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METHOD AND APPARATUS FOR WRAPPING ARMOR WIRE ON ENERGIZED CONDUCTORS

Filed May 9, 1945

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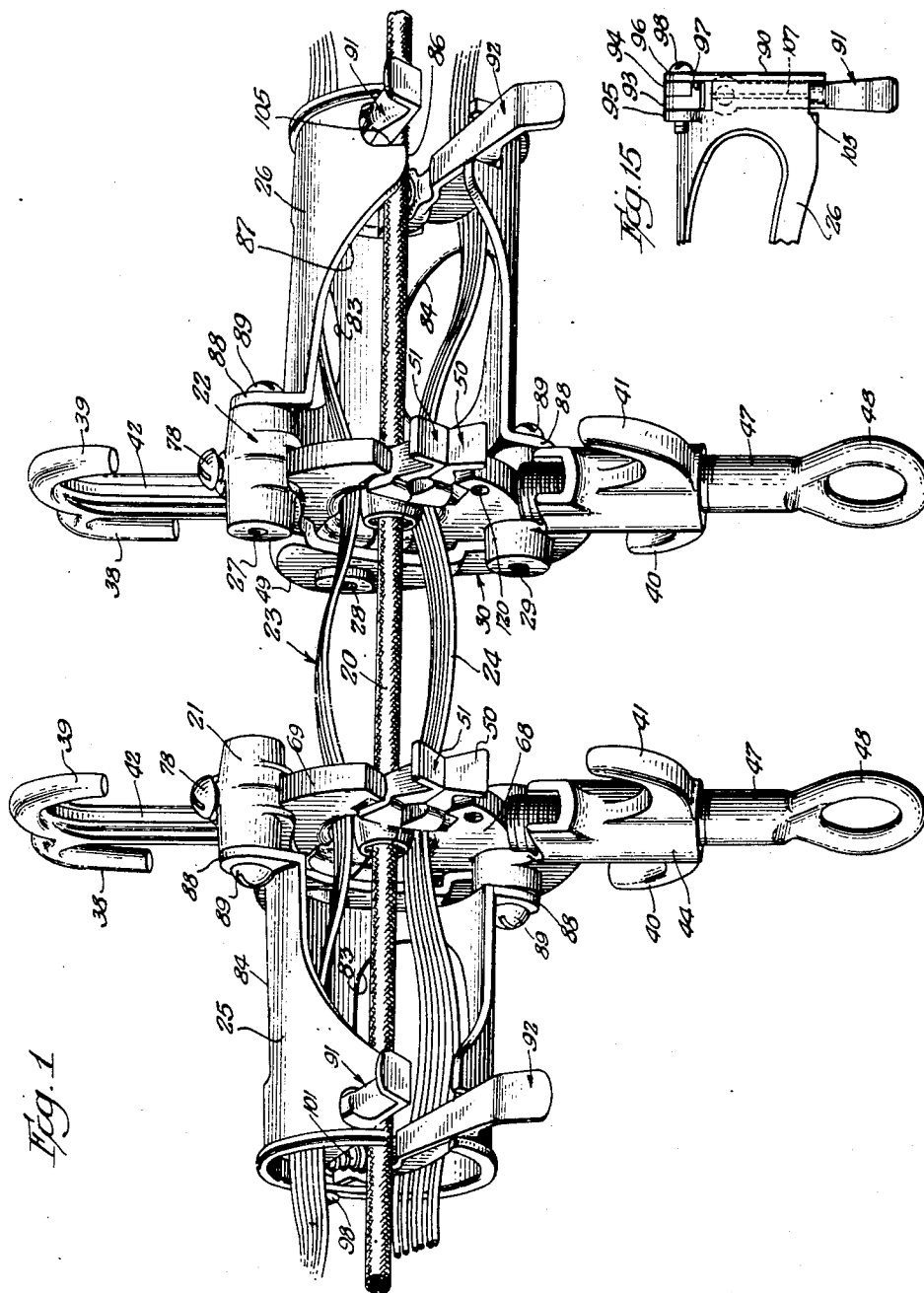


Fig. 1

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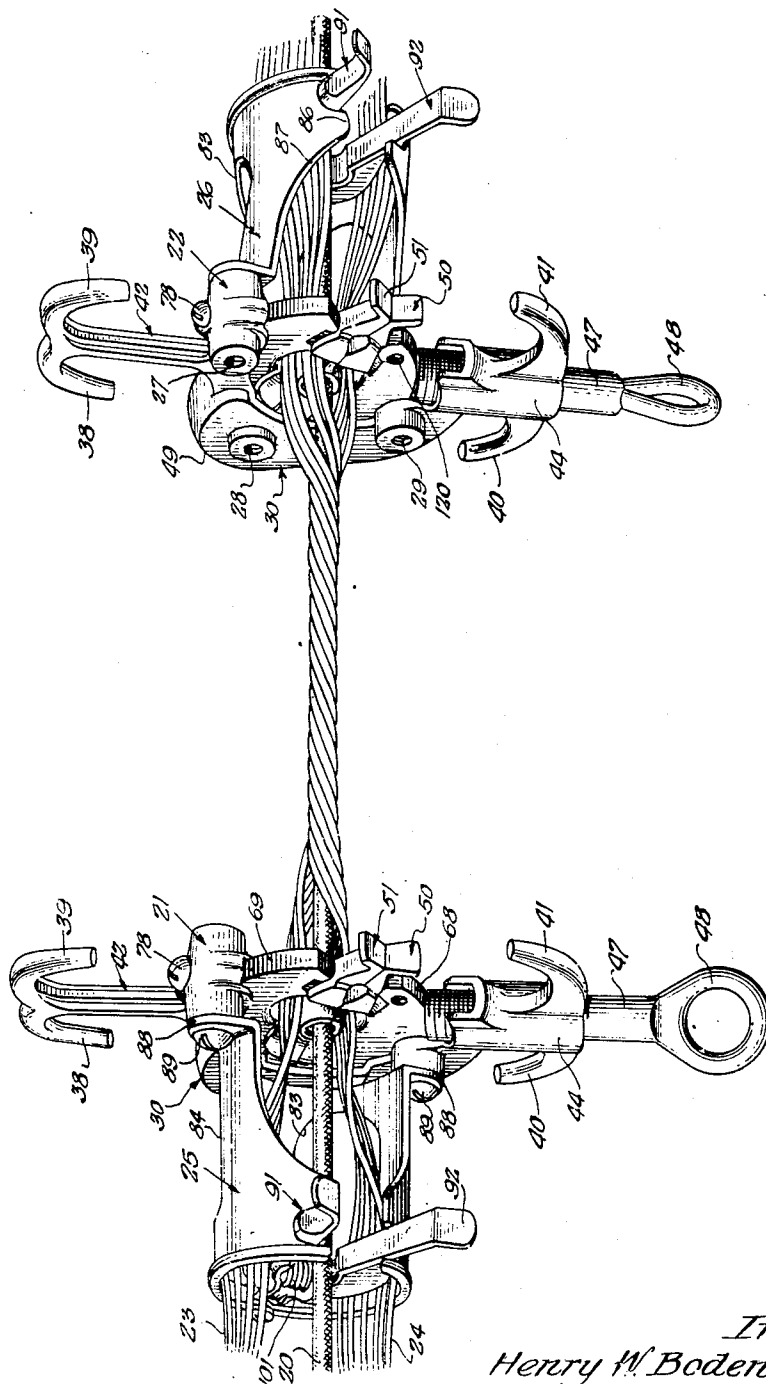
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4 Sheets-Sheet 2

Fig. 2



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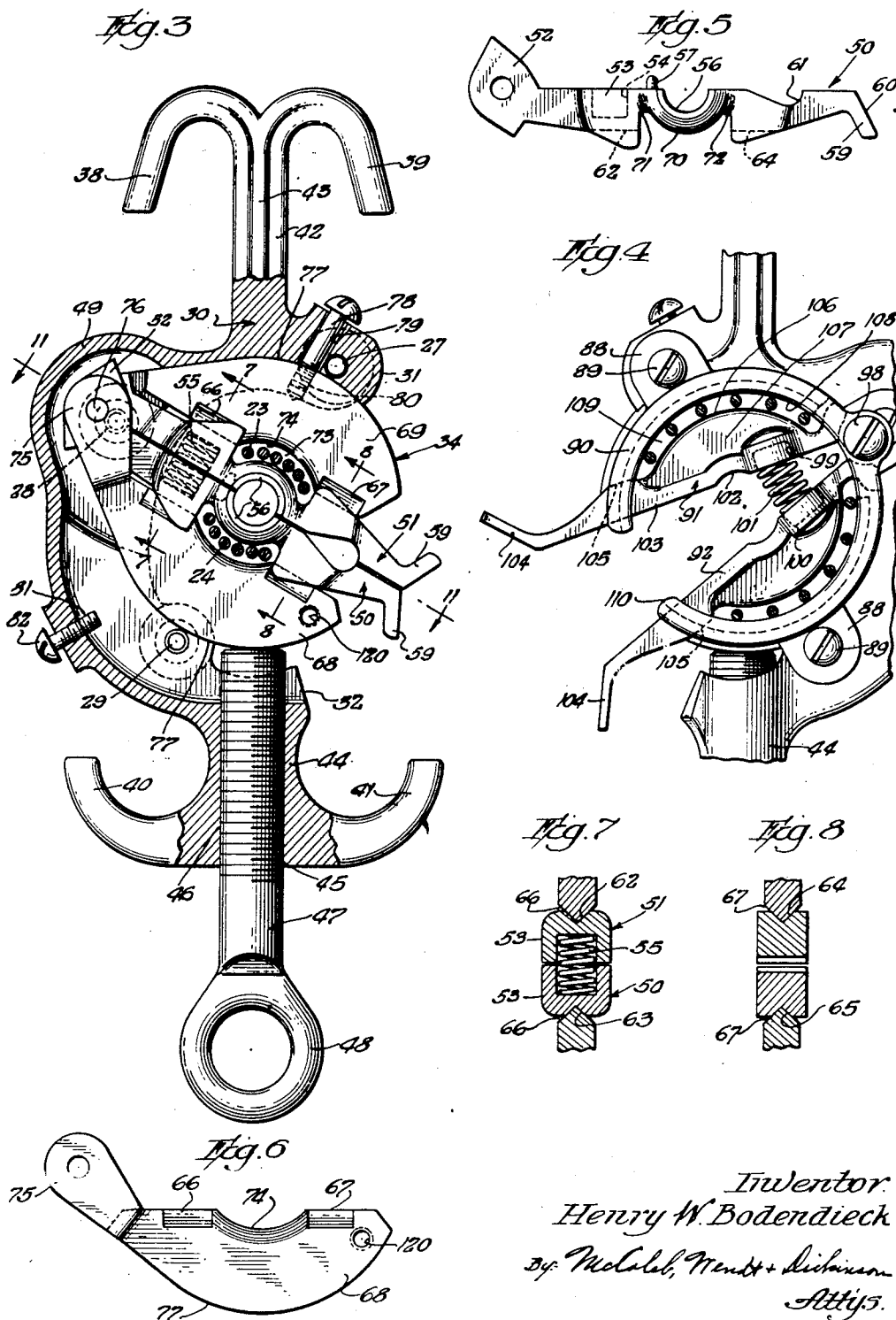
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METHOD AND APPARATUS FOR WRAPPING ARMOR WIRE ON ENERGIZED CONDUCTORS

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METHOD AND APPARATUS FOR WRAPPING ARMOR WIRE ON ENERGIZED CONDUCTORS

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Fig. 9

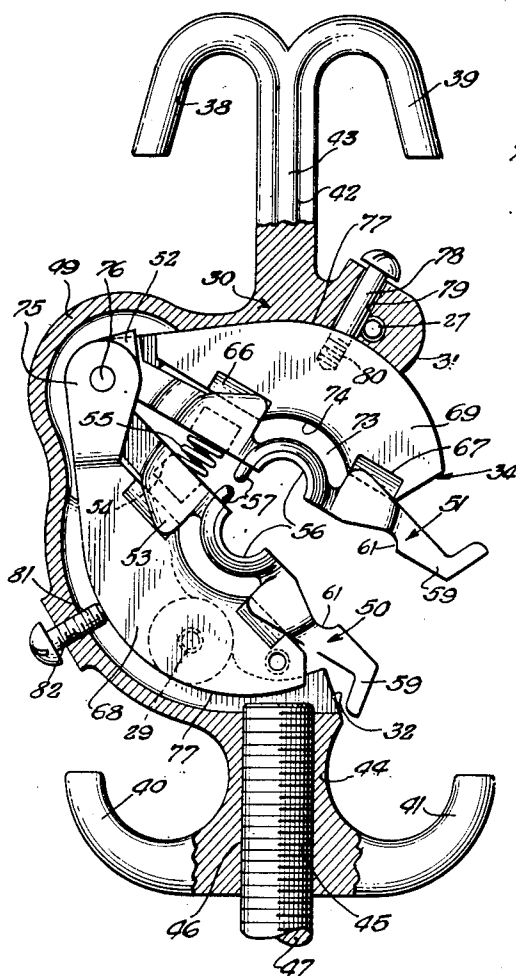


Fig. 10

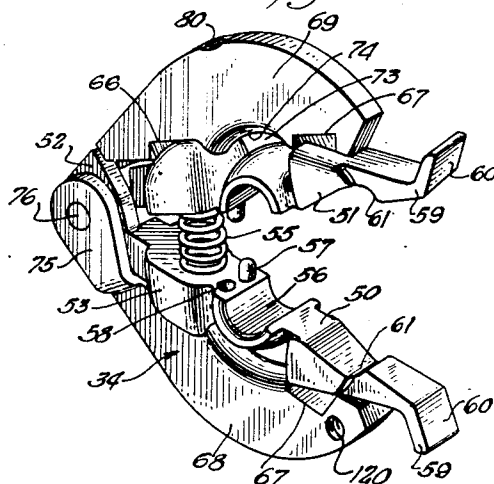


Fig. 14

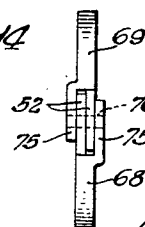


Fig. 12

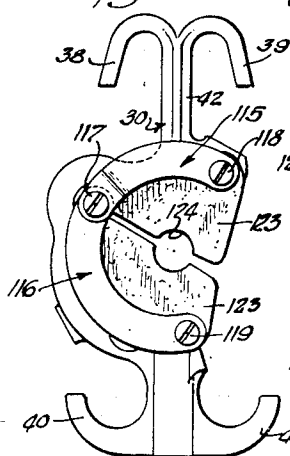


Fig. 13

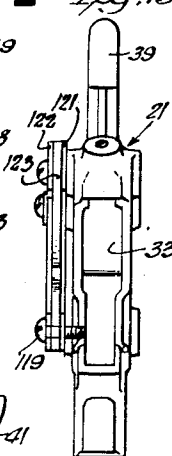
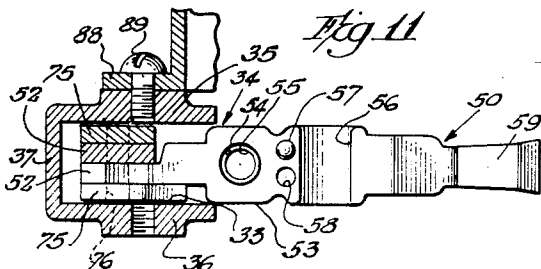


Fig. 11



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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR WRAPPING
ARMOR WIRE ON ENERGIZED CONDUCTORS

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Application May 9, 1945, Serial No. 592,807

20 Claims. (Cl. 57—10)

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The present invention relates to methods and apparatus for wrapping armor wire on energized conductors, and is particularly concerned with improved methods and tools for applying preformed armor wires to "hot" electrical transmission lines.

Preformed armor wires, such as helically formed wires for wrapping upon electrical conductors, have been used for preventing the wear and tear, wire burning or chafing of the conductors, preventing vibration fatigue of the parts, and for preventing all of the other defects attendant upon the use of transmission line conductors without such armor.

However, according to the methods of the prior art such preformed wires have been applied by hand or by the use of certain tools which do not permit the application of the preformed wires while the conductor is still energized.

One of the objects of the present invention is the provision of an improved method and an improved "hot"-line tool by means of which such preformed armor wires may be applied to the transmission line conductors while the line is fully energized, the tools being actuated by means of the usual clamp stick or by means of various types of electrically insulated operating sticks having hooks or other operating formations upon the working end of the stick.

According to the methods of the prior art the preformed armor wires were applied by hand one by one, and one of the objects of the present invention is the provision of an improved method and tool by means of which all of the required armor wires for a particular installation may be applied simultaneously with a minimum amount of labor and in practically the same time as is required according to the prior art methods to apply one wire by hand.

Another object of the invention is the provision of an improved method and operating tool for applying armor wires of the preformed type which is adapted to save time and labor and adapted to apply all the wires simultaneously and by means of which the armor installation is snugly and uniformly applied, although the conductor is energized and the operator is actuating the tool by means of an electrically insulated operating stick.

Another object of the invention is the provision of an improved operating tool for applying preformed armor wires, which is so constructed that the wires may be kept close enough to the conductor during the simultaneous application of all of the wires required for a particular installation

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so that the wires are not subjected to excessive bending or distortion which might result in a spreading of the ends of the armor wires or in a failure to have a snug application of the armor wires at their ends.

Another object of the invention is the provision of an improved armor wire assembly which is substantially self-supporting on the conductor after it has been assembled with the armor wires so that it may be hooked upon the transmission line conductor and so that the armor wires may be suitably supported in proper position to be wrapped simultaneously without possibility of injury of the conductor or of the armor wires.

Another object of the invention is the provision of an improved wrapping tool for preformed armor wires and an improved assembly which is so constructed that there is no teetering of the assembly on the conductor and so that the armor wires which are being wrapped are kept constantly arranged in a predetermined concentric alignment with each other so that as the wires are wound about the conductor they tend to stay in the wrapped position to which they are being moved by the tools instead of rebounding into the loose, unwrapped position, so that an operator may taken a new grip with his operating stick on the tool without undoing all that he has accomplished by his prior wrapping actions.

Another object of the invention is the provision of an improved operating tool for wrapping preformed armor wires, the operating jaws of which may be removed as a unit from their support so that the operator may support and operate jaws of a different size for use on conductors of considerably larger or considerably smaller size than the one for which the removed operating jaws were intended.

Another object of the invention is the provision of a hot-line wire wrapping tool for preformed armor wires which is simple in its construction, capable of economical manufacture, durable, easily handled by hot-line operating sticks, and adapted to be used for a long period of time without necessity for repair or replacement of its parts.

Another object of the invention is the provision of improved wire wrapping tools for preformed armor wires which are equally adaptable for operation on energized conductors or for more expeditiously and efficiently applying the wires to conductors when not energized.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar

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characters of reference indicate similar parts throughout the several views.

Referring to the drawings, of which there are four sheets,

Fig. 1 is a side elevational view of the armor wrapping tool or assembly shown in connection with the preformed armor wires and the transmission line conductor to which they are to be applied after the assembly has been lifted by means of a suitable hot line stick, and hooked on the conductor and after the jaws have been closed;

Fig. 2 is a similar elevational view showing the same assembly after the wrapping of the armor wires has progressed for a predetermined number of turns, with both ends of the armor installation still unfinished;

Fig. 3 is a vertical elevational view in partial section, showing one of the wrapping tools with its jaws closed, taken on the plane of the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary end elevational view of the auxiliary guiding jaw structure, with the wires in the position which they assume at this part of the tool;

Fig. 5 is a side elevational view of one of the main jaws of the tool, which jaw engages outside the conductor and inside the armor wires;

Fig. 6 is a side elevational view of one of the jaws of the wire guiding unit, which engage the outside of the wires;

Fig. 7 is a fragmentary sectional view, taken on the plane of the line 7—7 of Fig. 3, looking in the direction of the arrows, showing the spring arrangements for urging the main and auxiliary jaws into open position;

Fig. 8 is another fragmentary sectional view, taken on the plane of the line 8—8 of Fig. 3, looking in the direction of the arrows, showing the ridge and groove arrangements which keep these jaws in alignment with each other;

Fig. 9 is a view similar to Fig. 3, showing the tool before the armor wires are placed in it and before the jaws are closed by the application of the screw eye;

Fig. 10 is a view in perspective of the removable jaw unit of the tool, with the jaws in open position;

Fig. 11 is a fragmentary sectional view, taken on the plane of the line 11—11 of Fig. 3, looking in the direction of the arrows, showing the details of structure of the main jaws of the unit;

Fig. 12 is a side elevational view of a modified form of tool, in which the laterally projecting guide members of Figs. 1 and 2 have been replaced by means of a closely attached resilient guiding member located on each tool;

Fig. 13 is a front elevational view of this modification;

Fig. 14 is a fragmentary rear elevational view, showing how the parts of this modification are pivoted together;

Fig. 15 is a fragmentary end plan view of one of the auxiliary guides for holding the armor wires.

The armor wires which have been selected to illustrate the invention are round wires, but in some embodiments of the invention wires of different cross sectional shape, such as strips, ribbons, or square wires, may be employed.

Preformed armor wires of the type adapted to be applied by the present tools and methods are shown in the prior patent to T. F. Peterson, No. 2,275,019, on Cable reinforcement, issued March 3, 1942. Suffice it to say that the wires are

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preferably of steel or other relatively durable material, and they are spirally preformed with relation to the particular size of conductor to which they are to be applied and with relation to the number of wires to be used and the size of the wires, so that the pitch is such that when the wires are wrapped about the conductor they fit quite tightly and grip the conductor and form a side-by-side wire covering which is spirally wrapped about the cable or conductor.

The conductor illustrated is of stranded wire, but obviously the present armor may be applied to any kind of conductor. According to the present illustration, it happens that the size of conductor and wires and the pitch of the wires is such that eleven preformed wires are needed to complete the armor covering on the conductor.

Referring to Fig. 1, 20 indicates the electrical conductor which is to be covered by armor. 21 indicates the left armor wrapping tool, and 22 the right armor wrapping tool.

The eleven wires are arranged in two groups, the group 23 above including five wires, and the group 24 below including six wires. The armor wrapping tools 21 and 22 are substantially the same in construction, except that these are right hand and left hand tools, and they are distinguished one from the other in that the guide frames 25 and 26, which extend longitudinally of the conductor 20, extend in opposite directions, thus permitting the wrapping tools to come closer together.

It will be noted that the wrapping tool 22 has a plurality of threaded bores 27, 28, 29 on its left side in Fig. 1, thus showing that a single wrapping tool may have its guide frame 25 or 26 applied to either face.

Referring now to Figs. 3, 4, and 9, each wrapping tool preferably includes a body 30, which acts as a supporting frame and a partial housing for the various parts of the tool. This body 30 comprises a substantially C shaped portion, which may be seen in Fig. 9 as extending from the right point top 31 to the lower right part 32, which parts or points define an opening in the C.

The C shaped body 30 may be substantially rectangular in cross sectional shape, as seen in Fig. 11, and it is preferably formed with an inwardly open rectangular groove 33 for receiving the jaw unit shown in Fig. 10 and indicated in its entirety by the numeral 34.

The groove 33 in the C shaped body 30 is in effect defined by a pair of side flanges 35, 36 and a yoke flange 37. Thus the body 30 is essentially a channel shaped member in cross section, with one open side, the open side being located on the inside of the C. The body 30 is preferably formed with a plurality of oppositely located outwardly projecting hooks, indicated at 38, 39, at the top, and 40, 41 at the bottom.

The hooks 38, 39 at the top are supported by an upwardly extending column 42 provided with a rib 43 for reinforcing. The hooks 40 and 41 at the bottom are supported by a downwardly extending column 44, which has an axially extending threaded bore 45 extending through the column to the inside of the groove 33.

Thus the bore 45 serves to support the threaded end 46 of an eye bolt 47, the head of which is in the form of a circular eye 48.

In some embodiments of the invention differently shaped heads may be used on the screw bolt, but the eye head is preferably used, as it may be engaged by the same clamp stick or insulating

operating stick as is used to engage the hooks 38 to 40.

In some embodiments of the invention the hooks 38 to 40 may be changed to flanges, with through openings like the head of the eye bolt to be engaged by an operating stick, such as a switch pull which has a laterally extending lug at its upper end. However, hooks are preferred, as they are used with a greater number of types of operating tools.

The eye bolt 47 is adapted to engage the lowermost jaw of the jaw unit 34, moving it from the position of Fig. 9 to that of Fig. 3.

Referring again to the body 30, it will be noted that this body diverges slightly from the symmetrical shape of a capital letter C, as it has an outward bulge at 49 for accommodating the enlarged portion of the jaw unit 34, which is located at the pivot of the jaws.

The jaw unit 34 is shown in Fig. 10, apart from the rest of the tool; and it comprises a pair of main jaws 50, 51 of the types shown in Fig. 5, which are suitably shaped for rotatably supporting the tool on the conductor 20 and also for engaging and guiding the wires by having the wires engage the outside of the main jaws 50, 51.

The jaws 50 and 51 may be identical in shape; but being reversed in position, to bring the pintle flanges 52 of the jaws into engagement with each other; as the pintle flanges are laterally offset, this brings the two jaws into vertical alignment with each other.

Each jaw is preferably provided with a lateral enlargement at 53 just forwardly of the pintle flanges 52, and the enlargements 53 are each formed with a bore 54, serving as a socket for the helical compression spring 55. The spring 55 and sockets 54 are of such size and shape that the spring may be so compressed that it is completely housed in its sockets; but it urges the jaws 50, 51 apart.

Continuing with Fig. 5 toward the right of the spring sockets 54, each jaw is provided with a centrally located half cylindrical groove 56. The axis of this groove extends transversely to the length of the jaws. The two grooves 56 in the two jaws form a cylindrical bore when the jaws are closed, as shown in Fig. 3; and this bore is of such size that it will receive a predetermined number of conductors of different size.

The grooves shown are for a standard size of conductor, but larger or smaller grooves may be provided in jaw units for particularly small or particularly large conductors. In fact, the jaw unit 34 is made removable so that other jaws with different sized openings 56 may be employed for larger or smaller conductors.

Between the spring socket 54 and the conductor groove 56 each jaw is preferably provided with an outwardly projecting cylindrical pin 57 and beside the pin with a cylindrical socket 58.

The pin 57 of one jaw 50 will fit into the socket 58 of the other jaw 51, and vice versa; and thus these pins and sockets will keep the jaws in alignment when the jaws are closed. A more important function of the pins 57, cooperating with sockets 58, is that they prevent the conductor from passing beyond the conductor groove 56, where the conductor would otherwise be pinched, thus preventing any injury of the conductor.

Proceeding further in Figs. 10 and 5 outwardly toward the ends of the jaws, at the ends of the jaws there are preferably a pair of outwardly turned flanges or horns 58, 59, one on each jaw; and these flanges 59 have faces 60 that diverge

outwardly and tend to guide the jaws over the conductor with which they are to be used.

The diverging flanges give a wider opening at the ends of the jaws.

Between the ends of the jaws and the grooves 56 each jaw is preferably formed with a transverse groove 61, which is substantially cylindrical at its right side (Fig. 5) and has a tapered wall at its left side in Fig. 5. The groove 61 is relatively shallow, and it may be used as a clamping or ironing groove for engagement with the outside of the armor at the ends of the wires, to iron the armor wires down into place should any of them be disarranged when the job is being completed.

For this action the eye screw 47 is used to clamp the assembly or tool on the armor at the groove 61, the parts being in the position of Fig. 3; but with the jaws spread sufficiently to receive the armor in the grooves 61.

The cross sectional shape of the various parts of each jaw may vary as shown, the purpose being to provide each part with sufficient bearing to accomplish its function, but to save material where it is not needed.

On its rear side each jaw 50 or 51 is preferably provided with a pair of V-shaped grooves 62, 63, 64, 65. These grooves are indicated by the dotted lines in Fig. 5 on the lower side, and they are located on either side of cylindrical conductor groove 56 for the following purpose:

The grooves 62 to 65 are adapted to receive the complementary V-shaped edge portions 66, 67 (Fig. 6) which are formed on the auxiliary jaw members 68 and 69. These V-shaped edge portions 66, 67 engaging in the V-shaped grooves 62 to 65 also tend to keep the main jaws 50, 51 in alignment with the auxiliary jaws 68, 69. The central portion of each of the main jaws 50, 51, partially surrounding the half cylindrical groove 56, is also preferably cylindrical, as indicated at 70 (Fig. 5), terminating in a curved groove 71, 72 at each end so that when the main jaw 51 is placed adjacent the auxiliary jaw 69, as shown in Fig. 9, there is an arcuate aperture 73 formed by the surfaces just described, in conjunction with a partially cylindrical surface 74 on the inner side of each auxiliary jaw 68 or 69.

It is this arcuate aperture 73 between the main and auxiliary jaws which is to receive the armor wires, as shown in Figs. 1 and 2.

The auxiliary jaws 68 and 69 are also provided with offset pintle flanges 75, which are offset sufficiently so that when the auxiliary jaws are aligned with each other and located above and below the main jaws the pintle flanges 75 on the auxiliary jaws are located outside the pintle flanges of the main jaws.

These pintle flanges are shown in section in Fig. 11. They are all joined together pivotally by a rivet or pin 76. Auxiliary jaws 68, 69 may be substantially rectangular in cross section, and may have a sliding fit in the groove 33 of the housing 30. Each of these auxiliary jaws 68, 69 is slightly curved so as to form the arcuate aperture 73 on its inside, and slightly curved on its outside at 77 to have a substantial fit in the groove of the C-shaped body 30.

The uppermost of these jaws 69 is fixedly secured in its portion of the groove 33 by means of a screw bolt 78, which passes through a bore 79 in the body 30 and is threaded into a threaded bore 80 in the auxiliary 69. This leaves the other three jaws 50, 61 and 68 free to pivot inside the

housing, but they are all urged into the position of Fig. 9 by the spring 55.

Another screw bolt 81 is located in a threaded bore 82 in the C-shaped housing 30, projecting into the groove 33 to engage the lower jaw 68 and to determine the final position of this lower jaw when the eye bolt is retracted. The end of the eye bolt 47 engages the curved surface 77 of the lower auxiliary jaw so that the eye bolt is adapted to be turned in its threaded bore to drive the jaws together from the position of Fig. 9 to that of Fig. 3, where the jaws are engaged with the central grooves or apertures 56 about the conductor 20.

A tool including only the foregoing structure is capable of winding the preformed armor wires spirally upon a conductor, but the tools tend to get out of parallelism with each other unless they are provided with some auxiliary guide. Therefore, the tool is preferably provided with the laterally projecting guide frames 25, 26, shown in Fig. 1.

These guide frames consist of partial cylinders provided with a pair of apertures 83, 84 on their rear sides, and with a slot 86 on the front side, as shown in Fig. 1. The slot 86 is preferably widened to a substantial opening 87 toward each tool; and in general only sufficient of these cylindrical bodies 25, 26 is provided to furnish an adequate support for the guides, further to be described.

Each cylinder has the projecting attaching ears 88 which receive screw bolts 89 that are threaded into the bores 27 to 29 of the body 30 of the tool. Thus the cylindrical guide members 25, 26 project longitudinally of the conductor 20. The end portion or outer edge 90 of each guide frame 25, 26 is in effect another open C-shaped member, as shown in Fig. 4.

In order to support the tool in its most stable position for operation each guide member 25, 26 is also provided with a pair of pivoted jaws 91, 92. The jaws 91, 92 are provided with pintle flanges 93, 94 (Fig. 15), which pintle flanges are offset from each other so that they may be received between the flanges 95, 96 in a slot 97 in the guide frame 25 or 26 and pivotally mounted therein by a screw bolt 98, which is threaded into the flange 95.

Thus the jaws 91, 92 are pivoted in such manner as to be in alignment with each other. Each of these jaws 91, 92 has a spring socket 99 formed at an enlargement 100 for receiving the compression coil spring 101. Each jaw is also provided with a partially cylindrical transverse groove 102 for engagement with the electrical conductor 20.

Each jaw also has a plane surface 103 extending outward to its horn flanges 104, which spread diagonally outward to give the jaws a greater opening at their outer ends. The guide frames 25, 26 are provided with slots 105 (Fig. 1), into which the jaws 91, 92 are forced by the spring 101.

Thus the jaws 91, 92 are constantly held in the position of Fig. 1 by the spring. At its outer side each jaw is formed with a partially cylindrical surface 106 on a thin flange 107; and when the jaws are in the position shown in Fig. 4, the cylindrical edge surface 106 on the back of each jaw is spaced from the inner cylindrical wall 108 of each frame 25, 26 to provide an arcuate aperture 109 for receiving the groups of wires.

It will be noted that these arcuate apertures 109 are much longer, and they are also located

at a greater radius from the center of the conductor. The reason for this location is that at this point the wires actually tend to spread; and when the arcuate aperture 109 is so located, the guard assemblies carried by frames 25, 26 are adapted to engage the wires and hold them in their proper position, with the two tools in parallelism during the wrapping operation.

The jaws may be moved toward each other to permit the wires to be inserted at the opening 110 of the C-shaped frame 25 or 26. Then, of course, the opening will be behind each jaw 91 or 92, and between the frame and the rear side of each jaw.

The length of the auxiliary guide frames 25, 26 is preferably such that when the wires are in the tools, as shown in Fig. 1, and there is an outward bend between the tools, as shown in Fig. 1, and the tools have their main jaws engaging at the next adjacent inward bends of the wires, the auxiliary guide jaws 91, 92 engage the wires at the next outward bend of the wires.

Thus the arcuate slots are properly located to hold the wires side by side with each other so that they can be wrapped in an orderly manner on the conductor.

The mode of use and operation of the tools is as follows:

First, the eye bolts 47 are withdrawn to the position of Fig. 9, to permit maximum spreading of the jaws 68, 69 and 50, 51. The right hand and left hand tool may be laid upon a suitable support and the guide jaws 91, 92 may be moved toward each other to permit the insertion of the wires in an orderly fashion into the apertures 109.

Next, they are moved into the arcuate apertures 73 between the main jaws 50, 51 and the auxiliary jaws 68, 69 until half or approximately half of the wires are arranged in each of the series of apertures 73, 109 provided by the tools and guide frames, as shown in Fig. 1.

To do this it is only necessary to urge the jaws into a closed position against their springs successively and to insert the wires one by one into proper position. The wires may then be engaged at their ends with the floor or some other article to bring them into end alignment, and the tools may be slid longitudinally until there is an outward bulge in the two groups of wires 23, 24 between the tools and the main jaws are engaging the wires at an inward bulge.

At this time it will be found that the wires tend to spread at their ends into engagement with the cylindrical inner surface of the end portions of the guide frames 25, 26.

The assembly shown in Fig. 1 may then be lifted by means of a pair of clamp sticks, which may have their eyes or hooks engaging either one of the uppermost hooks 38 or 39 so that the assembly hangs downward from the tool ends of the clamp sticks.

The clamp sticks may then be used to lift the assembly and to place it on the conductor wire, the conductor wire entering between the jaws 50 and 51 when they are open, as shown in Fig. 9.

The downwardly extending eye bolts 47 and the general structure of the tools give the tools and the assembly a center of gravity which is lower than the uppermost groove 56 so that the assembly may be hooked on the wire; that is, it may be laid on the conductor 20 and it will be supported on the conductor by the uppermost groove 56. Then the clamp sticks may be removed from the upper hooks 38, 39 and may be engaged with the eyes 48 of eye bolts 47.

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The eye bolts are turned by means of the clamp sticks until the jaws 50, 51 are closed about the conductor, as shown in Fig. 3 and in Fig. 1. The assembly is now ready for the wrapping action to begin. This may be accomplished by means of two clamp sticks, one of which may engage the eye or any of the hooks of the left tool 21, while the other clamp stick engages the eye or any of the hooks of the right tool 22.

By means of the clamp sticks one tool is urged counterclockwise, that is, the left one in Fig. 1, and the other tool 22 is urged in a clockwise direction, thus causing the wires to be wrapped simultaneously side by side on the cable, as shown in Fig. 2.

It is desirable that the tool 22 be rotated clockwise at the same time that the tool 21 is being rotated counterclockwise; that is, two clamp poles should be used for pulling these tools in opposite directions simultaneously because the wrapping will then progress without exerting a twist on the conductor, as each tool will resist the turning action of the other.

The location of the tools and the preformation of the wires and the fit of the wires and the friction involved is such that the wrapping tools do not rebound against the direction in which they are being moved when the clamp stick is taken off to take a new grip on another hook. Thus step by step the clamp sticks may be used to rotate the wrapping tools, which in turn wrap all of the wires simultaneously.

As this wrapping progresses, naturally the tools must slide longitudinally of the conductor and of the wires, and the tools gradually spread from each other until they run off the ends of the wires as the wires become completely wrapped. Thus it is of assistance for the clamp sticks to be pulled in opposite directions longitudinally of the conductor as the tools are being rotated, as this longitudinal motion serves to cause the tools to move according to the pitch of the preformed armor wires.

By means of the present tools it is thus possible to apply all of the armor wires simultaneously while the conductor is energized, with perfect safety. Furthermore, much labor is saved over the application of the wires one by one according to the prior art, and much time is saved, as all of the wires may be wrapped in about the same time it takes to wrap one wire according to the prior art. Some time is, of course, involved in the placing of the wires in the assembly; but the total amount of time may be one-third or one-fourth of that involved according to the methods of the prior art.

Referring now to Figs. 12 to 14, these figures show a modification with a different type of guiding apparatus than that which is carried by the tubular guide frames 25 and 26 of Fig. 1.

In this embodiment of the invention the tool member is substantially the same, and the same apertures 27 to 28 are used with screw bolts for attaching the new auxiliary guide apparatus for stabilizing the assembly on the conductor.

In this embodiment there are attached a pair of auxiliary jaw members 115, 116. It should be noted that the upper jaw member 115 of this embodiment is fixedly secured to the body 30 by means of screw bolts 117, 118 in the apertures 28 and 27, but the lower aperture 29 of the body 30 is not used. The lower jaw 116 is attached to the jaw 68 by means of a screw bolt 119 (Fig. 12) in a threaded bore 120 (Fig. 3).

In this case each jaw consists of a curved sheet

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metal member 121, 122, the sheet metal members having between them a sheet of resilient material, such as rubber 123. The metal plates 121, 122 clamp the intermediate rubber sheet and give it support; and the two rubber sheets are of greater area than the metal sheets 122 and 121 so that when the jaws are assembled there is merely a relatively small hole 124 between the two jaws 115, 116.

The hole 124 is of substantially the same size as the hole which is formed by the grooves 56 in the winding tool; but as the wires tend to spread where they emerge from the wrapping tool, this is permitted by the rubber sheets 123, which bell outwardly and introduce a predetermined friction between the rubber and the armor wires.

The operation of this embodiment is substantially the same as the one previously described; but in this case the guiding jaws 115, 116 are controlled by the same spring 55 which urges them open with the main jaws 50, 51, and all of the jaws 50, 51, 68, 69, and 115, 116 are closed by means of the eye bolt 47.

When the wrapping tool of this embodiment is rotated, the friction between the rubber and the adjacent armor wires tends to hold the tool against unwinding or rebound. This apertured rubber sheet surrounding the armor wires also tends to increase the stability of the assembly and to keep the two tools in parallelism.

This embodiment is not, however, as effective as the preferred embodiment of Fig. 1 in maintaining such parallelism and stability because the rubber jaws which are used to accomplish the function are much closer to the individual wrapping tool.

The spacing of the auxiliary guide jaws 91, 92 from the wrapping tool by the cylindrical frames 25 and 26 makes the embodiment of Fig. 1 more effective in so far as stability and parallelism of the two wrapping tools is concerned.

Referring now to the method of operation of the present device, this may be summarized briefly as follows: First the wires are arranged in groups, and in each group the wires are arranged side by side in substantial parallelism; that is, the curves of each wire are equally distant from the curves in the next adjacent wire, and the assembly of wires is free from entanglements which would be caused by one wire crossing another.

Referring to the tool assembly of Fig. 1, it will be evident that the wires are so arranged. The two assemblies of wires are then brought into a position where the conductor to be wrapped is located centrally of the two groups, and the wires are now in position to be wrapped simultaneously while the individual wires are maintained in parallelism, within each group of wires.

The next step then is to guide the two groups of wires simultaneously while the two groups are being wrapped about the conductor. In some embodiments of the invention a single tool might be used, the ends of the wires being clamped and the tool progressing from the clamp end toward the free end of the wires.

However, it is more expeditious to utilize two wrapping tools and to locate them centrally of the ends of the armor wires and to proceed by starting the wrapping intermediate the ends of the armor wires, each tool progressing outwardly and oppositely toward the ends of the armor wires.

The two groups of wires are grasped in such manner that the wires are maintained in parallelism in the group, and they are then wrapped

about the conductor clockwise at one end and counterclockwise at the other end.

The wrapping brings the armor wires into engagement with the conductor at a medial portion of the armor wires, and thereafter the wrapping proceeds spirally outward toward the ends of the armor wires, the armor wires being laid simultaneously side by side to cover the conductor.

Due to the preforming of the armor wires they are already so shaped that they will fill the space between the successive turns of armor wires completely, and completely cover the conductor, which they also grip quite tightly.

When the conductor is energized, it is, of course, necessary to handle the armor wires by means of insulated operating sticks, such as clamp sticks; and these are most easily used when tools of the type shown in Fig. 1 are employed.

It will thus be observed that I have invented an improved hot line tool which is adapted to wrap preformed armor wires on an energized conductor with a considerable saving of time and labor.

Much inconvenience is saved to the users of current by the fact that the line need not be deenergized, as such armoring operations can be carried on with the present apparatus, with perfect safety, while the line is energized.

So far as I am aware, this is the first tool which is adapted to wrap preformed armor wires about a conductor when energized, or which is adapted to wrap a plurality of such wires simultaneously or in the manner described.

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. The method of wrapping preformed armor wires on a central core which comprises separating the armor wires into a pair of groups with the wires of each group arranged side by side in substantial parallelism, the groups being arranged oppositely with respect to the core, and simultaneously wrapping the preformed armor wires about the core while the wires are maintained in substantial parallelism during the wrapping operation.

2. The method of wrapping preformed armor wires on a central core which comprises separating the armor wires into a pair of groups with the wires of each group arranged side by side in substantial parallelism, the groups being arranged oppositely with respect to the core, and simultaneously wrapping the preformed armor wires about the core while the wires are maintained in substantial parallelism during the wrapping operation, the said wrapping beginning at a point intermediate the ends of the armor wires and progressing outwardly toward both ends of the armor wires simultaneously.

3. The method of wrapping preformed armor wires on a central core which comprises separating the armor wires into a pair of groups with the wires of each group arranged side by side in substantial parallelism, the groups being arranged oppositely with respect to the core, and simultaneously wrapping the preformed armor wires about the core while the wires are maintained in substantial parallelism during the

wrapping operation, the said wrapping beginning at a point intermediate the ends of the armor wires and progressing outwardly toward both ends of the armor wires simultaneously, and the said wrapping being carried on by means of insulated operating members, whereby the central core may remain energized.

4. A preformed armor wire wrapping unit comprising a pair of inner jaws and a pair of outer jaws, all of said jaws being pivoted together, the space between each inner jaw and outer jaw being formed with an arcuate slot of sufficient size to receive a plurality of preformed armor wires and to hold them in substantially side by side relation without overlapping.

5. A preformed armor wire wrapping unit comprising a pair of inner jaws and a pair of outer jaws, all of said jaws being pivoted together, the space between each inner jaw and outer jaw being formed with an arcuate slot of sufficient size to receive a plurality of preformed armor wires and to hold them in substantially side by side relation without overlapping, and the said inner jaws being formed with a pair of grooves forming an aperture when the inner jaws are closed, the apertures serving to guide the unit for rotation upon a conductor about which the armor wires are to be wrapped.

6. A preformed armor wire wrapping unit comprising a pair of inner jaws and a pair of outer jaws, all of said jaws being pivoted together, the space between each inner jaw and outer jaw being formed with an arcuate slot of sufficient size to receive a plurality of preformed armor wires and to hold them in substantially side by side relation without overlapping, supporting means for holding said unit, and spring means for urging said jaws apart.

7. A preformed armor wire wrapping unit comprising a pair of inner jaws and a pair of outer jaws, all of said jaws being pivoted together, the space between each inner jaw and outer jaw being formed with an arcuate slot of sufficient size to receive a plurality of preformed armor wires and to hold them in substantially side by side relation without overlapping, supporting means for holding said unit, and spring means for urging said jaws apart, and threaded means carried by said supporting means for actuating the jaws toward each other into a closed position against said spring means.

8. A preformed armor wire wrapping unit comprising a pair of inner jaws and a pair of outer jaws, all of said jaws being pivoted together, the space between each inner jaw and outer jaw being formed with an arcuate slot of sufficient size to receive a plurality of preformed armor wires and to hold them in substantially side by side relation without overlapping, and the said inner jaws being formed with a pair of grooves forming an aperture when the inner jaws are closed, the aperture serving to guide the unit for rotation upon a conductor about which the armor wires are to be wrapped, the said inner jaws being provided with overlapping members between the said grooves and the point of pivot of the inner jaws to prevent pinching of the conductor at that point.

9. A preformed armor wire wrapping unit comprising a pair of inner jaws and a pair of outer jaws, all of said jaws being pivoted together, the space between each inner jaw and outer jaw being formed with an arcuate slot of sufficient size to receive a plurality of preformed armor wires and to hold them in substantially side by side relation

without overlapping, and guide means for engaging inside and outside the wires in each group at a predetermined distance from the conductor upon which they are to be wrapped, said guide means being spaced longitudinally of the conductor from said unit.

10. A supporting and guiding member for a jaw unit for wrapping preformed armor wires on a conductor, comprising a housing member provided with an inner groove for receiving said jaw unit, said housing being open on one side and having threaded means for securing the jaw unit in said groove, a plurality of hooks projecting from said housing above and below, and said housing also having a threaded bore with an actuating member in said bore, and projecting into said groove to actuate the jaw unit located in said housing.

11. An auxiliary guiding mechanism for a wrapping tool for preformed armor wires comprising a substantially cylindrical member adapted to engage the armor wires on the outside, said member having a pair of pivoted jaws at one end and the pivoted jaws extending transversely of the cylindrical member, and being formed with outer curved surfaces inside the cylindrical member spaced from the cylindrical member to form an arcuate guide slot for maintaining the substantial parallelism of the armor wires while they are being wrapped by a tool.

12. An auxiliary guiding mechanism for a wrapping tool for preformed armor wires comprising a substantially cylindrical member adapted to engage the armor wires on the outside, said member having a pair of pivoted jaws at one end and the pivoted jaws extending transversely of the cylindrical member, and being formed with outer curved surfaces inside the cylindrical member spaced from the cylindrical member to form an arcuate guide slot for maintaining the substantial parallelism of the armor wires while they are being wrapped by a tool, said cylindrical member being provided with slots for receiving said pivoted jaws and confining the wires in said arcuate guide slots.

13. An armor wrapping assembly for preformed armor wires, comprising a pair of wrapping tools, each tool being provided with a substantially cylindrical bearing member for rotation about the conductor to be wrapped with armor, each tool also being provided with oppositely located arcuate slots for holding a plurality of preformed armor wires side by side without substantially any overlapping, the said tools being rotated in opposite directions when engaged with portions of the armor wires intermediate the ends of the armor wires to warp the armor wires simultaneously about a conductor located in said bearing, the tools sliding longitudinally of the armor wires and conductor as the wrapping progresses toward both of the ends of the armor wires.

14. An armor wrapping assembly for preformed armor wires, comprising a pair of wrapping tools, each tool being provided with a substantially cylindrical bearing member for rotation about the conductor to be wrapped with armor, each tool also being provided with oppositely located arcuate slots for holding a plurality of preformed armor wires side by side without substantially any overlapping, the said tools being rotated in opposite directions when engaged with portions of the armor wires intermediate the ends of the armor wires to warp the armor wires simultaneously about a conductor located in said bearing, the tools sliding longitudinally of the armor wires and conductor as the wrapping progresses toward

both of the ends of the armor wires, said tools being provided with a longitudinally extending supporting frame extending oppositely on each tool from the other tool, and said frames each supporting guide means for engaging the armor wires at a point spaced from the tools to prevent teetering of the tools and longitudinal slipping of the armor wires.

15. An armor wrapping assembly for preformed armor wires, comprising a pair of wrapping tools, each tool being provided with a substantially cylindrical bearing member for rotation about the conductor to be wrapped with armor, each tool also being provided with oppositely located arcuate slots for holding a plurality of preformed armor wires side by side without substantially any overlapping, the said tools being rotated in opposite directions when engaged with portions of the armor wires intermediate the ends of the armor wires to wrap the armor wires simultaneously about a conductor located in said bearing, the tools sliding longitudinally of the armor wires and conductor as the wrapping progresses toward both of the ends of the armor wires, said tools being provided with a longitudinally extending supporting frame extending oppositely on each tool from the other tool, and said frames each supporting guide means for engaging the armor wires at a point spaced from the tools to prevent teetering of the tools and longitudinal slipping of the armor wires, said guide means comprising members including said frame, having an arcuate aperture for receiving the armor wires.

16. An armor wrapping assembly for preformed armor wires, comprising a pair of wrapping tools, each tool being provided with a substantially cylindrical bearing member for rotation about the conductor to be wrapped with armor, each tool also being provided with oppositely located arcuate slots for holding a plurality of preformed armor wires side by side without substantially any overlapping, the said tools being rotated in opposite directions when engaged with portions of the armor wires intermediate the ends of the armor wires to wrap the armor wires simultaneously about a conductor located in said bearing, the tools sliding longitudinally of the armor wires and conductor as the wrapping progresses toward both of the ends of the armor wires, said tools being provided with a longitudinally extending supporting frame extending oppositely on each tool from the other tool, and said frames each supporting guide means for engaging the armor wires at a point spaced from the tools to prevent teetering of the tools and longitudinal slipping of the armor wires, said guide means comprising said frame of partially cylindrical shape at its ends and a pair of levers having convexly circular edges to form arcuate apertures in conjunction with said cylindrical end portions.

17. An armor wrapping assembly for preformed armor wires, comprising a pair of wrapping tools, each tool being provided with a substantially cylindrical bearing member for rotation about the conductor to be wrapped with armor, each tool also being provided with oppositely located arcuate slots for holding a plurality of preformed armor wires side by side without substantially any overlapping, the said tools being rotated in opposite directions when engaged with portions of the armor wires intermediate the ends of the armor wires to wrap the armor wires simultaneously about a conductor located in said bearing, the tools sliding longitudinally of the armor wires and conductor as the wrapping progresses toward

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both of the ends of the armor wires, the said arcuate aperture in said tool being located between a pair of pivoted jaws, and said tool having a pair of jaws on opposite sides of the conductor.

18. An armor wrapping assembly for preformed armor wires, comprising a pair of wrapping tools, each tool being provided with a substantially cylindrical bearing member for rotation about the conductor to be wrapped with armor, each tool also being provided with oppositely located arcuate slots for holding a plurality of preformed armor wires side by side without substantially any overlapping, the said tools being rotated in opposite directions when engaged with portions of the armor wires intermediate the ends of the armor wires to wrap the armor wires simultaneously about a conductor located in said bearing, the tools sliding longitudinally of the armor wires and conductor as the wrapping progresses toward both of the ends of the armor wires, the said arcuate aperture in said tool being located between a pair of pivoted jaws, and said tool having a pair of jaws on opposite sides of the conductor, said jaws being separable to permit insertion of the armor wires and to permit the assembly to be placed upon the conductor.

19. An armor wrapping assembly for preformed armor wires, comprising a pair of wrapping tools, each tool being provided with a substantially cylindrical bearing member for rotation about the conductor to be wrapped with armor, each tool

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also being provided with oppositely located arcuate slots for holding a plurality of preformed armor wires side by side without substantially any overlapping, the said tools being rotated in opposite directions when engaged with portions of the armor wires intermediate the ends of the armor wires to wrap the armor wires simultaneously about a conductor located in said bearing, the tools sliding longitudinally of the armor wires and conductor as the wrapping progresses toward both of the ends of the armor wires, said tools being carried by the ends of insulated operating sticks whereby they may be operated with the conductor energized.

20. The method of applying armor wires to energized conductors, which comprises pre-forming the armor wires into twisted helical members of relatively long pitch adapted to fit into position with a plurality of others of the same wires to form a continuous armor covering of wires edge to edge in helical form on the conductor, arranging said wires in groups side by side on the opposite sides of the conductor on which they are to be wrapped, and urging said groups in helical direction toward one end while simultaneously urging said groups in a helical direction toward the other end about the wire to wrap them simultaneously on the wire in the said edge to edge location.

HENRY W. BODENDIECK.

Disclaimer

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10 2,414,136.—*Henry W. Bodendieck*, Taylorville, Ill. **METHOD AND APPARATUS**
FOR WRAPPING ARMOR WIRE ON ENERGIZED CONDUCTORS. Patent dated
Jan. 14, 1947. Disclaimer filed Dec. 7, 1950, by the patentee.
Hereby enters this disclaimer to claims 1 and 2 of said patent.
[*Official Gazette January 9, 1951.*]