Nov. 3, 1959 T. T. BUNCH 2,910,822

APPARATUS FOR WRAPPING STRAND MATERIAL HELICALLY ABOUT AN ADVANCING CORE

Filed Sept. 6, 1957 2 Sheets-Sheet 1

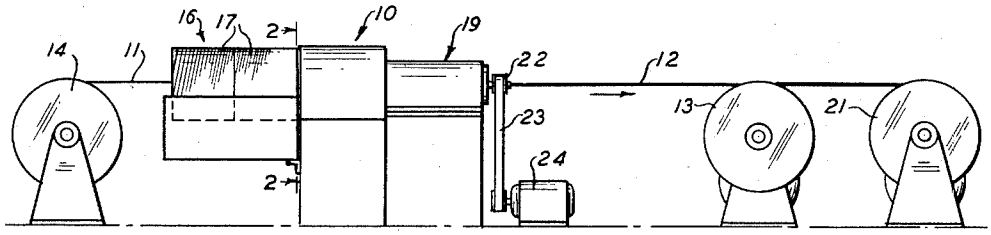


FIG. 1

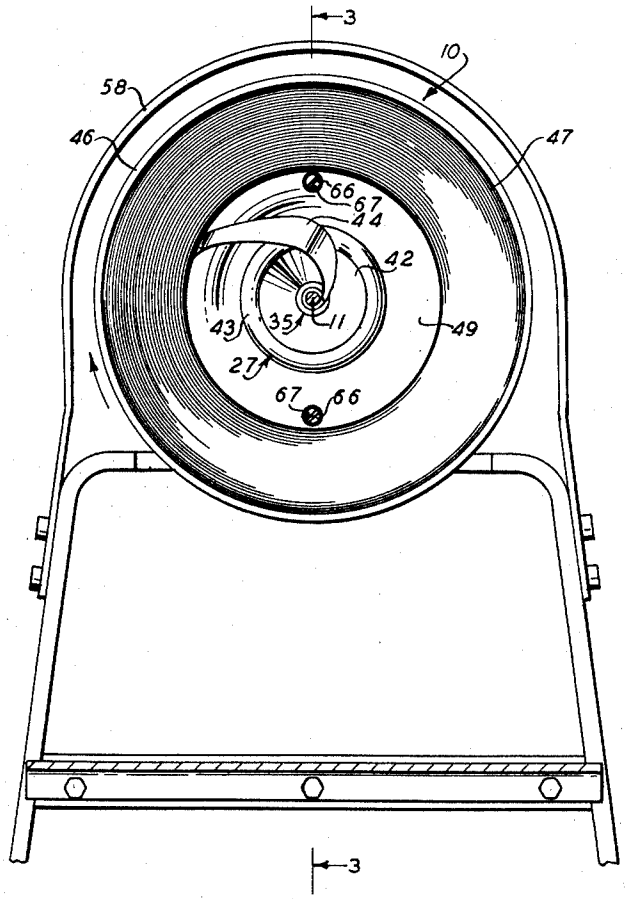


FIG. 2

INVENTOR.
T. T. BUNCH
BY A. C. Schwarz, Jr.
ATTORNEY

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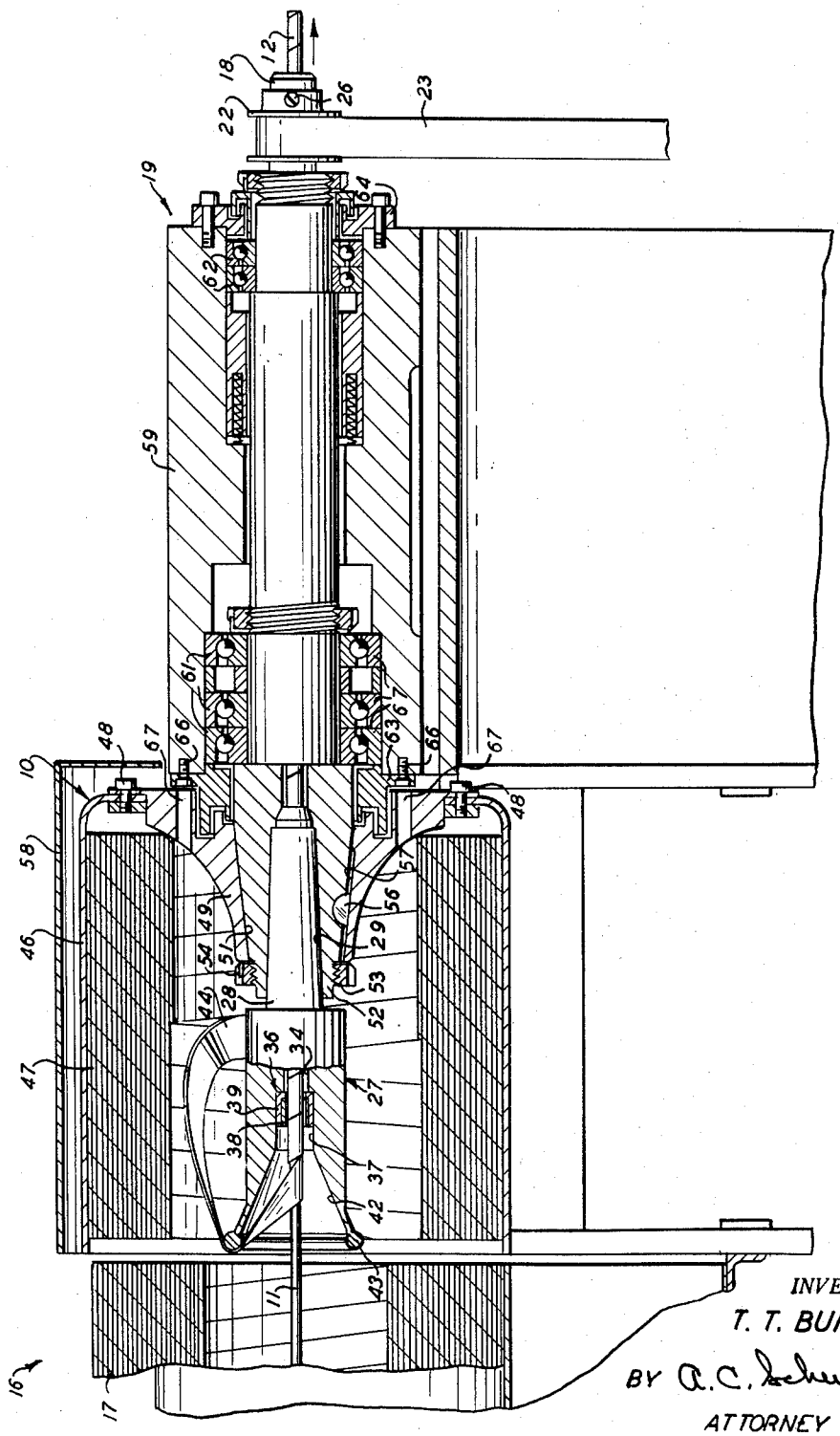


FIG. 3

INVENTOR.
T. T. BUNCH
BY A. C. Schwarz, Jr.
ATTORNEY

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APPARATUS FOR WRAPPING STRAND MATERIAL HELICALLY ABOUT AN ADVANCING CORE

Tillman T. Bunch, near Ashland, Baltimore County, Md., assignor to Western Electric Company, Incorporated, New York, N.Y., a corporation of New York

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4 Claims. (Cl. 57—18)

This invention relates to apparatus for wrapping strand material helically about an advancing core, and more particularly to apparatus for wrapping pressure-sensitive tape helically about an advancing cable core.

In the manufacture of communications cable, it is sometimes required to wrap a pressure-sensitive tape helically about an advancing stranded cable core. In the past, this was done sometimes by mounting a tape package having external take-off eccentrically about the axis defined by the advancing core, a counterweight being provided. In one particular operation, the speed of advancement of the core has been 40 feet per minute and the taping head has been rotated at 240 r.p.m. The tape packages practical for use with this taping head contained sufficient tape to wrap only about 600 feet of cable, thus requiring about seven stoppages in the wrapping of tape about a standard 4600 foot length of stranded cable core.

A stranding apparatus has been devised to strand such cable core at a speed of about 1000 feet per minute, twenty-five times faster than heretofore, as disclosed in applicant's copending application, Serial No. 624,873, filed November 28, 1956. The cable core therein described rotates about its longitudinal axis at a speed of about 1000 r.p.m. To wrap tape on such an advancing-rotating cable in a helix of the opposite lay, it is necessary to provide a taping head which will revolve about the core at a faster rate, an initial 1000 r.p.m. being required to overtake the rotation of the core and an additional 4000 r.p.m. being required to wrap a 1⅜ inch tape thereabout. Further, in order not to lose any of the advantage of the high speed of stranding, a tape package large enough to cover the entire commercial length of 4600 feet without interruption of the process is required.

An eccentric taping head, such as formerly used, is subject to an inherent speed limitation of about 500 r.p.m. for the size and weight tape package used and, if a package approximately seven times as large were devised to accommodate one entire 4600 foot length in one pass, the limiting speed would be much lower, if such a device were operable at all. A concentrically rotating tape package is not limited to such a low speed and when properly balanced and supported it is capable of sustaining speeds in excess of the 5000 r.p.m. desired here. As ordinarily devised and employed, the limiting factor for the speed of a concentrically rotating tape package is the design of the means for removing the tape from the package and applying it to the cable core.

An object, therefore, of the invention is to provide a new and improved apparatus for wrapping strand material about and advancing core.

Another object of the invention is to provide a concentrically rotatable taping head for wrapping a pressure-sensitive tape from capacious packages and at a rotary speed of the order of 5000 r.p.m. about a cable core advancing axially thereof at a speed of the order of 1000 feet per minute.

According to certain features of the invention, an apparatus is provided for wrapping a strand being withdrawn from a supply thereof helically about an advancing core to which the strand is connected for withdrawal thereby. The wrapping apparatus may include a rotary strand applicator having a bore through which the core advances and a circumferential lip extending around the bore at that end of the applicator which the core enters. Means are provided for mounting the applicator in such a position with respect to a strand supply that the strand withdrawing from the package advances in a direction having a component opposite to the direction of advancement of the core, passes about the lip of the applicator, and then enters the bore in the applicator. Further, means are provided for rotating the applicator about the line of advancement of the core, so that the withdrawing strand is tensioned as it passes about the lip of the applicator and is wrapped helically about the advancing core by the applicator after it enters the bore in the applicator.

More specifically, the strand supply is a rotating hollow package wound for internal payoff, and the applicator is rotated in the same direction as the package and at substantially the same speed. The applicator is mounted coaxially within the package so that the circumferential lip protrudes from the package to provide the desired travel of the withdrawing strand. Preferably, the applicator has a bellmouthed aperture for receiving the core and a beaded circumferential lip extending around the bellmouthed aperture.

Other objects and advantages of the invention will appear from the following detailed description of apparatus forming a specific embodiment thereof, when read in conjunction with the appended drawings, in which:

Fig. 1 is a side elevation of apparatus forming an embodiment of the invention, showing the wrapping apparatus in use;

Fig. 2 is an enlarged front elevation of the wrapping apparatus, taken along line 2—2 of Fig. 1, and

Fig. 3 is an enlarged cross-sectional view of the wrapping apparatus and associated spindle assembly taken along line 3—3 of Fig. 1.

Referring now in detail to the drawings, and in particular to Fig. 1, a wrapping head is provided, indicated generally by the numeral **10**, for wrapping strand material, such as tape, helically about an advancing core **11**, such as a stranded cable core, the wrapped core being indicated by the numeral **12**. The core **11** is advanced from left to right, as viewed in Fig. 1, by means such as a capstan **13**, from a supply reel **14** axially through a supply magazine, indicated generally by the numeral **16**, which contains a surplus pair of reserve strand packages **17—17**, thence axially through the wrapping head **10**, whereat the strand material is wrapped helically about the core **11** to form the wrapped core **12**.

The wrapped core **12** is then advanced by capstan **13** out of the wrapping head **10**, thence axially through a spindle **18** (Fig. 3) supported for rotation in a spindle assembly, indicated generally by the numeral **19**, thence around the capstan **13**, wherefrom the wrapped core is taken up on means such as a take-up reel **21**. The spindle **18** is rotated by suitable means such as a toothed pulley **22** keyed thereto, a toothed belt **23** for rotating the pulley **22** and a motor **24** for driving the belt **23**. The pulley **22** is secured against longitudinal sliding with respect to the spindle **18** by a set screw **26**. The capstan **13** is rotated by suitable means (not shown) to advance the core at a predetermined speed and means (not shown) are provided for correlating the speed of rotation of the spindle **18** with respect to the speed of advancement of the core, as determined by the speed of rotation of the capstan **13**.

Referring now to Figs. 2 and 3, the wrapping head **10**

includes a rotatable strand applicator, indicated generally by the numeral 27, secured by suitable means for rotation with the spindle 18. In the embodiment shown, a shank 28 of the applicator 27 is secured within the load end of the spindle 18 by a locking taper 29. The applicator 27 is formed with an axial bore 34 of greater diameter than the diameter of the desired wrapped core 12, which is advanced therethrough.

A closing die, indicated generally by the numeral 36, is preferably provided, positioned within the applicator 27 at a point beyond the point of application of the strand. As best seen in Fig. 3, the applicator 27 is provided with a counterbore 37 in which is seated the closing die 36. The closing die 36 is formed with an axial bore of approximately the same diameter as the diameter of the desired wrapped core 12, the inner surface of the die being of wear resistant material, preferably of Heanium, an alumina gem manufactured by the Heaney Industrial Ceramics Corp. The wrapped core 12 is advanced axially through the bore in the closing die 36 and in contact with the inner, wear resistant surface thereof, which shapes and presses the applied strand into a smooth helical layer about the core 11. In the embodiment illustrated in Fig. 3, a Heanium sleeve 38, having the desired axial bore, is cemented within a steel holding cup 39, which is inserted within the counterbore 37.

The applicator 27 is preferably formed with a bell-mouthed entrance portion 42, the front end of which has a beaded lip 43 extending around the periphery thereof and about which the strand 44 passes, being tensioned thereby, just prior to being wrapped about the advancing core 11.

A cylindrical cup 46 is provided for holding a package 47 of strand material to be wrapped. The cup 46 is secured by suitable means to the spindle 18 for rotation therewith. The cup 46 is mounted coaxially around the applicator 27, preferably in such position that the lip 43 extends slightly beyond the package 47 in the direction of advancement of the core 11, to the left as viewed in Fig. 3.

In the embodiment shown, the cup 46 is secured by means such as screws 48—48 to a hub 49, which is fitted to the load end of the spindle 18 by means of a mating taper 51. The extremity 52 of the spindle 18 is threaded to receive a lock nut 53 and a lock washer 54 which, when the lock nut 53 is tightened, maintain the fit between the hub 49 and the spindle 18. A Woodruff key 56 is mounted in a keyway 57 in the hub 49 to prevent slippage between the spindle 18 and the hub 49.

The strand package 47 is prewound so that an end is at the inside of the package 47 to permit continuous internal withdrawal therefrom, as seen in Figs. 2 and 3. The package 47 preferably comprises an elongated self-supporting cylinder extending approximately coextensively of the package holding cup 46, the strand 44 having been wound back and forth along the length of the package 47 in a plurality of layers, each layer having a plurality of helical turns therealong, thus supplying for continuous withdrawal a maximum number of linear feet of strand material in a compact easily handled package.

The package 47 preferably has an axial aperture substantially larger in diameter than the outer diameter of the applicator 27. The outer diameter of the package 47 is preferably slightly smaller than the inner diameter of the package holding cup 46, so that the package 47 may be inserted around the front end of the applicator 27 and into position within the cup 46 readily, and so that the package 47 may expand sufficiently under "hoop stress" to sustain its own centrifugal loading to avoid adding to the centrifugal stresses of cup 46.

In the wrapping of a stranded cable core, it is preferred to use a semi-pressure-sensitive tape so that the turns within the tape package are secured detachably to each other. The expression "semi-pressure-sensitive" tape is used, herein, to mean that the tape has sufficient tack to form a self-sustaining package, but has insufficient tack to prevent the tape from unwinding readily in response to the unwinding tension applied thereto. An example of a tape suitable for use herewith, is a fiberglass mesh strip impregnated with neoprene latex containing a small governed amount of a tackifying agent, such as rosin. In the taping of a stranded cable core advancing at 1000 feet per minute, it is preferred that the tension required to unwind tape from the package be not less than one-half pound nor more than one and one-half pounds per inch of width.

The reserve tape packages 17—17 are stored preferably in the magazine 16 located adjacent the entrance end of the cup 46, the core 11 advancing axially through the reserve packages 17—17. This arrangement facilitates insertion of a new package 17 when the package 47 being wrapped is exhaused. A safety cover guard 58 preferably covers the taping head 10, as seen in Fig. 3.

The spindle assembly 19, suitable for high speed applications, is detailed in Fig. 3 and comprises generally a bearing housing 59 in which are secured bearings 61—61 adjacent to the load of the applicator and the tape package assembly and spring preloaded bearings 62—62 opposite to the load, the bearings being secured within the housing 59 by labyrinth retaining caps 63 and 64, respectively. The previously mentioned hub 49 is designed to rotate about the retaining cap 63, defining a labyrinthine passage therewith for passage of vapor mist lubrication. The retaining cap 63 is secured to the housing 59 by a plurality of screws 66—66 and the hub 49 is provided with a plurality of bores 67—67, alignable with screws 66—66, to permit removal of the cap 63 when desired.

Operation

In the operation of the specific embodiment of the invention shown and described, the core 11 to be wrapped is advanced continuously by the capstan 13 from the supply reel 14, axially through the reserve strand packages 17—17, positioned within the magazine 16, thence axially through the strand applicator 27, whereat the strand material 44, continuously being served from the inside of the package 47, is wrapped helically about the advancing core 11. The core 11 and the strand material 44 engage each other just prior to being advanced axially through the closing die 36 contacting the wear resistant surface thereof, which forms and presses the strand material into a sized, smooth helical layer about the core 11. The smoothed wrapped core 12 is advanced axially through the shank 28 of the tape applicator 27, thence axially through the rotating spindle 18 out of the taping head 10, thence around the capstan 13 to the take-up reel 21.

As the core 11 advances, the spindle 18 and both the applicator 27 and the cup 46, secured for rotation therewith, are rotated continuously at a predetermined speed to wrap the strand 44 helically about the advancing core 11 to form the wrapped core 12. The angle of wrap and amount of overlap, if any, are determined by the relative speed of rotation of the strand 44 with respect to the rotation of the core 11 and the linear speed at which the core 12 is advanced, which speeds are preferably to be so regulated that successive turns overlap slightly.

The strand 44 is unwound internally from the package 47 by the pull exerted by the advancing core 11 on the strand material wrapped thereabout and is tensioned by: (1) the adhesion to the package, (2) centrifugal force, and (3) the capstan effect of friction between the strand 44 and the rotating lip 43. The strand 44 then passes about the rotating lip 43 of the applicator 27 and advances into windup position within the mouth of the applicator 27. It is preferred that the direction of advancement of the tape from the package 47 toward the lip 43 have a component opposite to the direction of advancement of the core 11, the angle of advance varying when helical turns of strand material unwind back and

forth along the length of a cylindrical package, as when the package 47 is mounted at a point to the rear of the front end of the applicator 27.

While it would be possible to secure positively the tape package 47 to the cup 46 for rotation therewith, for instance by providing spikes (not shown) insertable through the cup 46 into retaining contact with the package 47, it has been found that by using a package having an outer diameter slightly smaller than the inner diameter of the cup 46, to permit ready insertion of fresh strand packages, for example 17—17, the package 47 will generally rotate with the cup 46, possible slight slippage not being deleterious.

It will be manifest that this invention is not limited to the specific details described in connection with the above embodiment of the invention and that various modifications may be made without departing from the spirit and scope thereof.

What is claimed is:

1. Apparatus for wrapping a strand being withdrawn from a supply thereof helically about an advancing core to which the strand is connected for withdrawal thereby, which comprises: a rotary strand applicator having a bore through which the core advances and a circumferential lip extending around the bore at that end of said applicator which the core enters; means for mounting said applicator in such a position with respect to the strand supply that the strand withdrawing from the supply advances in a direction having a component opposite to the direction of advancement of the core, passes about the lip of said applicator, and then enters the bore in said applicator; and means for rotating said applicator about the line of advancement of the core, so that the withdrawing strand is tensioned as it passes about the lip of said applicator and is wrapped helically about the advancing core by said applicator after it enters the bore in said applicator.

2. Apparatus for wrapping a strand being withdrawn internally from a hollow rotating strand package helically about a core which advances coaxially through the package and to which the strand is connected for withdrawal thereby, which comprises: a rotary strand applicator having a bellmouthed aperture into which the core advances, an axial bore communicating with the bellmouthed aperture and through which the core advances, and a circumferential lip extending around the bellmouthed aperture;

means for mounting said applicator in such a position with respect to the strand package that the strand withdrawing from the package advances in a direction having a component opposite to the direction of advancement of the core, passes about the lip of said applicator, and then enters the bellmouthed aperture; and means for rotating said applicator in the direction of rotation of the package and at substantially the same speed, so that the withdrawing strand is tensioned as it passes about the lip of said applicator and is wrapped helically about the advancing core by said applicator after it enters the bellmouthed aperture in said applicator.

3. Apparatus according to claim 2, wherein the front end of the bellmouth of said strand applicator is formed with a beaded lip extending around the periphery thereof and about which the withdrawn strand passes, being tensioned thereby just prior to being wrapped about the advancing core.

4. In an apparatus for wrapping a semi-pressure-sensitive tape about an advancing core, wherein the core is advanced axially through a hollow tape package wound in a plurality of layers of helical turns for internal payoff and carried within a rotating cup for rotation therewith and wherein the tape is connected to the core so that the advancement of the core causes withdrawal of the tape from the package; the improvement which comprises a bellmouthed tape applicator mounted coaxially within the tape package for rotation with the cup and having an axial bore formed therethrough communicating with the bellmouth for passing the core, said applicator being provided with a beaded lip extending around the circumference of the bellmouth, said applicator being positioned so that the advancing core enters the bellmouth and so that the beaded lip protrudes from the tape package, whereby the tape withdrawing from the package advances in a direction having a component opposite to the direction of advancement of the core, passes about the beaded lip of said applicator being tensioned thereby, and then enters the bellmouth wherein the tape is wrapped helically about the advancing core by said applicator.

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