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STRAND ADVANCING APPARATUS AND METHOD

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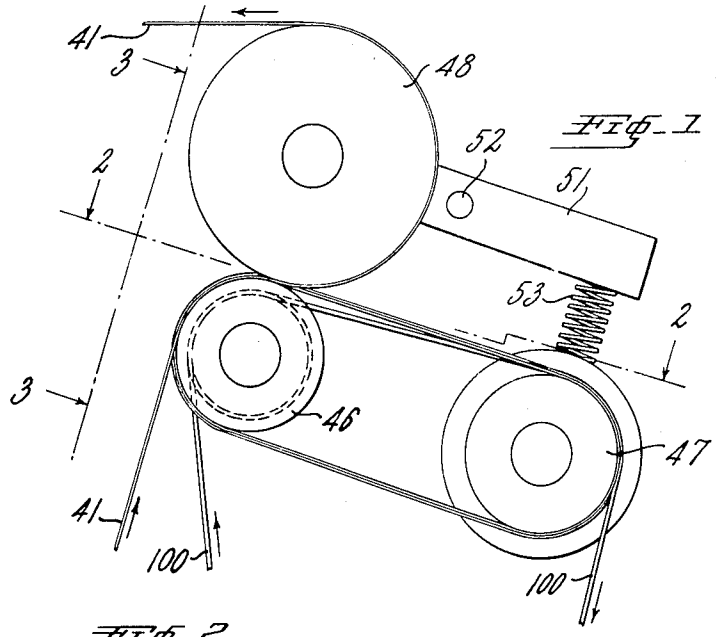
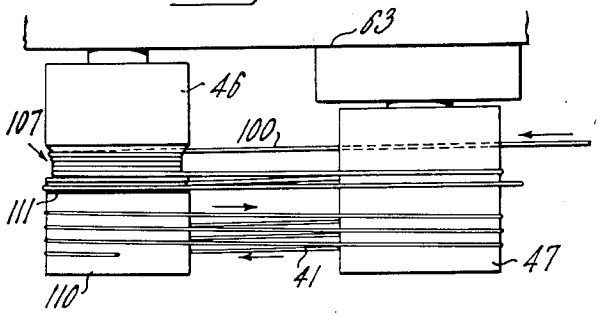


FIG. 1

FIG. 2



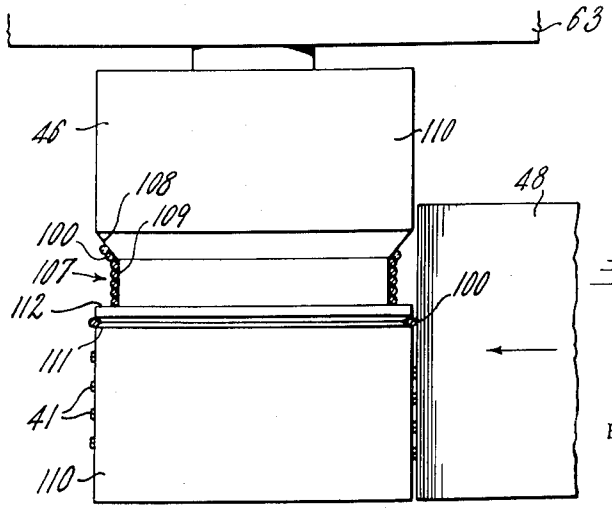


FIG. 3

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STRAND ADVANCING APPARATUS AND METHOD

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This invention relates to a method and apparatus for advancing a strand.

In my United States Patent 2,503,242 I disclose a machine for producing highly uniform, heavy two-ply yarn employed as tire cord, and in my United States Patent 2,729,051 I disclose a machine for winding the cord so produced into a precision wound package; these patents are incorporated herein in their entireties by this reference.

In my copending application entitled "Method and Apparatus for Making Ply Yarn" filed concurrently herewith, now Patent 2,986,865, I disclose and claim a novel method and apparatus for supplying a yarn plying machine entirely from a multiple end beam; said application is incorporated herein by this reference in its entirety.

In Patent 2,503,242 one yarn is held by metering rolls and advanced in a rotating balloon about a second yarn and to a plying point at a predetermined rate of speed while the yarn within the rotating balloon is also held by metering rolls and advanced to the plying point at substantially the same linear rate of speed as the first yarn. The two yarns are plied into a two-ply yarn, or cord, and this ply yarn is advanced at a predetermined rate of speed from the plying point to a package building means.

In that apparatus, separate means are provided for advancing the external yarn, the internal yarn, and the ply yarn produced. There are various types of conventional delivery rolls which can be used to advance these yarns, such as M rolls, two-grooved parallel rolls, 2 smooth rolls at an axis angle, and advancing reels, etc.

This invention relates to a novel strand advancing mechanism which does the work of such more complicated devices but which has fewer parts, and it relates to a method of using this mechanism.

One embodiment of the apparatus of this invention comprises a rotating cylindrical roll having a groove cut in its surface to a depth greater than the thickness of the strand to be advanced. The strand to be advanced is wrapped several times about this roll in this groove so the advancing strand passes first into this groove and then several times thereabout. After the strand leaves the groove it is pinched adjacent a second rotating surface to be held in frictional driving contact with this second surface. The rotation of the second surface is in a direction to tension the strand and to tend to advance the strand from the grooved roll.

As the second surface rotates, that portion of the strand wrapped in the groove of the roll is tensioned and pulled into frictional driving contact with the surface of the groove, so it is advanced by rotation of the roll.

For a better understanding of the nature of this invention, reference should be had to the following detailed description of a specific embodiment thereof when read in conjunction with the accompanying drawing, wherein:

FIG. 1 is a schematic front elevation of advancing rolls used in this invention;

FIG. 2 is a view along the line 2—2 of FIG. 1, and

FIG. 3 is a view along the line 3—3 of FIG. 1 with parts of the strand broken away.

The embodiment of the invention shown in the drawing is one designed for use in advancing yarns on a yarn plying machine of the type disclosed in said Patents 2,503,242 and 2,729,051, and in my copending application entitled "Method and Apparatus for Making Ply Yarn," now Patent No. 2,986,865, referred to hereinabove. The apparatus disclosed herein is admirably suited to pull the two-ply yarn of said patents and application from the yarn plying spindle, and to advance it toward the final windup package.

Referring now to the drawing, the apparatus in accordance with this invention comprises a rotatably driven cylindrical roll 46. As will be seen in FIGS. 1 and 3, roll 46 has a generally cylindrical surface, but it has two grooves cut in this surface. A first, relatively deep and broad groove 107 is of a depth such that a strand 100, such as the two-ply yarn of said application, to be advanced by the apparatus may lie within the groove and not have any portion thereof projecting above the cylindrical surface of the roll 46. This groove 107, which may be termed a delivery groove has generally a cylindrical base 109 which is wide enough to take several wraps of yarn 100 thereon in side by side relation. At one side of the base 109 groove 107 ends in a frusto-conical shoulder 108 which extends between the base 109 and the cylindrical outer surface 110 of roll 46 and forms a 45° angle with both the base 109 and cylindrical surface 110. At the other side of base 109 groove 107 ends in a shoulder 112 which projects at right angles to base 109 and extends between this base and surface 110.

At one side of groove 107 and spaced a little distance therefrom, there is cut in the cylindrical surface 110 a second but narrower and shallower groove 111. As best shown in FIG. 3, the width and depth of this groove are such that when the strand 100 to be advanced lies in the groove 111 a portion of the strand 100 projects outwardly of the surface 110 of roll 46.

To complete the apparatus, there is provided an idler roll 47 spaced from roll 46 and freely rotatable about an axis generally parallel to the axis of roll 46 and a rubber covered presser roll 48 which rotates against roll 46. Roll 48 is carried at the end of arm 51 which is pivoted on shaft 52, and roll 48 is urged by spring 53 into engagement with driven metering roll 46, so that the strand 100 to be advanced may be nipped in the shallow groove 111 of the driven metering roll 46 and the presser roll 48.

All of the apparatus thus far described may be supported on a frame 63, such as the frame of a yarn plying machine if it is to be used in conjunction with such a machine, and the metering roll 46 may be driven in the manner disclosed in the above mentioned patents and application.

A strand 100 which is to be advanced while under tension, as for example is the case when the strand 100 is a ply yarn produced in accordance with the aforementioned patents, is led to the driven roll 46 in the direction indicated by the arrows in FIGS. 1 and 2. This strand 100 is wrapped several times about the roll 46 in the groove 107 so that the strand 100 leaves the groove 107 adjacent the right angular shoulder 112 and enters on the frusto-conical shoulder 108. From the groove 107, the strand 100 passes to the idler roll 47 and in a partial wrap thereabout to be directed back to the driven roll 46 to be wrapped partially about roll 46 in the groove 111. Yarn 100 is pinched in this groove between the presser roll 48 and surfaces of roll 46 which form the groove 111.

As the roll 46 rotates, strand 100 which is gripped between walls of groove 111 of roll 46 and the rubber surface of rubber covered presser roll 48 is pulled by rotation of roll 46. This pulling of strand 100 tensions in turn the several wraps of the strand 100 on the base 109 of groove 107 so that the wraps in groove 107 are pulled into tighter frictional engagement with the surfaces of groove 107. Accordingly due to the frictional contact of

the strand **100** with the rotating surfaces of roll **46**, the strand **100** is advanced by the rotation of roll **46**.

The apparatus shown in the drawing is especially advantageous when used in a yarn plying machine of the type disclosed in the aforesaid patents and application because this machine requires that a single yarn be fed to a plying point at a predetermined rate of speed, and that the plied yarn be withdrawn from the plying point at a predetermined but lesser rate of speed.

A portion of the cylindrical surface **110**, in conjunction with the presser roll **48** and idler roll **47**, can be used to advance the single end yarn **41** to the plying point of such machines by wrapping the yarn **41** back and forth several times around rolls **47** and **46** and under roll **48** as shown in FIGS. 2 and 3. When roll **46** is so used to advance yarn **41** the groove **107** can be used to advance the plied yarn at a lesser rate of speed than yarn **41** is advanced. It has been found that when two 1650 denier rayon yarns are plied 10.6 turns per inch at a spindle speed of about 7,000 r.p.m., a good practical roll has a diameter for the cylindrical surface **110** of 1.185 inches, a diameter for the cylindrical base **109** of 1.040 inches, and a width of groove **111** at the periphery of the roll of about .029 inch, and the sides of the groove **111** form a 30° angle with each other. When two single 850 denier nylon yarns are plied with 13 turns per inch at a spindle speed of about 7,000 r.p.m., a diameter of cylinder **110** of .958 inch, a diameter of groove **109** of .834 inch, and a width of a 30° groove **111** of about .020 inch is found to be very satisfactory.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

1. Apparatus for advancing a strand, comprising a driven first member having a cylindrical surface adapted to be rotated about the axis of the cylinder when said member is driven, said member having walls defining a first groove in said surface, said groove having a wall against which a strand may rest, said last mentioned wall being spaced radially inwardly from said cylindrical surface such that the groove has a depth radially of said cylindrical surface equal to or greater than the thickness of the strand to be advanced, said groove having a width axially of said cylindrical surface several times the width of the strand to be advanced, whereby the groove is adapted to receive the strand to be wrapped therein on said last mentioned wall a plurality of times radially inwardly of said surface, said member having walls defining a second groove in said surface adapted to receive the strand therein, at least one of the walls defining said second groove forming a surface against which a strand may rest, said last mentioned wall being disposed to maintain a portion of such strand projecting radially outwardly of said cylindrical surface, said last mentioned surface being adapted to rotate about the axis of said cylindrical surface at a linear rate of speed greater than the linear rate of speed of said wall against which a strand may rest in said first groove, a rotatable presser roll having a cylindrical surface the axis of which is substantially parallel to and adjacent said cylindricl surface of said first member, said presser roll being positioned and adapted to press said portion of a strand projecting from said second groove between the cylindrical surface of said presser roll and said surface of said second groove, whereby said strand is tensioned by driving engagement with said surface of said second groove and urged by the tension so induced into frictional driving engagement with the wall against which it rests in said first groove.

2. Apparatus in accordance with claim 1 including a rotatable roll spaced from said first member and adapted to receive the strand after it leaves said first groove and before it enters said second groove.

3. Apparatus in accordance with claim 1 wherein said cylindrical surface has a portion adapted to receive a second strand to be wrapped thereabout, and wherein said presser roll has a portion adapted to press the first-named strand against said first member at the second groove and to press the second strand at the portion of the cylindrical surface about which said second strand is wrapped, whereby the second strand is advanced at a different rate of speed than said first mentioned strand and in a predetermined relationship thereto and a rotatable roll spaced from said first member and having a surface adapted to receive said second strand in wraps extending about said first member and said roll.

4. The method of advancing a strand which comprises wrapping the strand about a member having a rotating surface in a plurality of wraps whereby the strand may be advanced by the frictional force between the strand and said rotating surface when the plurality of strand wraps on said surface are urged thereagainst by tension in said strand, after said strand leaves said plurality of wraps on said surface disposing said strand on a second surface rotating at a greater linear rate of speed than said first mentioned surface, pressing said strand against said second surface with such force that friction therebetween causes said second surface to tend to carry such strand with it as it rotates yet permits substantial slippage therebetween whereby the advancing strand is tensioned in the pluraliy of strand wraps on said first mentioned surface, and delivering the strand from said second surface at substantially the linear rate of speed of rotation of said first mentioned surface.

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