Oct. 11, 1949. B. M. SHEPARD 2,484,055

CORE REPLACING APPARATUS AND METHOD FOR STRANDED CABLES

Filed Jan. 5, 1948

3 Sheets-Sheet 1

FIG. 1.

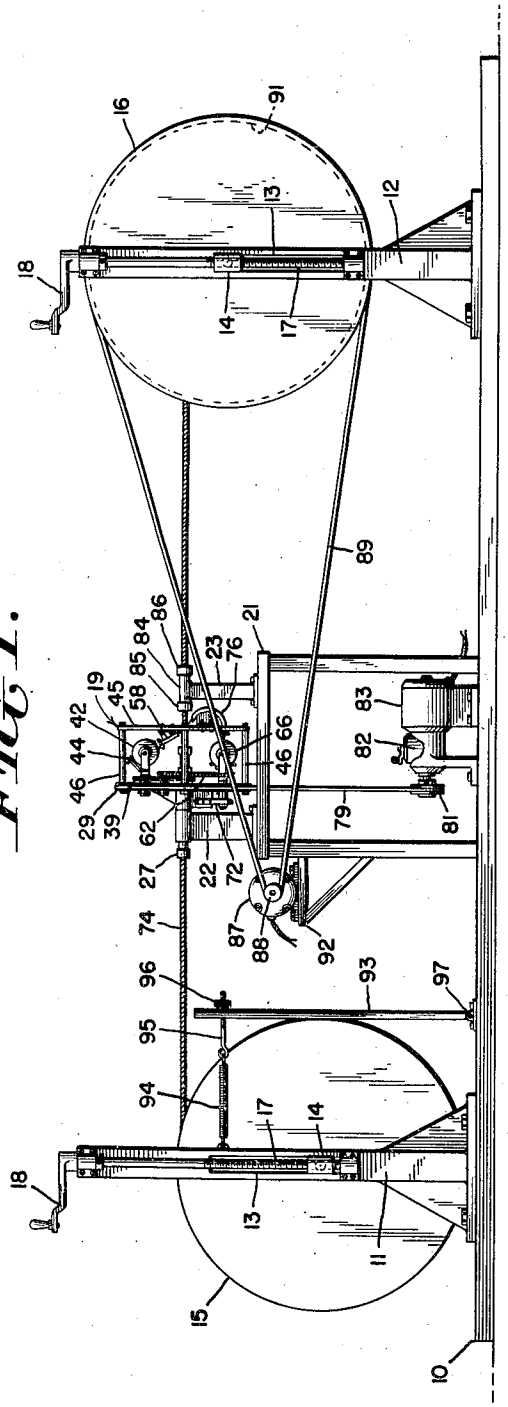


FIG. 5.

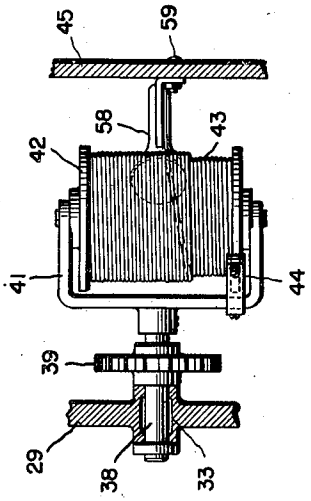
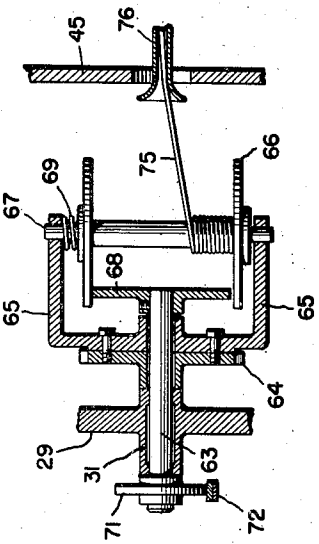


FIG. 4.



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3 Sheets-Sheet 2

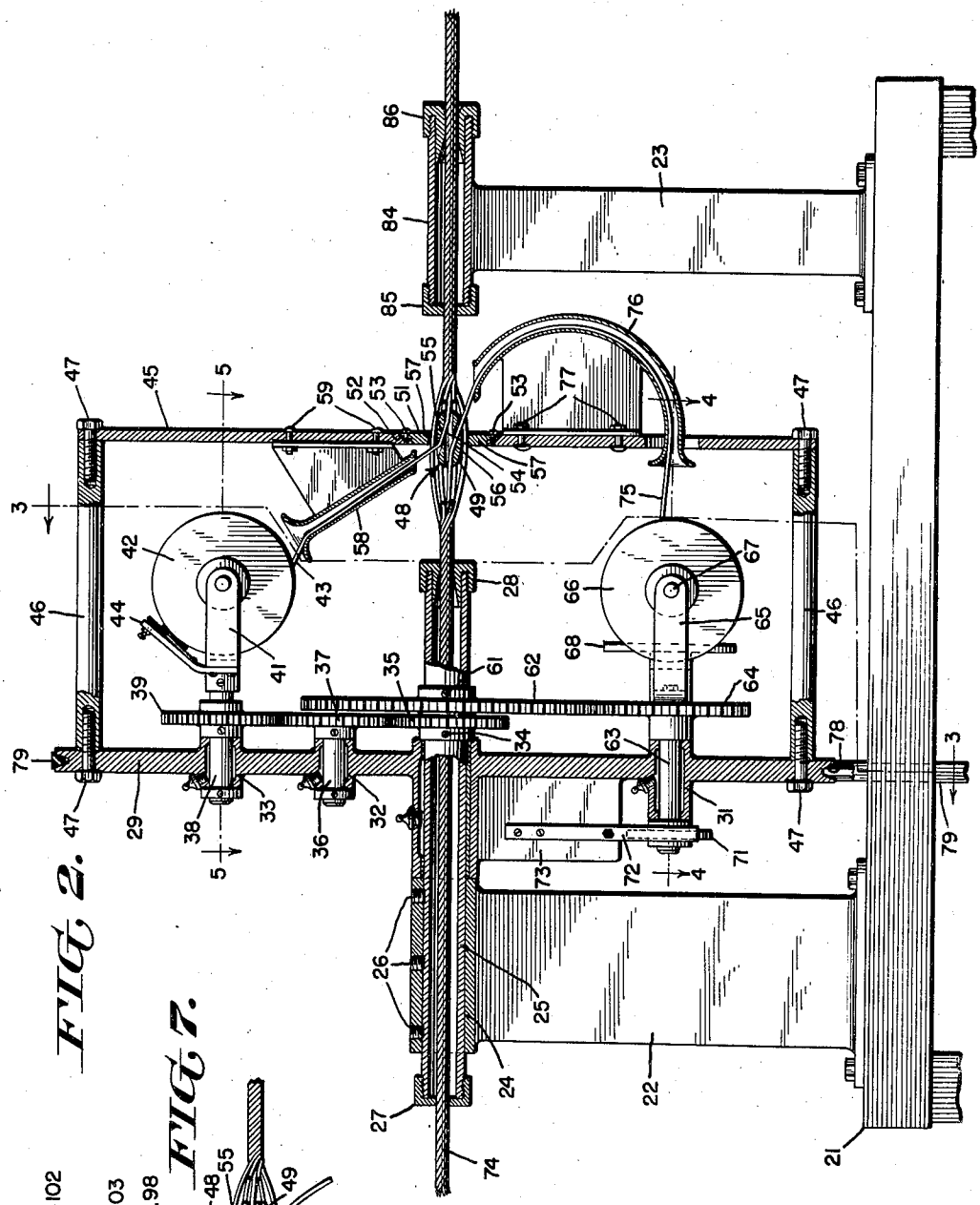


FIG. 2.

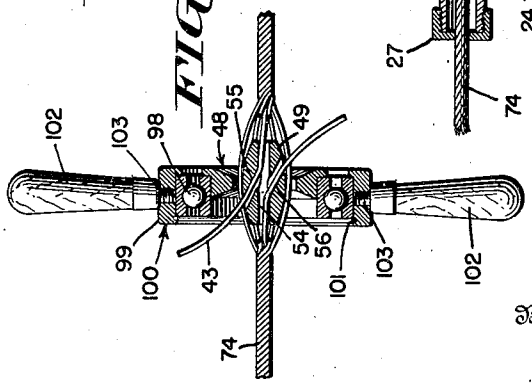


FIG. 7.

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CORE REPLACING APPARATUS AND METHOD FOR STRANDED CABLES

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FIG. 3.

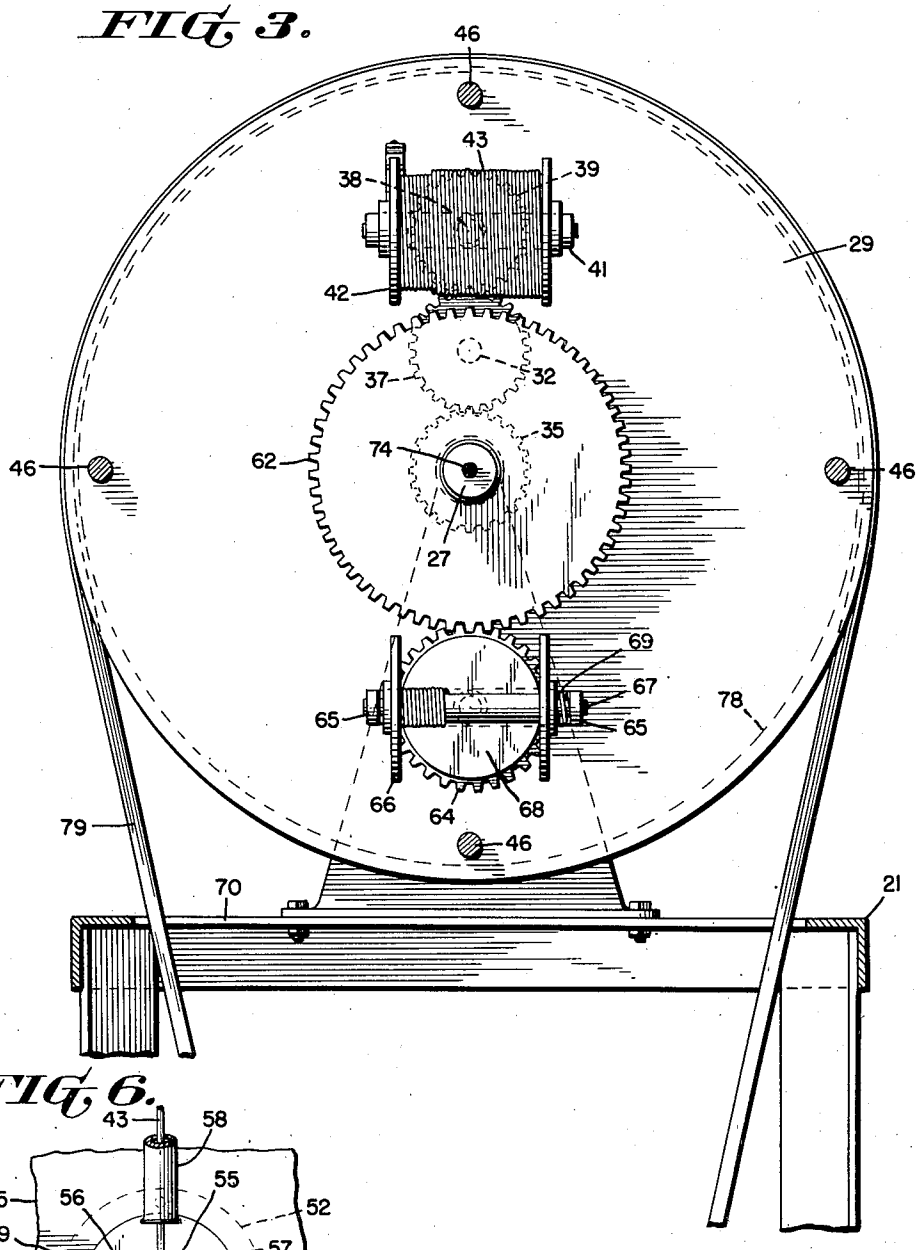
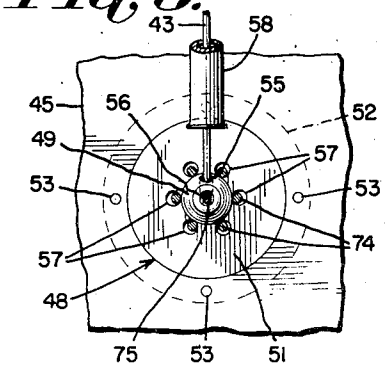


FIG. 6.



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CORE REPLACING APPARATUS AND METHOD FOR STRANDED CABLES

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Application January 5, 1948, Serial No. 476

10 Claims. (Cl. 57—1)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The present invention relates generally to devices for extracting and inserting the core of wire rope or cable. More specifically the invention relates to a method and apparatus for withdrawing the core of a conventional wire rope or cable and inserting in the place thereof a new core therefor or a core in the form of an insulated electrical conductor, or the like, by a continuous operation in which the rope or cable is fed from a paying out drum, run through a mechanism which interchanges the cores and wound on a receiving drum.

It heretofore has been found difficult in practice to accomplish the foregoing operations without entangling or twisting and breaking the cores.

The device of the present invention provides a simple means for avoiding such difficulty by passing the cable along the axis of a rotatable structure supporting a pair of spools for respectively receiving the discarded core and paying out the insulated electrical conductor. Further difficulty is avoided in arranging the core paying out and receiving spools in such a manner as to prevent twisting of the cores as they are fed into and extracted from the cable.

An object of the present invention is to provide a new and improved cable core extracting and inserting apparatus in which entanglement of the cores is avoided.

Another object is to provide a method and apparatus for interchanging the core of a stranded cable with an electrical conductor as the cable is fed between paying and receiving drums.

Another object is to provide a method and mechanism for interchanging cores in a stranded cable by momentarily separating the strands and simultaneously therewith extracting and inserting the interchanged cores as the cable is fed between paying and receiving drums.

Another object is to provide a method and hand operated device for practicing the method wherein the strands of a cored cable are momentarily separated and simultaneously therewith the core is removed and replaced with an insulated electrical conductor in response to relative movement between the device and the cable.

Another object of the invention is to provide a cable core extracting and inserting mechanism in which twisting and breaking of the cores is prevented.

Still another object is to provide a mechanism in which the strands of a cable are separated momentarily and simultaneously therewith the core of the cable is removed and an insulated electrical conductor is inserted in place thereof as the cable is fed from one drum to another.

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A further object is to provide a cable core extracting and inserting mechanism which is power driven and therefore is particularly adapted for use with cables of great length.

A still further object is to provide a cable core extracting and inserting mechanism which is simple in operation, economical to manufacture, and durable in use.

Still further objects, features and advantages of the present invention will become apparent to those skilled in the art from the following specification taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a view in side elevation of apparatus according to the preferred embodiment of the present invention and suitable for practicing the preferred method thereof;

Fig. 2 is an enlarged detail sectional view of the core interchanging mechanism per se;

Fig. 3 is a view in section taken substantially along line 3—3 of Fig. 2;

Fig. 4 is a view in section taken along line 4—4 of Fig. 2;

Fig. 5 is a view in section taken along line 5—5 of Fig. 2;

Fig. 6 is a face view of the strand and core separator, a portion of the supporting disc being shown; and

Fig. 7 is a sectional view of a hand operated device embodying an alternate form of the invention particularly adapted to be used with short sections of cable.

Referring more particularly to the drawings in which like numerals indicate like parts throughout the several views, there is provided a base 10 having mounted at each end thereof supports 11 and 12. The supports 11 and 12 are provided with elongated slots 13 receiving slide bearings 14. Cable drums 15 and 16 are rotatably mounted in bearings 14 of supports 11 and 12 respectively. Screws 17 individual to bearings 14 are constructed and arranged in such a manner with respect to supports 11 and 12 as to raise or lower the drums 15 and 16 upon turning the screw cranks 18 in the desired direction. This arrangement is for the purpose of raising drum 15 as the cable is payed out and of lowering drum 16 as the cable is wound thereon, thereby to maintain the cable in substantially a straight line condition as it passes into and out of the mechanism indicated generally at 19.

The mechanism 19 is supported by standards 22 and 23 on a table 21, the table, in turn, be-

ing mounted on base 10. Standard 22 has fixedly secured in the bore 24 thereof a tubular shaft 25 as by set screws 26. Shaft 25 is provided with faired cable guides 27 and 28 at the ends thereof. Rotatably mounted on shaft 25 is a pulley wheel 29 having bearing bores 31, 32, and 33.

Fixedly mounted on shaft 25 as by set screw 34 is a gear 35. A shaft 36 is mounted for rotation in bore 32 and carries a gear 37 which meshes with gear 35. A shaft 38 is mounted for rotation in bore 33 and has secured thereto gear 39 meshing with gear 37. Bifurcated support 41 is secured to one end of shaft 38. Core paying out spool 42 is pivotally mounted on the arms of the support 41 and carries a supply of cable core such, for example, as an insulated electrical conductor 43. A friction brake 44 is carried by one of the arms of support 41 and has an adjustable friction element which bears against the periphery of drum 42. The purpose of this arrangement is to prevent over-running of the drum as the cable core is drawn therefrom.

Disc member 45 is mounted in spaced relation to one side of pulley 29 by spacer rods 46, bolts 47 being inserted through bores in pulley 29 and disc member 45 and threaded into the ends of spacer rods 46. Mounted at the axis of disc member 45 is a core and strand separator indicated generally at 48 and having a hub portion 49 and a flange portion 51.

The flange 51 is secured in a recessed opening 52 in disc 45 by screws 53. Hub portion 49 has a central bore 54 and angular bores 55 and 56 communicating therewith. Arranged in the flange 51 and adjacent the hub is a plurality of bores 57. Aligned between the bore 55 and the drum 42 is a flared guide tube 58 having a bracket secured to disc 45 by bolts 59.

Fixedly mounted on shaft 25 by set screw 61 is a large gear 62. A shaft 63 is positioned in bore 31 of pulley 29 and has a small gear 64 loosely mounted thereon which is in meshing engagement with gear 62. The relative sizes of the gears are such that a two to one ratio is provided.

Secured to the gear 64 and adapted to rotate therewith is a bifurcated support 65. Core receiving spool 66 is supported in openings in supports 65 by a shaft 67. One of the flanges of spool 66 is brought into frictional engagement with a wheel 68 by means of a spring 69 sleeved about shaft 67 and interposed between one of the arms of support 65 and the hub of the spool.

Secured to the other end of the shaft 63 is a brake wheel 71 having a coacting brake 72 which may be generally similar to brake 44, the brake being supported by a web 73 integrally formed on pulley 29.

As will be apparent in Figs. 2 and 3 the gears 35, 37, and 39 are arranged in such a manner with a one to one ratio therebetween that as the pulley 29 is rotated the axis of drum 42 will always maintain a horizontal position as the drum travels in a planetary course about the axis of the pulley. The purpose of this arrangement is to prevent twisting of insulated conductor 43 as it is payed from spool 42, through guide tube 58, bores 55 and 54, and thence into the center of a cable 74.

It will also be apparent that gears 62 and 64 are arranged in such a manner that core receiving spool 66 will be rotated on shaft 63 two revolutions to one of the pulley 29. At the same time, spool 66 will be rotated on its shaft 67 as the pulley is rotated by reason of friction wheel 68 and brake 72 in a direction to wind in the discarded core 75 of cable 74. The ratio of the friction drive is such that the speed of rotation of spool 66 is greater than necessary to receive discarded core 75 for any effective winding diameter of the spool, sufficient slippage occurring between wheel 68 and brake 72 to maintain such winding speed as to prevent kinking or breaking of the core.

The drum turns two revolutions on shaft 63 to one of the pulley, as aforementioned, in order to prevent twisting of the core 75 as it passes from cable 74, through bores 54 and 56, through a guide tube 76 bracketed to disc 45 by bolts 77, and thence onto spool 66. The guide tube 76 differs from tube 58 in that it has a reverse bend causing two revolutions of the core for one of the pulley as the core passes toward the spool.

Pulley 29 has formed at the periphery thereof a groove 78 which receives a V-belt 79. The V-belt passes through a slot 70, Fig. 3, in table 21 to pulley 81 mounted on the shaft of change speed gear box 82 of electric motor 83. Thus, a drive is provided for the mechanism 19 which can be synchronized with the speed of the cable passing therethrough by proper adjustment of gear box 82.

Mounted on standard 23 is a tubular member 84 having faired guides 85 and 86 through which the cable 74 passes after leaving the core and strand separator 48.

The cable is then wound on drum 16. Power for rotating drum 16 is supplied by electric motor 87 having a pulley 88 mounted on the shaft thereof. Pulley 88 receives the V-belt 89 which is also passed around a flange of drum 16, a groove 91 being provided in the periphery of the flange for the V-belt. The motor 87 is mounted on a bracket 92 on table 21.

In the operation of the device of the present invention, the cable 74 is passed from drum 15 through the guides of tubular shaft 25. The individual strands of the cable are separated and are passed through bores 57 in core and strand separator 48. Core 75 of the cable is fed through central bore 54 and angular bore 56, through guide tube 76 and around the hub of spool 66.

Simultaneously therewith, insulated conductor core 43 is fed from drum 42, through guide tube 58, angular bore 55, central bore 54, and thus into the center of cable 74. The cable is reformed on the opposite side of core and strand separator 48 after which the cable is passed through the guides of tubular member 84 and thence around the hub of drum 16.

During the foregoing operation, drums 15 and 16 are raised or lowered by adjustment of cranks 18 to positions which bring the cable into alignment with the guides of members 25 and 84. The purpose of the foregoing is to provide a straight line pull on cable 74 through the guides of members 25 and 84.

In order to provide sufficient tension on cable 74, a brake bar 93 is brought against the periphery of drum 15 by spring 94 which is attached at one end to support 11, the other end being attached to eye-bolt 95 which passes through the bar 93 adjacent its upper end and has a tension adjusting nut 96 threaded thereon. The bar 93 is pivotally supported on the base 10 as at 97.

Motor 87 drives drum 16 thereby winding cable 74 thereon and drawing the cable through mechanism 19. The gear drives for spool supports 41 and 65 prevent the cores from twisting during the operation, thereby avoiding excessive straining or breakage of the cores.

Referring now to Fig. 7, a hand operated cable

core extractor and inserting device generally designated 100 is disclosed in which the core and strand separator 48 is mounted in a ball race 98 secured in a ring member 99 by a locking ring 101. Handles 102 having screw shanks 103 are threaded into the ring member. A core and strand separator is thus provided which is particularly adapted for hand operation on short lengths of cable where the entanglement of the cores is not a significant problem.

In the operation of device 100, as the device is moved along the length of the cable the cable strands are separated as a result of passing through the bores 57 of separator 48. The core to be discarded is fed through the bores 54 and 56 and out of the cable while the insulated conductor core passes through bores 55 and 54 and into the center of the cable, the cable being reformed on the other side of separator 48.

While the invention has been disclosed in particularity with respect to two examples thereof which give satisfactory results, it is, of course, understood that further changes and modifications may be made within the scope of the appended claims by those skilled in the art after understanding the invention without departing from the spirit and scope of the invention.

The invention herein described and claimed may be manufactured and used by or for the Government of the United States for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. Apparatus for separating the strands of a cable and simultaneously therewith replacing the core thereof, comprising a support, spaced paying out and receiving drums mounted on said support, means for driving the receiving drum thereby to draw the cable from the paying out drum, means for maintaining the cable in a straight line as it is drawn from the paying out drum on to the receiving drum, a strand and core separating structure mounted for rotation on the support intermediate said drums, said structure having an axial bore and a plurality of spaced bores concentrically arranged around said axial bore for receiving the core and the strands of the cable whereby the strands are separated from the core, a receiving spool for the core mounted on the separating structure, means including a lateral bore in the separating structure for guiding the core outwardly of the cable as it moves through a portion of the axial bore to the receiving spool, a paying out spool for a substitute core mounted on the separating structure, means including a second lateral bore in the separating structure for guiding the substitute core from the paying out spool into the cable through another portion of the axial bore, means for supporting said spools on the separating structure in such a manner to prevent twisting of the cores as they move between their respective spools and the cable, means for rotating the separating structure, means for driving the receiving spool as the separating structure rotates, and means for reforming the cable as it passes from the separating structure onto the receiving drum.

2. Apparatus for momentarily separating the strands of a cable and simultaneously therewith replacing the core thereof, comprising a support, a strand and core separating structure mounted for rotation on said support, means for rotating said separating structure, said separating structure having an axial bore and a plurality of bores disposed in spaced relation concentrically around the axial bore for respectively receiving the core and the strands of the cable thereby to separate the strands from each other and from the core, said structure having a first lateral bore communicating with said axial bore for cooperation therewith to guide the core from the cable through the strands while the strands are separated, said structure having a second lateral bore communicating with the axial bore for cooperation therewith to guide a substitute core into the cable through the strands while the strands are separated, a cable paying out drum mounted on the support and spaced from one end of the separating structure, a receiving drum mounted on the support and spaced from the opposite end of the separating structure, means for driving the receiving drum thereby to draw the cable through the separating structure, means for maintaining the cable in a straight line as it passes through the separating structure, and means supported on the separating structure for preventing twisting of the cores as they are moved into and out of the separated strands of the cable.

3. An apparatus for momentarily separating the strands of a cable and simultaneously therewith extracting the original core and inserting a substitute core therefor comprising, in combination, a support, a strand and core separating structure mounted for rotation on said support and having a pulley disc and a second disc spaced therefrom for rotation therewith, means for rotating said separating structure, said second disc having an axial bore therein and a plurality of bores concentrically disposed in spaced relation around the axial bore for respectively receiving the core and the strands of the cable thereby to separate the strands from each other and from the core, said second disc having a first lateral bore communicating with said axial bore for cooperation therewith to guide the original core from the cable through the separated strands and a second lateral bore communicating with the axial bore for cooperation therewith to guide the substitute core into the cable through the separated strands, a spool for paying out the substitute core, means for supporting said paying out spool on said pulley disc for rotation about an axis perpendicular to the paying out axis thereof and perpendicular to the plane of the pulley disc, means for maintaining said paying out axis parallel to said support as the pulley disc rotates thereby to prevent twisting of the substitute core as it moves into the cable, a spool for reeling in the extracted core, means for supporting the reeling in spool on the pulley disc for planetary travel about the cable in such a manner as to prevent twisting of the extracted core as it is wound on the reeling in spool, and means for driving the reeling in spool about the reeling in axis thereof in predetermined relation to the rotation of the pulley disc thereby to wind the extracted core on the reeling in spool and maintain the core taut between the cable and spool.

4. Core replacing apparatus for a stranded cable comprising, in combination, a support, a strand and core separating structure mounted on said support for rotation about said cable and having a pulley disc and a second disc spaced therefrom, means including a pair of spaced drums for drawing the cable therebetween and through said separating structure, means for rotating the separating structure in synchronism

with the spiral twist of the strands of the cable as the cable passes through the separating structure, said second disc having an axial bore and a plurality of bores arranged concentrically therewith and spaced thereabout for respectively passing the cable core and strands therethrough thereby to separate the strands from each other and from the core, said second disc having first and second lateral bores communicating with said axial bore for cooperation therewith to guide the original core and a substitute core therefor respectively from and into the cable through the separated strands, means for reforming the strands about the substitute core after the cable leaves the separating structure, a pair of spools for respectively reeling in and paying out the original and substitute cores, means for supporting said spools on said pulley disc for rotation about respective planetary axes perpendicular to their spool axes and perpendicular to the plane of the pulley disc, means for rotating the paying out spool about its planetary axis at the speed of rotation of the pulley disc and in the opposite direction therefrom thereby to prevent twisting of the substitute core as it moves into the cable, means for doubling back the original core as it leaves the cable and guiding it onto the reeling in spool, means for rotating the reeling in spool about its planetary axis the same direction and at twice the speed of the pulley disc thereby to prevent twisting of the core as it is wound on the reeling in spool, and means including a frictional over drive connection between the reeling in spool and the pulley disc for rotating the spool about its spool axis at sufficient speed to wind the extracted core in taut condition on the spool.

5. In a core extracting and inserting mechanism for use with spirally wound wire cables, the combination of a supporting structure, a cable feed drum, a cable receiving drum, substantially constant speed driving means for said cable receiving drum, means for supporting said cable drums in such a manner that the cable is maintained at a substantially horizontal position as it passes from the feed drum to the receiving drum, a rotatable structure positioned between said drums and having the cable passing therethrough, variable speed driving means for said rotatable structure whereby the rotation of the rotatable structure may be synchronized with the spiral winding of the cable strands passing therethrough, a cable strand and core separator fixedly mounted on said rotatable structure for rotation therewith and concentrically with respect to the axis of rotation thereof and having a plurality of bores for respectively passing the core and the strands of the cable in spaced relation therethrough as the cable passes through the rotatable structure, means for guiding the core of the cable outwardly thereof through the separated strands, means for guiding an insulated conductor into the cable through the separated strands, and means for reforming the strands about the conductor after the strands and conductor have passed through said separator.

6. An extracting and inserting mechanism for cable cores comprising, in combination, a cable paying out drum, a cable receiving drum, means for varying the vertical position of said drums, a fixed tubular shaft having guides adapted to receive the cable, a disc pulley rotatably mounted on said shaft, a gear fixed to said shaft, a pair of intermeshing planetary gears mounted on said disc pulley, said fixed and planetary gears being of the same size and one of said planetary gears meshing with the fixed gear, a core feeding spool mounted on the other of said pair of planetary gears with the axis of the spool perpendicular to the axis of the gear, said gears causing the spool axis to maintain a fixed horizontal position as the spool revolves planetarily about the axis of said disc pulley, a second gear fixed to said shaft, a third planetary gear rotatively supported on the disc pulley and intermeshed with said second fixed gear, said third planetary gear and said second fixed gear having a predetermined ratio whereby the third planetary gear is rotated in the same direction as the disc pulley and at twice the speed thereof, a core receiving spool mounted on said third planetary gear with the spool axis thereof parallel to the disc pulley, a plurality of spacers, a disc member secured by said spacers to said disc pulley and rotatable therewith, a strand separator coaxially mounted on said disc member and having a plurality of bores for respectively passing the core and the strands of the cable therethrough, said separator having diametrically opposed angular bores communicating with the bore individual to the core for guiding the original core and a substitute core therefor from and into the cable respectively through the separated strands, a straight guide tube interposed between one of the angular bores and the feed spool for guiding the substitute core therebetween, a curved guide tube having a reverse bend and interposed between the other one of the angular bores and the receiving spool for guiding the core therebetween, and means for driving said receiving drum.

7. The method of replacing the core of a stranded cable comprising, the steps of paying out the cable from a source of supply, guiding a length of the payed out cable in a straight line, separating the strands of a portion of said length of cable, extracting the cable core through the separated strands, doubling back the extracted core, reeling in the extracted core, rotating the extracted core about the cable in a direction and at a speed corresponding to the spiral winding of said strands and about a planetary axis at twice the speed and in the same direction as the rotation of the core about the cable, inserting a substitute core from a source of supply into the cable through the separated strands, rotating said source of supply of the substitute core about the cable in the direction and at the speed of rotation of the extracted core about the cable and about a planetary axis at the same speed of rotation thereof about the cable and in the opposite direction, reforming the cable about the substitute core, and reeling in the reformed cable.

8. Apparatus for momentarily separating the strands of a cable and simultaneously therewith extracting the original core and inserting a substitute core therefor comprising, in combination, a support, a strand and core separating structure mounted for rotation on said support and having a pulley disc and a second disc spaced therefrom for rotation therewith, means for rotating said separating structure, said second disc having an axial bore therein and a plurality of bores disposed in spaced relation around the axial bore for respectively receiving the core and the strands of the cable thereby to separate the strands from each other and from the core, said second disc having means for guiding the original core from the cable through the separated strands and means for guiding the substitute core into the cable through the separated strands, a first spool mounted on said pulley disc for paying out the

substitute core into its respective guiding means, a second spool mounted diametrically opposite to said first spool on said pulley disc for reeling in the original core from its respective guiding means, driving means for said spool operatively connected to said separating structure driving means and effective to prevent twisting of the cores during the paying out and reeling in operations, and means for drawing the cable through said structure.

9. Apparatus for separating the strands of a cored wire cable and simultaneously therewith extracting the original core thereof and inserting a substitute core therein comprising, a separating structure having a first disc and a second disc, means operatively connected to said first disc for rotating the disc, said second disc being attached to said first disc and rotative therewith, means for separating the strands of said cable, said separating means being mounted on the second disc axially thereof and fixed thereto for rotation therewith, guide means associated with said separating means for guiding the original core out of the cable while the strands are separated and for guiding the substitute core into the cable simultaneously therewith, a pair of spools operatively mounted on said first disc for respectively paying out the substitute core and reeling in the original core, means operatively connected to said disc rotating means for rotating said spools about the cable, means for maintaining said cores in an untwisted condition during the paying out and reeling in operations, and means for drawing the cable through said separating structure.

10. Apparatus for replacing the core of a cable

comprising, in combination, a base, a separator structure rotatably mounted on said base and constructed and arranged to pass the cable therethrough, said structure having a pair of interconnected discs, means for rotating said structure, a cable strand and core separator constructed and arranged to pass the cable therethrough and secured to one of said discs coaxially thereof for rotation therewith, said separator having an axial bore and a pair of radial bores communicating with said axial bore for respectively receiving and guiding the cable core out of the cable and a substitute core into the cable, said separator having a plurality of longitudinal bores spaced about the axial bore to receive respectively the individual strands of the cable thereby to space the strands for said movement of the cores into and out of the cable, means for drawing the cable through the separator, a pair of spools mounted for rotation on the other of said discs, means including one of said spools for reeling in the core of the cable as said separating structure rotates, and means including the other of said spools for paying out the substitute core as the separating structure rotates.

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