

March 3, 1942.

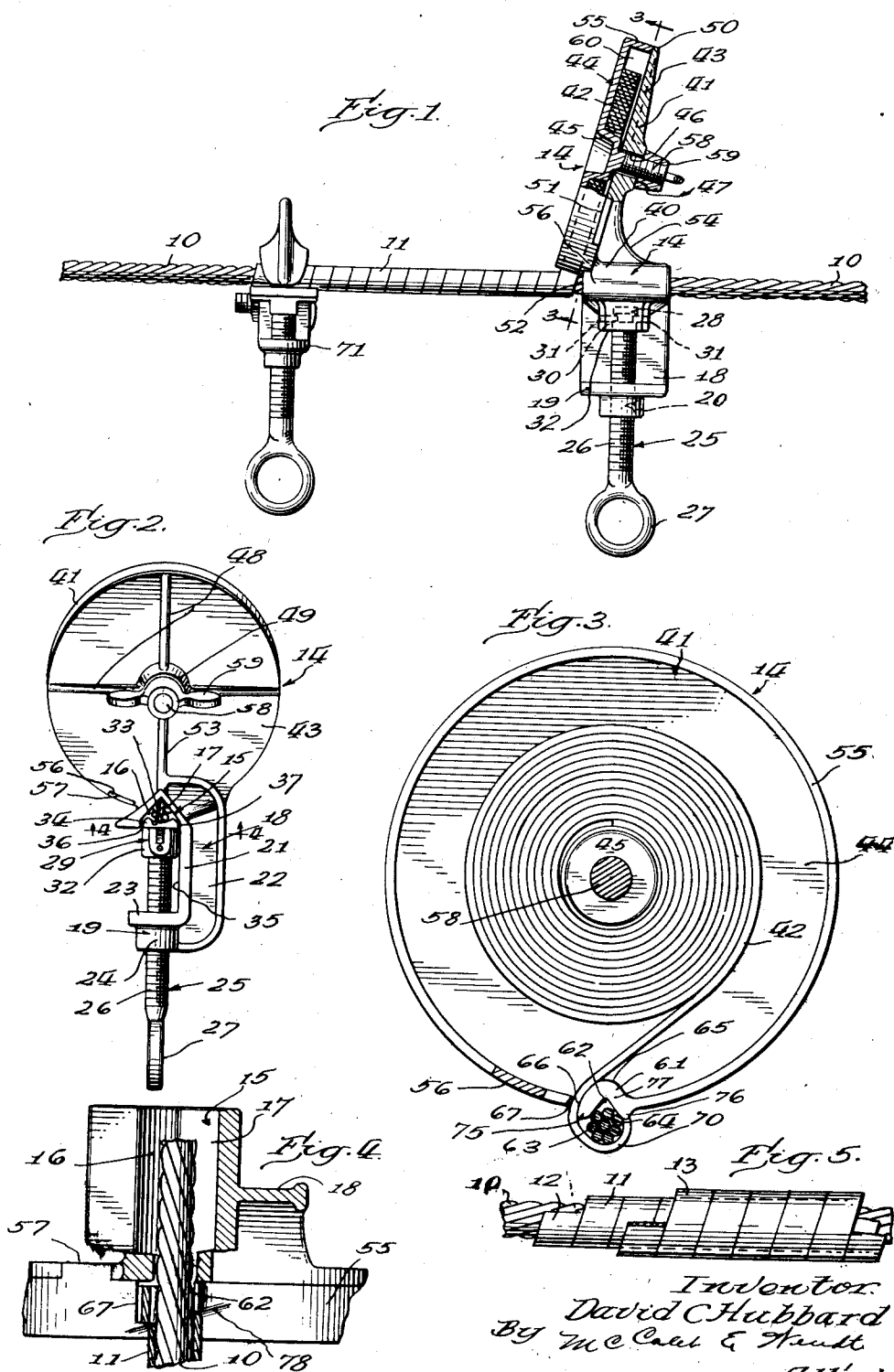
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APPARATUS FOR WRAPPING ARMOR ON CONDUCTORS

Filed Feb. 14, 1941

2 Sheets-Sheet 1



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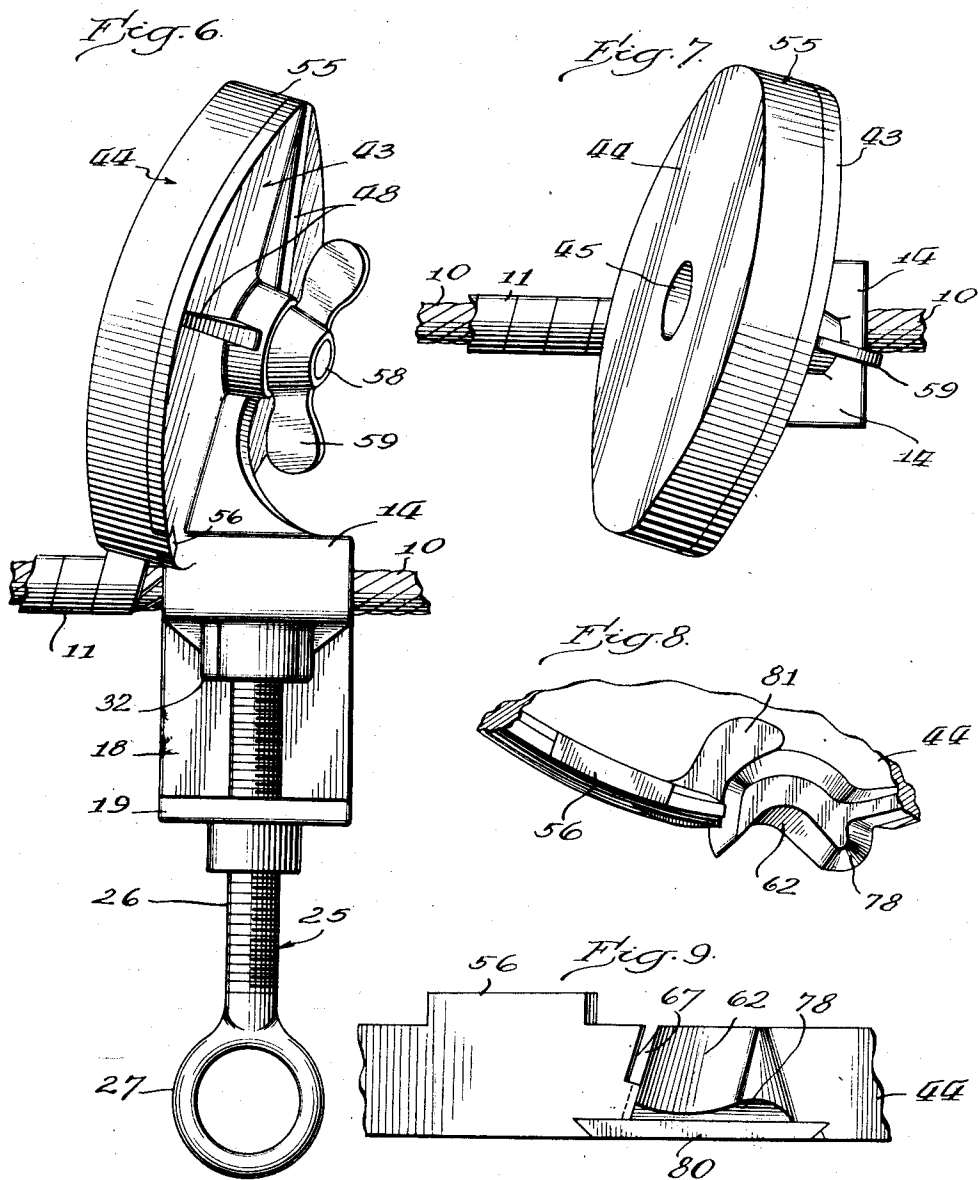
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2 Sheets-Sheet 2



Inventor.
David C Hubbard
By McCall & Hunt
Attys.

UNITED STATES PATENT OFFICE

2,274,833

APPARATUS FOR WRAPPING ARMOR ON CONDUCTORS

David C. Hubbard, Centralia, Mo., assignor to
A. B. Chance Company, Centralia, Mo., a corporation of Missouri

Application February 14, 1941, Serial No. 378,865

7 Claims. (Cl. 57—10)

The present invention relates to methods and apparatus for wrapping armor on conductors, and is particularly concerned with the provision of devices whereby metallic armor may be applied to cable conductors on high tension transmission lines and the like.

Such armor tape, which is also called "flat armor wire," is used for the protection of the conductor against abrasion. It is recommended for use wherever conductors are held by suspension clamps or by certain types of insulators.

Another function of the armor tape is that it tends to decrease bending stresses at the point of support, due to conductor vibration. This protects the conductor from stresses due to fatigue.

When it is desired to attach a tap-off clamp to a conductor without any possibility of damage to the conductor, it may be provided with such an armor tape protection. The armor tape then provides an excellent electrical contact between the tape and the conductor. The tap-off clamp may then be attached to the conductor over the armor.

The armor will then serve to protect the conductor against pitting, which may be caused by arcing of the current from a part of the tap-off clamp to the conductor. The clamp can be attached very tightly to secure an excellent contact between the clamp and the armor without any possibility of nicking the conductor by the squeezing action of the clamp. Nicking of the conductor is to be avoided because it produces a tendency toward breakage at that point.

One of the objects of the invention is the provision of an improved device which is adapted to apply tapes of armor of various bendable metals spirally and smoothly to a cable or the like without appreciable space between the spiral turns in such manner that a cable conductor may be protected against abrasion or other destructive action on the cable conductor.

Another object of the invention is the provision of an improved armor wrapping device of the class described which is adapted to be provided with a plurality of magazines for receiving armor strips of different width so that by the use of these alternative magazines armor of various widths may be applied to cable conductors or the like.

Another object of the invention is the provision of an improved armor wrapping device which may be used to apply armor to cables of various diameters by virtue of the construction and arrangement of the parts of the device and by means of which the ends of the armor wrapping

may be ironed down into tightly wrapped contact with the cable.

Another object of the invention is the provision of an improved armor wrapping device which is simple, sturdy, economical, capable of being actuated by means of disconnects or other hooked or headed tools carried by relatively long insulated poles so that a finished job of armor application may be made on cables which are subject to the risk of energization, without danger to the operator.

Another object of the invention is the provision of improved methods of applying armor to cables and the provision of improved armor construction for cables by means of which the cables may be more effectively protected than with the devices of the prior art.

Another object of the invention is the provision of an improved device and method for wrapping armor on cables by means of which waste of the armor is reduced, due to the elimination of loss of the armor strip at each end of the wrapping and to the more effective application of all of the armor strip length to the cable.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts through the several views.

Referring to the drawings of which there are two sheets:

Fig. 1 is an elevational view in partial section, showing the armor on the cable and the wrapping device in the course of applying it;

Fig. 2 is a vertical elevational view of the armor wrapping device, taken from the right of Fig. 1, with the cable in section;

Fig. 3 is a full sized sectional view, taken on the plane of the line 3—3 of Fig. 1, looking in the direction of the arrows, showing the construction of the magazine and the armor in the course of being wrapped.

Fig. 4 is a fragmentary sectional view, taken on the plane of the line 4—4 of Fig. 2, looking in the direction of the arrows, showing the cable and the armor and adjacent parts of the device in the act of wrapping armor on the cable;

Fig. 5 is a fragmentary elevational view in partial section, showing a cable provided with a double wrapped armor;

Fig. 6 is an elevational view, similar to Fig. 1, of a modified form of device in which the magazine is tilted so that its axis does not intersect the axis of the conductor. Such a tilt is found desirable when relatively narrow tapes are to be

wound, because it has been found that the tape which extends tangentially from the conductor as it is being wound, is slightly tilted so that theoretically, the magazine should not be arranged with its axis in a plane which cuts the conductor;

Fig. 7 is a top plan view of the device of Fig. 6;

Fig. 8 is a fragmentary view in perspective of that part of the magazine housing which guides the tape as it emerges from the magazine.

Fig. 9 is a fragmentary side elevational view of the same portion of the housing shown in Fig. 8.

Referring to the two sheets of drawings, 10 indicates a metal conductor cable of a high tension transmission line, the cable being of the type having a multiplicity of strands of aluminum or copper, spirally wrapped upon a core strand. However, any type of cable may be equipped with armor, and the specific construction of the cable does not materially affect the application of the invention.

11 indicates a wrapping of armor in the form of a metallic strip of bendable metal, such as, for example, an aluminum tape, or a copper tape. The tool is particularly adaptable for application of aluminum or copper tapes to aluminum or copper conductors.

I desire it to be understood, however, that any known bendable metal may be wrapped by means of my armor wrapping device.

The wrapping 11 comprises a plurality of spiral turns of a metal strip, such as aluminum or copper, the turns having their adjacent edges close together without any substantial spacing, and the ends of the armor are ironed or bent into tight engagement with the cable, as at 12 in Fig. 5.

While the present tool is adapted to wrap the armor in a clockwise direction, it should be understood that the device can be used for wrapping in a counterclockwise direction, if its parts are arranged in a reverse direction with respect to the direction of rotation.

My cable wrapping may be of one layer, as shown in Fig. 1, or it may include two layers, as shown in Fig. 5, where the second layer is indicated at 13.

By the use of two right hand and left hand wrapping devices, the two layers of Fig. 5 may be wrapped in opposite directions, thereby giving the armor a greater strength and a greater tendency to retain its position on the cable.

The armor wrapping device 14 comprises a body which is preferably formed with a substantially V-shaped groove at 15 for engaging the cable. In some embodiments of the invention, where the device is intended to be used only on one size of cable, this groove might be made of half cylindrical form, fitting the cable; but the V-shaped groove 15 is adapted to engage cables of various sizes.

The body portion forming the groove is preferably of substantial width, extending as shown in Fig. 1, along the cable, for a sufficient length of the cable, so that the engagement between the walls of the groove 15 and the cable is like that of a bearing, effecting a guiding of the device rotatively on the cable.

The length of the bearing surface should be such as to provide a steady support for the wrapping device while it is rotating on the cable. The groove 15 is formed by the diverging surfaces 16 and 17 in the groove, and the body having the groove is provided with a depending leg 18, hav-

ing a laterally turned foot 19, which is provided with a threaded through bore 20.

The screw bolt 25 is preferably of the eye type, adapted to be engaged by conventional clamp sticks, or sticks of the hook type, or sticks having laterally projecting headed members passing through the eye. The bolt 25 is for all practical purposes substantially the same as that of a hot wire clamp of the eye type.

Its threaded shank 26 is threaded in the bore 20, and its eye 27 depends below the body of the armor wrapper. The uppermost end of the shank 26 is received in a socket 28 formed in a clamping shoe 29, and the bolt has a rotating engagement in the socket 28.

For this purpose the upper end of the bolt 26 is preferably provided with an annular groove 30 in the socket 28, and a pair of metallic pins 31 are riveted in complementary apertures in the depending cylindrical lug 32 of the shoe 29, with their ends projecting into the annular groove 30 for sliding engagement with the walls of the groove. Thus the eye bolt 25 is adapted to retract or advance the shoe 29 into engagement with the cable.

The shoe 29 preferably comprises a cast metal member, the upper side of which is formed with a partially cylindrical cable-engaging surface 33. This cylindrical surface is formed on a radius substantially equal to that of the largest cable with which the device is to be used.

The shoe 29 has a depending cylindrical lug 32, as previously described, and an elongated rectangular body 34 carried by said lug and extending longitudinally of the cable 10.

The width of the cable-engaging body 34 is such that it fits loosely between the adjacent wall 35 of the flange 21 of leg 18 and a parallel depending surface 36, which extends downward from the wall 16 of the groove 15. The edge 37 of the shoe body 34 has sliding engagement with the side 35 of flange 21 so as to prevent rotation of the shoe as it is being driven upward or downward by the eye bolt 25.

The wrapping device is thus adapted to be clamped on a cable 11, with the cable in the groove 15 and engaged by the cylindrical surface 33 of the shoe 29.

The engagement between the shoe, cable and groove is sufficiently loose to permit rotation of the wrapping device on the cable. The body 40 of the wrapping device is provided with an upwardly extending magazine, indicated at 41, for receiving a coil 42 of the armor tape, such as aluminum, copper, or other metals to be wrapped on the cable.

The magazine 41 is preferably formed of two parts, a supporting plate 43, which is integral with the body 40, and carried thereby, and a cup-shaped cylindrical member 44, which encloses the edge and opposite side of the coil 42.

The magazine supporting plate 41 is not at right angles to the axis of the cable 10, but is at an oblique angle to the axis of the cable such that when the coil 42 is rotatably supported upon the hub 45 the armor tape emerges from the magazine at the proper angle for spirally wrapping on the cable 10. This angle naturally varies with the diameter of the conductor because the pitch of the tape varies with the diameter of the conductor and the width of the tape.

Therefore, the slope of the magazine is preferably made to correspond to the slope or pitch of the tape as it projects downwardly in a tan-

gent from the conductor of the most popular size or the conductor most frequently used.

In other embodiments of the invention the magazine-supporting plate 43 may be adjustably mounted, or devices may be provided for cables of various diameters and tapes of various width.

The magazine-supporting plate 43 has a centrally located bore 46 and a flat thrust bearing surface 47 on its rear side surrounding the bore. The plate 43 may be substantially circular, and it may be provided with a plurality of radially extending reinforcing ribs 48 extending from its edge to a centrally located lug 49 surrounding the bore.

The plate may be tapered in thickness from its center outward toward its edge 50. Its inclined face 51 is preferably flush with the end walls 52 of the grooved body 40. The reinforcing rib 53 may be widened at the bottom, as indicated by the curved edge 54 of this rib in Fig. 1, the rib joining the body 40 to the plate 43.

The magazine member 44 comprises a substantially cylindrical cast metal member, which has a flat circular body and a laterally projecting cylindrical flange 55. The outer diameter of this magazine member is similar to that of the magazine-supporting plate 43. The edge of the cylindrical wall 55 engages the face of the plate 43. At one point the cylindrical wall 55 may be extended, forming an axially extending lug 56, which engages in a complementary groove 57 in the plate 43, to prevent rotation of the magazine member 44 on the plate 43.

The magazine member 44 has a centrally located inwardly extending hub 45, which is substantially cylindrical, but preferably slightly tapered, for casting purposes. The hub 45 carries a centrally located and axially extending threaded supporting bolt 58, which passes through the bore 46 in the plate 43, and is provided with a wing nut 59. A smaller wing nut may be employed, if desired.

The wing nut 59, threaded on the bolt 58, draws the magazine member 44 into tight engagement with the plate 43, forming a coil chamber 60 surrounding the hub 45. At its lower side in Fig. 1 and Fig. 3 the cylindrical wall 55 of the magazine member 44 is provided with an enlargement or a thicker portion 61, which is formed on its lower side with a V-shaped groove 62, the walls of which slope similar to those of the groove 15 in the body 40.

The thickened portion 61 of the magazine wall in which the groove 62 is formed projects radially from the cylindrical housing in the form of two ribs 75 and 76, Fig. 3. On the open face of the magazine cover 44, this thickened portion 61 and the ribs 75 and 76 terminate in a plane surface 77 adapted to engage the adjacent flat face of the supporting plate 43.

The opposite ends of the ribs 75 and 76 terminate in a diagonally extending plane surface indicated by the dotted line 78 in Fig. 4. It is this diagonal surface 78 on the protruding ribs 75 and 76 that engages the edge of the last turn of wrapped tape, and cams the assembly longitudinally of the conductor by its thrust on the edge of the wrapped tape as the assembly rotates.

The V-shaped extension 75 and 76 on the bottom of the magazine is an important feature of the device. The exterior face 78 of this extension extends at an angle which corresponds approximately to the angle made by the tape in passing

around the conductor. This sloping face, which is held down close to the conductor by the clamping means of the tool, bears against the edge of the tape that has just been applied, and acts as a cam against this tape edge.

The sloping surface 78 forces the tool along on the conductor by such an amount or at such a rate that the successive turns of tape are drawn into place beside the previous turns so that the tape is wrapped smoothly and spirally with the adjacent edges engaging each other. Thus the camming surface 78 has such a pitch that it gives the armor taping device such an endwise motion along the conductor as to provide such spacing of the turns of tape that there may be no overlapping, nor any cracks between the turns. Therefore, the surface 78 on the V-shaped extending portions 75 and 76 is preferably accurately machined according to the size of tape that the magazine is designed to accommodate.

The walls of the V-shaped groove 62 have been indicated by the numerals 63 and 64. They also engage the cable conductor 10. The inner surface 65 of this enlargement 61 may be gradually curved so as to present no sharp angles for engagement with the armor tape in the form of the coil 42. Thus the surface at 65 is described as a cylindrical surface of relatively small radius, the radius of the engaging surface increasing at the point 66, where the tape emerges from the magazine.

The magazine wall 55 is provided with a slot 67, one wall of the slot being described by the surface 66 of the enlargement, and the other wall being formed by an edge of the flange 55. This slot is of sufficient width to pass metallic tape of any desired thickness intended to be used with the device, and its depth is substantially the same as the width of the tape. The depth of the magazine is preferably then the width of the tape in order to prevent undue bending on the roll of the tape.

Experience has shown that when the depth of the slot 67 and the length of the V-shaped groove 62 along its center are substantially equal, and both are approximately the same as the width of the tape, the smoothest operation may be secured.

The width of the cylindrical wall 55 in Fig. 1 depends upon the largest width of the metal tape to be used in the device, leaving a slight clearance between the edges of the tape in the coil and the walls of the magazine member 44 and plate 43.

The method of applying the armor tape is as follows: The aluminum or copper tape is wrapped into a spiral coil, having a central aperture of sufficient size to receive the hub 45, the coil being of sufficient size to be received in the magazine space 60. The free end of the coil extends tangentially from the coil 42 out of the slot 67, and it is formed with a substantially U-shaped or hook-shaped cylindrical end portion 70, fitting on the cable 10 when the device is in the position of Fig. 3.

The wrapping device or unit 14 is held in a clamp stick, and the tape is engaged with the cable conductor, the U-shaped part being clamped down by means of a hot wire clamp or other suitable means.

One lineman may hold the hot wire clamp by means of a clamp stick to prevent rotation, and the other may then clamp the unit on the cable by actuating the eye bolt 25 until the unit is secured on the cable, but is loose enough for rota-

tion. The clamp stick may then be removed from the eye 27 by means of the second lineman; and while the first lineman holds the top clamp or wire tong 71 (Fig. 1) to prevent rotation, the second lineman may use a disconnect or similar tool to engage the eye 27 of the winding device and to rotate this unit in a clockwise direction.

The V-shaped grooves 32 and 15 and the cylindrical surface 33 are in close frictional engagement with the cable, but rotation is permitted, and as the unit rotates the unit slides spirally along the cable conductor, being forced axially of the cable conductor by the wrapping of the armor.

The frictional engagement of the unit with the cable tends to keep the tape tightly wrapped on the cable as the wrapping progresses, and prevents any unwrapping at the time when the disconnect stick may be disengaged from the eye 27. The unit is caused to slide longitudinally of the cable by engagement of the camming surface 78 with the edge of the tape wrapped on the cable. The force required to pull the tape from the magazine tends to keep the tape tightly wrapped about the conductor.

As the end of the tape runs out of the magazine, a short end may remain, projecting from the conductor cable. The lineman then opens the winding tool sufficiently to fit over the armor at this end, moves the tool backward over the projecting end of the armor, and adjusts it again for rotation.

The unit is then rotated in the same direction, and it irons and bends backward the end of the armor into close cylindrical engagement with the cable conductor.

Before removing the tap clamp from the starting end, it is also loosened slightly and rotated in such direction as to rotate off the end of the armor so that it bends down or irons down the starting end of the armor tape.

A wire tong or other tool may also be used for this same purpose.

As the V-shaped grooves 62 and 15 will fit the cables of various sizes and will also fit the exterior surface of an armor portion of the cable, the device may be used for producing double wrappings, as shown in Fig. 5. Of course, it is also applicable to cables of different sizes.

My method of providing a cable conductor with armor comprises the formation of a metallic armor tape with a cylindrical hook-shaped portion, shaped to engage the cable when the armor tape is disposed at the proper angle for spirally wrapping on the predetermined size of cable employed.

This cylindrical end is then fixedly secured to the cable conductor and the metallic armor strip being formed into a spiral coil, the armor tape then being spirally wrapped on the cable conductor while unrolling from the coil, sufficient resistance or friction being applied in the wrapping operation to tension the armor tape tightly about the conductor cable as it is spirally wrapped.

Thereafter the small loose ends of the spiral armor wrapping are bent over into close spiral engagement with the cable, where they remain, due to the bendable character of the material employed, which is preferably aluminum or copper armor tape.

In some embodiments of my method, I may wrap two such layers of metallic armor tape successively upon the same portion of a cable con-

ductor in the same spiral direction, or in opposite directions.

It will thus be observed that I have provided an improved armor wrapping device and improved methods of application of armor to conductor cables by means of which the length of the armor wrapping may be predetermined, and all of it may be used, without any waste at the ends of the armor tape.

The armor wrapping is applied by virtue of the rotation of the coil about the conductor cable, with the armor tape under tension, and it is not necessary to effect an ironing of the wrapping, as it is applied to the cable.

My device and method are capable of being used for applying more than one layer of armor to a cable at the same section of the cable, and they may be used for cables of different diameters. The entire operation may be carried out by means of disconnect poles or clamp sticks, or similar tools, so that there is no danger to the lineman in applying these devices to energized cable conductors.

The present device is capable of applying the metallic armor wrapping tightly without any substantial cracks between the successive spiral turns and in such manner that it will remain on the cable conductor for a long period of time and will stand considerable rough usage or abuse.

My wrapping device is simply constructed, and may be made of a few metal castings and threaded members, and it requires a minimum amount of machining in its use.

Referring to Figs. 6 to 9, these are views of a modified form of device in which the magazine is arranged at the theoretically correct angle for wrapping the tape on the cable conductor without any twisting, and without any possibility of overlapping.

Comparing Fig. 6 with Fig. 1, it will be observed that while the magazine 44 and supporting plate 43 are tilted toward the right in both devices, the device of Fig. 1 has its magazine axis at such an angle that it would intersect the axis of the conductor.

The device of Fig. 6, however, has its axis given a further twist which renders the back of the plate 43 visible in Fig. 6, although this is an elevational view. This last angularity varies with the width of the tape in relation to the diameter of the conductor covered, and it depends upon the pitch of the armor tape wrapped on the conductor. In the embodiment shown, it is tilted fifteen degrees to the axis of the cable.

In this embodiment of the invention, the slot 67 (Fig. 9) has been tilted with respect to the axis of the cylindrical magazine cover 44. The slot 67 is also of less depth than the depth of the magazine, giving more room on each face of coil 42 of tape in the magazine.

The groove 62 (Fig. 8, Fig. 9) has been made with a curved inner surface instead of the V-shape shown in Fig. 3, and the camming surface which engages the edge of the tape previously wrapped is indicated at 78. With the additional tilt of the magazine in the device of Figs. 6 to 9, this camming surface 78 extends in the same transverse direction as the face of the magazine.

In order to make this camming surface 78 deeper, the adjacent exterior cylindrical surface of the magazine 44 has been flattened at 80 to prevent the magazine from interfering with the entrance of the cable into the groove 62.

Inside the magazine cover 44 there has been provided an inwardly extending lug having a flat

guide surface 81 guiding the edge of the tape into the slot 67. The operation of this modification is substantially the same as that previously described, except that its magazine is disposed at the theoretically correct angle for applying the tape without twisting.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. An armor wrapping device comprising a cast metal body having an elongated V-shaped groove for engaging a cable, said body having a depending leg with a laterally projecting foot having a threaded bore for receiving an eye bolt, a shoe having a flat guiding surface engaging said leg to prevent its rotation and having rotative engagement with the end of said eye bolt, said shoe having a curved surface for engaging the side of said cable opposite to said V-shaped groove, and an armor tape magazine carried by said body at a predetermined pitch angle for wrapping armor tape on a cable as the body is rotated and caused to progress spirally along the cable.

2. An armor wrapping device comprising a cast metal body having an elongated V-shaped groove for engaging a cable, said body having a depending leg with a laterally projecting foot having a threaded bore for receiving an eye bolt, a shoe having a flat guiding surface engaging said leg to prevent its rotation and having rotative engagement with the end of said eye bolt, said shoe having a curved surface for engaging the side of said cable opposite to said V-shaped groove, and an armor tape magazine carried by said body at a predetermined pitch angle for wrapping armor tape on a cable as the body is rotated and caused to progress spirally along the cable, said magazine comprising a supporting plate extending at a predetermined pitch angle, said plate having a centrally located aperture, and a magazine member comprising a hub having a threaded member in said latter bore, said hub supporting a coil of armor tape, and said hub carrying a circular wall and a cylindrical wall for forming a magazine, said cylindrical wall having a slot through which the armor tape emerges as said device is rotated spirally on a cable to wrap the tape on the cable.

3. In a metal tape wrapping device, the combination of a metal body having a grooved clamp adapted to be engaged on a conductor, with a magazine for receiving a coil of metal tape carried by said body, said magazine having an aperture from which the tape may be withdrawn, and said magazine having formed on its exterior surface adjacent said aperture, a diagonally extending groove for engaging the conductor at such an angle that the metal tape may be spirally applied to the conductor without twisting.

4. In a metal tape wrapping device, the combination of a metal body having a groove clamp adapted to be engaged on a conductor, with a magazine for receiving a coil of metal tape carried by said body, said magazine having an aper-

ture from which the tape may be withdrawn, and said magazine having formed on its exterior surface adjacent said aperture, a diagonally extending groove for engaging the conductor at such an angle that the metal tape may be spirally applied to the conductor without twisting, said magazine also having formed upon it, transversely of said groove, a diagonally extending camming surface for engaging the edge of the tape last wrapped, and camming the magazine longitudinally of the conductor at such a rate that the metal tape will be wrapped with the edges of its successive turns engaging each other.

5. An armor wrapping device for high tension conductors, comprising a pair of movably mounted clamping members and threaded means carried by one clamping member and engaging the other for engagement with a clamp stick to actuate said clamping members, one of said clamping members having a tapered groove for receiving line conductors of various sizes, and a magazine carried by said device for rotatably supporting a coil of flat tape, said magazine being arranged at a predetermined angle so that the tape which emerges from the magazine is applied spirally to the line conductor, the coil rotating in said magazine, said magazine having a slot spaced from the line conductor a greater distance than the thickness of said tape, whereby the tape is adapted to be wrapped into spiral conformity with the outer surface of the line conductor by tension as the device is rotated and slid longitudinally of the line.

6. An armor wrapping device for high tension conductors, comprising a pair of movably mounted clamping members and threaded means carried by one clamping member and engaging the other for engagement with a clamp stick to actuate said clamping members, one of said clamping members having a tapered groove for receiving line conductors of various sizes, and a magazine carried by said device for rotatably supporting a coil of flat tape, said magazine being arranged at a predetermined angle so that the tape which emerges from the magazine is applied spirally to the line conductor, the coil rotating in said magazine, said magazine having a slot spaced from the line conductor a greater distance than the thickness of said tape, whereby the tape is adapted to be wrapped into spiral conformity with the outer surface of the line conductor by tension as the device is rotated and slid longitudinally of the line, said magazine being carried by said grooved clamping member whereby the magazine is additionally spaced from the line conductor when applied to an initial layer of armor and so that a plurality of layers can be applied.

7. In a metal tape wrapping device, the combination of a metal body having a grooved clamp adapted to be engaged on a conductor, with a coil supporting hub for receiving a coil of metal tape carried by said body, said body having a flange provided with an aperture from which the tape may be withdrawn, and said body having formed on its exterior surface adjacent said aperture, a diagonally extending groove for engaging the conductor at such an angle that the metal tape may be spirally applied to the conductor without twisting, by rotating the body on said conductor.

DAVID C. HUBBARD.