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CUTTER FOR PRODUCING STAPLE FIBER AND FLOCK

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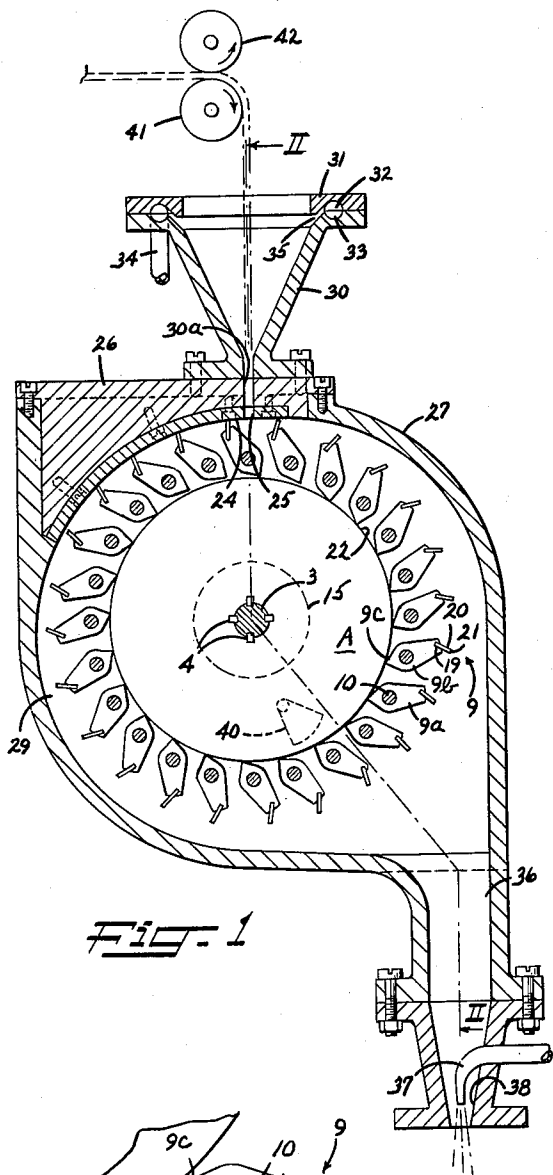


Fig. 1

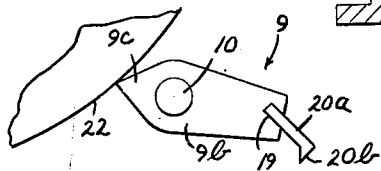


Fig. 3

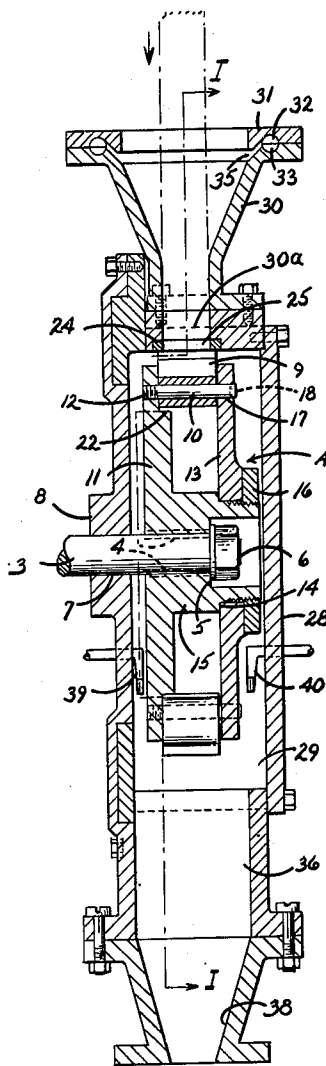


Fig. 2

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CUTTER FOR PRODUCING STAPLE FIBER
AND FLOCK

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This invention relates to a cutting device for reducing the length of fibrous materials, such as for producing staple fiber or flock from continuous filament bundles, such as yarns, tows, or the like.

It is the primary object of the present invention to provide a cutter of simple construction adaptable to the cutting of fibrous or filamentary materials to discontinuous lengths of any predetermined size, such as may be desired for the production of staple fiber or for the production of flock having as short a length as about one millimeter or less. An ancillary object is to provide such a cutting device in which centrifugal force is relied upon for controlling the engagement of the cutter edge with a cooperating shear member. Other objects and advantages of the invention will be apparent from the drawing and the description thereof hereinafter.

In the drawing, illustrative of the invention, Figure 1 is a sectional view taken on line I—I of Figure 2,

Figure 2 is a section taken on line II—II of Figure 1, and

Figure 3 is a view showing a modified cutter element.

The cutting device of the present invention comprises a rotatable member A secured to a shaft 3 by means of keys 4, and a washer 5, and a nut 6. The shaft 3 is rotatably mounted within a bore 7 of a suitable supporting frame 8 and means (not shown) is provided for driving the shaft 3. One or more elements 9 are pivotally mounted on one or more pins 10 adjacent to the periphery of the rotatable member A. To facilitate assembly, the member A comprises a disc 11 having a plurality of threaded apertures 12 into which the pins 10 are screwed. A removable centrally apertured plate 13 slides into position against a shoulder 14 formed on the hub 15 of the rotatable member A and a locknut 16 secures the structure in place. In assembling the unit, the elements 9 are slipped over the outer ends of pins 10 and the plate 13 is provided with a plurality of bores 17 adapted to register with the pins 10. The outer ends of pins 10 may be provided with a polygon-shaped recess or socket 18 to facilitate the entry of a wrench. The pivotally mounted elements 9 are eccentrically weighted, that is their center of gravity is offset from the axis of the pins 10 and as shown in Fig. 1, the heavier side or portion 9a is provided with a slot 19 into which there is press-fitted a cutter element 20 having a cutting edge 21. The sleeve 9b of the element 9 has a lug or equivalent projec-

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tion 9c extending from the element 9 out from the sleeve 9b in a direction opposite to the direction of offset of the center of gravity from the axis of pin 10. This lug 9c is adapted to engage an annular shoulder 22 formed on the disc 11 and when so engaged it serves to limit the swinging motion of element 9 in a clockwise direction about its axis of rotation under the action of centrifugal force.

At one or more stations about the rotatable member, there is mounted a shear plate 24 provided with an opening 25 which may take the form of a round bore or an elongated slot and in the specific embodiment illustrated is shown as a slot extending parallel to the axis of rotation of the member A. This shear plate may be supported by any suitable means, such as the insert block 26 adapted to fit within the housing 27, all of which is supported on the frame 8. A cover plate 28 closes the outer face of the housing.

The housing 27 when used has an inner cylindrical surface 29 eccentrically disposed with respect to the shaft 3 so that the elements 9 engage only the shear plate 24 and are free of engagement of the housing 27, thereby limiting the wear on the cutter edges to the short distance of engagement with the shear plate 24.

Means may be provided for assisting the feed of the fibrous or filamentary material through the opening 25 and illustratively such means comprises the funnel-shaped guiding member 30 in the mouth of which there is fitted an annular ring 31. Mating annular grooves 32 and 33 in the ring 31 and the flange of the funnel 30 provide a channel into which a fluid medium may be supplied as by means of the conduit 34 and the inside edge of such channel is connected with a communicating flared annular passage 35 which directs the fluid medium into the funnel 30 as a hollow cone-shaped body. The space within the funnel communicates with the passage 25 through an aligned passage 30a.

The housing 27 is provided with a discharge opening or conduit 36 communicating tangentially with the interior of the housing at a point circumferentially spaced from the cutting station in the direction of travel of the cutter edges. A jet of water, air or other fluid issuing from the nozzle 37, which may be disposed in a gradually narrowing passage 38 in the discharge conduit, thereby forming an aspirator, may serve to reduce the pressure in the housing thereby favoring the suction of the filamentary material through the opening 25 into the path of the blades. Optionally, fluid nozzles 39 and 40 may be disposed

in the chamber within the housing adjacent the discharge opening 36. These nozzles may be shaped as shown in Fig. 1 to provide a fan-shaped distribution of fluid sweeping past the cutter elements toward the discharge opening.

The elements 9 are uniformly spaced with their axes of rotation concentric with respect to the axis of shaft 3 when more than one such pivotally mounted element 9 is provided. The number of such elements provided together with the speed of rotation and the rate of feed of the filamentary material into the aperture 25 controls the fiber length of the cut material. The material to be cut may be fed simply by gravity when the axis of rotation of shaft 3 is mounted horizontally with the funnel 30 at the top, or it may be fed exclusively by the jet of fluid medium issuing from the annular passage 35, regardless of the orientation of the device when mounted for operation, whether with its axis of rotation horizontal, vertical, or at any angle therebetween. If desired, the feeding may be controlled by means of positive delivery means, such as a pair of nip rolls 41 and 42, or an equivalent positive delivery device may be assisted by gravity and/or the fluid medium issuing from passage 35. The fluid medium employed in the passage 35 and that employed in nozzles 37, 39 and 40 may simply be compressed air or it may be steam, water, or any other liquid or gas. Furthermore, the fluid medium employed may contain or be a conditioning agent, such as a lubricant, for the filamentary material being handled.

When more than one shear member 24 is provided, they are preferably equidistantly spaced apart angularly with respect to the axis of rotation of the member A so that dynamic balance will be achieved. A plurality of discharge openings corresponding in number to the number of shear plates should be provided and each discharge opening should be positioned in advance of the next shear member.

Although the cutters 20 in Fig. 1 are provided with cutting edges which are disposed at the corner of a right dihedral angle, a sharper cutting edge may be employed as shown in Fig. 3 where the cutter element 20a has a forwardly projecting foot 20b, the leading edge of which serves as the cutting edge and is disposed at the corner of an acute dihedral angle.

In operation, the material to be cut, whether it already be in loose fibrous form or is in the form of a continuous bundle of continuous or discontinuous filaments, proceeds through the funnel 30 and through the opening 25 into the housing 27 where the protruding ends are cut by the leading edges 21 of the knives or cutter element 20. In the lower portion of a cycle of revolution of the cutters as viewed in Fig. 1, the knife edges are out of contact with the housing and the lugs 9c bear against the annular shoulder 22 because of the swinging action exerted upon the elements 9 by centrifugal force. As the knives approach cutting position, they engage the shear plate 24 and are thereby swung in a counter-clockwise direction as viewed in Fig. 1 about the axis of pins 10. Very quickly after such engagement, the outer sides of the cutter elements 20 coincide or rub against the inside face of the shear member 24 until they reach the opening 25 where they bear against the shear member only at their extreme lateral portions as shown in Fig. 2. The bearing force of the knives against the shear member 24 de-

pends upon the centrifugal force acting thereon. Hence, it is possible to control the cutting action and to vary it in accordance with the requirements of any particular material to be cut. Thus, to cut heavier filamentary masses, a heavier pivotally mounted element 9 or a higher speed of rotation may be provided. Any such speed of rotation must be correlated with the rate of feed, such as by the rolls 4 and 42, to give the desired length of cut. By providing numerous cutters about the periphery of the member A, it is possible to cut a short flock without using extremely high speeds of rotation.

Even without the nozzles 37, 39 and 40, the rotating action of the cutters tends to assist the feed of the filamentary material through the opening 25 by the creation of a reduced pressure beneath the shear plate in the vicinity of this opening and this effect may be increased by properly vaning the interior of the housing. The use of nozzles 37 and/or 39 and 40 enhance this suction effect and also assist in assuring that fibers are not carried past the discharge opening 36 by the rotating elements 9. The turbulence created by the knife or knives in that portion of the housing through which the fibers are carried on the way to the discharge opening serves to thoroughly open the fibers.

The cutting device of the invention is an extremely simple and effective machine. It has relatively few parts and is relatively free of any liability to get out of order and is easily maintained. The cutter elements are readily removable for sharpening through the operation inherently involves a self-sharpening action because of the rubbing of the knife edges over the shear plate 24. The device can be used for cutting all sorts of continuous or discontinuous filamentary material, such as fibers or continuous filament yarns or tows of artificial or natural materials, such as cotton, wool, silk, rayon of the cellulose acetate or regenerated cellulose type, casein, nylon, and vinyl resins, such as polymers and copolymers of vinyl chloride, vinyl acetate, acrylonitrile, vinylidene chloride, polyethylene, etc.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A cutting device comprising a rotatable member, means for rotating the member about its axis, a swingable element pivotally mounted on the member on an axis parallel to the axis of the member adjacent the outer portion of the rotatable member, said element having its center of gravity offset from its axis in a direction outwardly therefrom during operation of the device and having on its heavier side a cutter edge extending parallel to the axis, a fixed shear member having an inwardly facing arcuate surface arranged to be engaged by the cutter edge along a portion of the path of the cutter edge, an aperture in the shear member, and means for guiding material to be cut through the aperture into the path of the cutter edge.

2. A cutting device comprising a rotatable member, means for rotating the member about its axis, a plurality of swingable elements pivotally mounted on the member on axes parallel to the axis of the member at spaced points on a concentric circle adjacent the periphery of the rotatable member, each of said elements having its center of gravity offset from its axis

in a direction outwardly therefrom during operation of the device and having on its heavier side a cutter edge, a fixed shear member having an inwardly facing arcuate surface arranged to be engaged by the cutter edges along a portion of the path of the cutter edges, an aperture in the shear member, the center of curvature of the arcuate surface of the shear member being substantially parallel to but offset from the axis of the rotatable member so that the cutter edges move inwardly as they pass in engagement with the shear member to the aperture and means for guiding filamentary material to be cut through the aperture into the path of the cutter edges.

3. A device in accordance with claim 2 comprising positive delivery means for controlling the rate of feed of the filamentary material through the aperture.

4. A device in accordance with claim 2 in which the shear member is mounted within a housing, said housing having an internal cylindrical wall surrounding the rotatable member and eccentric with respect to the axis of rotation of the member so that the cutter edges do not engage the housing and a discharge opening in the housing.

5. A device in accordance with claim 2 comprising fluid means to assist the feeding of the filamentary material through the aperture.

6. A device in accordance with claim 2 in which the axis of rotation of the rotatable member is horizontal and the aperture in the shear member is disposed above the rotatable member so that feeding may be effected by gravity.

7. A device in accordance with claim 6 in which the shear member is supported in a housing having an internal surface which is not engaged by the cutter edges and having a discharge opening at the bottom thereof.

8. A device in accordance with claim 6 in which fluid means is provided to assist the feeding of the material to be cut through the aperture.

9. A device in accordance with claim 4 comprising an aspirator for directing a fluid stream toward the discharge opening to assist discharge of cut material therethrough.

10. A device in accordance with claim 4 comprising nozzles within the housing for directing fluid streams toward the discharge opening to assist discharge of cut material therethrough.

11. A device in accordance with claim 1 in which the rotatable member comprises a disc mounted on a drive shaft, said disc having an annular shoulder, a pin mounted in the disc at a point spaced radially outwardly from the annular shoulder, said pin providing the axis upon which the swingable element is mounted, and a plate having a bore through which the pin extends for retaining the swingable element on the pin, a locknut being provided to secure the retaining plate against a shoulder on the hub of the disc, said swingable element having a lug projecting out from the element in a direction inwardly from the axis of the pin during operation of the device.

12. A cutting device comprising a rotatable member, means for rotating the member about its axis, a freely swingable element pivotally mounted on the member on an axis parallel to the axis of the member adjacent the outer portion of the rotatable member, said element having its center of gravity offset from its axis in

a direction outwardly therefrom during operation of the device and having on its heavier side a cutter edge extending parallel to the axis, a fixed shear member having an inwardly facing arcuate surface arranged to be engaged by the cutter edge along a portion of the path of the cutter edge, an aperture in the shear member, and means for guiding material to be cut through the aperture into the path of the cutter edge.

13. A cutting device comprising a rotatable member, means for rotating the member about its axis, a swingable element pivotally mounted on the member on an axis parallel to the axis of the member adjacent the outer portion of the rotatable member, said element having its center of gravity offset from its axis in a direction outwardly therefrom during operation of the device and having on its heavier side a cutter edge extending parallel to the axis, a fixed shear member having an inwardly facing arcuate surface arranged to be engaged by the cutter edge along a portion of the path of the cutter edge, an aperture in the shear member, the center of curvature of the arcuate surface of the shear member being substantially parallel to but offset from the axis of the rotatable member so that the cutter edge moves inwardly as it passes in engagement with the shear member to the aperture, and means for guiding material to be cut through the aperture into the path of the cutter edge.

14. A cutting device comprising a rotatable member, means for rotating the member about its axis, a freely swingable element pivotally mounted on the member on an axis parallel to the axis of the member adjacent the outer portion of the rotatable member, said element having its center of gravity offset from its axis in a direction outwardly therefrom during operation of the device and having on its heavier side a cutter edge extending parallel to the axis, a fixed shear member having an inwardly facing arcuate surface arranged to be engaged by the cutter edge along a portion of the path of the cutter edge, an aperture in the shear member, the center of curvature of the arcuate surface of the shear member being substantially parallel to but offset from the axis of the rotatable member so that the cutter edge moves inwardly as it passes in engagement with the shear member to the aperture, and means for guiding material to be cut through the aperture into the path of the cutter edge.

15. A device as defined in claim 14 in which the rotatable member comprises an annular outwardly facing surface spaced inwardly of the pivotal axis of the swingable element a distance less than the length of the lighter side of the swingable element so as to limit the swinging of the element on its axis.

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