

March 15, 1960

S. V. HAAS, JR

2,928,229

APPARATUS FOR TREATING TEXTILES

Filed Aug. 10, 1954

3 Sheets-Sheet 1

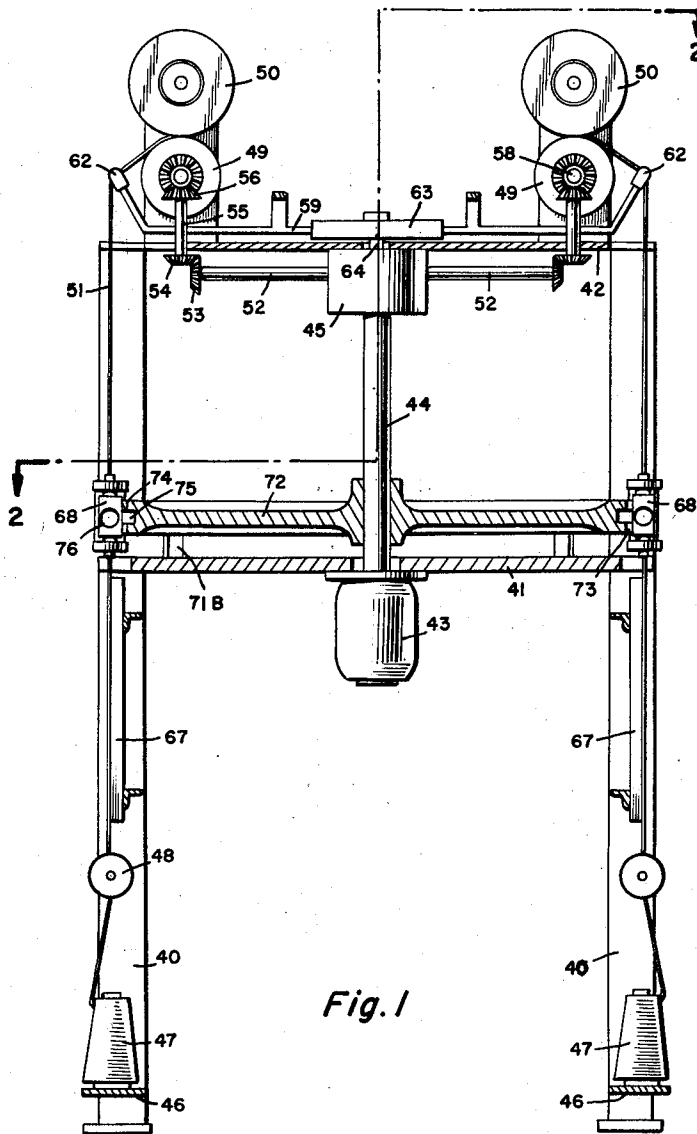


Fig. 1

INVENTOR

SIDNEY V. HAAS JR.

BY

Wilford A. Jeter

ATTORNEY

March 15, 1960

S. V. HAAS, JR

2,928,229

APPARATUS FOR TREATING TEXTILES

Filed Aug. 10, 1954

3 Sheets-Sheet 2

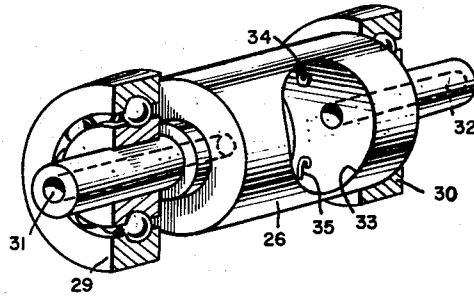


Fig. 4

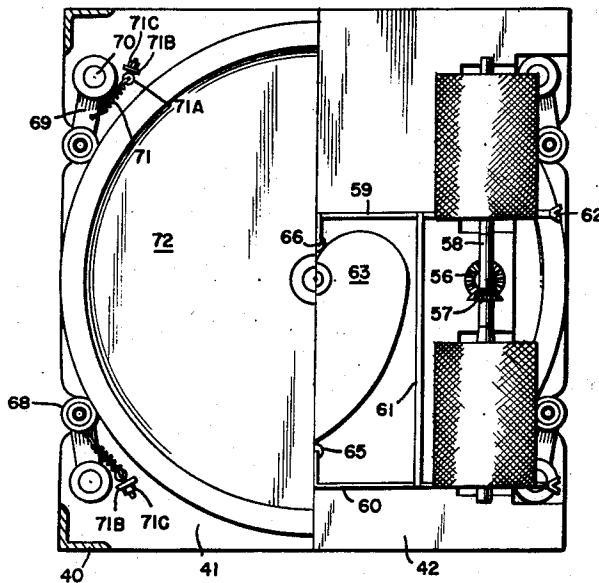


Fig. 2

INVENTOR

SIDNEY V. HAAS, JR.

BY *Wilford A. Jeter*
ATTORNEY

March 15, 1960

S. V. HAAS, JR

2,928,229

APPARATUS FOR TREATING TEXTILES

Filed Aug. 10, 1954

3 Sheets-Sheet 3

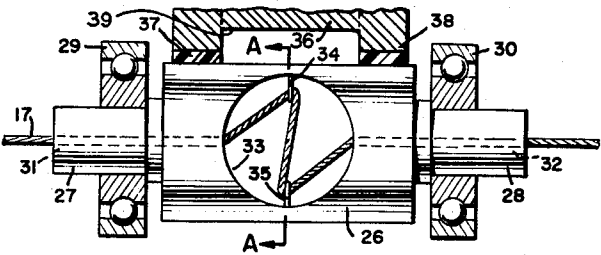


Fig. 5

SECTIONS A-A

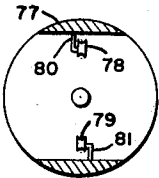


Fig. 6

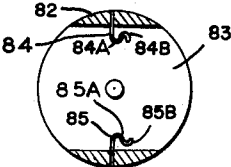


Fig. 7

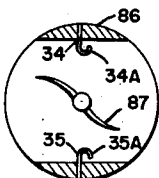


Fig. 8

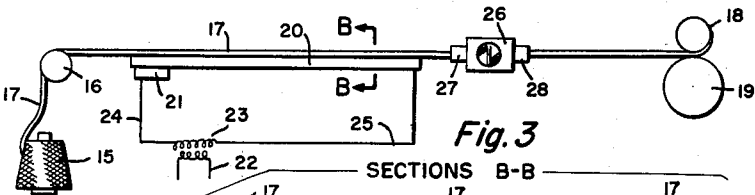


Fig. 9

SECTIONS B-B



Fig. 10

Fig. 11



Fig. 12

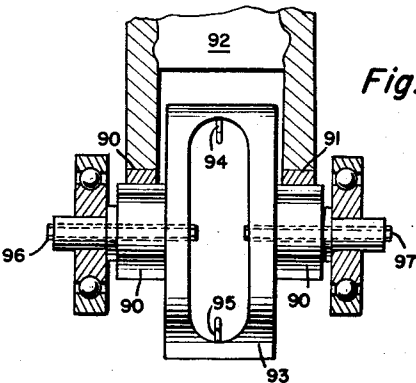


Fig. 13

INVENTOR

SIDNEY V. HAAS, JR.

BY *Frederic A. Jeter*
ATTORNEY

1

2,928,229

APPARATUS FOR TREATING TEXTILES

Sidney V. Haas, Jr., West Orange, N.J., assignor, by direct and mesne assignments, to Valco Machine Co., Union City, N.J., a corporation of New Jersey

Application August 10, 1954, Serial No. 448,806

11 Claims. (Cl. 57—77.3)

The present invention relates to textiles and more particularly to textile yarns used in knitting stretchable garments so that a single size garment may fit people of varying sizes.

Heretofore some textile yarns and particularly nylon which have the characteristic of acquiring a permanent set have been used for making knitted garments such as socks so that a single size of sock will fit feet of considerably different sizes thereby making it possible to reduce the inventory in a store and still have sufficient products to supply the trade for all sizes of persons.

The present practice of producing such yarns is to provide a permanent set in the yarn which gives it a tendency to assume coil spring shape. This is accomplished by putting substantially parallel continuous strands through a conventional spinning machine which produces a twist while winding the twisted yarn on an aluminum spool or bobbin. The yarn is then subjected to a heat treatment as by high pressure steam to produce a permanent coil spring set in the twisted yarn. After the yarn had been so heated for a sufficient time to acquire the permanent set it was allowed to cool and thereafter it was passed through a spinning machine and the twist removed, the untwisted yarn being wound on a spool or bobbin. The tendency of the yarn to return to twisted or coil spring condition remains in the yarn. The twisting spindles used in this type of work could generally operate at a speed not greater than 14,000 r.p.m. and the rate of production is therefore very small, in the order of 0.4 pound of nylon yarn per spindle per week. Because of high costs of production the use of this type of yarn has been limited.

An object of the present invention is to overcome the deficiencies of the prior art and produce a yarn with a permanent set by an economical method and inexpensive apparatus.

Another object is to provide apparatus for producing permanent distortion of strand material without requiring intermediate handling thereof.

A further object is to provide yarn treating apparatus for imparting a permanent tendency toward twisting of the yarn and thereafter removing the twist so that the treated yarn will tend to coil like a spring.

Another object of the present invention is to provide a method of manufacturing yarns having a tendency toward permanent distortion.

A further object is a yarn product having a tendency toward permanent distortion.

Another object is to produce an easily threaded false twisting spindle.

Other objects and advantages of the invention will be apparent as the description proceeds and upon reference to the drawings wherein:

Fig. 1 is a vertical section with some parts omitted of one form of the invention in which a single frame carries a plurality of false twisting spindles and supply and take-up bobbins;

2

Fig. 2, a section taken substantially on the broken line 2—2 of Fig. 1;

Fig. 3, a schematic elevational view of another form of the apparatus illustrating the basic principles of the method;

Fig. 4, a perspective of one form of the false twisting spindle with the bearings shown in section;

Fig. 5, a detailed view of the false twisting spindle showing the bearings in section and a portion of the friction drive wheel;

Figs. 6, 7 and 8, sections of modified forms of spindles taken on a transverse line corresponding to line A—A of Fig. 5;

Figs. 9, 10 and 11, sectional views of modified forms of heating elements taken on a line corresponding to section line B—B of Fig. 3 of the corresponding modified heating elements; and,

Fig. 12, another form of false twisting spindle having an enlarged central portion in which the thread engaging fingers are spaced apart a greater distance.

Briefly, the present invention includes apparatus and a method for treating yarn as well as the yarn product and comprises tension guide means for yarn as the yarn is drawn from a supply and means for winding up the yarn on a take up bobbin. Between the tension guide means and the winding means a heater for the yarn provides sufficient heat for allowing a permanent distortion to occur in the yarn. The heated yarn is twisted by means of a false twisting device or a spindle located between the heater and the wind up means. The spindle has an axial passage therethrough communicated with a transverse opening in which radially spaced guide fingers are mounted. The spindle is rotated on the axis of the yarn and cooling air passes through the axial passages and transverse opening during the rapid rotation of the spindle. The guide fingers cause the yarn to follow a generally Z-shaped path through the spindle within the transverse opening. The yarn which may be nylon is fed from a supply bobbin through the tension guide and in contact with or in sufficiently close relation to the heating means for acquiring a distortable condition and thence through the inlet axial passage in the spindle and over the guide fingers in the transverse opening and through the outlet axial passage of the spindle to the winding means. The winding means is operated at a suitable speed so that the heating means may heat the yarn to a sufficiently high temperature for example in the case of nylon a temperature in the neighborhood of 380° to 400° F. had been found to be suitable and the spindle is rotated at sufficient speed to produce the desired amount of false twist in the yarn; such false twist remains in the yarn while the yarn passes over the guide fingers in the transverse opening or bore of the spindle. Suitable treatment including gas or liquid will be applied when other yarns are being processed in accordance with the characteristics thereof and a lower or higher temperature may be used as required. Air is drawn through the passages and forced out through the transverse opening or bore thereby cooling the yarn in the spindle sufficiently to set the tendency toward twisting in the yarn and after the yarn passes the second guide finger such yarn is continuously untwisted and wound on the take up bobbin.

Referring more particularly to the drawings, and Fig. 3 thereof, a supply bobbin 15 has the yarn thereof guided through a tension guide device 16 which may be two parallel disks adjustably spring pressed together as is well-known in the art, and from such tension disks the yarn 17 is drawn and wound upon a take up bobbin 18 which rests on a winding device or driven roller 19 which is operated at a selected speed and engages the yarn thereby producing a definite longitudinal speed in the yarn 17. A heating device or plate 20 which is

shown as an electrically heated iron has its temperature adjustably controlled by a thermostat 21 for maintaining the heating plate at a selected temperature to produce the proper temperature in the yarn. Electric current is supplied to the heating plate by means of a transformer having a primary winding 22 which may be connected to a conventional supply of electricity, and a secondary supply 23 connected by means of conductors 24 and 25 to the terminals of a heating element in the plate 20. The heating element may thereby be controlled for delivering the desired amount of heat to the yarn passing thereover by suitable adjustment of the thermostat 21 under the conditions of operation. The transformer composed of coils 22 and 23 is preferably adjustable to vary the voltage to the heating element for controlling the heating thereof to obtain more accurate control.

It is assumed that the yarn 17 is a continuous sliver with substantially no twist in the yarn and such yarn passes from tension device 16 over the heater 20 and through a spindle 26. The spindle 26 has reduced end portions 27 and 28 which are mounted in ball bearings 29 and 30 (shown in Figs. 4 and 5). The spindle 26 is provided with axial passages 31 and 32 therethrough which are substantially in alignment with the yarn 17. The spindle 26 is provided with a transverse opening or bore 33 in communication with the passages 31 and 32 and on the inner periphery of bore 33 guide fingers 34 and 35 are fixed to the spindle and engage the yarn 17. The guide fingers 34 and 35 include hooks 34A and 35A and the plane of the hooks is substantially at right angles to the axis of the spindle, both hooks are facing in the same direction for ease of threading. The guide fingers 34 and 35 may be of metal or of metal having a porcelain covering or other suitable material. The guide fingers are disposed on opposite sides of the axis of the spindle 26 and serve to guide the yarn in a Z-shaped path from the outlet of passage 31 to the inlet of passage 32 assuming the yarn moves from left to right in Fig. 5. The spindle 26 is driven by means of a driving roller 36 which is rotated by conventional means and such driving roller has frictional surfaces 37 and 38 on its periphery arranged in spaced relation with a recess or peripheral groove 39 formed between such frictional surfaces to permit cooling air to be pumped from the spindle 26. The frictional surfaces may be provided on the spindle 26 instead of on the driving roller and only one friction surface may be used for each spindle thereby reducing costs. The frictional surfaces may be made of rubber-like material for reducing shock and vibration. Such cooling air enters through the outboard ends of passages 31 and 32 and is forced out through the outer ends of transverse opening or bore 33. The diameter of yarn 17 is appreciably less than the diameter of passages 31 and 32 thereby leaving space for cooling air to be drawn into the spindle and pumped therefrom by the centrifugal force on the column of air in transverse opening 33. The pumping action is similar to the action of other centrifugal pumps and the total cooling is sufficient to set the tendency to twist in the yarn.

The spindle being continuously rotated as the yarn is fed produces a twist in the yarn and such twist remains in the yarn until that portion of yarn passes guide finger 35 and thereafter the twist is removed so the yarn wound on the take-up bobbin has substantially no twist, or has substantially the same twist as the yarn on supply bobbin 15.

An upstanding frame (Figs. 1 and 2) includes a plurality of uprights 40 fixedly supporting a horizontally extending intermediate plate 41 and top plate 42. A motor 43 is supported on the intermediate plate 41 and drives a shaft 44 which extends to a gear box 45 suspended from the top plate 42. A plurality of brackets 46 support a plurality of supply bobbins 47 of yarn 51. A corresponding number of tension devices 48 are mounted

on the frame adjacent the supply bobbins and a plurality of windup bobbins 50 resting upon the windup rollers 49 producing a continuous tension and take-up action on the yarn 51 which is drawn from the supply bobbins 47.

The windup rollers are driven by means of shafts 52 extending from the gear box, bevel gears 53, 54, intermediate shaft 55, bevel gears 56, 57 which in turn drive windup roller shafts 58 connected to the windup rollers 49 thereby positively driving the windup rollers at a definite speed. A bevel winding mechanism includes a movable frame having a pair of longitudinal members 59 and 60 and a plurality of transverse members 61 carrying yarn guides 62. The movable frame is mounted for movement parallel to the axis of shafts 58 and such frame is oscillated by means of a heart-shaped cam 63 which is driven from the gear box 45 through a shaft 64. The level winding frame has follower rollers 65 and 66 cooperating with the heart-shaped cam 63 for producing the oscillating motion of the level winding frame. The gear box 45 is of known design with suitable gearing for obtaining the desired gear ratios between the various shafts.

A plurality of heating elements 67 are mounted on the supporting frame above the tension means 48 and beneath the intermediate plate 41. Such heating elements 67 are similar to the heating element or plate 20 (Fig. 3), the temperature thereof being controlled by similar means.

A plurality of false twisting spindles 68 are mounted in yokes 69 which are pivotally mounted on stub shafts 70 supported on the main frame or on the intermediate plate 41. The spindles 68 are biased into engagement with the drive wheel by suitable means such as springs 71. The tension springs 71 may be adjusted by any suitable means such as eye bolts 71A passing through lugs 71B on plate 41 and adjusted by nuts 71C. The plate 41 may be provided with access openings. The false twisting spindle 68 is similar to the spindles shown in Figs. 3, 4 and 5 and suitable bearings on the spindle are mounted in the yoke 69 to rotatably support such spindles for high speed rotation.

Fixed on the shaft 44 is a driving wheel 72 which has spaced frictional surfaces 73 and 74 with a recess or circumferential groove 75 extending therebetween so that air moving outwardly from the transverse bores 76 of the spindles 68 will be unobstructed and the cooling of the yarn can be readily accomplished in the machine.

It will be evident that the number of spindles and the number of supply and take-up bobbins on the upstanding frame may be varied in accordance with requirements and the heating elements 67 will be arranged to properly heat the yarn so that a permanent set may be obtained in each yarn.

By the circumferential arrangement of spindles about a single driving wheel an appreciable saving of floor space is obtained and supporting frame units with various numbers of spindles can be added to a mill to increase the production in accordance with actual requirements.

Referring to Figs. 6, 7 and 8, other forms of false twisting spindles are shown. The false twisting spindle 77 of Fig. 6 includes guide rollers 78 and 79 mounted on L-shaped brackets 80 and 81 respectively. The rollers reduce the frictional drag on the twisted yarn while maintaining the twist in the yarn.

A spindle 82 (Fig. 7) has a transverse bore 83 in which guide fingers 84 and 85 are mounted. The guide fingers have hooks 84A and 85A formed therein for engaging the yarn and the rounded extensions 84B and 85B of the hooks prevent the yarn from snagging when it is placed on the hook.

A spindle 86 in Fig. 8 is provided with the usual yarn guides 34 and 35 and also with impeller blades 87 mounted on the spindle which additionally serves to in-

5

crease the cooling effect on the yarn passing through the bore or opening in the spindle.

A modified form of heating plate or unit 88 is shown in Fig. 9 having a V-shaped groove formed in its thread-engaging surface for obtaining proper guiding of the yarn 17 and similarly in Fig. 10 the yarn 17 is supported on a flat plate 20 corresponding to the showing in Fig. 3 while in Fig. 11 a heating plate 89 has a rounded groove formed in its yarn engaging surface for guiding the yarn 17 while the yarn is passing thereover.

Referring to Fig. 12, a modified form of spindle is mounted on bearings and includes cylindrical portions 90 for contacting the friction surfaces 91 of a drive wheel 92 while the central portion 93 of the spindle is appreciably enlarged to increase the size of the transverse opening and the spacing between yarn engaging hooks 94 and 95. Porcelain or ceramic yarn guides 96 and 97 in the form of inserts are mounted within the axial passages of the spindle for preventing wear on the spindle and reducing frictional drag of the yarn.

From the above description the utility of the apparatus and method is believed to be obvious. The supply bobbin 15 has a continuous sliver of thermoplastic yarn such as nylon in the form of a continuous strand thereon and it is desired to produce a permanent set in such yarn in a twisted condition and then remove the twist so that the product is a continuous sliver of untwisted yarn with a tendency toward twisting. The yarn 17 from the supply bobbin 15 is fed over a tension device 16 such as tension disks or positively driven pinch rollers and the yarn is then fed over the heating unit or plate 20 to the false twisting spindle 26. The yarn is fed through the axial passage 31 (Figs. 4 and 5) into the transverse bore 33 the yarn then being passed over the guide 34 and across to the opposed guide 35 and then into the outlet axial passage 32 and from such outlet axial passage of the spindle the yarn is wound upon a bobbin 18 which is supported upon and driven by a windup driving roller 19 to produce a predetermined speed of passage of the yarn. The spindle 26 is rotated at extremely high speeds in the neighborhood of 50,000 r.p.m. while the yarn is fed along at a speed to produce the desired twist in the portion of yarn passing the heater and passing through the spindle. The heating unit produces sufficient heat in the yarn making the yarn somewhat plastic to permit the yarn to be permanently distorted. The false twisting spindle 26 produces the desired amount of twisting or distortion beyond the elastic limit of the yarn and the false twisting spindle also serves to cool the twisted yarn evidently by the passage of air through the axial passages into the transverse bore 33 and outwardly from the transverse bore by centrifugal force on the air with the yarn simultaneously being drawn through the axial passages 31 and 32. The spindle therefore serves as a pump and cooling unit for cooling the yarn below its setting temperature while the yarn is in its twisted condition thereby maintaining the tendency to twist in the yarn. After the yarn passes through the spindle and past the hook 35 such yarn is untwisted but the tendency toward twist remains in the yarn and the yarn wound upon the bobbin 18 therefore has the desired set.

This yarn is particularly useful for knitted garments such as socks, underwear, shirts, and the like. Garments made from the yarn of the present invention can be produced at substantially lower cost, making such garments available to a larger number of customers.

The multiple units shown in Figs. 1 and 2 operate in a similar way and the yarn 51 therein may be maintained in contact with the heating element 67 by suitable means such as spring fingers or the heating element may be provided with a convex curvature in the direction of movement of the yarn or other suitable means. The yarn is wound in a level fashion by means of the movable thread guides 62 which are mounted for oscillating movement in a well-known manner.

6

From the above description, the advantages of the present invention in addition to the reduction in costs should be apparent. The small rotating mass of each false twisting spindle permits extremely high speeds and permits the use of extremely small anti-friction bearings, thereby insuring long life for the equipment.

The cylindrical shape of the transverse bore 33 of the spindle prevents "ballooning" of the yarn since the yarn is confined in the transverse bore, thereby permitting the extremely high speeds.

The yarn may be readily threaded through the false twisting spindle by means of the conventional wire hook and the yarn can be readily placed on the guide finger hooks with a simple manipulation of the threading hook.

A minimum of power is required due to the extremely small size of the spindle which has been as small as $\frac{5}{8}$ " in diameter. The use of two anti-friction bearings reduces the bearing load and reduces vibration problems. The spindle being symmetrical about its axis and the yarn path also being symmetrical reduce any unbalanced forces to a minimum. The yarn can be brought up to temperature as it moves over an appreciable distance over a corresponding period of time but the cooling takes place in a relatively small distance over a correspondingly brief period of time and principally at the most highly twisted state of such yarn, thereby producing the maximum tendency toward permanent distortion in the yarn. The spindle may be run in either direction and the drive wheel may be a single wheel as shown with spaced frictional circumferential portions or two drive wheels may be used. Also a single wheel having one frictional surface can be used. Belt drivers may be used if desired.

It will be obvious to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof and therefore the invention is not limited by that which is illustrated in the drawings and described in the specification, but only as indicated in the accompanying claims.

What is claimed is:

1. Apparatus for producing permanent set in yarn comprising a tension guide over which the yarn is passed and a take-up spaced from said guide for moving the yarn at a selected speed past said guide under selected conditions of tension and speed of movement, a heating device located adjacent said guide in the path of movement of the yarn for producing a temperature sufficiently high to provide a condition in the yarn to permit permanent distortion thereof, a hollow spindle mounted for rotation on the axis of said yarn and having a centrally disposed axial passage therethrough and a transverse opening intersecting said axial passage, a pair of guide fingers mounted on said spindle within the transverse opening of said spindle at opposite sides of said axis whereby the yarn is positively guided in a Z-path in said transverse opening and the yarn passes through said axial passage and to the take-up, means to rotate said spindle at a speed sufficient to produce the desired twist in the yarn between said guide and said spindle with relation to the speed of axial movement of the yarn to produce the desired twist in the yarn, said spindle subsequently removing the twist between said spindle and said take-up, said spindle serving to effectively cool said yarn while the yarn passes therethrough whereby a permanent set is given to said yarn between said guide and said take-up.

2. A false twisting spindle comprising a body having portions for mounting in anti-friction supports, said body having a passage extending through said body from end to end, said body having a transverse opening in communication with said passage and spaced yarn engaging elements in said opening fixed to said body on opposite sides of said passage.

3. The invention according to claim 2 in which the yarn engaging elements are hooks.

4. The invention according to claim 2 in which the

7

yarn engaging elements are hooks of hard and long wearing porcelain.

5. The invention according to claim 2 in which the yarn engaging means are rollers.

6. The invention according to claim 2 in which the yarn engaging elements are hooks with rounded extensions.

7. The invention according to claim 2 in which the spindle is additionally provided with air impelling means mounted thereon to increase the passage of air there-through.

8. The invention according to claim 2 in which the body is cylindrical.

9. A machine for producing a permanent set in a yarn comprising a hollow elongated spindle having axial guiding means at each end, said spindle having a transverse opening formed therein and communicating with said axial guiding means, a pair of guide means within said transverse opening and spaced apart on each side of the axis whereby a yarn may be treated in passing through the spindle in a path of Z-configuration, and means to rotate said spindle without interfering with the passage of air through said transverse opening.

10. A false twisting spindle comprising a body having an axial bore therethrough, means to rotatably support said false twister for rotation about the axis thereof, an opening extending transversely through the body of said false twister for the passage of cooling air therethrough, said transverse opening being substantially larger than the axial bore, hook means positioned within said transverse opening spaced from the axis of rotation and lying substantially equal distance from the axis whereby a strand may pass through the axial bore and be engaged by said hook means to obtain a substantially Z-configuration, and means to drive said false twister without interfering with the flow of air therethrough.

11. A machine for producing a permanent set in a

8

yarn comprising a body providing a spindle, means to rotatably support said spindle for rotation about an axis, each end of said body at the end of the axis thereof being closed and provided with relatively small axial openings providing axial guiding means at each end of said axis for guiding yarn through said body and for the movement of cooling air axially into said body, said body having a transverse bore formed in said body and communicating with the small axial openings, the wall surface of said transverse bore being non-concentric with the axis of rotation of said body and having surface portions radiating outwardly directly from said axial openings, at least one yarn guiding means mounted in said body within said transverse bore and spaced a substantial distance radially from the axis of said body whereby a yarn may be treated in passing through the body in a path deflected substantially to one side of the axis to assure the passage of cooling air into said body through said small openings and outwardly through said bore and into contact with said yarn, said guiding means being spaced out from the axis a greater distance than the radii of the openings, and means to rotate said body without interfering with the passage of air from said transverse bore.

References Cited in the file of this patent

UNITED STATES PATENTS

1,030,235	Finlay	June 18, 1912
2,111,209	Dreyfus	Mar. 15, 1938
2,227,910	Pool	Jan. 7, 1941
2,244,832	Finlayson et al.	June 10, 1941
2,463,618	Heberlein et al.	Mar. 8, 1949
2,463,620	Heberlein	Mar. 8, 1949
2,557,104	Hegedus	June 19, 1951
2,761,272	Vandamme et al.	Sept. 4, 1956
2,780,047	Vandamme et al.	Feb. 5, 1957