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PRODUCTION OF STAPLE FIBER

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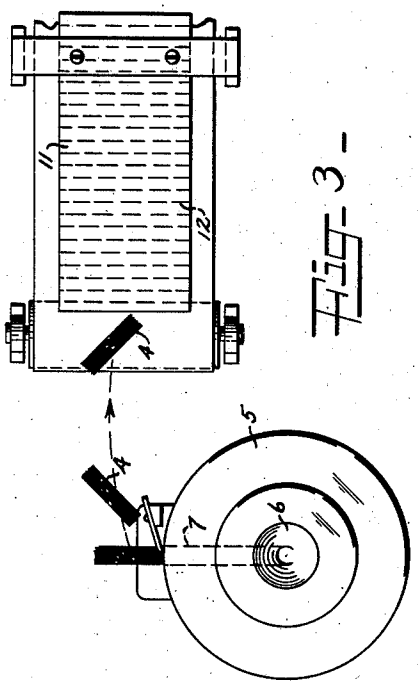


Fig-3-

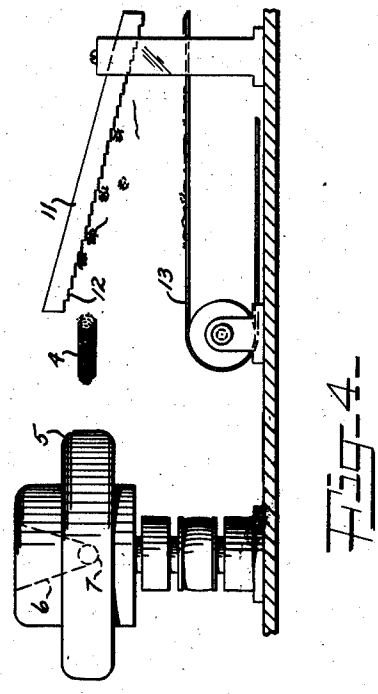


Fig-4-

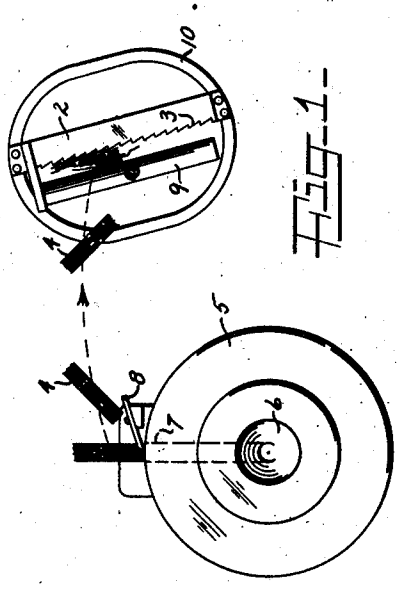


Fig-1-

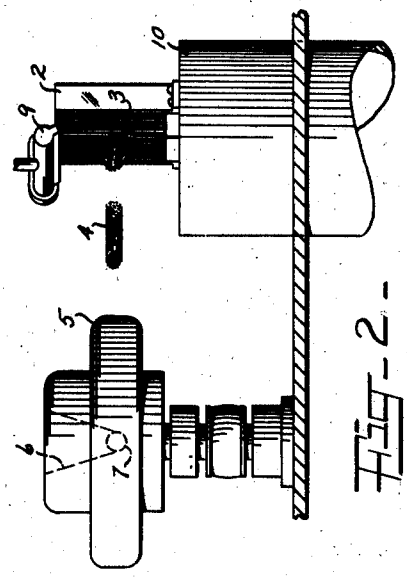


Fig-2-

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PRODUCTION OF STAPLE FIBER

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9 Claims. (Cl. 19—66)

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This invention relates to 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, the fiber clumps are subjected to an opening effected by throwing them against an obstruction 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 carrying out the procedure of the invention while the fiber clumps are in a wet condition such that the fibers 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.

The opening treatment in accordance with the invention whether performed under conditions favoring crimping or not may advantageously be associated directly with the cutting operation by arranging the indented surface obstruction in the path of discharge of the cut fiber clumps from a cutter of the Beria type applying a rotatable member for delivering the continuous filamentary tow to the cutting element by centrifugal force. 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,

Figure 2 is an elevation of the embodiment of Figure 1,

Figure 3 is a plan view of a second embodiment

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of the invention, associated with a staple fiber cutter, and

Figure 4 is an elevation of the embodiment of Figure 3.

Figures 1 and 2 show one form of apparatus adapted to accomplish the invention. As there shown, an upright obstruction 2 having a serrated surface 3 is arranged to receive clumps 4 of staple fibers thrown thereagainst. Any form of device may be employed to throw the clumps of staple fibers against the obstruction, but, as shown, there is employed a form of staple fiber cutter which normally throws the clumps of fibers cut therefrom at a fairly high velocity. This cutter comprises a rotating disc 5 having an axial feed channel 6 communicating with a radial channel 7 which opens into the periphery of the disc, 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 disc or by a fluid jet, such as of water or air, directed into the axial channel so that the tow extends from the periphery of the disc and is brought by rotation of the disc into cutting relationship with a stationary knife 8 (or a plurality thereof positioned about the periphery of the disc). The serrated surface 3 of the obstruction is arranged in the path of travel of the fiber clumps 4 thrown from the disc 5 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 gravity, by means of a fluid jet 9 which is shown above the indented surface of the obstruction with a long orifice adapted to sweep the entire surface. A duct 10 is arranged beneath the obstruction 2 so that it may receive the opened clumps discharged from the indented surface.

Figures 3 and 4 show a modified arrangement in which the obstruction is provided with an inverted stepped surface 12 on which the surfaces of the steps are arranged substantially parallel to the plane of rotation of the radial channel 7 of the disc 5 of a staple fiber cutter such as that shown in Figures 1 and 2. Since the fiber clumps 4 have a high velocity when they strike the stepped under surface 12 of the obstruction 11, the various steps shear off portions of the fiber bundles or clumps. As in the embodiment of Figures 1 and 2, carrying out the invention with

fiber clumps which are in a wet or somewhat softened condition also gives rise to crimping since the fiber clump ordinarily strikes the steps at an angle. A suitable conveyor, here shown as a conveyor belt 13, is disposed beneath the obstruction 11 to receive the opened staple and transfers it to the next point of operation. If desired, a jet of fluid may be arranged to cooperate with the obstruction in a manner similar to that in Figures 1 and 2.

The indented surface of the 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 of the 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 3 and 4 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 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 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 procedure of this invention to staple fiber clumps at the time of their cutting while 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 procedure of the present invention has the additional highly important advantage of being readily combined with the cutting operation so that these two steps can for practical purposes be considered as a single operational procedure.

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

I claim:

1. In a device adapted to subject fibers to opening, crimping or the like, an obstruction having an indented surface and means for impelling a clump of textile fibers of spinnable length at high velocity in free flight against said surface, said obstruction having a pitch distance facing the clump in its flight less than the effective dimension of the clump parallel thereto.

2. In a device adapted to subject fibers to opening, crimping or the like, an obstruction having a grooved surface and means for impelling a clump of textile fibers of spinnable length at high velocity in free flight against said surface, said obstruction having a pitch distance facing the clump in its flight less than the effective dimension of the clump parallel thereto.

3. In a device adapted to subject fibers to opening, crimping or the like, an obstruction having a stepped surface and means for impelling a clump of textile fibers of spinnable length at high velocity in free flight against the surface, said obstruction having a pitch distance facing the clump in its flight less than the effective dimension of the clump parallel thereto.

4. In a device adapted to subject fibers to opening, crimping or the like, an obstruction having a grooved surface and means for impelling a clump of textile fibers of spinnable length at high velocity in free flight against said surface with the length of the clump generally transverse of the grooves, said obstruction having a pitch distance facing the clump in its flight less than the effective dimension of the clump parallel thereto.

5. In combination, an obstruction having a stepped surface and means for impelling a clump of textile fibers of spinnable length at high velocity in free flight against the surface with the length of the clump in a plane approximately parallel to the corner edges of the steps, said obstruction having a pitch distance facing the clump in its flight less than the effective dimension of the clump parallel thereto.

6. In combination, an obstruction having an indented surface, means for cutting a clump of textile fibers from a bundle of continuous filamentary material and for impelling the clump in free flight against said surface, said obstruction having a pitch distance facing the clump in its flight less than the effective dimension of the clump parallel thereto.

7. In combination, a centrifugal cutting device for simultaneouly cutting filamentary material and for impelling the fiber bundle cut therefrom and an obstruction having an indented surface arranged to present its indented surface to the cut fiber bundle impelled from said cutter.

8. In combination, a centrifugal cutting device for simultaneously cutting filamentary material and for impelling the cut fiber bundle therefrom and a grooved obstruction arranged in the path of discharge of the cut fiber bundle with the grooves transverse to the plane of flight of the bundle.

9. In combination, a centrifugal cutting device for simultaneously cutting filamentary material and for impelling the cut fiber bundle therefrom and an obstruction having a stepped surface arranged to receive the cut fiber bundles discharged therefrom with the corner edges of the steps in a plane approximately parallel to the plane of flight of the clump.

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