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MANUFACTURE OF CRIMPED FILAMENTS

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The present invention relates to the drying of artificial filaments and the like, such as staple fibers made from viscose solution. It is a primary object of our invention to impart to such fibers a superior crimp or curl.

We have found that the degree and stability of the crimp or curl in artificial fibers depends to a large extent on the method in which said fibers are dried. So, for instance, fibers which have an opportunity to shrink and twist freely during the drying operation have a superior crimp compared to fibers dried in a dense mass. Wet artificial fibers dried in heavy layers do not have an opportunity to contract and move freely in accordance with the surface tensions created during the drying, and as a result these fibers are rather straight and do not possess a pronounced crimp or curl which is very desirable in the subsequent textile operations.

We have also found that the intensity with which the drying operation takes place has a considerable effect on the final physical properties of the fibers and in particular on the crimp of cut fibers. It is known that artificial fibers, and particularly viscose staple fibers, have a shrinking tendency during drying which is the cause for the twisting of said fibers. We have also found that the higher the drying temperature the more violent said shrinking and twisting action becomes.

In view of the above we have found that the most intense drying action can be obtained by drying artificial fibers in a high-frequency electric field. By adjusting the temperature created in this high-frequency field to just below the critical point as far as the quality of the fibers are concerned, we can shorten the drying of artificial fibers to one minute or less. In view of the fact that we confine our drying to a loose layer of fibers, we can dry these fibers in a fraction of the time it requires, for instance, to dry a spool or a cake of rayon yarn. Temperatures of 150° F. are well below the critical point, and the quality of the final product will not be affected unless the temperature is raised materially above 150° F.

According to our invention, we dry artificial fibers, such as cut staple fiber or continuous filaments, in a loose thin layer. We prefer such a layer of cut staple fiber to have a thickness of less than two inches. Such a layer may for instance be produced by loosely dropping wet cut staple fibers onto a surface without applying any pressure to said layer from above. Similarly, bundles of continuous filaments are dried

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in loose condition to form curled filaments for conversion into spun rayon yarn.

The invention presents a number of important advantages. For instance, the viscose fibers present their greatest intensity of curling, crimping or crinkling, when treated as individuals. Under such conditions the wetted fiber is able to have its natural action during drying, since it is not affected by neighboring fibers in determining the characteristics of its shrinking action.

A process for producing this effect is presented in U. S. patent to Schwartz et al., No. 1,986,945, in which the staple fibers, while in loose condition are subjected to a blast of heated air to provide the drying operation, the blast causing the fibers to be blown about within the air and thus are acted upon by the air as individuals. The process, while efficient in producing the crimping result, is necessarily of low productive capacity due to the fact that to enable the production of the individuality status through the air blast operation, it is essential that the wet fibers form a very thin layer to enable the blast to move them quickly into the floating status and thus provide for the rapid drying that is contemplated. This limits the number of fibers which can be given treatment per unit of time. In addition, the floating dried fibers must again settle for collection, thus tending to increase the time length of production. The low rate of production thus tends to increase the treatment cost of the individual fiber, a result that is partially overcome by the fact that the air blast producing mechanism can be of low cost structurally and operatively.

A contrasting process designed for treating fibers, and which includes crimping, is disclosed in the U. S. patent to Brabander, No. 2,390,572, in which the process has the fibers arranged in tow form and then subjected to the action of a high frequency electric current field designed to dry fibers. Since the field will reach each of the fibers of the tow without requiring separation of the latter into its individuals, the process will be able to increase the number of fibers treated per unit of time as compared with the Schwartz process. However, the dried product which results does not present the intensity of crimping that results from the Schwartz process, and where the higher intensity is desired, a separate crimping action is contemplated. The lower crimping condition is primarily due to the arrangement of the fibers into the tow formation, in which adjacent fibers are in intimate contact so that the natural shrinking of a fiber cannot

take place, since contact of adjacent fiber inherently affects the character of the shrinking action, and thus affects the development of the crimps. This condition is not changed during drying since the tow remains intact, the result being that the crimps which may be produced on a fiber are controlled in the main by the effect set up by the contacting adjacent fibers of the tow. In other words, the fibers are not being treated as individuals, but collectively and thus prevent the natural fibers shrinkage activities.

In the present process, which utilizes the high frequency electric current field as the drying source, the treatment of the wetted viscose fibers differs materially from the above. The intensity of crimping of the fibers is obtained but under largely increased capacity conditions. These results are obtained by the manner in which the fibers are handled prior to entering the high frequency drying field.

As above pointed out, the wet stapled fibers are so handled as to produce a layer-like formation having a thickness not exceeding two inches, this formation then being subjected to the action of the field for the purpose of drying the fibers. The formation is produced by strewing (by dropping loosely) the fibers on the surface which supports the formation while subjected to the action of said field. In strewing the fibers, the activity is more or less upon the fibers as individuals, the activity tending to produce a layer of loose fibers in which the fibers, due to the strewing manner of producing the layer formation, produce a more or less promiscuous distribution of fibers in which superposed fibers overlap underlying fibers in various relationships, since the falling fibers follow no predetermined definite course, as hereinafter explained, thus producing the formation which is advanced through the field in such form.

As will be understood, when strewing the fibers no pattern form of layer is produced, the fibers simply assuming the positions they may have when, at the end of their fall following the drop, reaching contact with the support or the preceding fibers. Hence, there is no uniformity in the arrangement of the fibers as to position. As is apparent, the general effect of the strewing action will be to cause the fibers to have their directions of length extending in varied directions as between fibers and tending to provide a promiscuous arrangement of the fibers as well as the arrangement of succeeding falling fibers of the layer, with the general result that while there will be contact between superposed fibers of the layer, the contact between individual fibers is practically limited to the point where one fiber crosses another. Since several fibers will provide such crossing contact with a fiber, there is produced a temporary stability as between fibers which tends to preserve their positions in the layer. Obviously, this produces a very loose but stable formation, since the several contacts are generally spaced.

While there is a contacting condition between superposed fibers of the layer, the contact area is slight as compared with the fiber length, and since the portions of the fibers between contact points is free from contact and is thus able to have normal shrinking action, the fibers dry practically as individuals. With a limit as to thickness of the layer, the weight of the superposed

fibers will not materially affect the normal shrinking except possibly at the contact points. Consequently, the fibers will approach the maximum number of crimps usually produced by the natural shrinkage of the fiber in presence of a rapid drying action.

There is no change in position of fibers relative to each other after the formation layer has been produced by the strewing development so that the time for treatment of the fibers is held to the minimum, but the heating can be more accurately controlled. Since the fibers do not change their relative positions and the formation advances through the field intact, it makes possible ready control of any desired temperature variations during the advance. As the high frequency current effects reach all of the fibers in the depth of the formation, there is uniformity in the heating of fibers, thus providing high efficiency in the drying operation with the fiber drying action substantially uniform in the individual fibers and, therefore, of the collection of fibers within the formation.

A method for drying artificial silk in a high-frequency field has been described in U. S. Patent 2,373,374. However, said patent does not refer to the making of curled or crimped filaments which is the main purpose of our invention, and we do not claim anything set forth in said patent.

Whereas we have described our invention above in detail, we do not wish to be confined in the scope of our invention to the application set forth herein.

What we claim is:

1. In the treatment of viscose fibers for crimping purposes and the like, the method steps which consist in producing a layer-like formation of wetted staple fibers by strewing (by dropping loosely) the wetted fibers into a layer formation of loose fibers with the fibers in superposed relations of patternless type and with the fibers of the layer having limited contact with adjacent superposed fibers to produce a formation having a thickness of not exceeding two inches, and then subjecting the fibers of the formation to the drying action of a high-frequency electric current field upon the formation for a limited period not exceeding one minute of time and with the formation fiber arrangement undisturbed during such period of drying activity by the field, to thereby produce fiber crimping intensity approaching maximum by natural shrinkage activity of the individual fibers.

2. A method as in claim 1 characterized in that the intensity of the drying field is such as to raise the temperature of the fiber within such period to a value less than the critical value at which damage to the fiber would ensue.

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