Sept. 22, 1942. J. E. SPALDING ET AL 2,296,298

STAPLE FIBER CUTTER

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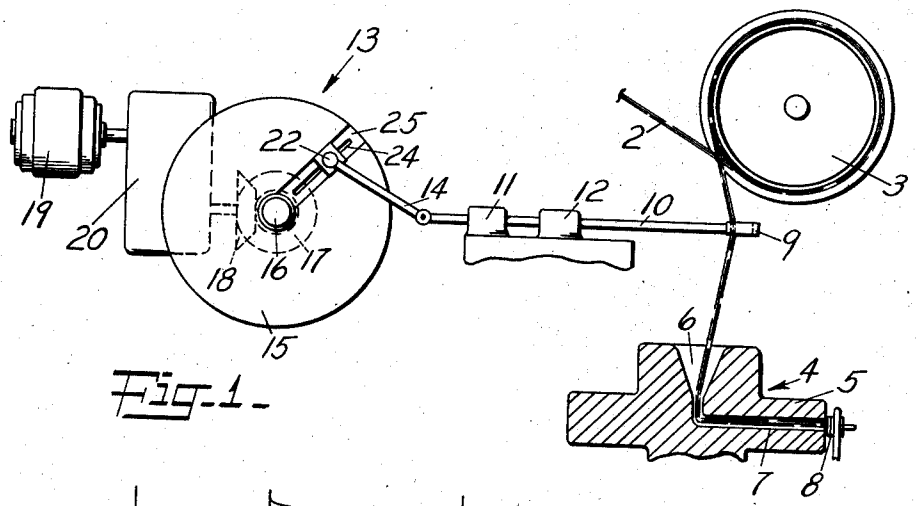


Fig-1-

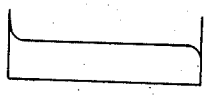


Fig-4-

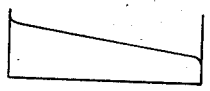


Fig-5-

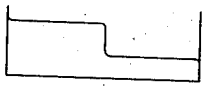


Fig-6-

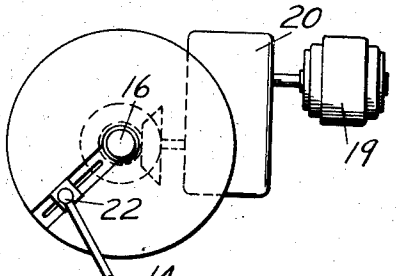


Fig-3-

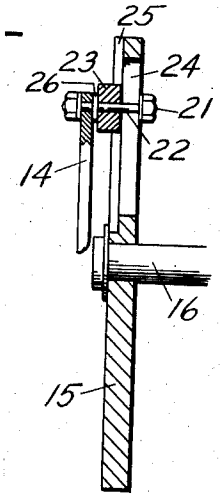
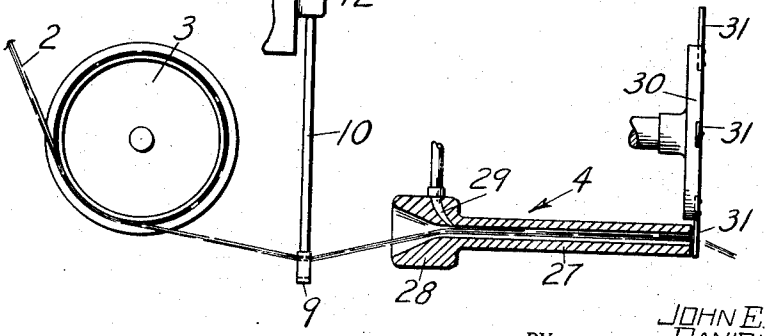


Fig-2-



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STAPLE FIBER CUTTER

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17 Claims. (Cl. 164—17)

This invention relates to an apparatus for cutting staple fibers to produce a product having a variety of lengths.

It has been generally accepted that textile fibers of similar or different character blend better during processing and produce a yarn of better uniformity if the fibers have a diversity of lengths. The optimum extent and distribution of such diversity differs according to the type of yarn or fabric which is to be produced and the textile system which is to be employed therefor. It is the object of this invention to provide an apparatus for facilitating the production of staple fibers having a diversity of lengths, which apparatus may be controlled to produce mixtures of fibers having an indefinitely large number of combinations of staple lengths. Such distributions of lengths are conveniently represented by stable fiber diagrams, commonly referred to in the art as "Baer diagrams." Further objects of the invention will be apparent from the drawing and description thereof hereinafter.

In the drawing, illustrating certain embodiments of the invention,

Figure 1 shows an elevation of one embodiment,

Figure 2 shows an enlarged detail view of the crank mechanism of Figure 1, partially in cross section,

Figure 3 shows an elevation of a second embodiment of the invention, partially in cross section,

Figure 4, Figure 5, and Figure 6 show length distribution diagrams obtainable in accordance with the invention.

In general, the invention involves a feeding means for positively delivering a tow or filamentary bundle at a fixed rate to a cutting device and the interposition of a device between the positive feeding means and the cutting means to alter the length of the filamentary material which is presented to the blades of the latter between successive instants of cutting.

In Figures 1 and 2, filamentary material 2 in the form of a bundle or tow is drawn about the drum 3 one or more times from which it is delivered at a constant rate, depending upon the speed of rotation of the drum, to the cutting means 4, which is shown in this figure as constituting the centrifugal disk 5 having the entrance 6 connected with the radial channel 7 therein and the knife 8. While only one knife is shown, the frequency of cutting may be modified by substituting a plurality of knives around the disk periphery. Similarly other factors, such as the speed of rotation of the centrifugal disk, may be varied to obtain any desired cutting frequency.

In passing from the feeding drum 3 to the cutting device 4, the filamentary material passes through the eye 9 of a reciprocating rod 10 operated in guides 11 and 12 by the crank mechanism 13 linked to the other end of the reciprocating rod 10 by the member 14. The crank mechanism comprises a disk 15 mounted for rotation with the shaft 16 which is operated by means of bevel gears 17 and 18 connected with the motor 19 and variable speed gear box 20. The crank arm may be adjusted by loosening the nut 21 and sliding the stud bolt 22 and block 23 along the slot 24 and groove 25 respectively, and again clamping the stud bolt 22 in position at the desired distance from the center of the shaft 16. The bolt may be formed with the flange 26 to permit of clamping it in the desired position and to serve as a bearing for the face of the end of the link member 14 pivoted upon the stud bolt.

In Figure 3, the feeding drum 3 and reciprocating rod 10 with its connections are arranged to cooperate with a modified form of cutting means 4. The cutter comprises a tube 27 having a head 8 in which a nozzle 29 is formed which may be supplied with compressed air for forcing the filamentary bundle through the tube. A rotary disk 30 provided with one or more cutting knives 31 (four being shown in Figure 3) cuts the filamentary material as it emerges from the tube.

In operation of the device, the feeding drum preferably rotates at constant speed thereby delivering the filamentary material at a constant rate. Similarly the centrifugal disk (referring to Figure 1) rotates at a constant speed in a manner that would normally produce from filamentary material fed to it at a constant rate, fibers having substantially equal lengths. However, the function of the reciprocating rod is to vary the length of path of the filamentary material from the feeding drum to the entrance (and consequently the exit) of the disk. Hence, by making the eye of the reciprocating rod occupy various positions at successive instants of cutting, the amount of filamentary material protruding from the centrifugal disk at successive instants of cutting differs and depends upon tne extent to whicn the length of the path of the filamentary material has been increased or decreased between successive instants of cutting. For example, should one instant of cutting coincide with the

position of the guide eye which is in alignment with the shortest path of the filamentary material as it passes from the delivery drum to the entrance of the centrifugal disk, and should the following instant of cutting coincide with that position of the guide eye which produces maximum displacement from this shortest path, then a minimum staple length is obtained from the latter cut. Conversely, should one instant of cutting coincide with the guide eye position corresponding with the maximum displacement from the shortest path of the filamentary material and the successive instant coincide with the guide eye position which is in alignment with this shortest path, then a maximum staple length results from the latter cut.

The median staple length is regulated by bringing the speed of the feeding device and frequency of cuts into proper relationship. The maximum and minimum staple lengths are regulated by bringing the extent (amplitude) and periodicity of the motion of guide eye into proper relation with the frequency of cuts. The distribution among the variety of lengths is regulated by controlling the synchronization, or deviation therefrom, between the instants of cutting and the motion of the guide eye; also by regulating the nature of the motion of the guide eye as for example, simple harmonic motion or more complex motions obtainable by cams, linkages, etc.

For a given median staple length there are an infinite number of combinations of extent and periodicity of motion of the guide eye which result in the same maximum and minimum length. However, the distribution is affected by the particular combination which is selected. The periodicity may or may not be synchronized with the frequency of cutting, as desired. If synchronization is employed, only a limited number of staple lengths, corresponding to the synchronized relationships, are produced; if synchronization is not employed fibers of substantially all lengths between minimum and maximum are obtained. When synchronization is not employed, the greater the frequency of the periodic motion of the guide eye, the larger the percentage of fibers at lengths near the maximum and minimum lengths; the less the frequency the larger the percentage of lengths near the median length.

To illustrate these relative differences, reference may be had to Figures 4, 5, and 6. In Figure 4 there is shown a distribution diagram of staple fiber produced with a relatively low frequency of the periodic motion of the guide eye, the motion not being synchronized with the instants of cutting. In Figure 5 there is shown a distribution diagram of staple fiber produced with a relatively high frequency of the guide eye motion, no synchronization being employed. In Figure 6 is shown a distribution diagram of a staple resultant from synchronizing the motion of the guide eye with that of the cutting means such that successive cuts come only at the instant of maximum displacement or the instant of minimum displacement of the path of the filamentary material passing from the feeding means to the cutting means. In these figures the vertical distances to the curve represent the length of fibers while equal distance along the horizontal axis of the diagram represents equal numbers of fibers. In addition to the examples cited, an indefinitely large number of combinations of lengths and distributions may be obtained by regulating the controlling variables described herewith.

To obtain further variations, adjustment may be made of the distance between the delivery drum and the entrance to the cutting means, which two points function generally as stationary guides between which the moving guide eye operates. Variation of this distance produces an effect corresponding to that resulting from variation in extent of the motion of the guide eye. If desired, fixed guides may be placed at any points on either side of the moving guide eye. Such an arrangement simplifies any calculations that may be desired to be made to predetermine the character of the distribution diagram of the product desired. If desired, there may be a multiplicity of fixed and moving guides for achieving particular distributions of staple length.

While preferred embodiments of the invention 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 or scope of the invention as defined by the appended claims.

What we claim is:

1. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, means for feeding filamentary material to said cutting means, and means for varying the lengths of the filamentary material extending from the feeding means to the cutting means at successive instants of cutting.

2. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, means for feeding filamentary material to said cutting means, and means for varying the rate of delivery of said filamentary material to said cutting means between successive instants of cutting.

3. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, means for feeding said filamentary material to said cutting means, means for altering the path of said filamentary material between said feeding means and said cutting means between successive instants of cutting.

4. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, means for feeding said filamentary material to said cutting means, a movable guide for said filamentary material between said feeding means and said cutting means, and means for moving said guide to various positions to alter the lengths of filamentary material instantaneously held between said feeding means and said cutting means at successive instants of cutting.

5. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, means for feeding said filamentary material to said cutting means, a movable guide for said filamentary material between said feeding means and said cutting means, and means for imparting periodic motion to said guide such that a component of the motion is transverse to the path of said filamentary bundle.

6. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, means for feeding said filamentary material to said cutting means, two stationary guides for said filamentary

material spaced apart and located between said feeding means and said cutting means, and means extending between said stationary guides for varying the length of the path of the filamentary material therebetween.

7. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, means for feeding said filamentary material to said cutting means, two stationary guides for said filamentary material spaced apart and located between said feeding means and said cutting means, a movable guide for said filamentary material between said stationary guides, and means for moving said guide into and out of alignment with said stationary guides.

8. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, means for feeding said filamentary material to said cutting means, two stationary guides for said filamentary material spaced apart and located between said cutting means and said feeding means, a movable guide for said filamentary material between said stationary guides, and means for imparting periodic motion to said guide such that one component of the motion is transverse to the line between said stationary guides.

9. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, and means for varying the length of fibers severed from said filamentary material at successive instants of cutting.

10. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, means for feeding filamentary material to said cutting means, and means for varying the lengths of the filamentary material presented by said feeding means to the cutting means at successive instants of cutting.

11. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, means for feeding filamentary material to said cutting means, said feeding means comprising a positive feeding element, and means for varying the lengths of the filamentary material extending from the positive feeding element to the cutting means at successive instants of cutting.

12. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, and means associated with said feeding means for altering the path of said filamentary material as it approaches said cutting means between successive instants of cutting.

13. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, means for feeding said filamentary material to said cutting means, a movable guide associated with said feeding means, and means for moving said guide to various positions to alter the lengths of filamentary material presented by said feeding means to said cutting means at successive instants of cutting.

14. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, means comprising a positive feeding element for feeding said filamentary materials to said cutting means, a movable guide for said filamentary material between said positive feeding element and said cutting means, and means for moving said guide to various positions to alter the lengths of filamentary material instantaneously held between said feeding means and said cutting means at successive instants of cutting.

15. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, means for feeding said filamentary material to said cutting means, said feeding means comprising a positive feeding element delivering said filamentary material at a constant rate, a movable guide for said filamentary materials between said positive feeding element and said cutting means, and means for moving said guide to various positions to alter the lengths of filamentary material instantaneouusly held between said positive feeding element and said cutting means at successive instants of cutting.

16. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, means for feeding said filamentary material to said cutting means, said feeding means comprising a positive feeding element for delivering said filamentary material at a constant rate, a movable guide for said filamentary materials between said positive feeding element and said cutting means, and means for imparting periodic motion to said guide such that a component of the motion is transverse to the path of said filamentary bundle.

17. In apparatus of the character described, means for cutting filamentary material at intervals to discontinuous lengths, means for feeding said filamentary material to said cutting means, said feeding means comprising a positive feeding element for delivering said filamentary material at a constant rate, two stationary guides for said filamentary materials spaced apart and located between said positive feeding element and said cutting means, and means extending between said stationary guides for varying the length of the path of the filamentary material therebetween.

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