The present invention relates to a system for straightening pull-threads in knitted hosiery, which are accidentally produced during the manufacture of the hosiery.

This invention has particular application to nylon hosiery, which is the most popular form of hosiery at the present time, but it may also be used for straightening pull-threads in other hosiery, e.g., cotton, silk and rayon hosiery. For illustrative purposes, but without limitation thereof, the invention will be described hereafter with respect to nylon hosiery; it being understood that the method and means can be used in a similar manner for other hosiery.

The fact that nylon is a plastic type material and thus may be softened by heat and “reset,” renders it especially adaptable to the method and means of this invention, which includes as a final step, a heating of the straightened pull-thread so that it will be reset in its original length and position. Hosiery knitted of other plastic threads would likewise be adaptable to this method of straightening pull-threads.

Nylon fibers are identified generally as synthetic linear long chain polyamide fibers. They have, at present, largely replaced all other fibers, such as, for example, silk, rayon and like materials in the production of hosiery. A full description as to the chemical identity and characteristics possessed by nylon fibers is given in W. H. Carothers Patents Nos. 2,071,250, 2,071,261 and 2,071,253. Likewise, the employment of these fibers in the production of hosiery is described in Patent No. 2,157,119 to J. B. Miles and Patent No. 2,157,116 to W. H. Carothers.

Nylon hose are commonly made by knitting on either a circular or flat knitting machine, and the knitting is followed by a number of operations on the hose, including a pre-boarding operation in which the nylon hose is trained over a metal leg-shaped form and subjected to a steam treatment to “set” the yarn and shape the hose substantially like the contour of the human leg. A number of other operations are necessary to produce a finished nylon hose, e.g., lubricating, scouring, dying, finishing, rinsing, etc.

The handling of the hose during these various operations results in a substantial number of “pull-threads” or what is commonly referred to by the consumer as a “snag.” Actually, a pull-thread is not one which is broken or pulled out of the hose, but rather is one which is kinked or drawn up and results usually in a small hole in the finished hose. This defect is commonly referred to by the operators or inspectors as a “fish-eye,” “snake-eye,” “duck-eye,” or “cat-eye.” Nylon hose possessing a pull-thread or distorted stitch obviously cannot be marketed as first-class hosiery, but must be classified as “seconds,” or at least a lower grade, and sold in this form at a reduced price.

Some attempts have been made heretofore to correct pull-threads by restoring the thread to its original position in the fabric and thereby render the nylon hose suitable for sale as first-class hosiery. However, nylon fibers possess inherent physical and chemical characteristics which have rendered the methods heretofore attempted of limited utility. Furthermore, the now popular very sheer nylon hose is particularly susceptible to pull-threads or snags and has made the pull-thread problem of substantial commercial importance.

In accordance with my invention, I have provided, for the first time, a satisfactory practical method and means for straightening pull-threads and permanently restoring the straightened threads in nylon hose to their original or natural position. The method comprises tensioning the area of the hose containing the pull-thread over a forming cup, stroking the pull-thread in the line of its kink and away from the hole formed therein with a special type of needle, until the pull-thread is straightened to its normal length, moistening the area containing the straightened pull-thread, and ironing the moistened area with a special type of iron until the straightened thread is “set” and permanently restored to its original position in the hose.

Regarding the first requirement above, of tensioning the defective portion of the hose over the forming cup, the tension should be regulated, through practice, to a degree sufficient to straighten that part of the hose but nevertheless leave it loose enough to permit the needle to follow the “course” when stroking the hose with the needle. Also, care should be exercised in holding the needle at a sufficient angle to prevent tearing or fraying of the threads in the hose when stroking with the needle, as might otherwise occur if the needle were held straight up.

The special “needle” which I have found of particular utility for straightening the pull-threads has a handle, a pointed needle shaft united to the handle, and a dull or ball point at the working end of the needle shaft. The needle shaft is advantageously made of stainless steel or German silver, which minimize any tendency to mark the hose.

For smoothing and setting the thread after it
has been straightened to its original length and position, I have developed a special form of iron comprising a hollow handle, a hollow shaft connected to the handle, a hollow triangular tip positioned in the forward end of the hollow shaft, insulated, electric current conducting wire extending through said handle, and insulated high resistance wire positioned within said shaft and said tip and having its ends connected to the electric wire, said high resistance wire being designed to limit the heat of the tip below the melting point of the nylon threads. This temperature control is such that the iron will not burn the hose even if left in contact with the hose.

Further features and advantages of the method and means of my invention for straightening pull-threads and restoring the straightened thread in the hose to its original position, will be clearly understood from the detailed description given hereinafter in conjunction with the accompanying drawings in which:

Fig. 1 is a perspective view illustrating the first step of my invention for straightening the pull-thread;

Fig. 1a is a perspective view illustrating the next step of my invention, for moistening the straightened thread;

Fig. 2 is a perspective view of the third step of my invention for smoothing and setting the straightened thread;

Fig. 3 is a plan view of one form of needle suitable for use in my invention;

Fig. 4 is a plan view of another form of needle suitable for use in my invention, in which the needle shaft is detachably threaded to the handle;

Fig. 5 is a longitudinal view partly in section of the needle of Fig. 4;

Fig. 6 is a plan view of a third form of needle suitable for use in my invention, in which the needle shaft is detachably connected to the handle by means of a chuck or pin vice;

Fig. 7 is a longitudinal view partly in section of the needle of Fig. 6;

Fig. 8 is a vertical cross-section of the electrically heated iron suitable for use in the smoothing and setting step of my method; and,

Fig. 9 is a perspective view of a stand or rest holding the iron of Fig. 8.

Referring now to the several figures in the drawings, and at first to Fig. 1, for illustration of the first step in my method, it will be observed that the nylon hose 1 having a pull-thread 2 is positioned, with the above mentioned regulated tension, over the open top of the cup 3. The latter may be of any suitable shape such as, for example, cup-shaped, goblet-shaped, etc., and made from any desired material, e.g., metal, porcelain, plastic, or wood. As herein illustrated, the cup 3 comprises a cylindrical base 4, a stem 5, and a hollow cylindrical body member 6, the body member 6 having a cylindrical lip 7 over which the nylon hose 1 will be tensioned.

After the area of the nylon hose 1 containing the pull-thread 2 has been tensioned over the lip 7 of the member 3, the operator presses his fingers 8 at the top of the hollow member 3 to maintain the desired tension and retain the hose in a smooth, substantially flat plane. The operator then positions the needle-like member 9 in his fingers 10 and places the dull or ball-point end 11 of the needle 9 in contact with the pull-thread 2. The angle at which the needle is held with respect to the hose, as illustrated in Fig. 1, is about 45°, but the needle may be lowered to a greater angle if desired.

The operator then begins a gentle stroking action with the needle 9 in the line of the kink of the pull-thread 2 and away from the center of the hole formed in the hose 1 by the pull-thread 2. It has been found best to use at first short strokes and gradually increase the length of the strokes until the end of the pull-thread is reached.

Usually the operator will stroke first to the right of the hole as shown in Fig. 1, and then orient his right hand and stroke to the left of the hole, until the entire length of the pull-thread is straightened, and as a result the hole is gradually minimized in size and finally disappears. The steady stroking action with the ball-point needle 9 will gradually "work out" the kink of the pull-thread 2 and restore the straightened thread to its original length and position.

Following the above described straightening action, the straightened thread and adjacent area of the hose is next moistened, to condition it for the subsequent treatment with the heated iron. This moistening treatment as illustrated in Fig. 1a is an important step in that it makes possible a final and permanent setting of the straightened thread in the succeeding ironing operation.

As illustrated in Fig. 1a, the operator applies with his finger a small amount of moisture to the affected small area of the hose. This may be done by dipping the finger or fingers 10 in a small bowl of water, or by rubbing them on a wet sponge, and then lightly rubbing the hose so that the drops of water deposit on the threads and produce a moistened area such as illustrated at 13.

The straightened and moistened thread, which was the pull-thread, is now ready for the final smoothing and setting operation with the heated iron, as illustrated in Fig. 2. The operator holds the iron by the handle 21 and applies the blunt tip 15 to the moistened area 13 and begins a gentle, steady stroking action in the line of the straightened thread. The heated tip 15 effects a further straightening and softening of the pull-thread 2, evaporates the moisture in the area 13, and causes the thread 2 to become "set" in its restored length. It will be understood from the above description that the three steps of straightening, moistening, and smoothing and setting may be carried out without removing the hose from the forming cup, and that the three operations may be carried out in close succession. Following the last step the hose is removed from the forming cup and is ready for final inspection and packing.

I have ascertained from actual experiences that the above described steps of my novel method for straightening pull-threads and permanently restoring the straightened threads to their original location may be efficiently carried out with the special instruments illustrated in Figs. 3 through 9 of the drawing. Referring at first to Fig. 3, a needle suitable for use in the first step of my method comprises a hexagonal-shaped handle 16 having its lower portion conically shaped, a needle member 9 having one end pre-shaped and fitted within the conically shaped portion of said handle, and a ball-shaped point 12 integrally formed at the opposite end of the member 9. This rounded point 12 is important to prevent damage to the hose. It may be formed originally and reshaped as often as necessary by buffing on a felt roll and using jeweler's rouge. The handle 18 may be made of any suitable material such as,
for example, wood, metal, preferably a light metal such as aluminum, glass, porcelain, plastic, etc.

Referring now to Figs. 4 and 5 wherein a modified form of a needle is shown, it will be observed that this modified needle comprises a hollow handle 11, a member 16 threadably engaged with said handle at the lower end thereof, and a needle 9 of the same structure and material hereinbefore described secured to one end of said member 16, whereby the needle when not in use may be safely housed within the handle 11.

Another modified form of needle, as illustrated in Figs. 6 and 7, is of similar construction to the needle shown in Figs. 4 and 5. In this second modification the instrument comprises a hollow handle 17, and a chuck or pin-vise arrangement illustrated at 18 and 20 for holding the needle 3, which is of the same structure and material as hereinbefore described, and is positioned within the handle 17 when not in use. The advantages of these two modified forms of needle are that the points of the needle may be completely protected from any harm when not in use. This is important in order to ensure that the ball-point 12 of the needle 9 will retain its desired rounded shape.

An iron which I have developed for use in my method as described above, is illustrated in Fig. 8 of the drawings. It comprises a handle member 21 having a hollow shaft 22 extending there-through. A tubular member 23 is secured to one end of the handle 21 by a collar 22. The outer end of the member 23 is bent to form an angled lower shank portion 25. This bent portion 25 is of particular utility in that it permits the operator to iron in a flat level plane. Positioned within the lower shank portion 25 is a metal heating element 15 preferably made of a chrome alloy steel and about five-sixteeth inches in diameter and one inch in length. The tip 15 may be positioned within the lower shank portion 25 by any suitable means, such as a simple press fit. Extending through the hollow bore 22 of the handle 21 is a conventional electrical lead line 27 having an outlet plug 28 for connection to an ordinary 110-volt power source.

Insulated and spiral wound high resistance wire 29 is positioned within the hollow shank 23 and the tip 15. This resistance wire has its ends 30 connected across the electrical lead lines 27. This high resistance wire 29 is commercially available and is covered with an asbestos insulation 31. The wire is centrally positioned within the hollow shank 23 in a manner so as to avoid any substantial contact of the wire with the side walls of the shank 33. This construction provides an air space insulation which keeps the shank 23 from becoming too hot. The insulated high resistance wire 29, however, comes into direct contact with the inner walls of the heating tip 15 to provide a quick and even heat. The length of the wire 29 and the dimensions of the tip 15 are so adjusted that the temperature of the tip will not exceed approximately 230°F. Otherwise, the iron would cause a melting of the nylon fibers.

Additionally, it should be noted that the heated tip 15 possesses a substantially blunt or flat cylindrical point in order to use the instrument for its intended purpose. If an instrument possessing an angled tip such as that found in a soldering iron were employed in my method, it would be difficult to iron out and set the straightened thread.

Another feature of my iron is the collar 33 which is secured to the electrical lead 27. This collar is adapted to abut against the shoulder 34 formed within the hollow portion of the handle 21. By this construction it will be readily observed that the wire can never be pulled out from the handle due to the collar 33 striking against the shoulder 34.

Referring now to Fig. 9, there is shown a small stand 35 adapted to provide a handy support or rest for the heating iron 14 when not in use. The support 35 comprises a base 33 of any suitable size and an upright hollow shaft 37 mounted on said base 33. Positioned within the hollow portion 33 at its upper end is a supporting member 38 which has its upper ends split to form a Y-shaped support 39 in which the shank portion 23 of the heating iron may be placed. This stand may be formed of wood, plastic, metal or other suitable material. By this construction I provide a stand or support 38 which permits the operator to have ready access to the heating iron and likewise maintain the heated tip out of contact.

I claim:
1. The method of straightening pull-threads in hosiery knitted of thermoplastic threads and permanently restoring the straightened threads to their original position, which comprises tensioning the area containing the pull-thread over a supporting member, stroking said pull-thread with a needle in the direction of said pull-thread sufficiently to straighten the pull-thread and restore the straightened thread to its normal length and position, moistening said restored thread and applying a heated iron to said moistened thread to maintain the thread permanently in its straightened position.

2. The method of straightening pull-threads in nylon hose and permanently restoring the straightened threads to their original position, which comprises tensioning the area containing the pull-thread over a supporting member, stroking said pull-thread with a needle in the direction of said pull-thread sufficiently to straighten the pull-thread and restore the straightened thread to its normal length and position, moistening said restored thread and applying a heated iron to said moistened thread to "set" the nylon thread permanently in its straightened position.

3. The method of straightening a pull-thread in nylon hose and permanently restoring the straightened thread to its original length and position, comprising stroking the pull-thread with a rounded point needle until the pull-thread is straightened, moistening the straightened thread, and heating the thread at a temperature sufficient to set the nylon thread without damaging the hose.

4. A method as defined in claim 3 and in which the needle during stroking is positioned at an angle of at least 45° with respect to the hose.

5. A method as defined in claim 3 and in which the pull-thread is stroked in the direction of the length of the pull-thread and at first with short strokes and then with progressively longer strokes to the outer end of the pull-thread.

6. An electrically heated blunt pointed iron for use in smoothing and setting previously straightened pull-threads occurring in hosiery, comprising a hollow handle, a metal shank connected to one end of said handle, blunt cylindrical heating tip positioned within said shank, electrical leads extending through said hollow handle, high resistance insulated wire positioned within said shank and said tip and having its ends connected across said electrical leads, said tip and said high resistance wire being of
Such character as to heat said tip no higher than about 235°F.

7. An electrically heated blunt pointed iron for use in smoothing and setting previously straightened pull-threads occurring in nylon hosiery comprising a hollow handle, a hollow metal shank connected to one end of said handle, and said metal shank having its outer end bent to form substantially a right angle thereto, a blunt hollow cylindrical heating tip positioned within said shank, electrical leads extending through said hollow handle, high resistance insulated wire positioned within said shank and said tip and having its ends connected across said electrical leads, said tip and said high resistance wire being of such character as to heat said tip no higher than about 235°F.

8. An electrically heated blunt pointed iron for use in smoothing and setting previously straightened pull-threads occurring in nylon hosiery comprising a hollow handle, a hollow metal shank connected to one end of said handle and having its lower end bent to form substantially a right angle thereto, a blunt hollow chrome alloy steel heating tip positioned within said shank, electrical leads extending through said hollow handle, high resistance insulated wire positioned within said shank and said tip, said high resistance wire being free from contact with the side walls of said shank and being in close contact with the side walls of said tip, said high resistance wire having its ends connected across said electrical leads, and said tip and said high resistance wire being of such character as to heat said tip no higher than about 235°F.

An electrically heated blunt pointed iron adapted for use in smoothing and setting previously straightened pull-threads occurring in nylon hosiery comprising a hollow handle, a shoulder recess positioned within said handle, a hollow metal shank connected to one end of said handle, a blunt hollow cylindrical heating tip positioned within said shank, electrical leads extending through said hollow handle, a flanged collar secured to said wire and adapted to abut against said shoulder, high resistance insulated wire positioned within said shank and said tip and having its ends connected across said electrical leads, and said tip and said high resistance wire being of such character as to heat said tip no higher than about 235°F.

10. The method of straightening pull-threads in hosiery knitted of thermoplastic threads and permanently restoring the straightened threads to their original position, which comprises tensioning the area of the hosiery containing the pull-thread, stroking the pull-thread in the direction of the pull until the pull-thread is restored to its normal length and position, moistening said restored thread and applying heat to said moistened thread to maintain the thread permanently in its straightened position.

11. The method of straightening a pull-thread in nylon hose and permanently restoring the straightened thread to its original length and position, comprising stroking the pull-thread in the direction of the pull until the pull-thread is restored to its normal length and position, moistening the restored thread, and heating the moistened thread at a temperature sufficient to set the nylon thread without damaging the hose.

12. In the method of straightening pull-threads in nylon hose, the step of stroking the pull-thread in the direction of the pull with a pointed instrument until the pull-thread is restored to its normal length and position.

13. An electrically heated blunt pointed iron for use in smoothing and setting previously straightened pull-threads occurring in nylon hosiery, comprising a hollow handle, a hollow metal shank connected to one end of said handle, electrical leads extending through said hollow handle, high resistance insulated wire positioned within said shank and having its ends connected across said electrical leads, and means positioned in the extending end of said shank and adjacent said high resistance insulated wire for heating the blunt end of the iron no higher than about 235°F.

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