

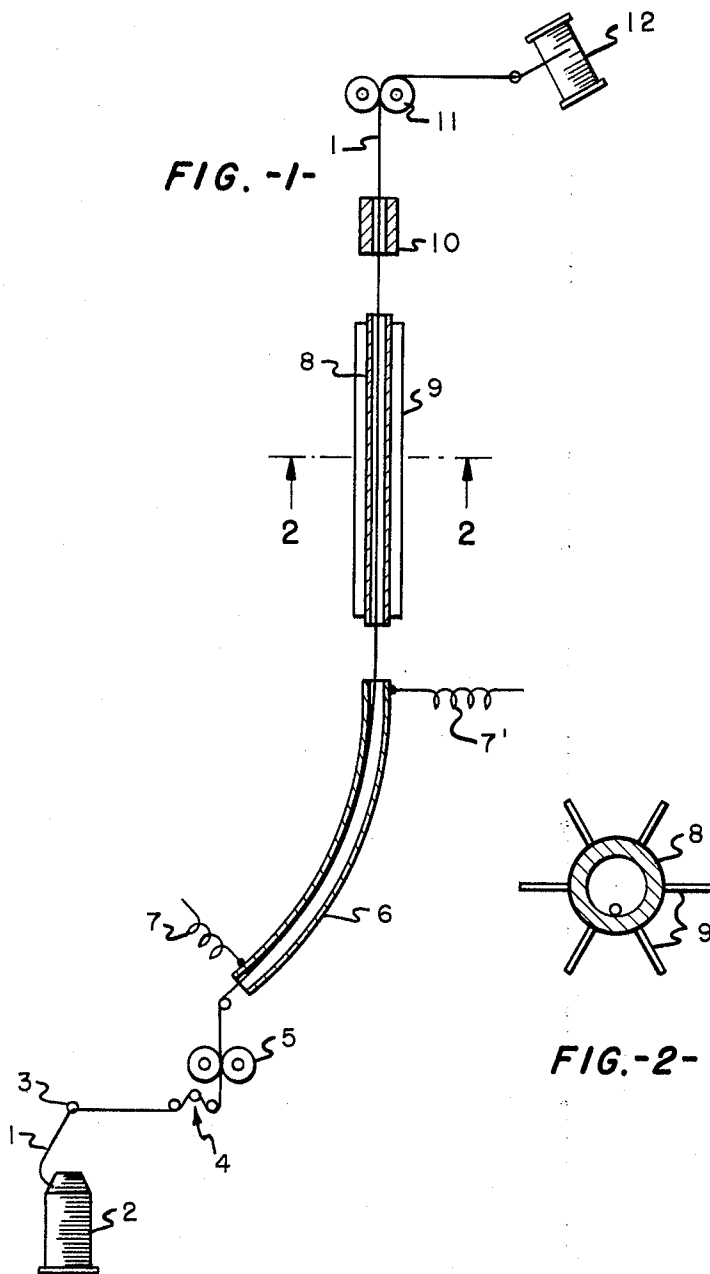
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PROCESS FOR PRODUCING BULKED YARN

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**PROCESS FOR PRODUCING BULKED YARN**  
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This application is a continuation-in-part of copending application Serial No. 76,854, filed December 19, 1960, now abandoned.

This invention relates to improvements in the production of bulked yarn by a false twisting and heat setting process.

In the production of bulked yarns, it has been known for some time to employ a continuous process in which the yarn is subjected to a false twist which runs back along the yarn to a heat setting zone. The present invention relates to a novel combination of pre-heating and cooling steps.

In the process of this invention, thermoplastic filaments are pre-heated prior to inserting twist therein and rapidly cooled after heat setting, but prior to untwisting of the yarn. It has been found that yarns of high denier can be provided with excellent bulking characteristics at relatively high speeds by this novel combination of pre-heating and post-cooling steps.

The rapid cooling operation produces particularly desirable bulking properties when combined with a pre-heating procedure whereby false twisted yarn is passed first through a pre-heating zone before it is permitted to accept the twist imposed upon it by the false twister. After pre-heating, the yarn is permitted to accept the twist of the false twister by being passed into a heat-setting zone.

After heat-setting, the yarn is rapidly cooled, preferably by passage through a tubular element of small internal diameter where it is maintained in light brushing contact with the wall of the tube for a short distance. The tubular element may be cooled either by exterior fins which serve to increase the surface of contact with the outer air or by circulating liquids through a jacket provided on the tube. Cold water can be used for this purpose.

The tubular element is placed between the heat-setting device and the false twister and, of course, the brushing contact of the yarn with the interior of the tubular element is not sufficient to prevent the false twist from running back beyond the tubular element to the heat-setting device. A typical tubular element for high denier yarn may, for example, have an internal diameter of 1.5 mm., an external diameter of 3 mm. and a length of 50 mm. It may carry radial fins extending 5 mm. from the external surface of the tube.

The yarn can be pre-heated by a separate heater separated from the heat-setting means of a false twisting system by means, such as a yarn guide around which the yarn is wound several times, to stop the imposed false twist, although this technique is much less preferred to one wherein the pre-heating zone is contiguous with the heat-setting means of a false twisting system. Regardless of the means used, it is preferred to subject the yarn to a temperature approaching that of the setting temperature, e.g., about 230° C. for 6,6 nylon.

Heating devices which may be utilized to provide, in a single heater, both a pre-heating zone and a heat-setting, twist-imparting zone are described in British Patents 733,707, 745,337, 771,346, 787,619 and 809,479. In these heaters, the yarn is passed in an arcuate path in contact with a heater surface, generally of metallic construction. It is essential that the yarn be fed into the

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arcuate heater in such a manner that the contact between the yarn and heater surface is such that the yarn is restrained from accepting the twist imposed on it by the false twisting device until after it is passed through the heater for some distance. During the time it is restrained from twisting the yarn is pre-heated.

It should be noted that either the degree of arc of the heater, or the angle of feed-in of the yarn, must be adjusted to provide the desired pre-heating zone.

Pre-heating is continued until the yarn is sufficiently modified, or softened, that it will overcome the restraining frictional force and accept the imposed twist. Alternatively, pre-heating is continued until the yarn has passed through the arcuate heater for a sufficient distance past the point at which frictional restraint is higher so that the yarn overcomes the frictional forces and accepts the imposed twist.

This particular combination of steps, wherein thermoplastic yarn is pre-heated in an untwisted state, twisted, set rapidly cooled and untwisted, produces excellent bulking properties in thermoplastic yarn particularly in yarns of high denier.

The invention enables yarns of more than 100 denier to be treated in false twisting machines running at 100,000 revolutions per minute or more at linear velocities of the order of 40 meters per minute or higher.

The invention is illustrated in the accompanying drawings where the tubular, rapid-cooling element is associated with a setting device, consisting of a curved metal tube, heating by the passage of electric current through the metal of the tube itself, as described in British Patent 809,479.

In the drawings:

FIGURE 1 represents diagrammatically a complete apparatus, and

FIGURE 2, a cross section of the rapid-cooling tube.

The yarn 1 is taken off over end from a let-off package 2, through a guide 3 and tension gate 4 to a feed device 5.

Thereafter, it passes through the heat-setting tube 6, heating by an electric current supplied to terminal 7, 7', the curvature of the tube insuring close contact of the yarn with the heated internal surface thereof. Yarn 1 is fed into heat-setting tube 6 in such a manner that the frictional contact between the yarn and the internal surface of the tube is sufficiently high to restrain twist imposed by twister 10 from running all the way through the tube towards the yarn let-off package 2.

Consequently, the yarn is restrained from accepting the twist imposed upon it by a false twister 10, thereby providing, upstream from the heat-setting zone, a pre-heating zone where the yarn is heated at a temperature approximating the heat-setting temperature. As the yarn 1 is modified or softened, it is capable of overcoming the restraining frictional forces and accepts the imposed twist.

The location in the tube 6 where twist is imparted to the yarn varies with the denier, the speed and the angle of entry of the yarn into the tube. In general, however, the pre-heating zone will constitute less than one-half of the length of the tube and most often less than one-third of the length of the tube.

The yarn then passes to a cooling tube 8, which as stated above may have an internal diameter of 1.5 mm. and an external diameter of 3 mm., the tube being provided with radial fins 9 for the purpose of cooling. If desired, cold air may be blown upon these fins.

The yarn then passes through a false twister 10, a feed device 11 and a take-up package 12. It will be noted that the false twister and cooling tube are in substantial

alignment so that the false twist runs back along the yarn into the heater tube 6.

In the cross section shown in FIGURE 2, the yarn is making contact with the internal surface of the cooling tube 8. It is to be understood, however, that this contact is not maintained continuously, but rather is a light brushing contact.

That which is claimed is:

1. In a process wherein thermoplastic filaments are twisted, heat set and untwisted, the improvement which comprises pre-heating said filaments in a zone while restraining the filaments from receiving twist, heating in a second zone until the filaments are sufficiently modified to overcome the restraining force and accept the imposed twist, and rapidly cooling said yarns by passing through a cooling zone after heat-setting, but prior to untwisting said yarn.

2. The process of claim 1 wherein the pre-heating zone and twist-inserting, heat-setting zone are contiguous.

3. A process for producing bulked yarn comprising providing a length of thermoplastic yarn having an original twist level; imposing false twist forces upon the length of thermoplastic yarn; pre-heating said length of yarn while substantially frictionally restraining the yarn to prevent its becoming twisted for a given length; the pre-heating of said yarn being along this given length where it is substantially untwisted; said pre-heating continuing until the yarn overcomes the frictional forces of restraint and accepts the imposed twist; heat setting the twist therein; rapidly cooling said heat-set yarn; and untwisting said yarn to return it substantially to its original twist level.

4. The process of claim 3 wherein the yarn is pre-heated at a temperature approximating the heat-setting temperature.

5. A process for producing bulked yarn comprising imposing false twist forces upon thermoplastic yarn; frictionally restraining said yarn from accepting a twist; heating said yarn while still substantially, untwisted by said forces, said heating continuing until the yarn overcomes the frictional forces of restraint and accepts the imposed twist; heat-setting said yarn in its twisted condition; rapidly

cooling said yarn; and untwisting said yarn to remove the imposed twist therefrom.

6. A process for producing bulky yarns comprising imposing false twist forces upon thermoplastic yarn; imposing a restraining force on said yarn to prevent its becoming twisted for a given length; pre-heating said yarn along this length where it is substantially untwisted by said false twist, said pre-heating being conducted at a temperature such that the yarn becomes modified sufficiently that it can overcome said restraining force and accept the imposed twist; heat-setting said yarn in its twisted condition; rapidly cooling said yarn; and removing said imposed twist from said yarn.

7. The process of claim 6 wherein the yarn is restrained from accepting the imposed twist by passing said yarn through an arcuate path in contact with a heated surface.

8. The process of claim 7 wherein the yarn is passed continuously through said arcuate path.

9. The process of claim 8 wherein the yarn is both pre-heated and heat-set while passing continuously through said arcuate path.

10. The process of claim 9 wherein the heat-set yarn is cooled rapidly by contact with a cooled surface.

11. The process of claim 10 wherein the thermoplastic yarn comprises 6,6 nylon having a denier greater than about 100.

#### References Cited by the Examiner

##### UNITED STATES PATENTS

|           |         |                 |         |
|-----------|---------|-----------------|---------|
| 2,758,358 | 8/1956  | Shattuck        | 28—1    |
| 2,863,280 | 12/1958 | Ubbelohde       | 57—77.3 |
| 2,891,375 | 6/1959  | Vandamme et al. | 57—34   |
| 2,943,433 | 7/1960  | Van Dijk        | 57—34   |
| 2,949,659 | 8/1960  | Heijnis et al.  | 28—1    |
| 2,956,393 | 10/1960 | Ubbelohde       | 57—157  |
| 3,001,354 | 9/1961  | Davis           | 57—34   |
| 3,058,291 | 10/1962 | Heberlein       | 28—72   |

##### FOREIGN PATENTS

|         |         |                |
|---------|---------|----------------|
| 883,154 | 11/1961 | Great Britain. |
|---------|---------|----------------|

MERVIN STEIN, *Primary Examiner*.