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YARN HEATING APPARATUS

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Fig. 1.

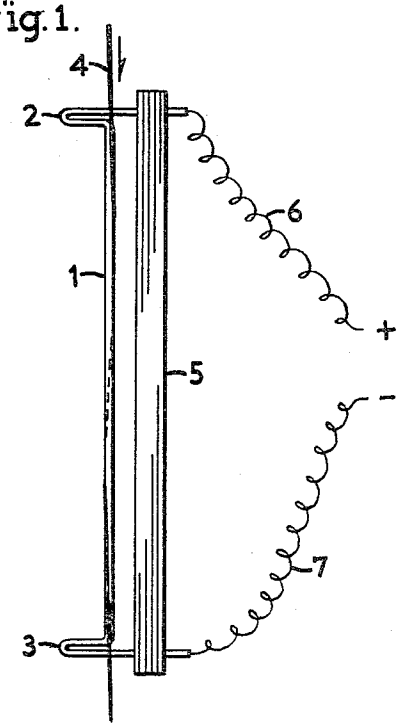
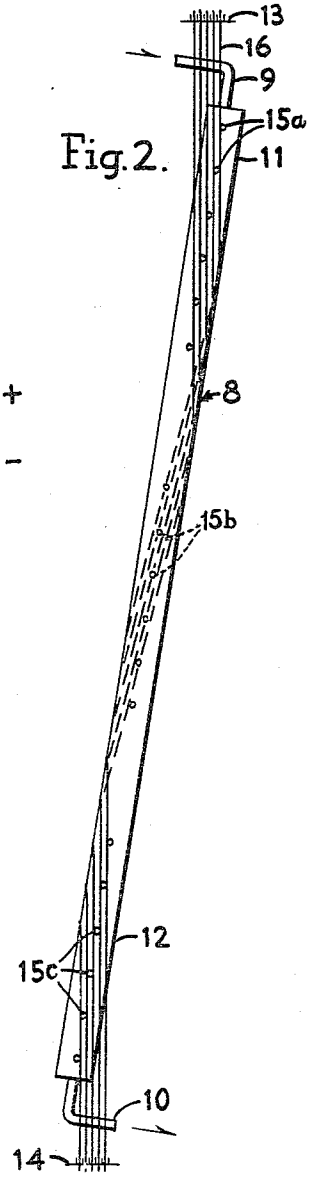


Fig. 2.



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YARN HEATING APPARATUS

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2 Claims. (Cl. 219—19)

This invention relates to the heat treatment of threads, yarns or the like and more particularly to a novel method and apparatus for the production of heat treated yarns of high quality and uniformity.

In the drying, curling, twist killing and pre-shrinking of yarns it is often necessary to subject the running yarn to contact with a heated surface. This may be done by moving the yarn in contact with a stationary heated surface or the surface may be moved at the same speed and in the same direction as the yarn.

An advantage of drying yarn on a heated surface that moves with the yarn is that the heating surface offers no drag to the yarn and hence imposes no tension during drying. On the other hand the heating of a moving surface is necessarily complicated, with the result that yarn heating machines incorporating this feature are expensive to build and to operate.

Despite the economic advantage of simple stationary heaters their use is accompanied by the disadvantage that the yarn contacting surface imposes drag on the heated yarn, the effect of which may be to cause irregular stretching. For reliable control a steady, firm contact between yarn and heater is desirable but enough pressure to maintain contact is often too much for the delicate yarn to withstand without damage.

It is an object of the present invention to provide an improved yarn heating method and apparatus that are characterized by simplicity and reliability and the use of which imposes on the yarn no drag of damaging magnitude.

It is proposed according to the present invention to guide the yarns in a helical path around a smooth heating surface at an angle of inclination of at least 70° and preferably 85° to 89°, angle of inclination as used herein referring to the angle defined between a plane normal to the longitudinal axis of the heating surface and the yarn.

Other objects and advantages of this invention will be apparent upon consideration of the following detailed description of several embodiments thereof in conjunction with the annexed drawings wherein:

Figure 1 is a view in elevation of a bar heater constructed in accordance with the teachings of the present invention and showing a single running yarn in a position thereon to be heated thereby; and

Figure 2 is a view in elevation of a heater bar of the present invention modified to accommodate a plurality of running yarns for simultaneous heating thereby.

Referring first to Figure 1, the numeral 1 designates a round bar having a smooth polished surface and an internal resistance through which it may be electrically heated to any desired degree. The bar includes a substantial straight portion but is bent at its ends to form integral thread guides 2 and 3. The entire structure is supported from a block 5 of insulating material by a portion of the heater bar stock. Electric current to accomplish the necessary heating is supplied through leads

6 and 7. As shown in the drawing, the numeral 4 designates the yarn to be heated. This yarn envelopes the bar 1 for about 360° so that it enters and leaves the heating zone in the same line.

While the sources of current shown are indicated as D. C. leads it is apparent that an A. C. heater may be used equally well. It is to be noted that the bar 1 is straight in that portion of its path where it is in contact with the yarn. It is possible, however, to curve the heater bars so long as the curvature does not oppose the formation of a helix by the yarn at an inclination not less than about 70°. While no such housing is shown it may be desirable to surround the heater of Figure 1 with a housing in order to maintain stable heating conditions against the adverse effects of cooling currents of air. The bar 1 of Figure 1 with the resistance therein is of round cross section but other shapes may be used and it is even possible to replace the resistance element with a hollow tube and to circulate therethrough a liquid heat exchange medium.

It will be appreciated that the diameter of the heating body such as the bar 1, its temperature and the angle of wrap are chosen to bring about the desired heating effect bearing in mind the chemical constituency of the thread, its denier and the purpose for which heat is applied. In determining the dimensions of the body such as the bar 1 it is known from experience that yarns may be pulled over a cylinder with tension of less than 6 g./100 den. where the yarn encircles the cylinder in a direction perpendicular to the axis of a cylinder over an arc not exceeding 15°. On the other hand, if the threads are not pulled in a direction perpendicular to the axis of a cylinder it appears that the arc may be essentially higher before the permissible pulling force is exceeded. To remain below a damaging tension where the thread is sliding through a helical path around a smooth cylinder at an angle of inclination of 70° the diameter of the cylinder should be about 89 cm. with a yarn contact therewith 100 cm. in length. Under these circumstances the encircling angle is 45°. With an angle of inclination of 85° and the same length of contact a cylinder of 58 cm. diameter is required, the encircling angle being 172°. With an angle of inclination of 88° and 89° the diameter of the tubes or bars to be used are .9 and .23 cm. respectively. The encircling angles are 430° and 860° respectively. The data given above are for the purpose of illustrating that with large angles of inclination it is not always necessary to apply the maximum permissible encircling or wrap.

While the arrangement shown in Figure 1 is entirely satisfactory for the handling of a single strand it is recognized that, from the point of view of economical use of heat, it is desirable to handle a plurality of threads at the same time. An arrangement for accomplishing this is shown in Figure 2. Here the heater is a tubular bar or body 8 provided with heat exchange fluid supply lines 9 and 10. The threads or yarns 16 run from top to bottom as depicted in Figure 2. Above the upper end 11 of the bar 8 there is a comb 13 for the purpose of separating into individual yarns a five yarn warp running to the heater. A similar comb 14 is located below the lower end 12 of the heating bar 8. Pins are arranged in groups of 6 on opposite sides of the bar 8. There is an upper group of pins 15*a* on the side facing the viewer of Figure 2. There is another group 15*b* on the side away from the viewer of Figure 2 in the middle of the bar 8 and a final group 15*c* again facing the viewer near the bottom 12 of the bar 8. These pins exceed by one the number of yarns in the warp. They maintain the components of the warp in mutually spaced relation in their helical wrap around the heating bar 8. Each

yarn is maintained at about an 85° inclination and effects a wrap of exactly 360° so that the warp running to the heater is parallel and aligned with the warp leaving the heater. It is recognized that the heater of either Figures 1 or 2 may be used as a part of a continuous spinning machine for the production of yarns.

What is claimed is:

1. Apparatus for heating a plurality of running yarns comprising a pair of yarn separating means disposed in spaced and laterally offset relation, an elongated body extending across the space between said pair of yarn separating means, means for heating said body and a plurality of groups of pins projecting radially from said body for guiding the plurality of running yarns in parallel but helical paths around said body, each group comprising a plurality of spaced pins aligned with the longitudinal axis of said body.

2. Apparatus for heating a plurality of running yarns comprising a pair of combs disposed in parallel but laterally offset relation, an elongated body extending across the space between said combs at an angle of inclination to the plane of the combs not substantially below 70°, means for heating said body and a plurality of groups of pins projecting radially from said body for guiding the plurality of running yarns in parallel but helical paths around said body, each group comprising a plurality of spaced pins aligned with the longiutdinal axis of said body and each group being disposed circumferentially around said body with respect to the next adjacent group.

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