

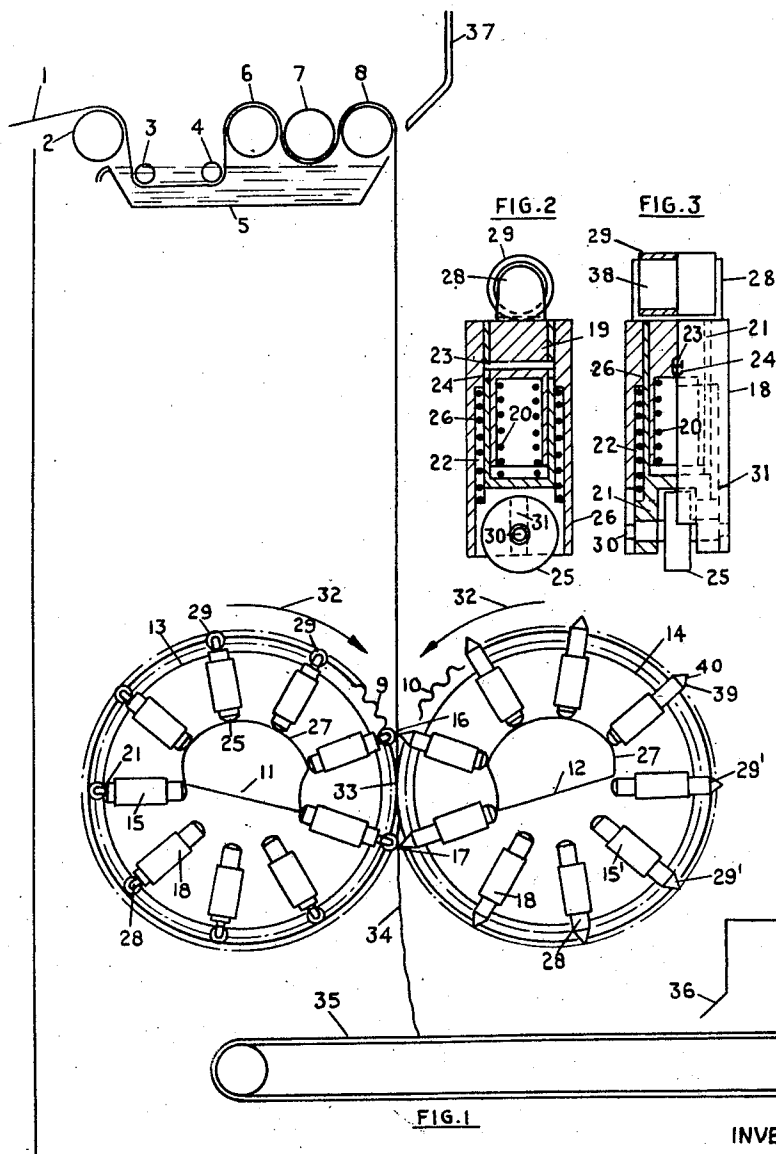
Dec. 3, 1957

I. F. STEWART ET AL.
METHOD AND APPARATUS FOR CRIMPING THE FILAMENTS OF A TOW OF
EXTENDABLE ARTIFICIAL FILAMENTS

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2 Sheets-Sheet 1



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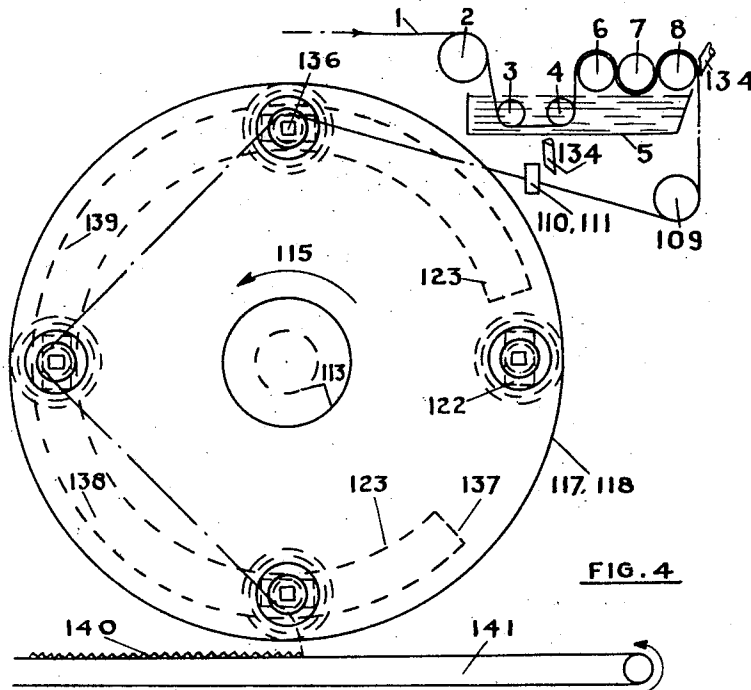


FIG. 4

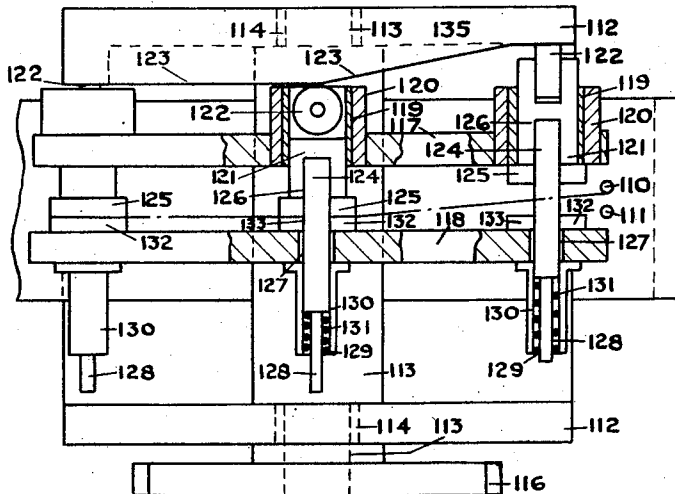


FIG. 5

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METHOD AND APPARATUS FOR CRIMPING THE FILAMENTS OF A TOW OF EXTENDABLE ARTIFICIAL FILAMENTS

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10 Claims. (Cl. 19—66)

The present invention is concerned with a method and apparatus for crimping the filaments of a tow of extendable artificial filaments as for example artificial filaments of proteins, as for instance of vegetable globulins or casein.

It is well known that when a tow of artificial filaments of protein as for instance peanut globulin which are initially relatively straight is wetted, stretched, relaxed and dried in the relaxed condition, the filaments become crinkled or crimped.

It has now been observed that a length of stretched wet tow of extendable filaments when under tension should be of a substantial length, as for example 3 to 8 inches, before there is a removal of the tension in order to produce improved crimping of the filaments and thus permitting their improved processing on textile machinery and the production of "loftier" and more coherent slivers and tops.

The object of the invention is to provide a method and apparatus for giving a high degree of crimp to the filaments of a continuously travelling tow of extendable artificial filaments by ensuring that lengths of stretched wet tow which are of said substantial length are relaxed intermittently while the wet tow is being fed forward and stretched continuously.

According to the present invention the method of crimping the extendable filaments of a continuously travelling tow comprises passing a wet tow of extendable filaments through a gripping delivery zone, applying at a position some distance away from said zone a timed succession of pulls each of which moves a substantial distance, as for example substantially in a straight line or in a circular path, away from said zone to an ultimate fixed position where it stops so as to remove the tow from said zone at a faster rate than that at which it is delivered by said zone while maintaining the contractility of the tow and wherein the time interval between the application of the successive pulls at said first mentioned position is such that the next pull is applied before the foremost pull stops and releases the tow at said ultimate fixed position, and thereafter drying the thus formed successive released lengths of tow.

Apparatus according to the invention comprises in combination a gripping, receiving and delivery means for a tow of filaments, means for applying at a predetermined position a timed succession of gripping means each of which is adapted to grip a tow of filaments at said predetermined position and in the gripping condition to move at a faster rate than that at which said gripping, receiving and delivery means is set to deliver a tow a substantial distance, for example substantially in a straight line away from said gripping, receiving and delivery means, or in a circular path to an ultimate fixed position where each gripping means opens and wherein the time interval between the arrival of the succession of gripping means at said first mentioned position is such that the next gripping means is adapted to grip the tow of filaments before

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the foremost gripping means which grips said tow opens at said ultimate fixed position.

Said gripping, receiving and delivery means may consist for example of mangle rollers in a gripping position.

The means for applying at a predetermined position a timed succession of gripping means may consist for example of a pair of rotatable toothed gear wheels which are arranged to mesh and wherein each of which carries a circular steel plate having around its circumference a number of equally spaced spring-loaded arms the springs of which on rotation of the plate move against a stationary centrally positioned cam so that when an arm on one circular plate contacts an arm of the other circular plate a gripping means is formed which moves in a straight line for a predetermined distance in the gripping condition when the said two contacting arms part.

Said means for applying at a predetermined position a timed succession of gripping means may also consist for example of two circular plates rigidly fixed to a common rotatable axle wherein one plate has round its circumference and at right angles thereto at least three equally spaced spring-loaded sliding members in which one end of each member on rotation of the plate moves against a stationary cam and acts on a spindle having a rigid fibre-clamping disc and wherein the other plate has the same number of correspondingly positioned clamping pads as the first mentioned plate has spring-loaded sliding members so that when a fibre-clamping disc contacts a clamping pad a gripping means is formed which moves in a circular path for a predetermined distance in the gripping condition when the said fibre clamping disc and clamping pad part.

The apparatus of the invention is preferably provided with a bath to permit the oncoming tow to be treated with liquid for instance cold water, a transport belt for collecting the released lengths of tow, and a drying oven.

One embodiment of the invention is illustrated by way of example with reference to the diagrammatic drawings Figs. 1, 2 and 3 accompanying the specification whereof Fig. 1 is a side elevation of the apparatus, Fig. 2 is a side elevation in section and on a much larger scale of an arm carrying a resilient padded tip which forms with an identical arm carrying a chisel edged tip a gripping device and shown from the same view point as that of Figure 1, and Figure 3 is a part sectioned elevation of Figure 2 viewed from a direction at right angles to that of Figures 1 and 2. Referring to the drawings Figs. 1, 2 and 3 a continuous tow 1 of insolubilised peanut protein filaments is passed over a guide roller 2 and under two other guide rollers 3 and 4 submerged in cold water in a bath 5, then through a system of gripping mangle rollers 6, 7 and 8 arranged to be driven at a controllable speed. The tow 1 is then fed downwards into a device consisting of a pair of toothed gear wheels 9 and 10 each of 24 inches pitch circle diameter and arranged to mesh and to turn about centres 11 and 12. The gear wheel 9 has fixed thereon a circular steel plate 13 and the gear wheel 10 has fixed thereon a circular steel plate 14. Plate 13 carries nine spring-loaded arms 15 fixed radially at equal angles (40°) around its circumference. Similarly plate 14 carries nine spring-loaded arms 15' fixed radially at equal angles (40°) around its circumference. These arms 15 and 15' are set with respect to the gear teeth so that as the wheels 9 and 10 turn an arm 15 and an arm 15' meet at a position 16 and remain in contact until position 17 is reached when the arms 15 and 15' part. The distance from position 16 to position 17 is approximately 8 inches. The spring-loaded arms 15 and 15' have a casing 18 rigidly fixed to the steel plates 13 and 14. Each casing 18 has a plunger 19 spring-loaded by spring 20 against a slidable member 21 which is itself

spring-loaded by spring 22 against the casing 18. Pin 23 limits the outward travel of the plunger 19 by being constrained between the slots 24 and so prevents the plunger 19 from being pushed too far out of the slidable member 21 by spring 20 or from dropping out at such times as a grip 15' or 15" is pointing downwards. The slidable members 21 have a roller 25 situated so that they are smoothly pushed in their sockets 26 in the casings 18 by stationary cams 27. The springs 22 oppose the action of the cams 27 and keep the rollers 25 pressed inwardly against the surface of the cams 27 except when the arms 15 and 15' are adjacent to the cutaway lower portions of the cams 27. The springs 22 also hold the slidable members 21 at the innermost limit of their travel which is terminated by the brackets 28 on the plungers 19 and are for securing the grip pads 29 and 29' because the brackets overlap the fixed casings 18. The axle pins 30 of the rollers 25 slide in the slots 31 in the casings 18 and prevent the planes of the rollers 25 from turning away from the planes of the cams 27 and consequently keep the slidable members 21 from turning. The pins 23 keep the plungers 19 from turning in the slidable members 21 so that the fibre-gripping pads 29 and 29' are at all times held with their axes parallel to the axes of the gears 9 and 10.

In action the gears 9 and 10 turn in the direction of the arrows 32 and bring opposed fibre-gripping pads 29 and 29' successively together at the position 16 where they grip the tow 1 and hold it tightly until they part at position 17. The profiles of the cams 27 are so shaped that the slidable members 21 recede from each other as they move from a position 16 to position 33 and approach again from position 33 to position 17 just enough to maintain a uniform grip on the tow 1 and also so that a fibre-gripping pad 29 with its corresponding fibre-gripping pad 29' will always catch the tow 1 at position 16 before the preceding fibre-gripping pads 29 and 29' release the tow 1 at position 17. The profile of the cams 27 as illustrated permits the use of a maximum preloading on the springs 20 in order to obtain the greatest possible grip at position 16, there being no further compression between the positions 16 and 33.

The peripheral speed of the gripping pads 29 and 29' is adjustable to any desirable speed in excess of that of the mangle rollers 6, 7 and 8 so that the tow 1 is held in tension between the mangle roller 8 and position 16. The peripheral speed of the wheels 9 and 10 is conveniently 1.3 to 1.8 times the peripheral speed of roller 8. As the mangle rollers 6, 7 and 8 and the spring-loaded gripping arms 15 and 15' rotate the tow 1 is continuously fed and gripped at position 16 and so the stretch produced between roller 6 and position 16 is maintained to position 17. The tension in the portion of the tow 1 from positions 16 to 17 is released as the gripping pads 29 and 29' release the tow 1 at position 17. The release of tension only affects the portion of the tow previously held between positions 16 and 17 and does not progress backwards beyond position 16 because tow 1 is gripped at 16 before the release takes place at 17 so that continued operation of the device of the invention brings the tow 1 forward and maintains it in its stretched condition for sudden release of a further length equivalent to the distance between 16 and 17. Crimping takes place on the release of the tension and the thus crimped tow 34 is permitted to drop gently on to a conveyor belt 35 which carries it without further handling through a drying oven 36.

It is desirable to provide a means 37 for dropping for instance water on to the tow 1 after it leaves the mangle roller 8 otherwise the mangled tow 1 is likely to be too dry to give a good crimp.

It is preferred that the fibre-gripping pads 29 should each be a resilient sheath which may be of rubber on a solid cylindrical core 38 and that the fibre-gripping pads

29' should each be a non-resilient block 39 with a narrow ridge 40 capable of being pressed into the gripping pad 29.

A tow 1 consisting of 30,000 filaments of 3.5 denier when treated in the aforesaid embodiment of the apparatus of the invention after cutting into staple lengths of 1.5 inches and thereafter processed at full speed without any processing aids in a cotton carding machine gives a satisfactory coherent.

A tow 1 consisting of 30,000 filaments of 5.0 denier when treated in the aforesaid embodiment of the apparatus of the invention after cutting into staple lengths of 5.0 inches and thereafter processed according to the worsted system gives slivers after carding, combing, and gilling which have improved coherence, openness and loftiness.

A preferred embodiment of the invention is illustrated by way of example with reference to the diagrammatic drawings Figs. 4 and 5, accompanying the specification whereof Figure 4 is a side elevation of the apparatus with the supporting framework removed and Figure 5 is a plan view sectioned in two places and with the means for wetting and feeding the tow omitted.

Referring to the drawings Figs. 4 and 5 a continuous tow 1 of insolubilised peanut protein filaments is passed over a guide roller 2 and under two other guide rollers 3 and 4 submerged in cold water in a bath 5, then through a system of gripping mangle rollers 6, 7 and 8 arranged to be driven at a controllable speed. The tow 1 is then fed under a guide roller 109 between guide posts 110 and 111 and into a device comprising a frame 112 having a shaft 113 carried in bearings 114. The shaft 113 is adapted to turn in the direction of the arrow 115 by gear 116. Circular plates 117 and 118 are rigidly fixed to the shaft 113. On plate 117 on equal radii of for example 9 inches and at 90° intervals the bearings 119 in their housings 120 guide the sliding members 121 each of which has a roller 122 suited to bear against the cam 123. The rod 124 has fixed thereto a rigid fibre-clamping disc 125 and is immovably secured in socket 126 in the sliding member 121 and is supported by bearings 127 in plate 118. The end portion 128 of the spindle 124 is square in section and the aperture 129 in the spring retaining housing 130 is square to suit. 131 is an ordinary helical compression spring. The clamping pad 132 is of a resilient material such as rubber and is fixed to the side of the plate 118. In its centre is a hole 133 allowing unrestricted movement of the spindle 124.

Means 134 for dripping water on to the tow 1 are provided after it leaves the mangle roller 8 and the roller 109.

In operation the plates 117 and 118 turn so that the tow 1 after having been wetted in bath 5 and metered forward by mangle rollers 6, 7 and 8 is wound over the rods 124 and gripped by the succession of fibre-clamping means formed from a fibre-clamping disc 125 and a clamping pad 132. The rising portion 135 of the cam 123 causes a clamping disc 125 and a clamping pad 132 to close upon the tow 1 by pushing the roller 122 and thereby imparting the necessary movement to the sliding member 121, the rod 124 and the rigid clamping disc 125. At the same time sufficient energy to re-open the fibre-clamping means is stored in the spring 131 since it is compressed by this movement. The square end portion 128 of the rod 124 slides within the square hole 129 in the housing 130 so the rod 124 and the sliding member 121 are prevented from turning. The roller 122 accordingly runs around the cam 123 with its plane at all times tangential to the radius on which it travels. Owing to the greater peripheral speed of the rods 124 over that of the feed rollers 6, 7 and 8 the tow is stretched when first gripped between a clamping disc 125 and a clamping pad 132 and the portions of the tow which are held between the clamping means formed from a clamping disc 125 and a clamping pad 132 are maintained by them in ten-

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sion. The profile of the cam 123 is so shaped that the tow 1 which is guided into the device at a suitable height by roller 109 and is given a little horizontal bias by the guide posts 110 and 111 so as to be caught upon rod 124 between the clamping disc 125 and clamping pad 132 is first gripped at or near position 136 (Figure 4) and is released in a succession of contiguous lengths (of about 12½ inches stretched length) by the opening of the gripping means formed by clamping disc 125 and clamping pad 132 at position 137. The tow 1 is thus held until its tension is released from these lengths one after the other as the leading clamping means holding each stretched length comes into position 137. It will be seen that even when the release has just taken place in position 137 the tow is still gripped securely at positions 138 and 139 so the tension in the oncoming tow is not at any time lost. The action of the device thus releases the tension of successive finite lengths of a stretched band of filaments.

Increase in output may be obtained by processing parallel tows simultaneously. This is economically achieved by widening the frame 112 and inserting further sets of plates 118 with their clamping means. The one cam 123 will operate all these clamping means because the rods 124 may be extended to penetrate all the plates and to carry all the clamping discs 125, and the one set of return springs 131 in their housings 130 placed on the plate 118 most distant from the cam 123 will likewise be sufficient.

Crimping takes place on release of the tension and the thus crimped tow 140 is permitted to drop gently on to a conveyor belt 41 which carries it without further handling to a drying oven (not shown).

What we claimed is:

1. Method of crimping the extendable filaments of a continuously traveling tow comprising passing the wet tow through gripping-delivery means, applying at a position a predetermined distance away from said means a timed succession of pulls each of said pulls moving a substantial distance away from said means to an ultimate fixed position where said pull ceases to enable removal of the tow from said means at a rate faster than that at which it is delivered by said means while maintaining the contractility of the tow, whereby the time interval between the application of successive pulls at said first-mentioned position is such that the next pull is applied before the former pull stops and releases the tow at said ultimate fixed position, and thereafter drying said successive released lengths of tow.

2. In an apparatus for crimping extendable filaments of a continuously traveling tow the combination comprising unitary gripping, receiving, and delivery means for the tow of filaments and means for applying a timed succession of filament grasping means each of said grasping means being adapted to engage a tow of filaments at a predetermined position and to move at a faster rate than that at which said gripping, receiving, and delivery means is set to deliver a tow to an ultimate fixed position where each grasping means opens, the time interval between the arrival of the succession of grasping means at the initial

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engaging position is such that the next grasping means is adapted to grasp the tow of filaments before release of the tow by a preceding grasping means at the ultimate fixed position.

3. A method as claimed in claim 1 wherein each of the timed succession of pulls moves substantially in a straight line.

4. A method as claimed in claim 1 wherein each of the timed succession of pulls moves in a circular path.

5. Apparatus as claimed in claim 2 wherein each of the timed succession of gripping means in the gripping condition is adapted to move a substantial distance in a straight line away from said gripping, receiving and delivery means.

6. Apparatus as claimed in claim 2 wherein each of said gripping means in the gripping condition is adapted to move in a circular path.

7. Apparatus as claimed in claim 2 wherein said gripping, receiving and delivery means consists of mangle rollers in a gripping position.

8. Apparatus as claimed in claim 2 wherein the means for applying at a predetermined position a timed succession of gripping means consists of a pair of rotatable toothed gear wheels which are arranged to mesh and wherein each of which carries a circular steel plate having around its circumference a number of equally spaced spring-loaded arms the springs of which on rotation of the plate move against a stationary centrally positioned cam so that when an arm on one circular plate contacts an arm of the other circular plate a gripping means is formed which moves in a straight line for a predetermined distance in the gripping condition when the said two contacting arms part.

9. Apparatus as claimed in claim 2 wherein the means for applying at a predetermined position a timed succession of gripping means consists of two circular plates rigidly fixed to a common rotatable axle wherein one plate has round its circumference and at right angles thereto at least three equally spaced spring-loaded sliding members in which one end of each member on rotation of the plate moves against a stationary cam and acts on a spindle having a fibre-clamping disc and wherein the other plate has the same number of correspondingly positioned clamping pads as the first mentioned plate has spring-loaded sliding members so that when a fibre-clamping disc contacts a clamping pad a gripping means is formed which moves in a circular path for a predetermined distance in the gripping condition when the said fibre-clamping disc and clamping pad part.

10. Apparatus as claimed in claim 2 which includes a bath to permit the oncoming tow to be treated with liquid, a transport belt for collecting the released lengths of tow and a drying oven.

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