March 5, 1968 O. G. GARNER 3,371,878

PAYOFF STAND

Filed Nov. 16, 1964 2 Sheets-Sheet 1

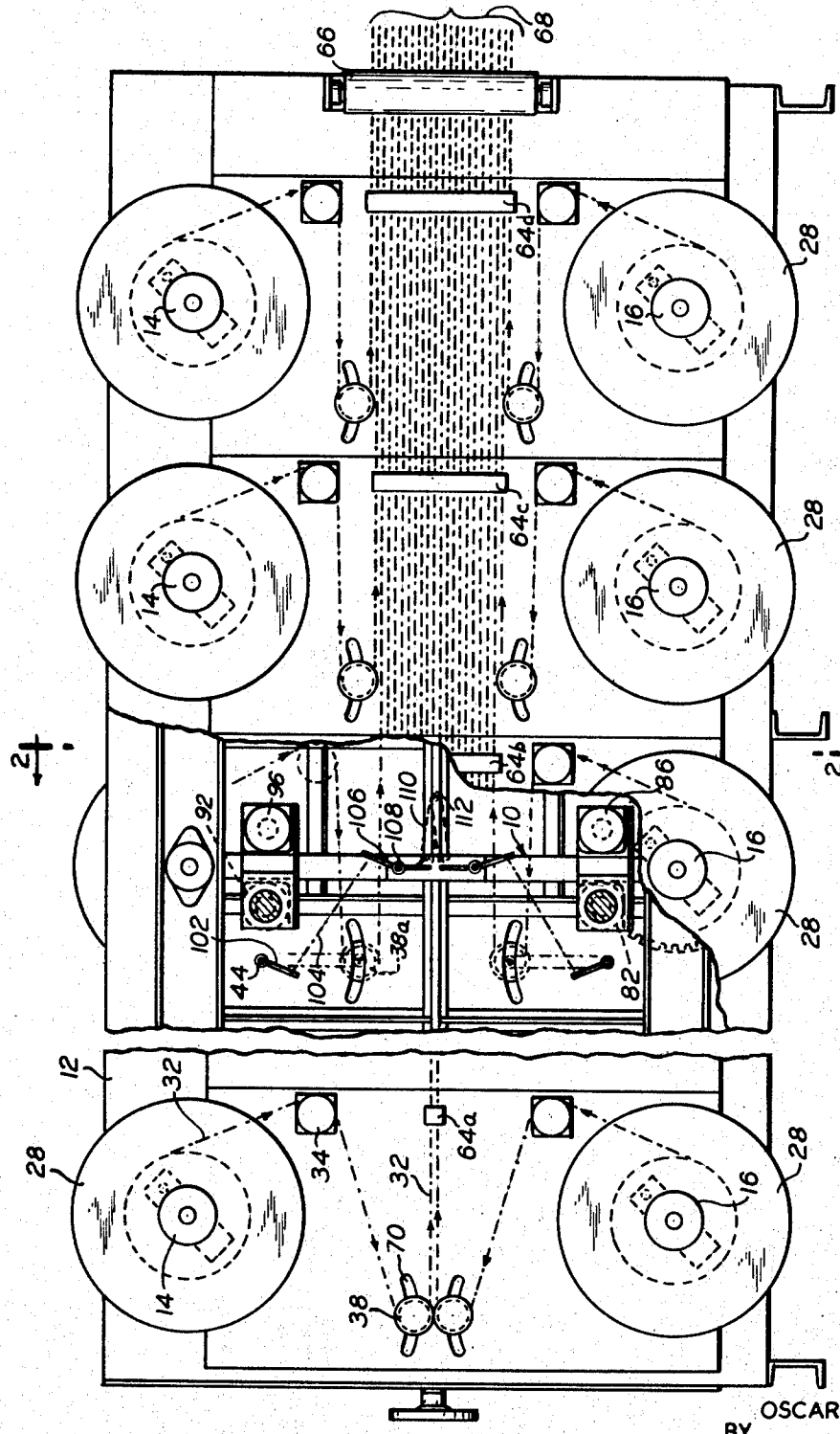

FIG. 1.

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FIG. 2.

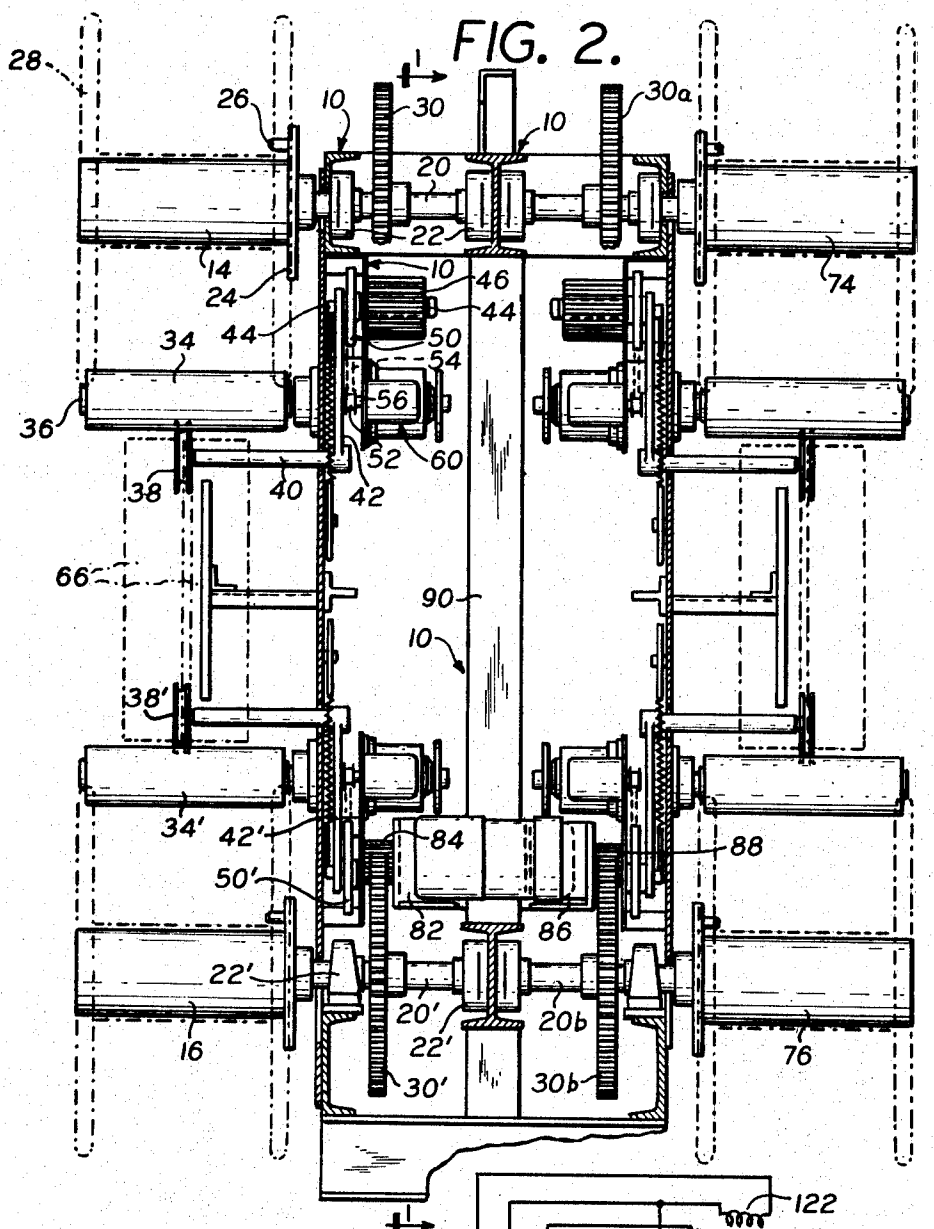
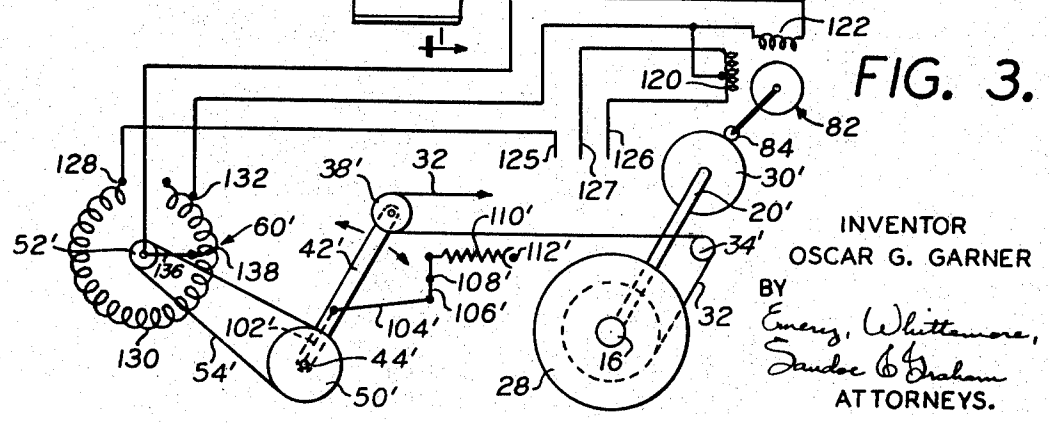


FIG. 3.



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PAYOFF STAND

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This invention relates to apparatus for supplying strands to a cabling machine, or other apparatus, and more especially for supplying wire strands for making stranded electrical conductors.

In the manufacture of telephone cables and similar communications lines it is very desirable that the various conductors whether they be single, paired, or grouped be kept at uniform tension when they are brought together to make the cable or next larger size grouping. Uniform tensions are necessary to give the cable the proper electrical characteristics. It is also true that the effect of good tension control during part of the manufacture is lost if at some other stage of manufacture there is poor, or no, tension control. This invention provides a system for tension control when feeding single, multiple, or grouped conductors during the manufacture of cables which gives essentially constant preselected tensions throughout the operation independent of varying wire speeds and changing drum diameters.

It is an object of the invention to provide improved apparatus, including a constant tension payoff system, for supplying strands to a cabling machine, or other apparatus.

Another feature of the invention is to withdraw strands from payoff spools that are at different levels, but with the strands drawn upwardly from the lower spools and downwardly from the upper spools in contrast with the conventional practice of taking the strands from the tops of all of the spools. In this latter case, the wires from the upper spools are so high from the floor that the operator cannot easily handle these wires during the string up or change over, or during any adjustment which becomes necessary during the operation of a particular payoff stand.

With this invention having the wire drawn downwardly from the upper spools the operator has easier access to all of the adjustments since they are in an area between approximately 26 and 54 inches from the floor, when using payoff spools of conventional diameters.

Another object of the invention is to supply the strands from the different spools with a normalizing or equalizing of the mechanical working imparted to the wires coming from the bottom row as compared to the wires coming from the top row of spools. By subjecting the strands from the different spools to the same amount of bending, and thus to identical mechanical working, the wires, either bare or insulated, are supplied with uniform temper of the conductors to the next operation to stranding, to the oscillating plates, or to cabling.

Another object is to provide an improved multispool payoff stand in which the spools, guides and tension control means are combined to obtain compact construction without having the spools of the upper row and their guides and tension control interfere with the corresponding structure of the lower row of the spools of the payoff stand.

Other objects, features and advantages of the construction will appear or be pointed out as the description proceeds.

In the drawing, forming a part hereof, in which like reference characters indicate corresponding parts in all the views;

FIGURE 1 is a fragmentary diagrammatic view of apparatus for supplying strands from a plurality of rows of spools in accordance with this invention, part of the apparatus being broken away and in section at the line 1—1 of FIGURE 2;

FIGURE 2 is an end view of the apparatus shown in FIGURE 1 with part of the structure broken away and in section at the line 2—2 of FIGURE 1; and

FIGURE 3 is a wiring diagram for the apparatus shown in the other figures.

The apparatus shown in the drawing includes a main frame **10** which includes a housing **12** extending for the full length of the apparatus. There are a plurality of spindles **14** along an upper row and a corresponding lower row of spindles **16**. The full size machine may include 30 spindles in each row depending upon the number of strands to be supplied; but the apparatus as shown in FIGURE 1 has a portion broken out in order to simplify the drawing and in order to show the construction on a larger scale without excessive duplication of parts.

Each of the spindles **14** is supported by an axle **20** (FIGURE 2); and this axle **20** is supported by axially spaced bearings **22**. The spindle **14** has a flange **24** at its inner end; and a stud **26** extends from the flange for engaging a socket in a spool **28** which is placed on the spindle **14**. The axle **20**, spindle **14**, flange **24** are rotated by a gear **30**, secured to the axle **20** and driven by a motor in a manner which will be described in connection with one of the other spindles.

Referring to both FIGURES 1 and 2, a strand **32** which unwinds from the spool **28** passes around a horizontal, payoff guide roller **34** that rotates freely on an axle **36**. The guide roller **34** is substantially the same width as the spool **28** so that the strand from the spool passes around the guide roll **34** regardless of the portion of the spool from which the strand may be supplied at any given instant.

Beyond the horizontal, payoff guide roller **34**, the strand **32** passes around a tension control roller **38** on an axle **40** carried by one end of an arm **42** which swings about a pivot shaft **44** mounted in a bearing **46**. There is a pulley wheel **50** secured to the shaft **44** so as to move angularly as a unit with the arm **42**; and this pulley wheel **50** is connected to another pulley wheel **52** by a belt **54**.

The pulley wheel **52** is on an axle **56** of an autotransformer **60** attached to the main frame **10** of the apparatus.

The purpose of the autotransformer **60** will be explained in connection with FIGURE 3.

For the present it is sufficient to understand, with reference to FIGURE 1, that the strand **32** from each of the spools **28** passes around the associated horizontal, payoff guide roller **34**, which rotates about a fixed axis, and then passes around the tension control roller **38** which changes the direction of travel of the stand **52** through substantially 180°. After passing around the tension control roller **38**, the strand **32** from each spool **28** passes within successive vertical guide means **64***a*, **64***b*, **64***c*, and **64***d* to other vertical guide means including rolls **66**. The group of strands from the different spools is embraced within the bracket **68** at the right hand end of the machine shown in FIGURE 1. It will be observed that the tension control rollers **38** of successive spools **28** are located progressively further from the center of the group of strands **68** as the different spools **28** are located closer to the discharge end of the pay-off stand. Thus each strand can be tangent to its tension control roller **38** while extending parallel to the other strands of the group **68**.

Where the axles of the tension control rollers **38** extend through the sides of the housing **12**, there is a slot **70** which permits movement of the axle and the tension

control roller 38 in a direction to accommodate more or less length of strand 32 in the loop of the strand that is formed by its passage around the tension control roller 38. The apparatus is constructed and arranged so that when the tension on the strand 32 increases, the tension control roller 38 moves towards the right in FIGURE 1 to offset the change in tension; and conversely when the tension on the strand 32 decreases, the tension roller 38 moves towards the left in FIGURE 1 so as to again subject the strand to the intended tension. The power operating means for moving the tension control rollers in accordance with changes in the tension strand will be explained in connection with FIGURE 3.

There are other spools 28 on the lower row of spindles 16. These spools 28 are identical with the spools on the upper spindles but they are turned around before being placed on the spindles so that they unwind in the opposite direction. Thus the strands from the upper spools 28 come downward to the horizontal guide rollers 34 and tension control rollers 38 whereas the strands from the lower spools 28 come upward to similar horizontal guide rollers 34′ and tension control rollers 38′. This locates all of the guide rollers and tension control rollers within a relatively narrow vertical zone so that all of them are a convenient distance from the lower end of the housing 12 which rests on the floor. All strands are within convenient reach of an operator when originally setting up the apparatus or when any strand requires attention.

There are other spindles on the opposite side of the main frame 10 from the spindles 14 and 16. These other spindles include a row of upper spindles 74 (FIGURE 2) and another row of lower spindles 76 which are opposite the spindles 14 and 16 respectively and which are on axles which are in axial alignment with the axles of the spindles 14 and 16. The parts associated with the upper spindle 74 shown in FIGURE 2 and which correspond with the same parts associated with the spindle 14 are indicated by the same reference characters with a letter "*a*" appended. Parts associated with the spindle 76 are indicated by corresponding reference characters as for the spindle 14 but with a letter "*b*" appended.

The spindle 16 is driven by a gear 30′ on an axle 20′; and power to drive the gear 30′ is supplied by a motor 82 connected to the main frame 10 and having a driving pinion 84 which meshes with the gear 30′. The corresponding spindle 76 on the other side of the machine is driven by the gear 30*b* secured to the axle 20*b* from a motor 86 which is secured to the main frame 10 and which drives the gear 30*b* by means of a pinion 88 on the armature shaft of the motor 86.

In order to make the apparatus more compact, the motors 82 and 86 are connected to the frame 10 in a staggered relation; that is, on opposite sides of a frame element 90 of the main frame 10. Thus the motors 82 and 86 are located at the same level but they mesh with the gears 30′ and 30*b* at different angular positions around the gears, as shown in the portion of FIGURE 1 which is broken away and in section. There are similar motors 92 and 96 for driving the gears 30 and 30*a* of the spindles 14 and 74, respectively.

Referring further to the broken away portion of FIGURE 1, there is a crank 102 secured to the pivot shaft 44 and there is a link 104 connecting the free end of the crank 102 with one arm of a lever 106 which swings about a fixed pivot 108 extending from the main frame of the apparatus. The other arm of the lever 106 is connected with a spring 110 which has its opposite end anchored at 112 to the frame of the apparatus. This spring 110 gives the shaft 44 a bias in a direction to maintain a longer loop of the strand around the tension control roller 34*a*.

FIGURE 3 shows a wiring diagram for one of the spindles 16. The axle and other parts associated with this spindle are indicated by the same reference characters as the corresponding parts for the spindle 14 shown in FIGURES 1 and 2, but with a prime appended. The motor 82, which drives the gear 30′ through the pinion 84 on the shaft of the motor 82′, is preferably a low inertia induction motor provided with a main winding 120 and a control winding 122.

A power line consisting of three conductors 125, 126, 127 has the conductor 125 connected to a tap 128 at one end of a single winding 130 of the autotransformer 60′. Another tap 132 near the opposite end of the coil 130 is connected with the center of the main winding 120 and also connected to a parallel circuit which joins the tap 132 with one end of the control winding 122. The other end of the control winding 122 is connected with the center connection of an arm 136 which carries a sliding contact 138 of the autotransformer 60′.

The sliding contact 138 moves along the length of the winding 130 as the arm 136 is rotated angularly and this controls the current flow in the control winding 122 of the motor 82. The opposite ends of the main winding 120 are connected with the conductors 126 and 127 of the power line.

The spring 110′ gives the tension control roller 38′ a bias toward the left in FIGURE 3. Any increase the tension of the strand 32 causes the tension control roller 38′ to rock the arm 42′ clockwise about the pivot axle 44′ and this rotates the arm 136 of the transformer 60′ to shift the slider or brush 138 in a direction to change the current flow in the control winding 122 so as to increase the speed at which the motor 82 rotates the spindle 16 and the spool 28. This increase in the rate of feed of the strand 32 decreases the tension in the strand.

Conversely, any decrease in the tension of the strand 32 permits the spring 110′ to move the tension control roller 38′ toward the left in FIGURE 3; and this movement of the tension control roller permits the spring 110′ to rock the arm 42′ counterclockwise about the axis of the pivot shaft 44′ so that the arm 136 is moved counterclockwise and the slider 138 moves in a direction to change the current in the control winding 122 so as to decrease the speed of the motor 82 and thus slow down the rate at which the strand 32 is unwound from the spool 28. This increases the tension of the strand 32. By constructing the motor 82 with low inertia, the control of the tension of this invention is extremely accurate and it can be made with any desired degree of accuracy by controlling the mechanical advantage between the tension indicating mechanism which includes the roller 38′, arm 42′ and the wheel 50′ with reference to the tension correcting mechanism which includes the autotransformer 60′ with its pulley 52′ driven from the pulley wheel 50′ through the belt 54′. By increasing the relative diameter of the pulley wheel 50′ with respect to the driven pulley wheel 52′, more movement of the slider 138 can be obtained for any given variation in tension of the strand 32 and thus the tension control can be made as accurate as desired.

The preferred embodiment of the invention has been illustrated and described, but changes and modifications can be made, and some features can be used in different combinations without departing from the invention as defined in the claims.

What is claimed is:

1. Wire strand supply apparatus including, in combination, a frame having a strand feed zone along which all strands from the apparatus are advanced substantially horizontally and substantially parallel to one another to a discharge end of the apparatus, the upper and lower limits of said feed zone being at a height from a floor for convenient handling of the strands during string up and change over by an operator standing on the floor, a plurality of rows of spindles supported by and extending substantially horizontally from the frame including one row at a level above said feed zone and another row at a level below said feed zone, the spindles extending outwardly toward the operator, spools on the respective spindles for holding the strands of wire, guide means over which strands from the respective spools on the spindles

pass to the strand feed zone, the guide means including a strand payoff guide for each spool and over which a strand passes as it comes from the spool, other guide means for the strand from each payoff guide including a tensioning roll around which the wire strand passes beyond the payoff guide to said strand feed zone, the tensioning roll being in such position that the wire strand moves substantially horizontally and generally parallel to the strands in said feed zone and to the strands at all of the other tensioning rolls as the strand approaches and leaves said tensioning roll, and means for mounting each tensioning roll for movement substantially parallel to the wire strands in said feed zone and in accordance with the tension of the strand for obtaining uniform tension in the strands in said strand supply apparatus.

2. The strand supply apparatus described in claim 1 characterized by the means for obtaining uniform tension including a sheave for each spindle and about which the strand from the spool on that spindle changes its direction of travel, an arm by which the sheave is carried, a fulcrum on which the arm swings to move the sheave selectively in directions to increase and to decrease the tension of the strand.

3. The strand supply apparatus described in claim 2 characterized by the sheave being in position substantially to reverse the direction of travel of the strand whereby the sheave causes a loop in the strand with the downstream side of the loop extending in substantially the direction of the other strands from the other spindles as the strands advance toward the delivery end of the strand supply apparatus, and the arm being movable in a direction to change the length of the strand in the loop without changing substantially its direction or the degree of wrap of the strand about the sheave.

4. The strand supply apparatus described in claim 3 characterized by different motor means for rotating spools on the respective spindles, a speed control device for each of the motor means, the speed control device being controlled by the movement of each arm about its fulcrum.

5. The strand supply apparatus described in claim 1 characterized by the frame having similar rows of spindles, guide means and payoff guides on opposite sides of the frame.

6. Strand supply apparatus including, in combination, a frame having a plurality of rows of spindles, each row extending lengthwise of the frame, and spindles extending horizontally from the frame and one row of spindles being at a lower level on the frame than the spindles of the other row, guide means over which strands from respective spools of the spindles pass, the guide means including a strand payoff guide for each spool and over which a strand passes as it comes from the spool, other guide means for the strand from each payoff guide and

around which the strand passes beyond each payoff guide, and means for mounting said other guide means for movement in accordance with the tension of the strand for obtaining uniform tension in the strands in said strand supply apparatus, said apparatus being characterized by the frame having similar rows of spindles, guide means and payoff guides on opposite sides of the frame, and further characterized by the spindles on opposite sides of the frame being at corresponding locations lengthwise of the frame in a corresponding level of the frame, motor means for rotating the spindles to control the tension of the strands including different electric motors for each spindle and motion-transmitting means through which each of the electric motors transmits rotation to its spindle, the motion-transmitting means for the corresponding spindles on opposite sides of the frame being offset lengthwise of the frame in opposite directions and the motors occupying positions at substantially corresponding positions widthwise of the frame but at locations spaced from one another lengthwise of the frame whereby the assembly is more compact in a transverse direction.

7. The strand supply apparatus described in claim 6 characterized by the motion transmitting means including a gear coaxial with the spindle to which it supplies power and another gear on the electric motor in mesh with the gear which is coaxial with the spindle, the gears of the electric motors which drive the corresponding spindles on opposite sides of the machine being at the same level as one another but meshing with their respective gears that are coaxial with the spindles at different phase angles so as to obtain the spacing of the motors lengthwise of the frames.

8. The strand supply apparatus described in claim 1 characterized by said apparatus being a payoff stand for wire strands that work harden when subjected to bending, the guide means about which the wire strands from the respective spools travel being in position to impart the same changes in direction and resulting total bending as the strands from the other spools, whereby the working of the different wire strands from the respective spools is uniform.

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