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CONVERSION OF CONTINUOUS FILAMENTS INTO STAPLE FIBERS

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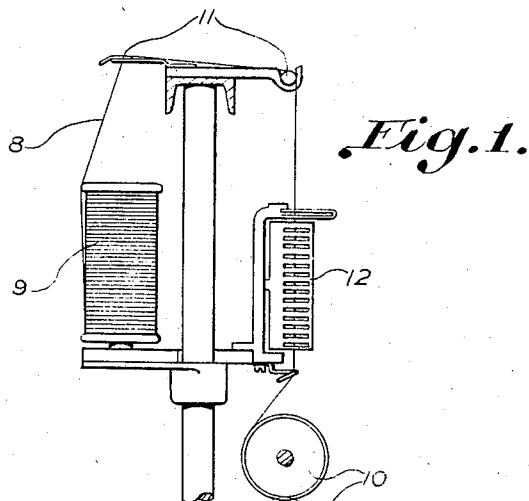
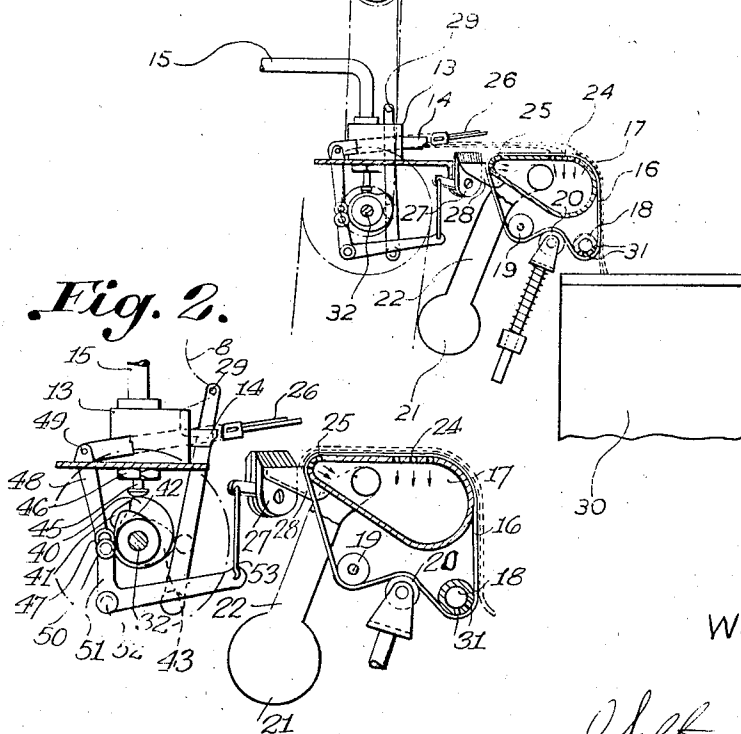


Fig. 1.

Fig. 2.



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CONVERSION OF CONTINUOUS FILAMENTS
INTO STAPLE FIBERS

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14 Claims. (Cl. 19—1)

The invention relates to the conversion of continuous filaments into staple fibers suitable for the production of spun yarns.

According to the invention a bundle of continuous filaments is continuously converted into staple fibers by the successive and repeated steps of feeding forward the bundle, seizing the ends of the filaments by applying suction thereto, and cutting from the seized filaments a predetermined length to yield a plurality of staple fibers. The repetition of the filament feeding and cutting steps produces a succession of bundles or groups of staple fibers of uniform length which may be collected in any convenient manner.

In order to produce staple fiber bundles or groups which can be opened easily and quickly in carding, blending or like operations, the continuous filaments are preferably separated one from the other at the end of the bundle prior to cutting, the cutting then producing loose, free staple fibers ready to be subjected to the operations referred to above.

The bundle of continuous filaments is preferably substantially twistless in order to allow of the separation of the component filaments one from the other to be effected without difficulty continuously with the feeding forward of the bundle. Thus, the bundle 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 should be sufficiently low to enable the component filaments to be separated one from the other.

The seizing of the ends of the filaments of the bundle may be effected by causing the filaments to extend over the surface of an endless permeable support such as a permeable band, or a drum or wheel having a permeable surface, through which the suction is applied. With such an arrangement the ends of the filaments are drawn to and held on the permeable surface by the suction and while so held can be cut by cutting means suitably disposed with respect to the support. By moving the support away from the cutting device the groups of cut fibers can be conveyed from the device and may be delivered by the support to a container for collecting the fibers.

The separation of the filaments over the requisite length (i. e. a length longer than the length of staple desired) may be effected as the filaments are about to be seized and cut into the groups of fibers. Thus, the end of the bundle may be subjected to the action of a gaseous blast that serves to separate the component filaments

of the bundle from each other and, at the same time, cause them to extend over the support. The blast of air from the ejector nozzle may, moreover, assist in removing the cut groups of fibers from the vicinity of the cutting device.

A form of cutting device suitable for dealing with the filaments, especially where the filaments are separated one from the other into the form of a flat band, comprises a pair of multi-toothed cutting members (e. g. as used in a hair-clipper) of a width sufficient to accommodate the separated filaments. The position of the cutting device with respect to the support may be determined in accordance with the length of the staple fiber desired, and the device is preferably disposed out of the path of the filaments as the filaments proceed to the support, the filaments and the cutting device being brought intermittently into engagement with each other, e. g. by deflecting the filaments into the teeth of the cutting device.

The cutting device may be disposed so as to cut the separated filaments obliquely across the width of the filaments so that the ends of the fibers of a group are progressively staggered lengthwise of the group. Such cutting assists in preserving the separated condition of the fibers and thus assists in producing groups which can be opened easily and quickly in a subsequent carding, blending or like operation.

By way of example the invention will now be described in greater detail with reference to the accompanying diagrammatic drawing. In the drawing:

Fig. 1 is a part cross-sectional end elevation of a filament cutting machine generally similar to a part of the machine shown in U. S. application S. No. 155,226 filed July 23, 1937, of which the present application is a continuation in part; and

Fig. 2 is a detail of Fig. 1 on a larger scale.

As shown in 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 flat flared ejecting orifice 14, the nozzle being fed with compressed air from a supply pipe 15.

The expression "substantially twistless" used in connection with the bundle, band or thread means that the bundle or the like 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 air blast issuing from the ejecting orifice 14 ejects the filaments 8 from the orifice and separates the filaments one from the other at the end of the bundle into the form of a substantially flat band during the ejection. The bandwise spreading of the filaments facilitates their subsequent manipulation, as will appear hereinafter. The bundle of filaments should not contain a finish that prevents the air current from separating the filaments and for this reason it is desirable to employ unlubricated filaments.

On being ejected from the orifice 14 the separated filaments 8 extend across an endless permeable band 16 which is driven over the surfaces of a suction conduit 17 and a compressed air conduit 18 by a roller 19 engaging the inside of the band. The band is kept taut by an idler roller 20 which is spring-urged into contact with the band. The suction conduit 17 is connected to a suction vessel 21 by a pipe 22, and the conduit 18 is supplied with compressed air by a further pipe (not shown).

As shown clearly in the drawing the conduit 17 is of flattened cross-section and is perforated at two points 24, 25, two separate streams of air thus flowing into the conduit through the permeable band 16, as indicated by the arrows. On the ejection of the filaments 8 from the orifice 14 the ends of the filaments are attracted to and held on the band 16 by the suction due to the perforations 24.

Substantially simultaneously with the sucking to the band 16 of the filament ends a cam 40, of a series of cams 40, 41, 42 and 43, fixed to a driving shaft 32 is caused by the rotation of the shaft to press the stem 45 of a valve 46 controlling the supply of air to the nozzle 13. The pressing of the stem interrupts the supply of air to the nozzle, and the separated filaments are left extending from the orifice 14 to the band 16.

The succeeding cam 41 (partly hidden from view by the cam 40) now bears against the end 47 of a deflecting lever 48, and causes the lever to rock about its pivot 49. The lever 48 is formed with a forked portion 26 which is caused by the rocking of the lever to bear downwardly upon the separated filaments 8 extending from the orifice 14 to the band 16, and deflect the filaments into the teeth of a multi-toothed cutting device 27 which is disposed obliquely with respect to the width of the separated filaments. On deflection, one limb of the forked portion 26 lies to each side of the cutting device 27 to ensure proper engagement of the filaments with the teeth.

On engagement of the filaments 8 by the teeth of the cutting device 27, the next cam, 42, bears against the end 50 of a lever 51 and causes the lever to rock about its pivot 52. The lever is connected by an upright arm 53 to the cutting device 27, the rocking of the lever thus operating the device to cut the filaments. Two or more cutting devices 27 may be arranged for operation by common actuating means, and two or more deflecting levers 48 may likewise be arranged for common actuation.

The freshly cut end of the fiber-group thus formed is sucked away from the cutting device 27 and on to the band 16 by the air current flowing into the conduit through the perforations 25, the air current being in part concentrated on the teeth of the cutting device by a shield 28 arranged between the cutting device and the per-

forations 25. A staple length or group of cut fibers is thus formed and laid on the surface of the moving band 16.

On operation of the cutting device 27 a pivoted guide member 29 normally disposed behind the continuous filaments 8 as they proceed in a straight line from the nip rollers 10 to the nozzle 13 is rotated about its pivot (viz. to the right as shown in the drawing) by the cam 43 and in so moving deflects the filaments from the straight line and draws their cut ends backwardly towards the orifice 14 clear of the teeth of the cutting device 27 to free the filaments for further forward movement.

With the filaments drawn clear of the cutting device 27 the guide 29 is retracted to its normal inoperative position and the air blast is restarted to separate and eject the filaments over the band 16 again from the orifice 14, by continued rotation of cams 43 and 40. The free ends of the separated filaments are again sucked to the band 16 in the manner shown in the drawing, and the sequence of operations described above is repeated.

The rate of progress of the continuous filaments 8 from the orifice 14 is dependent on the rate of rotation of the nip rollers 10 and by adjusting such rotation the staple length of the groups of fibers can be regulated. With the filaments delivered at a constant rate to a cutting device working with a constant frequency the cut fibers are substantially uniform in length.

While the nip rollers 10 feed the continuous filaments 8 to the nozzle 13 continuously, and the filaments are ejected from the nozzle to the band 16 intermittently, the ejecting and cutting operations are effected in such rapid succession that any 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.

In the manner described above a succession of groups of cut fibers are formed on the band 16.

The band feeds the groups of fibers forwardly to a container 30 disposed beneath the band, any groups tending to adhere to the band being blown therefrom by a blast of air which passes outwardly through the band towards the container from slots 31 formed in the conduit 18 and extending across the width of the band.

The cut fibers may then be spun in a manner analogous to the spinning of cotton or wool fibers, or may be blended with cotton or wool fibers prior to spinning.

As shown in the drawing, the cutting device 27 is disposed obliquely with respect to the width of the spread filaments so that the cut ends of the fibers are progressively staggered lengthwise of the groups. Such arrangement assists in preserving the separated condition of the fibers and enables the groups to be opened easily and quickly in a subsequent carding, blending or like operation.

While apparatus for the treatment of one bundle of filaments 8 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 order simultaneously to treat any desired number of continuous filament bundles. Again, while a sin-

gle bundle only is shown proceeding to the nip rollers 10 it will be understood that a plurality of such bundles could be fed to the nip rollers in a similar manner.

5 When cutting 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 rubbing of the
10 "gate" tensioning 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
15 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
20 10 may with advantage be covered with rubber or other electrical insulating material. The filamentary bundle 8 may be traversed to and fro along the length of the nip rollers 10 in order to prevent excessive wear on any one portion of the rollers.

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

1. Process for the manufacture of staple fibers, which consists in the successive and repeated
30 steps of feeding forward a bundle of continuous filaments, extending the ends of the filaments over a permeable support, passing a gaseous current through the support so as to seize the ends of the filaments and hold them to the support, cutting from the seized filaments a predetermined length to yield a plurality of staple fibers and removing the cut material from the support as
separate fiber lengths.

2. Process for the manufacture of staple fibers,
40 which consists in the successive and repeated steps of feeding forward a substantially twistless bundle of continuous filaments, separating the filaments of the bundle from each other at the end of the bundle, extending the separated filaments over a permeable support, passing a gaseous current through the support so as to seize the free ends of the separated filaments and hold them to the support, cutting from the separated
filaments a predetermined length to yield a plurality of staple fibers while the ends of the filaments are held to the support and removing the cut material from the support as separate fiber lengths.

3. Process for the manufacture of staple fibers, which consists in the successive and repeated steps of feeding forward a substantially twistless bundle of continuous filaments, separating the filaments of the bundle from each other at the end of the bundle, extending the separated filaments over a permeable support, passing a gaseous current through the support so as to seize the free ends of the separated filaments and hold them to the support, cutting from the separated
filaments a predetermined length to yield a plurality of staple fibers, moving the support, passing
65 a further gaseous current through the support to remove the fibers from the support and removing the cut material from the support as separate fiber lengths.

70 4. Process for the manufacture of staple fibers, which consists in the successive and repeated steps of feeding forward a substantially twistless bundle of continuous filaments, separating the filaments of the bundle from each other at the end of the bundle, extending the separated filaments

over a permeable support, passing a gaseous current through the support so as to seize the free ends of the separated filaments and hold them to the support, cutting from the separated
filaments a predetermined length to yield a plurality of staple fibers, passing a further gaseous
5 current through the support so as to hold to the support the freshly cut ends of the fibers, moving the support in the direction of the length of the fibers and removing the cut material from
10 the support as separate fiber lengths.

5. Process for the manufacture of staple fibers which consists in the successive and repeated steps of feeding forward a substantially twistless bundle of continuous filaments, subjecting the
15 end of the bundle to the action of a gaseous blast so as both to separate the filaments of the bundle from each other and to forward the filaments so that their ends extend over a permeable support, passing a gaseous current through the support
20 so as to seize the ends of the filaments and hold them to the support, cutting from the seized filaments a predetermined length to yield a plurality of staple fibers and removing the cut material
25 from the support as separate fiber lengths.

6. Process for the manufacture of staple fibers which consists in the successive and repeated steps of feeding forward a substantially twistless bundle of continuous filaments of cellulose acetate, separating the filaments of the bundle from
30 each other at the end of the bundle into the form of a flat band, extending the ends of the filaments over a permeable support, passing a gaseous current through the support so as to seize the ends of the filaments and hold them to the
35 support, cutting from the seized filaments a predetermined length to yield a plurality of staple fibers and removing the cut material from the support as separate fiber lengths.

7. Process for the manufacture of staple fibers
40 which consists in the successive and repeated steps of feeding forward a substantially twistless bundle of continuous filaments of cellulose acetate, electrifying the bundle to cause mutual repulsion and spreading of the filaments, separating
45 the spreading filaments from each other at the end of the bundle and extending the ends of the filaments over a permeable support, passing a gaseous current through the support so as to seize the ends of the filaments and hold them to
50 the support, cutting from the seized filaments a predetermined length to yield a plurality of staple fibers and removing the cut material from the support as separate fiber lengths.

8. Apparatus for the manufacture of staple
55 fibers, comprising means for feeding forward a bundle of continuous filaments, a permeable support, means for sucking a current of air through the support so as to seize and hold to the support the ends of the filaments, and a cutting
60 device adapted to cut from the seized filaments a predetermined length to yield a plurality of staple fiber.

9. Apparatus for the manufacture of staple
65 fibers, 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 permeable support, means for sucking a current of air through the support so as to seize and hold to the support
70 the free ends of the separated filaments, and a cutting device adapted to cut from the separated filaments a predetermined length to yield a plurality of staple fibers while the ends of the filaments are held to the support.

10. Apparatus for the manufacture of staple fibers, 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 adapted to cut from the separated filaments a succession of staple fibers of predetermined length, 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 ends of the staple fibers after cutting, a container disposed beneath the band and means for moving the band to discharge the fibers collected thereon into the container.
11. Apparatus for the manufacture of staple fibers, 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 adapted to cut from the separated filaments a succession of staple fibers of predetermined length, 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 ends of the staple fibers after cutting, a container disposed beneath the band, and means for passing a gaseous current through the band so as to discharge the fibers from the band into the container.
12. Apparatus for the manufacture of staple fibers, 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 and to forward the filaments, means for applying suction to the free ends of the separated filaments to seize them, and a cutting device adapted to cut from the seized separated filaments a predetermined length to yield a plurality of staple fibers.
13. Apparatus for the manufacture of staple fibers, 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, means for applying suction to the free ends of the separated filaments to seize them, and a cutting device adapted to cut from the seized separated filaments a predetermined length to yield a plurality of staple fibers.
14. Apparatus for the manufacture of staple fibers, 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 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, and a cutting device comprising a pair of multi-toothed co-operating members, said device being adapted to cut from the separated filaments a predetermined length to yield a plurality of staple fibers while the ends of the filaments are held to the support.

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