

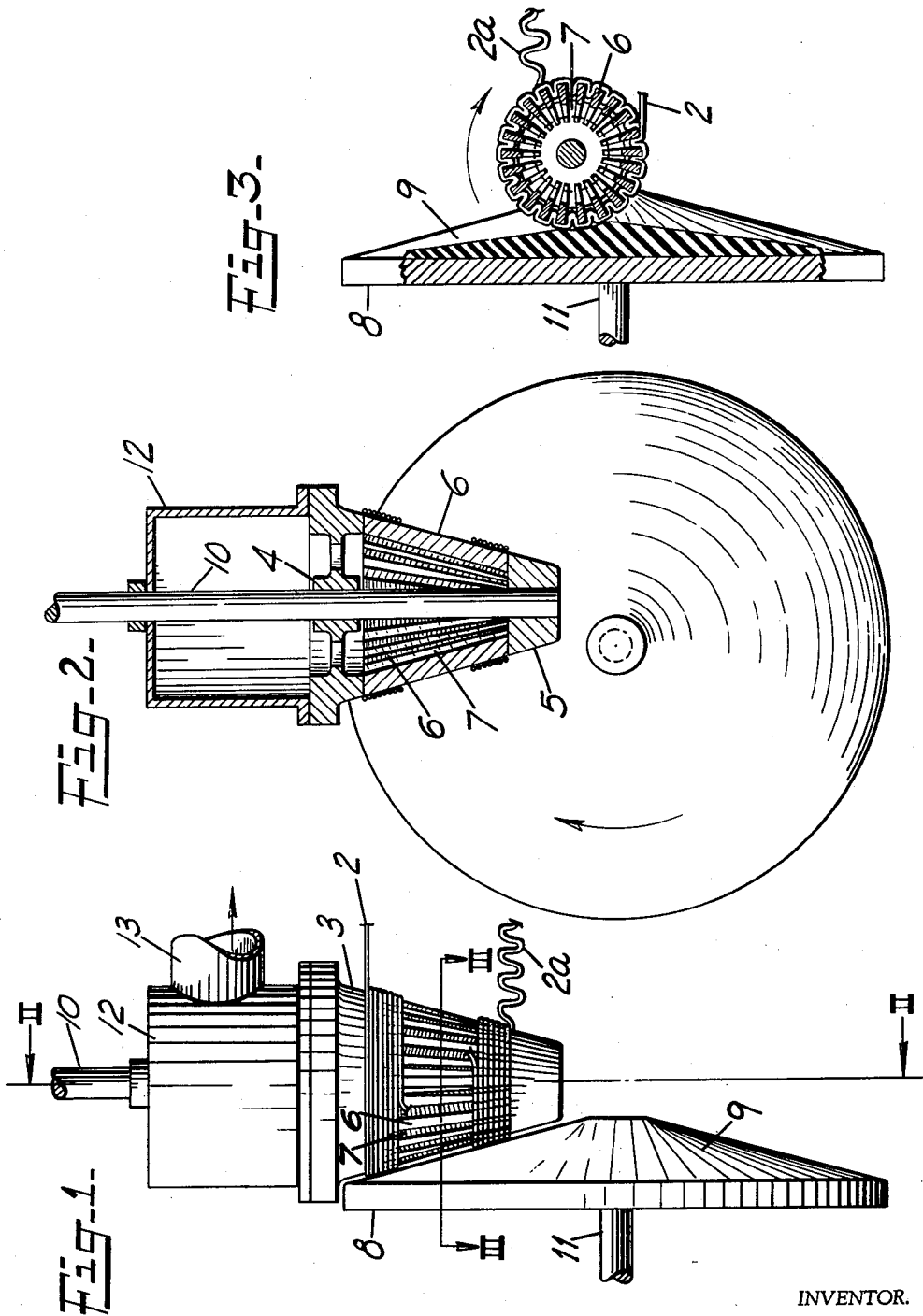
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METHOD AND APPARATUS FOR CRIMPING TEXTILE FIBROUS MATERIAL

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METHOD AND APPARATUS FOR CRIMPING
TEXTILE FIBROUS MATERIALAlvin Lodge, Meadville, Pa., assignor to American
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14 Claims. (Cl. 28—1)

This invention relates to the crimping or similar distorting of textile fibrous materials in the form of filaments, yarn, or tow.

It is an object of the invention to provide a novel method of crimping yarn and the like in accordance with which the yarn is disposed in circular or helical loops or windings, each such winding being caused to form a winding of gradually decreasing diameter whereby the excess material in the yarn is forced to occupy crimped or folded shapes. A further object of the invention is to provide for the application of a setting means to the windings of crimped yarn and the like before it is withdrawn from the generally circular or helical windings thereof. A further object of the invention is to devise a suitable form of apparatus to perform the method just described.

Further objects of the invention will be apparent from the description and the drawing herewith.

In the drawing, illustrative of the invention, Figure 1 is an elevational view of the apparatus for crimping yarn and the like.

Figure 2 is a sectional view taken on lines II—II of Figure 1, and

Figure 3 is a sectional view taken on the lines III—III of Figure 1.

The method of this invention is a modification of the methods disclosed in my prior applications Serial No. 398,014, filed June 14, 1941, now U. S. Patent Number 2,300,791, and Serial No. 399,439, filed June 24, 1941. In general, the method consists in forming the yarn or the like into windings or convolutions of a tapered helix and causing the yarn to enter the tapered helical winding at its largest diameter and forcing the thus formed helical convolution of large diameter into helical convolutions of approximately circular shape of gradually decreasing mean diameter or effective overall diameter while allowing and causing any excess length of the yarn or the like to flex inwardly of the winding at numerous substantially equidistantly spaced arcs around those convolutions having smaller diameter. The invention also contemplates a preliminary application of a softening agent to the yarn before it is formed into the tapered helical windings and the setting of the curliness or crimpiness in the yarn as it approaches its maximum extent in the smaller windings of the helix by causing the removal of the softening means. The rate of removal of the softening means may be so controlled as to make the setting of the crimp in the yarn substantially com-

plete at the time it is withdrawn from the helical windings. While various forms of apparatus may be employed to carry out the method, the apparatus shown in the drawing will be described as one embodiment suitable for performing the method.

As shown in the drawing, the uncrimped yarn 2, is fed to the exterior surface of a cage-like drum 3 having a conical shape and provided with suitable bearing portions 4 and 5 and the bars 6 which are separated by the slots 7 which communicate with the hollow interior of the tapered cage-like drum. A rotatable disc 8 having a generally conical surface 9 is pressed towards the drum 3. The conical portion 9 of the disc 8 is made of a suitable resilient material, such as rubber, synthetic rubber, etc. Either the drum or the disc or both may be fixed to the shafts 10 or 11 respectively, either or both of which may be positively driven. Preferably, however, the cone-faced disc is allowed to idle while the cage-like drum is positively driven at any desired speed. In Figures 2 and 3 the offset arrangement of the axis of the cage-like drum with respect to the axis of rotation of the disc is clearly shown. By virtue of this offset arrangement, the rotation of drum 3 in the direction indicated by the arrow in Figure 3 causes the several windings of yarn upon the cage-like drum to be forced downwardly, that is, toward the end of the cage-like drum having smaller diameter.

The drum is provided with a hood 12 within which the shaft 10 is free to rotate, and the hood 12 is provided with a discharge pipe 13 connected to a suitable exhaust fan or pump. By this means, air is drawn through the helical winding thereby acting in a manner to hold the winding against the drum and at the same time to bend and crimp the excess length portions of the yarn in the windings so that they extend between the several bars 6. In addition, when a softening medium is present in the yarn, the air drawn through the windings thereof upon the drum removes the softening medium progressively as the yarn proceeds from the largest diameter to the smallest diameter portion of the drum. If desired, any other gaseous hardening medium or a stream of heated air may be directed toward the drum 3 in such a way that it may be drawn through the yarn by the fan or pump.

While the bars 6 are shown in the drawing to have a tapered form, that is they gradually narrow from the larger end to the smaller end

of the drum, such form is not essential and they may have constant thickness throughout their lengths. While the resilient presser member 9 has been shown as a cone, a flat surfaced disc may be substituted, its axis of rotation being tilted so that the resilient surface passes substantially tangentially of the drum 3.

In operation, the yarn is fed upon the upper and larger end of the cage-like drum which is driven in the direction indicated by the arrow in Figure 3, and as the yarn is pressed by the resilient cone 9 against the drum 3, it is forced downwardly by virtue of the tendency of the resilient cone to continue to engage the yarn at that point of its surface where the yarn first makes substantial contact. Because of the offset arrangement of the axis of rotation of the cage-like drum with respect to that of the resilient cone, the tendency of each of the windings upon the drum is to be forced downwardly toward the smaller end thereof, this tendency being exerted upon every portion of the windings as it makes contact with the resilient cone upon each revolution of the drum. The sucking of the air through the windings tends to form crimps and bends therein and to direct them between the slots as the circumferential length of each winding progressively diminishes. This crimping becomes more extensive as the windings approach the smaller end of the drum. At the same time, the crimping is set more and more as the windings approach the smaller end by virtue of the repeated pressing of the windings throughout their peripheries against the resilient cone and also by virtue of the fact that any softening agent or plasticizer is gradually removed by the air drawn through the winding upon the cage-like drum. The crimped winding 2a as it is withdrawn from the drum may proceed to any suitable winding device or to a staple cutter if desired.

The yarn or the like to be crimped may be in a dried unmodified form or it may be softened. Any suitable softening means may be applied to the yarn. For example, the yarn may be passed through a steam atmosphere just before it reaches the drum of the device described. The yarn may also contain either incorporated therein or in a form of a coating such materials as pigments, fillers, dyes, lakes, fire-retardants, de-electrifiers, sizes, or lubricants, such as are commonly employed in the textile art. The yarn or the like may be made of any suitable natural or artificially produced fibrous material, such as cotton, wool, regenerated cellulose, cellulose acetate, etc. Likewise, it may be in the form of continuous or discontinuous filaments and it may be of any denier.

In the claims, the expression "textile fibrous material" is intended generically to include the various forms of the filaments contemplated by the invention, examples of which are indicated in the preceding paragraph. This expression is further intended to exclude woven fabrics, the invention contemplating such fibrous materials as tow, yarn, individual continuous filaments, or a bundle of continuous filaments whether twisted or untwisted, etc., such as are suitable for subsequent manufacture into textile fabrics.

While preferred embodiments of the invention have been disclosed, the description is intended to be illustrative only, and it is to be understood that changes and variations may be made without departing from the spirit or scope of the invention as defined in the appended claims.

What I claim is:

1. In a method of crimping textile fibrous material, the steps of distributing the material generally in configuration of a tapered helix, applying pressure against said material successively at a plurality of spaced portions of the convolutions in the helix and reducing the mean diameter of each convolution of the material in said helix by progressively forcing said convolutions into the space occupied by each smaller convolution adjacent thereto whereby the circumferential crowding of said material causes distortion thereof and forcing the material intermediate said portions to bend inwardly of said winding.

2. In a method of crimping textile fibrous material, the steps of distributing the material generally in a configuration of a tapered helix, applying pressure against said material at equidistantly spaced portions of the convolutions thereof in said helix, reducing the mean diameter of each convolution of the material in said helix by progressively forcing said convolutions into the space occupied by each smaller convolution adjacent thereto and simultaneously applying fluid pressure against said helical windings to cause bending of the portions of the convolutions thereof intermediate the first-mentioned portions.

3. In a method of crimping textile fibrous material, the steps of continuously distributing the material generally in the configuration of a tapered helix, applying pressure against said material at numerous equidistantly spaced portions of the convolutions of said helix and causing said pressure to progressively force said convolutions into the space occupied by each smaller convolution adjacent thereto whereby the longitudinal crowding of said material causes distortion thereof and applying gaseous pressure externally of said windings to cause distortion and bending of the material between the first-mentioned portions of said windings to occur inwardly of said helix.

4. In a method of crimping textile fibrous material, the steps of continuously softening said material and of continuously distributing the material generally in a configuration of a tapered helix, applying pressure against said material at approximately equidistantly spaced portions of the windings thereof in said helix and causing said pressure to progressively force said convolutions into the space occupied by each smaller convolution adjacent thereto whereby the longitudinal crowding of said material causes distortion thereof, and applying under pressure a heated gaseous medium externally of said winding to cause bending or distortion therein between the first-mentioned portions of the peripheries of said convolutions to be directed inwardly of said helix and to cause evaporation of said softening means from said material.

5. In an apparatus for crimping textile fibrous material, means for winding a textile fibrous material into the general form of a tapered helix, said means having an apicad ribbed winding surface, means for pressing said winding upon its external surface with a force tending to slide a portion of each of the convolutions of said winding toward the smaller end of the tapered helix and means arranged to cause pressure to be applied to the exterior of the convolutions for forcing excess length of the material in the convolutions of smaller diameter inwardly of the winding.

6. In an apparatus for crimping textile fibrous material, a rotatable drum member having an apicad slotted surface of the general shape of a cone, a rotatable resilient member, said members being arranged in near driving relationship to form a nip therebetween, said resilient member being arranged with its axis of rotation offset with respect to the axis of rotation of said drum so that such axes are neither parallel nor intersecting, and means for driving at least one of said members.

7. In an apparatus for crimping textile fibrous material, a rotatable drum member having an apicad slotted surface of the general shape of a cone, a rotatable resilient member of the general shape of a cone, said members being arranged in near driving relationship to form a nip between their surfaces, said resilient member being further arranged with its axis in a plane substantially perpendicular to the axis of the drum but in non-intersecting relationship to the axis of the drum, and means for driving at least one of said members.

8. In an apparatus for crimping textile fibrous material, a hollow drum having an apicad slotted conical surface, a rotatable cone having a surface of resilient material arranged in near driving relationship to said drum to form a nip between their surfaces, the cone being arranged with its axis in a plane substantially perpendicular to the axis of the drum but in non-intersecting relationship to the axis of the drum, and means for rotating said drum about its axis.

9. In an apparatus for crimping textile fibrous material, a rotatable hollow drum having an apicad slotted conical surface, a rotatable cone having a resilient surface, said drum and cone being arranged to form a nip between their inclined surfaces, said cone being arranged with its axis in a plane substantially perpendicular to the axis of the drum but in non-intersecting relationship to the axis of the drum, means for rotating said drum and means whereby the pressure within the interior of said hollow drum may be reduced.

10. In a method of crimping textile fibrous material, the steps of distributing the material into a tapered winding without twisting it, applying pressure against said material at a plurality of spaced portions of the convolutions of said winding, forcing the material intermediate said portions to bend inwardly of said winding, and progressively forcing said convolutions into the spaces occupied by each smaller convolution adjacent thereto.

11. In a method of crimping textile fibrous material, the steps of distributing the material

into a tapered single-layer winding, applying pressure against said material at a plurality of spaced portions of each of the convolutions of said winding, progressively forcing said convolutions into the spaces occupied by each smaller convolution adjacent thereto, and simultaneously applying pressure externally against substantially all of said winding to cause bending of the portions of the convolutions intermediate the first-mentioned portions.

12. In a method of crimping textile fibrous material, the steps of winding the material generally in a configuration of a tapered helix, applying pressure against said material in succession at a plurality of spaced portions of the convolutions thereof, reducing the mean diameter of each convolution of the material in said helix by progressively forcing said convolutions into the spaces occupied by each smaller convolution adjacent thereto and applying fluid pressure against said helical winding to cause bending of the portions of the convolutions thereof intermediate the first-mentioned portions.

13. In a method of crimping textile fibrous material, the steps of softening said material, continuously distributing the material in the general configuration of a tapered helix, applying pressure against said material in succession at a plurality of spaced portions of the convolutions thereof in said helix and causing said pressure to progressively force said convolutions into the space previously occupied by each smaller convolution adjacent thereto, and applying a heated gaseous medium externally of said winding to cause any bending or distortion therein between the first-mentioned portions of said convolutions to be directed inwardly of said helix and to cause evaporation of said softening means from said material.

14. In an apparatus for crimping textile fibrous material, a rotatable drum member having an apicad slotted surface of the general shape of a cone, a rotatable resilient member, said members being arranged in near driving relationship to form a nip between their surfaces, said resilient member being arranged with its axis of rotation offset with respect to the axis of rotation of said drum so that such axes are neither parallel nor intersecting but arranged to cause the convolutions of the material about the rotatable drum member to be forced toward the smaller end of the cone upon rotation thereof, means for driving at least one of said members and means arranged to cause pressure to be applied to the exterior of the convolutions.

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