

Oct. 1, 1963

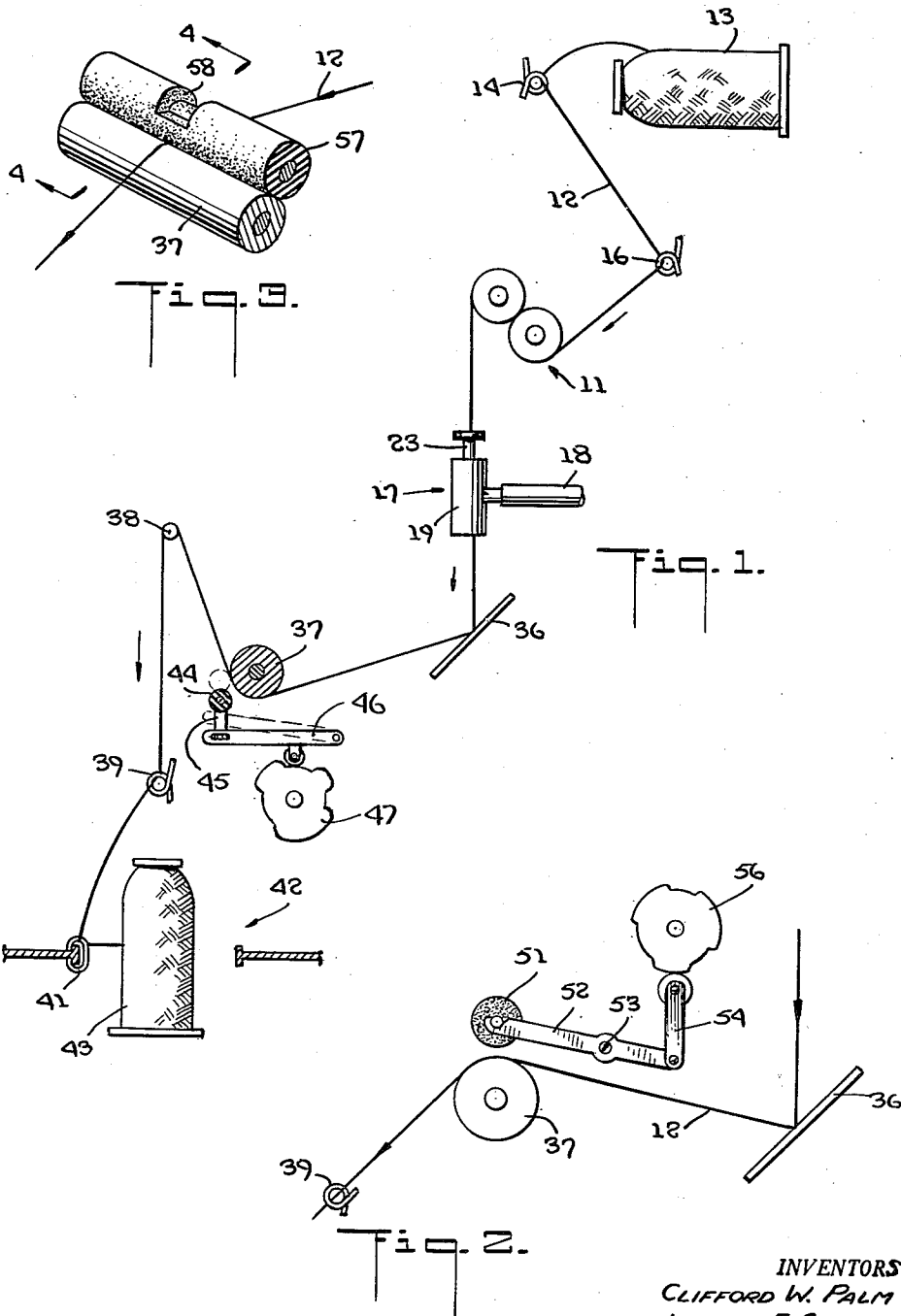
C. W. PALM ETAL

3,105,349

METHOD AND APPARATUS FOR PRODUCING NOVELTY YARN

Filed May 28, 1954

2 Sheets-Sheet 1



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Fig. 3.

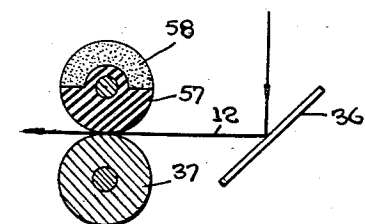


Fig. 4.

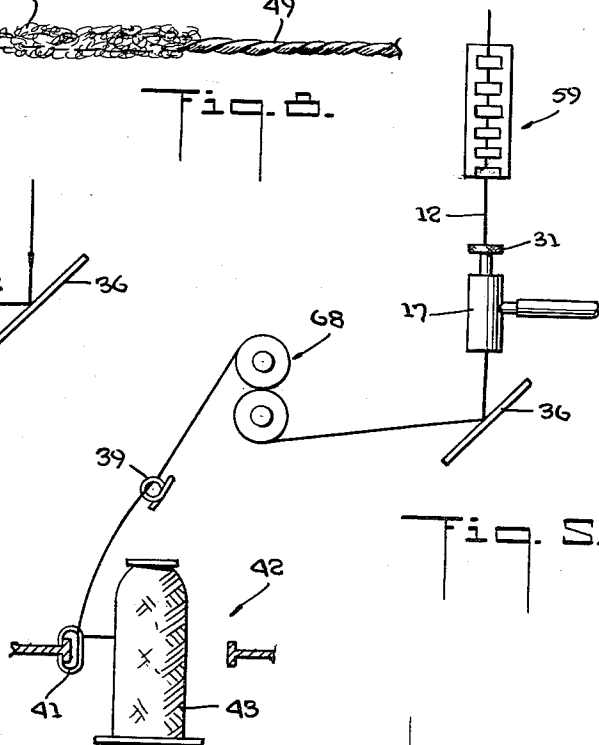


Fig. 5.

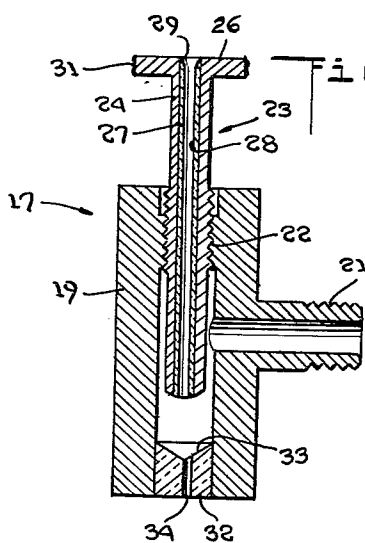


Fig. 7.

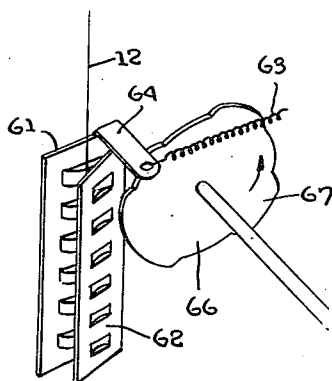


Fig. 6.

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METHOD AND APPARATUS FOR PRODUCING NOVELTY YARN

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Filed May 28, 1954, Ser. No. 433,117

3 Claims. (Cl. 57—34)

This invention relates to novelty yarn and relates more particularly to the production of loopy yarn.

Other objects of this invention will be apparent from the following detailed description and claims.

Loopy yarn is composed of a bundle of continuous filaments but has the hand or feel of a spun yarn made of staple fibers. Loopy yarn produced according to one process comprises a twisted bundle of substantially continuous filaments, which filaments are individually convoluted into coils, loops and whorls at random intervals along their lengths. The loopy yarn is characterized by the presence of a multitude of ring-like loops irregularly spaced along its surface and projecting from the main twisted bundle of filaments all along the length of the yarn. The loops project from the main body of yarn for varying distances, up to several times the thickness of said main body of the yarn, but most of the loops are of approximately equal size.

The production of the loopy yarn is effected by delivering a continuous filaments yarn by means of a driven primary feed roller, or other suitable means, to a jet where the yarn is subjected to the action of a turbulent stream of fluid, which is preferably a gas, such as air, substantially inert to the material of said yarn. The jet, which hereinafter will be called an "air jet," since air is the preferred and cheapest fluid, comprises an inlet tube adjustably mounted on a hollow T-shaped body, or T, having an air line connected to a source of compressed air. The yarn enters the air jet through the relatively long and narrow inlet tube, passes through a relatively wide chamber where it is subjected to the turbulent stream of air, and leaves the air jet, together with the air, through a relatively narrow orifice. For best results it is preferred to have the latter orifice slightly offset from or out of alignment with, the bore of the inlet tube. It is also desirable to adjust the yarn inlet tube so that the air leaves the air jet not only from said orifice but also from the entrance to said yarn inlet tube, with the air leaving from said orifice having a substantially higher velocity than the air leaving from said entrance to the yarn inlet tube.

The turbulent stream of air acts on the continuous filament yarn passing through the air jet, separating the individual filaments of said yarn and whipping them about sufficiently to form convolutions, so that the yarn leaving the air jet is voluminous and contains loops of individual filaments projecting from the main body of said yarn. The loops may be made more uniform in size and the frequency of the loops may be increased by impinging the yarn, as it leaves the air jet, against a solid surface, preferably against a flat smooth surface held at an angle of about 45° to the direction of flow of the yarn leaving the air jet. Although optimum results have been obtained when the angle is about 45°, other angles, for example, angles of 15° to 75°, have been employed with good results. The distance between the air jet and the point where the yarn impinges on the solid surface is preferably relatively short, e.g. on the order of 1/4" to 1". When the yarn is impinged against the solid surface it is not necessary that the yarn itself come into actual contact with said surface. Thus, the yarn may come into contact merely with the body of air which is pressed against said surface by the action of said air jet.

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The formation of loops in the yarn naturally results in a decrease in the tenacity of said yarn, since individual filaments of the yarn are pulled out of their normal substantially parallel position. In order to increase the tenacity of the loopy yarn and in order to make sure that the loops will remain permanently in said yarn, the loopy yarn is given a twist, using for this purpose a ring spinner or other suitable device. The amount of twist which is inserted into the yarn is variable and depends on several factors, such as the denier of the yarn, the tenacity desired and the yarn cross-section desired.

The looping yarn is fed from the air jet to the ring spinner, or other twisting device, by means of a plurality of secondary feed rolls which are driven at peripheral speeds which are lower than the speed at which the yarn is supplied to the air jet, i.e. lower than peripheral speed of the primary feed roll. The relative speeds of the primary and secondary rolls are so regulated that there is substantially no slack and the yarn is under substantially no tension between the air jet and the secondary rolls.

In accordance with the present invention there is produced a novelty yarn of uneven denier. This yarn comprises bulky loopy portions alternating with portions which are less bulky, the latter portions preferably being substantially free of loops. The bulky loopy portions are considerably less lustrous than the non-loopy portions. The yarn of this invention is highly suitable for the production of fabrics having a distinctive appearance.

The novel yarns of this invention are preferably produced by passing a bundle of filaments through a zone, e.g. the air jet described above, wherein the filaments are separated and whipped about sufficiently to form convolutions in said zone, removing the filaments from said zone under a tension sufficiently low to prevent said convolutions from straightening out, twisting said filaments together to form a yarn which is bulky and has a multitude of loops spaced along its surface, and intermittently increasing the tension on the yarn passing through said zone to produce a yarn whose bulkiness varies intermittently along its length. Preferably the tension is increased intermittently to an extent sufficient to prevent substantially the formation of loops to produce a yarn having alternate bulky, looping portions and substantially non-looping portions.

In carrying out to the process of this invention the yarn leaving the air jet is advantageously impinged against a solid surface, as described above, and thereafter passes to a ring spinner, or other twisting device, where it is twisted and wound on a driven rotating yarn package support, such as a bobbin.

In one embodiment of this invention the yarn is fed positively to the air jet at a substantially constant speed, the yarn package support mounted on the twisting device is rotated at a substantially constant speed, and the tension on the yarn is varied by intermittently retarding, at predetermined intervals, the filaments passing from the air jet to the rotating yarn package support. Thus, the filaments may be retarded by engaging them, intermittently, in a nip of a pair of rolls, at least one of which is driven.

In another embodiment of this invention the yarn is fed from the air jet to the twisting device at a substantially constant speed, the yarn package support mounted on the twisting device is rotated at a substantially constant speed, and the tension on the yarn is varied by intermittently, at predetermined intervals, decreasing the rate at which the filaments are fed into the air jet. Thus, the filaments may be retarded by causing them to pass through a gate-type tensioning mechanism which is closed and opened intermittently.

The mechanisms for retarding the filaments e.g. the gate-type tensioning mechanism or the pair of rolls de-

scribed above, may be actuated intermittently in any suitable manner, as by means of a cam. Preferably, the retarding mechanisms are actuated at non-uniform intervals so as to avoid producing less pleasing, repetitive patterns in the fabrics made from the yarns of this invention. To this end, the cam mentioned above may be provided with a plurality of irregularly spaced projections or depressions, and if desired, the cam may be driven, by any appropriate means, at a speed which varies irregularly.

In carrying out the process of this invention, the intervals of time during which the tension on the yarn is increased are advantageously longer than the intervals during which the tension is low enough to permit the formation of loops. Thus, the substantially non-loopy portions of the yarn will be longer than the loopy portions.

While this invention has its greatest value when employed with yarns of cellulose acetate, it is also applicable to yarns made of other materials. For example, the invention may be practiced with yarns composed of filaments of other organic derivatives of cellulose materials, e.g. cellulose esters such as cellulose propionate, cellulose butyrate, cellulose acetate-propionate or cellulose acetate-butyrate, or cellulose ethers such as ethyl cellulose or benzyl cellulose, polyesters such as polyethylene terephthalate, polyamides such as nylon, regenerated cellulose or other similar materials. All the filaments of the yarn may be of the same material or, if desired, a yarn composed of a blend of filaments of different materials may be employed. For practical purposes it is desirable to use a yarn which has a denier of about 150 to 4000 and which contains at least 40 filaments. The greater the number of filaments the greater the number of loops produced. For best results, it is also desirable than the yarn being treated should be substantially dry, i.e. substantially free from surface moisture, and that the filaments of the yarn should carry a coating of a small amount e.g. 1 to 5%, of any of the conventional anti-static textile lubricating agents commonly employed in the art. It is also desirable to start with a yarn having some twist. The provision of such an initial twist results in a more uniform distribution of the loops in the loopy portions of the finished yarn. Thus, for a yarn of cellulose acetate having 40 filaments and a total denier of about 150 an initial twist of about 2 turns per inch is desirable.

The yarn used may be of the bright, lustrous type or of the dull, delustered type, e.g. yarn made from a spinning solution containing small amounts of titanium dioxide or other delusterant, as is well known in the art. The variation in the luster between the loopy and non-loopy portions, previously mentioned, is particularly pronounced when lustrous yarn is used as the starting material.

In the accompanying drawings, in which like reference numerals indicate similar parts throughout the several views,

FIG. 1 is a side view, partly diagrammatic and partly in cross-section, of one embodiment of the apparatus,

FIG. 2 is a side view of a portion of another embodiment of the apparatus of this invention,

FIG. 3 is a perspective view of the retarding mechanism of still another embodiment of this invention,

FIG. 4 is an enlarged detail view in cross-section along the line 4—4 of FIG. 3,

FIG. 5 is a side view, partly in cross-section, of an embodiment of this invention which uses a gate-type tensioning mechanism,

FIG. 6 is a view showing the gate-type tensioning mechanism of the embodiment illustrated in FIG. 5 and showing the means for operating said mechanism,

FIG. 7 is a cross-sectional view of the air jet employed in accordance with this invention, and

FIG. 8 is a view of the yarn produced according to this invention.

Referring now to FIG. 1 of the drawings, reference numeral 11 designates a pair of primary feed rolls, which are

mounted for rotation and are driven by any suitable means. The rotation of the feed rolls 11 serves to draw a yarn 12 from a bobbin 13, through pigtail guides 14 and 16, in the direction shown by the arrows, at a substantially constant speed, and to deliver said yarn to an air jet 17, which is supplied with compressed air through an air line 18.

The air jet 17, which is shown in greater detail in FIG. 7, comprises a tubular T 19 provided with screw threads 21 for connecting the air line 18 thereto. Adjustably mounted within the T 19, by means of screw threads 22, is an inlet tube 23 composed of a tubular metallic shell 24 having a broad head 26 and tubular insert 27 cemented or otherwise secured to said shell 24. The tubular insert 27 is made of ceramic material, preferably the double silicate of aluminum and magnesium known as "Alsimag." The longitudinal bore 28 of the tubular insert 27 is of larger diameter than the yarn being treated and is straight and uniform, except that its entrance end 29 may be flared, if desired, to allow said yarn to enter more easily. The broad head 26 of the shell 24 is provided with a knurled edge 31 to enable the inlet tube 23 to be rotated manually to adjust its position in relation to the T 19. At the lower outlet end of the T 19 there is mounted, in any suitable manner, a tubular fitting 32, preferably made of the same material as the tubular insert 27. The opening of the fitting 32 varies along the length thereof, there being in said fitting a tapered portion 33 leading to a relatively long narrow orifice 34. The orifice 34 is so located that its center line is parallel to, but offset from, the center line of said bore 28. Offsetting the bore 28 of the inlet tube and the orifice 34 in this manner increases the turbulence in the air jet 17 and increases the tendency of the yarn to form loops. The position of the inlet tube 23 is so adjusted, with its exit end adjacent to the fitting 32, that the air which enters from the line 18 leaves the air jet 17 from both the entrance of the inlet tube 23 and the outlet of the orifice 34, although the air leaves through the orifice 34 at a much higher velocity than it does from said entrance.

The yarn leaving the air jet 17 is directed with some force against the smooth surface of a flat plate 36 (FIG. 1) by the action of the stream of air leaving the orifice 34. The plate 36, which may be made of aluminum or other suitable material is so mounted that the yarn impinges against its surface at an angle to said surface. Thus, it is desirable to mount the air jet 17 so that the path of the yarn through, and out of, said air jet is substantially vertical and to mount the plate 36 at an angle of about 45° to the vertical.

The yarn passes from the surface of the plate 36 under a smooth-surfaced metal roll 37, which is driven by any suitable means at a substantially constant rate such that its peripheral speed is less than the peripheral speed of the primary feed rolls 11. After leaving the roll 37 the yarn passes through or over guides 38 and 39, and then through the traveler 41 of a ring twister 42, of conventional construction. From the traveler 41 the yarn is taken up on a driven rotating bobbin 43.

Adjacent to the driven metal roll 37 there is provided a freely-rotatable roll 44 having a surface of rubber or other suitable friction material, such as felt or cork. This friction-surfaced roll 44 is mounted for movement in a vertical plane at the upper end of one or more rods 45 operatively connected, in any suitable manner, as through a pivoted lever 46, to a driven rotating cam 47 which acts to press said roll 44 intermittently against the surface of the metal roll 37, the roll 44 moving to the position shown in dotted lines in the drawing.

The engagement of the friction-surfaced roll 44 with the driven roll 37 causes the former to rotate at the same peripheral speed as said driven roll and causes the yarn passing through the nip of said rolls to move at said peripheral speed. The yarn is then twisted as it passes to the rotating bobbin 43. Although the action of the

rotating bobbin 43 also causes the yarn passing from the nip of the rolls 37 and 44 to said bobbin to be placed under tension, this tension is not transmitted to the yarn travelling to the nip of the rolls from the air jet 17. However, when the friction-surfaced roll 44 is moved away from the driven roll 37 the yarn can slip freely over the smooth surface of the driven roll 37 and, accordingly, the yarn travelling from the air jet 17 is placed under tension. This tension is sufficient to substantially prevent the formation of loops in said yarn by the air jet 17. Accordingly, as shown in FIG. 8, the yarn wound on the bobbin 43 has alternate looped portions 48 and unlooped portions 49.

Another effect of the withdrawal of the friction-surfaced roll 44 from the driven roll 37 is a decrease in the twist, measured in turns per inch, of the yarn wound on the bobbin 43 during the period when the friction-surfaced roll is withdrawn.

The projections and depression of the cam 47 are irregularly spaced so that the lengths of the looped and unlooped portions of the yarn are not uniform. This non-uniformity produces a more pleasing random effect in fabrics woven from said yarn.

As shown in the drawing, the roll 44 is so mounted that its vertical movement effects a gradual rather than an abrupt change in the yarn tension. Thus, the surface of roll 44 approaches the surface of roll 37 along a plane substantially tangent to the surface of said roll 37 and at a small angle to the yarn leaving said roll 44. Because of this gradual change in yarn tension the ends of the looped portions of the resulting yarn will taper gradually into the unlooped portions.

In the embodiment of this invention illustrated in FIG. 2, the yarn passing from the plate 36 to the guide 39 travels over the driven roll 37, and the roll 44 is replaced by a similar freely-rotatable friction-surfaced roll 51, which is mounted at one end of a bar 52 pivoted on a rod 53. The bar 52 and roll 51 are urged by any suitable force, e.g. their own weight, to bring the roll 51 into engagement with the driven roll 37. The pivoted bar 52 is operatively connected, as through a linkage 54, to an irregularly shaped driven cam 56. By the action of the cam 56 the roll 51 is intermittently raised out of engagement with the driven roll 37 and the yarn 12, and then lowered into engagement with said driven roll and yarn to cause the formation of alternate non-loopy and loopy portions, respectively, in the yarn.

In the embodiment illustrated in FIGS. 3 and 4 the intermittent engagement and disengagement of the friction-surfaced roll with the yarn is effected by the use of a friction-surfaced roll 57 resting on the driven roll 37 and having one or more cut-out portions 58. That is, the roll 51, bar 52, linkage 54 and cam 56 of FIG. 2 are replaced by the roll 57 of FIGS. 3 and 4. The friction-surfaced roll 57 is caused to rotate by its frictional engagement with the driven roll 37. When the roll 57 is in the position shown in FIGS. 3 and 4 its surface presses the yarn 12 against the surface of the driven roll 37 so that the yarn coming from the plate 36 is caused to move at the peripheral speed of said driven roll and loops are formed in the yarn, as explained previously. When the roll 57 has been rotated so that its cut out portion 58 is adjacent to the driven roll 37, the yarn 12 can move freely over the surface of the driven roll and no loops are formed in the yarn.

In the embodiment shown in FIGS. 5 and 6 the yarn 12, before travelling through the air jet 17, passes through a gate-type tensioning device 59, of conventional construction, or other suitable tensioning device adapted to retard intermittently the movement of the yarn passing to said air jet. The gate-type tensioning device 59 comprises two hinged leaves 61 and 62 (FIG. 6), one stationary and the other movable, having interfitting faces adapted to engage the yarn 12 and retard its movement

when the leaves are brought together, i.e. when the tensioning device is closed.

The movable leaf 61 is urged toward the stationary leaf 62 by the action of a spring 63 attached to a finger 64 projecting from the movable leaf. Means are provided for intermittently separating the interfitting faces of the leaves 61 and 62 in order to permit the yarn 12 to move through the tensioning device 59 more freely. In the embodiment shown in FIG. 6, this is accomplished by means of a rotary cam member 66, mounted on a shaft and having irregularly spaced projections 67. When one of the projections 67 strikes the finger 64, the leaf 61 is moved away from the stationary leaf 62, thus opening the tensioning device 59.

In the operation of the embodiment shown in FIGS. 5 and 6, the yarn 12 passes from a supply bobbin and suitable guides (not shown) similar to the supply bobbin 13 and guides 14, 16 shown in FIG. 1, then through the tensioning device 59, through the air jet 17, against the plate 36, to the nip of a pair of feed rolls 68, the stationary guide 39, the traveler 41 and the driven bobbin 43 of the ring twister 42. One of the feed rolls 68 is positively driven and at least one of said feed rolls has a surface of friction material so that the yarn is firmly engaged in the nip of said feed rolls and does not slip over them. When the tensioning device is closed the tension on the yarn, caused by the pull of the feed rolls 68 acting against the retarding effect of the tensioning device 59, is sufficient to prevent the formation of loops in said yarn during its passage through the air jet 17. When the tensioning device 59 is opened, the tension on the yarn is greatly reduced so that loops are formed by the action of the air jet 17.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention what we desire to secure by Letters Patent is:

1. Apparatus for making novelty yarns, which comprises a zone for separating and whipping about the filaments of a bundle of filaments supplied thereto to form convolutions in said filaments, means for supplying said bundle of filaments in the form of yarn to said zone at a substantially constant rate, means for withdrawing said filaments from said zone and for reforming them into yarn under a tension sufficiently low to prevent said convolutions from straightening out so as to form a bulky yarn, and means for intermittently increasing the rate of withdrawal of said filaments from said zone to produce a yarn whose bulkiness varies intermittently along its length, said means for withdrawing said filaments from said zone comprising a pair of feed rolls and a driven rotating yarn package support for twisting said filaments and winding them on said yarn package support, and said means for increasing the rate of withdrawal comprising means for intermittently effecting the disengagement of one of said pair of rolls from said yarn.

2. Apparatus as set forth in claim 1 in which said means for increasing the rate of withdrawal comprises means for intermittently effecting the disengagement of one of said pair of rolls from said yarn at predetermined non-uniform intervals.

3. Process for the production of novelty yarn, which comprises positively feeding a bundle of filaments at a substantially constant speed to a zone wherein the filaments are separated and whipped about sufficiently to bulk the filaments in said zone without introducing substantial convolutions, removing the filaments from said zone under a tension sufficient to substantially prevent said bulk from being lost, winding said filaments together on a yarn package support rotating at a substantially constant speed to cause said filaments to be twisted together to form a yarn which is bulky and has a multitude

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of loops irregularly spaced along its surface, and intermittently at predetermined intervals metering the filaments to retard the same passing from said zone to said rotating yarn package support to produce a yarn whose bulkiness varies intermittently along its length.

References Cited in the file of this patent

UNITED STATES PATENTS

87,555	Foskett	Mar. 9, 1869	
386,623	Boyd	July 24, 1888	10
1,898,085	Dreyfus et al.	Feb. 21, 1933	
2,038,722	Dreyfus et al.	Apr. 28, 1936	
2,098,981	Sowter	Nov. 16, 1937	
2,125,230	Hofmann	July 26, 1938	

5

2,128,184
2,152,222
2,251,247
2,359,847
2,504,523
2,590,806
2,783,609
2,852,906
2,874,443
2,874,444

520,934
971,812
470

8

Jewett	Aug. 23, 1938
Taylor	Mar. 28, 1939
Bauriedel	July 29, 1941
Hays et al.	Oct. 10, 1944
Harris et al.	Apr. 18, 1950
Vorderstrasse	Mar. 25, 1952
Breen	Mar. 5, 1957
Breen	Sept. 23, 1958
Griset	Feb. 24, 1959
Griset	Feb. 24, 1959

FOREIGN PATENTS

Belgium	Dec. 24, 1953
France	Jan. 22, 1951
Great Britain	of 1909