May 27, 1947. H. B. KLINE ET AL. 2,421,334

METHOD OF TREATING TWISTED FILAMENTARY MATERIALS

Filed April 26, 1944 3 Sheets-Sheet 1

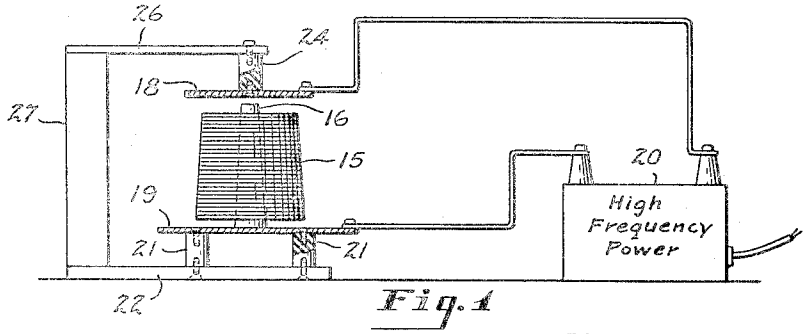


Fig. 1

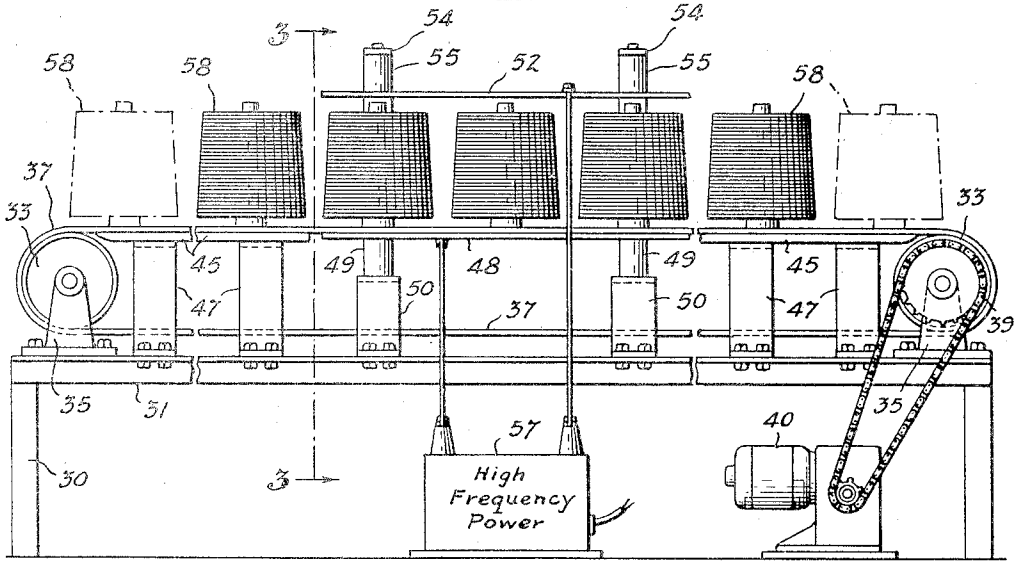


Fig. 2

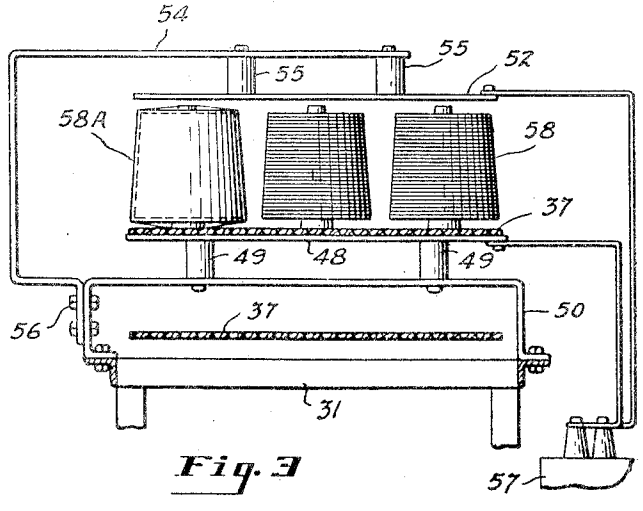


Fig. 3

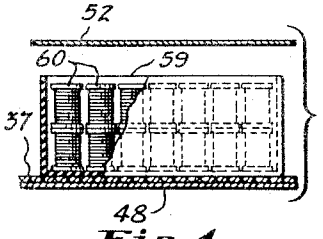


Fig. 4

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METHOD OF TREATING TWISTED FILAMENTARY MATERIALS

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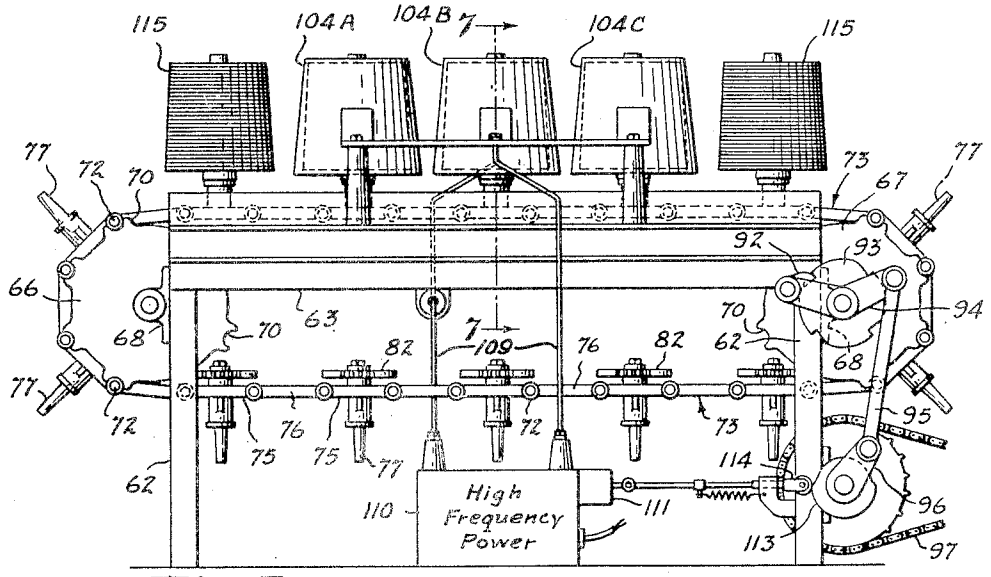


Fig. 5

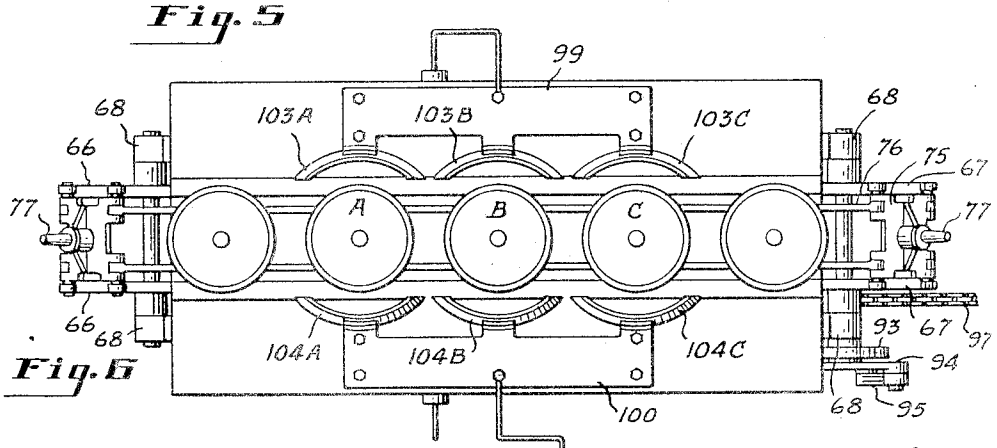


Fig. 6

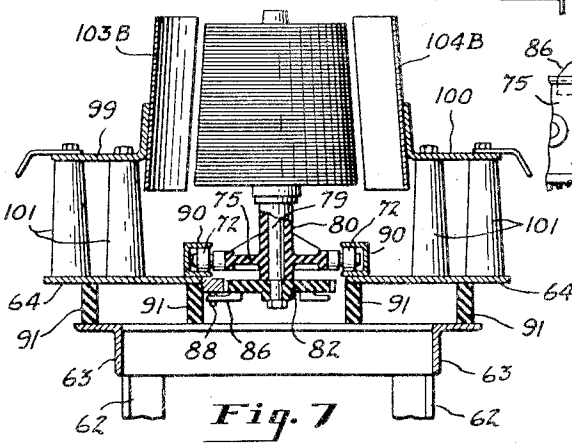


Fig. 7

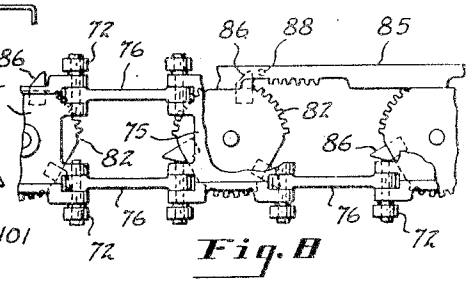


Fig. 8

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METHOD OF TREATING TWISTED FILAMENTARY MATERIALS

Filed April 26, 1944 3 Sheets-Sheet 3

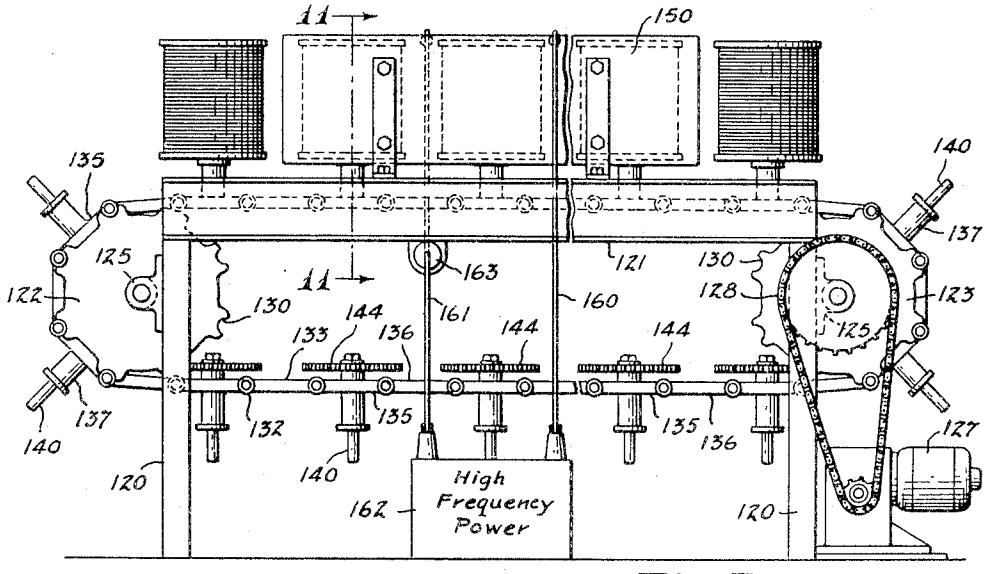


Fig. 9

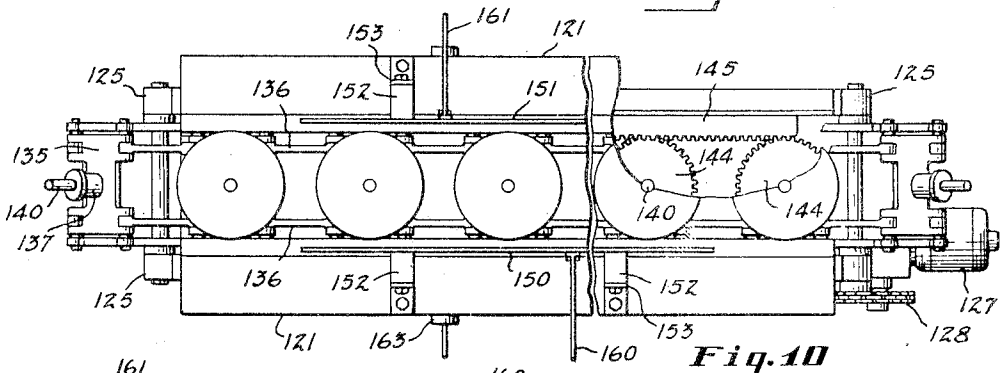


Fig. 10

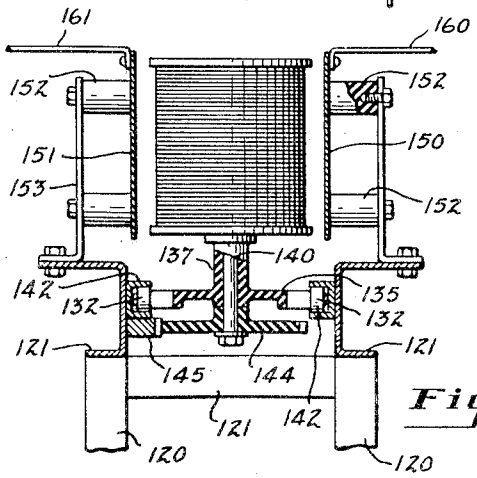


Fig. 11

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Patented May 27, 1947 2,421,334

UNITED STATES PATENT OFFICE

2,421,334

METHOD OF TREATING TWISTED FILAMENTARY MATERIALS

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Application April 26, 1944, Serial No. 532,740

19 Claims. (Cl. 28—72)

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This invention relates to nonmetallic twisted filamentary materials, and it provides a new process by which the liveliness of such twisted materials may be readily reduced. The invention also provides a new apparatus by which this process may be advantageously performed.

The apparatus of this invention is covered in divisional application Serial No. 697,392, filed on September 16, 1946. The application of the process of this invention to certain specific types of filamentary materials is covered in divisional applications Serial Nos. 595,094 and 595,095, both filed on May 22, 1945.

The term "twisted filamentary materials," as used throughout this specification, is intended to embrace twisted threads or thread-like materials, whether made by twisting one or more monofilaments or by twisting threads or yarns made up of a plurality of individual filaments or staple fibers, or by twisting narrow bands or ribbons, etc. The term "twisting" is intended to include such twisting operations as, for example, plying, cabling and the like.

In order to make the strength of filamentary materials, such as textile threads or yarns more uniform, it is common practice to twist the textile yarn in substantially air dry form a desired number of turns per unit length. The resulting twisted yarn not only has more uniform strength characteristics than the untwisted product, but also has a greater degree of resilience depending upon the amount of twisting to which it has been subjected.

For some purposes, textile yarns are given very substantial amounts of twist; thus, for example, in producing yarn or thread to be used in making crepe fabrics, a relatively high degree of twist is used. Similarly, in making hosiery or other products where resiliency is desired, a substantial amount of twist is imparted to the thread. Textile products which are used as reinforcing materials in the production, for example, of mechanical rubber goods such as tires, belts, and the like are also usually subjected to a plurality of twisting operations in forming the cord or other textile product used as the reinforcing material.

The resulting twisted textile products have a tendency to untwist themselves to release the strains imparted by the twisting operation. This tendency is sometimes referred to as liveliness of the yarn or thread. This liveliness may be observed by bringing together the ends of a short length of the twisted yarn. The loop of material between the two ends will twist upon itself to a

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greater or less extent depending upon the degree of liveliness of the material. The liveliness of the twisted yarn also manifests itself by a tendency of the yarn to form loops or kinks. Such loops or kinks are particularly objectionable when the twisted yarn is being unwound from the supply package on which it was collected in the course of the twisting operation. The liveliness of the yarn may also interfere with the smooth running of the yarn through various guides and other parts of the textile machinery used in forming finished cloth or cord products from the twisted yarn.

In order to reduce the liveliness of the twisted yarn or, as it is sometimes referred to, "to set the twist," it has been common practice to treat the twisted yarn with steam. The twisted yarn wound in package form is placed in a steam box and subjected to the action of steam until the twist has been sufficiently set. Another method which has been used involves subjecting the package of lively twisted yarn to a vacuum and then introducing steam. Still another method which has been proposed is the use of a circulating current of humidified heated air which passes around packages of the twisted yarn. All of these methods are generally conducted by a batch procedure and may require one or several hours to accomplish the desired twist-setting. In addition, the yarn packages treated by these methods generally contain no more than about one pound of yarn. Even with such small packages, however, non-uniform reduction of liveliness of the twisted products occurs due to nonuniform penetration of the wound packages by the steam or other gaseous treating medium or by liquid condensate formed during the treatment.

In accordance with the process of this invention, the liveliness of substantially air-dry twisted nonmetallic filamentary materials is reduced by heating wound packages of such materials dielectrically in a high frequency electrical field. By this process, it is possible to reduce the liveliness of such materials in a matter of minutes as compared with the much longer periods of time required by the methods described above. No steaming or humidifying apparatus is required in practicing the new process. The process may be performed as a batch operation, but it is particularly adaptable to being performed in continuous fashion.

The new process is of particular advantage in treating twisted nonmetallic filamentary materials in the form of a wound package. The wound package may be much larger than those generally

used in the twist-setting methods employed heretofore, and may, for example, contain as much as ten to twenty or more pounds of yarn. The twist of the yarn will be set in a remarkably uniform manner even when such relatively large yarn packages are used. The possibility of treating large packages of lively twisted yarn by the process of this invention results in considerable economies in handling the twisted material. Thus, for example, instead of handling ten spools or bobbins containing about one pound of yarn each, it is only necessary to handle one spool containing about ten pounds of yarn.

The wound yarn packages which are to be heated dielectrically in accordance with this invention may be in the form of a self-sustaining package, or in the form of a package wound upon a suitable supporting core such as, for example, a cone or spool. When using a core-wound package, the core should be made of a suitable nonmetallic material such as, for example, paper or wood. Sometimes, it is also desirable to wrap the package of lively twisted yarn in a sheet of relatively low porosity nonmetallic material, e. g., paper, and subject it to dielectric high frequency heating in this form.

The new apparatus by which the process of this invention may be advantageously performed includes, in general, a pair of spaced electrodes connected to a source of high frequency power and means for passing the nonmetallic material into the electrical field between the electrodes. More specifically, the apparatus also embraces an endless conveyor adapted to pass the material to be treated between the electrodes. The apparatus also may include means for holding packages of twisted materials and conveying them between the electrodes in order to subject them to the action of the high frequency electrical field.

The invention will be more fully described by reference to the accompanying drawings in which

Figure 1 shows an apparatus for treating a single package of twisted yarn;

Figure 2 shows an apparatus for passing packages of twisted yarn continuously through a high frequency field between two horizontal electrodes;

Figure 3 is a section through Figure 2 along the line 3—3 looking in the direction of the arrows;

Figure 4 illustrates the manner in which a plurality of small packages of twisted yarn may be subjected to a high frequency field by using the apparatus of Figures 2 and 3;

Figure 5 shows an apparatus by which packages of twisted yarn may be subjected intermittently to the action of a high frequency field, the packages being rotated in progressing from one pair of electrodes to another;

Figure 6 is a plan view of the apparatus of Figure 5;

Figure 7 is a section along lines 7—7 of Figure 5 looking in the direction of the arrow;

Figure 8 is a fragmentary view of the endless chain and associated parts used to advance the yarn packages through the apparatus illustrated by Figures 5 to 7, inclusive;

Figure 9 shows an apparatus in which rotating yarn packages are continuously passed through a high frequency field formed between two vertical electrodes;

Figure 10 is a plan view of the apparatus of Figure 9; and

Figure 11 is a section along the line 11—11 of Figure 9 looking in the direction of the arrows.

Referring more particularly to Figure 1, a cone

of lively twisted yarn 15 which has been wound upon a nonmetallic core 16 is placed between the horizontally disposed electrodes 18 and 19 which are, in turn, connected to the source of high frequency power illustrated diagrammatically at 20. The lower electrode 19 is mounted upon insulators 21 secured to the base member 22 by suitable means. The upper electrode 18 is secured to an insulator 24 which, in turn, is suitably mounted on the arm 26 of the frame member 27. The cone of yarn 15 is removed from the high frequency field between the electrodes 18 and 19 when the liveliness of the twisted yarn has been sufficiently reduced.

The apparatus illustrated by Figures 2 and 3 includes a table-like supporting structure 30 having a top 31. Belt-supporting cylinders 33 are journaled in the brackets 35 which are suitably mounted on the top 31. An endless nonmetallic belt 37 is positioned around the belt-supporting cylinders 33 and may be continuously rotated around these cylinders by means of the gear and chain drive 39 connected with the motor 40. Adjacent to each of the belt-supporting cylinders 33, the endless belt passes over supporting plates or receiving and discharge aprons 45 which are secured to the top 31 by means of brackets 47. Near the center of the apparatus, the endless belt 37 is supported by horizontally disposed electrode 48 which is mounted by means of insulators 49 and the U-shaped base member 50 on the top 31. An upper horizontally disposed electrode 52 is secured to arm 54 (Figure 3) by means of insulators 55, the arm 54 being secured at 56 to the base member 50. The electrodes 48 and 52 are connected to a source of high frequency power indicated diagrammatically at 57.

In using the apparatus of Figures 2 and 3, packages of twisted yarn 58 are placed by the operator on the moving belt 37 and are then conducted through the high frequency field between the electrodes 48 and 52. The treated yarn package, after emerging from between the electrodes, is thereafter removed by the operator. As shown in Figures 2 and 3, a plurality of yarn packages may be simultaneously passed through the high frequency field. If desired, the yarn package may be wrapped in a relatively low porosity nonmetallic material before being subjected to the high frequency field. Such a wrapped yarn package is illustrated, for example, by package 58A of Figure 3.

If a plurality of relatively small packages of twisted yarn is to be treated, it is advantageous to place these yarn packages in a container made of a nonmetallic material as illustrated, for example, in Figure 4. The entire container 59 with the yarn packages 60 enclosed therein is then placed on an apparatus such as is illustrated by Figures 2 and 3, and subjected to the action of the high frequency field.

It is sometimes desirable to subject the yarn packages intermittently to the action of a high frequency field. When this is the case, an apparatus such as that illustrated by Figures 5 to 8, inclusive, may be used with advantage. The apparatus there shown includes a frame structure having vertical members 62, and horizontal members 63. Pairs of sprockets 66 and 67 are journaled in the bearings 68 which are mounted on the vertical members 62 at each end of the frame structure. The sprockets 66 and 67 are provided with notched members 70 which are adapted to engage and support the rollers 72 of an endless chain 73 which travels around the sprockets 66

and 67. The chain itself is composed of a plurality of base plates 75 which are joined together by links 76.

The chain rollers 72 are supported by means of U-shaped channel members 90 which are mounted on the base 64, the base in turn being secured to the horizontal members 63 by means of suitable insulators 91.

Each chain base plate 75 is provided with a journaled spindle 77 which is adapted to receive a package of twisted yarn. The spindle shaft 79 (see Figure 7) passes through the bearing member 80 and is secured to the segment gear 82 underneath the base plate. When the endless chain 73 is moved by the sprockets 66 and 67, the spindles 77 mounted on the base plates 75, are caused to rotate by the engagement of toothed portions of the segment gears 82 with the racks 85. To insure proper engagement of the racks and the gears, projecting lugs 86 are made to engage pins 88 mounted just ahead of each rack. This arrangement will cause the lugs 86, upon striking the pins 88, to commence rotation of the segment gears 82.

The endless chain 73 is actuated by means of the pawl 92 and ratchet 93 which is in driving engagement with the sprocket 67. The pawl is actuated by means of bell crank 94 and the connecting rod 95 which is mounted on the crank arm 96. The latter is driven from a suitable source of power (not shown) which rotates the chain and sprocket drive 97.

The electrodes between which the high frequency fields are generated are each made up of three curved portions 103A, 103B, and 103C and 104A, 104B, and 104C, all of which are joined together by means of the bus bars 99 and 100. The bus bars are suitably mounted on insulators 101 and are connected through conductors 109 to a suitable source of high frequency power illustrated diagrammatically by 110. A circuit breaker 111 which is actuated by means of the cam 113 and cam follower 114 interrupts the flow of high frequency current at desired intervals.

In using the apparatus illustrated by Figures 5 to 8, inclusive, the operator places a package of lively twisted yarn 115 on the spindle 77. The movement of the pawl 92 and ratchet 93 causes the endless chain 73 and the yarn package 115 mounted on the spindle supported by the chain to advance in an an intermittent fashion. The amount of the advance at each step is sufficient to cause the package to pass from between electrodes 103A and 104A to between electrodes 103B and 104B, and, finally, to between electrodes 103C and 104C. When the yarn package is positioned between a pair of electrodes, it is subjected to the action of the high frequency field which is maintained between them. When the yarn passes from position A to position B, the cam 113 and follower 114 serve to open the circuit breaker 111 and thereby cut off the high frequency field. Additionally, in passing from position A to position B, the yarn package is caused to rotate because of the engagement of the segment gear 82 with the rack 85. In the apparatus shown, the yarn package is caused to rotate approximately 120° in passing from position A to B and another 120° in passing from B to C. This rotation is accomplished as the yarn package moves from one position to the next so that the yarn is stationary when it is subjected to the action of the high frequency field. The cam 113 is so designed that when the yarn package has completed its movement from position A to B, or from B to C, the circuit breaker will be closed so that the high frequency field will then again be maintained between the electrodes. After a sufficient lapse of time, the circuit breaker will again be opened by the cam and cam follower and the yarn package will then be advanced to the next position and, at the same time, rotated approximately 120°. Of course, it will be understood that segment gear 82 and rack 85 can be constructed to give any desired degree of rotation between steps.

Figures 9 to 11, inclusive, show an apparatus in which rotating yarn packages are continuously passed through a high frequency field between two flat vertical electrodes. The apparatus includes a frame structure comprising vertical members 120 and horizontal members 121. A pair of sprockets 122 and 123 are mounted on shafts journaled in bearings 125 suitably mounted on the vertical members 120. The pair of sprockets 123 are driven by a suitable power source such as the motor and gear transmission unit 127 which engages the chain drive 128. Each of the sprockets 122 and 123 are provided with projecting portions 130 having a notch therein which is adapted to engage the rollers 132 of an endless chain 133. The chain itself is composed of a series of base plates 135 which are joined to one another by means of the links 136. Each base plate 135 is provided with a pedestal 137 through which passes a spindle 140. The upper portion of the chain between the sprockets 122 and 123 is supported by means of the chain rollers 132 in the U-shaped channel member 142 which is suitably secured to the horizontal members 121. The spindle 140 is suitably secured at its lower end to a spur gear 144 which engages a rack 145 running longitudinally of the apparatus. The electrodes 150 and 151 are mounted by means of insulators 152 on the vertical supports 153, the vertical supports being in turn secured to the horizontal members 121.

To shield the upper portion of the endless chain base plate 135 from the high frequency field between the electrodes 150 and 151, it is desirable that the upper portion of the base plate 135, and particularly the pedestal 137, be made of an insulating material. The electrodes 150 and 151 are connected by means of conductors 160 and 161 to the source of high frequency power indicated diagrammatically at 162. Conductor 161 passes under the apparatus and may be suitably shielded from the apparatus by enclosing it in an insulating housing 163.

In using the apparatus illustrated by Figures 9 to 11, inclusive, the operator places a bobbin of lively twisted yarn, or other nonmetallic filamentary material, on the spindle 140 of the apparatus. As the spindle is advanced through the apparatus by means of the forward motion of the endless chain 133, the spur gear 144 which is secured to the spindle is caused to rotate by engagement with the rack 145. The package mounted on the spindle will thus be caused to rotate continuously as it passes through the high frequency field between the electrodes 150 and 151.

The invention will be more fully described by reference to the following examples although it is to be understood that the invention is not limited thereto.

Example 1

Cones of substantially air dry viscose rayon tire cord containing approximately 9 to 10% moisture are subjected to dielectric heating in an apparatus such as that illustrated by Figures 2 and 3.

The tire cord is made by plying together with twelve turns of S-twist, two strands of 1100 denier, 480 filament viscose rayon which have each been given 14.5 turns of Z-twist. Prior to twisting, the tire cord was treated with an aqueous finishing emulsion containing sorbitan monopalmitate so that the cord contains approximately .4%, by weight, of sorbitan monopalmitate. The cord is wound on a paper core to form a package containing about 4.15 pounds of rayon tire cord. This package, which is about 5.75 inches high and about 6.3 inches wide at its base, is wrapped in paper and then placed together with other similar packages on the moving belt 37, three packages being placed across the belt. The belt is made of cotton canvas.

The electrodes between which the wrapped tire cord packages are passed are about 28 inches wide and about 56 inches long. They are spaced apart a distance of about 7½ inches so that the cones of tire cord will pass readily between them. A current of approximately two amperes and having a frequency of about 3.85 megacycles is passed between the electrodes thereby creating a high frequency electrical field between them. The endless belt moves forward at a rate of approximately 6.5 inches per minute so that the cones of tire cord are subjected to the action of the high frequency electrical field for approximately eight minutes. They will be heated to a temperature of about 135 to 150° F. The tire cord, after being subjected to this treatment, has its liveliness substantially reduced so that the twist will be substantially completely set.

Example 2

Rayon tire cord of the same type as that referred to in Example 1 is wound on a paper core to produce a cone containing about 18.5 pounds of tire cord. This cone is then wrapped in paper and passed through an apparatus such as that referred to in Example 1. To accommodate the cone, which is about 11½ inches high and about 10¼ inches wide at its base, the electrodes are spaced about 12½ inches apart. The cone packages are placed across the belt two abreast. The current and its frequency are the same as in Example 1, but the belt speed is reduced to about 3.75 inches per minute so that the large cones of tire cord are subjected to the action of the high frequency electrical field for approximately fifteen minutes. The tire cord, after being subjected to this treatment, has its liveliness substantially reduced so that the twist of the cord is substantially completely set.

Example 3

A four and one-half pound cone of rayon tire cord such as is described in Example 1 is placed on one of the spindles 77 of an apparatus such as is illustrated by Figures 5 to 8, inclusive. Each of the curved electrodes are approximately 8½ inches wide and about 7½ inches high and their curvature conforms generally to that of the rayon cone. The electrodes are approximately 6¾ inches apart at the top where they are nearest the sides of the cone. The electrodes are inclined so that they are roughly parallel to the sides of the cone.

A current having a frequency of about 7½ megacycles per second with a power input of about one kilowatt is passed between the electrodes resulting in the creation of a high frequency field between them. The cones of yarn are passed between these electrodes at a rate such that the period of time for which the cord is subjected to the action of the high frequency field between each pair of electrodes is approximately one and one-half minutes, making a total of about four and one-half minutes of treatment of the cord by the high frequency field. The twist of the cord will be substantially completely set.

Example 4

Approximately 4.15 pounds of rayon tire cord of the type referred to in Example 1 are collected on a twist spool having a paper core impregnated with Bakelite and heads made of fiber-reinforced Bakelite. The spool filled with tire cord is approximately six inches in diameter.

A spool of this tire cord is placed on one of the spindles 140 of an apparatus such as is illustrated by Figures 9 to 11, inclusive. A current of about two amperes having a frequency of about 3.85 megacycles is applied between the electrodes which are advantageously about 56 inches long and, approximately 10 inches high. The electrodes are spaced apart a distance of about 7½ inches. The endless chain on which the spools are mounted travels at the rate of about 14.7 inches per minute so that the tire cord on the spools is subjected to the action of the high frequency field for a little less than four minutes. The spool is advantageously rotated at least one complete revolution during its passage between the electrodes.

The tire cord, after being subjected to the foregoing treatment, has its liveliness substantially reduced so that the cord may be readily used in the weaving of tire cord fabric. The twist, however, is not completely set.

Example 5

Cones of substantially air dry nylon cord containing about 2 to 3% moisture and made by imparting 10.7 turns of Z-twist to 2 strands of 272 filament 840 denier thread having 14.6 turns of S-twist are heated to a temperature of about 150 to 170° F. in a high frequency field. The liveliness of the cord will be substantially reduced by this treatment.

Example 6

A 2200 denier single-ply substantially air dry viscose rayon tire cord which has been subjected to a twist of 7 turns per inch is wound on a cone and heated in a high frequency field to a temperature of about 150° F. The liveliness of the cord will be substantially reduced.

Example 7

Spools of 75 denier 30 filament substantially air dry viscose rayon yarn which has been given 35 turns per inch of Z-twist are wrapped in oil paper and subjected to the action of a high frequency electrical field. The rayon is heated to a temperature of about 190° F. As a result of this treatment, the twist in the yarn is substantially completely set.

Example 8

Spools of 3-thread 13/15 denier substantially air dry raw silk which has been given 35 turns per inch of Z-twist are wrapped in oil paper and subjected to the action of a high frequency electrical field. The silk is heated to a temperature of about 180°–195° F. As a result of this treatment, the twist in the yarn is substantially completely set.

Example 9

Spools of 1/44 s. substantially dry air wool which has been given 18 turns per inch of Z-twist are wrapped in oil paper and subjected to the action of a high frequency electrical field. The wool is heated to a temperature of about 195° F. As a result of this treatment, the twist in the yarn is substantially completely set.

Although the foregoing examples have illustrated the application of the invention to various textile materials, it is to be understood that the process is not limited to these specific materials. In general, the process may be used to reduce the liveliness of any twisted nonmetallic filamentary materials. These include such organic materials as those of a cellulosic nature, or those of the nitrogen-containing type, or hydrocarbon polymers and their substitution products, or various others.

Among the cellulosic filamentary materials may be mentioned natural cellulosic yarns or threads made of cotton, flax, hemp, ramie, paper, and such artificial yarns or threads as those made of regenerated cellulose produced by the viscose or cuprammonium processes, as well as cellulose ethers and esters including an ester such as cellulose acetate.

The nitrogen-containing filamentary materials may include such natural yarns or threads as those produced from silk or wool; or artificial yarns or threads made from polymerized polyamides such as nylon, or protein-type yarns or fibers made, for example, from casein, soybean, peanuts, keratin, zein, alginic acid, etc.

Filamentary materials derived from hydrocarbon polymers and their substitution products may include polymers such as those derived from unsaturated hydrocarbons; for example, those formed by polymerizing an alkylene hydrocarbon such as ethylene, or by polymerizing substituted or unsubstituted hydrocarbons containing vinyl, or vinylidene linkages such as, for example, the vinyl chloride and vinyl acetate polymers and copolymers, e. g., "Vinyon," or vinylidene chloride polymers or copolymers of vinylidene chloride with vinyl chloride, e. g., "Saran," or polystyrene derivatives, etc.

Inorganic nonmetallic filamentary materials such as those of a silicious nature including, for example, glass, asbestos, rock wool, etc., may also be treated in accordance with the process of this invention.

The most desirable operating conditions to be used in reducing the liveliness of lively twisted nonmetallic filamentary materials by dielectric heating will, of course, vary considerably depending upon the particular results which are desired. Thus, for example, to completely set the twist of a lively material will require a longer period of treatment, other things being equal, than merely partially reducing the liveliness of the twisted material. For some operations, it may not be necessary to completely set the twist of the filamentary material.

In general, the conditions of treatment will also vary depending upon the nature of the material being treated. Sometimes, too, the nature of the finishing agent applied to the filamentary material prior to the twisting operation may also be a factor.

An indication of the amount of power dissipated as heat in the nonmetallic material when placed in the high frequency field between the electrodes is given by the following equation:

$$W=E^2\times 2\pi\times f\times C\times P.\ F.$$

in which W is the energy dissipated in watts as heat in the nonmetallic material, E is the voltage across the electrodes, f is the frequency with which the current supplied to the electrodes alternates, C is the capacitance of the condenser formed by the nonmetallic material being heated, and P. F. is the power factor of the material. It is evident that for a given material, the capacitance C (which is dependent upon the dielectric constant of the material) and the power factor P. F. will be substantially constant within a limited temperature range. It is also evident that the energy dissipated in the form of heat in the material may be controlled by varying either the frequency of the current supplied to the electrodes or the voltage across the electrodes. The frequencies selected may be as low as one megacycle per second or lower, and may range up to to ten or fifteen megacycles per second, although frequencies as high as thirty megacycles or more per second may also be used if desired. In general, the higher the frequency selected, the lower will be the voltage required. Usually, it is desirable to keep the voltage low to prevent corona discharge or other objectionable electrical effects.

If the power dissipated in the material is calculated and the specific heat of the material is known, it will be possible to calculate how much of a temperature rise will be produced by subjecting the material to a high frequency field under specified conditions. It is evident, of course, that the amount of heat generated should not be permitted to become so great as to adversely affect the filamentary material itself. Scorching of the material is manifestly undesirable. Similarly, with thermoplastic materials, the temperature should not be permitted to become so great that the physical properties of the filamentary material are adversely affected. In general, however, the twist is set more effectively at higher temperatures than at lower ones.

Other things being equal, the amount of treatment required by a material having a high degree of liveliness, usually a material having a high degree of twist, will be greater than with a material having a relatively minor amount of liveliness, usually a material with a low degree of twist.

The relatively low porosity nonconducting sheet material which may be used in wrapping the packages of filamentary material prior to subjecting them to the action of a high frequency electrical field may be merely the ordinary wrapping paper in which the material is wrapped for shipment. It may include such nonmetallic materials as Cellophane, glassine, paper, including water-resistant paper such as wax paper, rubber hydrochloride products such as "Pliofilm," "Koroseal," etc.

As previously indicated, when wound supported packages of filamentary material are subjected to the action of the high frequency electrical field, the supporting core of the package should advantageously be made of a nonmetallic material such as, for example, paper, wood, fiber, or various synthetic resins or plastics such as the phenol-aldehyde, glyptal, polystyrene, polyvinyl, etc., resins or plastics. There is, however, no objection to having some metal present in the supporting core provided, of course, it is suitably shielded or insulated so as not to adversely affect the action of the high frequency field on the filamentary material wound on the core.

We claim:

1. The method of reducing the liveliness of a substantially air dry lively twisted nonmetallic

filamentary material which comprises subjecting a wound package of said material to the action of a high frequency electrical field.

2. The method of reducing the liveliness of a substantially air dry lively twisted artificial organic filamentary material which comprises subjecting a wound package of said material to the action of a high frequency electrical field.

3. The method of reducing the liveliness of a substantially air dry lively twisted artificial cellulosic filamentary material which comprises subjecting a wound package of said material to the action of a high frequency electrical field.

4. The method of reducing the liveliness of a substantially air dry lively twisted cellulosic material selected from the class consisting of cellulose esters and ethers which comprises subjecting a wound package of said material to the action of a high frequency electrical field.

5. The method of reducing the liveliness of a substantially air dry lively twisted cellulose acetate filamentary material which comprises subjecting a wound package of said material to the action of a high frequency electrical field.

6. The method of reducing the liveliness of a substantially air dry lively twisted regenerated cellulose filamentary material which comprises subjecting a wound package of said material to the action of a high frequency electrical field.

7. The method of reducing the liveliness of a substantially air dry lively twisted viscose rayon filamentary material which comprises subjecting a wound package of said material to the action of a high frequency electrical field.

8. The method of reducing the liveliness of a substantially air dry lively twisted filamentary material selected from the class consisting of hydrocarbon polymers and their substitution products which comprises subjecting a wound package of said material to the action of a high frequency electrical field.

9. The method of reducing the liveliness of a substantially air dry lively twisted filamentary material derived from vinyl polymers which comprises subjecting a wound package of said material to the action of a high frequency electrical field.

10. The method of reducing the liveliness of a substantially air dry lively twisted filamentary material derived from the class consisting of vinyl and vinylidene polymers which comprises subjecting a wound package of said material to the action of a high frequency electrical field.

11. The method of reducing the liveliness of a substantially air dry lively twisted artificial organic tire cord which comprises subjecting a wound package of said cord to the action of a high frequency electrical field.

12. The method of reducing the liveliness of a substantially air dry lively twisted rayon filamentary material which comprises subjecting a wound package of said material to the action of a high frequency electrical field.

13. The method of reducing the liveliness of a substantially air dry lively twisted viscose rayon filamentary material which comprises enclosing a wound package of said filamentary material in a relatively low porosity nonmetallic material and subjecting said material in this form to the action of a high frequency electrical field.

14. The method of reducing the liveliness of a substantially air dry, lively twisted rayon tire cord which comprises subjecting a wound package of said cord to the action of a high frequency electrical field.

15. The method of reducing the liveliness of a substantially air dry lively twisted artificial organic filamentary material which comprises subjecting a wound package of said material formed on a nonmetallic core to the action of a high frequency electrical field.

16. The method of reducing the liveliness of a substantially air dry lively twisted artificial organic filamentary textile material which comprises enclosing a plurality of wound packages of said material in a relatively low porosity nonmetallic sheet-like material and thereafter subjecting the material in this form to the action of a high frequency electrical field.

17. The method of reducing the liveliness of a substantially air dry lively twisted artificial organic filamentary material which comprises enclosing a wound package of said material in a relatively low porosity nonmetallic sheet-like material and thereafter subjecting the filamentary material in this form to the action of a high frequency electrical field.

18. The method of reducing the liveliness of a substantially air dry lively twisted artificial organic filamentary textile material which comprises enclosing a wound package of said material which has been formed on a nonmetallic core in a relatively low porosity nonmetallic sheet-like material and thereafter subjecting the material in this form to the action of a high frequency electrical field.

19. The method of reducing the liveliness of a substantially air dry lively twisted rayon tire cord which comprises enclosing a wound package of said cord in a relatively low porosity nonmetallic sheet-like material and then subjecting the cord in this form to the action of a high frequency electrical field.

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