

July 8, 1941.

R. O. WILSON

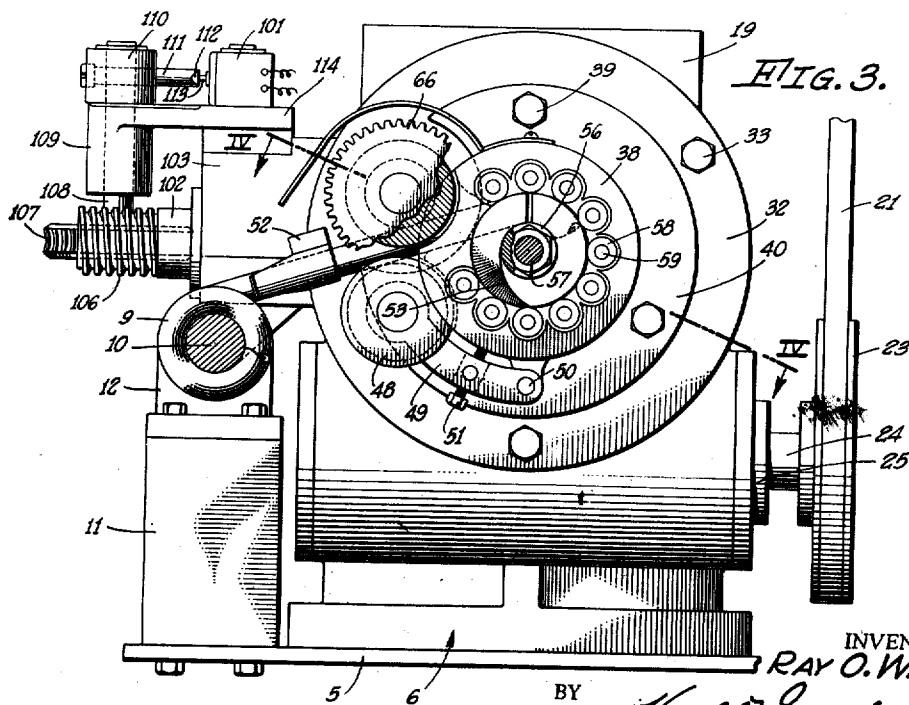
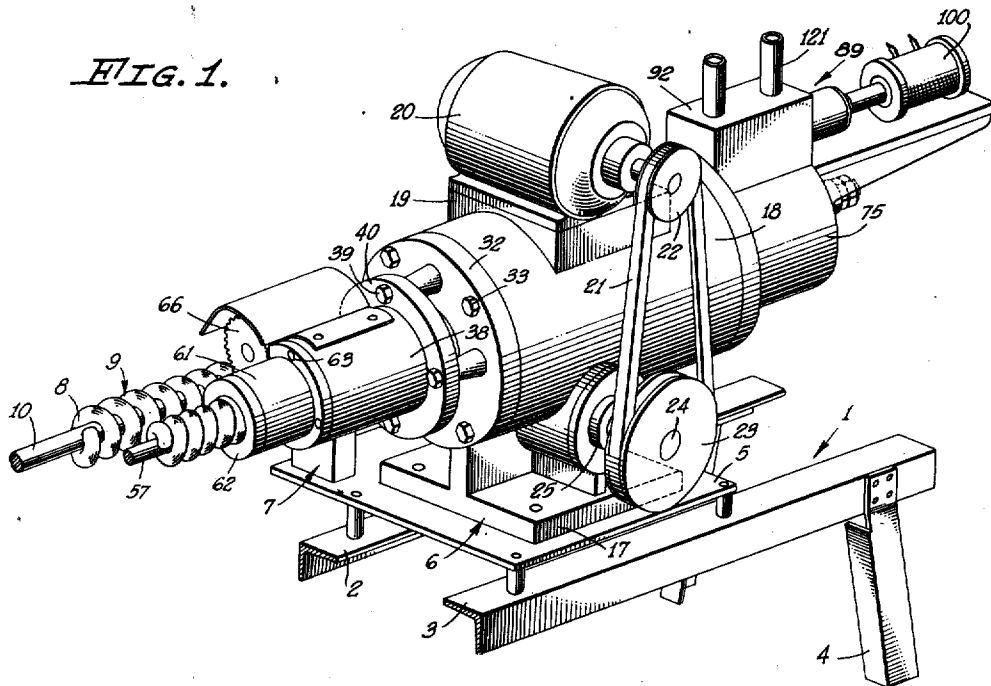
2,248,149

WINDING DEVICE

Filed Oct. 27, 1939

2 Sheets-Sheet 1

FIG. 1.



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2 Sheets-Sheet 2

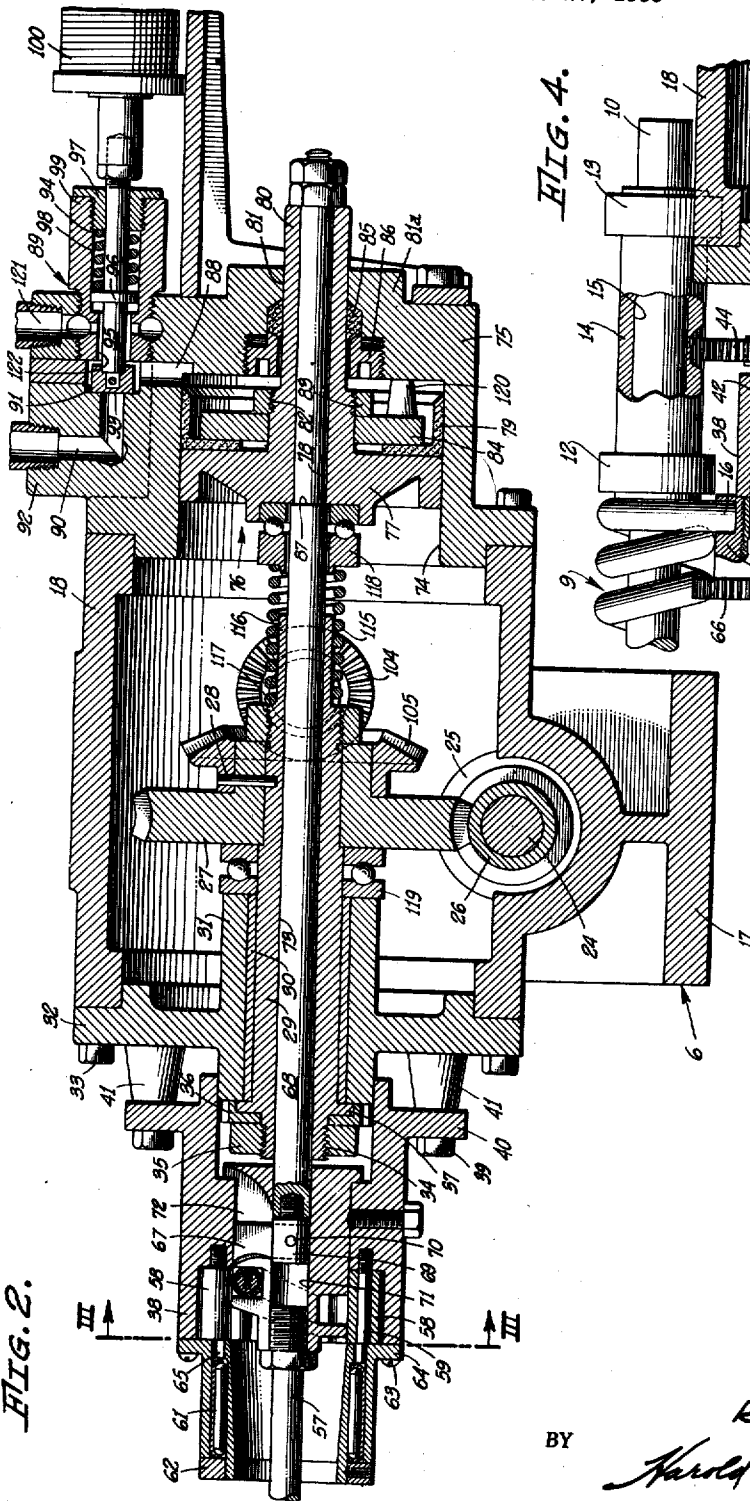
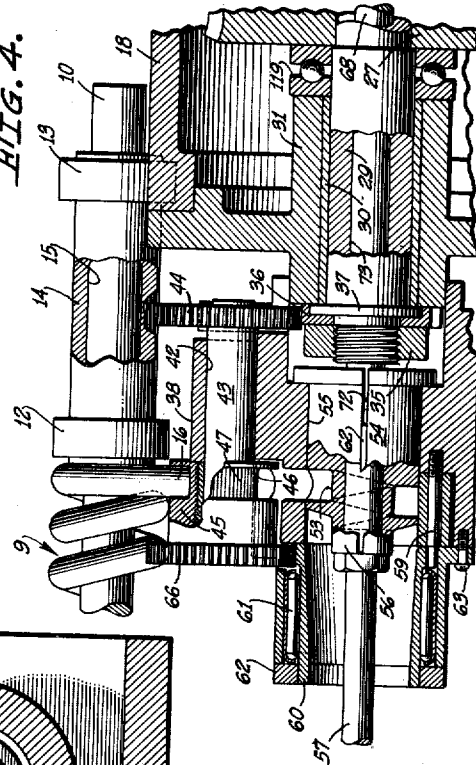


FIG. 2.

FIG. 4.



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WINDING DEVICE

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Application October 27, 1939, Serial No. 301,585

15 Claims. (Cl. 153—64)

My invention relates to a winding apparatus and has particular reference to an apparatus for rewinding a helically coiled member to reverse the pitch thereof.

In the manufacture of rubber insulated electrical conductors, such as extension cords and the like, it has been proposed to cure or vulcanize the rubber with the cord wound into an elongated helically coiled shape so that after curing and vulcanizing the cord would tend to remain in this coiled shape. It has been suggested that cords formed in this fashion would have the advantage of always being automatically extensible and retractable so as to just reach between the devices to which the opposite ends of the cord are attached. It is contended that the use of a cord of this type on an electric iron, for example, would provide for the cord extending between the electrical outlet and the iron without appreciable slack, thus permitting the iron to be moved to and fro while the cord extends and retracts to continuously take up the slack.

It has also been suggested that it would be very difficult to so form a helix of rubber or similar resilient material as to cause the helix to return after extension to a form in which adjacent loops of the helix are in close contact with each other, and it has been proposed to reverse the pitch of the helix after the forming thereof to increase the available restoring force and thus cause the adjacent loops of the reversed helix to lie in the desired close contact with each other.

It is accordingly an object of my invention to provide an apparatus for reversing the pitch of a pre-formed helically coiled resilient member.

It is also an object of my invention to provide an apparatus for making an extension device by reversing the pitch of a pre-formed helically coiled resilient member.

It is an additional object of my invention to provide an apparatus for re-winding a helically coiled resilient member in a reversed direction to reverse the pitch of the helix.

It is a further object of my invention to provide an apparatus of the character set forth in the preceding paragraphs in which means is provided for cutting the resilient member at predetermined spaced points along its length to provide a plurality of relatively short rewound helices from a single relatively long pre-formed helix.

It is also an object of my invention to provide an apparatus of the character set forth in the preceding paragraph in which the cutting operation is performed without perceptibly interrupting the re-winding operation.

It is an additional object of my invention to provide an apparatus of the character set forth in the preceding paragraph in which means is provided for controlling the linear length of member included in each of the rewound helices.

It is a still further object of my invention to provide an apparatus of the character set forth in the preceding paragraphs in which a means is provided for preventing jamming of the member in the re-winding apparatus.

It is also an object of my invention to provide an apparatus of the character set forth in the preceding paragraphs which includes means for feeding the resilient member about a stationary mandrel, a means for guiding the movement of the member to form a helix of reversed pitch, and a means for moving the rewound helix axially along the stationary mandrel.

Other objects and advantages of my invention will be apparent from a study of the following specifications, read in connection with the accompanying drawings, wherein:

Fig. 1 is a perspective view illustrating one form of the re-winding apparatus of my invention and showing the manner in which the pre-formed helix is supported and the manner in which the rewound helix is discharged from the machine;

Fig. 2 is a vertical longitudinal section through the apparatus shown in Fig. 1 and illustrating details of construction, particularly as regards the manner in which the cut-off tool is actuated;

Fig. 3 is an elevational view with parts shown in section, this view being taken substantially along the line III—III of Fig. 2 to illustrate the relative disposition of parts and the manner in which the resilient member is fed onto the forming mandrel; and

Fig. 4 is a fragmentary sectional view taken substantially along the line IV—IV of Fig. 3 to illustrate additional details of construction of the feeding, guiding, forming and cutting apparatus.

Referring to the drawings, I have illustrated herein the form of the apparatus of my invention which is particularly adapted to the re-winding of a helically coiled member in which the member comprises a rubber insulated electrical cord. As shown in Fig. 1 the apparatus may be supported at a convenient height above the floor or other working surface by means of a rack or framework 1 which includes a pair of spaced rails 2 and 3 carried upon a plurality of downwardly extending legs 4. Upon the rails 2 and 3 may be mounted a supporting plate 5 upon which is adapted to rest a re-winding apparatus 6 and a supporting device 7 upon which may be carried a resilient member 8 which has been wound into a helically coiled shape as indicated at 9.

In the manufacture of helically wound rubber insulated electrical cords it is proposed to wind a relatively great length of the cord 8 about a long cylindrical mandrel 10 prior to the curing or vulcanization of the raw rubber insulation which is placed about the electrical conductors.

It is proposed to thereupon cure or vulcanize the rubber so as to pre-form the member 8 into the helically coiled shape 9.

The supporting structure 7 may accordingly include a pair of uprights 11 upon which is mounted bearings 12 and 13 (see Figs. 3 and 4). Extended between these bearings and rotatably supported thereon is a short sleeve 14 having an internal bore 15 extending therethrough having a diameter such as to loosely and slidably receive the long mandrel 10 so that as one end 16 of the helically coiled member 8 is pulled from the mandrel 10 the mandrel and sleeve 14 may rotate within the bearings 12 and 13 while permitting the mandrel 10 to be progressively slid through the sleeve 14 to continuously dispose the feeding end of the helix 9 substantially adjacent the bearings 12. This accordingly provides for the maintenance of the feeding end 16 of the member 8 in a substantially fixed location relative to the re-winding apparatus 6 which is also carried by the supporting plate 5.

The re-winding apparatus 6 may include a base portion 17 upon which is carried a cylindrical housing 18 having a boss 19 formed on the upper side thereof to define a mounting space for an electric motor 20 or other suitable source of power. The electric motor 20 may be drivably connected to the re-winding apparatus by means of a belt 21 encircling a pulley 22 affixed to the shaft of the motor 20 and another pulley 23 secured to a drive shaft 24 which extends into the cylindrical housing 18 in a direction transverse to the longitudinal axis thereof.

As is shown in Fig. 2, the drive shaft 24 is journaled within the housing 18 as by means of bearings 25, a worm 26 being secured to the shaft 24 intermediately of the spaced bearings 25 and in a position to drivably engage a worm wheel 27. The worm wheel 27 is non-rotatably secured as by means of a pin 28 to a rotating sleeve 29 which is in turn journaled for rotation about an axis disposed parallel to the axis of the cylindrical housing 18 by means of a suitable bearing 30. The bearing 30 may be conveniently carried in its proper position by insertion into an elongated boss 31 formed on a housing cover member 32 which may be secured to one end of the housing 18 as by means of bolts 33. The bearing 30 comprises substantially the only support for the sleeve 29 and is consequently made relatively long relative to the length of the sleeve 29 so as to effectively prevent any transverse loads which are imposed upon the sleeve from causing a mis-alignment between the sleeve and the bearing 30.

The sleeve 29 is preferably reduced in diameter at its outer end and threaded as indicated at 34 to receive a nut 35 which may be screwed thereon to clamp a spur gear 36 between the nut and a flange 37 formed on the outer end of the sleeve 29. The spur gear 36 is intended to drive the feeding and winding apparatus which effects the re-winding operation on the resilient member 8. This apparatus may be carried on a bracket member 38 which may be secured to the housing cover 32 by means of bolts 39 passed through a flange portion 40 of the bracket 38 and threaded into bosses 41 formed on the outer surface of the cover 32.

As shown in Fig. 4 the bracket 38 is bored as indicated at 42 to rotatably receive a short shaft 43. Upon one end of the shaft 43 is affixed a spur gear 44 of such size and disposed in such location as to mesh with the aforementioned

spur gear 36 carried by the sleeve 29. Upon the opposite end of the shaft 43 is mounted a feeding wheel 45 which has a groove 46 formed therein adapted to receive the resilient member 8. The bottom of the groove may be scored or otherwise suitably roughened as indicated at 47 to provide a substantial frictional contact between the feeding wheel 45 and the resilient member 8. The resilient member 8 may be forced into firm engagement with the bottom of the groove 46 by means of a grooved idler wheel 48. This wheel may be mounted for adjustable movement toward and away from the feed wheel 45 by means of an arm 49 which is pivotally secured as indicated at 50 to the bracket 38 and which rotatably supports upon the other end the idler wheel 48. An adjusting screw 51 may be employed as desired to regulate the distance between the idler wheel 48 and the feed wheel 45.

It will be perceived that rotation of the electric motor 20 operates to likewise rotate the drive shaft 24 through the belted connection thereto and that rotation of the drive shaft 24 will be translated into rotation of the sleeve 29 within its bearing 30. The sleeve 29 being drivably engaged with the feeding wheel 45 through the spur gears 36 and 44 thus operates to rotate the feeding wheel 45. The direction of rotation of the motor 20 is so chosen as to cause the feeding wheel 45 to rotate in a direction to feed the length of resilient material 8 toward the center of the overhung bracket member 38.

Suitable alignment of the feeding end 16 of the resilient member 8, the feed wheel 45 and the idler wheel 48 may be insured by the employment of a guiding shoe 52. This shoe may, if desired, comprise a funnel-shaped member having a bore therethrough adapted to freely pass the resilient member 8 and is disposed in alignment with the groove 46 in the feeding wheel 45.

As the end 16 of the resilient member 8 is fed toward the center of the overhung bracket 38 by the feeding wheel 45 it is received in a helical channel 53 which is formed in the exterior of a plug member 54 received in an enlarged bore 55 provided in the overhung bracket 38. The bore 55 is preferably disposed in axial alignment with the sleeve 29. The channel 53 which is formed about the exterior of the plug member 54 preferably makes one full turn so as to guide the end 16 of the resilient member about one full helical turn in the desired direction of re-winding. The outermost end of the plug member 54 is reduced in diameter as indicated at 56 and threaded to receive a stationary mandrel 57. The mandrel 57 is provided with a diameter slightly smaller than the desired inside diameter of the helical shape into which the resilient member 8 is to be rewound.

I prefer to provide a means for reducing the friction between the resilient member 8 and the outer walls of the bore 55 during the time the resilient member 8 is being fed around the helical groove 53. For this purpose a plurality of rollers 58 may be employed. The rollers 58 may be disposed in such locations as to define a circle having a diameter substantially equal to the desired exterior diameter of the helical coil to be formed by re-winding the resilient member 8. Each of these rollers is accordingly preferably rotatably supported upon a pin 59 which is threadedly engaged with the body portion of the overhung bracket 38.

It will be observed that as the length of the

resilient material 8 is fed into the re-winding apparatus by the feeding wheel 45 an entering end thereof is guided about the first turn of the desired helical shape by means of the helical groove 53 and that continued operation of the feeding wheel 45 will continue to wind the length of resilient material into a helical shape to force the end thereof outwardly along the stationary mandrel 57.

It has been found that improved re-winding can be achieved by employing a means which tends to also pull the resilient material along the helical path defined by the groove 53. For this purpose I employ a rotating sleeve 60 which is mounted concentrically with the mandrel 57 and supported for rotation by means of pin bearings 61 carried in a carrier 62 which may in turn be secured to the outermost end of the bracket 38 as by means of screws 63 passing through a flange portion 64 formed on the carrier 62. Rotation may be imparted to the sleeve 60 by forming gear teeth 65 upon the innermost end thereof in a position to be drivably engaged with a spur gear 66 carried on the outermost end of the counter-shaft 43.

The sleeve 60 is provided with a bore through which the rewound coil of resilient material is passed. This bore may, if desired, be tapered so as to have that end which is located nearest the guiding groove 53 slightly larger than the diameter of the opposite end thereof. The gear ratios between the gear 66 and the gear formed by the teeth 65 is so adjusted as to provide a peripheral speed of the sleeve which is somewhat higher than the peripheral speed of the resilient material as it is fed along the mandrel 57.

Should the coils of the rewound material tend to expand sufficiently to bring the outermost surfaces thereof into contact with the walls of the sleeve 60, the frictional engagement between these walls and the resilient material will tend to cause additional winding of the material about the mandrel 57 so as to tend to reduce the diameter of the coil thus formed and also tend to pull the resilient material through the guiding channel 53 as it is fed by the feeding wheel 45.

It will be seen that this device eliminates all possibility of the material jamming within the machine since the driving operation of the sleeve 60 serves not only to tend to pull the material through the guiding channel but also to reduce the diameter of the coils to a point where they no longer engage the interior walls of the sleeve 60. On the other hand, the pushing of the material into the guide channel 53 by the feeding wheel 45 tends to increase the diameters of the coils to prevent their dragging against the exterior of the stationary mandrel 57. It will be seen that these two tendencies are automatically balanced in such manner as to provide for free and ready discharge of the helical coil from the machine as it is formed by the machine.

It is intended that the length of resilient material 8 which is included in each of the pre-formed helical coils 9 which are to be rewound by the previously described re-winding apparatus be as long as can be conveniently handled during the pre-forming operation. This length will, in most cases, be much greater than the desired length of material to be included in each of the rewound helical extension members and I, therefore, prefer to include in my apparatus a cutting device for cutting the resilient member 8 into such lengths as may be desired. This cutting operation may be readily performed by means of a

cutting knife 67 which is secured in one end of a slidable rod 68 as by means of a screw 69 threaded into the end of the rod 68 and split or slotted to receive the cutting blade 67. The blade 67 may be secured in the slot formed in the screw 69 as by means of a pin 70. The slidable rod 68 is mounted for axial slidable movement by providing a bore 71 which may constitute an extension of the bore in which the mandrel 57 is threadably received.

The plug member 54 is slotted as indicated at 72 to provide a guide which defines a path of movement for the blade 67 extending completely across one portion of the guiding channel 53 so that movement of the blade 67 to the left from the position illustrated in Fig. 2 will cause the blade to pass completely across that portion of the channel 53 and sever the resilient member at that point.

The slidable rod 68 is supported for axial slidable movement by means of the aforementioned bore 71 and also by means of a coaxial bore 73 provided in the sleeve 29. The rod 68 is preferably extended through the bores 71 and 73 and co-axially through a pneumatic cylinder 74 which may be formed within a cylinder block 75 secured in axial alignment with the housing 19 and disposed at the end thereof opposite to the end which is employed to support the previously described re-winding apparatus.

A piston 76 is slidably received within the cylinder 74, the piston 76 including a piston body 77 having a bore 78 therethrough for passing the end of the rod 68 and being adapted to slide within the cylinder 74. A pneumatic seal between the piston body 77 and the walls of the cylinder 74 may be achieved through the use of a cup leather 79 or similar packing element. For securing the cup leather in position the piston body 77 is preferably provided with a tail-piece 80 which passes through a bore 81 formed in a cylinder head portion 81a of the cylinder block 75 and serves as a guide for guiding the movement of the piston and the rod to which it is attached. The tail-piece 80 may be threaded as indicated at 82 and a nut and washer arrangement 83-84 may be employed to clamp the cup leather 79 against the inward face of the piston body 77.

Pneumatic leakage through the bore 81 may be prevented by employing a packing gland which includes a packing member 85 surrounding the tail-piece 80 and adapted to be clamped into sealing engagement therewith by means of a packing nut 86.

Sliding movement of the piston 76 to the left as viewed in Fig. 2 may be imparted to the slidable shaft 68 by forming that portion which is received in the bore 78 with a smaller diameter than the balance of the shaft so as to define a shoulder 87 against which the piston body 77 may bear. This sliding movement of the piston 76 to move the blade 67 into cutting relationship with the resilient member 8 may be caused by admitting a pneumatic fluid under pressure (for example, compressed air) into the space between the piston 76 and the cylinder head 81a. I accordingly provide an air passage 88 which communicates between the cylinder 74 and a control valve indicated generally at 89. The control valve may include an air supply port 90 which extends into communication with a valve chamber 91, the valve chamber 91 and the supply port 90 being formed in a valve body 92. The air passage 88 is also extended into com-

munication with the valve chamber 91 so that compressed air supplied through the supply port 90 may be conducted through the passage 88 to effect the desired sliding movement of the piston 76.

Admission of the air into the passage 88 may be controlled by means of a valve member 93 which is adapted to be pressed into sealing relationship with the end of the supply passage 90 by means of a compression spring 94 disposed in encircling relationship with a valve stem 95. The valve stem 95 is secured to the valve member 93 and carries a flange portion 96 against which one end of the spring 94 may bear, the other end of the spring 94 bearing against a bored plug member 97 threadedly engaged with a bore 98 formed in a boss 99 and adapted to receive the spring 94.

It will be seen that should the valve stem 95 be retracted against the restoring force of the spring 94 so as to place the supply passage 90 into communication with the air passage 88, the flow of pneumatic fluid under pressure into the space between the piston 76 and cylinder head 81a would operate to move the piston 76 to the left as viewed in Fig. 2 and effect a cutting operation of the resilient member 8. This retraction of the valve member 93 may be accomplished by coupling a solenoid 100 to the protruding end of the valve stem 95.

Actuation of the solenoid at the properly timed intervals to cut the resilient member 8 into the desired lengths may be accomplished by interposing in the electrical circuit for the solenoid 100 a control switch 101 which is adapted to be closed at intervals the length of which are in turn controlled by the amount of resilient member 8 which has been fed past the cutting member 67.

Such a control of the switch 101 may be derived by means of a switch actuating mechanism which includes a counter-shaft 102 extending transversely into the main housing 18. The counter-shaft 102 is journaled for rotation within a boss portion 103 of the housing 18 and carries on its inward end a bevel gear 104 drivably engaged with a similar bevel gear 105 which may be secured to the aforementioned worm wheel 27 by means of the pin 28. The exterior end of the counter-shaft 102 is provided with a worm 106 adapted to drive a coacting worm wheel 107.

The worm wheel 107 is secured to a vertically disposed shaft 108 which is journaled for rotation in a bearing bracket 109 carried by the boss 103. Upon the upper end of the shaft 108 is affixed a thrust collar 110 adapted to prevent downward movement of the shaft 108 through its bearing 109. The thrust collar 110 may be secured to the shaft 108 as by means of a pin 111 which may also serve as a switch actuating means having an outer end 112 thereof disposed in a position to momentarily close the switch 101 once each revolution of the shaft 108 by engaging a switch trigger 113.

It will be observed that the amount of resilient material 8 which is fed past the cutter 67 for each revolution of the switch actuating means 111 is dependent upon the gear ratios embodied in the bevel gears 104-105 and the worm drive 106-107. Accordingly, the amount of material to be included in each cut length can be readily controlled by adjusting the gear ratio of the worm drive 106-107 and for this purpose I prefer to mount the switch 101 upon an extension 114 of the bearing bracket 109 and in turn slid-

ably secure the extension 114 to the boss 102 so that the spacing between the shaft 108 and the shaft 102 may be altered at will to accommodate different sizes of worm wheels 107.

It will be observed that whenever sufficient material has been rewound into the desired helical shape to cause the switch actuating device 111 to operate the control switch 101 to complete the circuit to the solenoid 100, air under pressure will be admitted to the cylinder 74 and cause the cutter 67 to be rapidly moved across the path of the resilient material 8 and sever this material.

The piston 76 and the cutter shaft 68 secured thereto may be retracted from this position by means of a compression spring 115 which is disposed in encircling relationship with the cutter shaft 68 and adapted to extend between the sleeve 29 and the piston 76. I accordingly provide an extension 116 on the sleeve 29, this extension having a smaller exterior diameter at this point so as to provide a shoulder 117 against which one end of the compression spring 115 may bear. Since the compression spring 115 is, in this fashion, caused to rotate with the sleeve 29 while the piston 76 is non-rotatably received within the cylinder 74, I prefer to interpose a thrust bearing 118 between the other end of the compression spring 115 and the piston body 77.

It will be observed that as soon as the circuit to the solenoid 100 is broken, the valve member 93 will be again moved into sealing relationship with the air supply passage 90 by means of the compression spring 94, thus permitting the main compression spring 115 to force the piston 76 and the cutter 67 carried thereby in a returning direction to their retracted position, the reaction force of the spring 115 tending to move the sleeve 29 to the left being absorbed in a thrust bearing 119 which is interposed between the worm wheel 27 and the inward end of the bearing boss 31. The movement of the piston 76 toward the retracted position may be arrested by means of a stop member 120 carried by the washer 84 in a position to engage the inner wall of the cylinder head 81a at the time the piston is moved to its retracted position.

The air which is displaced by this returning movement of the piston may be discharged through an exhaust 121 which is also extended into communication with the valve chamber 91. In order, however, to prevent the pneumatic fluid under pressure from passing from the supply passage 90 directly to the exhaust 121 during the time the valve stem 95 is retracted by the solenoid 100, I arrange the valve chamber 91 and the valve member 93 in such fashion that when the valve stem is retracted the valve member 93 will be moved into sealing engagement with a communicating passage 122 extended between the exhaust 121 and the valve chamber 91 so as to close off the connection between the valve chamber 91 and the exhaust 121.

I prefer to so construct the valve 93 as to cause the piston 76 to be moved in the cutting direction extremely rapidly and I also prefer to arrange the spring 115 in such fashion that the returning movement of the piston and the cutter may be made with equal rapidity. The control switch 101 is also preferably arranged so that the circuit to the solenoid 100 is closed for a sufficient length of time to cause the cutter 67 to completely sever the resilient member 8 and then to immediately open this circuit. By arranging the cutting mechanism in this fashion so that it may be extremely fast in its action, there will be no per-

ceptible interruption in the feeding of the resilient material 8 since the cutter merely darts across the path of the material and back again with such rapidity that there is caused substantially no slippage between the feeding wheel 45 and the resilient material 8.

From the foregoing it will be observed that I have provided a winding apparatus which is particularly adapted for the rewinding of a long length of resilient material which has been pre-formed into the shape of an elongated helical coil and that this apparatus is adapted to re-wind this resilient member in such direction that the pitch of the resulting helical coil is opposite to the pitch of the coil originally formed by the member. It will be apparent that this reversal is accomplished in the form of the apparatus described by rotating the original and rewound helix in the same direction while reversing the direction of propagation of the helix. It will be apparent, of course, that the same results could be achieved by reversing the direction of rotation of the two helices while maintaining the direction of propagation of the same.

It will be further observed that the device of my invention is adapted to automatically cut a relatively long length of resilient material into any number of desired short lengths during the rewinding operation without perceptibly interrupting this re-winding operation.

It will be further observed that the form of the machine which I have just described is characterized by the provision of a unique feeding device which is adapted to be responsive to the diameter of the helix formed by the re-winding operation and which functions to simultaneously push and pull the material through the helix forming portion of the machine to thus prevent any jamming of the material in the machine.

While I have described my invention as being embodied in an apparatus particularly adapted for the re-winding of a helical member comprising a rubber insulated electrical conductor, it is to be understood that this device may be employed for the manufacture of extension devices comprising a helically coiled resilient member in which the pitch of the coils of the helix are reversed after forming irrespective of the nature of the resilient member employed.

While I have shown and described the preferred embodiment of my invention, I do not desire to be limited to any of the details of construction shown or described herein, except as defined in the appended claims.

I claim:

1. In an apparatus for making extension devices from a resilient member which has been pre-formed into an elongated helical coil, the combination of: means for supporting said pre-formed coil for rotation about its longitudinal axis; and means engageable with one end of said coil for moving said end through a helical path having a pitch opposite to the pitch of said pre-formed coil.

2. In an apparatus for making extension devices from a resilient member which has been pre-formed into an elongated helical coil, the combination of: means for supporting said pre-formed coil for rotation about its longitudinal axis; a means defining a helical path having a pitch opposite to the pitch of said pre-formed coil; and means engageable with said resilient member for feeding said member from said pre-formed coil and about said helical path.

3. In an apparatus for making extension de-

vices from a resilient member which has been pre-formed into an elongated helical coil, the combination of: means for supporting said pre-formed coil for rotation about its longitudinal axis; a means defining a helical path having a pitch opposite to the pitch of said pre-formed coil; means engageable with said resilient member for feeding said member from said pre-formed coil and about said helical path; and means for confining said member in said path.

4. In an apparatus for making extension devices from a resilient member which has been pre-formed into an elongated helical coil, the combination of: means for supporting said pre-formed coil for rotation about its longitudinal axis; means defining a helical path having a pitch opposite to the pitch of said pre-formed coil; means for feeding said resilient member from one end of said pre-formed coil and about said helical path; and means for feeding said pre-formed coil in the direction of its longitudinal axis to continuously dispose said end in alignment with said helical path as said resilient material is unwound from said pre-formed coil.

5. In an apparatus for making extension devices from a resilient member which has been pre-formed into an elongated helical coil, the combination of: means for supporting said pre-formed coil for rotation about its longitudinal axis; means defining a helical path for said resilient member having a pitch opposite to the pitch of said pre-formed coil; a feeding means disposed between said path and said coil and engageable with said resilient member to push said resilient member about said helical path to re-wind said member into a helical coil; rotatable sleeve means disposed in a position to receive said rewound helical coil as it is discharged from said path; and means for rotating said sleeve member in the direction of rotation of said rewound coil and at a speed higher than the peripheral speed of said rewound coil.

6. In an apparatus for making extension devices from a resilient member which has been pre-formed into an elongated helical coil, the combination of: means for supporting said pre-formed coil for rotation about its longitudinal axis; a means defining a helical path having a pitch opposite to the pitch of said pre-formed coil; means engageable with said resilient member for feeding said member from said pre-formed coil and about said helical path; and cutter means mounted for reciprocal movement across said path to cut said member.

7. In a winding apparatus for winding an elongated member into a plurality of elongated helical coils, the combination of: means for supporting a supply of said member; means engageable with said member for feeding said member from said supply and winding said member into a helical coil; cutter means mounted for reciprocal movement across the path of movement of said member to cut said member; and actuating means for said cutter means responsive to feeding of predetermined amounts of said member to reciprocate said cutter and cut said member into predetermined lengths.

8. In an apparatus for making extension devices from a resilient member which has been pre-formed into an elongated helical coil, the combination of: means for supporting said pre-formed coil; means engageable with said resilient member for feeding said member from said pre-formed coil and winding said member into a helical coil having a pitch opposite to the pitch

of said pre-formed coil; and means for cutting said member into predetermined lengths as it is fed from said pre-formed coil including a cutter mounted for reciprocal movement across the path of movement of said member, actuating means for so moving said cutter, and means responsive to the feeding of predetermined amounts of said member for controlling said actuating means.

9. In a rewinding device, the combination of: means for feeding an elongated member from a source of supply and about a helical path; a cutter mounted for reciprocal movement across the path of movement of said member; a cylinder; a piston connected to said cutter and movable in said cylinder for reciprocating said cutter; a source of pneumatic fluid under pressure; valve means for controlling admission of said pneumatic fluid to said cylinder; and control means for controlling the operation of said valve means including a means responsive to the feeding of a predetermined amount of said member past said cutter.

10. In an apparatus for making extension devices from a resilient member which has been pre-formed into an elongated helical coil, the combination of: means for supporting said pre-formed member for rotary movement in a specified direction about its longitudinal axis; means for feeding said member from one end of said pre-formed coil; means mounting said pre-formed coil for axial movement in one direction as said member is fed therefrom; means for guiding said member about a helical path to form a rewound helical coil rotating in said predetermined direction; and means for feeding said rewound coil axially in a direction opposite to the direction of axial movement of said pre-formed coil, whereby said member is rewound into a helical coil having a pitch opposite to the pitch of said pre-formed coil.

11. In a winding apparatus for winding an elongated member into a plurality of elongated helical coils, the combination of: means for supporting a supply of said member; means engageable with said member for continuously feeding said member from said supply and winding said member into a helical coil; cutter means mounted for reciprocal movement across the path of movement of said member to cut said member; control means actuable in response to feeding of predetermined amounts of said member past said cutter; and cutter drive means responsive to actuation of said control means for reciprocating said cutter with such rapidity as to cut said member without perceptibly interrupting said feeding thereof.

12. In a winding apparatus for winding an elongated member into an elongated helical coil, the combination of: means for supporting a supply of said member; feeding means for feeding said member from said supply in the direction of its length; a cylindrical housing member having an opening therein for receiving said member as it is fed from said feeding means; a plug member supported coaxially within said housing member; means on said plug member defining a helical groove thereabout having a cross section substantially identical with the cross section of said elongated member; and anti-friction means carried by said housing member and overlying said helical groove for confining said mem-

ber in said groove as it is fed therethrough by said feeding means.

13. In a winding apparatus for winding an elongated member into an elongated helical coil, the combination of: means for supporting a supply of said member; feeding means for feeding said member from said supply in the direction of its length; a cylindrical housing member having an opening therein for receiving said member as it is fed from said feeding means; a plug member supported coaxially within said housing member; means on said plug member defining a helical groove thereabout having a cross section substantially identical with the cross section of said elongated member; and anti-friction means comprising a plurality of rollers disposed with their axes parallel to the axis of said helical groove and carried by said housing member in a position extending across said groove to confine said member within said groove as it is fed therethrough by said feeding means.

14. In a winding apparatus for winding an elongated member into an elongated helical coil, the combination of: means for supporting a supply of said member; feeding means for feeding said member from said supply in the direction of its length; a cylindrical housing member having an opening therein for receiving said member as it is fed from said feeding means; a plug member supported coaxially within said housing member; means on said plug member defining a helical groove thereabout having a cross section substantially identical with the cross section of said elongated member; anti-friction means carried by said housing member and overlying said helical groove for confining said member in said groove as it is fed therethrough by said feeding means; and a stationary mandrel secured to said plug member and mounted coaxially therewith for receiving said helical coil as it is fed from said helical groove.

15. In a winding apparatus for winding an elongated member into an elongated helical coil, the combination of: means for supporting a supply of said member; feeding means for feeding said member from said supply in the direction of its length; a cylindrical housing member having an opening therein for receiving said member as it is fed from said feeding means; a plug member supported coaxially within said housing member; means on said plug member defining a helical groove thereabout having a cross section substantially identical with the cross section of said elongated member; anti-friction means carried by said housing member and overlying said helical groove for confining said member in said groove as it is fed therethrough by said feeding means; a stationary mandrel secured to said plug member and mounted coaxially therewith for receiving said helical coil as it is fed from said helical groove; a rotatable sleeve surrounding said mandrel and having an internal diameter substantially equal to the desired external diameter of said helical coil; and means for rotating said sleeve member in the same direction as said member is fed from said helical groove and at a peripheral speed greater than the speed of said feeding, whereby engagement between said rotatable sleeve and said helical coil operates to reduce the outside diameter of said coil and prevent jamming of said member within said groove.

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