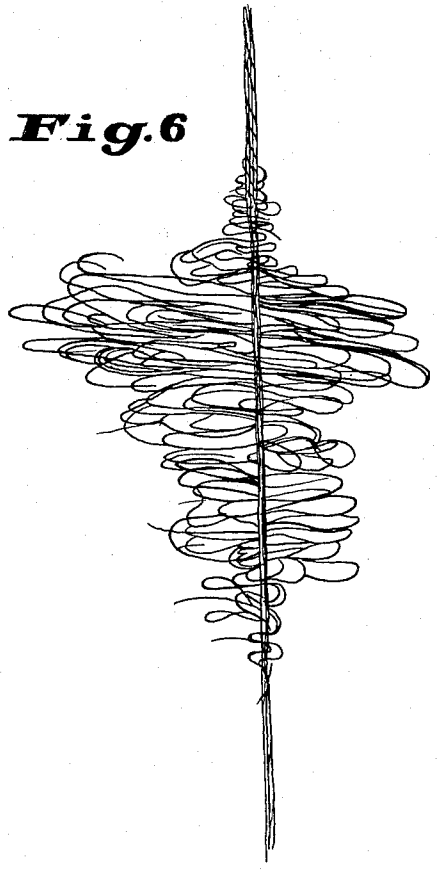
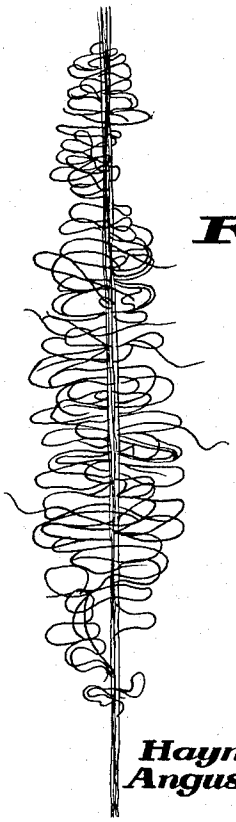


Fig. 7



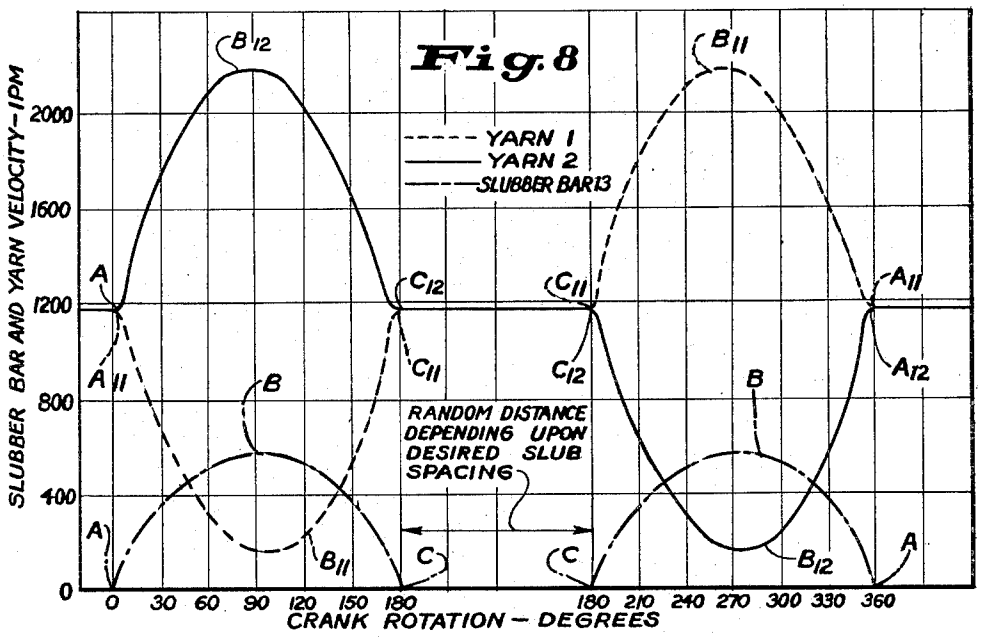
Haynie Jacobs
Angus Morehead
INVENTORS

BY R. Frank Smith
Harold N. Powell
ATTORNEYS

Dec. 10, 1963 H. JACOBS ETAL 3,113,413

APPARATUS AND METHOD FOR PRODUCING VOLUMIZED SLUB YARN

Filed June 8, 1959 4 Sheets-Sheet 4



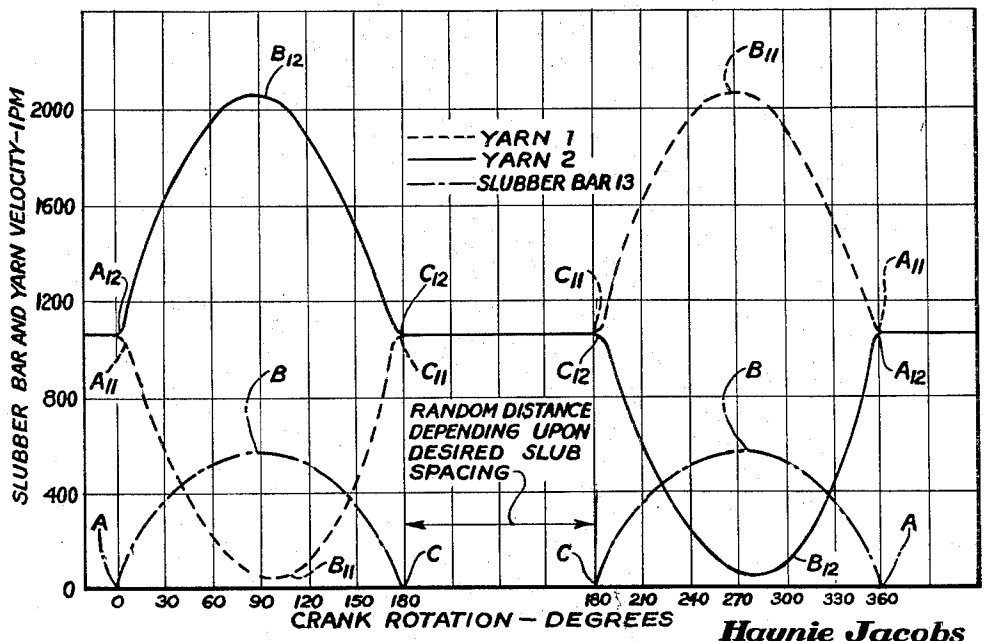


Fig. 9

Haynie Jacobs
Angus Morehead
INVENTORS

BY R. Frank Smith
Harold N. Powell

ATTORNEYS

United States Patent Office 3,113,413 Patented Dec. 10, 1963

3,113,413

APPARATUS AND METHOD FOR PRODUCING VOLUMIZED SLUB YARN

Haynie Jacobs and Angus Morehead, Kingsport, Tenn., assignors to Eastman Kodak Company, Rochester, N.Y., a corporation of New Jersey

Filed June 8, 1959, Ser. No. 818,698
8 Claims. (Cl. 57—34)

This invention relates to a novelty yarn product. More particularly, this invention concerns a novel apparatus and method for producing a yarn containing randomly spaced, sharp bulky slubs throughout the yarn.

There are a number of instances in the textile trade, such as for drapery and shirting fabrics, where a sharp, bulky, voluminous slub is desired for use. However, prior to the present invention, such type of continuous filament yarn material has not been readily and economically obtainable but generally has required the use of expensive and complicated novelty yarn twisters or has been restricted to viscose yarns which are wet spun by certain methods. However, our coworker, Richard F. Dyer, in his copending application Serial No. 400,544, has shown a process and apparatus whereby conventional yarn may be treated to impart certain novelty effects thereto in a more simple, economical manner than prior art processes. The present invention while in certain general respects being similar to our coworker's invention, distinguishes therefrom and constitutes an improvement thereover in the handling of several ends of yarns, applying intermittent treatment in a different manner, producing a yarn of completely different appearance and distinguishes in other respects as will be apparent from the description hereinafter set forth.

It is, therefore, apparent that the development of method and apparatus whereby a sharp, bulky, voluminous slub may be simply and economically produced represents a highly desirable result. After extended investigation we have found an improved method and apparatus involving the use of a single feed roll incorporated with a novel arrangement for alternately feeding multiple ends of excess yarn to a zone of streamlined high velocity air flow to form a volumized slub yarn of distinctive appearance.

This invention has for an object to provide an improved process and apparatus for making a volumized continuous filament slub yarn made from two or more ends of yarn and containing predetermined randomly spaced, sharp, bulky, voluminous slubs wherein the excess yarn in the slub consists of a matted, tangled mass of continuous filaments and where the core yarn contains no or substantially no filament loops. Another object is to provide economically produced, new and novel volumized slub yarn products from continuous filament yarn which products produce unusual fabric textures and appearances. Another object is to produce a novel slub yarn wherein the slubs are produced at randomly selected intervals by forming and injecting a mass of tangled continuous filaments into a carrier or supporting yarn. Another object is to provide a volumized slub yarn produced from multiple ends of which the functions of the core and the excess yarns may be interchanged among the multiple ends of yarn. Still another object is to provide a process of producing a volumized slub yarn by using a single feed roll and a novel arrangement for alternately varying the rate of feed of multiple ends of excess yarn to a zone of streamlined air flow. Still another object is to incorporate apparatus features on a standard twisting frame such that a volumized slub yarn may be produced economically. Other objects will appear hereinafter.

For a further understanding of our invention, reference will be made to the attached drawings which show in greater detail the process, product and apparatus of the present invention for producing a volumized slub yarn from two ends of yarn.

In the attached drawings forming a part of the instant application:

FIG. 1 is a diagrammatic side elevation view of one form of apparatus which may be used for carrying out our process;

FIG. 2 is a detailed plan view of the guide arrangement for alternately feeding multiple ends of yarn to the air jet;

FIG. 3 is a detailed view of one apparatus for actuating the slubber bar;

FIG. 4 is a drawing made from a photograph of a volumized slub yarn which may be produced by the present invention according to Example I which follows;

FIG. 5 is likewise a drawing made from an enlarged photograph showing in greater detail the appearance of the slub produced by the present invention according to Example I;

FIG. 6 is a simplified illustration of another type of volumized slub yarn made according to Example III hereof;

FIG. 7 shows the slub portion of a yarn made by the conditions of Example II;

FIG. 8 graphically describes the velocity characteristics of the yarns 1 and 2 as they enter the air jet in relation to the slubber bar motion 13 during a typical cycle of the process described in Example I; and

FIG. 9 also graphically depicts the velocity characteristics of the yarns 1 and 2 and the slubber bar 13 for a typical cycle of the process according to Example III.

Referring to FIG. 1, yarns 1 and 2 are withdrawn respectively from packages 3 and 4 through yarn guides 5 and 6. The strands are passed over piano wire tension guides 7, to feed roll 8. A pressure roll 9 is positioned on feed roll 8 for assisting in controlling the feeding of the yarn and preventing yarn slippage. The yarns from the aforementioned feed rollers are passed through a stationary yarn guide 10 to reciprocating yarn guides 11 and 12 where yarns 1 and 2 are separated and threaded respectively through 11 and 12, better shown in FIG. 2. These reciprocating yarn guides 11 and 12 are mounted on slubber bar 13. Details of means for reciprocating the slubber bar 13 will be described subsequently. After yarns 1 and 2 pass through yarn guides 11 and 12, they are fed angularly into an air jet 14 constructed as described in a Dyer Patent No. 2,924,868. In some cases it may be preferable to combine both ends 1 and 2 and pass them through a stationary guide 26 prior to their entering the jet. The volumized slub yarn 15 is removed angularly from the direction of flow of the gas stream and wound on a twister bobbin, tube winder or other suitable take-up means 16.

Reference will now be made to FIG. 2 which is a more detailed plan or top view of a novel guide arrangement for alternately feeding the yarns to the air jet. In this FIG. 2, yarns 1 and 2 are fed by feed roll 8 and pressure roll 9 (top view of these rolls shown) as described in connection with FIG. 1, to stationary yarn guide 10 where they are separated with yarn 1 passing through yarn guide 11 and yarn 2 through yarn guide 12. The two yarns are then fed to the air jet 14. Yarn guides 11 and 12 mounted on slubber bar 13 travel a linear path described by the movement of the slubber bar 13 as it reciprocates between points A and C. Consider the slubber bar 13 starting from rest at point A and moving continuously from position A through B to C. Simultaneously, yarn guide 12 travels from A_{12} through B_{12} to C_{12} and yarn guide 11 travels from A_{11} through B_{11} to C_{11}. When yarn guide 12 moves from A_{12} through B_{12} to C_{12}, the rate of feed of yarn 2 to air jet 14 is in-

creased. While yarn guide 12 is feeding yarn 2 at a faster rate to air jet 14, yarn guide 11 in moving from A_{11} through B_{11} to C_{11} decreases the linear feed rate of yarn 1 to air jet 14. As a result of the difference in linear feed rates of yarns 1 and 2, a larger amount of yarn 2 will enter the air jet than yarn 1. As such, yarn 1 acts as a core yarn and yarn 2 as an excess yarn. This excess of yarn 2 when fed accompanying yarn 1 to an air jet 14 characterized by its minimum of air turbulence and its high conversion of static to velocity energy will form a short, bulky, voluminous slub characterized by a multitude of tangled filament loops of the excess yarn interwoven into the core yarn filaments. Slubber bar 13 will remain at least at point C until it is desired to form another slub at which time slubber bar 13 will move from C through B to A. In this instance, yarn guide 11 travels from C_{11} through B_{11} to A_{11} and yarn guide 12 travels from C_{12} through B_{12} to A_{12}. As such, the functions of yarns 1 and 2 are reversed when slubber bar 13 moves from position C to A. In this case, yarn 1 is fed at a higher linear rate to air jet 14 than yarn 2. Thus, yarn 1 acts as the excess yarn while yarn 2 forms the core.

Referring now to FIG. 3, one apparatus for actuating the slubber bar 13 is pictured in this figure. Its versatility permits random spacing of the volumized slubs. A round shaft 18 is fitted with an eccentric crank 17. A continuously rotating roller chain idler sprocket 22 floating on shaft 18 is driven by a roller chain 23. Roller chain 23 contains numerous trigger pins 42 randomly spaced along its length. Integral with shaft 18 is a pin 21. Trigger pin 24 acts on pin 21 to rotate shaft 18 through one-half a revolution or 180 degrees. This rotation of shaft 18 is transmitted by eccentric crank 17 through connecting rod 27 to slubber bar 13 which reciprocates between points A and C. A drag brake 25 acting on brake drum 19 overcomes any inertial forces which tend to rotate shaft 18 after trigger pin 24 disengages pin 21. By properly spacing trigger pins 24 along a length of roller chain 23 any desirable slub pattern and spacing is possible. When trigger pin 24 strikes pin 21, slubber bar 13 moves from A to C. After trigger pin 24 disengages pin 21, slubber arm 13 will remain at point C until the next trigger pin rotates pin 21 when slubber arm 13 will move back from C to A.

Referring now to FIGS. 4, 5, 6 and 7, which illustrate the volumized slubs formed, the ratio of the constant yarn feed roll velocity to the maximum slubber bar velocity will affect the length and bulkiness of the slub formed. Varying this ratio by changing either the peripheral speed of the feed roll 8 or speed of the chain 23 determines whether the slub is a short, bulky slub or a long, less voluminous slub. By varying the throw of the crank arm 17 the amount of excess yarn delivered to the jet can also be varied and the diameter and length of the slub changed.

Of course, it is realized that other variables such as length of connecting rod 27 and relative spacings of guides 10, 11, 12, 26 and jet 14 may be introduced which will alter the differences in relative velocity of yarns 1 and 2 which will in turn affect the size and shape of the slub formed.

It will also be recognized that two ends of yarn could be substituted for the one end of yarn going through guides 11 or 12, if desired, to achieve different color effects or to obtain a blend of two yarns of different compositions.

A still further understanding of our invention will be had by a consideration of the following examples which are set forth to illustrate certain preferred embodiments.

Example I

The yarn described in this example was produced on a twister known in the textile field as a C6C Whitin twister, manufactured by the Whitin Machine Works in Whitinsville, Mass. This basic twister structure was altered by addition of reciprocating guide means, jets and auxiliary guide arrangements similar to those disclosed in the description of FIGS. 1, 2 and 3.

The conditions of operation in this example are set forth as follows:

Yarn: Two ends of 150 denier, 38 filaments, 0.3 t.p.i., bright acetate.	
Yarn feed roll surface speed	1,175 in./min.
Max. slubber bar velocity	544 in./min.
Feed roll speed/max. slubber bar velocity	2.16.
Slubber bar throw	9/16 inch.
Air pressure to jet	20 p.s.i.g.
Volumized slub yarn twist	3.57 Z.
Avg. volumized slub yarn denier	318.
Amount of excess yarn in slub	2 inches.
Slug length	¾ inch.
Slub ratio (slub denier/unslubbed denier)	4.2/1.
Avg. slub spacing	16 inches.
Avg. yarn tension at jet exit	22 grams.
Slub appearance	FIGS. 4 and 5.

The foregoing conditions produce yarn and slubber bar linear velocities as graphically shown in FIG. 8. Here the yarn velocities are those found in yarn strands 1 and 2 as the yarns enter the jet 14 during pulsation of slubber bar 13.

From FIG. 8, during 0°–180° crank rotation, it is seen that as the velocity of slubber bar 13 increases from point A the velocity of yarn 2 increases sharply; and rapid deceleration occurs in yarn 1 to start formation of a slub. This trend continues until the slubber bar 13 reaches maximum velocity at point B. At this time yarn 2 reaches maximum velocity, and yarn 2 is slowed to minimum velocity and the main body of the slub is formed. At this time the ratio between the velocity of yarns 2 and 1 exceeds 14:1. With continued crank rotation the slubber bar 13 and yarn 2 decelerate while yarn 1 accelerates. This trend is continued until the slubber bar comes to rest at point C after 180° of crank rotation at which time the velocities of yarns 1 and 2 have reached the same value, the slub has been formed, and the yarns again pass through the air jet without filament tangling. The yarns continue to feed through the jet at an equal rate for a random length of time depending on the distance between pins 24 on the pattern chain 23 of FIG. 3 until which time the second portion of the slubbing cycle is begun. This is initiated at point C with the crank positioned at 180°. As crank rotation progresses, slubber bar 13 accelerates, yarn 1 accelerates to act as the excess yarn, and yarn 2 decelerates to become the core yarn. Thus, the functions of the two strands are seen to have been reversed from their functions during the first portion of the cycle. When the crank has reached the 270° point of rotation, yarns 1 and 2 have reached maximum and minimum velocities, respectively; and the slubber bar 13 has attained maximum speed to form the body of the slub. Following this, the speeds of yarn 1 and slubber bar 13 decrease as the speed of yarn 2 increases until the slubber bar is brought to a stop at point A by the crank arm having completed its cycle after 360 degrees of rotation. With cessation of slubber bar action, yarns 1 and 2 feed at equal rates through the jet; and yarn is again produced free from filament disturbances until the next pin 24 on the chain 23 causes a new slub cycle to start.

A typical strand of the yarn produced by these specific conditions is illustrated in FIGS. 4 and 5. In FIG. 4 the yarn is composed of a 2-ply yarn 30 in which a random points there occur volumized or bulky slubs 31. At the ends 34 and 35 of the slub 31, it will be noted that the excess yarn blends into the core so as to form a normal appearing 2-ply yarn which continues to the next slub location. Referring to FIG. 5, which is an enlarged view of the slub structure, the core yarn may be noted at 36 and the excess in area 32. Note the slub is composed of

a matted, tangled mass of continuous filaments which are randomly entwined in the core yarn as at 33, for example.

Example II

The yarn described in this example was produced on a twister as referred to in Example I, which twister had incorporated apparatus parts similar to those discussed in FIGS. 1, 2 and 3. A typical strand of this yarn is illustrated in FIG. 7. The conditions of operation in this example were as follows:

Yarn: Two ends 150 denier, 38 filaments, bright acetate, 0.3 t.p.i.	
Feed roll surface speed	1,175 in./min.
Maximum slubber bar velocity	381 in./min.
Feed roll speed/max. slubber bar velocity.	3.09.
Slubber bar throw	9/16 inch.
Air pressure	20 p.s.i.g.
Volumized slub yarn twist	3.57 Z.
Volumized slug yarn denier	312.
Amount excess yarn in slub	2 inches.
Slub length	1½ inches.
Slub ratio (slub denier/unslubbed denier.	3.15/1.
Average slub spacing	24 inches.
Average yarn tension at jet exit	22 grams.
Slub appearance	FIG. 7.

It will be noted that the diameter of this slub is smaller and that it is more elongated. That is, by varying the conditions of operation a different volumized slub effect may be obtained.

Example III

The yarn described in this example was produced on the same kind of twister apparatus as described and used in the preceding examples. However, the conditions of operation were as follows:

Yarn: Two ends 150 denier, 38 filaments, 0.3 t.p.i. bright acetate.	
Feed roll peripheral speed	1,050 in./min.
Max. slubber bar velocity	578 in./min.
Feed roll speed/max. slubber bar velocity.	1.82.
Slubber bar throw	⅞ inch.
Air pressure	17 p.s.i.g.
Volumized yarn twist	4.53 Z.
Volumized yarn denier	398.
Amount excess yarn in slub	3.25 inches.
Slub length	1 inch.
Slub ratio (slub denier/unslubbed denier.	4.75/1.
Average slub spacing	7.5 inches.
Slub appearance	FIG. 6.

Close approximations to the actual velocities of the slubber bar 13 and the yarns 1 and 2 for Example III are graphically shown in FIG. 9. The action is similar to that explained in Example I with the exception that the difference in relative yarn speeds at maximum slubber bar velocity is much greater in order that more excess yarn may be thrown quickly into the slub. In this instance, this ratio of yarn speeds exceeds 50:1.

As indicated, the volumized slub product is illustrated in FIG. 6 and it will be noted that the diameter of this slub is very large, and the slub is quite hairy while the length is relatively short.

Example IV

The yarn described in this example was produced on twister apparatus as described. This yarn had the same slub characteristics and was produced under the same conditions as the yarn of Example I except the yarn was made from one end of 150/38/.3Z bright acetate and one end of 150/38/.3Z black Chromspun yarn. The striking color effect of the alternately black and white slubs blended with the grey background to give an unusual three-color fabric appearance.

Example V

The yarn described in this example likewise was produced on apparatus containing our novel means for moving the yarn, the air jet and like parts as in the other examples. The conditions of operation were as follows:

Yarn: Two ends 150 denier, 68 filament, semi-dull polyester yarn obainable commercially as Dacron yarn.	
Feed roll surface speed	1,230 in./min.
Maximum slubber bar velocity	571 in./min.
Feed roll speed/max. slubber bar velocity.	2.16.
Slubber bar throw	9/16 inch.
Air pressure to jet	20 p.s.i.g.
Volumized slub yarn twist	3.57 Z.
Volumized slub yarn denier	319.
Amount excess yarn in slub	2 inches.
Slub length	¾ inch.
Slub ratio (slub denier/unslubbed denier.	4.15/1.
Average slub spacing	16.5 inches.

In our preferred apparatus we have found that excellent results are obtained for a slubber bar throw of 9/16 inch when the uniform feed rate of the yarn is about twice the maximum linear speed of the slubber bar. With this 2/1 ratio a sharp, large well-defined slub is produced. If a larger ratio is used, however, a longer, leaner slub may be produced which may be desirable for some fabric applications. Too small a ratio may produce a slub too large to process well in subsequent winding and weaving operations. In our preferred process we maintain sufficient tension between the jet and bobbin balloon guide to prevent any treatment of the yarn filaments between the slubs. This tension is provided by the wind-up means. Thus, between slubs our yarn preferably has the appearance of a conventional two-plied filament yarn.

Although the description set forth above describes a single feed roll and novel guide arrangement incorporated with a twister of the Whitin construction, it is understood that in the broader aspects of this invention our invention is not limited exactly to such a particular apparatus. For example, the means for actuating the slubber bar 13 is not limited to an apparatus as described in detail in FIG. 3 but may be driven by other suitable means, such as a hydraulic or air cylinder, one revolution clutch and crank arm or solenoid. Certain other suitable yarn feeding and take-up device would be suitable, such as a parallel tube winder, which would wind up the yarn without the addition of twist.

Although the linear velocities of yarns 1 and 2 in FIGS. 8 and 9 were always positive in value, it is understood that the linear velocities of yarns 1 or 2 when acting as the core yarn could be zero or could pass through zero to a negative linear velocity. In the first instance wind-up of the yarn would actually cease momentarily during slub formation, and in the second instance yarn would actually be momentarily withdrawn from the wind-up bobbin. That is, referring to FIGURES 8 and 9, although positive values have been indicated, it will be observed that the lower portions of the curves as shown closely approximate zero under certain conditions. If the slubber bar speed is increased to a rate more than half of the rate of the yarn speed then the curve would pass through zero to a negative value. As indicated, this would be momentarily. The traveler and movement on the wind-up bobbin provides some flexibility. Hence, the yarn would not be broken if the negative conditions were not continued for an undue period.

Although cellulose acetate yarn was the yarn used in a number of the examples set forth and is a preferred yarn, the product is not limited to production from acetate yarn but is adaptable to use with other continuous fila-

ment man-made yarn, such as polyacrylonitrile, polyester and the like yarns.

Accordingly, it is thought apparent from the foregoing description, that the present invention represents a new method and apparatus for producing a slubby yarn, which comprises feeding at a constant rate two multifilament yarns simultaneously through a zone of high velocity streamline gaseous flow and at random intervals feeding one of said yarns at an increased rate while at the same time reducing the rate of feed of the second yarn such that in the broader aspects of our invention the ratios of the rates of feed of the yarns are intermittently and randomly varied from more than 5/1 to less than 1/5 and at other times the rates of feed are substantially equal. In the preferred embodiment, this ratio would usually be more than 10/1 to less than 1/10.

The invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinabove and as defined in the appended claims.

We claim:

1. An apparatus for making novelty yarn from a plurality of strands of yarn, which novelty yarn has spaced, sharp, bulky slubs, comprising in series yarn feeding means of constant and uniform speed, reciprocating yarn guide members adapted to be moved alternately in one direction and then in another direction, such that the yarn strands are fed alternately at a higher and lower rate than the input rate of said yarn feeding means, a bulking jet positioned to receive the several strands of yarn from said guide members, and means for taking up the bulked slub yarn from said jet at a rate which varies in response to the movement of the reciprocating guide members.

2. An apparatus in accordance with claim 1 wherein the guide members are positioned on a movable bar connected to an eccentric crank.

3. The method of manufacturing a novelty yarn product containing spaced, sharp, bulky slubs throughout the yarn, which comprises feeding at least two ends of multifilament conventional yarn at substantially constant and equal yarn speeds through feed means as input, conducting one end of yarn from the feed means through a guide means adapted to move in timed relationship to other guide means so as to alternately store and release the yarn end, conducting another of the yarn ends through such other guide means whereby each end of the yarn is alternately fed at a higher and slower rate than the input rate, conducting the several ends of yarn from the

aforementioned guide means through a bulking jet, subjecting the several ends of yarn in said jet to streamline air flow whereby the bulky slubs are formed on the yarn at a rate varying in response to the movement of the aforementioned guide means, withdrawing from the jet such slub yarn, and taking up the withdrawn yarn directly from the jet in package form at a variable rate in relation to the rate of feed of the particular yarn end forming the core yarn at any given instance.

4. A process in accordance with claim 3 wherein the bulked slub yarn from the jet is taken up on a twister bobbin at a variable rate.

5. In an apparatus in accordance with claim 1 for making a novelty yarn of the class indicated from a plurality of strands of yarn fed through a jet, a movable bar member, the yarn guide members being mounted on said bar member, and an eccentric crank associated with one end of the bar member.

6. An apparatus in accordance with claim 5 wherein the eccentric crank is connected with a rotatable shaft, said shaft being associated with pin and spocket means for actuating a predetermined rotation of the shaft.

7. An apparatus in accordance with claim 5 wherein the eccentric crank is connected with a rotatable shaft, which shaft is provided with a brake drum and brake for overcoming inertial forces which may tend to rotate said shaft beyond the desired rotation.

8. An apparatus in accordance with claim 5 wherein the eccentric crank is driven in synchronism with the constant speed yarn feeding means.

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