United States Patent

Smith

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[45] **Aug. 29, 1972**

[54] **METHOD AND APPARATUS FOR TREATING THERMOPLASTIC YARNS**

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[52] **U.S. Cl.** .....**57/34 HS**, 57/77.45, 57/157 TS

[51] **Int. Cl.** **D02g 1/02**, D01h 7/92, D01h 13/28

[58] **Field of Search**.....57/34, 34 HS, 77.3–77.45, 57/157, 157 TS, 104, 105

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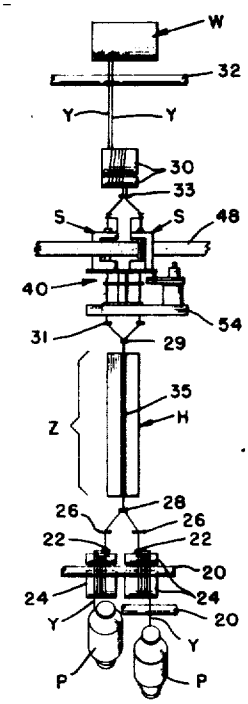
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Primary Examiner—Donald E. Watkins
Attorney—David Rabin

[57] **ABSTRACT**

A plurality of yarns drawn from supply packages converge into a single yarn path as the yarns pass through a heating zone and a false twist is applied separately to each yarn in the heating zone. Upon exiting from the heating zone the yarns diverge to separate spindles mounted on a common unit displaceable into and out of engagement with a drive means for providing S and/or Z twist to alternate yarns.

6 Claims, 17 Drawing Figures



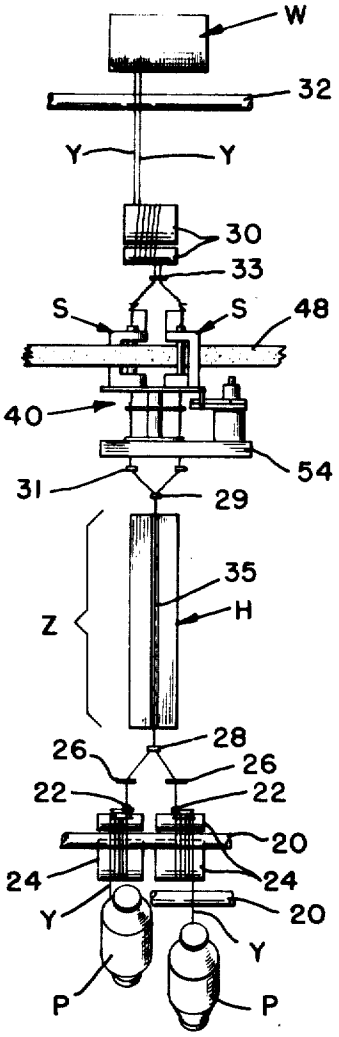


FIG. 1

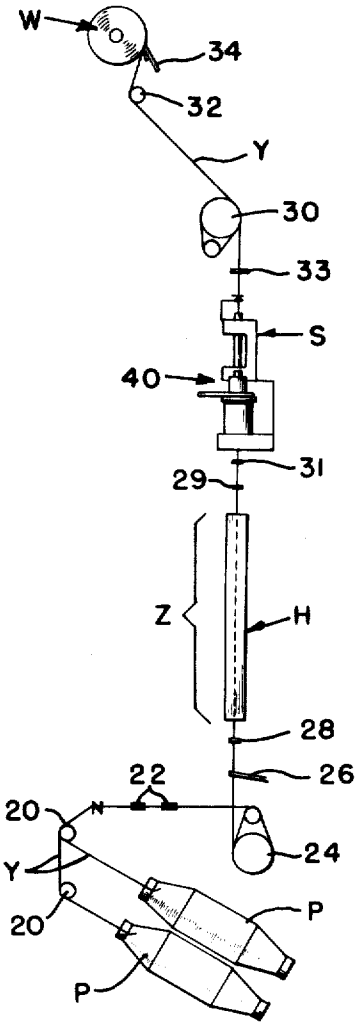


FIG. 2

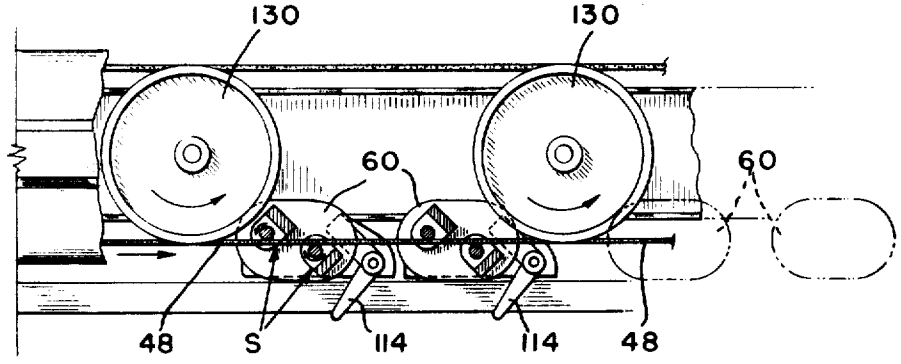


FIG. 3

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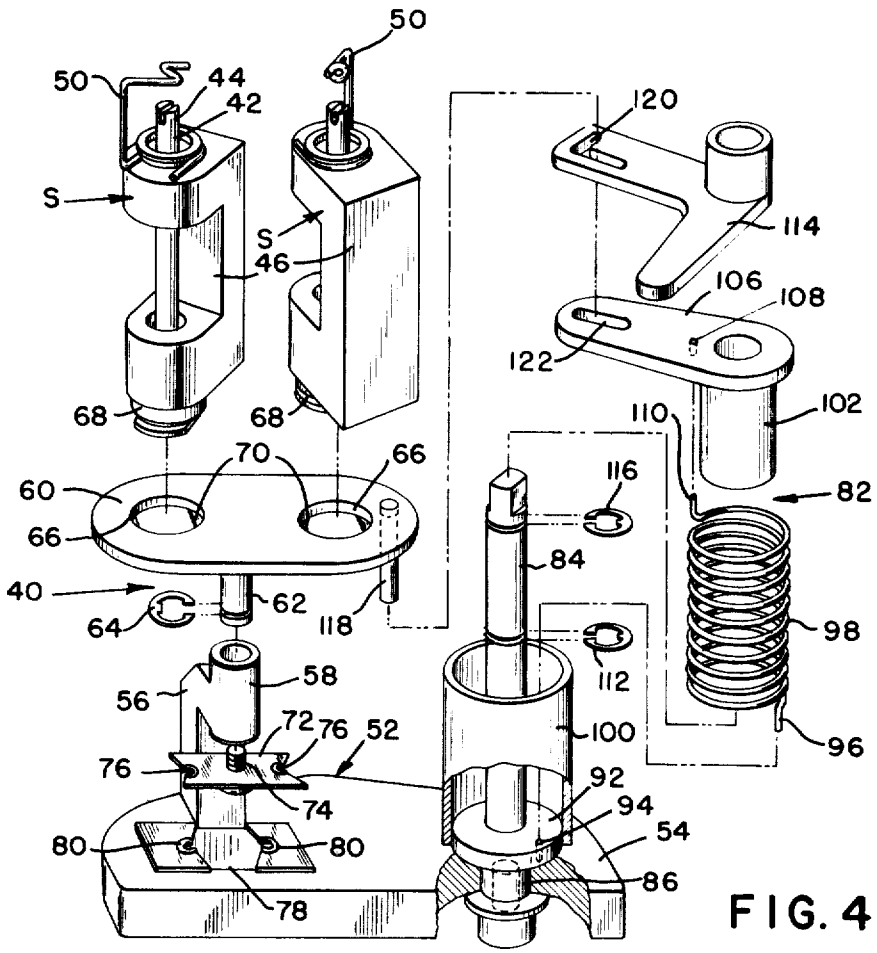


FIG. 4

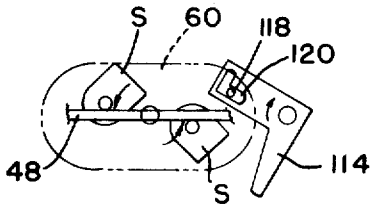


FIG. 5

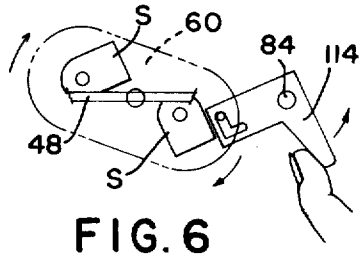


FIG. 6

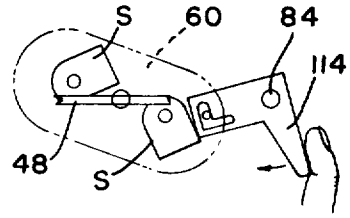


FIG. 7

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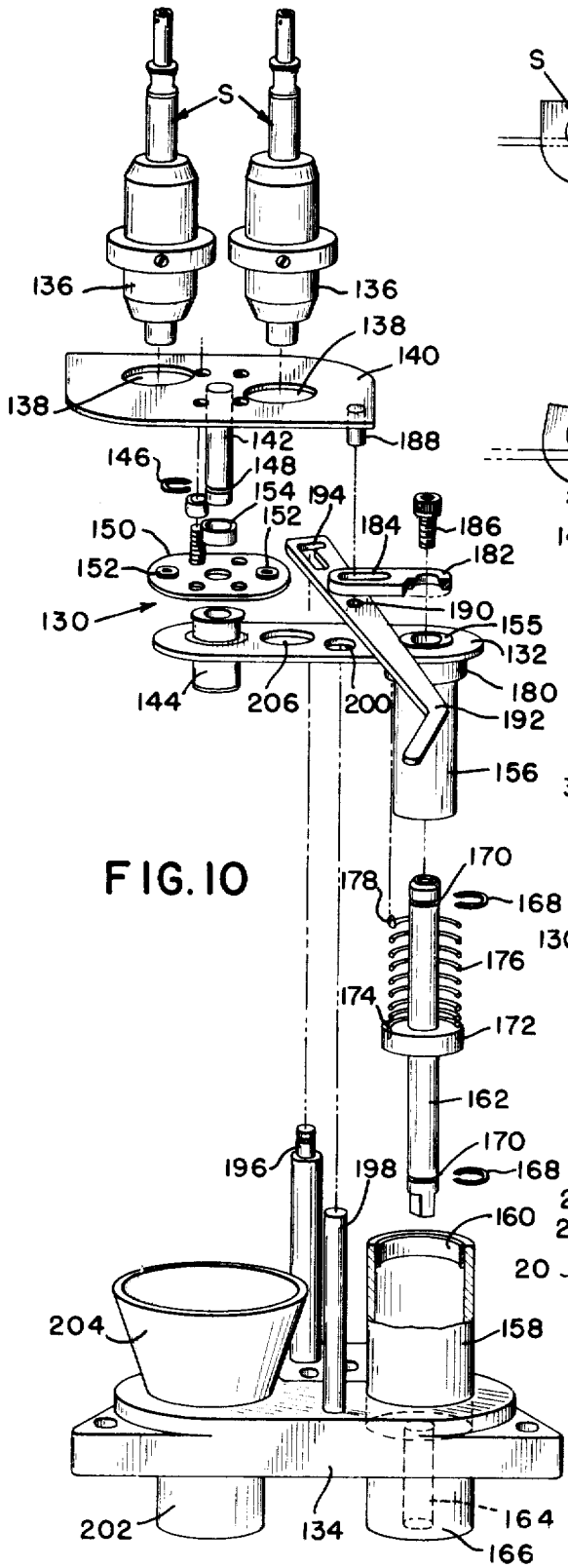


FIG. 10

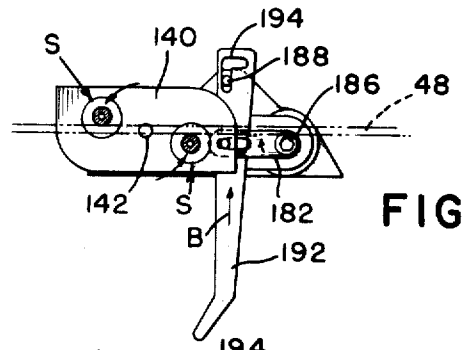


FIG. 11

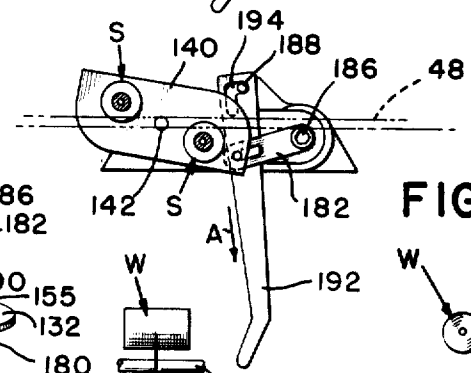
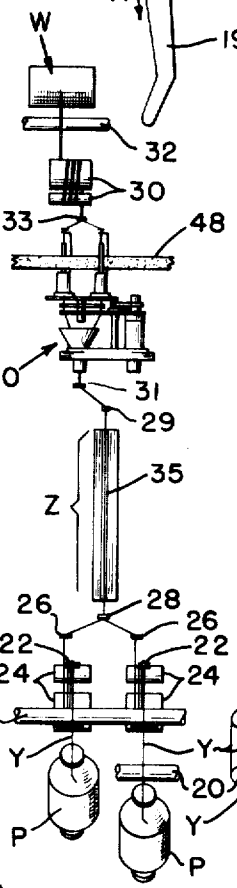


FIG. 12



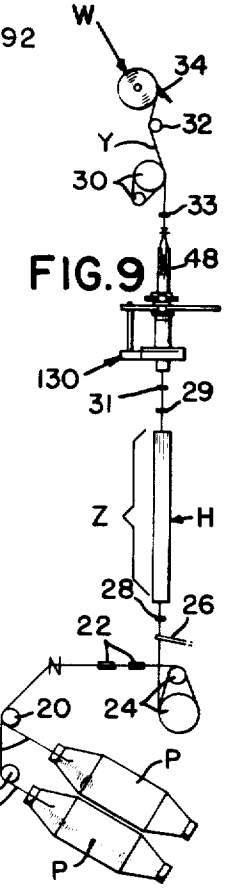


FIG. 9

FIG. 8

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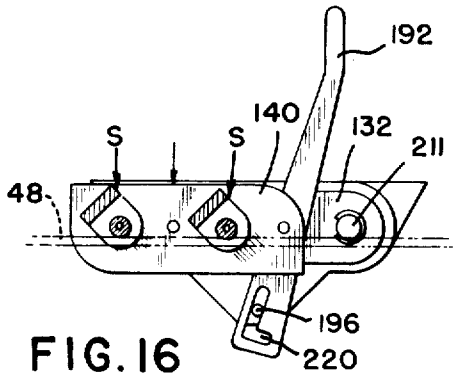


FIG. 16

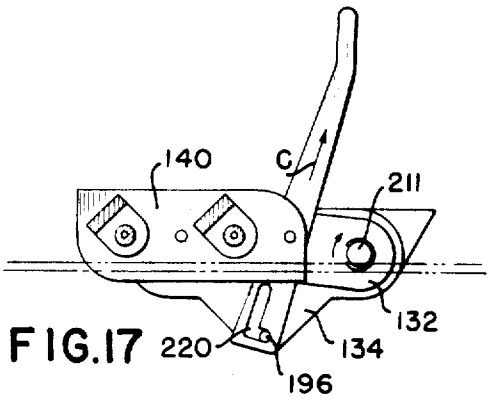


FIG. 17

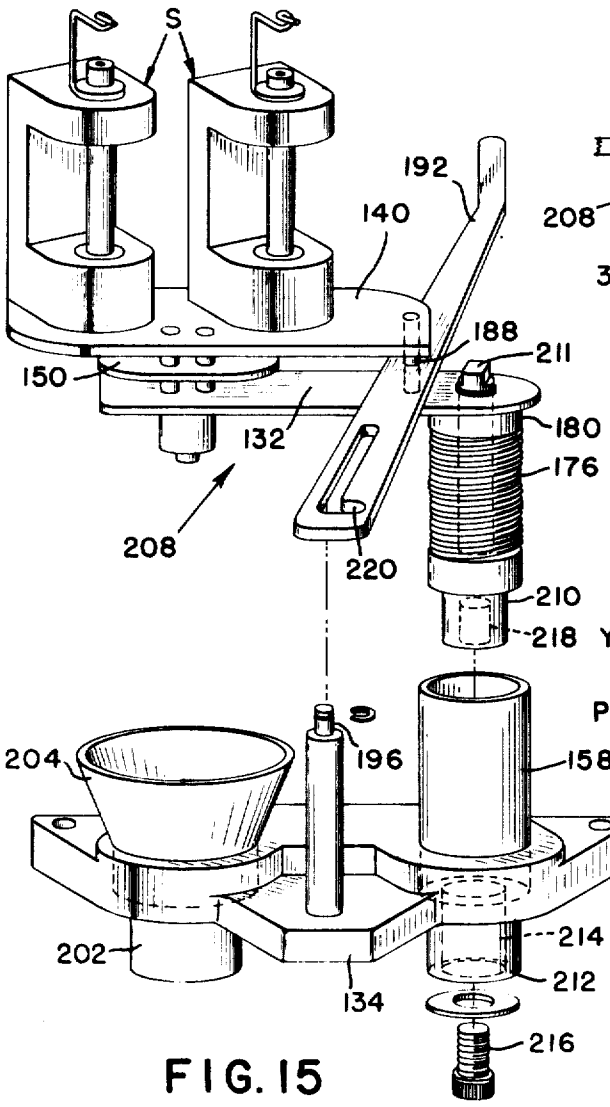


FIG. 15

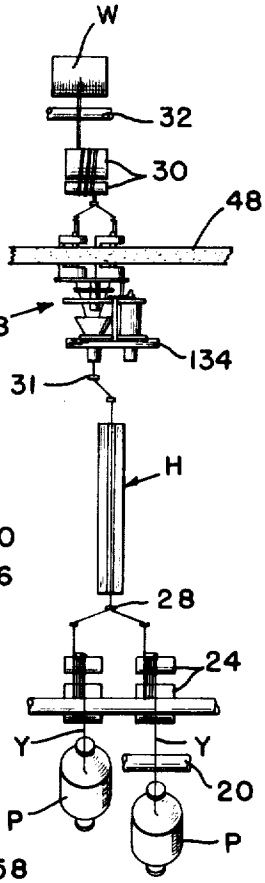


FIG. 13

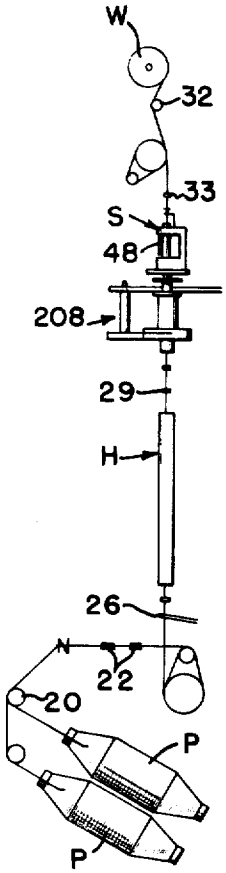


FIG. 14

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METHOD AND APPARATUS FOR TREATING THERMOPLASTIC YARNS

BACKGROUND, BRIEF SUMMARY, AND OBJECTS OF THE INVENTION

The present invention relates to the treatment of thermoplastic yarns and methods and apparatus for such treatment.

More particularly, the present invention relates to the treatment of thermoplastic yarns in such a way that the yarns have permanent kinks or curls so as to greatly increase the elastic stretchability of the yarns.

In recent years much attention has been given to the crimped yarns treated to assume a coil-like configuration so that they have inherent elasticity and bulkiness that distinguishes them from untreated yarns. Such yarns have been found to be highly desirable and have encountered unusual consumer acceptance.

At the present time there are certain known processes and apparatus for producing yarns of this type. One of the techniques being practiced on a large scale is that of twisting the yarn, setting the yarn by heat, and untwisting the yarn in a continuous operation. The continuous twisting and untwisting is accomplished by passing the yarn through a rotating spindle or body to impart twist in one direction on one side of the spindle and in the opposite direction on the other side of the spindle to impart a false twist to the yarn. Upon emerging from the false twist spindle, after being heat set, the yarn has an inherent twist in either the S or Z direction depending upon the direction of spindle rotation. In many instances S and Z yarns are subsequently twisted or applied together to give a balanced stable yarn without loss of stretch or bulk properties.

The machines for producing such yarns are usually quite large and require a considerable amount of space. In addition, where the yarn produced is composed of oppositely twisted S and Z yarns, separately heated and twisted, a number of operations and separate machines are normally required.

One of the primary objects of the present invention is to provide a process and apparatus for imparting crimp characteristics to yarn with a minimum amount of apparatus and number of steps required for this purpose.

Another object of the invention is to greatly increase the production capacity of stretch yarn machines by uniformly and evenly heating a plurality of yarns simultaneously in a prescribed path, and by substantially increasing the number of twist spindles for a given size machine thus providing a highly efficient and compact apparatus.

A further object of the invention is to provide a process and apparatus for efficiently heat setting yarns having the same or opposite twists applied thereto during treatment and combining together or collecting a pair of twisted yarns on a package.

Another object of the invention is the provision of a spindle unit for individually urging opposed spindles against opposite sides of a drive belt with equal forces by permitting the spindles to float or swing as a unit about a common pivot point.

With the above objects in view, the present invention is drawn to a method and apparatus for positively withdrawing a plurality of pairs of yarns from supply packages and applying a twist thereto. The yarns of each pair converge into a common prescribed path as they travel through a heating zone where a false twist is applied separately to each yarn. The yarns of each pair are twisted simultaneously in the same or in opposite directions, while they are in a plastic condition, by a pair of false twist spindles which are driven by a belt in frictional contact with the spindles. Each pair of spindles is mounted on a common support and biased into driving engagement with the belt. A locking mechanism is associated with each pair of spindles for releasably maintaining the spindles out of driving engagement with the belt. The yarns of each pair are positively drawn through the spindles and wound on separate packages, or wound on a common take-up spool in parallel relation.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a fragmentary front elevational view of structure according to the present invention for producing thermoplastic yarns;

FIG. 2 is a fragmentary side view of the structure of FIG. 1;

FIG. 3 is a fragmentary top plan view of a plurality of false twist spindles mounted on a machine frame, and the structure for supporting and driving each pair of spindles;

FIG. 4 is an exploded perspective view of a spindle assembly illustrating a pair of pivotably supported spindles and the mechanism for biasing the spindles into driving relation and maintaining the spindles out of driving engagement;

FIGS. 5–7 illustrate the manner in which the spindles are urged into driving relation with the drive belt, and locked in a non-driving relation with the belt;

FIG. 8 is a fragmentary front elevational view of a modified embodiment of the invention;

FIG. 9 is a side elevational view of the structure of claim 8;

FIG. 10 is an exploded perspective view of the spindle assembly of FIGS. 8 and 9;

FIG. 11 is a top plan view of the spindle assembly of FIG. 8 illustrating the spindle's positioned and frictional engagement with the driving belt;

FIG. 12 is a top plan view of the spindle assembly of FIG. 8 illustrating the leverage mechanism positioned to maintain the spindles out of engagement with the driving belt;

FIG. 13 is a fragmentary front elevational view of still another embodiment of the invention;

FIG. 14 is a fragmentary side elevational view of the structure of FIG. 11;

FIG. 15 is an exploded perspective view of the spindle assembly of FIGS. 11 and 12; and

FIGS. 16 and 17 are top plan views of the spindle assembly of FIG. 13 with the spindles in engaged and disengaged positions relative to the driving belt.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawing, FIGS. 1 and 2 illustrate a portion of a twister machine which includes conventional apparatus such as a frame, motor, drive mechanism, yarn guides and yarn take-up and supply packages. The machine usually includes a plurality of substantially identical assemblies, similar to the assembly of FIGS. 1 and 2, mounted side by side on an elongated frame, each assembly including a plurality of

false twist spindles adapted to be driven by a belt, and means for mounting the spindles to selectively contact the belt.

The structure of this invention includes a conventional creel, not shown, for supporting packages P of thermoplastic yarns Y to be treated. The yarns Y are drawn through a conventional heater unit H in a prescribed path and through conventional spindles S where a false twist is applied to each yarn Y separately. The yarns Y, Y are positively drawn from the spindles and wound in parallel fashion on a winding assembly W. Alternately, each yarn could be wound upon separate winding assemblies.

Referring to FIGS. 1 and 2, the yarns Y, Y withdrawn from packages P, P pass over stationary guides 20, through tensioning means 22, around lower feed rolls 24, through guide eyes 26, 28 and into the twist-heat zone Z. A suitable tensioning means 22 of conventional construction is provided for each of the yarns Y, Y and serves to prevent backing up of the twist in the yarns applied by the spindles and to hold a constant twist between the spindles S, S and the tensioning means 22. Upon emerging from the twist-heat zone Z and through the spindles S, S, the yarns Y, Y converge at guide 33 to relatively closely spaced parallel paths where they extend around rolls 30 for several convolutions and are fed over a guide 32 to a conventional winding assembly W having a means 34 for traversing the yarns in a suitable manner. The rolls 24 and 30, below and above the spindles S, S and heater unit H are positively driven to insure an even tension to the twist-heat zone Z and provide optimum take-up package formation. Tension on the yarns during the passage over the heater unit H and through the false twist spindles S, S is controlled primarily by rolls 24. These rolls supply the yarns to the heater at the desired level of overfeed or underfeed relative to the rate at which the yarns are withdrawn by the rolls 30.

The heater H is of a conventional type wherein at least two yarns Y, Y converge into a common path and come into direct contact with a heater surface in the forms of a groove 35. The yarns are heated, both, by conduction and by radiation from the walls of the groove 35. Alternatively, other conventional types of heaters could be used as long as a plurality of yarns converge and travel through the heat-twist zone Z in a substantially common path.

The several yarns Y, Y pass through the heater unit H in a common path and diverge to spaced parallel paths before passing through a plurality of false twist spindles S, S. The spindles are arranged in pairs so as to form a spindle assembly 40, as shown by FIG. 4.

The conventional spindles S, shown by FIG. 4, may be of the Leesona high-speed type disclosed in U.S. Pat. No. 3,044,247 consisting of a small twist tube 42 having a small twist pin 44 at the upper end thereof. The twist tube is supported by two sets of tungsten carbide bearings mounted in frame 46, having a pigtail guide 50 at the upper end, and is driven directly by a belt 48. In this manner the driven tube 42 positively rotates the yarn inserting one turn of S or Z twist into the yarn for every revolution of the tube.

A support unit 52 is provided to support each pair of substantially parallel spindle tubes 42 for rotation about their axes and for pivotable movement about an axis parallel to and intermediate said tube axes. The support unit includes a mounting block 54, adapted to be secured to the machine frame by suitable means, and an upstanding post means 56 having a hollow bearing portion 58 on the upper end thereof. A plate 60 having a depending stud 62 is rotatably received within and secured to bearing portion 58 by a C-clip 64. Spaced openings 66 are provided for receiving the bottom cap portion 68 of each spindle S and conventional fasteners, a portion of which can be seen at 70, in FIG. 4, secure each spindle in position upon plate 60.

A guide plate 72, having guide eyes 76 provided at each end thereof, is pivotably mounted on the lower end of bearing portion 58 by fastener 74. An opening 78 has been provided in base 54 such that a pair of spaced yarns extending from the heater unit H pass through fixed guide means 80, 80 and pivotably mounted spaced guides 76 and into the spaced spindle twist tubes 42, 42.

Mounted to one side of post 56 upon mounting block 54 is a toggle arrangement 82. The toggle arrangement comprises a fixed shaft 84 having an enlarged portion 86 at the lower end thereof which extends through an opening provided in the mounting block. Fastener 88 having a washer 90 thereon is threadably received within the enlarged portion 86 for fixedly positioning the shaft 84. A circular plate 92 fixed to shaft 84 has an opening 94 provided therein for receiving a downwardly turned end portion 96 of a coil spring 98. The spring 98 surrounds shaft 84 and is enclosed by a fixed sleeve 100. A cylindrical hub member 102 of a diameter to be loosely received within coil spring 98 has an elongated opening 104 therein for snuggly receiving shaft 84. Secured to the upper end of cylindrical hub member 102 and extending normal thereto is a lever arm 106 provided with opening 108 for receiving the upper end 110 of coil spring 98. A C-clip 112 maintains the member 102 in position on shaft 84. Rotatably mounted on the upper end of shaft 84 is an angularly disposed manipulating arm 114 secured in position by C-clip 116. An elongated pin 118 depending below rotatable plate 60 extends through L-shaped slot 120 in arm 114 and elongated slot 122 provided in lever arm 106 for pivoting plate 60 upon actuation of the arm 114.

The drive belt 48 for driving tubes 42, 42 extends between a pair of spindles S, S as illustrated by FIG. 3, and the spring 98 is tensioned to urge the spindles against the opposite faces of the drive belt which will thus simultaneously rotate the pair of spindles of assembly 40 in opposite directions providing an S twist in one yarn and a Z twist in the other yarn. Thus it can be seen that by manipulating the arm 114 in the manner illustrated by FIGS. 5–7, plate 60 can be pivoted to move the spindle tubes into or out of driving relation with the belt 48, and that in view of the toggle arrangement or cooperation between the pin 118 and slotted levers 106, 114, the spindles are biased into or out of driving relation. A large number of spindle assemblies 40 are arranged on a stretch yarn machine, one assembly 40 for each heating unit H. The belt 48, which engages and drives all of the spindles is driven by any suitable pulley and motor means. Thus it can be seen that the production capacity of a given machine can be approximately doubled by providing a spindle assembly 40, compris-

ing two spindle tubes **42, 42** for each of the normally fixed spindle assemblies conventionally mounted on approximately six inch centers. Further, the necessity of additional heating unit due to the increase of the number of yarns being processed is eliminated since two yarns, rather than one, are conveyed through the heat-twist zone Z in a common prescribed path.

Referring to FIGS. **8–12** of the drawing, numeral **130** designates a modified spindle assembly wherein spindles S, S are mounted upon a plate **132** which is pivotably secured adjacent one end portion upon mounting block **134**. The pivotable displacement of plate **132** permits the spindles S, S to float or center with respect to the driving belt **48**.

The spindle housings **136** extend through openings **138** and are secured to plate **140** by suitable fasteners, similar to fasteners **70** as shown in the embodiment of FIGS. **1–7**. The plate **140** is secured to a vertically depending post **142** which is mounted within a bearing or sleeve **144** for pivotable movement. A C-clip **146** receivable within a groove **148** retains the post **142** within the bearing **144**. The guide plate **150** having yarn guides **152** therein is positioned below plate **140** by spacer **154** and is secured to the plate **140** for movement therewith by suitable means, not shown.

Bearing **144** is fixedly secured to plate **132** for pivotable or swinging movement about the axis of depending hub member **156** which is secured to plate **132**. Hub member **156** is received within housing **158** and supported within a nylon bushing **160**. A shaft-like member **162** passes within housing **158** through bearing **155** and tubular member **156** and exits through an opening **164** formed within a boss **166** which is integral with the mounting block **134**. The shaft-like member **162** is retained within housing **158** by C-clips **168** positioned within grooves **170**, one C-clip being positioned below boss **166** and another C-clip being positioned above plate **132**. A disk-like member **172**, fixed to shaft **162** and supported within housing **158**, receives one end **174** of a pretensioned coil spring **176**. The opposite end **178** of the coil spring is fixed to the depending bearing portion **180** secured to plate **132**.

A lever arm **182** provided with an elongated slot **184** at the outer end thereof is secured to screw **186** to the upper end of shaft-like member **162**. The slot **184** receives a pin **188** depending from spindle support plate **140**. Note that the end of pin **188** is received within an opening **190** located intermediate the ends of manipulating lever **192**. Thus it can be seen that upon movement of lever **192** in the direction of the arrow A, FIG. **12**, the lever arm **182** and spindle plate **140** are displaced substantially to the position shown in FIG. **12**, against the biasing force of spring **176** to disengage spindles S, S from the driving belt **48**. The lever arm **192** can be releasably retained in the FIG. **12** position by means of L-shaped slot **194** which cooperates with post **196** secured to the mounting block **134**.

Since spring **176** biases plate **132** and lever arm **182** relative to each other, it can be seen that the biasing force applied to arm **182** can be varied by loosening screw **186** and adjusting the pivotable position of arm **182** relative to shaft **162**. In view of the fact that plate **132** and sleeve **156** are freely pivotable within housing **158**, with the elements in the position of FIG. **11**, the spindles S, S are permitted to center or adjust on opposite sides of belt **48** such that the belt applies substantially equal driving forces to each spindle. A post **198** passes through an enlarged opening **200** in plate **132** to limit the pivotable displacement of the plate.

The yarns Y, Y are directed from guide **31** through a smooth cone-shaped opening, not shown, in box **202** and mounting block **134**. A cone-shaped guard **204** having a lower inner diameter contiguous with the cone-shaped opening in boss **202** and mounting block **134** serves to direct the yarns to the guides **152, 152** and to limit the ballooning effect of the yarns. An enlarged opening **206** in plate **132** accommodates one yarn Y as it travels through guard **204** to guide **152**.

The spindles S, S shown in the FIGS. **8–12** may be of a conventional type including a small twist tube having a twist pin at the upper end similar to the tubes **42** and pins **44** of the embodiments of FIGS. **1–7**.

In the operation of the spindle assembly **130** of FIGS. **8–12**, the lever arm **192** is displaced in the direction of arrow A as viewed in FIG. **12** to pivot spindle S, S clockwise about post **142** and out of engagement with driving belt **48**. Pin **188** and slot **194** maintain the spindle in disengaged position. Upon properly threading yarns Y, Y through the assembly, lever **192** is rotated clockwise through a small angle allowing the slotted lever to slide over pin **188** and permitting the spring **176** to force the lever **182** in a clockwise direction. Since plate **140**, lever **192** and lever **182** are attached together by pin **188**, the lever **192** is urged in the direction of arrows B, FIG. **11**, while the plate **140** is spring biased in a counterclockwise direction about pivot post **142**, as shown by FIG. **11**. The plates **132** and **140** then are permitted to swing about the axis or shaft-like member **162** to align the belt **48** and spindle twist tubes located on opposite sides thereof such that equal driving forces are applied by the belt to each spindle.

In the embodiments illustrated by FIGS. **1–7** and FIGS. **8–12**, the spindles S, S fixed to each spindle assembly are positioned on opposite sides of a driving belt resulting in alternate yarns having S and Z twist applied thereto.

FIGS. **13–17** illustrate a modified spindle assembly **208** wherein both spindles S, S are located on the same side of the driving belt **48** for imparting S or Z twist to all yarns depending upon the direction of spindle rotation.

The mounting block **134**, yarn guard **204**, guides **152**, spring **176**, spindle support plate **140** and plate **132** are substantially equal to the corresponding elements of the embodiment of FIGS. **8–12**. The opposite ends of spring **176** are secured to the hub portion **180** of lever **132** and the bushing **210** which is non-rotatably secured within the boss **212**. The bushing **210**, secured to shaft **212**, is received within recess **214** of boss **212** and receives a fastener **216** in threaded aperture **218** for preventing rotation of the shaft. The biased force applied to plate **132** by spring **176** can be adjusted by loosening fastener **216**, rotating the shaft **211** to vary the spring tension, and retightening the fastener **216**.

The spring normally urges the plate **132** and consequently **140** and spindles S, S about the axis of shaft **211**, counterclockwise as viewed in FIG. **16**, such that the spindle twist tubes engage the driving belt **48**. Slotted lever **192** which is pivotably secured to plate

140 through pin 188 provides a means to disengage the spindles from the belt 48. The lever is pulled in the direction of arrow C, FIG. 17, and pivoted through a small arc to position the L-shaped slot 220 and pin 196 as shown.

I claim:

1. In a method for imparting crimp characteristics to continuous traveling thermoplastic yarns wherein the yarns are drawn through a heating apparatus and false twisted by spindles driven by a common drive belt, the steps of feeding a plurality of yarns from supply sources, converging the yarns into a common prescribed yarn path while maintaining the yarns in substantially parallel relation, heating the yarns in said common prescribed yarn path, diverging the yarns into spaced, parallel paths, separately twisting each of said yarns whereby the twist extends at least into said common prescribed yarn path, positively drawing the yarns through the spindles and the common prescribed yarn path, and collecting said yarns, said yarns being twisted by directing each yarn through a twist spindle while biasing the spindles about a vertical plane transversely of the driving belt into frictional engagement therewith, and frictionally driving the spindles.

2. The method of claim 1, wherein the yarns are separately twisted in opposite directions by biasing adjacent yarn spindles in opposite directions about a vertical plane extending between adjacent yarns.

3. Apparatus for imparting crimp to a plurality of thermoplastic yarns comprising at least two yarn supply means, a yarn heater unit having a common yarn guide path, means for continuously simultaneously drawing at least two parallel yarns over said heater unit in said common yarn path, a support frame, at least two yarn spindles mounted adjacent each other for imparting a twist to the yarns emerging from said heater unit, a common drive member for said spindles, a displaceable mounting unit for supporting said spindles for simultaneous displacement into and out of engagement with said common drive member, means pivotally supporting said spindle mounting unit upon said support frame, means for biasing said mounting unit relative to said frame for simultaneously urging said spindles into driving engagement with said common drive member, means for displacing and releasably locking said mounting unit and said spindles out of engagement with said spindle drive member, and means for collecting said yarns.

4. The apparatus of claim 3, said displaceable spindle mounting unit including a first member pivotally mounted upon said frame and a spindle retaining member pivotally mounted upon said first pivoted member for permitting said spindles to float and center with respect to said common drive member.

5. The apparatus of claim 3, said displacing means including a toggle mechanism for maintaining said spindles out of driving relation.

6. The apparatus of claim 3, including yarn guide means secured to said common mounting unit and positioned below said spindles.

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