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METHOD FOR CRIMPING TEXTILE FIBERS

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Fig 1

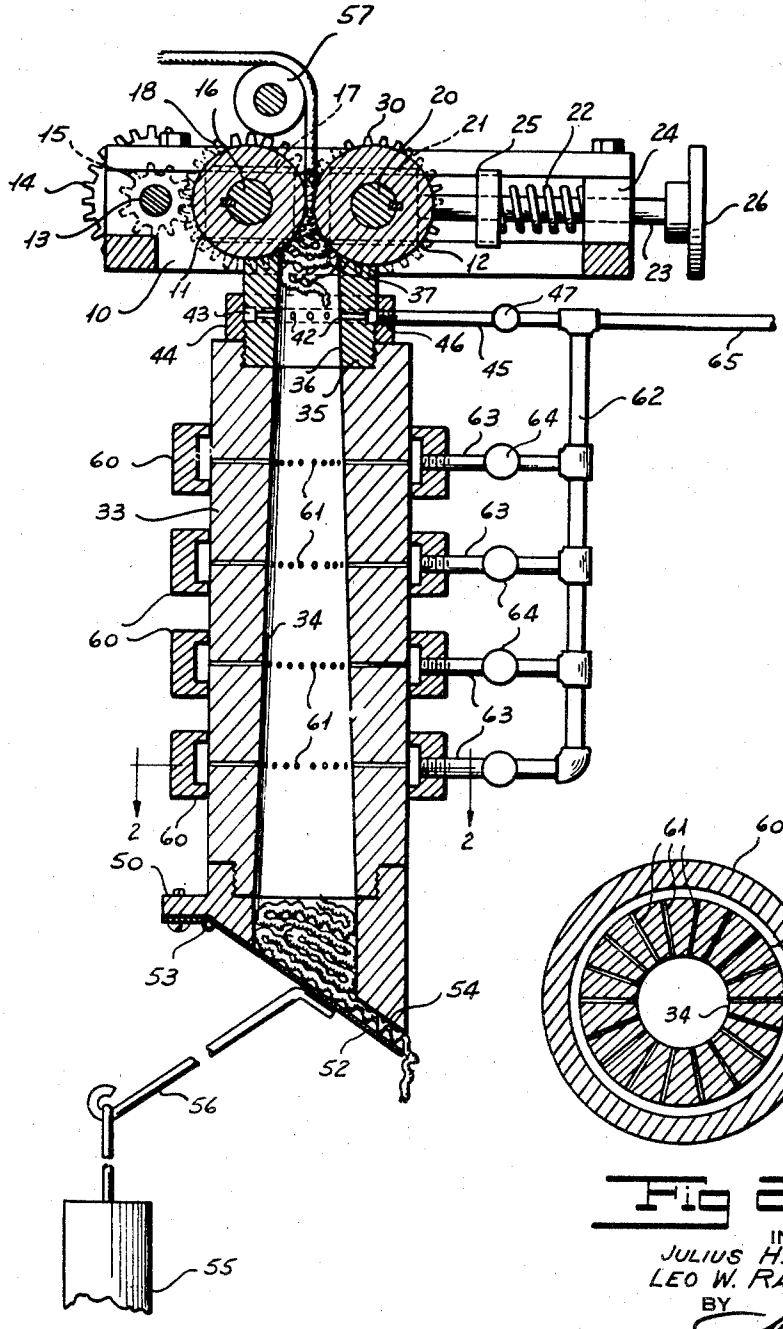

Fig 2

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METHOD FOR CRIMPING TEXTILE FIBERS

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3 Claims. (Cl. 19—66)

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This invention relates to a method for crimping textile fibers, and more particularly to a method for imparting a controlled crimp to wool and other naturally resilient fibers having similar characteristics.

An object of the invention is to provide a novel and improved method for producing a fiber characterized by a predominant, sharp, angular bend or crimp with the portions between bands substantially straight.

Another object is to provide a crimping method which is readily controllable for producing a uniformly crimped product.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

In accordance with this invention, the crimp is produced mechanically by feeding the pretreated fibers between feed rolls into a crimping chamber which is maintained full of fibers under a predetermined back pressure. As the fibers are forced into the crimping chamber, they are laid in a zig-zag form and are pressed to form sharp angular bends or crimps with intervening straight portions, the length of which depends upon several factors, such as the characteristics of the fibers and the pressure, temperature, and moisture conditions to which the fibers are subjected.

The crimp is set by treatment in a setting chamber with superheated water, under controlled conditions of time, temperature, moisture and pH in the range below which the natural resilience of the fibers resists deformation and above which degradation occurs, the relationship being such that the fibers are brought to the plastic condition necessary for the formation of a permanent crimp.

In the apparatus shown the crimping and setting chambers are continuous and are preferably formed with slightly flaring walls in the direction of feed so as to reduce the friction of the fibers against the walls. The walls may also be plated and polished to reduce the friction further. The setting chamber is of a size to hold the fibers for a predetermined setting time in their passage therethrough.

Passages are provided for the admission of the water into a plurality of zones spaced along the path of travel of the fibers in the setting chamber so as to maintain controlled conditions throughout the mass of fibers during their passage therethrough.

The novel features which are characteristic of this invention will be better understood by referring to the following description, taken in connection with the accompanying drawings in

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which a specific form of crimping apparatus has been set forth for purposes of illustration.

In the drawings:

Fig. 1 is a vertical section through an apparatus for carrying out the present process; and

Fig. 2 is a horizontal section taken along the lines 2—2 of Fig. 1.

Referring to the drawings more in detail, the crimper is shown as comprising a frame 10 carrying a pair of feed rolls 11 and 12 and drive shaft 13. The shaft 13 is journalled in the frame 10 and carries a pinion 15 and a sprocket 14 which is driven by a suitable power source, not shown. The feed roll 11 is keyed to a shaft 16 journalled in bearing blocks 17 fixed to the frame 10 and carrying a gear 18 meshing with the pinion 15. The feed roll 12 is keyed to a shaft 20 journalled in bearing blocks 21 which are slidable in the frame 10. The roll 12 is held in pressure engagement with the material fed between the rolls by springs 22 seated around threaded rods 23 which bear against the bearing blocks 21. The rods 23 extend through a bracket 24 attached to the frame 10 and carry nuts 25 and adjusting knobs 26. The nuts 25 are held against rotation by the frame 10. The springs 22 are seated between the nuts 25 and the bracket 24 and their tension may be adjusted by means of the knobs 26.

The shaft 20 carries a gear 30 meshing with the gear 18. The gears 18 and 30 have teeth of sufficient depth to remain in mesh throughout the normal range of sliding movement of the shaft 20 during the operation of the crimper.

Positioned below the rolls 11 and 12 is a vertical tube 33 having a tapered bore 34, forming a setting chamber. The tube 33 is attached to a saddle 35 having a tapered central bore 36 forming a crimping chamber and having a curved upper surface 37 conforming to the bight of the rolls 11 and 12 and machined to have a slight running clearance from the surfaces of the rolls. The saddle 35 is attached to the frame 10 and has a plurality of radial passages 42 for the injection of the superheated water into the crimping chamber. The radial passages 42 communicate with an annular passage 43 in the saddle 35 which is closed by a collar 44 to form an inlet manifold. The water is supplied to the annular passage 43 by a pipe 45 registering with a port 46 in said collar and connected to a header 62. A valve 47 controls the flow of setting agent through the pipe 45. A plurality of annular manifolds 60 are disposed around the tube 33 at spaced points along its axis and are connected with the bore 34 by rows of ports 61 which are spaced around the periphery of the tube.

The manifolds are connected to the header 62 by individual pipes 63, each controlled by a valve 64. The header 62 communicates with a supply pipe 65 through which the water is introduced.

At its lower end the tube 33 carries a flanged extension 50 to which a door 52 is hinged by hinge 53 and is held closed against the tapered end 54 of the extension 50 by a weight 55 attached to an arm 56 secured to the door.

For the crimping of wool the raw wool is first opened, scoured, for example with soap and soda ash in several stages, then washed in the usual manner to form stock wool. The scouring and washing may be carried out under conditions to leave the stock wool with the desired pH for crimping. This pretreated stock wool is fed directly at a uniform rate to the feed rolls 11 and 12 of the crimper through a suitable hopper or may be fed to a web-forming device such as a card and fed as a web or condensed into a rope which is fed over a guide roll 57 to the feed rolls 11 and 12 as a sliver or slubbing. If a more uniform feed is required, the stock wool may be picked and carded and condensed to a rope for the above purpose after one or more stages of carding. A uniformity in density of feed stock is preferred to prevent jamming or slipping at the feed rolls or undue lateral movement of the feed rolls.

In either case, the fibers are stuffed by the feed rolls 11 and 12 into the crimping chamber and through the setting chamber and are forced out of the bottom of the setting chamber against the pressure exerted by the discharge door 52. The fibers are held in the crimping and setting chambers by the door until they have been packed sufficiently to force the door slightly open against the force of the weight 55. The back pressure of the packed fibers causes the fibers being forced against the packed fibers by the feed rolls to be folded over in zig-zag crimps, the spacing of which depends upon the nature of the fibers, the pretreatment, and the back pressure.

The superheated water may be obtained for example by passing steam directly through the water in a closed vessel. When equilibrium is reached the water is placed under the steam pressure and attains the steam temperature. For example, steam under a pressure of about 15 pounds per square inch and at a temperature of about 250° F. may be used. The temperature may be varied between 212° F. and 275° F. according to the results desired, the pressure being correspondingly varied. The water from the container is introduced through the pipe 65, header 62, and passages 42 and 61 into the mass of packed fibers. The distribution of the water along the crimping and setting chambers is controlled by adjustment of the valves 47 and 64. The distribution is selected to maintain the mass of fibers at the optimum conditions of moisture content and temperature during their entire time in the setting chamber.

The density of the mass of fibers is sufficient to maintain the water under pressure while its heat is being transferred to the fibers. The quantity of water introduced is controlled in accordance with the desired temperature and moisture content of the fibers. Any excess of water drains out of the bottom of the chamber.

The back pressure at the entrance of the crimping chamber affects the size of the crimp, a higher pressure causing a finer crimp (more crimps per inch) and vice versa. For equilibrium conditions of moisture content and pH, the setting time varies inversely with the temperature.

The quantity and distribution of the water should be selected to cause the fibers to reach rapidly the desired temperature and moisture content and to maintain these conditions during their entire passage through the chambers. The fibers are thus crimped uniformly and under accurately controlled conditions of time, temperature and moisture.

The water which is injected into the crimping and setting chambers may contain added chemicals to aid in producing a permanent set. For example such setting agents as thioglycolic acid and its salts, such as calcium or sodium thioglycolate, formaldehyde, a sulfoxylate formaldehyde, such as zinc or sodium, and the like, may be used.

The crimped fibers emerge from the crimper in the form of a very condensed tow or rope, which is easily opened and separated. It may then be dried, carded and spun in the usual manner.

The fiber thus crimped is characterized by sharp angular bends or crimps which may or may not be uniformly spaced, but are separated by relatively straight lengths of fiber. It may be spun into yarn and skein dyed or may be picked and stock dyed in the usual manner.

It is evident that changes and modifications may be made in the apparatus without departing from the scope of the invention.

What is claimed is:

1. The method of imparting a permanent artificial crimp to textile fibers, which comprises gripping said fibers between closely spaced conveyor surfaces discharging into a substantially closed zone, and forcing the gripped fibers into said zone against the pressure of a mass of fibers held compacted under pressure in said zone, said pressure being adapted to cause the fibers to be progressively folded over and crimped as they are delivered from said conveyor surfaces, holding the mass of crimped fibers compacted under a substantially constant pressure to retain the crimp therein, introducing superheated water under pressure into said zone, treating the mass while thus compacted with said superheated water under conditions to produce a permanent set of said crimp in said fibers, and withdrawing the crimped fibers from said zone.

2. The method set forth in claim 1 in which the superheated water is at a temperature between 212° F. and 275° F.

3. The method set forth in claim 1 in which said superheated water is at a temperature of about 250° F. and at a pressure of 15 pounds per square inch.

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