Dec. 1, 1964 A. J. TLAMICHA 3,158,983

DELUSTERED PLASTIC THREAD OR TEXTILE

Original Filed March 17, 1961 2 Sheets-Sheet 1

FIG. 1

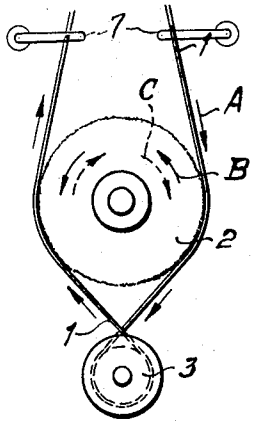


FIG. 2

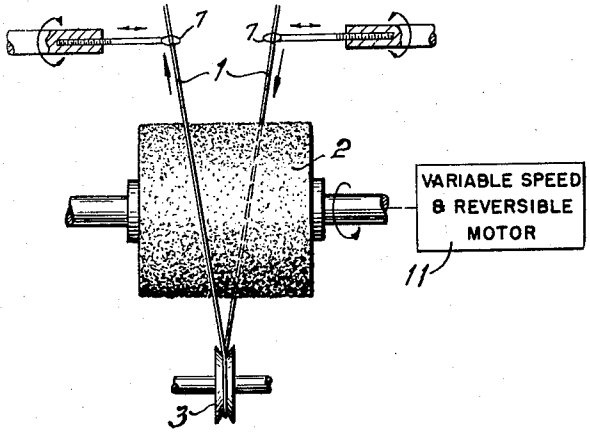


FIG. 3

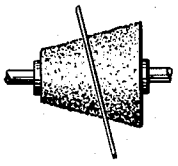


FIG. 4

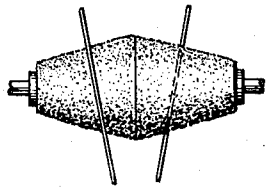


FIG. 5

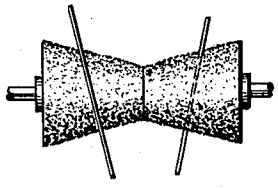


FIG. 6

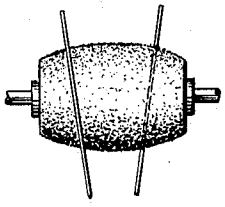


FIG. 7

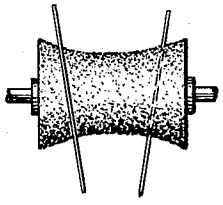


FIG. 8

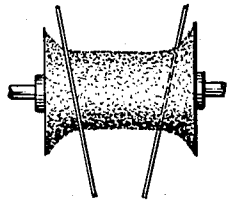
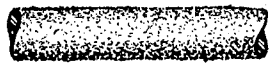


FIG. 9



FIG. 10



INVENTOR

ADOLF JAROSLAV TLAMICHA, Dec
Libuse Tlamicha, Executrix

BY Dicke & Craig

ATTORNEYS

Dec. 1, 1964 A. J. TLAMICHA 3,158,983

DELUSTERED PLASTIC THREAD OR TEXTILE

Original Filed March 17, 1961 2 Sheets-Sheet 2

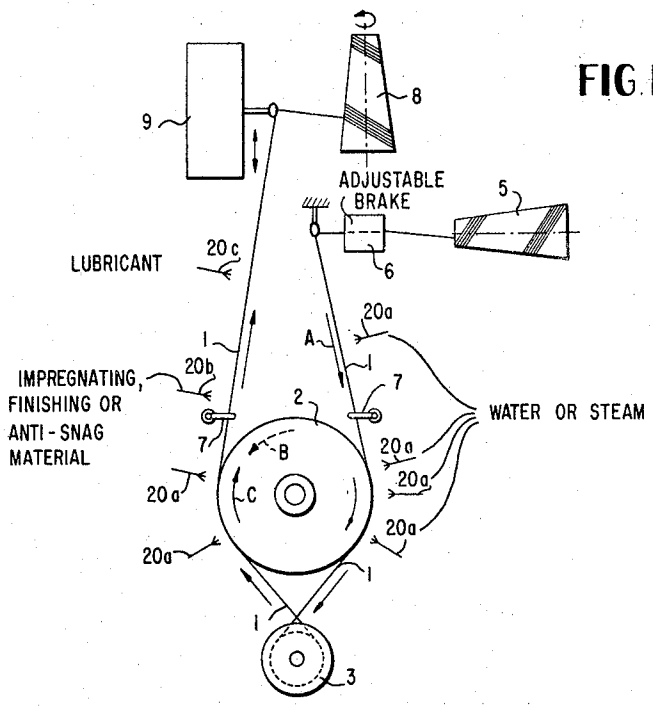


FIG. 11

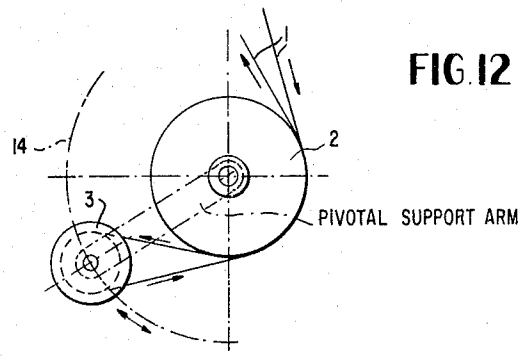


FIG. 12

INVENTOR.

ADOLF JAROSLAV TLAMICHA, Dec.
Libuse Tlamicha, Executrix

BY Dicke & Craig

ATTORNEYS

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DELUSTERED PLASTIC THREAD OR TEXTILE

Adolf Jaroslav Tlamicha, deceased, late of Goeppingen, Germany, by Libuse Antonie Tlamicha, sole heir and executrix, Goeppingen, Germany

Original application Mar. 17, 1961, Ser. No. 96,418, now Patent No. 3,140,526, dated July 14, 1964. Divided and this application Mar. 18, 1964, Ser. No. 353,322
Claims priority, application Switzerland, Mar. 25, 1960, 3,239/60
3 Claims. (Cl. 57—140)

This application is a division of the co-pending application Serial No. 96,418 of Adolf Jaroslav Tlamicha, filed March 17, 1961, now U.S. Patent No. 3,140,526.

The present invention relates to a method and an apparatus for delustering monofilament or multifilament thread which is made of highly molecular plastics, for example, polyamide.

In the manufacture of such plastic thread it is well-known that, due to the rapid cooling to which the thread has to be subjected after being formed, the outer surface of the thread becomes extremely smooth and much harder than the inner core of the thread. Textile fabrics which are produced of such plastic thread then have a high gloss which is often regarded as very undesirable. Although numerous efforts have been made to overcome this high gloss by special delustering agents and treatments, the results attained have so far been very inadequate and unsatisfactory, especially also since the slight delustering which can possibly be attained diminishes or even disappears entirely when the textile article has been in use for some time. It is also known to deluster such plastic thread by roughening or abrading its outer surface. These known roughening or abrading methods, however, incur the danger that the surface of the thread will be roughened or abraded unevenly and only at one side, and often so severely that the thread will break. This occurs particularly when roughening or abrading multifilament thread. For want of a better method of producing a lasting delustered effect, plastic multifilament thread has even been roughened intentionally to such an extent that some of the individual threads are torn. Obviously, such uneven and severe roughening considerably impairs the mechanical properties of the thread, for example, it increases the ductility of the thread excessively and decreases its tensile strength considerably.

It is an object of the present invention to provide a very simple method and an inexpensive apparatus for delustering monofilament or multifilament thread of highly molecular plastics, for example, polyamides, by superficially abrading or buffing the entire surface of such thread uniformly on all sides throughout its length so that the original circular cross section of the thread and its mechanical properties will remain unimpaired.

For attaining the above-mentioned object, the plastic thread is passed tangentially over a rotating roughening or abrading wheel in a direction oblique to the longitudinal axis of the wheel. Due to this tangential movement of the thread over the roughening wheel, the thread will be turned repeatedly about its own axis. For this purpose, the thread is preferably passed once or repeatedly at an oblique angle over a part of the peripheral surface of the rotating roughening wheel by feeding it either in the direction of the rotation of this wheel or in the opposite direction.

By proceeding in this manner the plastic thread will be uniformly but only superficially abraded or roughened at all points on its outer surface and along its entire length so that the undesired gloss will be completely and permanently eliminated. The dull finish of the thread will therefore remain during its entire subsequent use. The roughening or abrading operation renders the feel of the thread much softer so that it can no longer be

distinguished from natural yarn. Furthermore, since by the removal of the hard, shell-like outer surface, the new surface of the thread is much more porous, dyes will penetrate much more quickly into the thread so that the period required for dying the textiles made of such thread will be considerably reduced and the color fastness of such textiles will be improved.

Since the roughening operation is only superficial insofar as only the thin hard shell-like outer surface is roughened, while the softer inner core of the thread will not be touched, the mechanical properties of the thread will not be impaired. Thus, for example, a thread of 20 denier has a diameter of 48μ and the thickness of the hard outer layer amounts to about 5μ. The roughening operation according to the invention is, however, so superficial as to reach only to a depth of about 0.5μ. Therefore, the mechanical properties such as the ductility and the tensile strength of the thread will not be impaired regardless of whether the thread is of the monofilament or multifilament type, inasmuch as individual threads cannot possibly be damaged or torn, as it is the usual case when one of the known roughening operations is carried out. It is furthermore a very great advantage over all previous delustering methods that the roughening or abrading effect according to the invention remains absolutely uniform over the entire length of the thread, that is, over a length of many thousands of meters.

The roughening operation according to the invention also does not require any separate working step since it may be carried out in the course of the necessary spooling or rewinding of the thread. The bobbins will also be would much better and more uniformly since the layers of thread which are wound upon each other no longer engage with each other along a surface but only at points. The thread may thus be unreeled much more easily, with less resistance, and more uniformly.

In accordance with the purpose or the kind of textile article for which the thread is to be used, it is advisable to vary the degree of roughening the same. This may be done by different procedures, for example, by means of an adjustable thread brake or by varying the looping angle of the thread on the roughening wheel or by varying the ratio between the speed of the thread feed and the adjustable peripheral speed of the rotating, power-driven roughening or abrading wheel, or by changing the inclination between the axis of the roughening or abrading wheel and the direction of the thread thereon, or by a combination of several of these procedures. By varying the degree of roughening the thread, it is easily possible to attain textile products of different appearance. Thus, for example, if the roughening operation is carried out more severely, the thread will have a duller finish and the color effect will be increased.

According to another feature of the invention, the plastic thread may be sprayed either prior to, during, or after the roughening operation with one or several agents of the kind as subsequently mentioned. This may be done by conventional spraying means. Spraying the thread with water either prior to or during the roughening operation is of advantage especially if the thread is relatively thick and if it extends around the roughening wheel at a large looping angle and excessive frictional heating of the thread should be avoided by cooling it. Spraying the plastic thread with steam softens the surface which is to be roughened and therefore accelerates the roughening operation. Spraying the thread with a lubricant such as oil, glycerin or the like improves the further workability of the thread, for example, its passage through a textile machine or its spooling upon a bobbin or its unreeling therefrom. Spraying the plastic thread after the roughen-

ing operation with an impregnating material, a finishing material, or an antisnag material is of advantage if the thread is later to be used, for example, for textiles which are to be provided with either of these materials.

The apparatus for roughening or abrading monofilament or multifilament thread in accordance with the inventive method comprises a rotating, power-driven roughening wheel or roller. The plastic thread is passed over this wheel or roller in a direction oblique to the longitudinal axis thereof so as to engage with a part of its peripheral surface. The roughening roller or wheel preferably consists, for example, of a fine-grained silicon abrasive. Its speed of rotation is preferably adjustable and the direction of its rotation is preferably reversible.

By passing the plastic thread at an oblique angle over a part of the peripheral surface of the roughening wheel, the thread will be positively turned many times about its own axis. This turning insures that the entire surface of the thread will be uniformly roughened along its entire length and that it will retain its circular cross section. After the roughening operation, the thread will either twist back to its original condition because of its inner resilience or it will remain more or less twisted depending upon the distance provided between the roughening wheel and the bobbin or the textile machine.

The features and advantages of the present invention will become more clearly apparent from the following detailed description which is to be read with reference to the accompanying diagrammatic drawings, in which—

FIGURE 1 shows a front view of a rotating roughening or abrading wheel and of a guide pulley in the operation of roughening a plastic thread;

FIGURE 2 shows a side view of the arrangement according to FIGURE 1;

FIGURES 3 to 8 show diagrammatic views of different shapes of roughening rollers or abrading wheels according to the invention;

FIGURE 9 shows a highly enlarged side view of a piece of a monofilament thread prior to being roughened;

FIGURE 10 shows a similar view of the same piece of thread after being roughened;

FIGURE 11 is a somewhat schematic front view of an abrading or roughening installation in accordance with the present invention, somewhat similar to FIGURE 1 herein and showing certain further features thereof; and

FIGURE 12 is a schematic partial front view, similar to FIGURES 1 and 11 and showing a modified embodiment in accordance with the present invention.

As illustrated in FIGURE 1, the plastic thread **1** is applied tangentially upon a power-driven roughening or abrading wheel **2** in the direction of arrow A, and it runs over a part of the peripheral surface of this wheel, then over a guide pulley **3** and then again tangentially over the opposite side of the roughening wheel **2** from which it is either wound in the usual manner upon a bobbin or passed directly to a textile machine.

As indicated in FIGURE 2, the plastic thread **1** is also passed in an oblique direction over the surface of roughening wheel **2**. Due to this oblique movement, the thread will be positively turned or twisted many times about its own axis so that its entire smooth shell-like outer surface as indicated in FIGURE 9 will be uniformly abraded or ground off by the roughening or abrading wheel **2** and the thread will thereafter have a uniformly roughened appearance throughout its length, as indicated in FIGURE 10. This roughening or abrading operation also results in a thorough delustering of the thread, and the dull finish thus attained will remain permanently and the thread will never again become glossy. Since the surface of the thread is removed uniformly and only superficially, the thread will retain all of its important properties and advantages as previously described.

FIGURE 11 illustrates in front elevation a roughening or abrading installation in accordance with the present invention. The plastic filament **1** supplied from any suitable supply, for example, from bobbin **5** is fed, after passage through an adjustable brake **6** of conventional construction to the roughening or abrading wheel **2**. In the course of the engagement of the filament **1** with the surfaces of the roughening or abrading wheel **2**, the surfaces of the filament **1** are roughened or abraded as described above by the production of microscopically small grooves. After leaving the roughening or abrading wheel **2**, the filament **1** is then wound on bobbin **8** in any conventional manner, for example, by the use of a reciprocating guide loop **9** of conventional construction. In order to enable a change in the angle that the filament **1** makes with the axis of the roughening or abrading wheel **2**, adjustable eyelets or guide loops **7** are provided (FIGURES 1, 2, and 11) which are so constructed and arranged as to permit the displacement of these guide loops **7** in the axial direction of the wheel **2**. For example, as is well-known, this may be achieved by mounting the loops **7** on threaded spindles which, in turn, engage with axially stationary but rotatable internally threaded members whereupon upon rotation in the one or the other direction, the axial position of the guide loops **7** may be selectively varied. However, it is understood that instead of such conventional adjusting arrangement, any other known adjusting arrangement may be utilized.

In order to enable a change in the ratio between the feeding speed of the filament **1** and the peripheral speed of the roughening or abrading wheel **2**, the latter is driven from any suitable adjustable driving means, such as, a conventional variable speed electric motor **11**. To enable rotation of the wheel **2** in the direction B or C (FIGURE 1), the electric motor **11** may also be of the reversible type though it is understood that any other conventional reversing means may be used.

FIGURE 12 illustrates a front view of a modified arrangement, similar to FIGURES 1 and 11 in which the filament **1** is passed twice over the same side of the roughening or abrading wheel **2** in mutually opposite directions. Furthermore, in order to change the looping angle, that is, the arc along which the filament **1** engages with the surfaces of the roughening or abrading wheel **2**, the guide pulley **3** may be mounted so as to vary its position relative to the roughening or abrading wheel **2**. This is indicated schematically in FIGURE 12 by the dash and dot arc **14**, whereby any suitable means may be utilized to adjustably move the pulley **3** along this arc **14**, for example, by providing a support arm for the pulley **3** which is rotatably or pivotally mounted about the axis of the wheel **2** in such a manner that it may be secured in any desired position. Since such means are well-known in the art, a detailed showing thereof is dispensed with herein. In FIGURE 11, reference numerals **20***a* indicate schematically conventional nozzles that may be used to spray the filament with water or steam whereas nozzle **20***b* may be utilized to spray the filament with an impregnating, finishing or anti-snag material while nozzle **20***c* may be utilized to spray the filament **1** with a lubricant. These nozzles are of conventional known construction and the particular location thereof is not limited to that shown schematically only in FIGURE 11.

The degree to which the plastic thread **1** may be roughened may be varied by different means. Thus, for example, it is possible to regulate the tension of the thread by means of the adjustable brake **6** (FIGURE 11) so that the frictional pressure at which the thread engages with the roughening wheel **2** may be adjusted at will. The degree of roughening may also be varied by changing the degree of the oblique angle between the direction of the thread and of the longitudinal axis of the roughening wheel **2** by means of adjustable guide loops **7** (FIGURE 2) and also by changing the looping angle of the thread on the roughening wheel by means of the adjustable guide pulley **3** adapted to be selectively displaced along the arcuate path **13** (FIGURE 12). In the latter case, the plastic thread **1** may, for example, be

guided so as to pass both times over the same side of the roughening wheel **2**. For this purpose, guide pulley **3** may also be pivotally mounted about the axis of the roughening or abrading wheel **2** by any conventional means operable to displace wheel **2** along the arcuate path **14**, as mentioned hereinabove, so that, when it is pivoted further away from the side of the engagement of the thread with the roughening or abrading wheel **2**, the looping angle of the thread or the length of its engagement with the roughening wheel will be increased.

The degree of roughening is also dependent upon the variable difference between the feeding speed of the thread and the adjustable peripheral speed of the roughening wheel **2** realized by varying the speed of motor **11** (FIGURE 2). A still further variation of the roughening action may be attained by rotating the roughening wheel **2** either in the direction of arrow B, that is, opposite to the direction of feed of the thread, as indicated by arrow A, or by rotating the roughening wheel **2** in the same direction as the thread feed, as indicated by arrow C, again realized by means of the reversible motor **11** (FIGURE 2). If the roughening wheel is driven in the first-mentioned direction, the bobbins will be wound more tightly than when it is driven in the last-mentioned direction.

In order to increase the twisting of the thread about its own longitudinal axis during the roughening or abrading operation, it has also been found advisable to make the roughening roller or abrading wheel **2** of a shape different from a cylindrical shape as shown in FIGURE 2. Thus, for example, it may be made in the shape of a frustum as shown in FIGURE 3, or of a double frustum in which the bases of the two frustums face either toward each other, as shown in FIGURE 4, or in opposite directions, as shown in FIGURE 5. The roughening or abrading wheel may, however, also be of a convex, barrel-like shape, as shown in FIGURE 6, or of a concave shape, as shown in FIGURE 7, or its central part may be made cylindrical and be provided with outwardly flaring flanges, as shown in FIGURE 8. By being fed over the roughening or abrading wheel at an oblique angle to the axis thereof, the plastic thread has in each of these wheel shapes the tendency to run toward the side with an increasing diameter and it will thus be positively twisted many times about its own axis.

The threads of the present invention are, as mentioned above, monofilament or multifilament threads of highly

molecular plastics, especially polyamides, on the order of 20 denier or 49μ diameter. The term "filaments" as used hereinafter in the appended claims is to be considered limited to such mono- and multifilament threads.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. A delustered filament made of highly molecular plastics, characterized in that the surfaces thereof are provided substantially uniformly on all sides and over the entire length thereof with microscopic grooves produced by mechanically abrading the filament by engagement with abrading surfaces while simultaneously twisting said filament about its own longitudinal axis.

2. A delustered filament made of highly molecular plastics, characterized in that the surfaces thereof are provided substantially uniformly on all sides and over the entire length thereof with microscopic grooves produced by mechanically abrading the filament by engagement with abrading surfaces while simultaneously twisting said filament about its own longitudinal axis, said grooves having a depth of about 5 microns.

3. A delustered filament made of highly molecular plastics, characterized in that the surfaces thereof are provided substantially uniformly on all sides and over the entire length thereof with microscopic grooves produced by mechanically abrading the filament by engagement with abrading surfaces while simultaneously twisting said filament about its own longitudinal axis, said grooves having a depth of the order of one percent of the diameter of the filament.

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MERVIN STEIN, *Primary Examiner.*