July 29, 1941. H. DREYFUS 2,250,575

TEXTILE MATERIAL AND THE PRODUCTION THEREOF

Filed May 2, 1939 2 Sheets-Sheet 1

FIG. 1

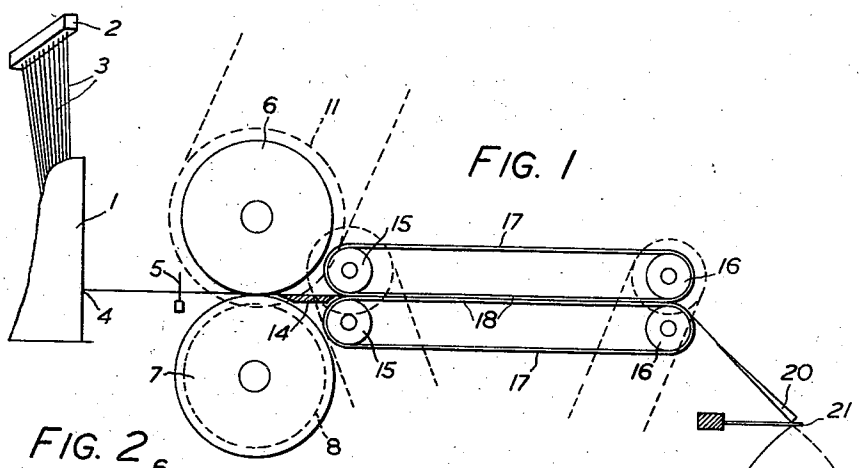


FIG. 2

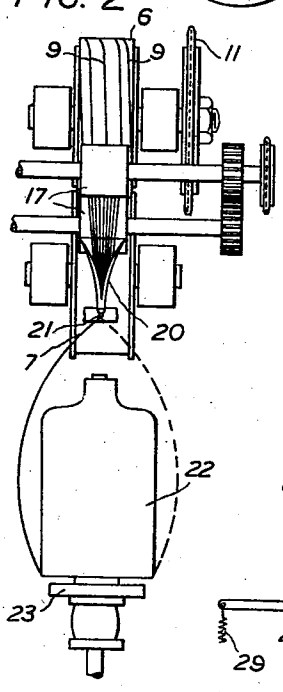


FIG. 5

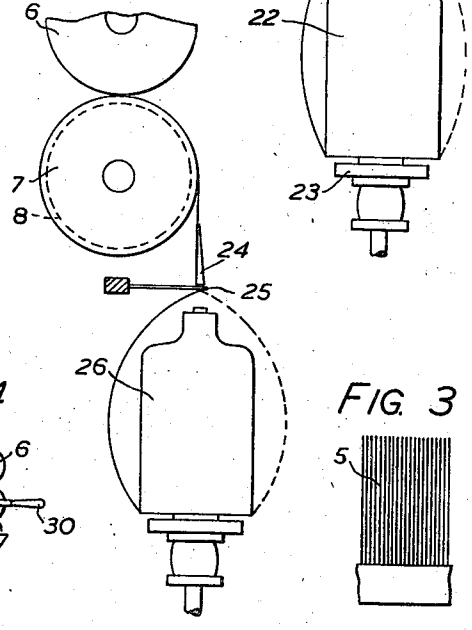


FIG. 4

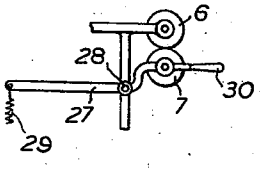
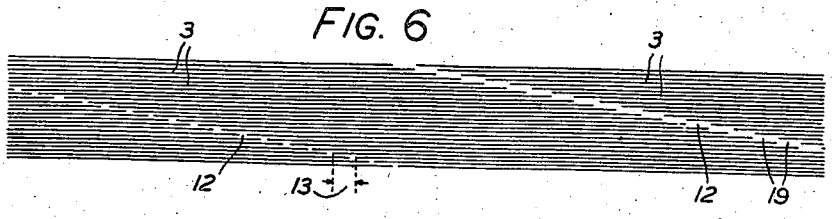


FIG. 3

FIG. 6



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FIG. 7

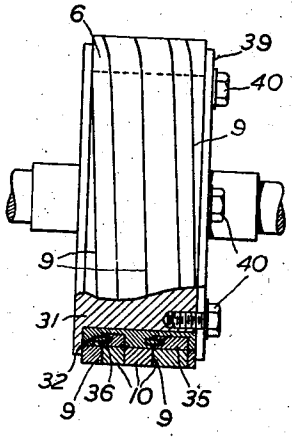


FIG. 8

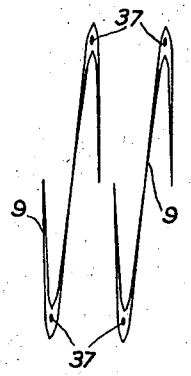


FIG. 9

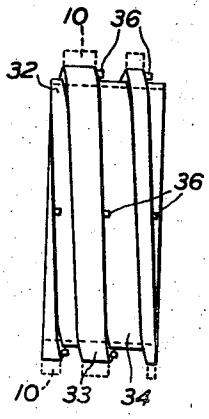
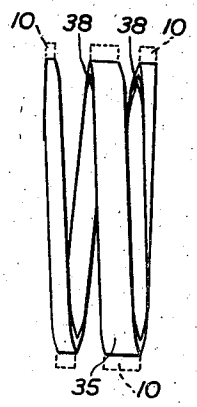


FIG. 10



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UNITED STATES PATENT OFFICE

2,250,575

TEXTILE MATERIAL AND THE PRODUCTION THEREOF

Henry Dreyfus, London, England

Application May 2, 1939, Serial No. 271,243
In Great Britain May 10, 1938

12 Claims. (Cl. 57—2)

This invention relates to textile materials, and in particular to the manufacture of staple fibre yarns from continuous filaments, it being especially concerned with the direct conversion of continuous filaments into a continuous staple fibre product.

According to the invention a plurality of continuous filaments are fed forward to a cutting position separated from each other so that each filament can be separately cut, and the cutting points of the plurality of filaments are distributed lengthwise of the filaments so that the end of a fibre produced by cutting one filament is displaced in the lengthwise direction of the filaments from that of a fibre produced from a neighbouring filament, and the ends of all the fibres produced by cutting one section of the plurality of filaments are substantially uniformly distributed with respect to each other in the lengthwise direction of the fibres. As the filaments are cut into fibres the several fibres are compacted, and twist is inserted so as to form the fibres into a continuous coherent product, which, by reason of the distribution of the ends of the fibres substantially uniformly throughout the length of the product, has a high degree of uniformity in its appearance and other physical characteristics. Thus, for example, for the production of a product containing fibres of approximately 10 or 12 inches in length, a bundle of, say, 20 or 24 continuous filaments fed to a cutting position in separated form may have its filaments separately cut at intervals of ½-inch in the length direction of the bundle, or one of 40–50 filaments at intervals of approximately ¼-inch, so that in the subsequently compacted product only one pair of opposed fibre ends exists in any ½-inch or ¼-inch section of the bundle.

With the filaments separated from each other and disposed as a relatively wide band, the cutting of each filament may conveniently be effected by a helical knife, preferably making one complete turn round the periphery of the cutting roller and if desirable more than one such turn. The roller having a periphery equal to the fibre length desired, each complete turn of the helical blade produces a line of cuts in the band of separated filaments which are uniformly distributed over a length of the band equal to the fibre length desired. The helical blade operates in conjunction with a suitable cutting bed, for example an endless supporting band or a second roller covered with resilient material, such as gutta-percha or rubber, to provide a support for the filaments as they are cut. Moreover, the helical blade may be embedded in a rubber or other resilient covering on its own roller, the cutting roller and the supporting roller thus forming a nip that serves to hold the filaments firmly during cutting, and also provides for the feeding of the filaments.

The invention will now be described in greater detail with reference to the accompanying drawings, in which—

Fig. 1 is a diagrammatic side elevation of cutting, compacting and twisting mechanism receiving filaments direct from a dry spining machine;

Fig. 2 is an end elevation of Fig. 1;

Fig. 3 shows a detail of Fig. 1;

Fig. 4 shows diagrammatically means for loading the cutting rollers of Fig. 1;

Fig. 5 shows a modification of the apparatus shown in Fig. 1;

Fig. 6 shows the manner in which cutting is distributed over the width of the band of filaments; and

Figs. 7–10 are details of the construction of the roller carrying the cutting blade in Fig. 1.

Referring to Fig. 1, a dry spinning cabinet 1 is provided with a line jet 2 in which a band of filaments 3 is extruded, the band passing from the cabinet 1 at a point 4 with its filaments still in separated condition. The separation of the filaments is maintained by means of a comb 5 so that the filaments reach the nip of a pair of rollers 6, 7 in the form of a wide band (see also Fig. 6). The roller 7 has a covering 8 of gutta-percha which serves both to enable the filaments to be gripped firmly between the rollers and to provide a cutting bed for a cutting blade carried by the roller 6. The cutting blade is in the form of a helical knife 9 making two complete turns around the roller 6, the edge of the blade lying flush with the surface of a rubber covering 10 with which the roller 6 is provided. A driving sprocket 11 enables the roller 6 to be driven at any desired speed and the nip between the rollers 6 and 7 enables the filaments to be drawn through the jet 2 at a speed equal to the peripheral speed of the rollers.

Because of the helical form of the blade 9, the band of filaments 3 is cut along lines 12 at an acute angle to the length of the filaments, the lengthwise distance between the consecutive lines 12 equalling the periphery of the roller 6. The filaments are thus converted into a band of long fibres and because of the separation of the filaments from each other, the end of one fibre is displaced by a substantial distance (indicated at 13) with respect to the length of the lengthwise direction of the filaments.

Although considerations of easily and effectively compacting the bundle of fibres limit the width of the band that can be formed by the separated filaments, a helical cutting blade enables the line of cuts to form an acute angle appropriate to the length of the fibres even when long fibres such as 10 or 12 inches are to be cut.

By the process according to the invention, the position at which the several filaments are cut is effected with great precision, so that whether the fibre lengths are made absolutely uniform throughout the whole product, or whether provision is made for some inclusion of fibres of different length, substantial uniformity is provided in the final product.

As regards the "separation" of the filaments from each other, it is to be understood that as far as practicable all the filaments in the bundle should be so positioned as to be cut individually, since the coincidence of any substantial number of fibre ends at any section in the bundle would detract materially from the desired uniform physical characteristics of the product. At the same time, it will be realized that if occasionally a small number, say 2, of filaments are simultaneously cut, thus producing fibres substantially coinciding in position, this will have little effect on the properties of the product. But the inclusion of "pencils" of closely disposed fibres, as arises when a thick thread or a bundle produced by assembling a number of threads of filaments is cut at a point, is avoided by the invention, which depends essentially on the cutting being so carried out that the fibre ends are displaced from each other in the lengthwise direction of the filament bundle.

The fibres may be withdrawn from the cutting position at a greater speed than that at which the filaments are fed to the cutting position, so that at any cutting point the fibre ends are drawn apart from each other. This is effected in Figure 1 by passing the band of fibres over a support **14** to the nip of a pair of rollers **15** between which and the second pair of rollers **16** is stretched a pair of elastic bands **17**, the inner runs **18** of the bands being nipped together so as to grip the fibres across the width of the fibre band. The rollers **15** have a peripheral speed equal to or slightly exceeding the speed of delivery of the fibres, and the rollers **16** are driven at a higher speed so that the runs **18** are stretched and have the effect of drawing the rear-most end of one fibre away from the forward end of the following fibre, as indicated at **19** in Fig. 6.

As the band of fibres leaves the rollers **16** it passes into a funnel **20** and through a balloon guide **21** to a cap spinning device **22**. The twist inserted runs back to the funnel **20**, and, aided by the funnel **20**, compacts the fibres and enables them to be collected as a coherent product on the bobbin **23**. In the modification shown in Fig. 5, the fibres pass directly from the roller **7** to a funnel **24** and thence by a balloon guide **25** to a cap spinning device **26**.

The roller **7** is mounted on a lever **27** pivoted at **28**, a spring **29** being connected to the lever **27** so as to urge the roller **7** upwardly against the roller **6** to provide the desired nip. A handle **30** on the lever **27** enables the roller **7** to be depressed for the filaments to be passed between the rollers in starting up.

The cutting roller **6** comprises a barrel **31** on which is mounted a sleeve **32** having a helical projection **33**, the sides of which are of a slightly different pitch so that the intervening gap **34** progressively narrows from right to left of the roller. A helical member **35** having its sides cut to the same different pitches as those of the projection **33** can be screwed into the gap **34**. The helical blade **9** (made in two sections, as shown in Fig. 8) is threaded on to the member **32** and registered therewith by means of pins **36** that engage holes **37** in the blade. Grooves **38** in one edge of the helical member **35** receive the pins **36** so that after threading the blade **9** on the member **32** the helical member **35** can be screwed into the gap **34** to nip the blade firmly into position. The member **35** is secured by means of a flange **39** and bolts **40**. The helical projection **33** on the member **32** and the helical member **35** have a rubber covering **10** lying flush with the edge of the blade **9**. The rubber **10** grips the filaments firmly against the gutta-percha covering **8** of the roller **7** and also allows the blade **9** to protrude sufficiently to cut the filaments at the nip of the rollers **6** and **7**.

The ends of the two sections of the helical blade abut against each other. In order to avoid non-cutting of a filament that might find itself nipped at the very slight gap between the sections, the filaments may be so guided by the comb **5** that half of them lie wholly within the sphere of influence of one blade section and the remainder within that of the other blade section.

The filament bundle may be of such a size that the fibrous product when compacted and twisted is suitable for direct use as a yarn, but if desired the product may be drafted to some lighter product, the uniform distribution of the fibres and substantial avoidance of coincident fibres in the bundle permitting such drafting to be effected.

The filaments to be cut may be made of cellulose acetate or other organic derivative of cellulose. The invention, however, may be applied to the production of a staple product from other continuous filaments, for example natural silk or regenerated cellulose filaments such as viscose, nitro-cellulose or cuprammonium artificial silk, or from mixtures of two or more kinds of filaments. The filaments may have different characteristics; for example, bright and dull (pigmented) filaments or filaments of different denier may be simultaneously treated.

The invention enables a continuous staple fibre product to be formed in a single operation from continuous filament bundles as produced by either the dry spinning method or the wet spinning method. The weight of the final product may correspond closely to that of the starting material, but, as mentioned above, the readiness with which the product may be drafted by reason of its uniform properties enables the continuous filament starting material to be prepared in a weight where most economical spinning (extrusion and setting) can be carried out, and the product can then be drafted to any lighter weight desired.

Having described my invention, what I desire to secure by Letters Patent is:

1. Process for the direct conversion of continuous filaments into a continuous staple fibre product, which comprises leading a plurality of continuous filaments in the form of a band, in which the filaments are separated, into the nip of a pair of contacting travelling surfaces, cutting each filament separately while it is travelling through the nip of said surfaces, the cutting points in the plurality of filaments being distributed lengthwise of the filaments so that the end of a fibre produced by cutting one filament

is displaced in the lengthwise direction of the filaments from that of a fibre produced from a neighbouring filament and the ends of all the fibres produced by cutting one section of the plurality of filaments are substantially uniformly distributed wtih respect to each other in the lengthwise direction of the fibres, and compacting and twisting the fibres into a continuous coherent product.

2. Process for the direct conversion of continuous filaments into a continuous staple fibre product, which comprises leading a plurality of continuous filaments in the form of a band, in which the filaments are separated, into the nip of a pair of contacting travelling surfaces, cutting each filament separately while it is travelling through the nip of said surfaces, the cutting points in the plurality of filaments being distributed lengthwise of the filaments so that the end of a fibre produced by cutting one filament is displaced in the lengthwise direction of the filaments from that of a fibre produced from a neighbouring filament and the ends of all the fibres produced by cutting one section of the plurality of filaments are substantially uniformly distributed with respect to each other in the lengthwise direction of the fibres, withdrawing the fibres at a greater speed from the nip of said surfaces than the speed at which the filaments are fed to said nip, so that at any cutting point the fibre ends are drawn apart from each other, and compacting and twisting the fibres.

3. Apparatus for the direct conversion of continuous filaments into a continuous staple fibre product, said apparatus comprising a pair of contacting travelling surfaces, means for arranging a plurality of continuous filaments into a band in which the filaments are separated, and leading the band of separated filaments to the nip of the said surfaces, means for cutting each filament separately while it is travelling through the nip of said surfaces with the cutting points of the filaments distributed lengthwise of the filaments so that the end of a fibre produced by cutting one filament is displaced in the lengthwise direction of the filaments from that of a fibre produced from a neighbouring filament, and means for compacting and twisting the fibres into a continuous coherent product.

4. Apparatus for the direct conversion of continuous filaments into a continuous staple fibre product, said apparatus comprising a pair of contacting rollers, means for arranging a plurality of continuous filaments into a band in which the filaments are separated, and leading the band of separated filaments to the nip of said rollers, a helical blade on the periphery of one of said rollers, the other roller acting as a cutting bed for said blade whereby each filament is cut separately while it is travelling through the nip of said rollers with the cutting points of the filaments distributed lengthwise of the filaments so that the end of a fibre produced by cutting one filament is displaced in the lengthwise direction of the filaments from that of a fibre produced from a neighbouring filament, and means for compacting and twisting the fibres into a continuous coherent product.

5. Apparatus for the direct conversion of continuous filaments into a continuous staple fibre product, said apparatus comprising a pair of contacting rollers, means for arranging a plurality of continuous filaments into a band in which the filaments are separated, and leading the band of separated filaments to the nip of said rollers, a resilient covering on one of said rollers, a helical blade carried on the periphery of said roller and protruding from said covering at the point of contact between said rollers, the other roller acting as a cutting bed for said blade whereby each filament is cut separately while it is travelling through the nip of said rollers with the cutting points of the filaments distributed lengthwise of the filaments so that the end of a fibre produced by cutting one filament is displaced in the lengthwise direction of the filaments from that of a fibre produced from a neighbouring filament, and means for compacting and twisting the fibres into a continuous coherent product.

6. Apparatus for the direct conversion of continuous filaments into a continuous staple fibre product, said apparatus comprising a pair of contacting rollers, means for arranging a plurality of continuous filaments into a band in which the filaments are separated, and leading the band of separated filaments to the nip of said rollers, a helical blade on the periphery of one of said rollers, the other roller having a resilient covering and acting as a cutting bed for said blade whereby each filament is cut separately while it is travelling through the nip of said rollers with the cutting points of the filaments distributed lengthwise of the filaments so that the end of a fibre produced by cutting one filament is displaced in the lengthwise direction of the filaments from that of a fibre produced from a neighbouring filament, and means for compacting and twisting the fibres into a continuous coherent product.

7. Apparatus for the direct conversion of continuous filaments into a continuous staple fibre product, said apparatus comprising a pair of contacting rollers, means for arranging a plurality of continuous filaments into a band in which the filaments are separated, and leading the band of separated filaments to the nip of said rollers, a resilient covering on each of said rollers, a helical blade carried on the periphery of said roller and protruding from said covering at the point of contact between said rollers, the other roller acting as a cutting bed for said blade whereby each filament is cut separately while it is travelling through the nip of said rollers with the cutting points of the filaments distributed lengthwise of the filaments so that the end of a fibre produced by cutting one filament is displaced in the lengthwise direction of the filaments from that of a fibre produced from a neighbouring filament, and means for compacting and twisting the fibres into a continuous coherent product.

8. Apparatus for the direct conversion of continuous filaments into a continuous staple fibre product, said apparatus comprising a pair of contacting rollers, a comb for arranging a plurality of continuous filaments into a band in which the filaments are separated and guiding the band of separated filaments to the nip of said rollers, a helical blade on the periphery of one of said rollers, the other roller acting as a cutting bed for said blade whereby each filament is cut separately while it is travelling through the nip of said rollers with the cutting points of the filaments distributed lengthwise of the filaments so that the end of a fibre produced by cutting one filament is displaced in the lengthwise direction of the filaments from that of a fibre produced from a neighbouring filament, and means for compacting and twisting the fibres into a continuous coherent product.

9. Apparatus for the direct conversion of continuous filaments into a continuous staple fibre product, said apparatus comprising a pair of contacting rollers, means for arranging a plurality of continuous filaments into a band in which the filaments are separated, and leading the band of separated filaments to the nip of said rollers, a helical blade on the periphery of one of said rollers, the other roller acting as a cutting bed for said blade whereby each filament is cut separately while it is travelling through the nip of said rollers with the cutting points of the filaments distributed lengthwise of the filaments so that the end of a fibre produced by cutting one filament is displaced in the lengthwise direction of the filaments from that of a fibre produced from a neighbouring filament, a funnel adapted to compact the fibres and means for twisting the fibres.

10. Apparatus for the direct conversion of continuous filaments into a continuous staple fibre product, said apparatus comprising a pair of contacting rollers, means for arranging a plurality of continuous filaments into a band in which the filaments are separated, and leading the band of separated filaments to the nip of said rollers, a helical blade on the periphery of one of said rollers, the other roller acting as a cutting bed for said blade whereby each filament is cut separately while it is travelling through the nip of said rollers with the cutting points of the filaments distributed lengthwise of the filaments so that the end of a fibre produced by cutting one filament is displaced in the lengthwise direction of the filaments from that of a fibre produced from a neighbouring filament, means for withdrawing the fibres from the nip of said rollers at a greater speed than that at which the filaments are fed to said nip and means for compacting and twisting the fibres into a continuous coherent product.

11. Apparatus for the direct conversion of continuous filaments into a continuous staple fibre product, said apparatus comprising a pair of contacting rollers, means for arranging a plurality of continuous filaments into a band in which the filaments are separated, and leading the band of separated filaments to the nip of said rollers, a helical blade on the periphery of one of said rollers, the other roller acting as a cutting bed for said blade whereby each filament is cut separately while it is travelling through the nip of said rollers with the cutting points of the filaments distributed lengthwise of the filaments so that the end of a fibre produced by cutting one filament is displaced in the lengthwise direction of the filaments from that of a fibre produced from a neighbouring filament, a pair of elastic bands forming a nip into which the filaments pass from the nip of said rollers, an input roller and a delivery roller for carrying each of said elastic bands, means for driving said delivery rollers at a speed greater than said input rollers and means for compacting and twisting the fibres emerging from said elastic bands into a continuous coherent product.

12. Apparatus for the direct conversion of continuous filaments into a continuous staple fibre product, said apparatus comprising a pair of contacting rollers, means for arranging a plurality of continuous filaments into a band in which the filaments are separated, and leading the band of separated filaments to the nip of said rollers, a resilient covering on each of said rollers, a helical blade carried on the periphery of said roller and protruding from said covering at the point of contact between said rollers, the other roller acting as a cutting bed for said blade whereby each filament is cut separately while it is travelling through the nip of said rollers with the cutting points of the filaments distributed lengthwise of the filaments so that the end of a fibre produced by cutting one filament is displaced in the lengthwise direction of the filaments from that of a fibre produced from a neighbouring filament, a pair of elastic bands forming a nip into which the filaments pass from the nip of said rollers, an input roller and a delivery roller for carrying each of said elastic bands, means for driving said delivery rollers at a speed greater than said input rollers and means for compacting and twisting the fibres emerging from said elastic bands into a continuous coherent product.

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