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S. C. NELSON

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CUTTING APPARATUS

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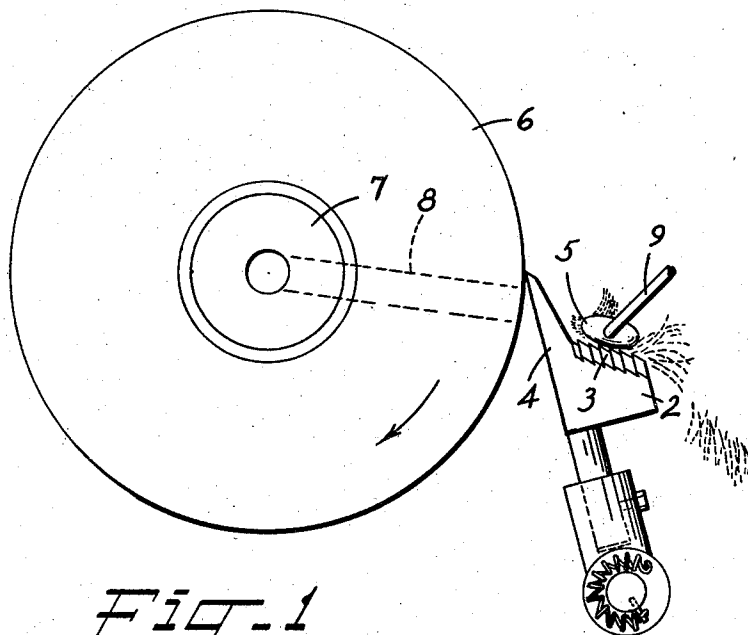


Fig. 1

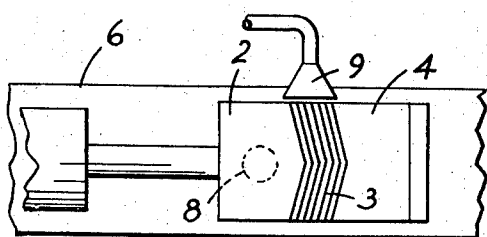


Fig. 2

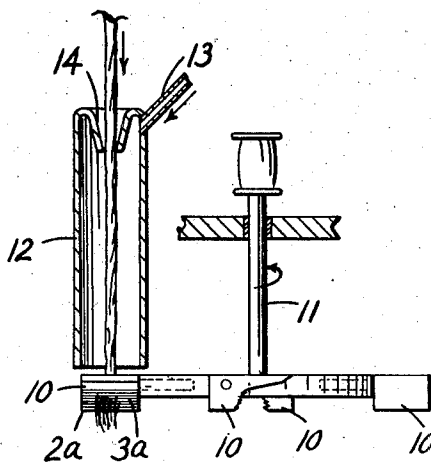


Fig. 3

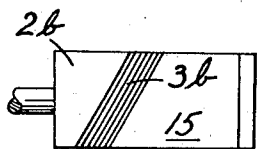


Fig. 4

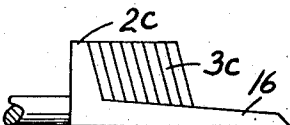


Fig. 6



Fig. 5

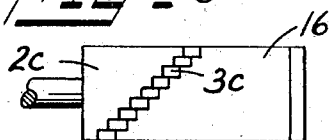


Fig. 7

INVENTOR.
Seddon C. Nelson
BY Carl A. Castellan
ATTORNEY

UNITED STATES PATENT OFFICE

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CUTTING APPARATUS

Seddon C. Nelson, Front Royal, Va., assignor to
American Viscose Corporation, Wilmington,
Del., a corporation of Delaware

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8 Claims. (Cl. 19—66)

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This invention relates to cutting apparatus for the production of staple fibers of rayon and other synthetic filamentary material and is particularly concerned with a process and apparatus for treating staple fiber during its manufacture to facilitate its subsequent processing and to improve its ultimate characteristics.

In many procedures for cutting continuous filamentary material to staple fibers, a continuous filamentary material proceeds to the cutting device as a heavy bundle such as in the form of a rope or tow of approximately circular, elliptical, or rectangular cross-section, frequently containing many thousands of filaments and this bundle is then cut to discontinuous lengths thereby forming numerous individual bunches or clumps of fibers. These clumps then proceed either to opening, carding, spinning and like processes or to subsequent stages of treatment, such as washing, bleaching, and then to the opening and other stages, depending upon their condition at the time of cutting.

In accordance with this invention, a cutting apparatus is provided in which there is relative motion at high velocity between a knife or equivalent cutting member and a cooperating member which may serve either to guide the material to cutting position or as a cooperating shear member or both, and the fiber clumps are subjected to an opening effected by collision at the time of cutting against a projection on the knife and presenting an indented surface composed of corrugations, serrations, notches and the like. The impact splatters the clump across or along the surface and the indentations assist the action by introducing offset points of impingement of the clump against the obstruction. By passing the continuous filamentary materials in a wet condition through the apparatus of the present invention so that the fibers cut are in a somewhat softened or plastic condition, there is obtained the additional desirable characteristic of crimpiness simultaneously with the opening operation so that a subsequent separate step of crimping is unnecessary to better adapt such staple fibers for subsequent textile processes, such as in carding and spinning. In this arrangement, crimping is obtained along with the opening provided the tow is in a wet or somewhat plastic condition at the time of treatment.

In the drawing, illustrative of the invention,

Figure 1 is a plan view of one embodiment of the invention, associated with a staple fiber cutter of the Beria type applying a rotatable mem-

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ber for delivering the continuous filamentary tow to the cutting element by centrifugal force.

Figure 2 is a face view of the knife of Figure 1.

Figure 3 is an elevation of a second embodiment of the invention, associated with a staple fiber cutter in which the knives are movable,

Figure 4 is a face view of a modified form of knife,

Figure 5 is a side view of the knife of Figure 4, and

Figures 6 and 7 are side and face views respectively of another modification.

Figures 1 and 2 show one form of apparatus embodying the invention. As there shown, an obstruction 2 having a serrated surface 3 is arranged upon the back of the knife 4 to receive clumps 5 of staple fibers thrown thereagainst. As shown, the knife 4 is employed with a Beria type of staple fiber cutter which normally throws the clumps of fibers cut therefrom at a fairly high velocity. This cutter comprises a shear member in the form of a rotating disk 6 having an axial feed channel 7 communicating with a radial channel 8 which opens into the periphery of the disk, the continuous filamentary material in the form of a tow being fed into the axial channel and being delivered by centrifugal force developed by rotation of the disk or by a fluid jet, such as one of water or air, directed into the axial channel so that the tow extends from the periphery of the disk and is brought by rotation of the disk into cutting relationship with the stationary knife 4 (or a plurality thereof positioned about the periphery of the disk). The serrated surface 3 of the obstruction is arranged in the path of travel of the fiber clumps 5 thrown from the disk 6 so that they are impacted thereupon and splatter across the surface thereof. This splattering is accentuated by the indentations of the surface so that considerable opening is accomplished thereby. The tow of continuous filamentary material may be in a plastic condition at the time of cutting so that the serrated surface 3 accomplishes a certain amount of crimping simultaneously with the opening of the clumps. When the fiber product is in a plastic condition, it may be desirable to assist its removal from the surface 3, which ordinarily would occur readily and rapidly by momentum or gravity, by means of a fluid jet 9 which is shown (Figure 2) above the indented surface of the obstruction with a long orifice adapted to sweep the entire surface.

Figure 3 shows a modified arrangement in which the obstruction 2a is provided on each of a number of rapidly rotating knives 10 carried by

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the shaft 11. In this form of device, the continuous filamentary material is fed downwardly through the tube 12 by the action of a jet of fluid, such as air or steam introduced at 13 back of the entrance 14. In this arrangement the obstructions 2a having the indented surfaces 3a are driven against the fiber clumps substantially immediately after they are cut.

Figures 4 and 5 show a modification of the indented obstruction 2b in which the serrations 3b slope back from one side to the other of the knife 15. This arrangement has a further advantage of directing the cut fibers downward.

Figures 6 and 7 show a further modification of the obstruction 2c in which the indentations 3c are disposed generally perpendicular to a plane parallel to the blade and shank of the knife 16.

The indented surface of the projection or obstruction may be arranged at various angles other than those shown in the drawing. Such variation yields somewhat distinct opening characteristics and when a wet filamentary material is being operated upon they provide some variation of crimping characteristics. The form of indentations may be various, the serrated and stepped modifications shown in the drawing being merely illustrative. The dimensions of the indentations may vary widely. However, certain dimensions are preferably smaller than particular dimensions of the clumps of staple fibers being cut, depending upon the manner in which the clumps strike the indented surface. For example, in the arrangement of Figures 1 and 2, where the length of the fiber clumps strikes transversely of the serrations, the "pitch" of the serrations should be smaller than the length of the clump, so that a clump bears against a plurality of the serrations. In the arrangement of Figures 6 and 7 where the steps shear off portions of the clump, the height of the steps facing the clumps should be smaller than the bundle thickness or diameter so that a plurality of shearings are effected upon each clump.

As stated above the operation of the cutting devices of this invention has as its main purpose the opening of the staple fiber clumps when it is performed upon a dry tow so that subsequent processing can be more efficiently performed upon the product. However, when the invention is applied to the handling of a wet continuous filamentary material, it has the function not only of opening the fiber clumps but of crimping the fibers within the clumps. Previous procedures involving the cutting of staple fibers from a continuous filamentary tow in a wet condition ordinarily sent the clumps obtained at the cutting step through wet treatment processes, such as washing, bleaching and then drying. It has been found that the application of the devices of this invention to the production of staple fiber from filamentary material in the wet condition has resulted in making the subsequent wet processing and drying treatments markedly more efficient since the opened staple permits a better penetration of the treatment liquids and a more uniform and rapid distribution of heat and gases in drying. The devices of the present invention have the additional highly important advantage of being extremely simple and inexpensive modifications of the knives alone.

While preferred embodiments have been disclosed, the description is intended to be illustrative only, and it is to be understood that changes and variations may be made without departing

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from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. A device for cutting continuous filamentary material to fibers of discontinuous lengths comprising a cutting member having a cutting edge, a member co-operating therewith to guide the leading end of the material into cutting position, means for imparting a high velocity to one of the members relative to the other in a direction generally transverse of the cutting edge, and a projection on the cutting member having an indented surface spaced back of the cutting edge and away from the guiding member in a direction transverse of the direction of the cutting edge and arranged to face the leading end of the material when the latter is near the cutting position so that collision of the fibers therewith occurs upon cutting action whereby an opening and crimping action is exerted upon the fibers as they collide.

2. A device for cutting continuous filamentary material to fibers of discontinuous lengths comprising a knife having a cutting edge, and a projection thereon having an indented surface spaced back of the cutting edge with its indentations disposed to provide longitudinal ridges lying in planes which are generally parallel to the cutting edge, said surface being inclined to face the material being cut so that collision of the fibers therewith occurs upon cutting action whereby an opening and crimping action is exerted upon the fibers as they collide.

3. A device for cutting continuous filamentary material to fibers of discontinuous lengths comprising a knife having a cutting edge, a member co-operating therewith to guide the leading end of the material into cutting position, means for imparting a high velocity to the knife in a direction generally transverse of the cutting edge, and a projection on the knife having an indented surface spaced back of the cutting edge and away from the guiding member in a direction transverse of the direction of the cutting edge and arranged to face the leading end of the material when the latter is near the cutting position so that collision of the fibers therewith occurs upon cutting action whereby an opening and crimping action is exerted upon the fibers as they collide.

4. A device for cutting continuous filamentary material to fibers of discontinuous lengths comprising a stationary knife having a cutting edge, a member co-operating therewith to guide the leading end of the material into cutting position, means for imparting a high velocity to the co-operating member in a direction generally transverse of the cutting edge, and a projection on the knife having an indented surface spaced back of the cutting edge and away from the guiding member in a direction transverse of the direction of the cutting edge and arranged to face the leading end of the material when the latter is near the cutting position so that collision of the fibers therewith occurs upon cutting action whereby an opening and crimping action is exerted upon the fibers as they collide.

5. In combination, a centrifugal cutting device having a stationary knife having a cutting edge, a rotary element for feeding a filamentary bundle endwise and outwardly into cutting engagement transverse of the knife, a projection on the back of the knife away from the rotary element having an indented surface spaced back of the cutting edge in a direction transverse of the direction of the cutting edge, said indented surface facing the portion of the bundle fed outwardly of the rotary

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element, and means for rotating the element at high speed to impel the cut fiber bundles against the indented surface of the projection on the back of the knife whereby an opening and crimping action is exerted upon the fibers as they collide.

6. A device for cutting continuous filamentary material to fibers of discontinuous lengths comprising a cutting member having a cutting edge, a member co-operating therewith to guide the leading end of the material into cutting position, means for imparting a high velocity to one of the members relative to the other in a direction generally transverse of the cutting edge, a projection on the cutting member having an indented surface spaced back of the cutting edge and away from the guiding member in a direction transverse of the direction of the cutting edge and arranged to face the leading end of the material when the latter is near the cutting position so that collision of the fibers therewith occurs upon cutting action whereby an opening and crimping action is exerted upon the fibers as they collide, and means for removing fibers from the indented surface.

7. A device for cutting continuous filamentary material to fibers of discontinuous lengths comprising a cutting member having a cutting edge, a member co-operating therewith to guide the leading end of the material into cutting position, means for imparting a high velocity to one of the members relative to the other in a direction generally transverse of the cutting edge, a projection on the cutting member having an indented surface spaced back of the cutting edge and away from the guiding member in a direction transverse of the direction of the cutting edge and arranged to face the leading end of the material when the latter is near the cutting position so that collision of the fibers therewith occurs upon cutting action whereby an opening and crimping action is exerted upon the fibers as they collide,

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and fluid means for blowing fibers from the indented surface.

8. In combination, a centrifugal cutting device having a stationary knife having a cutting edge, a rotary element for feeding a filamentary bundle endwise and outwardly into cutting engagement transverse of the knife, a projection on the back of the knife away from the rotary element having an indented surface spaced back of the cutting edge in a direction transverse of the direction of the cutting edge, said indented surface facing the portion of the bundle fed outwardly of the rotary element, means for rotating the element at high speed to impel the cut fiber bundles against the indented surface of the projection on the back of the knife whereby an opening and crimping action is exerted upon the fibers as they collide, and fluid means for blowing fibers from the indented surface.

SEDDON C. NELSON.

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