Sept. 5, 1967 J. C. CHEZAUD ET AL 3,339,237

APPARATUS FOR CONVERTING TOW INTO SLIVER

Filed July 24, 1964 2 Sheets-Sheet 1

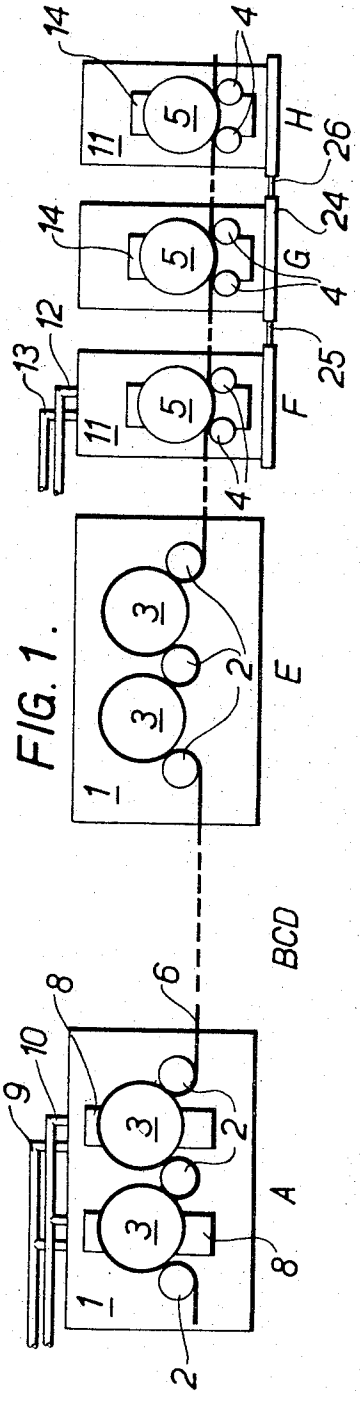

FIG. 1.

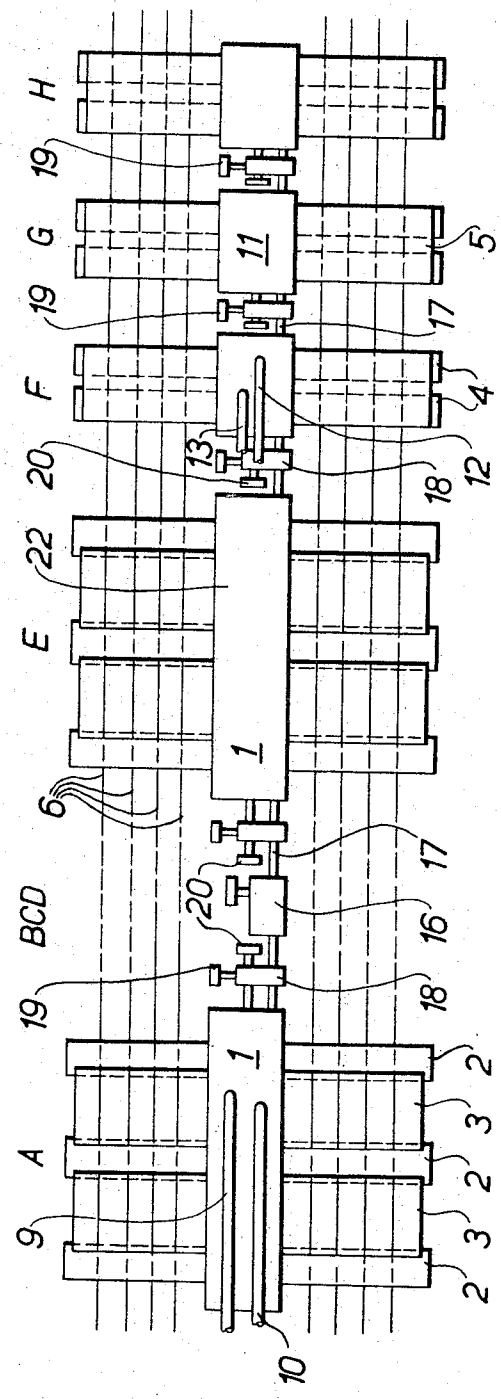

FIG. 2.

Stevens, Davis, Miller & Mosher

Sept. 5, 1967 J. C. CHEZAUD ETAL 3,339,237

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Filed July 24, 1964 2 Sheets-Sheet 2

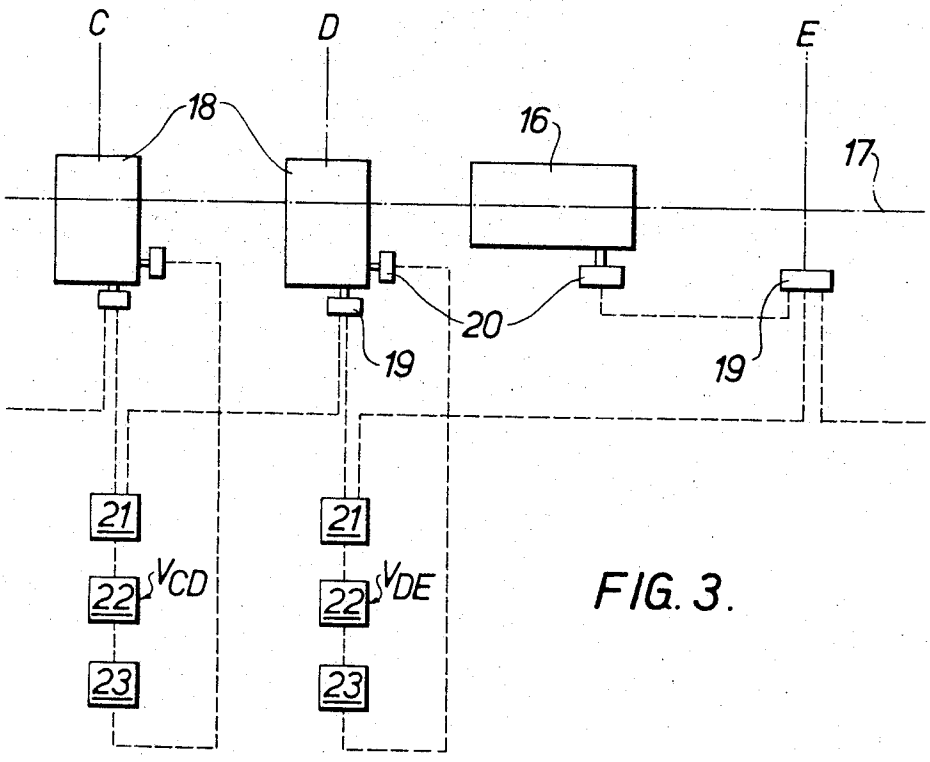

FIG. 3.

Stevens, Davis, Miller & Mosher

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APPARATUS FOR CONVERTING TOW INTO SLIVER

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The present invention concerns an apparatus for converting a tow of continuous textile filaments into a sliver of discontinuous filaments, which for the sake of simplicity will hereinafter be termed "tow" and "sliver."

In the production of yarns of artificial or synthetic fibres, a common practice is to cut continuous filaments so as to produce bulk fibres of similar length to cotton or wool fibres, and to subject these fibres, either alone or blended with other fibres, to the same spinning operations as natural fibres.

In another method of producing yarns from fibres, use is made of an apparatus which converts a tow into a sliver without losing the parallelism of the filaments constituting the tow, by cutting up the said filaments by means of a moving cylinder called a knife which is mounted above a plain cylinder called an anvil, the tow being pressed between the knife and the anvil. With this apparatus, fibres of uniform length are generally obtained. It is more useful to obtain fibres having an irregular staple length curve resembling that of natural fibres, which are not of uniform length. An oblique staple length curve can be obtained by feeding to the apparatus a tow, of which the angle in relation to the knife is varied. There is thus obtained a variable staple length, the curve of which, however, is not sufficiently similar to that of natural fibres. Moreover, since the fibres are broken up by compression, one of the disadvantages of this method resides in the deterioration of the ends of the fibres, which is not conducive to a good sliding action of the fibres one upon the other during the subsequent stretching operations.

Another method of cutting up a tow consists in subjecting the latter to a tractive force such that the elemental filaments of which it is composed exceed their elastic limit and are consequently broken, this operation being commonly known as breaking. The stretching operation imparts improved properties to the fibre yarn obtained from the sliver by conventional operations. More particularly, it greatly increases the tenacity of the filaments of which the yarn is composed and it reduces the unit count of the said fibres and gives them a tapered end. In apparatus for carrying out this method, the tow is stretched beyond its elastic limit between two pairs of rotating cylinders. In such an apparatus, the breaking of the filaments of the tow may occur at any point between the two pairs of cylinders and there is thus obtained a certain percentage of excessively long fibres which must be further treated on another apparatus in order to obtain a satisfactory staple length, whereby the cost is increased. Moreover, the existing apparatuses are not designed to work with synthetic fibres which, in this type of operation, behave differently from other textile fibres.

There also exists another type of apparatus in which, by means of rollers mounted in overhanging fashion on a single face of the said apparatus, the tow is subjected to a tractive force which brings it near to breaking point. The breaking being produced by using breaking bars of sintered alumina which produce an overstretch at certain points, whereby the breaking is localised. This type of apparatus gives good results, but only with acrylic fibres in the case of synthetic fibres, because when an attempt is made to break polyamide or polyester fibres, for example, these bars become very rapidly worn, so that they must be replaced a number of times each day.

An object of the present invention is to provide an apparatus for converting tows into slivers by breaking which allows the satisfactory working of synthetic fibres and the production of a sliver having a staple length curve more closely resembling that of natural fibres, which it has been impossible to obtain with existing apparatuses.

Advantageously, the apparatus according to the invention also comprises means by which, when the linear velocities of one pre-stretching train are changed, the linear velocity ratios previously established between the various trains of breaking and pre-stretching rollers can be maintained.

The invention also advantageously comprises means for cooling the rollers of the breaking and/or stretching trains and/or for cooling the tow by appropriate means, for example by the provision of cooled plates.

According to the present invention there is provided an apparatus for converting tow into sliver which includes sets of pre-stretching rollers arranged in a protruding fashion on each side of the apparatus and through which tow may be passed, and at least three sets of breaking rollers arranged in a protruding fashion subsequent to the pre-stretching rollers and through which the tow may be passed after passing through the pre-stretching rollers.

Embodiments of the invention will now be described with reference to the accompanying drawings which show diagrammatically in FIG. 1 a side view of a line of apparatus; in FIG. 2 a plan view of the apparatus together with control apparatus; and in FIG. 3 a schematic plan of the circuitry required.

Referring to the figures there are shown apparatus A and E and dotted lines at B, C and D indicate the existence of three intermediate apparatus each of which represents a pre-stretching train. The apparatus shown at F, G and H are breaking trains.

Each pre-stretching train comprises a central control unit **1** having rollers protruding on both lateral sides. Each side has three driving rollers **2** and two self-locking rollers **3**. These five rollers are mounted in an overhanging fashion. It is obvious that the number of driving rollers and self-locking rollers may be changed without departing from the scope of the present invention. The self-locking rollers comprise pneumatic or hydraulic lifting devices indicated at **8** and a removable casing. Mounted on the said casing is a covering which may consist, for example, of rubber, of polyamide or of a material of the resin-impregnated fabric type or any other suitable material. Such a casing makes it possible for the worn coverings to be rapidly changed, although this device is not essential. The lifting device is individually controlled in each train and on each machine face. The driving rollers and the self-locking rollers may be cooled by water circulated via pipes such as **9**, **10**, so that the filaments do not adhere to the said cylinders.

Each breaking train comprises a central control unit **11** and, on each working face, two driven rollers **4** and one pressure roller **5** so as to form a double gripping point on the tows **6** which pass through the whole line of apparatus. The pressure rollers **5** may be cooled by cold water circulated through pipes such as **12**, **13** and comprise in addition a removable casing. The driving rollers **4** may also be cooled by cold water circulation from the same pipes. The cooling of these rollers makes it possible to dissipate the thermal energy produced by the breaking operation and prevents fibres from adhering to the pressure members, while ensuring good preservation of the covering fitted on the casing. The pressure rollers **5** are applied against the rollers **4** by means of a hydraulic jack, as indicated at **14**.

The general drive of the machine is provided by a mo-

tor **16** which acts through a reduction gearing on a transmission shaft **17** extending along the length of the machine. This shaft drives the primary trains of variable speed gears **18**, which control the various pre-stretching and breaking trains.

The pre-stretching trains A, B, C and D and the breaking trains F, G and H are driven through the said variable speed gears.

Each variable speed gear drives a tacho-generator **19** which supplies a (direct or alternating) voltage proportional to the velocity of rotation of the train. The comparison at **21** of the voltages of the generatrices of two consecutive trains supplies, in continuous manner, a voltage proportional to the pre-stretching rate to which the tow is subjected between these two trains. This voltage is then compared at **22** with a reference voltage corresponding to the required stretching rate. The difference between these two voltages, appropriately amplified at **23**, acts on the servo-motor **20** controlling the adjustment of the speed of the variable speed gear concerned. The process described hereinabove provides a step-by-step adjustment of the speed of all the trains, starting from a train the speed of which is taken as a reference. The speed of the pre-stretching train E is chosen as a fixed reference speed, but it is to be understood that the speed of any pre-stretching or breaking train may be taken as the reference speed. By means of this system, it is possible when the stretching ratio between two pre-stretching trains changes, to maintain the same stretching ratio in the upstream pre-stretching zones, and in the event of a change of the stretching ratio between two breaking trains, to maintain the same stretching ratio in the downstream breaking zones.

Each working face of the breaking machine may be supplied with one tow or with a plurality of tows, the advantage being obtained in the latter case that the sliver obtained has better homogeneity, the effect of which is reflected in the subsequent stages of the conversion of the sliver into textile articles. A pre-stretching takes place between the trains A and B, B and C, C and D, D and E, and E and F. As a result of the path followed by the tow or tows, which pass around the self-locking rollers (**3**), the said rollers are automatically applied against the driving rollers and prevent slipping of the tows.

On entering the breaking train F, the twos are stretched slightly below the breaking point of the elemental filaments of which they are composed. The distance between the various breaking trains is advantageously made adjustable for example, by mounting the train G on movable platform **24** and acting upon it with hydraulic rams **25** and **26**. The stretching between the trains F and G is sufficient to break the elemental filaments of the tow. The distance between the trains G and H is smaller than that between the trains F and G, so that the long fibres can be re-broken and a staple length curve can be obtained in which the slope, i.e. the proportion of short fibre and long fibre in relation to the mean, is well adapted for working the sliver under optimum conditions in the succeeding preparing and spinning machines. Also, if desired, more than three breaking trains may be employed, for example if it is desired to reduce the mean height of the staple length curve. Likewise, the number of pre-stretching trains may be changed without departing from the scope of the present invention.

On leaving the breaking trains, the sliver advantageously enters a crimping device of a type known per se, the apparatus then comprising one crimping device to each face of the machine.

We claim:

1. An apparatus for converting tow into sliver, said apparatus comprising a plurality of sets of pre-stretching rollers arranged in a protruding fashion on each side of the apparatus and through which tow may be passed, at least three sets of breaking rollers arranged in a protruding fashion subsequent to the pre-stretching rollers and through which the tow may be passed after passing through the pre-stretching rollers, drive means to drive said sets of rollers at predetermined surface velocities, a device for regulating said surface velocities in accordance with the desired stretching rate, said device comprising means for detecting said velocities, means for comparing the velocity detecting signals with reference values corresponding to the desired stretching rates, and means operatively connected to said drive means for adjusting the velocities of at least one set of said rollers in response to change in velocity of another of said sets of rollers to maintain the desired stretching rate.

2. An apparatus for converting tow into sliver, said apparatus comprising a plurality of sets of pre-stretching rollers arranged in a protruding fashion on each side of the apparatus and through which tow may be passed, at least three sets of breaking rollers arranged in a protruding fashion subsequent to the pre-stretching rollers and through which the tow may be passed after passing through the pre-stretching rollers, drive means to drive said sets of rollers at predetermined surface velocities and to establish a ratio of the velocities of said sets of rollers, and means operatively connected to said drive means to vary the velocity of at least one of said sets of rollers in response to change in velocity of another of said sets of rollers to maintain said ratio.

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