METHODS OF AND APPARATUS FOR ADVANCING AND COILING STRAND MATERIAL

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ABSTRACT OF THE DISCLOSURE

A strand coiler is provided with a helically-wound spring which circumscribes a strand-engageinent service of a drum-type capstan. The spring is extended to a certain extent so that there is some degree of tension provided therein. The coil spring provides the necessary force between the strand material and the strand-engagement surface of the coiler so that the coilier will function satisfactorily. Adjustment and wear problems associated with leaf springs are significantly reduced by the use of the circumferentially-placed spring.

BACKGROUND OF THE INVENTION

Field of the invention

The invention relates to methods of and apparatus for producing compressive forces between a strand material and a drum-type capstan which is being used to advance and coil the strand material.

Description of the prior art

Drum-type capstan and coiler arrangements have been used in the past extensively. Various devices have been used to provide compressive force between the strand material which is being advanced and coiled and a strand-engagement service of the capstan. These devices have included such things as rollers which are biased inwardly to the strand-engagement surface of the capstan and which engage with the strand material to provide force thereon, leaf spring mounted at various points around the periphery of the capstan and belts of flexible material which are mounted on pulleys separate from the capstan in such a way that the belts are forced to engage with some degree of force on a portion of the strand-engagement surface while traveling around their respective supporting pulleys. The prior art devices used for generating compressive forces as needed on drum-type capstans have the disadvantages of requiring rather precise and time-consuming adjustments in order that the right degree of force is obtained; and additionally, they are subject to rapid wear particularly when used in the advancing and coiling of metallic wire at high speeds. Stationary springs are subject to having grooves worn into their surfaces by the passage of wire thereover. Pressure rollers and belts, if they are formed of substantially, non-deformable materials, must be adjusted very accurately and if they are formed of resilient materials, such as rubber or other elastomers are subject to rapid wear due to wire abrading their surfaces.

Leaf springs and rollers also have the disadvantage of being available for entanglement with the strand material in the event of a break occurring in the strand material. When advancing and coiling strand material, a break in the strand which results in the strand becoming entangled with either leaf springs or rollers may vary well result in a bending out of shape or breakage of the leaf springs or rollers.

SUMMARY OF THE INVENTION

It is an object of the invention to provide new and improved methods of and apparatus for producing compressive forces between a strand material and a drum-type capstan which is being used to advance the strand material.

It is another object of the invention to provide methods of and apparatus for generating compressive forces between a strand material and a drum-type capstan, wherein a need for periodic adjustment of force-producing elements is substantially eliminated.

It is a further object of the invention to provide methods of and apparatus for generating compressive forces between strand material and a drum-type capstan, wherein localized wear on force-producing elements is greatly reduced.

It is a still further object of the invention to provide methods of and apparatus for generating and maintaining compressive forces between strand material and a strand-engagement surface of a coiler wherein the probability for strand entanglement and resultant breakage of equipment is greatly reduced.

An apparatus for advancing strand material embodying certain features of the invention may include means for causing relative movement of the strand material and the strand-engaging surface for wrapping successive portions of the strand material on the strand-engaging surface and simultaneously removing successive portions of the strand material from the strand-engaging surface and an annular member circumscribing and being in compressive relationship with the entire circumference of at least a portion of the strand-engaging surface for producing and maintaining compressive force between successive portions of the strand material and the strand-engaging surface.

A method for advancing strand material embodying certain features of the invention may include the steps of simultaneously wrapping successive portions of strand material on a strand-engaging surface and removing like amounts of the strand material from the strand-engaging surface and providing and maintaining a compressive force between successive portions of the strand material and the strand-engagement surface around the entire circumference of at least a portion of the strand-engagement surface.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and features of the present invention will be more readily understood from the following detailed description of specific embodiments thereof when read in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of a strand-advancing and coiling apparatus with portions thereof broken away for purposes of clarity and with a departure position of the strand material displaced counterclockwise from its actual position for purposes of clarity.

FIG. 2 is a sectional view of FIG. 1 taken along the line 2—2 which illustrates the relationship of an inventive, force-producing member and a drum-type capstan, with size and position of the strand material being exaggerated for purposes of clarity.

DETAILED DESCRIPTION

Referring now to FIGS. 1 and 2, a strand material 20 is led into a coiling apparatus, designated generally by the numeral 22, from some prior operation (not shown) such as wire drawing. The strand is passed over a lead-in sheave 24 and is led into a central aperture 26 of a shaft 28. A belt pulley 30 is mounted on the shaft 28, and
the pulley is driven by a belt 32 from a power source (not shown).

The shaft 28 is connected to a rotatable plate, designated generally by the numeral 34. A sheave, designated generally by the numeral 36, is mounted rotatably on the rotatable plate 34 by a bracket 38 and projects through an aperture 42 in the shaft 28. The sheave 36 is provided with a wire-guiding groove 40. The center of the groove 40 is aligned with the center of the aperture 26 so that the strand material 20 which is passing through the aperture can properly engage the sheave 36.

The strand material 20 progresses from the sheave 36 to a canted sheave 44 which is mounted on the rotatable plate 34 by a bracket 42. An additional sheave 54 is mounted to an adjustable bracket 55 in such a position that the sheave 54 assists in maintaining the strand material 20 within a groove 56 of the sheave 50. A bight 57 formed of successive portions of the strand material 20 extends from the groove 56 of the sheave 50 and orbits around the strand-engagement surface 58 of a tapered drum-type capstan, designated generally by the numeral 60.

As the strand material 20 is wrapped around the strand-engagement surface 58, it is formed into a series of convolutions 62—62. The convolutions 62—62 are urged downwardly on the drum-type capstan 60 by a roller 64 which is mounted to the rotatable plate 34 by a bracket 66. The vertical position of the roller 64 is adjustable with respect to the rotatable plate 34.

As the strand material 20 reaches the strand-engagement surface 58 at a position in contact with the roller 64, a corresponding portion of the strand material is displaced from the lowestmost portion of the convolutions 62—62 by the force generated by the new portion of the strand material entering the convoluted pattern on the strand-engagement surface 58.

A device incorporating the above-identified features is available as a conventional coiler from the Synchro Machine Company, Perth Amboy, New Jersey, under the tradename "Continicou," model SY—3577.

A resilient, force-producing member 68 is positioned around the capstan 60 in an annular configuration so that the force-producing member completely circumscribes the strand-engagement surface 58. The force-producing member is preferably a helically-wound spring which has been stretched to a certain extent in its placement in position around the strand-engagement surface 58. It has been found that it is preferable that the spring be formed of spring-steel, music wire having a circular cross section.

It has been found that a properly functioning spring for advancing annealed copper wire in the size ranges of 19 AWG to 26 AWG in the case of the capstan 60 being 30 inches in diameter can be made by winding a spring "close-wound," i.e. with all convolutions being adjacent, on a 3/8 inch diameter from 0.03 inch music wire so that the spring is 27 inches long and then extending the spring until it will circumscribe the approximately 94 inches of circumference of the capstan 60. A spring which will appropriately advance hard copper wire in the size range of 12 AWG to 14 AWG can be made by winding .045—.050 inch diameter music wire, "close-wound," with a diameter of 3/8 inch, a length of 27 inches. In order to advance hard copper wire on the coiler 22, it is necessary to provide the force-producing member 68 with enough internal tension to overcome the springiness of the copper wire.

The force-producing member 68 is supported in its engaged position on a stationary plate 70. A clamping ring 72 is placed around the force-producing member 68 to hold the force-producing member in position on the plate 70 and is held in place by screws 73—73. The clamping ring 72 is preferably a rolled metal ring having a general shape complementary to the contiguous outer surface of the force-producing member 68, but the ring should not retard circumferential motion of the force-producing member around the capstan 60 or rotating motion of the force-producing member about its own circumferential axis.

The circumferential and rotative motions of the force-producing member 68 are extremely valuable in the operation of the coiling apparatus 22. As the convolutions 62—62 progress downwardly along the strand-engagement surface 58, the convolutions urge the force-producing member 68 to rotate about its circumferential axis. The rotation of the force-producing member 68 about its circumferential axis has the effect of throwing the lowermost convolutions 62—62 off of the strand material 20 off of the strand-engagement surface 58 and onto a takeup device (not shown) with highly desirable predictability and uniformity. The rotative motion of the force-producing member 68 in the case of a helically-wound coil spring also has the effect of causing the force-producing member to move circumferentially about the strand-engagement surface 58. The rotative movement is due to the frictional engagement of the helically-wound spring wire acting like a screw thread on the surfaces of the clamping ring 72 and plate 70. Thus, when the strand material 20 is being wound on the strand-engagement surface 58, one of the force-producing members 68—68, formed of a helically-wound spring which is wound with, for example, a right hand pitch, will progress around the strand-engagement surface in a clockwise manner.

Circumferential motion of the force-producing member 68 helps to provide uniformity of tension in the member 68, distributes wear of the member 68 and the strand-engagement surface 58 more uniformly and consequently, contributes to an overall increase in uniformity of performance of the coiling apparatus 22.

A plurality of rods 76—76 extend downwardly from the drum-type capstan 60 and cooperate with levers 77—77 which swing inwardly into engagement with the rods to form an accumulator system when one of the takeup devices (not shown) is changed. A tapered guide 80 helps constrain the portions of the strand material 20 as they fall to the takeup.

Other annular configurations of the force-producing member 68 can be used, e.g. a band of rubber or other elastomeric material would be effective; and a coil spring formed of wire having non-circular cross section would also function properly. A series of contiguous rollers held together resiliently by a spring or rubber band would also perform satisfactorily.

Although an embodiment of the invention has been described wherein the capstan 60 is of the commonly known "dead-block" type, it is obvious that the invention is capable of being utilized in an advancing and coiling system which incorporates a "live-block" capstan. "Live-block" systems are ones in which a capstan component rotates rather than remaining stationary as in the case of "dead-block" systems. The inventive force-producing member 68 could be made to function properly with a "live-block" capstan as well as on a drum-type capstan 60. In that event the spring would be mounted so that it would move with the "live-block."

It is to be understood that the above-described arrangements are simply illustrative of the invention. Other arrangements may be devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. A method for advancing strand materials, which comprises the steps of:
   - simultaneously wrapping successive portions of strand
material on a strand-engagement surface and removing like amounts of the strand material from the strand-engagement surface, and providing and maintaining compressive forces on the outer periphery of successive portions of the strand material, simultaneously around the entire circumference of at least a portion of the strand-engagement surface so that successive portions of the strand surface.

2. The method of claim 1, which comprises the step of: creating orbital motion in a bight of strand material formed of successive portions thereof around the strand-engagement surface so that the strand material becomes wound thereon.

3. The method of claim 1, which comprises the step of: applying a component of force to successive portions of the strand material normal to the compressive force, simultaneously around the entire circumference of at least a portion of the strand-engagement surface so that the strand material is urged longitudinally along the strand-engagement surface.

4. Apparatus for advancing strand material, which comprises:

a strand-engagement surface,

means for causing relative movement of the strand material and the strand-engagement surface for wrapping successive portions of the strand material on the strand-engagement surface and simultaneously removing successive portions of the strand material from the strand-engagement surface, and

an annular member circumscribing and being in compressive relationship with the entire circumference of at least a portion of the strand-engagement surface for producing an maintaining compressive force between successive portions of the strand material and the strand-engagement surface.

5. The apparatus of claim 4, wherein the annular member comprises a helically-wound spring.

6. The apparatus of claim 4, wherein the annular member is mounted so that the member is free to revolve about its circumferential axis.

7. The apparatus of claim 4, wherein the strand-engagement surface is stationary and rotating means are provided for winding the strand material thereon.

8. The apparatus of claim 4 wherein the strand engagement surface is moved in order that the strand material is wound thereon.

9. The apparatus of claim 5, wherein the winding of the helix of the spring and counting of the spring is such that the rotation of the spring about its circumferential axis will tend to urge the spring circumferentially around the strand engagement surface.

10. The apparatus of claim 5, wherein the extended length of the spring in position around the strand-engagement surface is between three and four times the minimum length of the spring that exists when all convolutions of the spring are adjacent one another.

11. The apparatus of claim 7, wherein the axis of rotation of the rotating means is vertical.

12. The apparatus of claim 7, wherein means are provided to restrain the force-producing member from moving in a direction parallel to the axis of rotation of the rotating means.

13. The apparatus of claim 10, wherein the strand-engagement surface to between 80 and 100 inches in circumference and the cross-sectional diameter of the spring is between 0.50 inch and 1.00 inch.

References Cited

UNITED STATES PATENTS

1,995,498 3/1935 Demsey et al. -------- 242—82
3,033,484 5/1962 Crum ------------------ 242—82

NATHAN L. MINTZ, Primary Examiner
It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 63, "abrad ing their surfaces" should read --abranding across their surfaces--. Column 4, line 46, "constrain the" should read --to constrain the--. Column 5, line 9, "surface." should read --material are urged against the strand engagement surface.--; Column 5, line 34, "an" should read --and--. Column 6, line 11, "counting" should read --mounting--; Column 6, line 27, "to" should read --is--.

SIGNED AND SEALED
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