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2,733,753

AUTOMATIC WIRE TAPING APPARATUS

Filed Nov. 23, 1951

4 Sheets-Sheet 1

FIG. 1

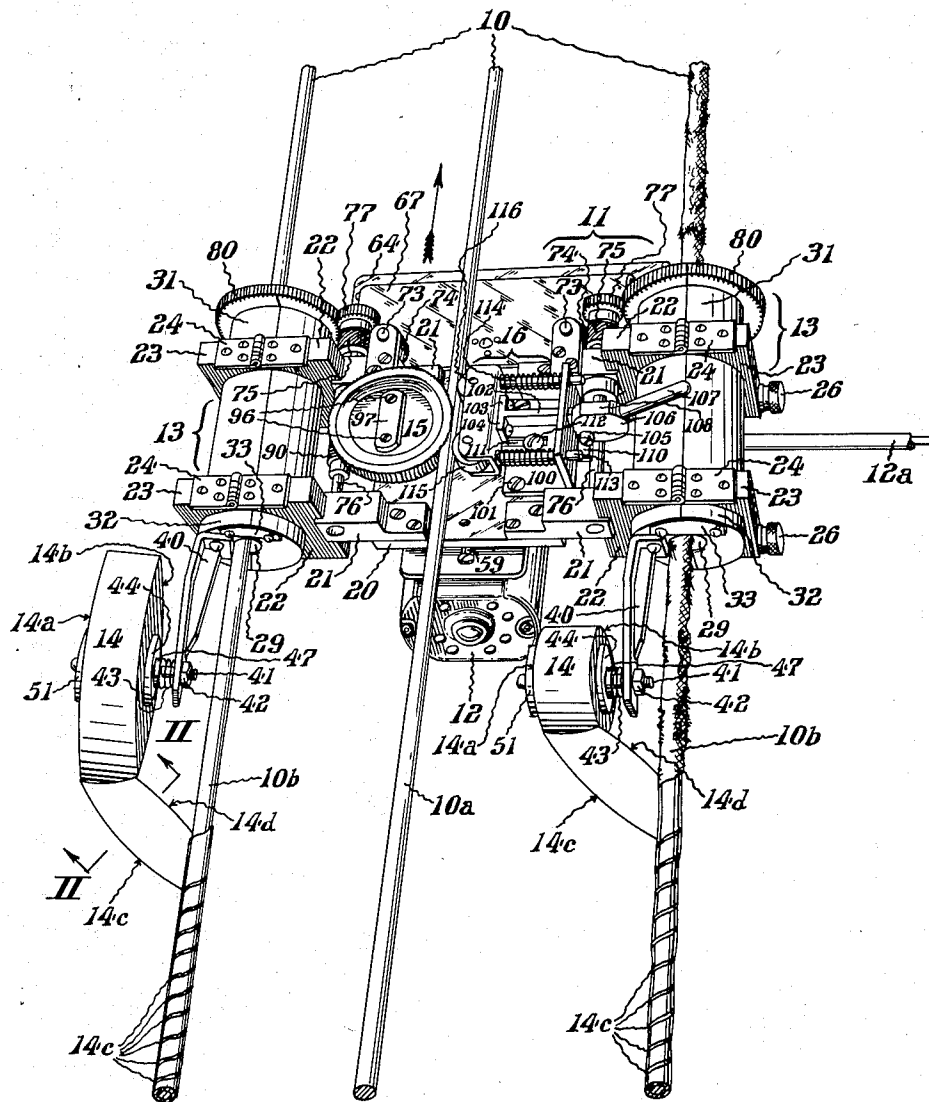
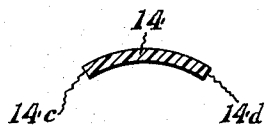


FIG. 2



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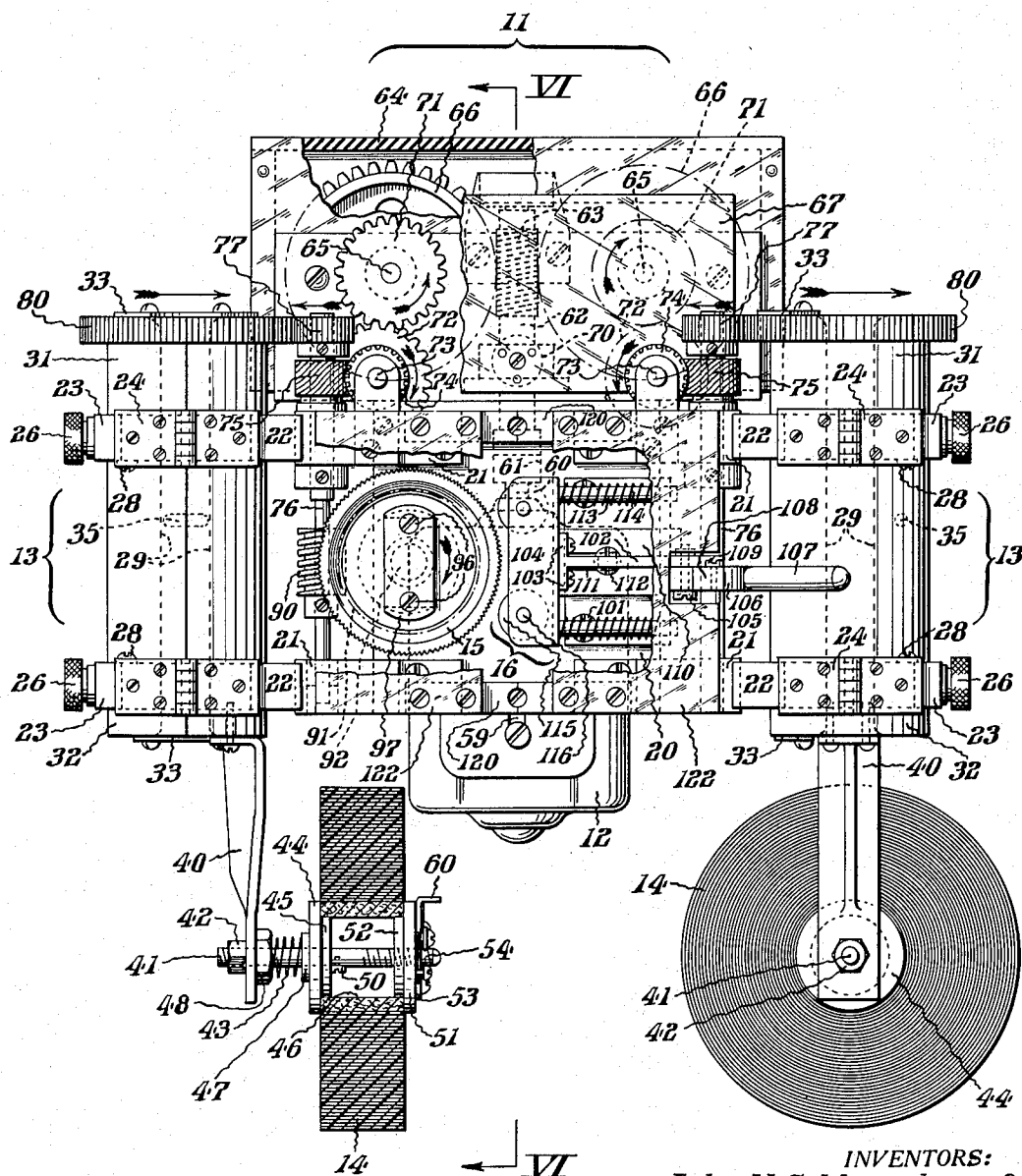
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FIG. 3.



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FIG. 4-

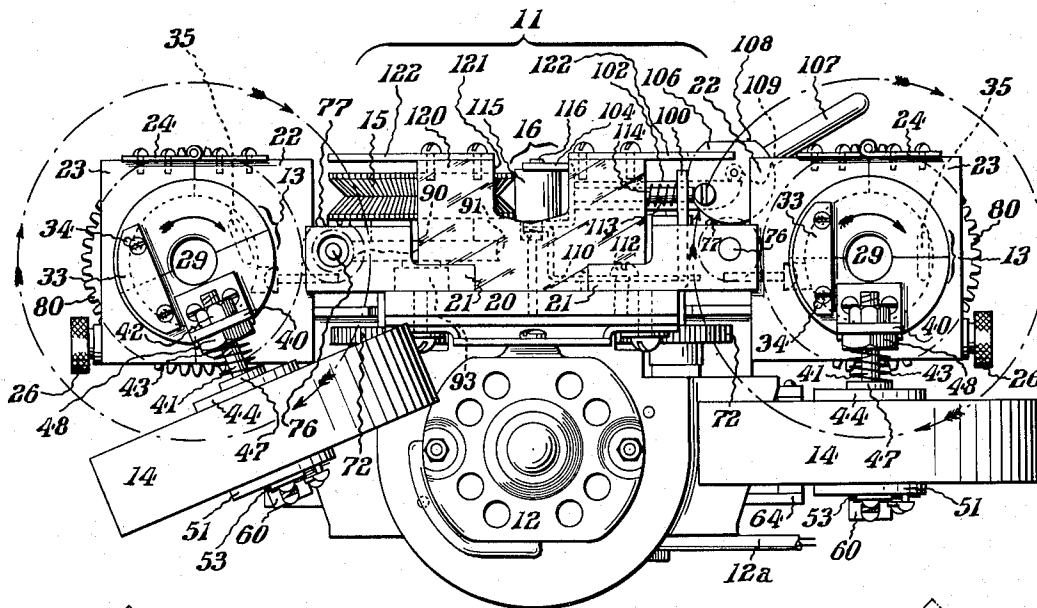
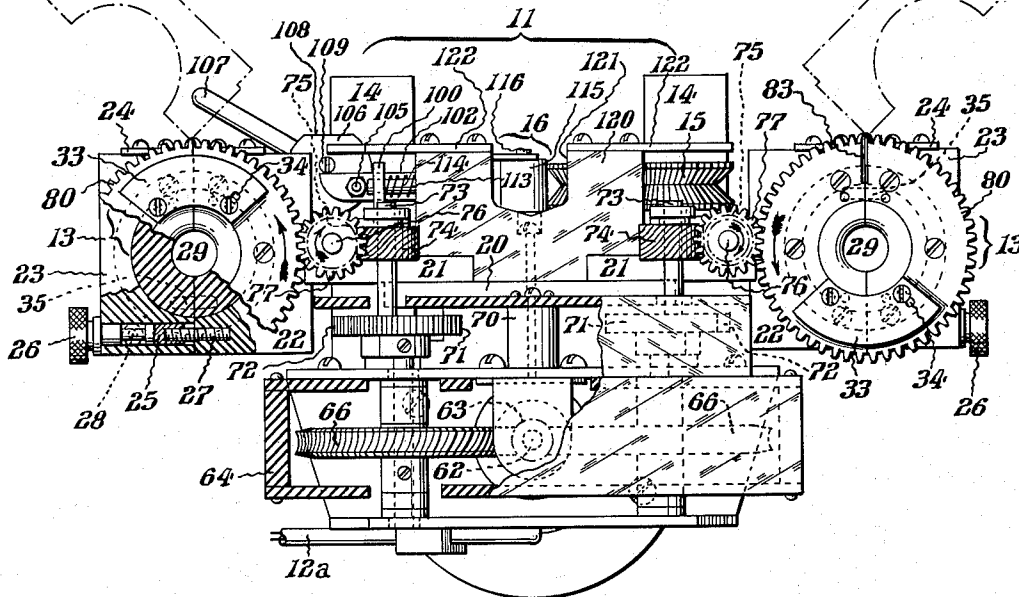


FIG. 5-



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AUTOMATIC WIRE TAPING APPARATUS

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5 Claims. (Cl. 154—1.8)

This invention relates to apparatus and method for applying covering to an elongate body such as wire, tube or the like. The invention further relates to the covered elongate body produced.

It has heretofore been conventional practice of electric service companies to remove and replace electric wires such as secondary bus installations, for example, when the insulation of such wires deteriorates. Since these wires are often subjected to severe weather conditions, deterioration has represented a serious problem due to high cost of removal and replacement. In many instances, the original insulation or covering of the wires is badly weather-beaten, while the wires themselves remain in good condition and have sufficient capacity for the intended purpose.

It has heretofore been proposed to cover electric wires with covering such as tape or the like, but this practice has not been followed to any great extent for insulating out-door electric wires prior to our invention, in that no simple, economical method or machine has been devised to apply the tape rapidly and securely to the wires without removing the wires from the supporting means therefor.

It is accordingly one object of our invention to provide a simple, economical apparatus and method for applying covering to an elongated body such as a wire or the like. Another object is to provide a covered elongate body in which the covering is effectively sealed around the wire.

While wire-taping machines have previously been proposed, these have been complicated and bulky, and have not been entirely successful for effecting the rapid taping of multiple-wire systems. It is accordingly another object of our invention to provide apparatus adapted to be suspended from the wires of a multiple-wire system with capacity to move continuously along the wires and to apply tape to a plurality of wires at one time. Still another object is to provide taping apparatus of this character capable of operating in confined places, and on wires disposed relatively close to one another.

Some of the wire taping apparatus and methods of the prior art have been characterized by their inability to apply the tape securely and permanently to the wire, particularly where irregularities are encountered in the surface of the wire being taped. Such irregularities may be in the form of badly deteriorated insulation, for example. It is accordingly a further object of the invention to provide apparatus and method for applying tape firmly and permanently to wire without removing deteriorated insulation therefrom. Another object is to apply tape to a wire which has an irregular outside surface, and to provide wire thus taped.

Still another object of the invention is to provide automatic wire taping apparatus capable of taping energized wires with safety. Another object is to provide a compact, stabilized wire-taping machine. Other objects and advantages of the invention will further become apparent hereinafter, and in the drawings, whereof:

Fig. 1 represents a view in perspective of a wire-taping machine constituting one embodiment of our invention,

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with certain cover and end plates removed in order to disclose important details;

Fig. 2 represents a sectional view of tape, taken as indicated by the lines and arrows II—II which appear in Fig. 1;

Figs. 3, 4 and 5 represent plan, rear and front elevations respectively, of the apparatus shown in Fig. 1; and

Fig. 6 represents a sectional view taken as indicated by the lines and arrows VI—VI which appear in Fig. 3.

Referring particularly to Fig. 1 of the drawings, the number 10 designates the wires of a typical three-wire system, comprising a central wire 10a which is normally grounded, and two outside polarity wires 10b. Suspended from a carriage 11, which extends transversely below the wires 10, is a drive motor 12 and a pair of rotatable split sleeves 13, which have central apertures through which the outside wires 10b pass. The motor 12 is geared to rotate the sleeves 13 around wires 10b, as will appear hereinafter. Each rotatable sleeve 13 carries a roll of elastic adhesive tape 14 which revolves with the sleeve 13 around the wire 10b. The apparatus also includes a serrated drive wheel 15 coacting with the clamping device comprehensively designated 16 to grip the central wire 10a. Wheel 15 is driven through gears (further to be described) from motor 12, thereby advancing the apparatus bodily along the wires 10 as the rolls of tape 14 are revolved around the outside wires 10b.

In the specific embodiment of the invention selected for illustration in the drawings, the carriage 11 includes a plate 20, preferably of Bakelite or other insulative material. Four bracket pieces 21 are affixed to the corners of plate 20. An inner bearing block 22, having a semi-circular outwardly-facing bearing surface, is fixed to each bracket piece 21. A matching bearing block 23, having an inwardly disposed semi-circular bearing face, is attached by means of hinge 24 to the top of each bearing block 22. An internally threaded sleeve 25 which has a knurled knob 26 (Fig. 5) extends into an opening in each bearing block 23 and coacts with a corresponding threaded shaft 27 fixed in each bearing block 22 to secure the blocks 22, 23 together. Each sleeve 25 is held in place by a set screw 28.

Each of the rotatable sleeves 13 has a pair of annular grooves of rectangular cross section disposed adjacent each end of said sleeve 13. The sleeves 13 are split longitudinally to form two sections, and are separable from the device as a whole. Each sleeve 13 is mounted with its annular grooves in registry with the aligned openings formed in the bearing blocks 22, 23, as shown in section in Fig. 5, the sleeve diameters at the bases of the grooves being substantially equal to the diameters of the aligned openings in the bearing blocks 22, 23. Each sleeve 13 also has a smooth cylindrical bore 29 at its center. At its forward and rear end 31, 32 each sleeve 13 extends beyond the ends of bearing blocks 22, 23. A locking plate 33 is detachably secured by means of shoulder screws to each section of the split sleeve 13. Plate 33 has a slot 34 coacting with the screws to provide means for hingedly securing the sections of the split sleeve 13 in position relative to one another, and for opening up said sections to accommodate a wire within the central longitudinal aperture defined by bore 29. One of the split sleeves 13 carries a dowel pin 35 which coacts with a corresponding bore in the other split sleeve 13 to keep the sleeves 13 aligned.

Means are provided for mounting a roll of tape on each sleeve 13 for movement of the roll bodily around the axis of the wire being taped. The number 40 designates an L-shaped bracket the base of which is fixed to the rear end 32 of sleeve 13, at a point spaced outwardly from the axis of rotation of the sleeve 13. A pin 41

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extends through an aperture near the free end of bracket 40, such pin having a threaded end receiving a nut 42 which bears against one face of bracket 40. A spacer nut 48 is also threaded on the pin 41. Spaced by means of helical spring 43 from bracket 40 is a washer 47 bearing against a disc 44 (preferably of fiber or other rigid insulating material), both of which have central apertures through which pin 41 extends. Washer 47 may be keyed to or rotatable on the pin 41, depending upon the amount of braking action upon disc 44 desired. Disc 44 carries an integral disc 45 of lesser diameter and preferably of the same material adapted to fit within the central core 46 of adhesive tape 14. Screw 50 is threaded into pin 41 and serves as a stop retaining the discs 44, 45 against the washer 47 and the spring 43. At the opposite side of the roll of tape 14 is another disc 51 carrying a central disc 52, the discs 51, 52 being substantially identical to discs 44, 45. Discs 51, 52 are adjustable along pin 41 toward and away from the bracket 40 by means of stop 53 which coacts with the threaded or grooved end 54 of pin 41. Stop 53 is preferably of hard metal or other hard material and has a central slot 55 (Fig. 6). The hard material at the ends (or at least one end) of central slot 55 is tapered or sharpened or otherwise made of sufficiently reduced thickness to permit them to enter into engagement with the grooves or threads 54 at the end of pin 41. The stop 53 is movable transversely relative to pin 41, along the line defined by guide slots 56. A leaf spring 57, having one end urged against the handle 60 of stop 53, and the other end secured to disc 51 by screws, serves continuously to urge the handle 60 away from pin 41 and thereby to maintain engagement of the slot end within the grooves or threads 54. The members 54 are preferably in the form of continuous threads, since, by turning the handle 60 around the axis of pin 41, continuous adjustment is thereby provided for moving the roll of tape 14 toward and away from bracket 40. The roll of tape 14, together with the unitary assembly mounted on shaft 41, may also be moved toward and away from bracket 40 by adjusting the nuts 42, 48.

However, the members 54 may be in the form of spaced-apart independent grooves and equivalent stop means, rapid adjustment being attained by depressing handle 60 against the action of leaf spring 57, forcing the tape roll to the desired position along shaft 41, and releasing handle 60 for return of stop 53 to operative position in the grooves or threads 54.

Means are provided for rotating the sleeves 13 to move the tape 14 bodily around the axis of the wire. The drive motor 12 is energized through wires 12a from any suitable power source, preferably from any of the lines 10a, 10b, 10c themselves. It is suspended from plate 20 and adjustable along slots 59 and has an output shaft 60 connected through coupling 61 to worm shaft 62 carrying a worm 63. The worm shaft 62 and worm 63 are preferably mounted in a housing 64 of plastic material such as Bakelite or the like, the shaft 62 being supported therein on bearings. A pair of spaced-apart, vertical shafts 65 are also supported in housing 64, with gears 66 fixed thereon in position to mesh with worm 63. In a housing 67 supported on top of housing 64 by fiber or other insulating spacers 70 are gears 71 which are also fixed on shafts 65 and mesh with gears 72 fixed on shafts 73. Also fixed on shafts 73 are helical gears 74 which mesh with helical gears 75 mounted on longitudinal shafts 76. Each shaft 76 also carries a pinion 77 of fiber or other insulator which meshes with a split gear 80 mounted on the sleeve 13. Gear 80 consists of two separable halves affixed to one end of each sleeve 13. Plates 33, together with slots 34, provide for adjustment and separation of the halves of gear 80, which are cut away to provide a slot 83 into which a screw driver or other tool may be inserted to effect separation.

Means are also provided for connecting the wire taping device mechanically to the central wire 10a, and to drive

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the device through such connection. One of the longitudinal shafts 76 carries a worm 90 which meshes with a gear 91 mounted on a vertical shaft 92 which is supported on a block 93 mounted on plate 20. The serrated drive wheel 15 carries a collar 95 which is supported upon the gear 91. Screws 96, which extend through a retainer plate 97 as well as drive wheel 15 and collar 95, are threaded into gear 91 thereby fixing the drive wheel 15 to gear 91 for rotation jointly about vertical shaft 92. Thus the motor 12, acting through the gear train, serves to rotate the serrated drive wheel 15.

An angle iron 100, the base of which is fixed to the plate 20 by screws 101, supports the clamping device 16. The upright leg of angle iron 100 has a vertically disposed slot through which a pull bar 102 extends. Pull bar 102 has flanges 103 which are fixed to the back of a channel 104 the open end of which faces toward serrated drive wheel 15. At its opposite end, the pull bar 102 has a threaded opening for reception of a screw 105, whereby a disc 106 having a handle 107 is eccentrically attached to the pull bar 102. The disc 106 is free to turn about the screw 105 which serves as a pivot. In the course of such turning movement the edge of disc 106 bears against the back of angle iron 100 thereby pulling the bar 102 and channel 104 toward the angle iron 100. Disc 106 has a flat edge 108 which coacts with the back of angle iron 100 to lock the pull bar 102 in its retracted position. Screw 109 serves as a stop for disc 106, engaging upon the top of pull bar 102. An angled guide plate 110 (Fig. 4) is affixed to the bottom of channel 104 and serves to support it above the plate 20. The horizontal leg of guide plate 110 is slotted at 111 and moves along the line of said slot which coacts with the screw 112 to form guide means for plate 110. The central portion of the base of the upright wall of angle iron 100 is slotted to permit penetration of the free end of guide plate 110 therethrough. The same upright wall is also apertured to receive the guide rods 113 which are attached to channel 104 near its ends. Helical spring 114, normally under compression, are disposed coaxially with the guide rods 113 and bear against the angle iron 100 and channel 104 to urge the channel 104 continuously toward the serrated drive wheel 15. Rollers 115 are mounted on vertical pins 116 near the ends of channel 104, and are spaced apart from one another and from the point of contact between serrated wheel 15 and central wire 10a to provide a particularly firm grip on the wire. The rollers 115 thus coact with serrated drive wheel 15 to clamp the central wire 10a against the drive wheel 15, which accordingly grips the wire 10a securely and, by reason of its rotation under the influence of motor 12, drives the entire wire taping apparatus by positive engagement bodily along the wires as the rolls of tape 14 revolve in timed relation bodily around the wires 10b.

It will be observed that the serrated wheel 15 and rollers 115 are disposed substantially along the longitudinal center of the machine while the bores 29 of sleeves 13 are spaced equally from the longitudinal center and disposed below the members 15, 115. Moreover the motor 12 is disposed substantially along the same longitudinal center line and below the cylinders 13.

As indicated in Figs. 3 to 6 of the drawings, a pair of front and rear end walls 120 are mounted on plate 20 and bracket pieces 21. The upper central portions of the end walls 120 are cut away at 121 to provide clearance for the central wire 10a. Cover plates 122 extend longitudinally of the device between the respective front and rear end walls 120.

The roll of tape 14 consists of elastic adhesive tape which may be in the form of vinyl resin tape, rubber tape, or other tape having adhesive applied to at least one face, and having capacity to stretch under tension and to contract due to its own elasticity when tension is relieved. In employing the term "elastic" we refer to it in the commonly accepted sense rather than the technical one,

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and do not apply the term "elastic" to such materials as steel or other metals which are capable of undergoing only a very slight percentage elongation before the elastic limit is exceeded. Thus, by way of illustration only, the elasticity of the tape in accordance with this invention is preferably on the order of 25% elongation or above, as contrasted to the elongation of metals.

It will be observed that the axis of the tape roll 14 is disposed at an angle, preferably substantially at right angle, to the axis of the wire to be taped. Accordingly one edge 14a of the tape 14 in the roll is continuously maintained at a greater distance from the wire 10b than is the opposite edge 14b of tape 14. As indicated in Fig. 2, the portion of the tape located between the roll of tape 14 and the wire 10b has a curved cross section. Moreover this tape is stretched and maintained under tension as it is applied to the wire, as will further be described. By reason of the angle of tape relative to wire, the lagging edge 14c of the tape is stretched to a greater extent than is the leading edge 14d. Thus the lagging edge 14c is longer than leading edge 14d, measured from tape roll to wire, and is under a greater tension. Brake means as previously described may be applied to the tape roll to coast with the drive means and maintain the tape under tension, or this tension may be created by the adhesive action of the adhesive in the tape roll, either alone or in combination with brake means, or by other equivalent brake means. The adjustable brake means shown in the drawings and previously described herein is, however, preferred.

The operation of the apparatus will be apparent from the foregoing. The machine is prepared for suspension on the wires by unscrewing threaded sleeves 25, swinging the outer bearing blocks 23 about their hinges to the position shown in dot-dash lines in Fig. 5, removing the sleeves 13, and opening them up by pivoting the two elements forming each sleeve about the screws securing them to the plates 33 at each end. The sleeves 13 are then moved over wires 10b to place them in the central openings or bores 29. By reversing the first mentioned operations, the cylinder elements are closed around the wire and secured within the bearing blocks 22, 23.

The central wire 10a is gripped by swinging handle 107 toward the longitudinal center of the machine, whereupon eccentric disc 106 bears against the back of angle iron 100 and moves the rollers 115 away from serrated drive wheel 15. The machine is raised to place wire 10a between wheel 15 and rollers 115, whereupon handle 107 is released, activating the springs 114 which continuously urge the rollers 115 for yieldable engagement with wire 10a.

The end of each tape roll 14 is affixed to the wire to be wound, and the nuts 42, 48 positioned with respect to pin 41 to adjust the roll 14 toward or away from the wire 10b. Each stop 53 is adjusted along the pin 41 to regulate the braking effect of washer 47 on disc 44. The lead wires 12a are then connected to a power source, preferably any of the wires 10a, 10b themselves, and the serrated drive wheel moves the machine bodily forward. This places unequal stresses at the edges of the tape, the lagging edge being under greater tension than the leading edge. The gear ratios of the drive for the serrated wheel 15 are predetermined and are maintained in definite relation to the gear ratios of the drive for sleeves 13, in such relation that, for each full revolution of tape roll 14 around wire 10b, the machine advances bodily along the wires for a distance less than the width of the tape which is affixed in spiral form to the wire, said distance being measured along the axis of the wire. Accordingly, each wrap of tape overlaps the leading edge of the preceding wrap, the lagging edge 14c of the tape thus being the only edge exposed upon completion of the tape winding operation. In the finished taped wires, as shown in Fig. 1, one edge 14c of the tape is under tension greater than the other edge 14d, and the body of the

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tape covers continuously the edge which is under the lesser tension. This is of particular advantage and importance since resistance to deterioration and long life of tape and wire are achieved by reason of the adhesive seal formed. This is of particular advantage in applying tape to wire carrying weather-beaten or other deteriorated wire-covering, which is often irregular in size and shape, as indicated in Fig. 1 of the drawings.

Our machine is further advantageous in that the rehabilitation of wires by the application of tape represents a very substantial conservation of metal and other materials as well as a saving of time and expense. The wire may be taped rapidly and continuously even in confined places, since the axis of tape roll 14 is preferably substantially transverse or perpendicular to the wire being taped, and tape roll 14 is adjustable toward and away from the wire.

The tape-carrying sleeves 13 preferably consist of fiber or other insulating material so they may readily be applied to an energized bus; moreover certain of the gears, particularly gear 77, consist of fiber or other insulating material, preventing passage of electric current through the gear trains.

It will be appreciated that, while the invention is of particular advantage for carrying into effect the simultaneous covering of a plurality of wires, certain features of the invention are also applicable to the taping of a single wire. Thus, the machine may consist of a single cylinder 13 mounted on a modified carriage, the arrangement of parts being modified to the extent that the carriage also carries automatic means effective upon the same wire for driving the cylinder bodily along the wire and simultaneously rotating it around the wire, all substantially as previously described. Counterbalancing means or ballasting means may be provided to restrain the apparatus from rotating bodily around the single wire, or the machine may be pulled along the wire by means of a tow rope which stabilizes the apparatus and maintains it in upright position on the wire.

Although we have described our invention by reference to one specific embodiment thereof, it will be apparent to those skilled in the art that changes may be made in the particular form of the apparatus specifically described and illustrated herein, including reversals of parts and substitution of equivalents as well as changes in the sequence of steps of the method, and that certain features of the invention may be used to advantage without the use of other features, all within the spirit of the invention as defined in the appended claims.

Having thus described our invention, we claim:

1. Apparatus for covering at least one wire in a system including at least two substantially parallel wires, comprising a carriage, drive means on said carriage, means including a rotatable gripper element operatively connecting said drive means to a first one of said wires to drive the carriage longitudinally along said wire, rotatable means on said carriage, said rotatable means surrounding another of said wires with capacity to revolve around and relative to said other wire, means for connecting said rotatable means to said drive means for revolution relative to said other wire in timed relation to the longitudinal movement of the carriage along the first wire, and wire-covering dispensing means carried by said rotatable means, said dispensing means rotating with said rotatable means and concurrently moving longitudinally with said carriage for applying covering in helical form to said other wire.

2. Wire taping apparatus comprising a carriage, means for supporting the carriage from the wire, drive means carried by the carriage for moving said carriage bodily along the wire, rotatable support means supported on said carriage and actuated from said drive means for rotation around the wire in timed relation to the movement of the carriage along the wire, a shaft carrying a roll of elastic adhesive tape supported on said rotatable

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support means for combined movement around and along said wire, the axis of said shaft being disposed at an angle to the axis of the wire, and brake means opposing the rotation of said roll about said shaft, said rotatable support means, said shaft and said brake means being co-operatively related to provide capacity for applying said tape in stretched helical form about said wire with one of the lateral edges of the applied tape under greater tension than the other.

3. Apparatus for covering at least one wire in a system including at least two substantially parallel stationary wires, comprising a carriage, drive means on said carriage, means including a rotatable gripper element in the form of a serrated wheel and coating clamping means including a pair of spring-pressed rollers urged against one of said wires opposite said serrated wheel operatively connecting said drive means to said one of said wires to drive the carriage along said wire, rotatable sleeve means on said carriage, means for mounting said rotatable sleeve means around another of said wires with capacity to revolve around said other wire, means for connecting said rotatable sleeve means to said drive means for revolution about said other wire, and wire-covering dispensing means carried by said rotatable sleeve means for applying covering in helical form to said other wire.

4. Apparatus for covering an elongate body which is substantially stationary and restrained against rotation comprising a rotatable member having capacity to revolve around the body, drive means for revolving said rotatable member and for concurrently moving it longitudinally along said body, a shaft mounted on said rotatable member, said shaft having an axis which is disposed at an angle to the axis of the elongate body, a roll of elastic adhesive tape rotatable about the axis of said shaft, a friction member on said shaft, spring means continuously urging said friction member toward said roll,

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and adjusting means coacting with said shaft to adjust the roll toward and away from the spring and thereby to vary the resistance of said friction member to the rotation of said roll around said shaft, said rotatable member, said shaft and said adjusting means being co-operatively related to provide capacity for applying said tape in stretched helical form about said wire with one of the lateral edges of the applied tape under greater tension than the other.

5. Apparatus for covering an elongate body which is held against rotation, comprising a rotatable member having capacity to revolve around and relative to said body, drive means for revolving said rotatable member and for concurrently moving it longitudinally along said body, and dispensing means carried by said rotatable member, said dispensing means carrying an elastic tape and having capacity for applying it in stretched helical form around said body with one of the lateral edges of said tape under greater tension than the other.

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