

Sept. 25, 1956

C. W. SAMMONS ET AL
TREATMENT OF TEXTILE FIBERS

2,763,898

Filed May 25, 1951

2 Sheets-Sheet 1

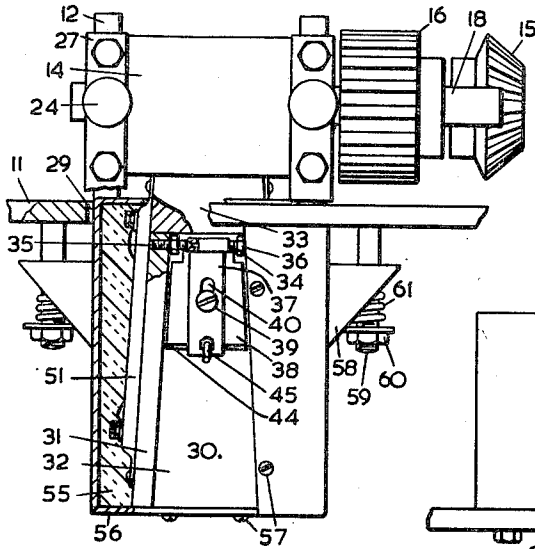


FIG. 1.

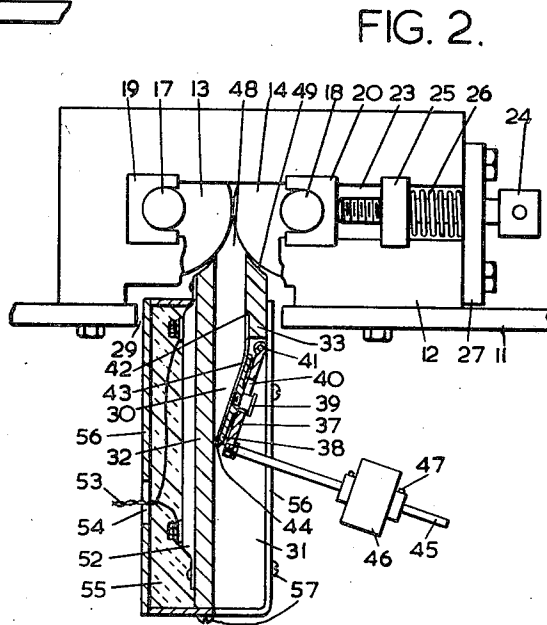


FIG. 2.

FIG. 3.

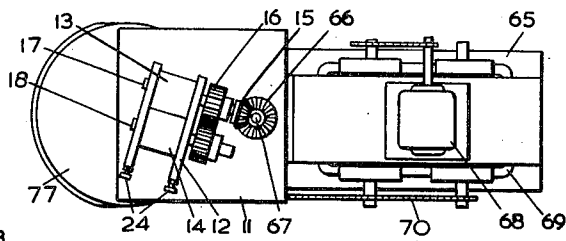
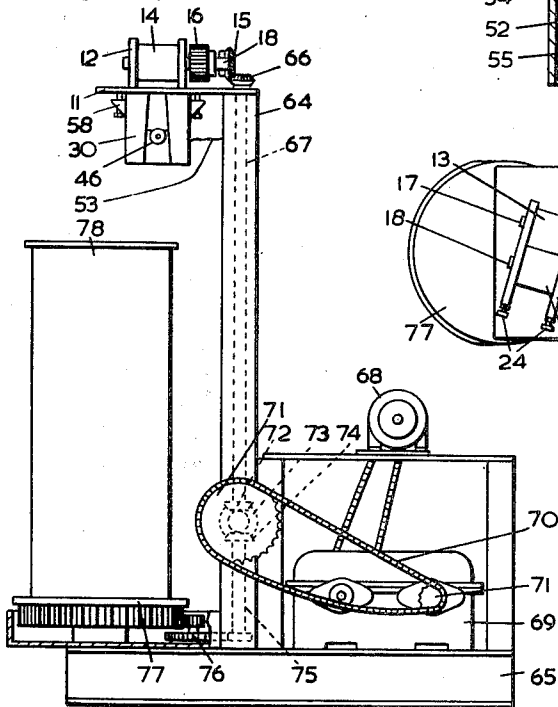


FIG. 4.

C. W. SAMMONS
G. E. MORTIMER
J. W. FISHER
INVENTORS

L. B. & C. Levinson
ATTORNEYS

Sept. 25, 1956

C. W. SAMMONS ET AL
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2 Sheets-Sheet 2

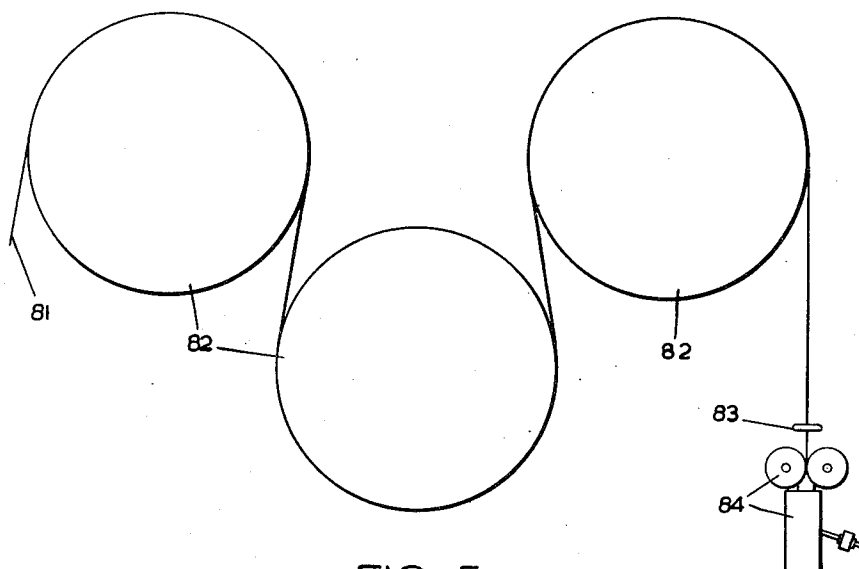


FIG. 5.

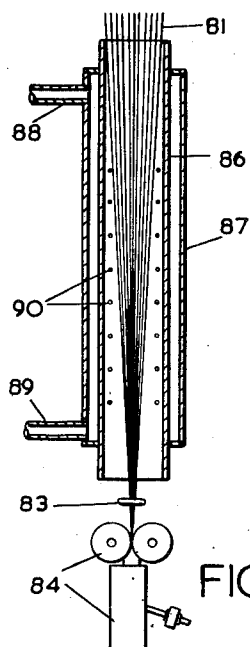


FIG. 6.

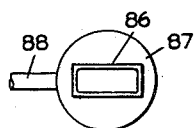


FIG. 7.

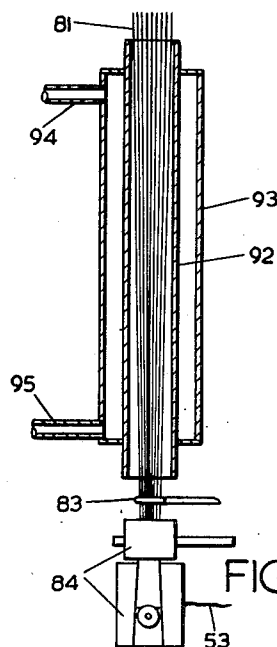


FIG. 8.

C. W. SAMMONS
G. E. MORTIMER
J. W. FISHER
INVENTORS

L. S. & C. W. Sammons
ATTORNEYS

1

2,763,898

TREATMENT OF TEXTILE FIBERS

Charles William Sammons, George Ernest Mortimer, and James Wotherspoon Fisher, Spondon, near Derby, England, assignors to British Celanese Limited, a corporation of Great Britain

Application May 25, 1951, Serial No. 228,196

Claims priority, application Great Britain May 31, 1950

1 Claim. (Cl. 19—66)

This invention relates to the treatment of textile fibres and particularly to a method and apparatus for the mechanical treatment of continuous filaments or staple fibres for the purpose of imparting crimp thereto.

In one method and apparatus for imparting crimp to textile fibres, a continuous sliver of staple fibres or a bundle or tow of continuous filaments is forcibly fed, e. g. by passing it through a pair of driven nip rollers heavily pressed together, into one end of a confined passage from the other end of which its emergence is strongly resisted, e. g. by a loaded closure flap requiring a substantial pressure to force it open. On entering the passage, the fibres assume a crimped or buckled form or configuration and, while passing in that form through the passage, are subjected to a substantial degree of pressure by the subsequently entering fibres before they can be forced out of the passage against the resistance. The pressure to which they are thus subjected fixes the crimp and causes it to be retained by the fibres after they have emerged from the passage.

According to the present invention, in a process of the kind referred to, the fibres are subjected to the crimping pressure in the confined passage while they are hot, with the object of increasing the permanence and/or the intensity of the crimp imparted to the fibres. An apparatus according to the present invention, for treating textile fibres by the method defined above, comprises a pair of nip rollers, means for driving said nip rollers, a passage fitting closely at one end thereof to said nip rollers, means for resisting the emergence of fibres from the other end of said passage, and means for heating fibres that are fed by said nip rollers into said passage.

Preferably the fibres are heated while they are in the confined passage, by supplying heat to some or all of the walls of the passage. Alternatively or in addition, however, the fibres may be heated immediately before they reach the feed rollers and forced into the passage while they are hot, so that they are still hot when they are subjected to crimping pressure in the passage. Heat can be applied to the walls of the passage by providing the walls with electrical heating elements or with a jacket for the reception of steam, hot water or other fluid heating medium. The application of heat to the fibres immediately before they reach the rollers can be effected by passing them round or in contact with a heated roller, or in sliding contact with a curved heated surface. Alternatively the fibres may be passed through a tube that is heated, e. g. electrically or by a heating jacket, or that is supplied with steam or other heated gas which is passed through the tube, preferably in the same direction as the fibres so as to impinge on the nip rollers and to heat them as well as the fibres.

The means for resisting the emergence of the fibres from the confined passage is preferably in the form of a hinged flap constituting continuation of one side of the passage and provided with means, such as strong springs or, and preferably, a weight-loaded lever, for urging the flap inwards, in a direction such as to close the passage.

2

A crimping device of this kind that is particularly suitable for the purposes of the present invention is described in co-pending U. S. application Serial No. 228,206, filed May 25, 1951, and now Patent No. 2,693,008.

The process and apparatus of the invention are particularly applicable to filaments or fibres of a thermoplastic nature, e. g. to artificial filaments or staple fibres of cellulose acetate or other organic derivative of cellulose such as cellulose propionate, cellulose butyrate, cellulose acetate butyrate, cellulose acetate stearate and ethyl cellulose, or of synthetic linear polymers such as polyamides, or of vinyl compounds such as copolymers of vinyl acetate with vinyl chloride, vinylidene chloride or acrylonitrile. The invention, however, is also applicable to non-thermoplastic fibres such as cotton or linen fibres, or continuous filaments or staple fibres of regenerated cellulose. The imparting of the crimp to the fibres may be facilitated, especially in the case of non-thermoplastic fibres, by the application thereto immediately before crimping of a liquid such as water or an aqueous finish or lubricant. The amount of liquid so applied should be carefully controlled and limited so as not to increase unduly the amount of heat that must be applied to the fibres.

The fibres may be supplied to the process and apparatus according to the invention either in the form of a bundle or tow of continuous filaments or in the form of a loose but coherent product, generally slightly twisted, of staple fibres. The crimped filaments or fibres resulting from the treatment may be collected in any convenient way, e. g. by winding, preferably under low tension, on bobbins, swifts, reels or the like or by coiling into a can, and may be converted into yarns or otherwise used in a separate subsequent operation or series of operations. Alternatively the products may be fed directly from the crimping apparatus to the subsequent operation or series of operations in which they are to be used. The invention is of especial importance in relation to the crimping of continuous filaments which are subsequently to be cut or otherwise converted into suitable lengths for spinning into staple fibre yarns. In this case the crimped filaments may be passed directly to a cutter for conversion into staple fibre, or may be collected as a tow suitable for use in a subsequent tow-to-top conversion, in which the continuous filament tow is converted directly into a continuous top of staple fibre while maintaining the continuity of the product as a whole.

By way of example some forms of apparatus according to the invention and the mode of their operation will now be described in greater detail with reference to the accompanying drawings in which,

Figure 1 is a front elevation and Figure 2 a side elevation, both partly in section, of a heated crimping device,

Figure 3 is a side elevation and Figure 4 is a plan showing the layout of an apparatus in which the crimping device of Figures 1 and 2 is employed, and

Figures 5-8 are diagrammatic drawings showing three alternative methods of heating the fibres, in which the fibres are heated before they reach the crimping device.

Referring to Figures 1 and 2 the crimping device shown therein is mounted on a base plate 11 on which are two upstanding side brackets 12 carrying between them a pair of nip rollers 13, 14 each of 1/4" radius. The rollers 13, 14 are driven, in a manner to be described hereafter, through a bevel gear 15 and are geared to one another by spur gears 16 mounted on the spindles 17, 18 of the rollers 13, 14. The bevel gear 15 is mounted on the spindle 17. The spindles 17, 18 are carried in half-bearings 19, 20 sliding in horizontal slots 23 in the side brackets 12. The half-bearings 19 are lodged in the ends of the slots while the half-bearings 20 are urged towards the half-bearings 19 by means of screws 24 threaded into blocks 25 also slidable in the slots 23, the

blocks 25 being engaged by springs 26 which abut against end plates 27 on the brackets 12. The pressure exerted by the springs 26 can be adjusted by turning the screws 24.

Beneath the rollers 13, 14 a rectangular hole 29 is formed in the base plate 11 through which extends the crimping passage, indicated generally at 30. The passage 30 is formed by side walls 31, a rear wall 32, and a short front wall 33 let into suitably shaped recesses in the front edge of the side walls 31. The side walls 31 diverge slightly as shown in Figure 1, to avoid jamming of a mass of fibres in the passage 30. Screwed through the side walls 31 just below the lower edge of the front wall 33 are two pins 34 slotted at their outer ends as at 35 to receive a tool for the adjustment of their position and secured in place by lock nuts 36. The inner ends of the pins 34 are conically pointed and enter into conical enlargements (not shown) at the ends of a bore 41 (Figure 2) near the top edge of a flap 37 which is thus pivoted on the pins 34. Loosely mounted beneath the flap 37 is a plate 38 shaped to conform to the side walls 31 and secured to the flap 37 by means of a screw 39 passing through a slot 40 in the flap. At 42 on the inner face of the front wall 33 is brazed the upper edge of a sheet 43 of flexible brass, the wall 33 being relieved below 42 so that the wall and the sheet 43 together present a smooth surface. The lower edge of the sheet 43 is rolled at 44 so as to form a bead 44 just below the lower edge of the plate 38 and serving to support the plate. Screwed into the flap 37 near the lower edge thereof is a rod 45 extending at right-angles to the flap and carrying a cylindrical lead weight 46 adjustable along the length of the rod 45 and secured in position by means of set screws 47. The upper ends of the side walls 31 of the crimping passage are shaped at 48 to conform to the nip of the rollers 13, 14 while the upper edges of the rear and front walls 32, 33 are bevelled at 49.

The passage constituted by the walls 31, 32, 33 is heated by means of electrical strip resistance elements 51 of convenient type, fixed to the side walls 31, and by similar elements 52 fixed to the rear wall 32. The elements 51, 52 are connected in parallel and supplied with current through leads 53 passing through a hole 54 in the rear plate of a casing 56 surrounding the crimping passage. The casing 56 is filled with heat-insulating material 55 and is firmly secured to the side and rear walls 31, 32 by screws 57.

Welded to the sides of the casing 56 are horizontally extending brackets 58 through which pass studs 59 screwed into the underside of the base plate 11. Nuts 60 are screwed on the ends of the studs 59 and act through springs 61 so as to urge the crimping passage 30 upwards. By these means the shaped mouth 48, 49 of the passage 30 is constantly urged into engagement with the curved surfaces of the nip rollers 13, 14 and maintains contact with the rollers if they move apart as fibres pass between them.

The crimping device described above is employed in conjunction with a conventional coiler mechanism as shown in Figures 3 and 4. The base plate 11 of the crimping device is mounted at the top of a cylindrical column 64 rising from the base 65 of the coiler mechanism. A bevel gear 66 for engagement with the bevel gear 15, described above, is mounted on the upper end of a shaft 67 extending up the column 64. The shaft 67 is driven from an electric motor 68 through an infinitely variable gear 69 which is connected by means of a chain 70 and sprockets 71 to a bevel gear 72. The bevel gear 72 drives two bevel gears 73, 74, the gear 73 being mounted on the lower end of the shaft 67 while the gear 74 is mounted on the upper end of a further shaft 75. From the shaft 75 the drive is transmitted through gears 76 to a rotatable platform 77 on which is placed a coiler can 78 lying below the mouth of the crimping passage.

In the operation of the device a thick sliver of staple fibres or a tow of continuous filaments is fed by the nip rollers 13, 14 into the passage 30 in which it is retained by the weight-loaded flap 37, 38 and is thereby subjected to crimping pressure. While the fibres are subjected to crimping pressure in this manner, they are heated by means of the elements 51, 52. When sufficient pressure is built up in the passage 30, the flap 37, 38 is forced open and the crimped product emerges continuously into the coiler can 78 which is rotated to distribute the tow or sliver of crimped filaments or staple fibres in the can 78.

Figure 5 shows an alternative method of heating the fibrous tow or sliver. The tow or sliver, shown at 81, is passed in succession round three large steam-heated drums 82 before being led to a guide 83 from which it proceeds to a crimping device 84 similar to that described with reference to Figures 1 and 2 except that the heating elements 51, 52 may be omitted. The casing 56 and insulation 55, however, are retained in order to prevent the filaments or fibres being unduly cooled while they are in the crimping device 84.

In the arrangement shown in Figure 6 a tow of continuous filaments 81 is caused to pass through an inner tube 86 provided with a steam jacket 87 through which is passed steam supplied by a pipe 88 and removed by a pipe 89. The steam in the jacket 87 is allowed to escape slowly into the interior of the tube 86 through steam passages 90. The steam thus escaping condenses on the filaments of the sliver or tow 81 so that the filaments, when they pass through the guide 83 to the crimper 84, are not only heated but are in a moist condition. As shown in Figure 7, the tube 86 is of rectangular section.

In the arrangement shown in Figure 8 the sliver or tow 81 is passed through an inner tube 92 surrounded by a jacket 93 through which are passed hot vapours supplied by a pipe 94 and removed by an exhaust pipe 95. By the selection of substances of suitable boiling point for the vapours supplied to the jacket 93, the jacket can be maintained at a temperature suitable for heating the filaments or fibres 81 to the desired degree before they enter the crimper 84. In any of the cases shown in Figures 5-8 additional heat may be supplied by the provision of heating elements 51, 52 supplied with power through leads 53, as indicated in Figure 8.

Having described our invention, what we desire to secure by Letters Patent is:

Apparatus for imparting crimp to textile fibres, said apparatus comprising a pair of nip rollers, means for driving said nip rollers, a passage fitting closely at one end thereof to said nip rollers, means for resisting the emergence of fibres from the other end of said passage including a flap pivoted on a hinge and constituting a continuation of one side of said passage, means for urging said flap inwards, in a direction such as to close said passage, and a sheet of flexible material anchored at one end within said passage and covering said hinge and the surface of said wall and of said flap on each side of said hinge, and heating means surrounding the walls of said passage and adapted to supply heat by conduction to the inner surfaces of said walls.

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