

July 6, 1943.

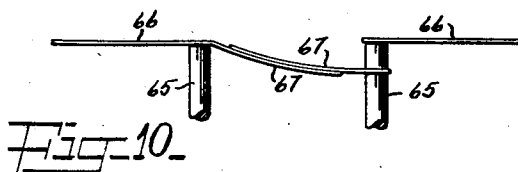
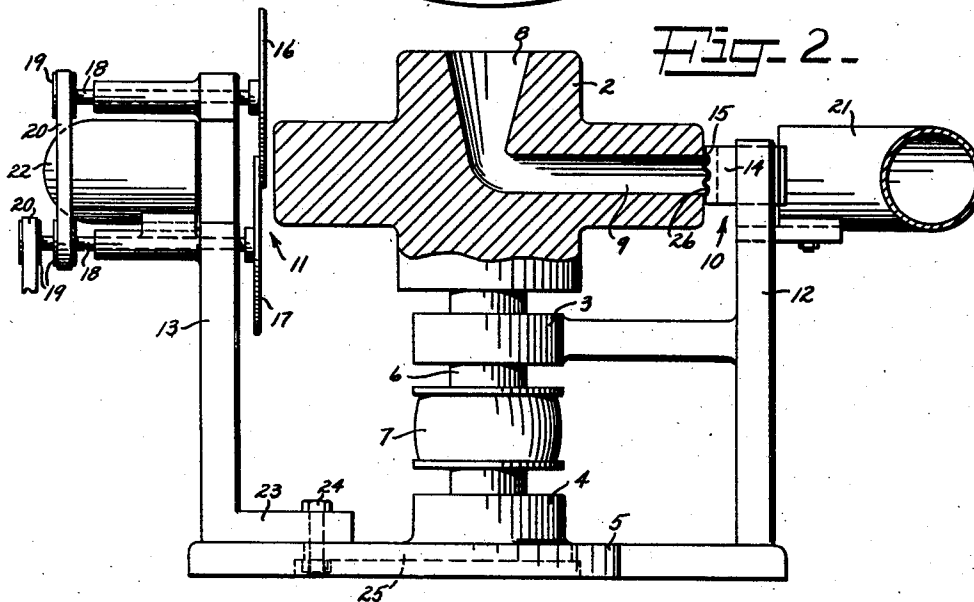
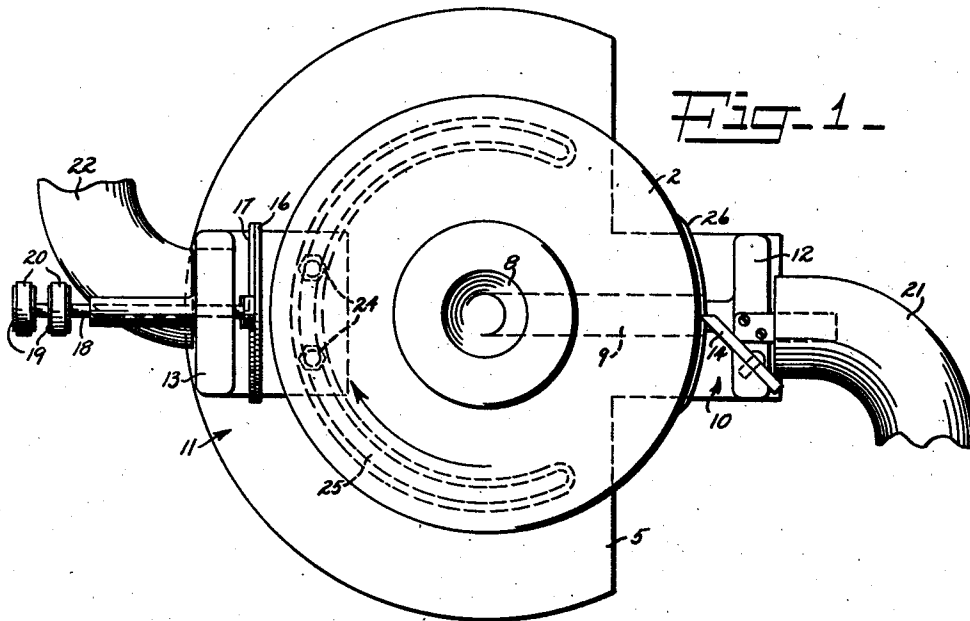
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2,323,644

MACHINE FOR CUTTING STAPLE FIBERS

Filed April 30, 1942

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

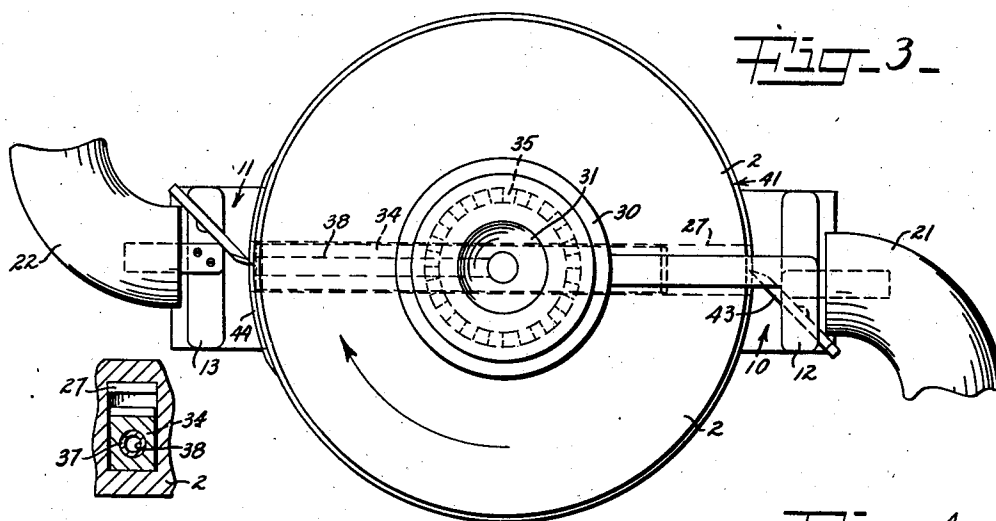


Fig-5-

Fig-4-

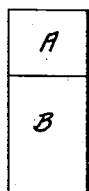
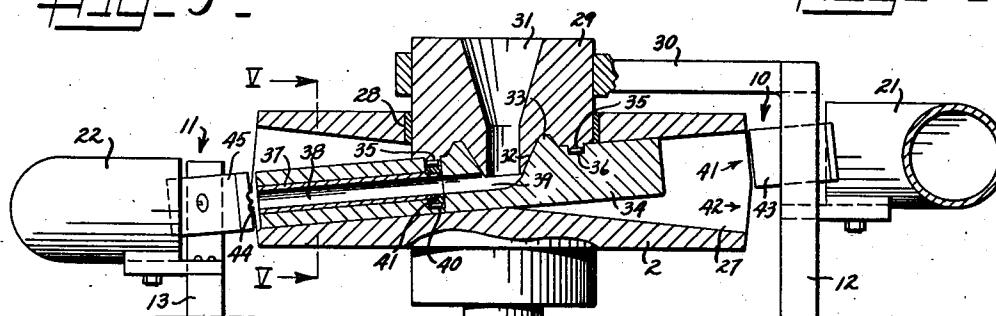


Fig-11-

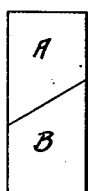


Fig-12-



Fig-13-

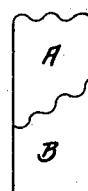


Fig-14-



Fig-15-



Fig-16-

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MACHINE FOR CUTTING STAPLE FIBERS

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3 Sheets-Sheet 3

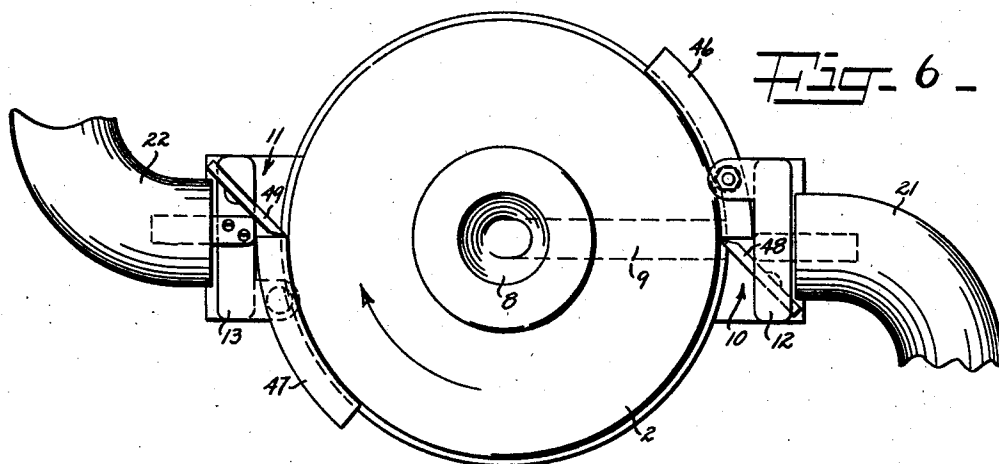


Fig. 6 -

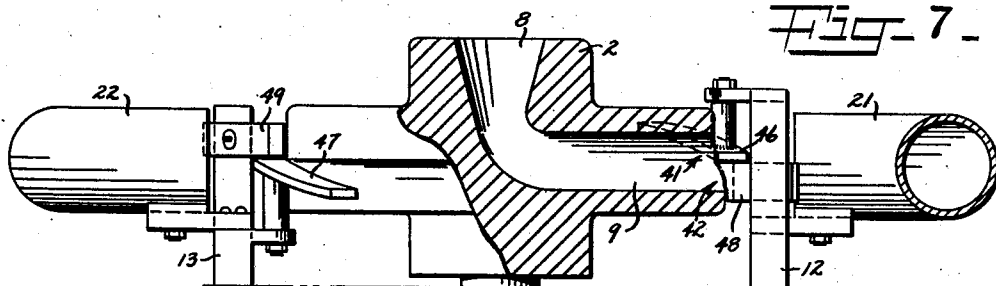


Fig. 7 -

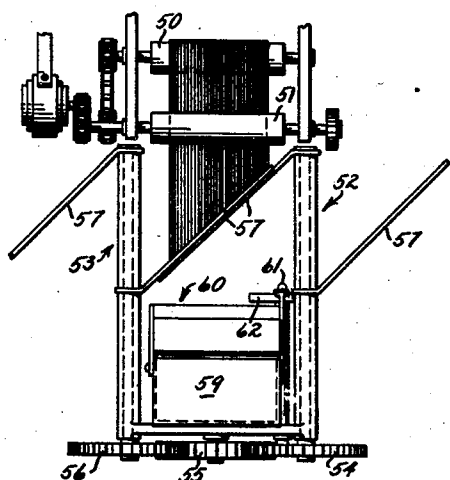


Fig. 8 -

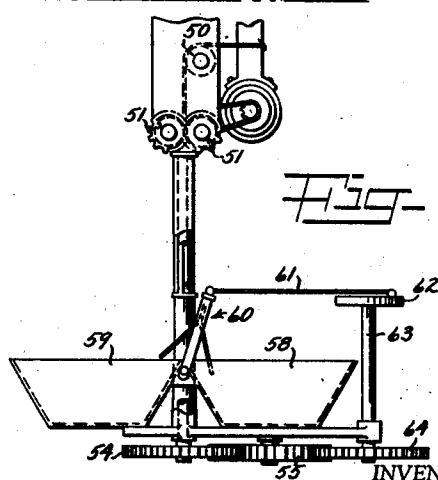


Fig. 9 -

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2,323,644

MACHINE FOR CUTTING STAPLE FIBERS

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Application April 30, 1942, Serial No. 441,117

13 Claims. (Cl. 164—39)

This invention relates to the production of staple fibers by cutting continuous filamentary material.

It is an object of the invention to provide a novel arrangement of apparatus for cutting staple fibers in which the clumps of staple fibers produced are more advantageously adapted to subsequent manipulative processes so that such processes, for example opening and working into a sliver, may be satisfactorily performed with a considerable reduction in the amount of work necessary for their successful accomplishment. It is a further object of the invention to provide an apparatus capable of producing a plurality of batches of staple fibers, simultaneously by a single machine, the apparatus being such that the staple fibers in each batch may be either similar to or distinct from those in the other batches. Further objects and advantages of the invention will be apparent from the drawings and the description thereof hereinafter.

In the drawings, illustrative of the invention, Figure 1 is a plan view of one embodiment of the invention,

Figure 2 is an elevational view of the embodiment of Figure 1,

Figure 3 is a plan view of another embodiment of the invention,

Figure 4 is an elevational view of the embodiment of Figure 3,

Figure 5 is a cross-sectional view taken on the lines of V—V of Figure 4,

Figure 6 is a plan view of a third embodiment of the invention,

Figure 7 is an elevational view of the embodiment of Figure 6,

Figure 8 is a front elevational view of a fourth embodiment of the invention,

Figure 9 is a side elevation of the embodiment of Figure 8,

Figure 10 shows a modified form of cutter adapted to be used in the embodiment of Figures 8 and 9,

Figures 11 to 16 inclusive illustrate some of the various types of staple fiber product that may be obtained with facility in accordance with the invention.

Figures 1 to 7 show the invention as applied to cutting devices of the type which involves the use of a rotary member which may develop centrifugal force to direct the filamentary bundle to the cutting elements. Referring first to Figures 1 and 2, the device comprises a disk 2 rotatively supported within suitable bearings 3 and 4 mounted on a suitable base 5. The shaft 6 of

the disk is provided with a suitable pulley 7 by which it may be driven through a belt and a motor (not shown). The disk 2 is of a common construction and comprises an axial channel 8 into which the bundle of filamentary material to be cut is led, which channel communicates with a radial channel 9 from which filamentary material is expelled by the centrifugal force generated by the rotation of the disk into the cutting elements 10 and 11. The centrifugal force may be supplemented or, if desired, rendered relatively insignificant by a blast of fluid, such as a jet of water or air, directed into the axial channel 8 to feed the filamentary material through the disk 2. The base of the machine is provided with two standards 12 and 13 for supporting cutting elements on opposite sides of the rotating disk 2. While the device is provided with one form of cutting device at one side of the machine and another form at the opposite side of the machine, for certain purposes it is contemplated to provide substantially identical cutting means at the opposite sides of the rotating disk. The cutting element 10 is constituted of a knife 14 whose cutting edge 15 is so shaped as to cooperate with the contour of the peripheral surface of the rotating disk 2 adjacent the opening of the radial channel 9 therein to effect cutting of the filamentary material. The cutting element 11 is shown as composed of a pair of rotating disks 16 and 17, at least one of whose edges is sharpened to constitute a knife edge and whose edges overlap in the fashion shown. These cutting disks 16 and 17 are mounted on shafts 18 which are adapted to be rotated by suitable pulleys 19 and belts 20 cooperating therewith. The oppositely positioned standards 12 and 13 support distinct ducts 21 and 22 respectively for the removal of the staple fiber cut at each cutting position. Each of these ducts lead to a distinct receptacle or fiber working machine and the discharge of the fiber product therethrough to the receptacle may be facilitated by suitable suction devices.

One or both of the standards, such as 13, is preferably provided for adjustment such as by a foot 23 which may be adjustably secured about the periphery of the disk by sliding the bolts 24 through the arcuate slot 25 in the base 5 to any desired position.

As shown in Figures 1 and 2, a plurality of ridges 26 which extend peripherally along the disk transverse of the opening of the radial channel 9 therein cooperate with a corresponding number of indentations in the cutting edge 15 of

the knife 14 thus producing a wavy cut in the staple fiber at one end thereof. Since the other end of each clump of staple fiber is cut substantially straight by the cutting device 11, each clump contains a mixture of fibers having various lengths and which are regularly or irregularly staggered at one end. These characteristics are of great value in assisting the subsequent opening of the clump so that less work is necessary in order to successfully prepare the product for subsequent spinning. Not only does the staggering reduce the amount of work necessary to open the staple fiber but it also effects a certain amount of preliminary heterogeneous distribution of the various length fibers in the staple product by producing them as a mixture from the very start.

The cross-sectional shape of the ridges 26 (and the complementary shape of the cutting knife 10 cooperating therewith) may be selected as desired to give any desired range in the staple fiber length within the individual clumps cut and to give any desired heterogeneous distribution of the various lengths within the clump. Thus, for example, the more or less sinusoidal wave shown in Figure 2 may be replaced with a more sharply zig-zag or serrated edge. The waves and serrations may have more or less amplitude and various "wave lengths" or "pitch." The waves and/or serrations may be regular or a distinctly irregular wave or serration may be employed. While the wave in Figure 2 is superimposed upon a generally cylindrical periphery of the disk, the disk periphery upon which the ridges are superimposed may be constituted by a frusto-conical surface or the spherical (or "frusto-spherical") surface of a spherical segment.

It should be noted that the serrated cut may or may not be symmetrical or balancing, in the sense that it may or may not indent the fiber clump being cut at as many places and to the same extent as it indents the end of the tow or sheet from which the clump is cut. That shown in Figure 2 is not symmetrical in this sense. Hence, the clump of staple fiber obtained at the right side of the machine (as viewed in the drawings) is not identical to that obtained at the left of the machine but is complementary to it. For this reason, it is desirable to discharge the material cut by one of the cutting elements, such as 10, into one vessel, such as by duct 21 and that obtained from the other of the cutting elements 11, to a separate receptacle by duct 22. Assuming that the shape of the ridges 26 and the knife edge 15 is so determined as to produce a staple fiber mixture entering duct 21 which has a particular selected range of staple fiber lengths and that this range is inconsistent with the production of a staple fiber mixture of identical constitution entering duct 22 at the other side of the machine, it does not necessarily follow that the product entering duct 22 is to be considered a waste product or that it is necessarily a second grade product. It may constitute a valuable mixture for the production of yarn by spinning in accordance with a system distinct from that employed with the product entering duct 21. If necessary in certain cases, it may be advantageous to add a certain proportion of staple fibers of selected lengths to the product obtained from duct 22 to make it substantially equivalent to the product obtained from duct 21 of the machine or to make it a distinct product peculiarly adapted for the manufacture of yarn by a different spinning system.

Whereas the two products obtained with the

cutting elements disposed in the opposite relation as shown in Figures 1 and 2 would have approximately the same average length, the standard 12, may be shifted to any desired extent along the arcuate slot 25 in the base 5 of the machine to obtain any desired difference in the average length of fiber in the two products. If desired, a plain cylindrical disk 2 without ridges 26 may be operated with two similar or different cutting elements disposed at irregular distances about the periphery of the disk 2 so that staple fiber products differing substantially only in their average length may be obtained in the two different receptacles.

It is to be understood that although two cutting elements 10 and 11 are shown disposed about the periphery of the rotary disk 2, a greater number of such cutting elements may be so disposed and a corresponding number of discharge ducts and fiber receptacles may be employed. In such modifications, the cutting elements may be disposed at equal or unequal distances about the periphery of the disk and the several cutting elements may be substantially identical or distinct in character (as in Figures 1 and 2) depending upon the character of products desired.

Figures 3 to 5 show a second embodiment of the invention employing a modified form of rotating disk 2 cooperating with a plurality of cutting elements 10 and 11 supported on standards 12 and 13 corresponding to the arrangement of Figures 1 and 2.

In this embodiment, the disk 2 is formed with a transverse slot 27, rectangular in cross-section throughout, which converges to the center of the disk. Though shown extending entirely through the disk 2, the slot 27 may open to the disk periphery at only one of its ends. The upper portion of the disk 2 is provided with a circular opening 28 communicating with the transverse slot 27. A feeding guide 29 extends downwardly into and has a sliding fit in the opening 28 of the disk 2 and is supported stationarily by means of a suitable bracket 30 secured to one of the standards. This guide 29 is provided with an axial channel 31 therethrough and its bottom surface is generally sloped. The sloped bottom surface is provided with an annular V-shaped groove 32 adapted to cooperate with an annular V-shaped projection 33 on an oscillating guide 34 mounted in the transverse slot 27 for rotation with the disk 2. In addition, the sloped bottom of the guide 29 is provided with an annular gear rack 35 which extends downwardly therefrom into a groove 36 which extends annularly in the oscillating guide 34 and in the disk 2. An internal sleeve 37 fits rotatably within the oscillating guide member 34 and has an internal longitudinal channel 38 coextensive with an internal channel 39 of the oscillating guide member 34 which communicates with the channel 31 in the thread guide 29. The oscillating guide member 34 is provided with a slot 40 within which a ring gear 41 may be received for rotation with the sleeve 37. The ring gear 41 is secured to the sleeve 37, such as by threading, and is operated by the rack 35 on the fixed guide member 29.

The disk 2 presents two cutting surfaces 41 and 42. These surfaces may correspond in general to two cones having apices at opposite sides of the disk. The cutting surface 41 of the disk 2 is shown to be plain about the upper periphery and is adapted to cooperate with a straight-edged knife 43 at the right of the machine from which the staple fiber is discharged into the duct 21 and

a suitable receptacle. The lower cutting surface 42 of the disk 2 may be provided with ridges 44 of any desired shape, similar to those mentioned in the previous embodiments, which are adapted to cooperate with a complementary shaped knife edge on the knife 45 at the left of the machine from which the staple fiber product is discharged through the duct 22 into a separate receptacle.

The gear ratios between the annular rack 35 and the ring gear 41 upon the sleeve 37 is so selected with respect to the speed of rotation of the disk 2 as to remove any twist imparted to the filamentary bundle by virtue of the rotation of the radially extending portion of the filamentary bundle with respect to the axially extending portion of the filamentary bundle being fed to the disk. If desired, different ratios may be employed to give any desired twisting of the filamentary bundle. In addition, it is within the scope of the invention to omit the rack on the stationary guide member and to substitute a plain oscillating guide member 34 without the rotating inner sleeve 37.

The device of Figures 3 to 5, like that of the previous embodiment, may be modified to cooperate with any number of cutting elements which may be spaced at different distances apart as well as equal distances apart about the periphery of the rotating disk 2. In such modifications, the periphery of the disk 2 may be divided into a correspondingly greater number of cutting surfaces to cooperate with the increased number of cutting devices. The cutting surfaces about the periphery of the disk need not be symmetrically disposed with respect thereto, especially when the cutting elements are distributed at unequal distances about the periphery of the disk 2.

Figures 6 and 7 show a third embodiment of the invention in which the disk 2 provided with the axial feeding channel 8 communicating with the radial channel 9 has the portion of its periphery corresponding to the width of the radial channel 9 extending transverse thereof divided into a plurality of cutting surfaces 41 and 42 of any desired shape. As shown, the upper cutting surface 41 is a straight line at right angles to the radial channel 9 and the lower cutting surface 42 is a convex curve to give a variable length staple fiber mixture. A plurality of standards 12 and 13 support a corresponding number of cutting elements 10 and 11, as in the preceding embodiments, at equal or unequal distances apart about the periphery of the disk. The standards 12 and 13 also support the discharge ducts 21 and 22 for delivering the staple fibers cut at each cutting device to separate receptacles and, in addition, they support, preferably pivotally as shown, deflecting members 46 and 47 which extend about a portion of the disk periphery closely conforming thereto and serving to force the staple fiber bundle extending from the disk 2 one way or the other to be cut by one or the other of the knives. The deflecting member 45 at the right of the machine serves to deflect the staple fiber bundle downwardly into the lower half of the channel so that it is cut by the knife 48 having a curved cutting edge. The deflector 47 at the other side of the machine causes the staple fibers to ride upwardly into the path of the straight-edged knife 49. To facilitate the deflecting of the fiber bundle into one or the other portions of the radial channel 9, this radial channel may be formed (as shown) with a longer dimension in the direction of deflecting than that transverse of this direction.

Figures 8 and 9 show a different type of staple fiber cutting apparatus modified in accordance with the invention. In this embodiment, a sheath of continuous filamentary material in which the filaments are substantially parallel are fed over a roll 50 by means of a pair of feeding rolls 51 driven suitably as by the motor, sprockets and chain, and the gears shown so that the sheath proceeds downwardly into the path of a pair of rotating knives 52 and 53. These knives are supported for rotation on vertical shafts into cutting opposition, such rotation being effected by a set of three gears 54, 55 and 56 in mesh, one of which may be driven by a suitable connection to a motor (not shown). Each rotating knife comprises a plurality of blades 57 so arranged as to effect successive cuttings at a different angle transverse of the sheath of filamentary material. As shown in Figure 8, each knife has two blades extending in a parallel direction from opposite ends of its hub or shaft. Such knives cut the staple fiber sheath alternately in opposite angles thus producing a mixture of various lengths fibers. Two receptacles 58 and 59 are positioned underneath the cutting station, one to each side thereof. A deflecting member 60 is pivoted along the line of division between the two receptacles. The deflecting member 60 is composed of three surfaces extending transverse of the device so that its cross-section in a plane at right angles thereto has the general shape of an inverted Y. The deflecting member 60 is rocked by a suitable link 61 attached eccentrically (through a crank disk 62) to a shaft 63 which is rotated by a gear 64 in mesh with the gear 55 of the chain for driving the knives so that the deflecting member 60 directs the staple fibers of each alternate cut into a separate one of the two receptacles 58 and 59.

While the knives shown in this embodiment have straight cutting edges, one or both of them may be curved or serrated to provide any desired type of cut. In Figure 10, for example, there is shown a form of cutting device which may be substituted for that of Figures 8 and 9 in which each knife 65 has one blade 66 capable of cutting at right angles transverse of the filamentary sheath and another blade 67 having a knife edge shaped as a sweeping curve capable of producing two staple fiber products each containing various length fibers therein.

The blades of the knives in the embodiments of Figures 8 to 10 may be arranged to form either equal or unequal dihedral angles about the axis of the knife. If desired, the speed of feeding the filamentary sheath may be varied to obtain different average lengths of fiber in the separate products.

Figures 11 to 16 show illustrative systems of the cutting either of a sheath of filaments as in Figures 8 and 9 or of a tow in Figures 1 to 7. In Figure 11, the cuts are made by a straight blade at right angles with respect to the filamentary material in which the only difference between alternate cuts is in the average length. Figure 12 shows alternately cutting with straight blades at right angles and at a distinct inclination to right angles with respect to the filamentary material. In this example, each cutting contains staple fibers of different lengths and the two products A and B may be made substantially the same in composition or, by adjusting the time between cuts, the average length of fiber in one cut may be more or less than that in the other cut. Figure 13 is similar to Figure 12

except that one of the cuts is made with a blade having a sweeping curve to give a staple fiber product having a predetermined mixture of staple fiber lengths. In this case it will be noted that the fiber product A is distinct in character from that in product B and that either product may be made with any desired average fiber length to adapt them to particular spinning systems. Figure 14 is similar to Figure 12 except that the cuts are made along wavy lines to produce staple fiber products having various lengths and to produce clumps having staggered contours at their ends. Figure 15 is similar to Figure 14 except that the alternate cuts made in this case along serrated lines are given opposite inclinations from a line at right angles to the filamentary bundle or sheath. Figure 16 is similar to Figure 14 with the exception that the wavy lines of cut are changed to serrated lines and the average length of product A is less than the average length of fiber in product B.

In the claims, the term "alternate" is intended to refer to one member of a repetitive series of two or greater than two members. In addition, the expression "filamentary material" is intended to refer to filaments per se or aggregates thereof, such as bundles, sheets, or tows thereof, and to exclude fabricated structures formed therefrom, such as by felting, weaving, knitting, braiding and the like.

While preferred embodiments of the invention have been disclosed, it is to be understood that changes and variations may be made without departing from the spirit and the scope of the invention as defined by the appended claims.

What I claim is:

1. In cutting apparatus described, means for intermittently cutting a continuous filamentary material to discontinuous lengths and means for directing alternate cuts into separate discharge channels.

2. In cutting apparatus described, means for repetitively cutting a continuous filamentary material to form a plurality of series of discontinuous masses having different characteristics, and means for directing alternate masses having similar characteristics into separate discharge channels.

3. In cutting apparatus described, means for repetitively cutting a continuous filamentary material to form a plurality of series of discontinuous masses having different average fiber lengths and means for directing alternate masses having similar characteristics into separate discharge channels.

4. In cutting apparatus described, means for repetitively cutting a continuous filamentary material to form a plurality of series of discontinuous masses having different average fiber lengths, said masses containing fibers of various lengths, and means for directing alternate masses having similar characteristics into separate discharge channels.

5. In cutting apparatus described, a rotatable member for feeding filamentary material outwardly therefrom, cutting devices disposed at a plurality of points about the rotatable member in the path of the filamentary material, and separate discharge channels associated with each of said cutting devices.

6. In cutting apparatus described, a rotatable member for feeding filamentary material outwardly therefrom, cutting devices disposed at a plurality of points about the rotatable member in the path of the filamentary material, means for

adjusting the position of at least one of said devices about the periphery of said member and separate discharge channels associated with each of said cutting devices.

7. In cutting apparatus described, a rotatable member for feeding filamentary material outwardly therefrom, cutting devices disposed at a plurality of points about the rotatable member in the path of the filamentary material, at least one of said cutting devices being of such form as to impart a predetermined cut of different outline than that produced by at least one other cutting device, and separate discharge channels associated with each of said cutting devices.

8. In cutting apparatus described, a rotatable member for feeding filamentary material outwardly therefrom, the periphery of said rotatable member having a predetermined shape at least adjacent the point of emergence of said filamentary material therefrom, a knife positioned adjacent the rotatable member and having a blade of a shape adapted to cooperate with said predetermined peripheral shape of said rotatable member to cut the filamentary material, a second cutting device adjacent the periphery of the rotatable member and arranged to operate independently of said peripheral shape, and separate discharge channels associated with each of said cutting devices.

9. In cutting apparatus described, a rotatable member for feeding filamentary material outwardly therefrom, the periphery of said rotatable member having a predetermined shape at least adjacent the point of emergence of said filamentary material therefrom, a plurality of knives positioned about the rotatable member, each of said knives having a shape adapted to cooperate with a substantially different portion of the predeterminedly shaped periphery of said rotatable member, means associated with each knife for directing the filamentary material entirely into that portion of the shaped periphery of said rotatable member with which the respective knife cooperates, and separate discharge channels associated with each of said knives.

10. In cutting apparatus described, a rotatable member for feeding filamentary material outwardly therefrom, the periphery of said rotatable member having a predetermined shape at least adjacent the point of emergence of said filamentary material therefrom, a plurality of knives positioned about the rotatable member, each of said knives having a shape adapted to cooperate with a substantially different portion of the predeterminedly shaped periphery of said rotatable member, stationary guides extending about the periphery of said rotatable member in advance of each of said knives and arranged to deflect the filamentary material into their respective knives, and separate discharge channels associated with each of said cutting devices.

11. In cutting apparatus described, a rotatable member for feeding filamentary material outwardly therefrom, the periphery of said rotatable member having a predetermined shape at least adjacent the point of emergence of said filamentary material, a stationary filamentary guide having an axial channel and a sloped bottom extending into said member, an oscillatory member arranged in a recess in said rotatable member having a longitudinal channel communicating with the axial channel of said guide and having a varying surface adapted to cooperate with the sloped portion of said guide, a plurality of knives positioned about the rotatable member, each of

said knives having a shape adapted to cooperate with a substantially different portion of the predeterminedly shaped periphery of said rotatable member, and separate discharge channels associated with each of said knives.

12. A staple fiber product comprising clumps of staple fibers, the ends of the fibers in each clump being arranged in a staggered line having a plurality of indentations whereby said product is adapted to be readily opened and subsequently worked. 10

13. A staple fiber product comprising clumps of fibers, said clumps containing a mixture of various lengths of fibers and having the ends of the fibers therein arranged along a staggered line 5 having a plurality of indentations whereby the product is adapted to be readily opened and subsequently worked.

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CERTIFICATE OF CORRECTION.

Patent No. 2,323,644.

July 6, 1943.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, first column, lines 37, 42, 49, 56, 64 and 71, and second column, lines 5, 15, 30, 46 and 62, claims 1 to 11 inclusive, strike out the word "described"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 10th day of August, A. D. 1943.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.