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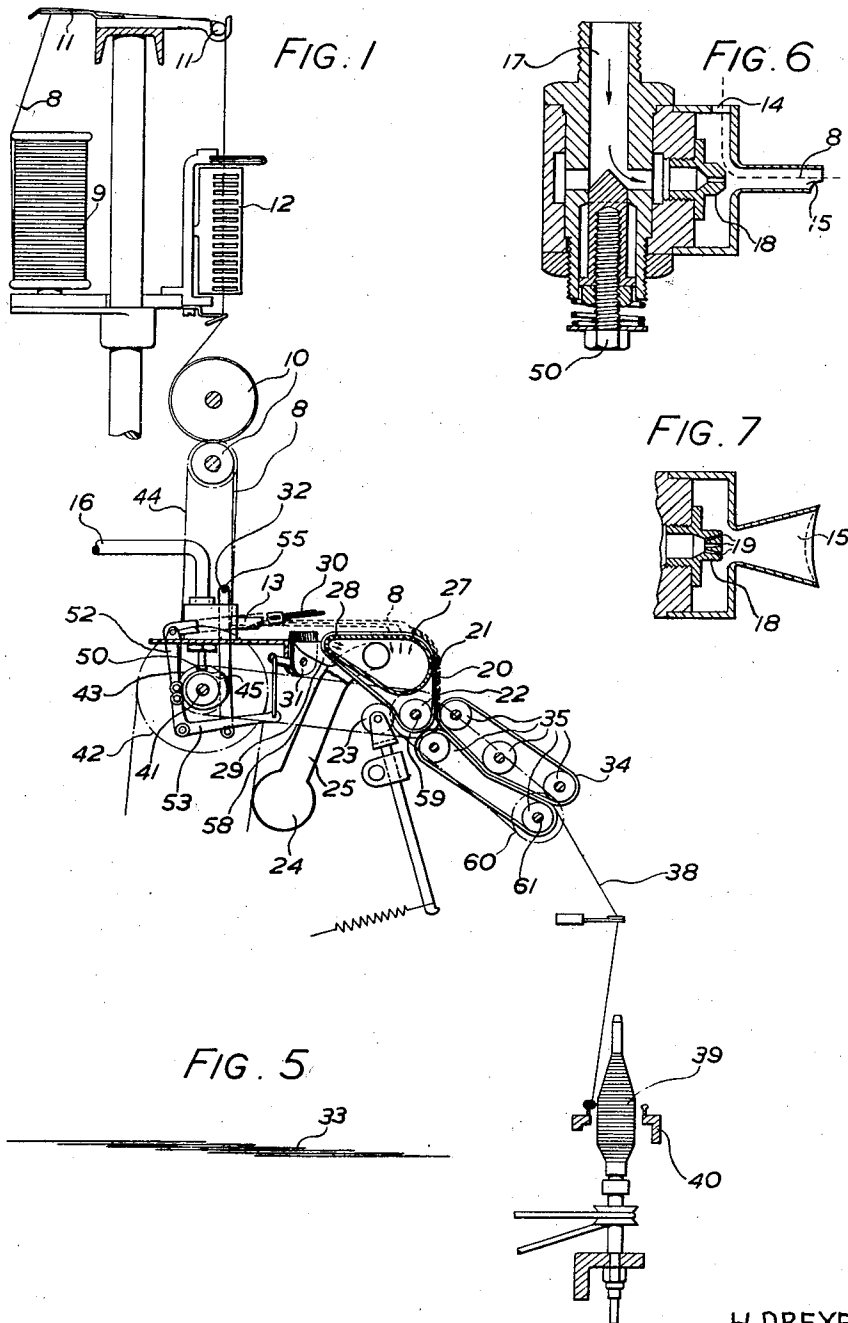
H. DREYFUS ET AL

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MANUFACTURE OF STAPLE FIBER PRODUCTS FROM CONTINUOUS FILAMENTS

Filed July 23, 1937

2 Sheets-Sheet 1



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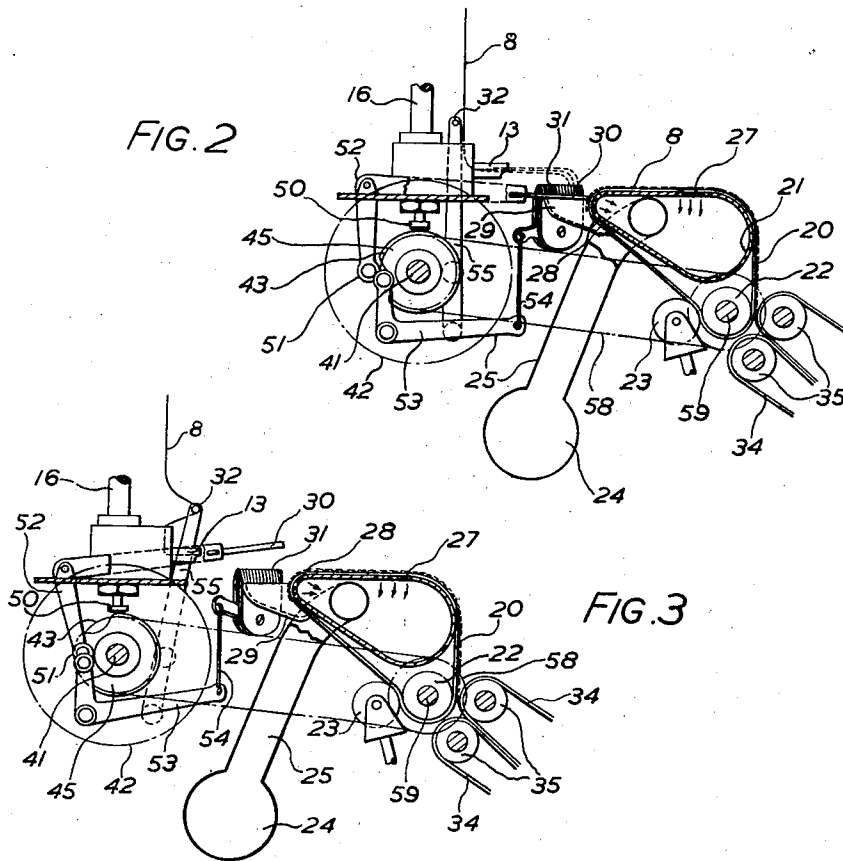
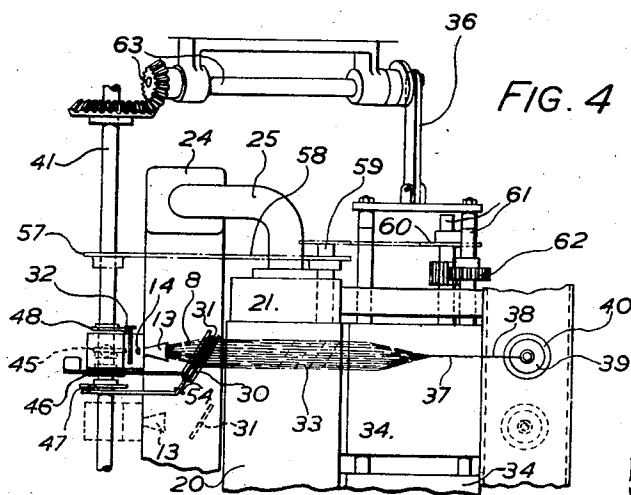
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MANUFACTURE OF STAPLE FIBER PRODUCTS FROM CONTINUOUS FILAMENTS

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This invention relates to the manufacture of staple fiber products from continuous filaments.

Though artificial filaments are produced in substantially continuous form, and though the bulk of such filaments have up to the present been absorbed by the textile industry as "continuous filament" yarns, many processes have been devised and proposals put forward for converting artificial filaments into staple fiber yarns so as to form a product in which can be found some of the characteristics of artificial filaments together with properties ordinarily obtained only from fibers of naturally occurring products such as cotton or wool. Thus, artificial filaments supplied either as relatively short lengths cut from hanks, or in substantially continuous lengths direct from the spinning machine, have been cut into fibers of definite short lengths, which fibers are then worked up into yarns by processes similar to those accorded to the naturally occurring fibers of similar lengths, with the advantage that apart from substantial uniformity of fiber length no preliminary cleaning operation is necessary. In view, however, of the compact form in which the filaments are fed to the cutter, the fibers lie closely side by side in the form of bundles, and an opening operation is essential in order to separate fiber from fiber and form the uniformly distributed mass necessary for subjection to the type of operation applied to cotton and other fibers.

The method just outlined involves a long series of operations in which the mass of fibers prepared by the opener is gradually converted into yarn. There have been suggested, however, processes for converting the continuous filaments directly or substantially directly into staple fiber yarns. Thus, with the idea of forming a fibrous product in the form of a sliver, slubbing, or roving intended to be drafted to a finer count and twisted into yarn, it has been proposed to subject a bundle of continuous filaments to a continuous breaking operation employing nip rollers, all the filaments in turn being broken without the product losing its continuity. Such an operation gives a product having fibers the length of which is more or less haphazard and cannot be predetermined, and, moreover, the breaking of the filaments impairs the physical properties of the original material to such an extent that fibers having the properties desired in a staple fiber yarn cannot be obtained.

A further mode of operation comprises subjecting a bundle of continuous filaments to pres-

sure against a cutting surface between which and the filaments there is relative motion in the direction of movement of the filaments, the pressure being confined substantially to a point in the length of the bundle so as to effect cutting of the filaments into fibers. This product again contains fibers having a range of different lengths, but, since the conversion in this operation is effected by cutting, the physical properties of the filaments are not substantially modified.

Proposals have been made which involve cutting a thick compact bundle of continuous filaments by knives, which may be set obliquely to the length of the bundle, while maintaining continuity of the bundle considered as a whole, the fibrous product thus obtained being essentially in a form that necessitates drafting by conventional operations in order to convert it into a yarn; moreover, as a result of the compact form in which the filaments are cut (and in this respect the cutting corresponds closely with the operation above described of converting continuous filaments into a mass of fibers requiring to be opened before they can be further processed), such necessary drafting is difficult of accomplishment. Furthermore, many of the steps ordinarily applied in the spinning of cotton and wool fibers are necessary for the conversion of the product into yarn.

The present invention has for its object to produce continuous staple fiber products containing cut fibers of predetermined length directly from continuous filaments, e. g., cellulose acetate, viscose, cuprammonium, or natural silk filaments, or mixtures of two or more of these.

According to the invention a substantially twistless bundle of associated continuous filaments is continuously converted into a staple fiber product by feeding forward the bundle, separating the filaments of the bundle from each other at the end of the bundle, cutting from such separated filaments a predetermined length to yield a group of fibers, and repeating these operations so as to obtain a succession of groups of separated fibers, and, while the cut fibers are still separate assembling the groups of fibers in such a manner that the forward ends of fibers of each group extend beyond, i. e., overlap, the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and then compacting the fibers into the continuous staple fiber product.

By reason of the separated condition of the fibers of the groups and the arranging of the groups so that the forward ends of fibers of each group extend beyond or overlap the rearward ends of fibers of the preceding group, the fibers of the successive groups intermingle, to enable the groups to be compacted into a coherent product.

The bundle of associated continuous filaments to be converted into the staple fiber product may take the form of a band or thread of untwisted filaments or of a thread having a very low degree of twist, but in the latter case, the degree of twist must be sufficiently low to enable the component filaments to be separated one from the other. The expression "substantially twistless" used in connection with the bundle means that the bundle contains no twist or that if any twist is present in the bundle, it should be insufficient to hinder free separation one from the other of the component filaments at the end of the bundle.

The regularity of the cross-section of the continuous staple fiber product may be enhanced by ensuring that the fibers produced by cutting the separated filaments are so disposed that the ends of the fibers are distributed along the length of the product. Thus, groups of separated fibers may be cut from two or more bundles of continuous filaments and associated and compacted into a single continuous staple fiber product, or groups of separated filaments derived from one or more bundles may be cut so that the ends of the fibers formed from each group are staggered with respect to the ends of the fibers formed from the other groups, the groups of fibers so formed then being associated and compacted into a single continuous staple fiber product having fiber ends distributed at regular intervals along its length. Again, the separated filaments of a bundle may be cut obliquely to their length so that the ends of the fibers of each group are progressively staggered lengthwise of the group, the ends maintaining such staggered disposition whether or not the groups are associated with other groups cut from another bundle or other bundles) and forming a continuous product of regularly distributed fibers.

Further, a single bundle of continuous filaments may be divided into two or more groups of separated filaments, each group being cut into a succession of separated fibers of predetermined length, which are assembled and compacted, in the manner referred to above, to form an individual continuous staple fiber product. In this way a number of continuous staple fiber products may be formed from a single bundle of continuous filaments. This procedure is advantageous for the production of continuous staple fiber products of fine count or denier, e. g., 50, 100 or 150 denier.

By way of example the invention will now be described in greater detail with reference to the accompanying diagrammatic drawings of which—

Fig. 1 is a part cross-sectional end elevation of a filament converting and yarn forming machine; Figs. 2 and 3 show a detail of Fig. 1 on a larger scale;

Fig. 4 is a plan view of Fig. 1 with certain elements removed for clarity of illustration;

Fig. 5 is a diagram illustrating the construction of the continuous staple fibre product formed in the apparatus illustrated in the preceding figures; and

Figs. 6 and 7 are part cross-sectional elevation and plan views respectively of a detail of Figs. 1 to 4.

Referring to Fig. 1 a bundle of substantially

twistless continuous filaments 8 is withdrawn from a supply bobbin 9 by a pair of nip rollers 10, the filaments passing from the supply bobbin to the rollers by way of guides 11 and through a "gate" tension device 12. The nip rollers 10 feed the filaments to an ejector nozzle 13 formed with a filament entrance hole 14 (see Figs. 4 and 6) and a flat flared ejecting orifice 15, the nozzle being fed with compressed air from a supply pipe 16.

As indicated by arrows in Fig. 6 the air passes downwardly along a conduit 17 and through a jet 18 to the orifice 15, the jet being formed with three diverging passages 19 in order to spread the blast of air as it passes through and out of the orifice 15, the flat flared shape of which assists in flattening and spreading out the current fan-wise.

The passage of the air from the jet 18 to the orifice 15 creates suction at the filament entrance hole 14 with the result that the filaments are sucked through the hole and into the main air current which serves both to eject through the orifice 15 a length of the filaments longer than the length of the staple desired and to separate the filaments of the length one from the other in the form of a substantially flat band during the ejection, any slight degree of twist in the bundle being freed under the influence of the air blast. The bundle of filaments should not contain a finish that prevents the air blast from separating the filaments, and for this reason it is desirable to employ unlubricated filaments.

On being ejected from the orifice 15 the separated end portions of the filaments 8 extend across an endless permeable band 20 which is driven over the surface of a suction conduit 21 by a roller 22 engaging the inside of the band. The band is kept taut by an idler roller 23 which is spring-urged into contact with the band. The suction conduit 21 is connected to a suction vessel 24 by a pipe 25.

As shown in Figs. 1 to 3 the conduit 21 is of flattened cross-section and is perforated at two points 27, 28, two separate streams of air thus flowing into the conduit through the permeable band 20, as indicated by the arrows. On the ejection of the filaments 8 from the nozzle 15 the ends of the filaments are seized and held to the band by the suction due to the perforations 27, as shown clearly in Fig. 1.

Substantially simultaneously with the sucking to the band 20 of the separated filament ends the supply of air to the nozzle 13 is momentarily stopped (in a manner to be described later) and a two-limbed deflecting member 30 (shown partly broken for convenience) disposed near the orifice 15 above the filaments descends and presses the filaments downwardly into engagement with the teeth of a multi-toothed cutting device 31 of the "hair-clipper" type positioned with its teeth projecting substantially normally to the path of the filaments between the orifice 15 and the band 20, one limb of the deflecting member lying to each side of the cutting device to ensure proper engagement of the separated filaments with the teeth (see Fig. 4).

The cutting device 31 is then operated to sever the filaments into a group of staple fibers, and the rearward end of the group thus formed is sucked away from the cutting device and on to the band by the air current flowing into the conduit through the perforations 28, the air current being in part concentrated on the teeth of the cutting device by a shield 29 arranged between the cutting device and the perforations 28. A

group of separated fibers is thus cut and laid on the surface of the moving band 20.

On operation of the cutting device 31, a guiding member 32 normally disposed behind the continuous filaments as they proceed in a straight line from the nip rollers 10 to the nozzle 13 is moved forwardly (viz. to the right in Figs. 1 to 3) and in so moving deflects the filaments from the straight line and draws their cut ends clear of the teeth of the cutting device 31 to free the filaments for further forward movement under the influence of the air blast (see Fig. 3).

With the filaments drawn clear of the cutting device, the guide 32 is retracted to its normal inoperative position and the air blast is restarted to separate and eject the filaments over the band 20 again from the orifice 15. The ends of the separated filaments are again sucked to the band 20 in the manner shown in Fig. 1 and the sequence of operations described above is repeated.

The rate of progress of the filaments 8 from the orifice 15 is dependent on the rate of rotation of the nip rollers 10, and by adjusting such rotation, the staple length of the fiber groups laid on the band 20 can be regulated. With the filaments delivered at a constant rate to a cutting device working with a constant frequency, the fiber groups are substantially uniform in length.

Also, the rate of movement of the band 20 in the direction of the length of the fiber groups is regulated in accordance with the rate of progress of the filaments 8 from the nozzle 15 so that as the fiber groups are collected on the band they are assembled in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group. The overlapping fiber groups are shown in Fig. 4, and diagrammatically in Fig. 5, the groups forming a continuous assembly 33 of fibers on the band 20.

The band 20 feeds the assembly 33 forwardly to a pair of endless travelling rubbing bands 34 driven by rollers 35. The upper rubbing band of the pair is reciprocated transversely with respect to the assembly 33 by crank and link mechanism 36 (to be described later) in order to roll and compact the assembly into a substantially cylindrical staple fiber product 37 (Fig. 4) which is twisted into a yarn 38 and wound on a bobbin 39 by a ring spinning device 40.

As shown in Figs. 1 and 4 the cutting device 31 is disposed obliquely with respect to the separated filaments so that the cut ends of the filaments are progressively staggered lengthwise of each group (see Fig. 4). Such arrangement assists in intermingling fibers of successive groups with each other, and in evenly distributing the ends of the fibers along the length of the assembly 33 (and hence along the length of the ultimate yarn 38) and assists in constructing a product having substantially uniform strength throughout its length.

It will be apparent from the foregoing description that since the cut groups are caused to overlap, the denier of the resultant product is greater than that of the initial filamentary bundle 8, the increase in denier depending on the degree to which the filaments overlap, more overlap giving a product of greater denier and vice versa.

The various elements of the machine described above are operated in the following manner:

A shaft 41 driven by a chain sprocket 42 carries a chain sprocket 43 (Figs. 1-3) which drives by a chain 44 the lower nip roller 10 at a predetermined speed, the upper roller being driven by frictional contact with the lower. While the nip

rollers 10 feed the continuous filaments 8 to the nozzle 13 continuously and the filaments are separated and ejected from the nozzle to the band 20 intermittently, the ejecting and cutting operations are effected in such rapid succession that the small amount of slack formed in the filaments between the rollers and the nozzle due to the continued feed of the filaments during the periods in which the compressed air supply is stopped is insignificant and is quickly taken up by the air blast when the air supply is restarted. The nip rollers 10 may, however, be driven intermittently in accordance with the timing of the air blasts.

The shaft 41 carries also four cams 45, 46, 47, 15 48, the cam 45 being positioned directly beneath the nozzle 13 and engaging a spring-urged valve controlling member 50 which on rotation of the cam is raised and lowered within the conduit 17 to stop and start the flow of air from the supply 20 pipe 16 at the requisite intervals, in the manner apparent from Fig. 6.

The cam 46 bears on a follower 51 supported by a pivoted bell-crank lever 52 carrying the two-limbed deflecting member 30, the relative setting 25 of the cams 45, 46 being such that immediately the cam 45 has raised the valve member 50 to stop the flow of air to the jet 18 (i. e., after the ejection of a length of filaments longer than the length of the staple desired), the cam 46 rocks 30 the bell-crank lever 52 clockwise (as seen in Fig. 1) about its pivot to bring about the deflection of the ejected filaments into the teeth of the cutting device 31. The shape of the cam 45 and/or the rate of rotation of the shaft 41 determines the length of the filaments ejected at each operation of the nozzle 13 (and consequently the length of the cut group), a longer ejecting period resulting in a longer length and vice versa. The perforations 27, 28 formed in the suction conduit 40 21 are arranged over a substantial portion of the width of the conduit in order to accommodate different lengths of fibers.

Immediately after the deflection of the filaments into the teeth of the cutting device 31, the cam 47 rocks an associated bell-crank lever 53 which is connected to the cutting device 31 by an upright arm 54, the rocking of the lever 53 raising the arm 54 and so causing the arm to operate the cutting device.

With the filaments thus cut, the cam 48 pushes outwardly (viz. to the right in Fig. 1) a pivoted upright lever 55 to the end of which is fixed the guide 32, the consequent outward movement of which deflects the continuous filaments extending between the nip rollers 10 and the nozzle 13 and draws the cut ends of the filaments from the teeth of the cutting device 31 (see Fig. 3).

The cam 45 now releases the valve controlling member 50 to restart the supply of compressed air to the jet 18 and the filaments are again separated and ejected from the nozzle 15, when the sequence of operations described above is repeated.

The shaft 41 carries a further chain sprocket 55 57 which drives through chain and sprocket gearing 58 a shaft 59 upon which is mounted the roller 22 which drives the band 20. The shaft 59 drives, in turn, through chain and sprocket gearing 60 a lower shaft 61 upon which is mounted the foremost roller 35 driving the lower rubbing band 34, the drive being transmitted from the lower to the upper roller 35 on the upper shaft 61 through gearing 62.

The shaft 41 drives through bevel and shaft 75

gearing 63 the crank and link mechanism 36 which reciprocates the upper rubbing band 34. In order to allow of the reciprocation, the gearing 62 transmitting drive from the lower roller 35 to the upper roller is wide enough to allow of the reciprocation of the upper rubbing band while maintaining the drive thereto.

While apparatus for the treatment of one bundle of filaments only has been referred to in the foregoing description it will be understood that any number of such forms of apparatus could be disposed in side by side relation, in the manner indicated in Fig. 4, in order simultaneously to treat any desired number of continuous filament bundles. Also, where, for any reason it is desired to produce a product having a denier sensibly greater than that of the initial bundle of continuous filaments 8, two or more adjacent products 37 may be associated on leaving the rubbing bands 34 and spun into one yarn by a common twisting device such as the ring spinning device illustrated in the drawings, or a cap, or flyer spinning device.

When cutting and converting continuous filaments of material such as cellulose acetate or other organic derivative of cellulose having a high di-electric strength and consequently liable to retain charges of static electricity, it is found that the "gate" tension device 12 in addition to subjecting the filaments to the desired tension electrifies the filaments and thus causes them to repel each other with the result that the filaments are given a desirable preliminary spreading prior to entering the ejector nozzle 13. Such preliminary spreading may be enhanced by limiting the opportunity for the static charge to leave the filaments prior to entering the nozzle, and for this reason at least the upper nip roller 10 may with advantage be covered with rubber or other electrical insulating material. In order to prevent excessive wear on any one portion of the nip rollers 10 the filaments 8 may be traversed to and fro along the length of the rollers.

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

1. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments into a staple fiber product by feeding forward the bundle, separating the filaments of the bundle from each other at the end of the bundle so that the filaments assume a fan shape, cutting from such fan-shaped separated filaments a predetermined length to yield a group of fibers and repeating these operations so as to obtain a succession of groups of separated fibers, and, while the cut fibers are still separate, assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and then compacting the fibers into the continuous staple fiber product.

2. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments into a staple fiber product by feeding forward the bundle, subjecting the end of the bundle to the action of a gaseous blast so as to separate the filaments of the bundle from each other for a length longer than the length of staple desired, cutting from such separated fila-

ments a predetermined length to yield a group of fibers and repeating these operations so as to obtain a succession of groups of separated fibers, and, while the cut fibers are still separate, assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and then compacting the fibers into the continuous staple fiber product.

3. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments into a staple fiber product by feeding forward the bundle, separating the filaments of the bundle from each other at the end of the bundle for a length longer than the length of staple desired so that the filaments assume a fan shape, seizing the free ends of the fan-shaped group of filaments, cutting from the seized filaments a predetermined length to yield a group of fibers and repeating these operations so as to obtain a succession of groups of separated fibers, and, while the cut fibers are still separate, assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and then compacting the fibers into the continuous staple fiber product.

4. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments into a staple fiber product by feeding forward the bundle, subjecting the end of the bundle to the action of a gaseous blast so as to separate the filaments of the bundle from each other for a length longer than the length of staple desired, seizing the free ends of the filaments, cutting from the seized filaments a predetermined length to yield a group of fibers and repeating these operations so as to obtain a succession of groups of separated fibers, and, while the cut fibers are still separate, assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and then compacting the fibers into the continuous staple fiber product.

5. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments into a staple fiber product by feeding forward the bundle, separating the filaments of the bundle from each other at the end of the bundle for a length longer than the length of staple desired, applying suction to the free ends of the separated filaments to seize them, cutting from the seized filaments a predetermined length to yield a group of fiber and repeating these operations so as to obtain a succession of groups of separated fibers, and, while the cut fibers are still separate, assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple

fiber may be produced, and then compacting the fibers into the continuous staple fiber product.

6. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments into a staple fiber product by feeding forward the bundle, separating the filaments of the bundle from each other at the end of the bundle for a length longer than the length of staple desired, extending the separated filaments over a permeable support, passing a gaseous current through the support so as to seize the free ends of the filaments and hold them to the support, cutting from the seized filaments a predetermined length to yield a group of fibers and repeating these operations so as to obtain a succession of groups of separated fibers, and, while the cut fibers are still separate, assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and then compacting the fibers into the continuous staple fiber product.

7. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments into a staple fiber product by feeding forward the bundle, dividing the filaments of the bundle into groups, separating the filaments of the respective groups from each other at the ends of the groups for a length longer than the staple desired and so that the filaments assume a fan shape, cutting from the end of each fan-shaped group a predetermined length of the separated filaments to yield a group of cut fibers from each group of continuous filaments, the cutting being effected in a manner such that the ends of the fibers cut from each group are staggered with respect to the ends of the fibers cut from the other groups, and repeating these operations to obtain from each group of continuous filaments a succession of cut groups of separated fibers, and, while the fibers of the cut groups are still separate, associating the successions of groups of fibers in such a manner that the forward ends of the fibers of each group overlap the rearward ends of the fibers of the preceding group and then compacting the associated groups into a single continuous staple fiber product.

8. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments into staple fiber products by feeding forward the bundle, dividing the filaments of the bundle into groups, separating the filaments of the respective groups from each other at the ends of the groups for a length longer than the length of staple desired and so that the filaments assume a fan shape, cutting from the end of each fan-shaped group a predetermined length of the separated filaments to yield a group of cut fibers from each group of continuous filaments, and repeating these operations to obtain from each group of filaments a succession of groups of cut fibers, and, while the cut fibers are still separate, assembling the successions of groups of fibers cut from each group of filaments in such a manner that the forward ends of the fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the successions of groups coherent continuous products consisting of staple

fibers may be produced, and then compacting the successions of groups to form from each one an individual continuous staple fiber product.

9. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments into a staple fiber product by feeding forward the bundle, separating the filaments at the end of the bundle into the form of a flat band for a length longer than the length of staple desired and so that the filaments assume a fan shape, cutting from such fan-shaped separated filaments a predetermined length to yield a group of fibers and repeating these operations so as to obtain a succession of groups of separated fibers, and, while the cut fibers are still separate, assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and then compacting the fibers into the continuous staple fiber product.

10. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments into a staple fiber product by feeding forward the bundle, separating the filaments of the bundle from each other at the end of the bundle for a length longer than the length of staple desired and so that the filaments assume a fan shape, cutting such fan-shaped separated filaments obliquely across the width of the bundle to yield a group of separated, staggered fibers of predetermined length, and repeating these operations so as to obtain a succession of such groups of fibers, and, while the cut fibers are still separate, assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and then compacting the fibers into the continuous staple fiber product.

11. Process for the manufacture of staple fiber products which consists in continuously converting a substantially twistless bundle of associated continuous filaments into a staple fiber product by feeding forward the bundle, separating the filaments of the bundle from each other at the end of the bundle for a length longer than the length of staple desired and so that the filaments assume a fan shape, cutting from such fan-shaped separated filaments a predetermined length to yield a group of fibers and repeating these operations so as to obtain a succession of groups of separated fibers, and, while the cut fibers are still separate, assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and then rubbing the assembled groups of fibers so as to roll and compact them into the continuous staple fiber product.

12. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments into a staple fiber product by feeding forward the bundle, separating the

filaments of the bundle from each other at the end of the bundle for a length longer than the length of staple desired and so that the filaments assume a fan shape, cutting from such fan-shaped separated filaments a predetermined length to yield a group of fibers and repeating these operations so as to obtain a succession of groups of separated fibers, and, while the cut fibers are still separate, assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and then compacting the fibers into the continuous staple fiber product, and twisting the product into yarn.

13. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments of artificial material into a staple fiber product by feeding forward the bundle, separating the filaments of the bundle from each other at the end of the bundle so that the filaments assume a fan shape, cutting from such fan-shaped separated filaments a predetermined length to yield a group of fibers and repeating these operations so as to obtain a succession of groups of separated fibers, and, while the cut fibers are still separated, assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and then compacting the fibers into the continuous staple fiber product.

14. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments of cellulose acetate into a staple fiber product by feeding forward the bundle, separating the filaments of the bundle from each other at the end of the bundle so that the filaments assume a fan shape, cutting from such fan-shaped separated filaments a predetermined length to yield a group of fibers and repeating these operations so as to obtain a succession of groups of separated fibers, and, while the cut fibers are still separate, assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and then compacting the fibers into the continuous staple fiber product.

15. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments of cellulose acetate into a staple fiber product by feeding forward the bundle, separating the filaments of the bundle from each other at the end of the bundle for a length longer than the length of staple desired and so that the filaments assume a fan shape, cutting from such fan-shaped separated filaments a predetermined length to yield a group of fibers and repeating these operations so as to obtain a succession of groups of separated fibers, and, while the cut fibers are still separate, assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap

the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and then compacting the fibers into the continuous staple fiber product, and twisting the product into yarn.

16. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments of cellulose acetate into a staple fiber product by feeding forward the bundle, electrifying the bundle to cause mutual repulsion and spreading of the filaments, separating the spreading filaments of the bundle from each other at the end of the bundle for a length longer than the length of staple desired, cutting from such separated filaments a predetermined length to yield a group of fibers and repeating these operations so as to obtain a succession of groups of separated fibers, and, while the cut fibers are still separate, assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and then compacting the fibers into the continuous staple fiber product.

17. Process for the manufacture of staple fiber products, which consists in continuously converting a substantially twistless bundle of associated continuous filaments into a staple fiber product by feeding forward the bundle, separating the filaments of the bundle from each other at the end of the bundle into the form of a flat fan-shaped band, cutting from such fan-shaped band of separated filaments a predetermined length to yield a group of fibers and repeating these operations so as to obtain a succession of groups of separated fibers, and, while the cut fibers are still separate, assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and then compacting the fibers into the continuous staple fiber product.

18. Apparatus for the manufacture of staple fiber products, comprising means for feeding forward a bundle of continuous filaments, means for separating the filaments of the bundle from each other at the end of the bundle in such a manner that they assume a fan shape, a cutting device adapted to cut from the fan-shaped group of separated filaments a succession of groups of separated fibers of predetermined length, means for assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and means for compacting the fibers into a continuous staple fiber product.

19. Apparatus for the manufacture of staple fiber products, comprising means for feeding forward a bundle of continuous filaments, an ejector nozzle adapted to receive the end of the bundle and to apply thereto a gaseous blast so as both to separate the filaments at the end of the bundle from each other over a length longer than the length of the staple desired and to forward

the filaments, a cutting device disposed in or near the path of the blast produced by the nozzle and adapted to cut from the separated filaments a succession of groups of separated fibers of predetermined length, means for assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and means for compacting the fibers into a continuous staple fiber product.

20. Apparatus for the manufacture of staple fiber products, comprising means for feeding forward a bundle of continuous filaments, means for separating the filaments of the bundle from each other at the end of the bundle for a length longer than the length of staple desired and in such a manner that they assume a fan shape, means for seizing the ends of the fan-shaped group of separated filaments, a cutting device adapted to cut from the seized filaments a succession of groups of separated fibers of predetermined length, means for assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and means for compacting the fibers into a continuous staple fiber product.

21. Apparatus for the manufacture of staple fiber products, comprising means for feeding forward a bundle of continuous filaments, an ejector nozzle adapted to receive the end of the bundle and to apply thereto a gaseous blast so as both to separate the filaments at the end of the bundle from each other over a length longer than the length of the staple desired and to forward the filaments, means for seizing the ends of the separated filaments, a cutting device adapted to cut from the seized filaments a succession of groups of separated fibers of predetermined length, means for assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and means for compacting the fibers into a continuous staple fiber product.

22. Apparatus for the manufacture of staple fiber products, comprising means for feeding forward a bundle of continuous filaments, an ejector nozzle adapted to receive the end of the bundle and to apply thereto a gaseous blast so as both to separate the filaments at the end of the bundle from each other over a length longer than the length of the staple desired and to forward the filaments, a permeable support, means for sucking a current of air through the support so as to seize and hold to the support the free ends of the separated filaments, a cutting device comprising a pair of multi-toothed co-operating members, said cutting device being adapted to cut from the seized filaments a succession of groups of fibers of predetermined length, means for moving the support in the direction of the length of the fiber groups so as to carry the last received group forward to some extent before the succeeding group is received, rubbing bands adapted to receive the fiber groups from the support and to compact the fibers into a coherent

continuous product, and a twisting device adapted to twist into yarn and wind the product.

23. Apparatus for the manufacture of staple fiber products, comprising means for feeding forward a bundle of continuous filaments, an ejector nozzle having a flat, flared ejecting orifice, said nozzle being adapted to receive the end of the bundle and to apply thereto a gaseous blast so as both to separate the filaments at the end of the bundle from each other into the form of a flat band and to forward the filaments from the orifice, a cutting device adapted to cut from the separated filaments a succession of groups of separated fibers of predetermined length, means for assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and means for compacting the fibers into a continuous staple fiber product.

24. Apparatus for the manufacture of staple fiber products, comprising means for feeding forward a bundle of continuous filaments, an ejector nozzle adapted to receive the end of the bundle and to apply thereto a gaseous blast so as both to separate the filaments at the end of the bundle from each other over a length longer than the length of the staple desired and to forward the filaments, means for interrupting and restarting the blast at intervals so as to cause the filaments to be forwarded intermittently, a cutting device disposed near the path of the blast produced by the nozzle and adapted to cut from the separated filaments a succession of groups of separated fibers of predetermined length, means for assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and means for compacting the fibers into a continuous staple fiber product.

25. Apparatus for the manufacture of staple fiber products, comprising means for feeding forward a bundle of continuous filaments, means for separating the filaments of the bundle from each other at the end of the bundle for a length longer than the length of staple desired, suction means for seizing the ends of the separated filaments, a cutting device adapted to cut from the seized filaments a succession of groups of separated fibers of predetermined length, means for assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and means for compacting the fibers into a continuous staple fiber product.

26. Apparatus according to claim 25, comprising a suction conduit disposed near the cutting device and formed with perforations at points in its periphery, an endless permeable band contacting with the surface of the conduit, said conduit being disposed in a manner such that air flowing through the perforations sucks to the band the ends of the separated filaments prior to and during cutting, and the freshly cut end of each group of filaments after cutting, and means for moving the band across the surface of the conduit in the direction of the length of the

fiber groups so as to carry the last received group forward to some extent before the succeeding group is received.

27. Apparatus for the manufacture of staple fiber products, comprising means for feeding forward a bundle of continuous filaments, means for separating the filaments of the bundle from each other at the end of the bundle in such a manner that they assume a fan shape, a cutting device adapted to cut from the fan-shaped group of separated filaments a succession of groups of separated fibers of predetermined length, said cutting device being disposed so as to cut the separated filaments obliquely across the width of the bundle, means for assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced and means for compacting the fibers into a continuous staple fiber product.

28. Apparatus for the manufacture of staple fiber products, comprising means for feeding forward a bundle of continuous filaments, means for separating the filaments of the bundle from each other at the end of the bundle, a cutting device comprising a pair of multi-toothed co-operating members having a relative longitudinal movement, said cutting device being adapted to cut from the separated filaments a succession of groups of separated fibers of predetermined length, means for assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and means for compacting the fibers into a continuous staple fiber product.

29. Apparatus for the manufacture of staple fiber products, comprising means for feeding forward a bundle of continuous filaments, means for separating the filaments of the bundle from each other at the end of the bundle in such a manner that they assume a fan shape, a cutting device disposed out of the path of the filaments, means for bringing the end portions of the fan-shaped group of separated filaments into engagement with the cutting device at intervals so as to form from the continuous filaments a succession of groups of separated fibers of predetermined length, means for assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced,

and means for compacting the fibers into a continuous staple fiber product.

30. Apparatus for the manufacture of staple fiber products, comprising means for feeding forward a bundle of continuous filaments, means for separating the filaments of the bundle from each other at the end of the bundle in such a manner that they assume a fan shape, a cutting device adapted to cut from the fan-shaped group of separated filaments a succession of groups of separated fibers of predetermined length, means for assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, means for compacting the fibers into a continuous staple fiber product, and means for twisting the product into yarn.

31. Apparatus for the manufacture of staple fiber products, comprising means for feeding forward a bundle of continuous filaments, a "gate" tension device adapted to engage the bundle so as to electrify the component filaments thereof and cause mutual repulsion and spreading of the filaments, means for separating the spreading filaments from each other at the end of the bundle, a cutting device adapted to cut from the separated filaments a succession of groups of separated fibers of predetermined length, means for assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and means for compacting the fibers into a continuous staple fiber product.

32. Apparatus for the manufacture of staple fiber products, comprising means for feeding forward a bundle of continuous filaments, means for separating the filaments of the bundle from each other at the end of the bundle in such a manner that they assume a fan shape, a cutting device adapted to cut from the fan-shaped group of separated filaments a succession of groups of separated fibers of predetermined length, means for drawing the filaments clear of the cutting device after the cutting of each group of fibers, means for assembling the groups of fibers in such a manner that the forward ends of fibers of each group overlap the rearward ends of fibers of the preceding group to such an extent that upon subsequently compacting the fibers a coherent continuous product consisting of staple fiber may be produced, and means for compacting the fibers into a continuous staple fiber product.

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