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STAPLE FIBER CUTTING MECHANISM

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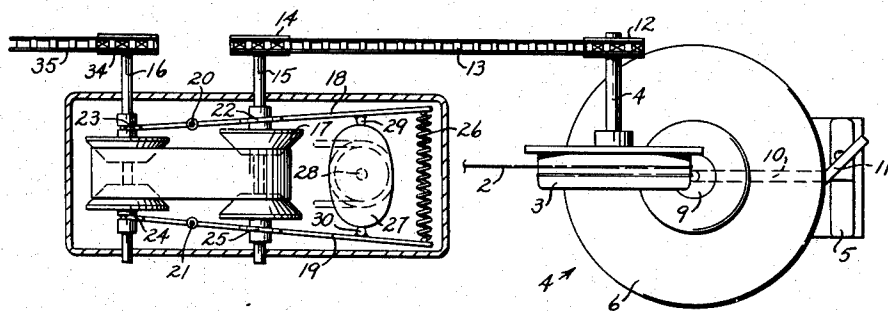


Fig. 1-

Fig. 3-

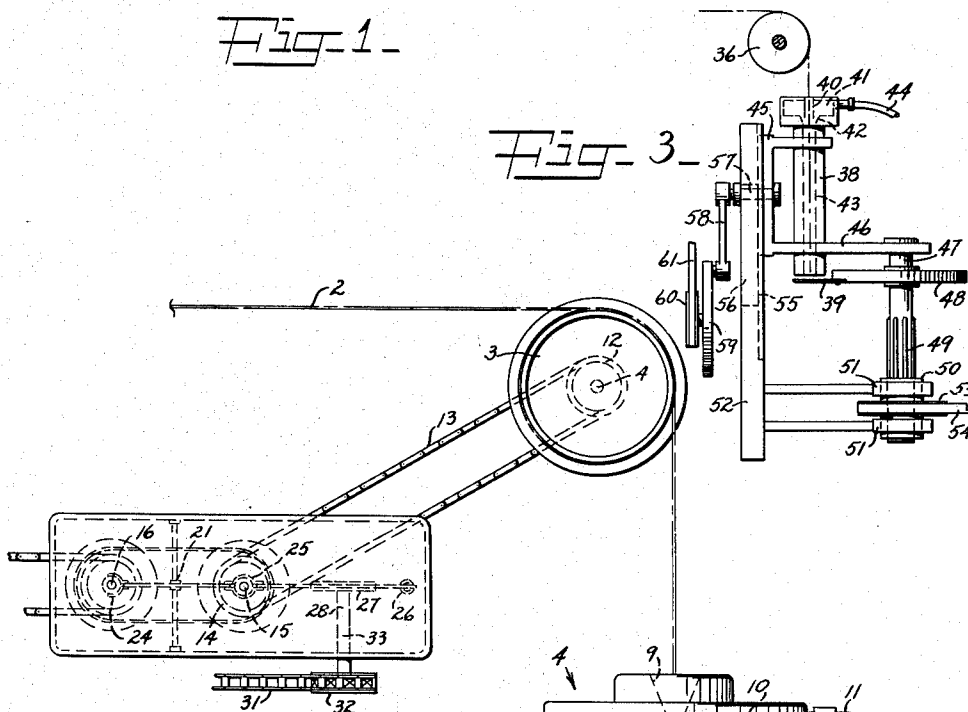


Fig. 2-

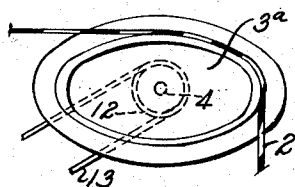


Fig. 4-

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STAPLE FIBER CUTTING MECHANISM

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19 Claims. (Cl. 164—36)

This invention relates to an apparatus for cutting staple fiber to produce a product directly having a plurality of lengths.

It has been determined that textile fibers of similar or different character blend better during processing, particularly according to the woolen or worsted systems, and produce a yarn of improved 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. It is a further object of the invention to provide novel arrangements for producing staple fiber products composed of mixtures of fibers having a diversity of lengths and in which the various fibers may be characterized by variations in other characteristics, such as denier, stretch and shrinkage. Further objects of the invention will be apparent from the drawing and the description thereof hereinafter.

In the drawing, illustrating certain embodiments of the invention,

Figure 1 is a plan view of one modification, with certain parts in cross-section,

Figure 2 is a side elevation of the embodiment of Figure 1, and

Figure 3 is an elevation of a second embodiment of the invention.

Figure 4 is a side elevation of a modified form of delivery roll.

In accordance with this invention, a tow or other bundle of filamentary material is delivered to one or more cutting positions and means are provided for varying the amount of tow presented for cutting at successive instances of cutting. More specifically, this variation in the delivery of tow to the cutting position may be performed by varying the relative distance between the cutting means and a constant speed tow delivery roll, by variations in the linear peripheral speed of the delivery roll, or by a combination of both of these devices.

Figures 1 and 2 show an embodiment in which the speed of the tow roll is varied. As shown in these figures, the tow 2, as it is removed from a suitable source of supply, such as directly from an artificial filament spinning machine or from a creel, is lapped about the feed or delivery roll 3

one or more turns and proceeds to the cutting device 4 which may be any suitable staple fiber cutter. The specific cutter shown is of the Beria type and comprises a suitable stand 5 within which the cutter disk 6 is rotatably mounted so that it may be driven by means of the pulley 7 on its shaft 8. The disk 6 has the entrance channel 9 which communicates with the radial channel 10 and by virtue of centrifugal force, the filamentary material is thrown radially outwardly from channel 10 into the way of the knife 11, which may be stationarily mounted. The delivery roll 3 is mounted on a suitable shaft 4a to which a sprocket 12 is fixed, this sprocket being driven by a chain 13 and the sprocket 14 upon the shaft 15 of any form of variable speed transmission. The variable speed transmission shown is of a well known type and comprises the parallel shafts 15 and 16, each of which is provided with a pair of conically faced pulleys 17 having their conical faces opposed which are adapted to be moved closer together or farther apart by the levers 18 and 19 pivoted at 20 and 21 and are provided with yokes 22, 23, 24, and 25 extending about the hubs of the pulleys and may be provided with suitable pins adapted to project into grooves within the hubs. These levers are connected at their free ends by means of a spring 26 which tends to bring the free ends together. In addition, an oval or elliptical cam 27 is mounted upon a vertical shaft 28 between the two levers and a short distance from their connection with the spring. The levers may be provided with suitable followers 29 and 30, such as rollers, adapted to press against the surface of the cam. This cam may be rotated at any desired speed by means of a suitable motor (not shown) and a chain 31 operating upon a sprocket 32 mounted on the shaft 33. In this manner, the cam alternately spreads and permits the spring to bring together the free ends of the levers, thereby constantly varying the ratio between the two parallel shafts of the variable speed transmission. The power receiving shaft 16 is provided with a sprocket 34 by which it may be driven by a chain 35 and a motor (the latter not being shown).

A staple fiber product having any desired maximum and minimum fiber lengths and any desired length distribution may readily be obtained by substituting different shapes of cams, by varying the speed of the cam used, or by changing the speed and changing the cam. Further variations may be made by changing the sprocket ratios, though ordinarily sufficient variation may

be obtained by controlling the speed of rotation of the cam or by selecting a cam of particular shape. Alternatively, the linear peripheral speed of the tow delivery roll may be varied by substituting a tow roll of non-circular shape, such as an elliptical roll 3a shown in Figure 4, and operating it at either constant or varying angular velocity. In any case, the maximum speed of the tow delivery from roll 3 should preferably not exceed the radial velocity imparted by centrifugal force to the filamentary material within the centrifugal disk. Where necessary or desirable, the velocity of the filamentary material through the centrifugal disk may be increased by directing a jet of fluid, such as of liquid or air into the entrance channel of the centrifugal disk to assist the filamentary material therethrough. In some cases, it is permissible to increase the speed of rotation of the centrifugal disk to increase the speed of travel of the filamentary material therethrough, but this procedure is circumscribed by the fact that increase of rotation of the disk increases the frequency of cutting.

The filamentary bundle proceeding to the delivery roll may be taken from a creel of wound packages of filamentary material, such as spools or bobbins of yarns or cakes of rayon. Alternatively, the filamentary material proceeding to the delivery roll may be taken directly from a spinning machine by which is meant a machine for spinning artificial filamentary material by extrusion of plastic material, such as viscose and the like, through the orifices of spinnerets from which it is drawn through a suitable coagulating medium about the periphery of a godet positively driven at substantially constant speed, or in succession about the periphery of a plurality of such godets between any two or more of which the material may, if desired, be subjected to stretching or shrinkage or to stretching and shrinkage in succession. The filamentary material proceeding from the godet or godets of each spinning station on the machine (for example, from the godets 26 of the machine of Griffin Patent 1,950,922) may be directed by suitable guides to a common tow delivery roll, such as roll 3 of Figure 2. In this case, the operation of the tow delivery roll at varying speed varies the tension on the filamentary material while still in somewhat plastic condition as it travels from the last godet at each station to the tow delivery roll, but it does not affect the filaments in proximity to the spinnerets which might give rise to spinning difficulties. The staple fiber product obtained when the speed of the tow delivery roll 3 is continually varied is composed of individual fibers which have various deniers and which have been variously stretched and therefore exhibit various characteristics of extensibility, strength, shrinkage, etc.

Figure 3 shows in elevation another embodiment of the invention in which there is provided a means for changing the distance from the tow delivery roll 36 to the cutting device 37 by imparting relative movements thereto. This relative movement may be accomplished either by means of oscillation or reciprocation of the tow roll or by means of oscillation or reciprocation of the cutting device. In the simplest form, the tow delivery roll is rotated at constant speed, but further variation in the length of staple fiber may be produced by superimposing a variation which would be effected by variations in the speed of the tow roll in addition to varying the distance from the tow roll to the cutting means. 75

Where the variation in distance between tow roll and cutting means is obtained by moving or displacing the tow roll, such movement or displacement may be imparted in such a manner and may be so controlled that it does not affect the tension in the tow, particularly if it is being taken directly from a spinning machine, as it approaches the tow delivery roll regardless of whether this tension is constant or continually varying by virtue of constant speed or continually varying speed of rotation respectively of the tow roll. On the other hand, the movement of the tow roll may be such as to cause a variation of the tension in the tow as it approaches the tow roll. The former condition is obtained by moving the tow roll so that the point of tangency of the tow on the roll where it first comes into contact with the roll swings about an arc centered at the last tow guide of the spinning machine preceding the tow delivery roll. The latter condition, on the other hand, in which the motion of the tow roll affects the tension in the tow as it approaches the tow roll is obtained by movements of the tow roll which do not fall in such an arc.

In the illustrative embodiment of Figure 3, the tow passes about the tow delivery roll 36 which, as shown, is mounted at a fixed point for rotation thereabout and is preferably rotated at constant speed, though, if desired, additional effects may be obtained by varying the speed of the tow roll continually. The filamentary tow or bundle, as it proceeds from the tow roll 36, passes through the tubular guiding means 38 into the path of a rotating knife 39. This tubular guide 38 comprises a short nipple 40 at its entrance which extends through a surrounding chamber 41 in the head and terminates concentrically of the opening 42 of the main bore 43 in the tubular guide where it adjoins the chamber. A flexible connection 44 communicates with the chamber 41 so that it may be provided with a jet of fluid, such as water or air, regardless of its position during its motion. This fluid jet serves to draw the filamentary material through the main portion of the tubular guide and is of sufficient force to take up any slack that might otherwise occur in the length of tow extending from the tow roll 36 to the tubular guide 38 as they approach and recede from each other. The tubular guide 38 is securely mounted within the slidable bracket 45, upon one of the arms 46 of which the shaft 47 for the cutting disk 48 is rotatably supported. The shaft of the cutting disk is splined at its lower end 49 and is adapted to be rotated by an internally grooved sleeve 50 which is supported within the bearings 51 upon a stationary member of the machine, such as the guide plate 52. The grooved sleeve 50 is provided with a pulley 53 which is operated by the belt 54, the splines permitting the shaft 47 to be reciprocated axially within the grooved sleeve 50. The bracket 45 is slidably mounted within a suitable dovetail grooved guideway 55 within the plate 52 which is provided with a slot 56 for accommodating a pin 57 which extends therethrough from the bracket 45 to a connecting rod 58, the other end of which is eccentrically secured to the crank disk 59 which may be rotated by its shaft mounted in suitable bearings. A pulley 60 and belt 61, for example, transmit power to the crank disk shaft from a motor (not shown).

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 variation may be made without departing from the spirit or scope of the invention as defined by the appended claims.

What I claim is:

1. In combination, means having at least one cutting station for cutting filamentary material at intervals to discontinuous lengths, means comprising a positive feeding element for feeding said filamentary material to said cutting means, and means for varying the distance from said element to said cutting station of the cutting means during operation.
2. In combination, means having at least one cutting station for cutting filamentary material at intervals to discontinuous lengths, means comprising a positive feeding element for feeding said filamentary material directly to said cutting means, and means for continuously varying the distance from said element to said cutting station of the cutting means.
3. In combination, means having at least one cutting station for cutting filamentary material at intervals to discontinuous lengths, means comprising a positive feeding element for feeding said filamentary material to said cutting means, and means for effecting relative motion between said element and said cutting station of the cutting means during operation.
4. In combination, means having at least one cutting station for cutting filamentary material at intervals to discontinuous lengths, means comprising a positive feeding element for feeding said filamentary material to said cutting means, and means for continuously effecting relative motion between said element and said cutting station of the cutting means during operation.
5. In combination, means having at least one cutting station for cutting filamentary material at intervals to discontinuous lengths, means comprising a positive feeding element for feeding said filamentary material to said cutting means, and means for moving said cutting means to vary the distance of the cutting station from the feeding element during operation.
6. In combination, means having at least one cutting station for cutting filamentary material at intervals to discontinuous lengths, means comprising a positive feeding element for feeding said filamentary material to said cutting means, and means for continuously moving said cutting means to vary the distance of the cutting station from the feeding element.
7. In combination, means for cutting filamentary material at intervals to discontinuous lengths, means comprising a positive feeding element for delivering said filamentary material to said cutting means, and means for varying the delivery speed of said feeding means during operation.
8. In combination, means for cutting filamentary material at intervals to discontinuous lengths, means comprising a rotatable roll for positively delivering said filamentary material to said cutting means and means for varying the speed of rotation of said roll during operation.
9. In combination, means for cutting filamentary material at intervals to discontinuous lengths, means comprising a rotatable member for positively delivering said filamentary material to said cutting means, said member being of non-circular cross-section to effect a variation of linear peripheral speed and delivery speed, and means for rotating said member.
10. In combination, means for cutting filamentary material at intervals to discontinuous lengths, means comprising a rotatable roll for positively delivering said filamentary material to said cutting means and means for continuously varying the speed of rotation of said roll.
11. In combination, means for cutting filamentary material at intervals to discontinuous lengths, means comprising a positive feeding element for delivering said filamentary material to said cutting means during operation, and means for varying the speed of said positive feeding element during operation.
12. In combination, means having at least one cutting station for cutting filamentary material at intervals to discontinuous lengths, means comprising a positive feeding element for delivering said filamentary material to said cutting means, means for effecting relative motion between said element and said cutting station of the cutting means during operation, and means for varying the speed of said positive feeding element during operation.
13. In combination, means having at least one cutting station for cutting filamentary material at intervals to discontinuous lengths, means comprising a positive feeding element for delivering said filamentary material to said cutting means, means for varying the speed of said positive feeding element during operation, and means for moving said cutting means to vary the distance of the cutting station from the feeding element during operation.
14. In combination, means having at least one cutting station for cutting filamentary material at intervals to discontinuous lengths, means comprising a rotatable roll for positively delivering said filamentary material to said cutting means, means for varying the speed of rotation of said roll during operation, and means for effecting relative motion between said element and said cutting station of the cutting means during operation.
15. In combination, means having at least one cutting station for cutting filamentary material at intervals to discontinuous lengths, means comprising a rotatable roll for positively delivering said filamentary material to said cutting means, means for varying the speed of rotation of said roll during operation, and means for moving said cutting means to vary the distance of the cutting station from the feeding element during operation.
16. In combination, means for cutting filamentary material at intervals to discontinuous lengths, means comprising a rotatable roll for positively delivering said filamentary material to said cutting means, means for continuously varying the speed of rotation of said roll, and means for continuously moving said cutting means to vary its distance from the feeding element during operation.
17. In combination with a machine for spinning artificial filamentary material having one or more positively driven substantially constant speed godets associated with the spinneret or spinnerets at each spinning station and a common positive feeding element for delivering the filamentary material from said machine, means having at least one cutting station for cutting the filamentary material proceeding from said roll at intervals to discontinuous lengths, and means for effecting relative motion between said element and said cutting station of the cutting means.
18. In combination with a machine for spinning artificial filamentary material having one or more

positively driven substantially constant speed godets associated with the spinneret or spinnerets at each spinning station and a common positive feeding element for delivering the filamentary material from said machine, means for cutting the filamentary material proceeding from said roll at intervals to discontinuous lengths, and means for varying the linear speed of said feeding element during operation.

19. In combination with a machine for spinning artificial filamentary material having one or more positively driven substantially constant

speed godets associated with the spinneret or spinnerets at each spinning station and a common positive feeding element for delivering the filamentary material from said machine, means for cutting the filamentary material proceeding from said roll at intervals to discontinuous lengths, means for varying the linear speed of said feeding element during operation and means for effecting relative motion between said element and said cutting station of the cutting means during operation.

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