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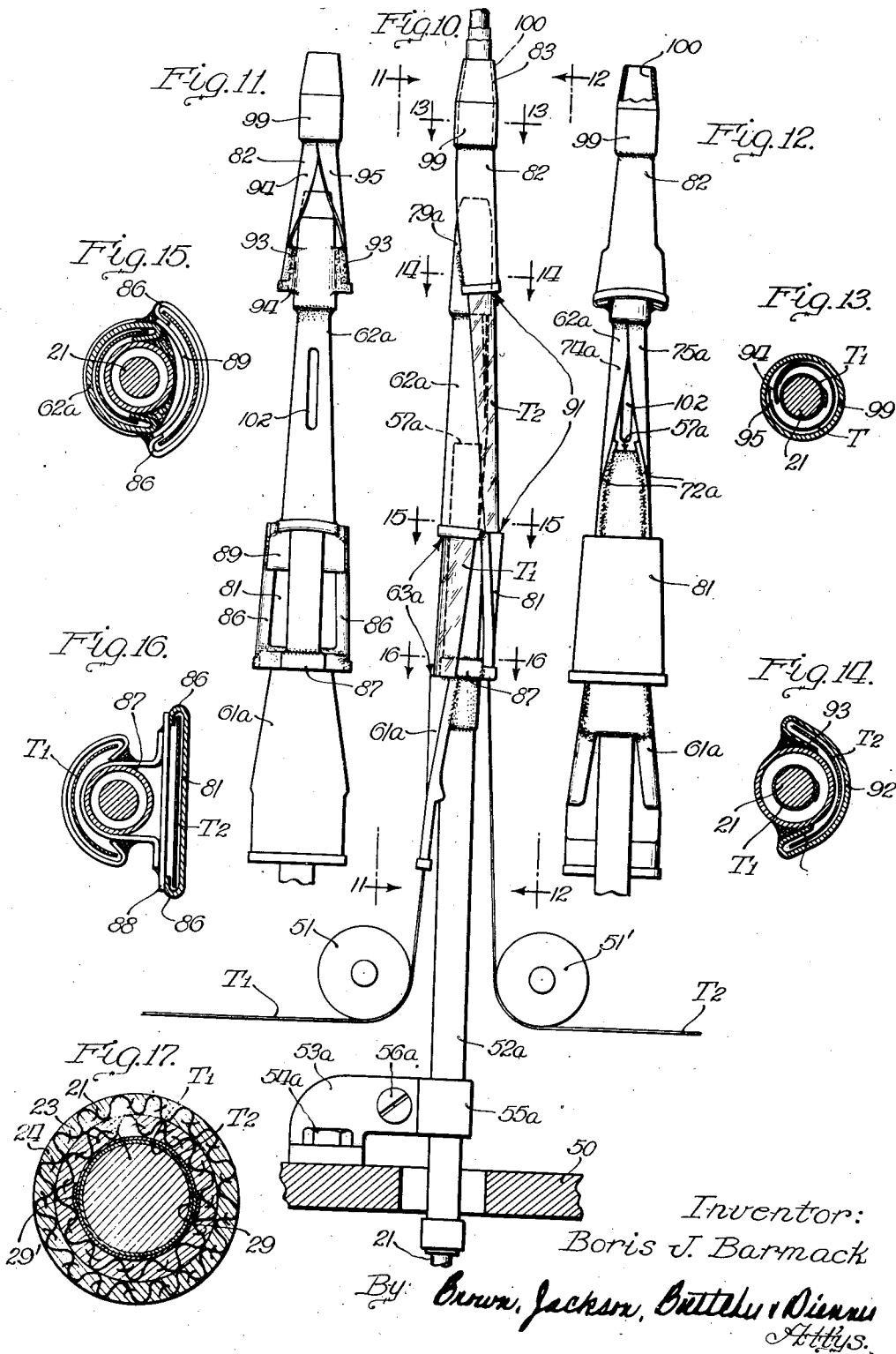
B. J. BARMACK

2,372,645

GUIDE FOR APPLYING INSULATION TO CONDUCTORS

Filed June 13, 1941

4 Sheets-Sheet 2



Inventor:
Boris J. Barmack
By: *Crown, Jackson, Butcher & Quinn*
Attys.

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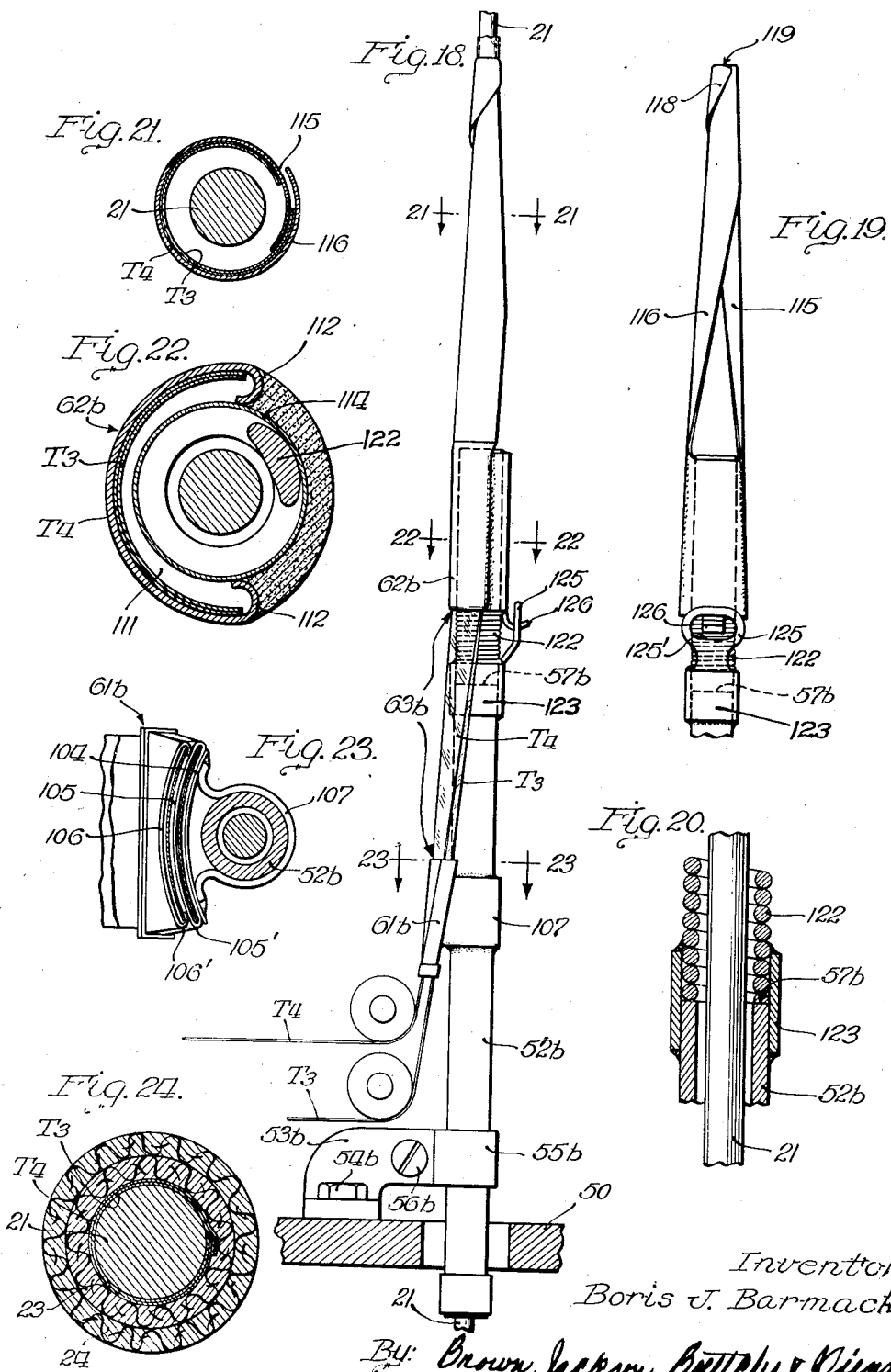
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Inventor:
Boris J. Barmack

By: Brown, Jackson, Butcher & Vickers
Attys.

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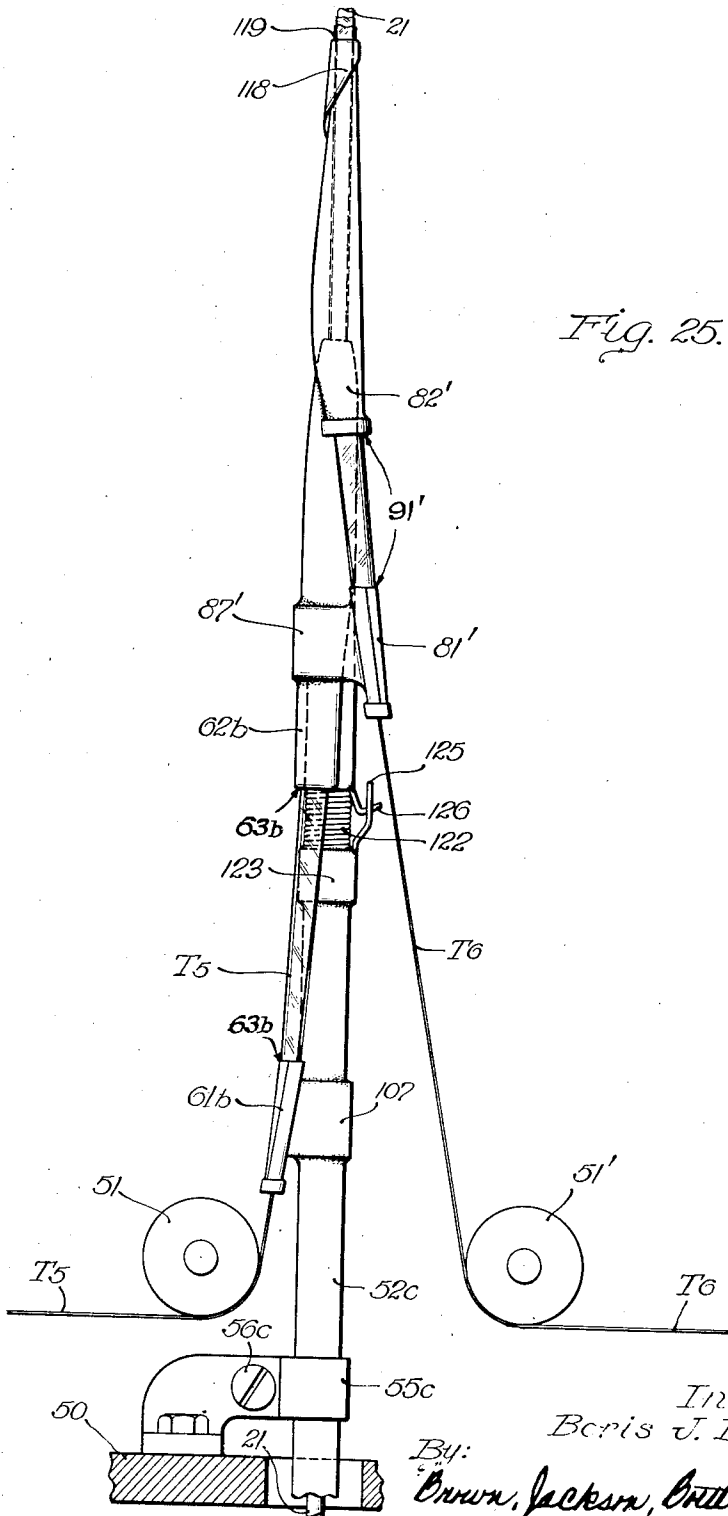


Fig. 25.

Inventor:
Beris J. Barmack

By:
Brown, Jackson, Britcher & Quinn
Attys.

UNITED STATES PATENT OFFICE

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GUIDE FOR APPLYING INSULATION TO CONDUCTORS

Boris J. Barmack, Chicago, Ill.

Application June 13, 1941, Serial No. 397,957

14 Claims. (Cl. 154—2.26)

The present invention relates to guides for applying insulation to electrical conductors such as wires and cables. More particularly, the invention pertains to improvements in guides for applying a tape form of insulation longitudinally on the conductor wire. That is to say, the tape form of insulation is applied so as to embrace the conductor as a sheath, with the seam extending substantially longitudinally or axially of the conductor.

The present application is a continuation-in-part of my copending application Serial No. 238,969, filed November 5, 1938. The present application is also related to my recent companion application, Serial No. 396,442, filed June 3, 1941, which, likewise, was a continuation-in-part of the earlier application Serial No. 238,969. This later application Serial No. 396,442 was issued as Patent No. 2,345,229 on March 28, 1944. My original application Serial No. 238,969 disclosed one embodiment of the improved guide constituting the subject matter of the present application. In my original application and in my recently filed copending application I have disclosed various embodiments of insulating tape which can be applied longitudinally on the conductor by the improved guide apparatus herein shown. In its preferred composition, such tape is advantageously composed of cellulosic materials, although it may also be composed of other materials, as set forth in my other applications. After the cellulosic tape has been applied to the conductor, one or more additional coverings is then applied over the tape, serving to hold the tape in place and to protect it from the weather, abrasion, and other deleterious factors. The preferred practice is to apply one or more braided coverings over the cellulosic tape, and to then impregnate the braids with an insulating saturant.

In connection with the application of the cellulosic tape to the conductor by the improved guide apparatus of the present application, distinct advantages accrue to this longitudinal application of the cellulosic tape. For example, where it is desired to maintain high dielectric and moisture excluding characteristics, it is necessary to overlap the material at the seam or meeting edges of the tape, and the longitudinal seam results in a smaller amount of seam area than in the case of a spiral seam following from a spiral application of a tape covering. Thus, the longitudinal method of application results in a decided saving of material. Also, the possibility of leakage through the seam is reduced proportionately to the reduction of seam area.

A further advantage of the longitudinal application of the cellulosic tape is the greater rapidity and facility with which it can be applied to the conductor. The cellulosic tape can be applied directly in the braiding machine, preliminary to the application of the first braid on the conductor, and the tape can be applied as rapidly as the braids are applied, so that the step of applying the cellulosic material need not slow up the operation of applying the braids.

The various features, objects, and advantages of my improved guide apparatus will appear from the following detail description of different preferred embodiments. In the accompanying drawings illustrating such embodiments:

Figure 1 is a side elevational view of one embodiment of my improved guide apparatus;

Figures 2, 3, 4, 5, 6, 7, and 8 are sectional views taken on the planes of the lines 2—2, 3—3, 4—4, 5—5, 6—6, 7—7, and 8—8, respectively, of Figure 1.

Figure 9 is a cross sectional view through the finished conductor after the longitudinal tape has been applied by the guide apparatus of Figures 1 to 8, and after the outer braids have been applied over the tape;

Figure 10 is a side elevational view of another embodiment of my improved guide apparatus, particularly adapted for the separate application of two tapes or layers to the conductor in building up a multi-ply longitudinal tape on the conductor;

Figure 11 is a view at right angles to Figure 10 as represented by the arrows 11—11 of Figure 10;

Figure 12 is a similar view from the opposite side, as represented by the arrows 12—12 of Figure 10;

Figures 13, 14, 15, and 16 are transverse sectional views taken on the planes of the lines 13—13, 14—14, 15—15, and 16—16, respectively, of Figure 10;

Figure 17 is a cross sectional view through the finished conductor after the two diametrically opposite longitudinal tapes have been applied to the conductor by the guide apparatus of Figures 10 to 16 and after the outer braids have been applied over the tape;

Figure 18 is a side elevational view of still another embodiment of my improved guide apparatus;

Figure 19 is a fragmentary front view of the latter embodiment of guide;

Figure 20 is a longitudinal detail section

through the mounting spring of said latter embodiment;

Figures 21, 22, and 23 are transverse detail sections taken approximately on the planes of the lines 21—21, 22—22, and 23—23 of Figure 18;

Figure 24 is a cross sectional view of the finished conductor after the two tapes have been applied by the guide apparatus of Figures 18 to 23; and

Figure 25 is a side elevational view of a further embodiment of my improved guide apparatus.

Referring to the embodiment illustrated in Figures 1 to 8, inclusive, my improved guide apparatus is preferably mounted directly in the braiding machine which applies the one or more layers of braid over the conductor. Such layers of braid are applied over the longitudinal insulating tape which is applied by the present guide apparatus. These braiding machines usually comprise a plurality of decks or platforms arranged one above the other, there being one of these decks for each braid to be applied. The conductor is passed up through the decks or platforms substantially centrally thereof. Each platform carries a series of bobbins or spools of yarn which are shuttled in and out with a rotary motion and from which the threads run inwardly to the centrally disposed wire in the application of each braid. If two braids are to be applied, there are two of these platforms each carrying a series of rotating bobbins, and, if only one braid is to be applied, there is only one platform carrying a series of rotating bobbins. The improved guide apparatus for enveloping the wire in the cellulose sheath, prior to the application of the first braid, is mounted on the lowermost of such platforms carrying a series of rotating bobbins. One of these platforms is diagrammatically illustrated at 50. The insulating tape is indicated in its entirety at T, this tape being led from a supply reel which is usually located to one side of the machine. In this type of installation, the tape is thence directed around a guide roller 51 for passing upwardly to the guide apparatus. With this embodiment of guide apparatus, the tape may consist of only a single ply thickness of material, or it may be a multi-ply or composite tape made up of a plurality of plies or layers of material, as disclosed in my copending applications. Such tape comprising a multi-ply or composite arrangement of two or more thicknesses may be built up or pre-fabricated before being led to the guide apparatus.

The guide apparatus comprises a vertical guide tube 52 which serves to direct the conductor 21 to the point where the tape is to be applied. This tube is suitably supported on the platform 50, as by an angle bracket 53 which is bolted to the platform at 54. The upper end of the bracket is formed with a circular clamping portion 55 which releasably grips the tube 52 through the instrumentality of the screw 56. Releasing this screw enables the tube 52 to be shifted upwardly or downwardly in the clamping portion 55 for adjusting the height of the guide apparatus relatively to the platform 50. This adjustable mounting also enables the guide tube 52 and the folding guide apparatus carried thereby to be rotated to different angular positions to enable the insulating tape or tapes to be led in from different angles. The upper end of the tube 52 is indicated in dotted lines at 57.

Fixedly mounted on the upper portion of the tube 52 are two vertically spaced tape folding

guides 61 and 62. The intervening opening or space 63 between these two guides enables the cellulose tape to be threaded through the guide apparatus with greater ease and facility in the initial operation of starting the tape, as will presently appear. Referring first to the lower tape folding guide 61, this guide comprises a short sleeve 64 rigidly secured to the tube 52, and a sheet metal guide element 65 which is rigidly secured to the sleeve 64. As shown in Figure 2, the guide member 65 has inwardly bent side lips 66 which form guide channels for confining the edges of the cellulose tape. The guide member starts with a flat contour at the lower end where the tape enters, and from this point upwardly the guide member takes on a cylindrical contour of gradually diminishing radius. Thus, the tape is gradually folded or curled along its lengthwise dimension in passing upwardly through the lower guide device 61. The upper ends of the inwardly bent side lips 66 are secured in any suitable manner to the sleeve 64, such as by welding, brazing or soldering, as indicated at 67.

That portion of the tape issuing from the upper end of the guide or forming element 61 is only partly curled into the finished cylindrical sheath. The remainder of the folding or curling operation is performed within the upper guide or folding element 62. The tape encounters appreciable friction in the folding or shaping operation, and when the entire operation is performed in a single continuous guide structure, difficulty is sometimes encountered in forcing the starting end of a very thin, pliable tape entirely through such guide structure. This is avoided by having the entire guide or folding device separated into two spaced sections 61 and 62, with the intervening opening 63. The tape can be grasped with the fingers in this opening, being squeezed against the surface of the tube 52 and then pushed upwardly to feed the same through the upper guide section 62.

The upper guide section also comprises a sheet metal strip 71 which has its lower portion curved to a substantially semicircular contour, as shown in Figure 5. This lower portion has inwardly bent side lips 72 which form guide channels for the edges of the tape, similarly to the side lips 66 of the lower guide section. These side lips 72 start from the lower end of the upper section 62 and terminate approximately at or slightly above the end 57 of the supporting guide tube 52. Said lips are suitably secured to the guide tube, as by welding, brazing, or soldering, such being indicated at 73. From the point where the upper ends of the lips 72 terminate, the sheet metal side walls of the guide device taper inwardly in the form of two skirt portions 74 and 75. The skirt portion 74 converges inwardly at a sharper taper than the skirt portion 75, and hence that edge of the tape which is guided by the skirt portion 74 is wrapped directly against the wire, whereas that edge of the tape which is guided by the other skirt portion 75 is caused to overlap the first-mentioned edge of the tape.

Secured to the upper end of the sheet metal portion 71, as by the welded, brazed, or soldered joint 78, is an end guide or nose 79. Formed within this end guide or tip 79 is a tapered bore 80, see Figure 8, which is accurately aligned with the upper end 57 of the supporting guide tube 52. The aforementioned skirt portion 74 which has the sharper taper for directing one edge of the tape into direct contact with the wire extends slightly up into the enlarged lower end of

the tapered bore 80, terminating in said bore adjacent to the lower end of the guide tip 79. The reduced upper end of the tapered bore 80 is accurately gauged to have a relatively snug fit over the cellulose sheath when the latter snugly encircles the wire. Thus, this tapered bore serves to cylindrically press or compact the cellulose tape about the wire so that the sheath is firmly closed around the wire. Said tapered bore also serves to accurately guide the sheathed wire at a point beyond the folding zone where the skirt portions 74 and 75 wrap the tape about the wire. Thus this upper guide 79 prevents any whipping or throwing of the wire such as might bring it into too close proximity to the inner skirt portion 74. Whipping of the wire towards this inner skirt portion may cause the cellulose tape to be scored or cut by pressure contact against the edge of said inner skirt portion, or may cause rapid wear of said skirt portion. Both of these conditions are avoided by provision of the upper guide tip 79. The latter is preferably composed of relatively hard metal so as to minimize wear from contact with the tape passing there-through.

Figure 9 is a cross section through the finished conductor after the tape T has been applied thereto by the guide apparatus of Figures 1 to 8, inclusive, and after the two outer braids have been applied over the longitudinal tape. In the example illustrated, the tape is of multi-ply or composite fabrication comprising an inner ply or layer 26, an outer ply or layer 27, and an adhesive or bonding medium 28 therebetween for causing the two plies to adhere to each other. As illustrative of preferred materials which may be applied, the inner ply 26 may be composed of cellulose acetate or ethyl cellulose, and the outer ply 27 may be composed of regenerated cellulose, such as "MST" Cellophane manufactured by E. I. du Pont de Nemours & Company. The adhesive 28 may be any suitable bonding medium, or it may be the heat-sealing coating which is a characteristic of the "MST" Cellophane. The two outer braids 23 and 24 which are applied over the tape T are preferably impregnated with a saturant such as an air-blown petroleum asphalt maintained at a fluid temperature in the neighborhood of 300° to 350° F. The temperature of this saturant effects a heat seal of the tape and also renders any thermoplastic materials of the tape sufficiently plastic for a short time to assist in sealing the seam 29 and to close all interstices, air spaces, etc. For a more detailed description of the different component materials of which the tape T can be made, and for a more detailed description of the action of the high temperature saturant on the tape and on the braids, attention is directed to my aforementioned pending applications.

The embodiment of guide apparatus illustrated in Figures 10 to 16, inclusive, has been devised to apply separate tapes T1 and T2 to the conductor 21 at angularly spaced points around the conductor. For example, the two tapes may be applied to the conductor from diametrically opposite sides thereof so that the seam of the outer tape is diametrically opposite to the seam of the inner tape, i. e., angularly spaced substantially 180° therefrom, as shown in Figure 17. In many respects this modified construction is substantially identical with the previously described construction, and, accordingly, in referring to identical or corresponding parts in the modified construction the same reference numeral pre-

viously used will be employed, with the suffix "a" applied thereto. The guide tube 52a is supported on the platform 50 by the angle bracket 53a which is bolted to the platform at 54a. The upper end of the bracket is formed with a circular clamping portion 55a which releasably grips the tube 52a through the instrumentality of the screw 56a, the release of which enables the tube 52a to be shifted upwardly or downwardly in the clamping portion for adjusting the height of the guide apparatus relatively to the platform 50. The upper end of the tube 52a is indicated in dotted lines at 57a. The first or inner tape T1 passes around the guide roller 51 and thence passes upwardly through the vertically spaced folding guides 61a and 62a. The second or outer tape T2 is led to the guide apparatus from the diametrically opposite side of the conductor, from whence it passes around the guide roller 51' and thence upwardly through the two vertically spaced folding guides 81 and 82.

Referring to the folding guides 61a and 62a of the inner tape T1, the lower guide 61a is substantially identical with the lower guide 61 of the preceding embodiment, and, similarly, the upper guide 62a is also substantially identical with the upper guide 62 of said preceding embodiment. The cylindrical nose 79a which extends from the upper guide 62a of this second embodiment is substantially identical with the end guide or nose 79 of the first embodiment. However, in this second embodiment, such cylindrical nose 79a is not the end tip of the guide apparatus, but instead another end tip or nose 83 projects upwardly from the end of the other tape guide 82. The intervening opening or space 63a is retained between the lower and upper guides 61a and 62a substantially as in the preceding embodiment, so as to enable the tape T1 to be threaded through the guide apparatus with greater ease and facility in the initial operation of starting this tape.

Referring now to the lower and upper guides 81 and 82 for the second or outer tape T2, the lower guide 81 is advantageously attached to the main mounting tube 52a at a point diametrically opposite to the vertical space 63a intervening between the guides 61a and 62a. The lower guide 81 is formed quite similar to the opposite lower guide 61a in that the lower entrance end of the guide 81 is relatively flat for receiving the entering tape T2 (Figure 16) and the upper discharge end of the guide is curved considerably to start the operation of folding or wrapping the tape T2 over the outside of the inner tape T1 (Figure 15). This guide has inwardly bent side-lips 86 which form guide channels for confining the edges of the tape T2. The lower portion of said guide 81 is soldered or otherwise secured to a metallic strap 87 which embraces the tube 52a immediately above the guide 61a. As shown in Figure 16, a flat strip or bar 88 has its ends soldered to the lower corners of the guide lips 86, and the mounting strap 87 is soldered to this bar and to the tube 52a. At the upper discharge end of the guide 81 an arcuate plate 89 is soldered to the guide lips 86 and then in turn to the lower end of the guide 62a.

An intervening opening or space 91 is provided between the discharge end of the lower guide 81 and the entrance end of the upper guide 82. This space 91 facilitates threading the second tape T2 through the lower and upper guides 81 and 82, in substantially the same manner described of the openings 63 and 63a.

The upper guide 82 for the second tape is quite similar in construction and operation to the upper guide 62 or 62a for the tape T or T1. This upper guide section comprises a sheet metal strip 92 which has its lower portion curved to a substantially semi-circular contour, as shown in Figure 14. Said lower portion has inwardly bent side lips 93 which form guide channels for the edges of the tape, similarly to the side lips 86 of the lower guide section 81. These side lips 93 start from the lower end of the upper guide section 82 and terminate below the upper end of the circular end piece 79a, as clearly shown in Figure 11. Said lips are suitably secured to the end member 79a, as by welding, brazing, or soldering, as indicated at 84. From the point where the upper ends of the lips 93 terminate, the sheet metal side walls of this guide device 82 taper inwardly in the form of two skirt portions 94 and 95 (Figures 11 and 13), similarly to the manner in which the two skirt portions 74a and 75a of the guide 62a taper inwardly. The skirt portion 94 converges inwardly at a sharper taper than the skirt portion 95 (Figure 13), and hence that edge of the tape T2 which is guided by the skirt portion 94 is wrapped directly against the inner tape T1, whereas that edge of the tape T2 which is guided by the other skirt portion 95 is caused to overlap the first-mentioned edge of the tape. As shown in Figure 13, the separate guide sections for the inner and outer tapes are so arranged that the overlap seam of the inner tape T1 extends longitudinally along one side of the conductor and the overlap seam of the outer tape T2 extends longitudinally of the conductor at the diametrically opposite side, whereby there is an angular span of approximately 180° between the overlap seam of the inner tape and the overlap seam of the outer tape. The skirt portion 74a of the guide section 62a and the skirt portion 94 of the guide section 82 are preferably arranged innermost with respect to their companion skirt portions 75a and 95 so that the direction of overlap of the seam of the outer tape corresponds to the direction of overlap of the seam of the inner tape, as shown in Figure 13. This arrangement may be reversed, if desired, so that the two tapes will not have the same direction of overlap.

Secured to the upper end of the sheet metal guide portion 92, as by the welded, brazed or soldered joint 98, is an end guide or nose 99. Formed within this end guide or tip 99 is a tapered bore 100 corresponding to the tapered bore 80 of Figure 8, this tapered bore being accurately aligned with the upper end 57a of the supporting guide tube 52a. The aforementioned skirt portion 94 which has the sharper taper for directing one edge of the tape T2 into direct contact with the inner tape T1 extends slightly up into the enlarged lower end of the tapered bore 100, terminating in said bore adjacent to the lower end of the guide tip 99. The reduced upper end of the tapered bore 100 is accurately gauged to have a relatively snug fit over the two tapes T1 and T2 when the latter snugly encircle the wire 21. Thus, this tapered bore serves to cylindrically compress or compact the cellulose tapes T1 and T2 about the wire so that the composite cellulose tape is firmly closed around the wire. Said tapered bore also serves to accurately guide the sheathed wire at a point beyond the folding zone where the skirt portions 94 and 95 lap the outer tape about the inner tape, substantially as described in connection with the tapered bore 80 of the first described embodiment.

If desired, a longitudinal slot 102 may be formed

in the guiding and folding device 62a to permit a sharp instrument to be engaged more effectively against the tape T1 for threading the starting end of such tape upwardly through the guiding and folding devices 81a and 82a. A like arrangement may be provided for the outer tape T2, if desired. Each tape T1 and T2 may be composed of a single ply thickness of material, or either or both tapes may be composed of a multi-ply or laminated arrangement, as disclosed in my copending applications.

Referring now to the third embodiment of my invention illustrated in Figures 18 to 23, inclusive, there are several elements in this embodiment which are similar to or identical with elements in the first described embodiment, and to such elements I shall apply the same reference numerals with the suffix "b" appended thereto. The main guide tube 52b is suitably supported on the platform 50 by the angle bracket 53b which is bolted to the platform 54b as previously described. Releasing the screw 55b of the circular clamping portions 55b enables the tube 52b to be shifted upwardly or downwardly in said clamping portion for adjusting the height or angular position of the guide apparatus relatively to the platform 50. The upper end of the guide tube 52b is indicated in dotted lines 57b. This embodiment also comprises a lower folding guide section 61b and an upper folding guide section 62b, separated by an intervening vertical space 63b. These two guide sections are preferably constructed to simultaneously apply two tapes T3 and T4 in directly superposed relation on the conductor 21. To this end, the lower guide section 61b comprises three strips of sheet metal 104, 105 and 106 defining the inner, intermediate and outer walls of two guideways through which the two tapes are passed. This guide assembly is secured to the tube 52b by a mounting strap 107 which is soldered to the inner strip 104 and which embraces the tube 52b. Side lips 105' on the strip 105 are soldered to the strip 104, and side lips 106' on the strip 106 are soldered to the strip 105, thereby forming guide channels for confining the edges of the two tapes. The lower ends of these guide channels are relatively flat, and the upper ends have a substantial curvature formed therein for starting the cylindrical curvature in the tapes as they issue from this lower guide assembly.

The upper guide device 62b receives both tapes T3 and T4 within a single guide channel 111 formed in the upper guide device. The lower portion of the guide section 62b is formed with inwardly turned side lips 112 which are soldered to a short cylindrical mounting sleeve 114. Above this mounting sleeve the two side portions of the sheet metal member 62b taper and converge inwardly to form the skirt portions 115 and 116 for effecting the overlapping seam relation of the two tapes about the conductor. The tongue of sheet metal, of which the portions 114 and 115 form the side edges, diminishes in width as it proceeds upwardly. This tapering tongue of sheet metal is also cut on a constantly changing bias so that the outer edge 116 has a helical pitch angle which continuously diminishes toward the upper end of the guide device. This results in the sheet metal being formed with a spiral or helical extremity 118 which is wrapped almost completely upon itself. The result of this particular formation is the production of a resiliently expansible tip 119 which constantly maintains a resilient compression pressure against the

two tapes as the conductor and tapes issue from the upper end of the guide apparatus.

This upper guide section 62b and resiliently expansible tip 119 have a flexible mounting which enable them to swing laterally in any direction, so that if the wire tends to whip or throw laterally as it issues from the upper end of the guide apparatus there will be no tendency to cut or score the cellulosic tapes against the discharge tip. Such flexible mounting is obtained through the interposition of a helically coiled wire spring 122 between the upper and lower sections of the guide apparatus. The lower convolutions of said spring are soldered within a sleeve 123 which has its lower end soldered over the upper end of the main guide tube 52b, as shown in Figure 20. The upper portion of the spring 122 extends up through the sleeve 114 and through the surrounding portion of the guide section 62b, the spring being rigidly secured thereto by soldering, brazing or in any other desired manner. The free intermediate convolutions of the spring between the sleeve 123 and the sleeve 114 permit lateral flexing or tipping of the guide section 62b and tip 119 in any direction relatively to the lower guide section 52b. To prevent any accidental elongation of this portion of the spring beyond its elastic limit, a cooperating stop eye 125 and stop hook 126 are secured to the lower and upper guide sections, in shunt of the spring. The eye 125 is formed integral with or is secured to the sleeve 123, and the hook 126 is formed integral with or is secured to the sleeve 114. The aperture 125' in the eye member 125 is made considerably larger than the hook 126 so as to permit a considerable range of tilting movement of the upper guide section relatively to the lower guide section without having the hook strike the side edges of the aperture 125'. The principal function of these two stop members 125, 126 is to prevent the entire upper guide section from being pulled upwardly beyond the elastic limit of the spring 122 in the event of accidental jamming of the wire and tapes in the upper constricted end of the guide apparatus. For example, an imperfect joint occurring between the ends of two adjoining lengths of tape may create a thickened portion which will exert a considerable friction within the resiliently expansible tip 119 of the guide apparatus. This frictional drag may tend to pull the upper guide section upwardly with the wire with sufficient force to stretch and deform the spring 122 unless positive stop means be provided for limiting such upward motion of the guide tip. The stop means 125, 126 performs this function of limiting upward movement of the upper guide section and also performs the function of preventing any abnormally large lateral deflection of the upper guide section in the whipping or throwing of the wire.

Figure 24 illustrates a cross-section of the finished conductor wherein the two tapes T3 and T4 have been applied by the guide apparatus of Figures 18 to 23. The overlapping edges of the tapes are either superposed or in close proximity to each other. The resiliently expansible and contractible tip 119 functions somewhat analogously to an extruding or shaping die for closely compacting the two tapes against the wire and against each other, and for causing the two tapes to be compressed in a very tight wrap. Each tape may be of single ply or multi-ply construction.

Figure 25 illustrates another embodiment which combines certain features of Figures 10 and 18. In this construction, the two tapes T5

and T6 are applied to the wire from opposite sides so that the seams 29 and 29' are disposed at opposite sides of the wire, as shown in Figure 17. The inner or first tape T5 passes through the folding guides 61b and 62b, which are similar to the guides 61b and 62b of Figure 18. The outer or second tape T6, passes through the guides 81' and 82', which are similar to guides 81 and 82 of Figure 10. The two tapes are brought together in the upper guide 82' substantially in the same manner as in Figure 10. However, in this embodiment of Figure 25 the guide 82' does not terminate in the rigid end tip 99 as in Figure 10, but instead it extends upwardly as indicated at 118 to form the resiliently expansible end tip 119' of Figure 18. This end tip compresses both tapes against the wire in substantially the same manner described in connection with Figure 18. The upper section of the guide apparatus is resiliently mounted for limited lateral flexing and endwise shifting through the interposition of the helical spring 122 between the sleeve 123 and the upper portion of the unit carrying the guide sections 62b, 81', 82' and expansible tip 119. The stop members 125, 126 limit the flexing or extension of the spring.

In each of the above-described embodiments, the guide apparatus is preferably adjusted vertically in the adjustable mounting bracket 53—53c to dispose the tip end of the apparatus in relatively close proximity to the level where the first layer of braid 23 is applied. For example, the level where the wire and its insulating tape or tapes issue from the guide apparatus may be only an inch or two below the level where the threads of the first braid start wrapping around the wire and tapes. Hence, there is no opportunity for either tape to become loosened or unwrapped before the braids envelope the tapes and anchor them in place.

While I have illustrated what I regard to be the preferred embodiments of my invention, nevertheless it will be understood that such are merely exemplary and that numerous modifications and rearrangements may be made therein without departing from the essence of the invention.

I claim:

1. In guide apparatus of the class described, the combination of a receiving portion for receiving a wire and directing it generally to the point where a tape is to be applied, folding means folding the tape around the wire in longitudinally extending sheath form, said folding means comprising one skirt portion for directing one edge of the tape into contact with the wire and another skirt portion for folding the opposite edge of the tape over the first-named edge to form an overlapping seam, an end guide beyond said folding means for pressing said tape against the wire, and means mounting said end guide for lateral movement relatively to said receiving portion of the guide apparatus.

2. In guide apparatus of the class described, the combination of means for guiding a wire to the point where a tape is to be applied, a first guide for partially shaping the tape to sheath form, a second guide for continuing the shaping of the tape to sheath form around the wire, said two guides having an open space therebetween in which the tape can be grasped to facilitate threading the tape through the guide apparatus, and movable mounting means enabling said second guide to be displaced laterally in following the run of said wire.

3. In apparatus for applying an insulating

tape along a conductor wire with its seam extending substantially parallel to the length of the wire, the combination of a main guide tube adapted to receive a wire from a source of supply, a bracket for mounting said guide tube on the platform of a braiding machine, said bracket comprising adjusting means for adjusting the height of said guide tube, a tape folding guide carried by the upper portion of said guide tube and receiving the insulating tape from a source of supply, said folding guide folding the tape about the wire in sheath form, an end portion above said folding guide for pressing said tape against the wire, and movable mounting means enabling said end portion to be deflected laterally in following the run of the wire.

4. In apparatus for mounting in a braiding machine for applying an insulating tape longitudinally along a conductor preparatory to applying a braid over the conductor, the combination of a main guide tube adapted to receive the wire from a source of supply, a bracket for mounting said guide tube on a platform of said braiding machine, said bracket comprising a clamping portion embracing said tube and releasable to enable said tube to be adjusted vertically to said braiding machine, a lower tape folding guide carried by said tube and receiving the insulating tape from a source of supply, said lower folding guide partially folding the tape about the wire in sheath form as the wire issues from said guide tube, an upper tape folding guide above said lower guide for continuing the shaping of the tape about the wire to produce an enclosing insulating sheath with its seam extending axially of the wire, and mounting means for said upper folding guide enabling said guide to be deflected laterally in following the run of the wire, said wire passing through said mounting means.

5. In apparatus for mounting in a braiding machine for applying an insulating tape longitudinally along a conductor preparatory to applying a braid over the conductor, the combination of a main guide tube adapted to receive the wire from a source of supply, a bracket for mounting said guide tube on a platform of said braiding machine, said bracket comprising a clamping portion embracing said tube and releasable to enable said tube to be adjusted vertically and rotatively relatively to said braiding machine, a lower tape folding guide carried by said tube and receiving the insulating tape from a source of supply, said lower folding guide partially folding the tape about the wire in sheath form as the wire issues from said guide tube, an upper tape folding guide above said lower guide for continuing the shaping of the tape about the wire to produce an enclosing insulating sheath with its seam extending axially of the wire, said lower and upper guides having an open space therebetween in which the tape can be grasped to facilitate threading the tape through the guide apparatus, and means movably mounting said upper folding guide on the upper portion of said guide tube.

6. In apparatus for applying an insulating tape along a conductor wire with its seam extending substantially parallel to the length of the wire, the combination of a main guide tube adapted to receive the wire from a source of supply, a lower tape folding guide carried by said tube and receiving the insulating tape from a source of supply, said lower folding guide partially folding the tape about the wire in sheath form as the wire issues from said guide tube, an upper tape fold-

ing guide above said lower guide for continuing the shaping of the tape about the wire to produce an enclosing insulating sheath with its seam extending axially of the wire, and mounting means enabling said upper folding guide to have free lateral movement said lower folding guide and said upper folding guide having an open space therebetween in which the tape can be grasped to facilitate threading the tape through the guide apparatus.

7. In apparatus for applying an insulating tape along a conductor wire with its seam extending lengthwise of the wire, the combination of a main guide tube adapted to receive the wire from a source of supply, a lower tape folding guide carried by said tube and receiving the insulating tape from a source of supply, said lower guide partially folding the tape about the wire in sheath form as the wire issues from said guide tube, an upper tape folding guide above said lower guide for continuing the shaping of the tape along the wire, said upper folding guide comprising two skirt portions converging toward the wire for causing the side edges of said tape to be brought together about the wire in an overlapping seam which extends lengthwise of the wire, one of said skirt portions converging toward the wire at a more rapid rate than the other skirt portion for causing its side edge of the tape to occupy an under position in said overlapping seam, said lower folding guide and said upper folding guide having an open space therebetween in which the tape can be grasped to facilitate threading the tape through the apparatus, a coiled spring resiliently supporting said upper folding guide for yieldable movement, said wire passing through said coiled spring, and stop means for limiting the range of said yieldable movement.

8. In apparatus for applying an insulating tape along a conductor wire with its seam extending lengthwise of the wire, the combination of a main guide tube adapted to receive the wire from a source of supply, a lower tape folding guide carried by said tube and receiving the insulating tape from a source of supply, said lower guide partially folding the tape about the wire in sheath form as the wire issues from said guide tube, an upper tape folding guide above said lower guide for continuing the shaping of the tape along the wire, said upper folding guide comprising two skirt portions converging toward the wire for causing the side edges of the tape to be brought together about the wire in an overlapping seam which extends lengthwise of the wire, one of said skirt portions converging towards the wire at a more rapid rate than the other skirt portion for causing its side edge of the tape to occupy an under position in said overlapping seam, and spring means resiliently supporting said upper guide for permitting lateral movement thereof relatively to said lower guide.

9. In apparatus for applying a tape lengthwise of a conductor wire, the combination of tape folding means through which the tape passes in being applied to the wire, and resilient mounting means for said folding means permitting displacement of the latter from a normal position under stress imposed thereon by the wire.

10. In apparatus for applying a tape lengthwise of a conductor wire, the combination of tape folding means through which the tape passes in being applied to the wire, and a coil spring resiliently mounting said folding means for permitting the latter to shift laterally or longitudi-

nally with respect to the normal path of the wire, said wire running through said coil spring.

11. In apparatus for applying a plurality of tapes lengthwise of a conductor wire, the combination of wire guiding means, tape guiding and folding means arranged to guide inner and outer tapes to the wire from opposite sides thereof and to fold said tapes about said wire to form inner and outer sheaths having longitudinally extending seams disposed substantially at opposite sides of the wire, a tip portion through which the wire and applied tapes pass, and resilient mounting means enabling said tip portion to swing laterally relatively to a normal position.

12. In an apparatus for applying an insulating tape along a conductor wire with its seam extending substantially parallel to the length of the wire, the combination of a main guide tube adapted to receive the wire from a source of supply, a tape folding guide adapted to fold the insulating tape about said wire, a tip portion through which the wire and applied tape are passed, a helically coiled mounting spring connected between said guide tube and said tip por-

tion for resiliently mounting said tip portion for endwise and lateral movement relatively to said guide tube, said wire passing axially through said mounting spring, and stop means for limiting the endwise and lateral movement of said tip portion relatively to said guide tube.

13. In apparatus for applying a tape lengthwise of a conductor wire, the combination of tape folding means through which the tape passes in being applied to the wire, and resilient mounting means for said folding means permitting longitudinal and lateral displacement of the latter from a normal position under stress imposed thereon by the wire.

14. In apparatus for applying a tape lengthwise of a conductor wire, the combination of tape folding means through which the tape passes in being applied to the wire, and resilient mounting means for said folding means permitting longitudinal displacement of the latter from a normal position under stress imposed thereon by the wire.

BORIS J. BARMACK.