March 22, 1938. F. V. JOHNSON ET AL 2,111,630

STRAND HANDLING APPARATUS

Filed Jan. 14, 1937 4 Sheets-Sheet 1

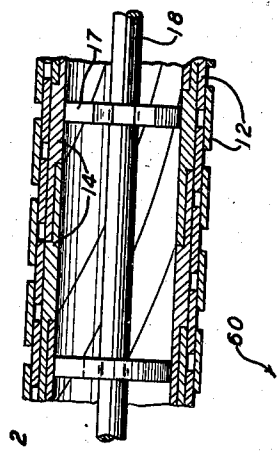


FIG. 2

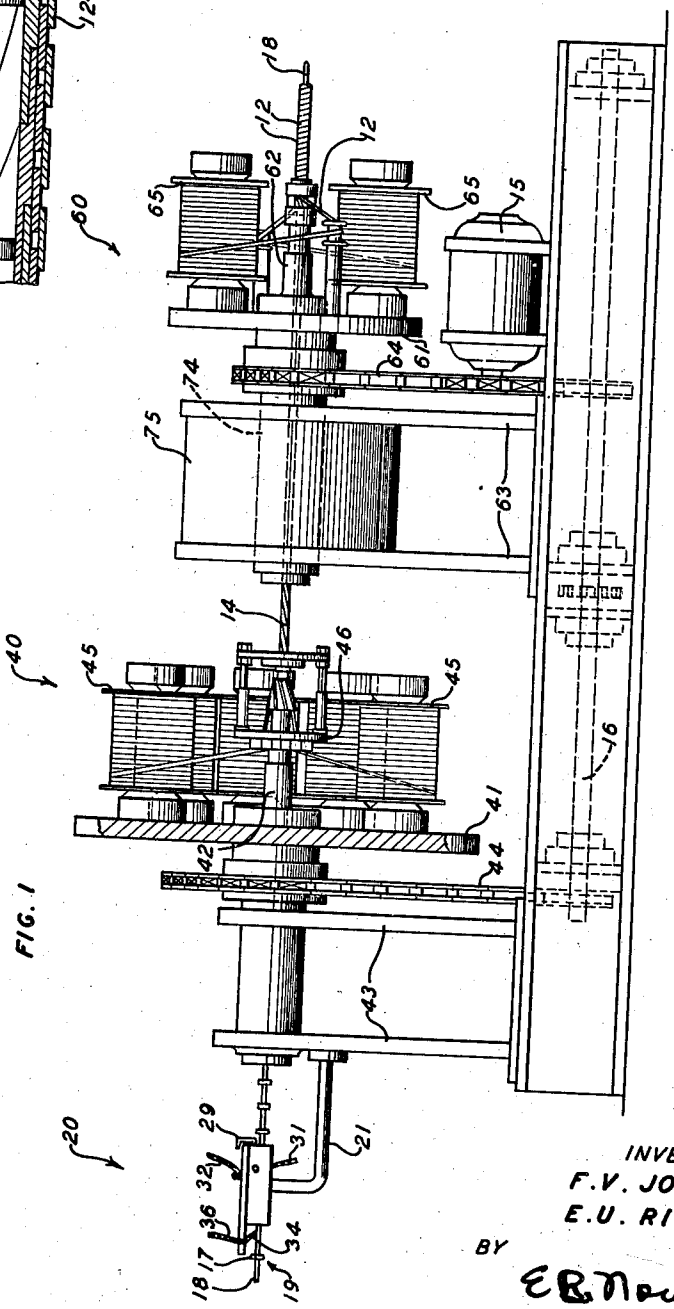


FIG. 1

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Filed Jan. 14, 1937 4 Sheets-Sheet 2

FIG. 5

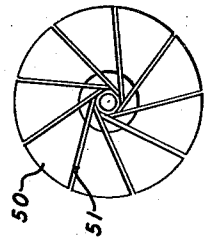


FIG. 4

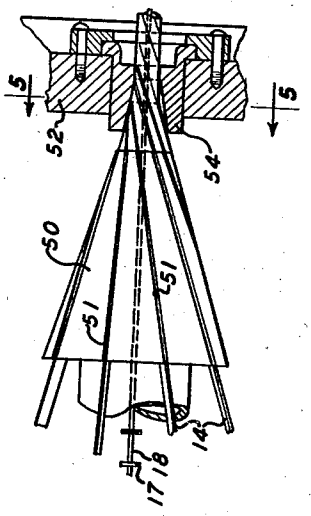
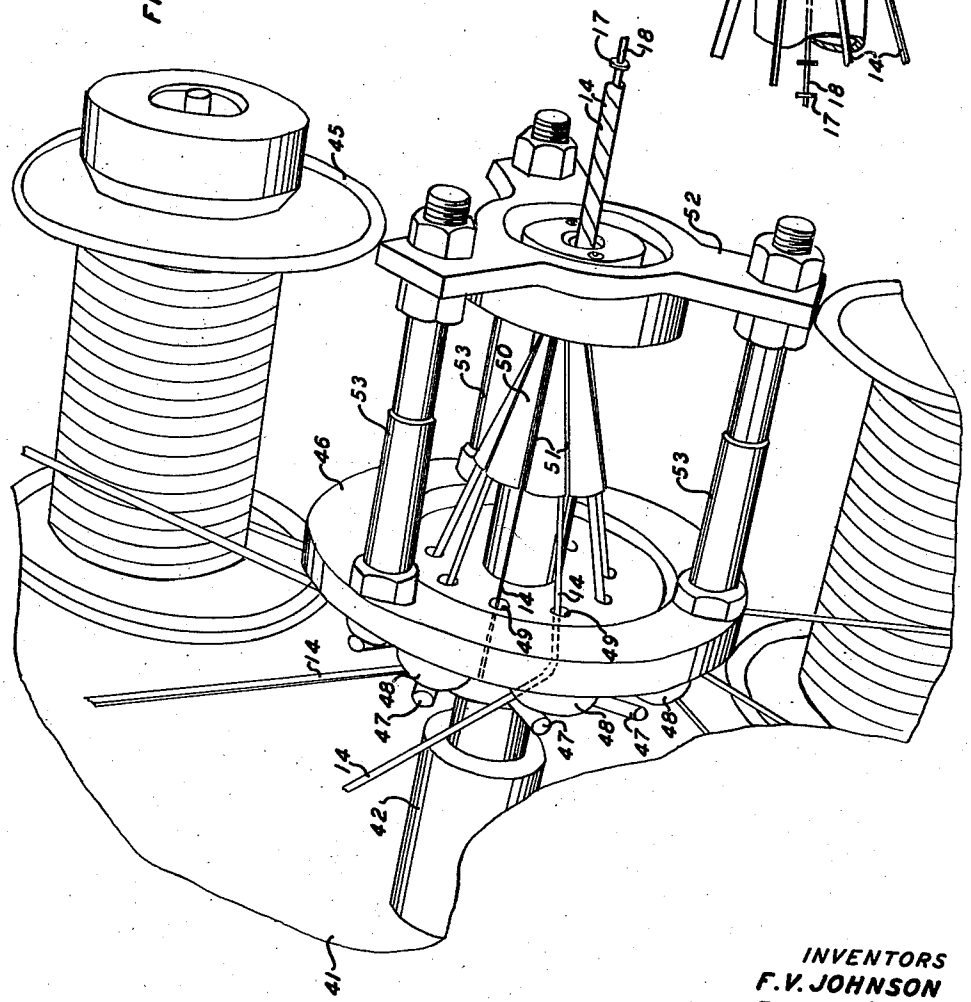


FIG. 3



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STRAND HANDLING APPARATUS

Filed Jan. 14, 1937 4 Sheets-Sheet 3

FIG. 7

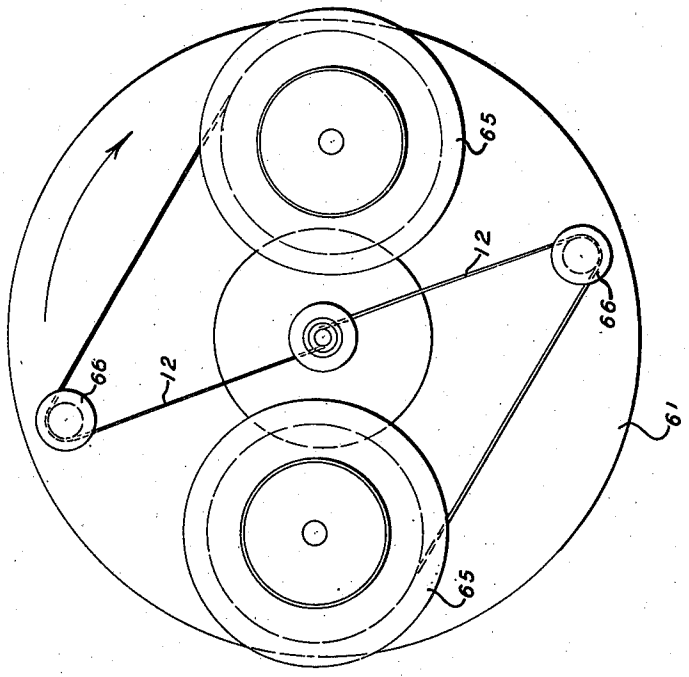
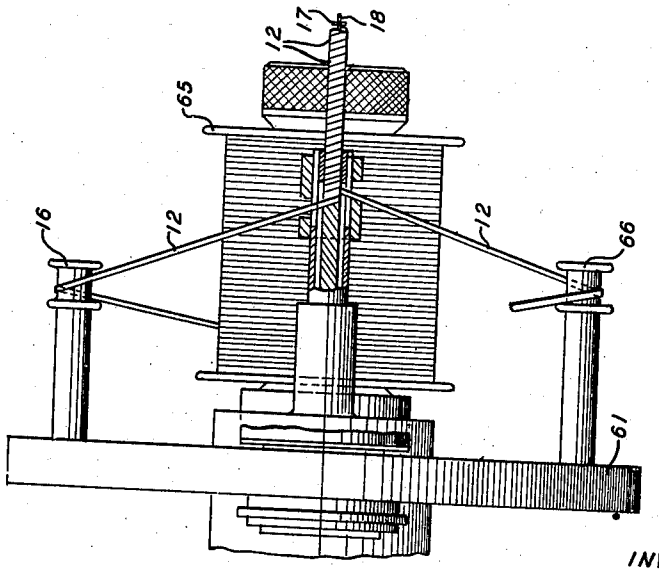


FIG. 6



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STRAND HANDLING APPARATUS

Filed Jan. 14, 1937 4 Sheets-Sheet 4

FIG. 8

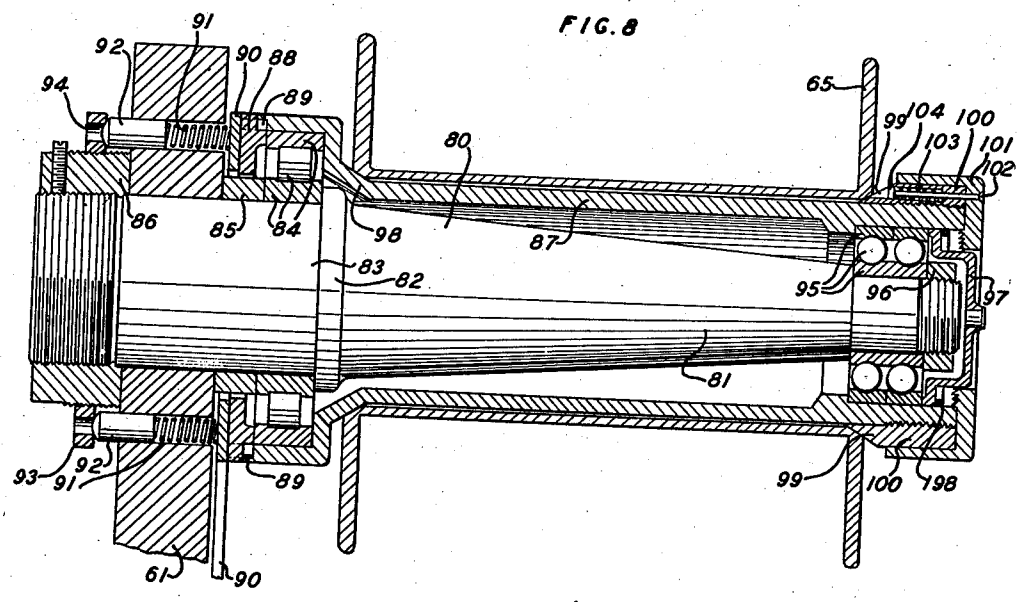


FIG. 9

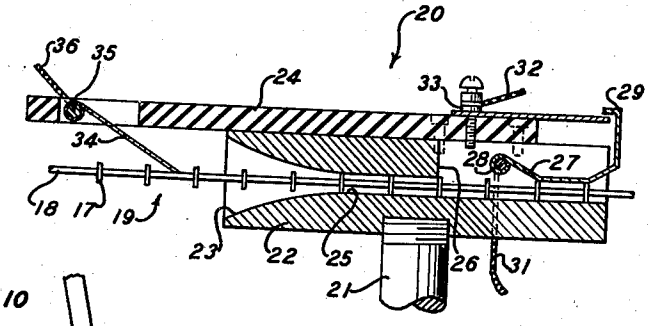


FIG. 10

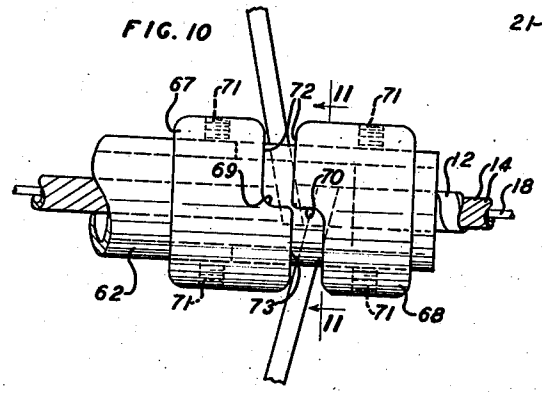
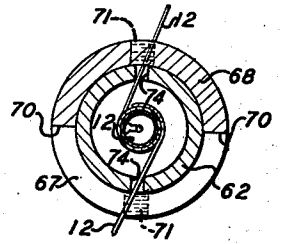


FIG. 11



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UNITED STATES PATENT OFFICE

2,111,630

STRAND HANDLING APPARATUS

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Application January 14, 1937, Serial No. 120,492

8 Claims. (Cl. 117—34)

This invention relates to strand handling apparatus and more particularly to apparatus for combining strands into cable, especially in the case of the manufacture of coaxial conductor units for use in communications.

One type of coaxial conductor unit especially applicable in some branches of the communications art comprises a central axial inner conductor, usually a solid metal wire, having a plurality of insulating spacing members mounted at intervals thereon, and a hollow cylindrical outer conductor resting on the spacing members. The outer conductor in one form of such a conductor pair, consists of metal tapes wound spirally over the spacing members, and preferably of a flat Z-shaped cross section to overlap each other in a quasi shiplap relation, giving a smooth inner and outer surface to the hollow cylinder formed by the tapes. These tapes are preferably of copper or copper alloy. In some instances, for mechanical or electromagnetic reasons or both, it may be desirable to provide over the outer conductor a protective sheath of spirally wound and overlapping tapes of steel or other electromagnetically effective alloy. Since such coaxial conductor pairs or units are frequently used to carry currents of high frequency, it may be important that the component parts be combined with great uniformity of relation to each other.

An object of the present invention is to provide apparatus in which strands, and particularly the component strands of the coaxial conductor units or pairs above described, may be rapidly, efficiently and accurately combined in a uniform manner.

One embodiment of the invention contemplates a coaxial conductor assembling apparatus having means to examine and test a central conductor with insulating disks positioned at predetermined intervals thereon for missing disks, means to apply a plurality of Z-tapes of metal over the disks including means to ensure accurate interrelation of the tapes to each other at the point of application, means to reduce or prevent possibly disturbing vibration of the nascent coaxial pair, means to apply a plurality of flat metal tapes as a protective sheath over the outer conductor, and means to detect, signal and destroy fortuitous short circuits between the two conductors of the pair.

Other objects and features of the invention will clearly appear from the following detailed description of one embodiment thereof in an apparatus for assembling a coaxial conductor unit or pair taken in connection with the accompanying drawings in which the same reference numerals are applied to identical elements in the several figures and in which

Fig. 1 is a diagrammatic view in side elevation and partly in section of the apparatus;

Fig. 2 is an enlarged longitudinal axial section of a portion of the product of the apparatus;

Fig. 3 is a broken enlarged view in perspective of the Z-tape applying unit;

Fig. 4 is an enlarged detached view in side elevation and partly in section of the Z-tape guide member and compacting die;

Fig. 5 is an enlarged detached view in end elevation of the Z-tape guide member;

Fig. 6 is a detached enlarged view in side elevation and partly in section of the armor tape applying means;

Fig. 7 is a corresponding view thereof in end elevation;

Fig. 8 is an enlarged detached view in central longitudinal section of one of the tape supply reel supports;

Fig. 9 is an enlarged detached view in central vertical section of the detector unit;

Fig. 10 is an enlarged detached view in side elevation of the armor tape guide, and

Fig. 11 is a section on the line 11—11 of Fig. 10.

The embodiment of the invention herein disclosed comprises a sequence of coacting units, namely a testing unit generally indicated at 20 in Fig. 1, an outer conductor assembling unit 40, and an armor sheath assembling unit 60.

An axial or inner conductor 19 may be thought of as comprising a strand 18 of copper wire with radially slotted disks 17 of insulating material positioned transversely thereon at predetermined intervals. This inner conductor 19 is drawn in Fig. 1 from any suitable supply not shown at the left and passes first into the testing unit 20 (Figs. 1 and 9).

The testing unit 20, which is conveniently mounted on a bracket 21 supported by the frame of the apparatus, comprises a metal body 22 and a contact support 24 of insulating material carried on the body. The body has a longitudinal passage 25 formed with a flaring entrance 23 and communicating at its rear end with a chamber 26. The latter portion of the passage 25 is dimensioned to pass the strand 19 freely but without appreciable lateral freedom.

A missing disk detector contact 27 is mounted in the chamber 26. This contact 27 is a strip of metal pivoted at its rear end to be freely pivotable under gravity on a pin or screw 28 mounted horizontally in the walls of the chamber and above

the path of the strand and disks. The main part of the contact extends generally horizontally to the right and is formed with a downwardly convex bulge dimensioned to be supported in the position shown in Fig. 8 by the normally located disks 17, but to drop down if any disk be missing or out of place. The outer end of the contact 27 is formed as an upstanding and reversely bent hook 29 rising a little above and overlying the tip of a flat contact 30 mounted on the upper face of the insulating support 24. Electrical leads 31 and 32 connected respectively to the pivot 28 and to a terminal 33 on the contact 30 are connected any appropriate signalling circuit not shown but comprising a source of current and a signal device. If a disk 18 be missing or materially displaced, when its proper site on the strand 17 passes under the bulge of the contact 27, the latter will drop and touch contact 30 and so close the signal circuit through the leads 31 and 32.

Another gravity contact member 34 is pivotally mounted at 35 in the insulating support 24 and is connected to a lead 36 for a purpose to be hereinafter explained.

From the testing unit 20, the strand 19 passes on through the device 40 whose function is to form a tubular outer conductor consisting of a number of tapes of copper or other suitable material, over the strand 19 and preferably resting closely on the peripheries of the disks 17. These copper tapes or ribbons are of Z-shaped cross section and are to be laid spirally over the disks 17 with overlapping edges in a quasi shiplap fashion.

Turning now to Figs. 1, 3, 4 and 5, the copper tape assembling unit 40 is carried on a disk like base 41 mounted on a horizontally disposed hollow shaft 42 journalled in standards 43, 43 and driven in rotation by a chain 44 from a main drive shaft 16, which in turn is driven by a motor 15. A plurality (in this case nine) of Z-tape supply reels 45 is mounted on the right hand face of the base 41 in a manner to be described hereinafter. A disk 46 is rigidly mounted on the shaft 42 and is provided on its left side with guide pins 47 and guide members 48 in associated pairs, a tape 14 from each supply reel 45 passing over one pin 47 and its associated member 48 and through a corresponding aperture 49 in the disk 46, to enter one of a corresponding plurality of slots 51 formed in the conical outer surface of a tapering hollow guide nose 50 also rigidly mounted on the right hand end of the shaft 42. A spider 52 mounted on the disk 46 on pillars 53 carries a compacting die 54 into whose funnel shaped entrance the tip of the nose 50 enters.

The strand 19 passes axially through the hollow shaft 42, the nose 50 and the die 54. As it emerges from the nose 50, the guide slots 51 lay the tapes 14 on the disks 17 of the strand 19 in such wise that the tapes are properly interrelated with each other and with the strand 19 to be forced by the die 54 to lie shiplap in a cylinder on the disks 17 in the mutual relation indicated in Figs. 2 and 3. The slots 51 are not straight line generators of the conical surface, but are plane sections of the cone such that each is in a plane tangent to the cylindrical surface of the completed outer conductor in the forming die 54.

In the apparatus illustrated, the base 41 with the disk 46, nose 50 and die 54 is rotated relatively slowly and counter-clockwise as seen from the right in Fig. 1, and hence the tapes 14 are laid on the disks 17 with a long left hand twist.

From the die 54 the completed bare conductor pair passes on to the armor sheathing unit 60. Here, Figs. 1, 6, 7, 10 and 11, a disk like base member 61 is mounted on a hollow shaft 62 through which the conductor pair passes. The shaft 62 is journalled in supports 63 and driven by a chain 64 from the motor 15. Two supply reels 65, each containing a supply of smoothly flat tape 12 of steel or other suitable material are mounted in a manner to be hereinafter described, on the base 61 to rotate therewith.

From the reels 65 the armor tapes 12 pass over guide members 66 rigidly secured to the base 61 and thence at an unvarying angle to the coaxial conductor pair to be wound thereon, one tape 12 being wound directly on the tapes 14 in a slightly open helix and the other tape 12 being wound to lie over and cover the narrow helical gap between turns of the first tape 12. To ensure accurate relative positioning of the tapes 12, the right hand end of the shaft 62, which is longitudinally slotted at 74, 74 to allow the tapes 12 to pass, has a guide device mounted rigidly thereon comprising two symmetrically identical sleeves 67 and 68. The mutually proximate ends of these sleeves are stepped as at 69 and 70, and the sleeves are locked in place on the shaft 62 by jam screws 71 in such fashion as to leave quasi slots 72 and 73 extending transversely half across and offset with respect to each other. Each of these slots is of such dimensions that the tapes 12, one in each slot, have each only one possible path from the corresponding guide 66 to the winding point on the core, being controlled laterally with respect to each tape by the walls of the corresponding slot 72 or 73.

The base 61 is driven in rotation at higher speed than the base 41 and in the opposite direction. Hence the tapes 12 are laid on in a helix of relatively short pitch and right hand twist.

Since one tape 12 is wound over the other, the supply reel 65 for the outer tape 12 will be emptied more rapidly than the reel supplying the inner tape 12. The reels being for convenience identical in size and shape will rapidly become and remain of unequal weight even if they were alike at any given time. Hence there will necessarily be rotary unbalance in the unit 60 most of the time. To obviate vibration from this cause, the journal support 74 for the shaft 62 is mounted in a casing 75 which can be filled with granular or cast lead or other suitably heavy material to control the vibration.

From the unit 60 the completed product passes on to suitable propelling means and take-up means not shown but of any appropriate construction.

Each of the reels 45 and 65 is mounted on the corresponding base 41 or 61 in the manner shown in Fig. 8. Let it be assumed that one of the reels 65 is here represented. A stub shaft 80 having a tapered outer portion 81 terminating at the left in an integral collar 82, has its cylindrical base 83 mounted in a corresponding aperture in the base 61. An anti-friction bearing 84 has its inner raceway about the portion 83 and abutted against the stop shoulder furnished by the collar 82. An annular filler 85 is interposed between the raceway and the base 61, and these parts are drawn tightly together by a nut 86 on the threaded end of the shaft base 83 beyond the base 61.

A hollow sleeve 87 is mounted at its left end over the outer raceway of the bearing 84 and abuts against a brake collar 88 loosely surrounding the shaft base 83. There are four pins 89 mounted in the collar 88 and extending into corresponding recesses in the end of the sleeve 87, so that the collar 88 is driven in rotation by the

sleeve. A stationary brake member 90 surrounds the shaft 83 loosely and extends all across the base 61 to be mounted in the same fashion on another similar shaft 83 not shown in Fig. 8, and is thus held against rotation about either shaft 83. A plurality of compression springs 91 housed in corresponding bores in the base 61 urge the stationary member 90 against the rotating member 88 to prevent the reel 65 mounted on the sleeve 87 from overrunning and to provide the necessary tension on a strand drawn from the reel. Each of the springs 91 is backed by a plug 92 sliding in the corresponding bore and these plugs 92 are adjusted in and out of the bores and are held in adjusted position by abutting at their left hand ends against a threaded collar 93 mounted on the externally threaded surface of the nut 86. Each plug 92 is hemispherically rounded at its outer end and the collar 93 is provided with a plurality of corresponding recesses or apertures 94 so that the ends of the plugs yieldingly prevent accidental rotation of the collar 93.

The outer or right hand end of the sleeve 87 is mounted on the outer raceway of an anti-friction bearing 95 whose inner raceway is secured on the outer end of the shaft 81 by a nut 96. An oil cap 97 is held in place within the end of the sleeve 87 by a snap ring 198.

The sleeve 87 is formed near its left end with a conical wedge portion 98 dimensioned to enter the central bore of the reel 65 to hold and support the left side of the reel. The right side of the reel is held and supported on a corresponding conical wedge 99 formed on a sleeve 100 threadedly supported on the correspondingly threaded outer or right end of the sleeve 87 and which may be screwed in or out on the sleeve 87 to grip or release the reel. A cap 101 is formed to fit over the body of the sleeve and is connected to the sleeve to be longitudinally slidable thereon but rotationally locked thereto by one or more bolts 102 mounted in the cap and slidable in corresponding bores in the sleeve body 100. These bores are enlarged at their left hand ends to receive compression springs 103 surrounding the bolts and held between the nuts 104 of the bolts and the shoulders of the bores. Thus the cap 101 is held yieldingly pressed to the left with the inner surface of the end wall of the cap pressed against the extreme end face of the sleeve 87.

This end face of the sleeve 87 and the corresponding part of the end wall of the cap 101 are formed with coacting serrations held in engagement by the springs 103, which prevent the cap 101 from being rotated to withdraw the sleeve 100 from the reel 65 unless the cap be drawn away from the sleeve 87 against the tension of the springs 103, but which serrations act in ratchet fashion to permit the cap to be rotated to advance the sleeve 100 into the reel.

The conductor tapes 14 or the armor tapes 12 or both are connected in any suitable fashion not shown to one side of an appropriate electrical circuit also not shown, the other side of which circuit is connected to the lead 36 and so to the contact 34. This circuit then serves to detect any accidental short circuit between the axial conductor 18 and the coaxial cylindrical conductor 14, 14.

The apparatus herein disclosed is illustrative of one form of embodiment of the invention only and may be widely modified and departed from in many ways without departing from the spirit and scope of the invention as pointed out in and limited solely by the appended claims.

What is claimed is:

1. In a strand handling apparatus, strand guiding means comprising a body having an outer conical surface and a central bore coaxial with the conical surface, the said body being also formed with a guide slot cut into the conical surface in a plane tangent to a core strand passing through the central bore.

2. In a strand handling apparatus, strand assembling means comprising a body having an outer conical surface and a central bore coaxial with the conical surface, the said body being also formed with a plurality of guide slots cut into the conical surface, each slot lying in one of a plurality of planes tangent to and enveloping a core strand passing through the central bore.

3. In a strand handling apparatus, strand assembling means comprising a body having an outer conical surface and a central bore coaxial with the conical surface, the said body being also formed with a plurality of guide slots cut into the conical surface, each slot lying in one of a plurality of planes tangent to and enveloping a core strand passing through the central bore, and the slots being equally spaced apart around the bore.

4. In a strand handling apparatus, strand assembling means comprising a body having an outer conical surface and a central bore coaxial with the conical surface, the said body being also formed with a plurality of guide slots cut into the conical surface, each slot lying in one of a plurality of planes tangent to and enveloping a core strand passing through the central bore in combination with an intertwisting die to receive the core strand passing through the central bore and a plurality of cover strands passing respectively through the slots, to intertwist the cover strands about the core strand.

5. In a strand handling apparatus, strand assembling means comprising a body having an outer conical surface and a central bore coaxial with the conical surface, the said body being also formed with a plurality of guide slots cut into the conical surface, each slot lying in one of a plurality of planes tangent to and enveloping a core strand passing through the central bore in combination with means to supply the core strand to the central bore, means to supply a cover strand to each of the slots, and an intertwisting die to receive the core strand passing through the central bore and a plurality of cover strands passing respectively through the slots, to intertwist the cover strands about the core strand.

6. An apparatus for assembling strands, comprising means to supply a core strand, means to supply a pair of flat tape-form strands, and means to serve the two tape strands on the core strands in helical windings with the turns of one of the tape strands superimposed upon the adjacent edges of adjacent turns of the other tape strands, the said serving means including a hollow shaft having a pair of radial slots in the wall thereof, and a pair of sleeve-like guide members mounted on shaft and having each its end toward the other formed with a step whereby the two guide members define therebetween a pair of mutually offset tape guiding slots over the pair of radial slots in the shaft.

7. An apparatus for assembling strands, comprising means to supply a core strand, means to supply a plurality of strands of flat Z-shaped cross section, means to supply a pair of flat tape

form strands, means to guide the core strand and the Z-strands to an intertwisting point and to interrelate the Z-strands in shiplap fashion about the core strand, comprising a body having an outer conical surface and a central bore coaxial with the conical surface to receive and pass the core strand and the said body being also formed with a plurality of guide slots cut into the conical surface, each slot lying in one of a plurality of planes tangent to and enveloping a core strand passing through the central bore and adapted to receive and guide the Z-strands, means to intertwist the Z-strands into a closed walled tubular sheath about the core strand comprising an intertwisting die, and means to serve the two tape strands on the tubular sheath in helical windings with the turns of one of the tape strands superimposed upon the adjacent edges of adjacent turns of the other tape strands, the said serving means including a hollow shaft having a pair of radial slots in the wall thereof, and a pair of sleeve-like guide members mounted on shaft and having each its end toward the other formed with a step whereby the two guide members define therebetween a pair of mutually offset tape guiding slots over the pair of radial slots in the shaft.

8. In an apparatus for handling strands, a serving head comprising a rotatable base member, a plurality of strand supply means mounted thereon to rotate therewith, and a strand guide member coaxially mounted on the base member and comprising a body having an outer conical surface and a central bore coaxial with the conical surface, the said body being also formed with a plurality of guide slots cut into the conical surface, each slot lying in one of a plurality of planes tangent to and enveloping a core strand passing through the central bore.

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