June 14, 1966 W. B. McCASKILL 3,255,507

CRIMPING APPARATUS

Filed Jan. 28, 1964

FIG. I

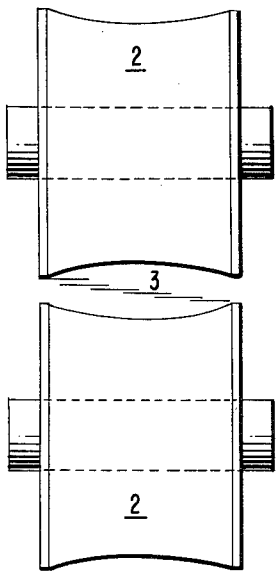


FIG. II

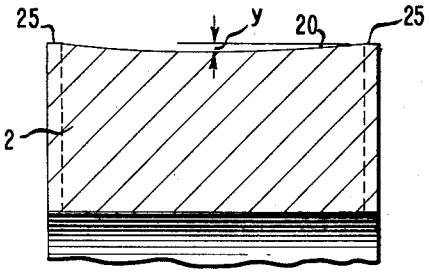


FIG. III

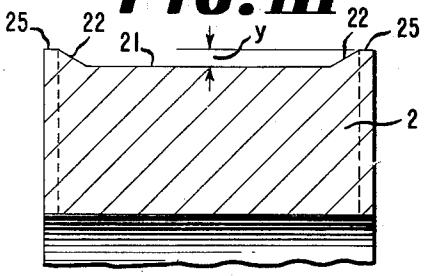
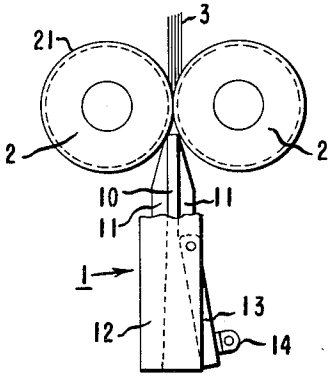


FIG. IV



INVENTOR

WILLIAM BRAND Mc CASKILL

BY David Katz.

ATTORNEY

United States Patent Office 3,255,507 Patented June 14, 1966

3,255,507

CRIMPING APPARATUS

William Brand McCaskill, Waynesboro, Va., assignor to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware

Filed Jan. 28, 1964, Ser. No. 340,636
4 Claims. (Cl. 28—1)

This invention relates to apparatus for crimping synthetic textile fibers. It is more particularly concerned with a modification of the stuffer-box crimper to improve tow uniformity and quality.

The stuffer-box crimper is commonly used to impart crimp to filaments in the form of a tow. The tow will usually have a total denier of several hundred thousand. Such a large mass of fibers is difficult to crimp uniformly. It is a common practice to fold the edges of the tow so that the edges at crimping will be as thick as or thicker than the central portion. It is necessary to do this so that the crimper rolls will be able to grab the edges of the ribbon bundle and force them along with the center portion of the bundle into the crimper box. If the edges of the ribbon bundle are thin, they flutter and eventually break out at the crimper rolls causing machine wraps. However, special equipment is required to turn in the edges of the tow ribbon. Furthermore, the amount of edge fold will sometimes vary and the thickness of the edge will not be constant. This is apt to give trouble in processing the crimped tow.

Thus, after the crimping process, the tow may be cut into staple length fiber or it may be converted directly into yarn by stretch-breaking on the Turbo Stapler and the Hood Doubler and drafting on pin drafters. In either case, however, it is essential that the fiber should have a uniform tow thickness and should be free of damaged fibers. Non-uniform tow is difficult to process on the Turbo Stapler, and heavy selvages result in Turbo Stapler breaks and slubby sliver. Unevenness in the tow and heavy selvages also result in non-uniform heating at the Turbo heater plates.

It is accordingly an object of this invention to eliminate the necessity of folding-over the edges of the tow and to make possible the production of crimped tow with no heavy selvages.

Other objects and achievements of this invention will become apparent as the description proceeds.

These results are obtained in this invention by making the feed rolls of the stuffer-box crimper slightly thinner along the major portion of their length, from the midpoint of each roll outward, compared to the diameter of the roll in its end regions. In other words, the rolls are shaped to leave an oblong gap between the rolls, extending along their nip line and being wider in the central region of said nip line than at its edges. For further details in this repect, reference is now made to the accompanying drawings, in which:

FIG. I is a top view of a pair of feed rolls with a lenticular space between them along their nip line, both spacing and curvature being exaggerated for easy visual perception.

FIG. II is a vertical section through the upper half of one roll, to bring out clearly the construction of the operating edge.

FIG. III is a similar vertical section, but showing a modified outline for the roll surface.

FIG. IV is a vertical diagrammatic view of a crimper provided with improved feed rolls according to this invention.

Taking up now the drawing in detail, FIG. IV shows a conventional stuffer-box crimper, for instance, of the type described in U.S.P. 2,747,233. In brief outline, this device comprises a stuffing box **1** and feed rolls **2**, **2**, through the nip of which tow **3** is continuously forced into the vertical chamber **10** formed by sidewalls **11**, **11** and front and rear walls **12** of the stuffing box. Except when tow is passing therebetween, the two rolls are kept nearly in contact with each other by the action of a spring-and-lever arrangement and stops (not shown). One of the sidewalls **11** terminates short of the bottom of the vertical chamber and is provided at its lower end with a hinged leg or clapper device **13** which is pressed inwards against the packed tow by a counterweight hung at **14**. When the pressure of the crimped fiber inside the chamber overcomes the force of the counterweight, leg **13** yields and part of the tow is discharged into a container.

In the present invention, the rolls **2**, **2** are shaped to form an oblong and narrow gap in the central region, which gap however, is wider in its mid-region than at its edges. Flat shoulders **25**, **25** may be provided at the extreme edges of the rolls, but these are not essential. Between these shoulders (if any are provided), the roll cylinder is made of smaller diameter than at the shoulders. The amount of depression is not great. It certainly should not be made so great as to permit the tow to be fed in without much pressure crosswise of its plane, since traction between roll surface and tow is essential to compel the tow to enter the crowded chamber below. Customarily, the depth y (FIGS. II and III) will be of the order of a few thousandths of an inch. As a general proposition, however, the value of y may be related to the denier distribution of the tow lengthwise of the rolls. For instance, if the tow comprises 470,000 deniers and the length of the rolls is 2.5 inches, and if allowance is made for the shoulder portions at the edges of the rolls and for the thinner edges of the tow itself, an average distribution of about 200,000 denier per inch of roll length is obtained. Accordingly, the value of y can be defined as being from about 0.0007 to 0.0030 inch for each 100,000 den./inch of average tow distribution.

The total width of the gap between the rolls, in the midregion, will, of course, be $2y$ plus whatever additional separation is found desirable between the rolls. For instance, in practice with the hitherto standard (straight edged) rolls, it has been found possible to control the nature of the crimp obtained by the degree of separation between the rolls. For a herringbone crimp, for instance, a separation of 0.017 to 0.022" has been found best. With the rolls of the present invention, the distance between roll axes will be adjusted so that the total separation between them (inclusive of the quantity $2y$) shall fall within the same range, at least in the midregions of the length of the nip.

The length of the gap is equal to the width of the rolls, whether shoulders are provided or not, for, as said above, the rolls are generally kept from actual contact with each other at any point. The function of the shoulders is merely to eliminate sharp edges at the extreme ends of the roll. Accordingly, their width is not critical and is preferably kept small. For instance each shoulder may be given a width from 1 to 5% of the total width of the roll, with the length of the gap therebetween being from about 90 to 98% of the width of said rolls.

The actual shape of the gap is not critical. In FIG. II it is shown to be of a continuously curving shape **20**, resembling the outline of a convex optical lens. In FIG. III, on the other hand, the edge of the gap is essentially saucer shaped, that is, flat at the center, as at **21**, and sloping at **22**, **22** toward the shoulders **25** at the edge portions. Between these two extremes, many intermediate shapes are possible.

The section of FIG. III would seem most fitting for a tow which is made up of laterally overlapping ribbons (as shown at 3 in FIG. I), and which, accordingly, is of essentially uniform thickness throughout except at the extreme edges where only a single ribbon thickness exists. It will be noted, incidentally, that the representation of the stacking of tow 3 in FIG. I along a slanting line is merely conventional or diagrammatic, since in actual practice the width dimension of the tow will be parallel to the axes of the two rolls. The separation between the two rolls in FIG. I is likewise diagrammatic and exaggerated. As already mentioned, the edges of the rolls in the nip line are preferably in tight contact with the tow at all points of its width, including the extreme edges.

In a saucer shaped design as in FIG. III, it is recommended, a practical guide, to make the flat central portion over 70 to 85% of the width of each roll (length of the gap); each rising portion about 10 to 6.5%; and each shoulder portion from 5 to 1% of the roll width.

In actual tests with this invention, good results have been obtained with a lenticular model whose characteristic dimensions were as follows:

Diam. of roll=4 in.; max. depression, y=0.002 to 0.003 in.

Width of roll=2.5 in.; width of each shoulder=0.03 to 0.25 in.

The advantages of this invention will now be readily apparent. The use of the concave crimper rolls of this invention results in tows that are free from non-uniform edges folds and heavy selvages. It also eliminates the equipment used to fold over the edges of the tow. Tows produced by use of the concave rollers are relatively free of splits and process well on the Turbo Stapler.

The details of the above description are susceptible of wide variation and modification, within the skill of those engaged in this art. For instance, there is no need for undercutting both rolls to the same depth. Any other distribution yielding a total gap between the rolls equal to $2y$ (if the rolls are put in contact with each other) will operate in the same manner. As a matter of fact, the entire depth of $2y$ may be cut out in just one of the rolls, leaving the other one with the hitherto standard straight edge.

I claim as my invention:

1. A crimper for synthetic textile tow, comprising in combination a stuffing box and a pair of oppositely revolving cylindrical feed rolls in parallel alignment and in near contact with each other, whereby to squeeze into the stuffing box a continuous textile tow when one is passed through the nip therebetween, at least one of said rolls being shaped along its outer, cylindrical surface to be slightly thinner in the midportions thereof compared to its extreme edges, whereby to provide a gap between the rolls whose width is narrower at its ends than in the midregions thereof.

2. A crimper as in claim 1, said rolls being shaped to possess oppositely facing narrow shoulders at each edge, and to form a crosswise narrow, longitudinal gap between said shoulders, the length of said gap being from about 90 to 98% of the width of said rolls, and the largest width of said gap, if said rolls are put in contact with each other, being between 0.0015 and 0.0060" for each 100,000 denier per inch in the intended average distribution of said tow along the width of said rolls.

3. A crimper having rolls as in claim 2, said narrow gap being of an essentially uniform width extending on each side of the midpoint of the cylinders for a total length equal to between 70 and 85% of the length of said gap and narrowing down from there on gradually outward until the gap reaches the region of said juxtaposed shoulders.

4. A crimper having rolls as in claim 2, said narrow gap being of an essentially double-convex lenticular shape.

References Cited by the Examiner

UNITED STATES PATENTS

1,164,629	12/1915	Bergman	226—189
2,747,233	5/1956	Hitt	19—66
3,145,429	8/1964	Resor	19—157

FOREIGN PATENTS

835,176	9/1938	France.

DONALD W. PARKER, *Primary Examiner.*

L. K. RIMRODT, *Assistant Examiner.*