Dec. 2, 1958 H. D. FARDON, JR., ET AL 2,862,279

TOW CRIMPING APPARATUS

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FIG.1.

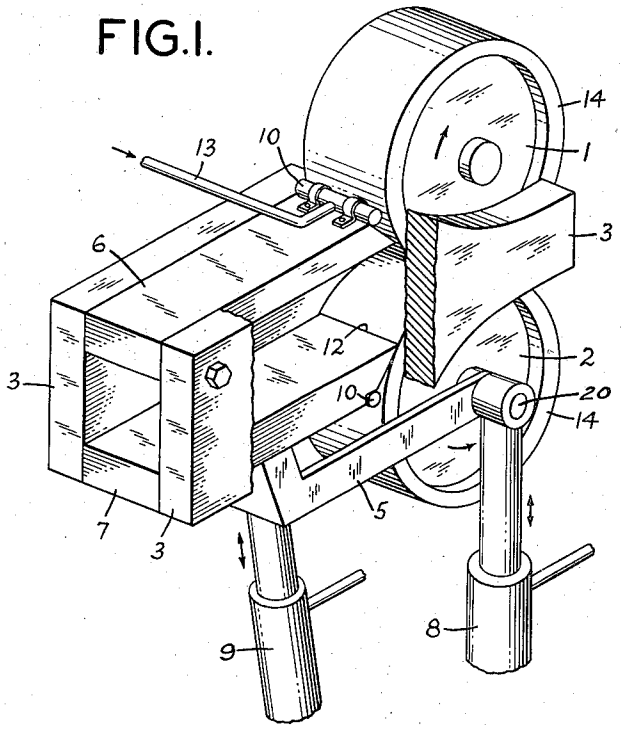
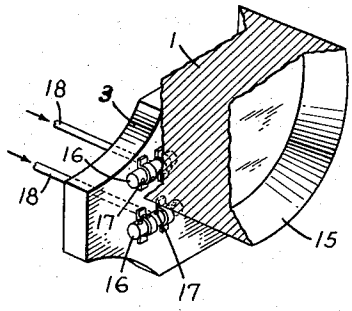


FIG.3.



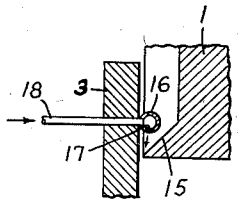


FIG.2.

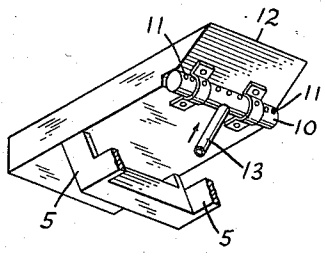


FIG.4.

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TOW CRIMPING APPARATUS

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4 Claims. (Cl. 28—1)

This invention relates to improved crimping apparatus of the type wherein a pair of rolls forces filamentary material through the nip of the rolls into a crimping chamber. By filamentary material we mean a tow of continuous filaments or a sliver of staple filaments.

In apparatus of the above stated type, especially when operated at speeds of at least about 150 feet per minute, and especially when operated using a fusible thermoplastic such as polycaprolactam, problems frequently arise due to lodging and entrapment of filaments being crimped, in crevices where the walls of the crimping chamber closely approach the circular side surfaces of the feed rolls, e. g. with clearance of about 0.01 inch or less. A special problem with thermoplastic filaments is created by the fusion of filaments under frictional heat, e. g. filaments in contact with the surfaces of the feed rolls and/or in contact with walls of the crimping chamber. Hard lumps in the tow and/or a deposit in the crevice results. These faults seriously impair tow quality and uniformity of crimping action of the crimping apparatus. The deposits soon necessitate shut-down of the apparatus. These problems are especially acute in operations at high speed because in such operations the feed rolls carry the filaments toward the crevices with great force and high friction.

The present invention represents a simple and effective means of mitigating the problem of trapped and fused filaments. Our invention comprises feeding a bundle of filaments through the nip between a pair of cylindrical feed rolls into a crimping chamber adjacent the nip with the feed of the filaments being at a speed of at least about 150 feet per minute; and spraying liquid, e. g. water, from outside the crimping chamber into the crevice where the surface of a feed roll meets a wall of the crimping chamber. In particular in accordance with our invention the spray is delivered by a header type spray tube mounted outside the crimping chamber and having an inlet for liquid, and outlets for liquid which are directed toward said crevice; and the crevice is formed by a knife edge meeting a surface.

Where "meeting" of a roll surface with chamber walls, or "line of contact" or "linear contact" is referred to herein it is to be understood that approach at close clearance is included in the scope of these terms.

A considerable pressure on the liquid being sprayed is best, e. g. pressure in the range between about 30 and about 100 p. s. i. g. Suitably the spray outlets can be holes of diameter in the range between 1/64 and about 1/16 inch and can be arranged in a line with separations between centers in the range between about 1/8 and about 1/4 inch. The flow rate (in G. P. M.) of the spray liquid from the outlets is suitably between about 0.01 U. S. gallon and about 0.5 U. S. gallon per minute, per inch of linear contact between the roll surface and the crimping chamber wall. Preferably the line of contact is defined by a knife edge as explained in more detail below.

In the accompanying drawings, which are partially diagrammatic,

Fig. 1 is a perspective view, partially broken away, showing a crimping apparatus provided with our spray tubes.

Fig. 2 is a detail view showing the lower wall 7 of the crimping chamber of Fig. 1 as it comes to a knife edge, fitted with one of our spray tubes.

Figs. 3 and 4 are detail views showing the location of the spray tubes in an alternative form of our invention.

The principal parts of a crimping apparatus of a type suitable for use in accordance with our invention are shown in Fig. 1. These parts are a pair of cylindrical feed rolls **1** and **2** and an adjacent crimping chamber. The feed rolls of Fig. 1 comprise an inner roll with a shrunk on annular outer sleeve **14** thereon. Roll **1** is fixed in place and roll **2** is supported for vertical movement to accommodate, in the nip between the rolls, tows of varying thickness.

In Figs. 3 and 4 showing an alternative form of outer sleeve on the rolls, the sleeve **15** is beveled to a circumferential knife edge meeting the crimping chamber side wall **3**. This sleeve is designed to be replaceable when the knife edge or the cylindrical surface of the sleeve becomes worn.

The crimping chamber of Fig. 1 comprises side plates **3** fitting against the circular ends of the feed rolls; the fixed wall or doctor blade **6** meeting the cylindrical surface of feed roll **1** in a knife edge; and the inwardly urged wall or gate **7** meeting the cylindrical surface of feed roll **2** in a knife edge **12**.

As shown in Fig. 1 the inwardly urged gate **7** is suitably connected, e. g. by being affixed to a supporting plate, to form a single unit with a rotatable arm **5**. The arm **5** is pivoted concentrically about the axis **20** of movable feed roll **2** so that the edge of the gate will remain at the same close clearance from the circumference of the feed roll as the gate moves in and out of the chamber, or as movable feed roll **2** itself moves up or down to close or open the nip between the rolls.

Suitably pneumatic piston **8** urges roll **2** toward roll **1**, and pneumatic piston **9** urges gate **7** inwardly into the crimping chamber.

In accordance with our invention at least one header type spray tube (**10** in Figs. 1 and 2, and **16** in Figs. 3 and 4) is mounted outside the crimping chamber, preferably affixed near the knife edge contact between feed roll surface and crimper wall. These spray tubes have inlets for liquid designated **13** in Figs. 1 and 2, and **18** in Figs. 3 and 4. The spray tubes have outlets, illustrated by holes **11** of Fig. 2 and holes **17** of Figs. 3 and 4, directed toward the crevice between the feed roll and the crimper wall.

In operation, tow is fed by the feed rolls into the crimping chamber against the resistance of the inwardly urged gate **7**. The liquid for the spray, e. g. water, is simultaneously fed into the spray tubes at pressure suitably about 40–80 pounds per sq. in., and sprays from the outlets at rates suitably between 0.05 and 0.25 U. S. gallon per minute per inch of roll width.

The following example is illustrative of the operation and advantages of a process and apparatus in accordance with our invention; but the invention is not to be considered as limited to all details of the example.

Example

The crimping apparatus used was of the type shown in Fig. 1 wherein a pair of rolls 6 inches in diameter and 3 inches in width forced a tow of polycaprolactam filaments of 200,000 total denier, 6 denier per filament into a crimping chamber at 350 feet per minute. Doctor blade and gate were set to meet the rolls at 0.001 inch clearance; and gate and nip pressures were adjusted to give 20 crimps

per inch. The spray tubes had 1/64" holes located 1/4" apart.

Using 0.5 G. P. M. of water under 40 p. s. i. g. pressure at each tube, a well crimped high quality tow free of fused sections was produced with smooth, uniform operation.

When the water in the top or bottom tube was turned off, fusing occurred on the top or bottom of the tow, respectively. When the water was turned on, fusing ceased. Moisture content of the tow was uniform and could be controlled.

When, under otherwise the above described operating conditions, water was sprayed on the full width of the rolls at 6 G. P. M., instead of using our spray tubes, fusion of the top and bottom of the tow occurred. Water was squeezed off the tow by the rolls. The moisture content of the tow was not uniform and was hard to control. Water is a suitable liquid for use because of its effects of cooling, lubricating, and softening the filaments heated by friction. Any other cooling liquid can be used, with at least some of the benefits obtained using water; in accordance with our invention.

We claim:

1. Process of crimping a bundle of filaments fed by cylindrical rolls into a crimping chamber, which comprises feeding such bundle at a linear speed of at least about 150 feet per minute into said chamber and spraying liquid from outside the chamber into the crevice where a surface of a feed roll meets a wall of the crimping chamber.

2. Process as defined in claim 1, wherein the liquid is under pressure in the range between about 30 and about 100 p. s. i. g.; the crevice is formed by a knife edge meeting a surface; and the flow rate of liquid spray is in the range between about 0.01 U. S. gallon and about 0.5 U. S. gallon per minute per inch of contact between said knife edge and said surface.

3. Apparatus for crimping bundles of filaments comprising a pair of cylindrical feed rolls mounted to form a nip; a crimping chamber adjacent said nip; a knife edge line of contact between a surface of at least one of said rolls and wall of said crimping chamber; and at least one header mounted outside the crimping chamber having an inlet for liquid and outlets directed toward said knife edge line of contact between the surface of the roll and the crimping chamber wall.

4. Apparatus as defined in claim 3, wherein the crimping chamber comprises a pair of side plates fitting against the circular ends of the feed rolls and a pair of walls meeting the cylindrical surfaces of the feed rolls in knife edges, a header is affixed on the outside near the knife edge of each of said walls; and the outlets from the headers have diameter in the range between about 1/64 inch and about 1/16 inch and are arranged in a line with separations between centers in the range between about 1/8 inch and about 1/4 inch.

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