July 17, 1934. G. E. PHILLIPS 1,966,516

METHOD OF AND MEANS FOR MAKING ARMORED CABLES

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Fig. 1.

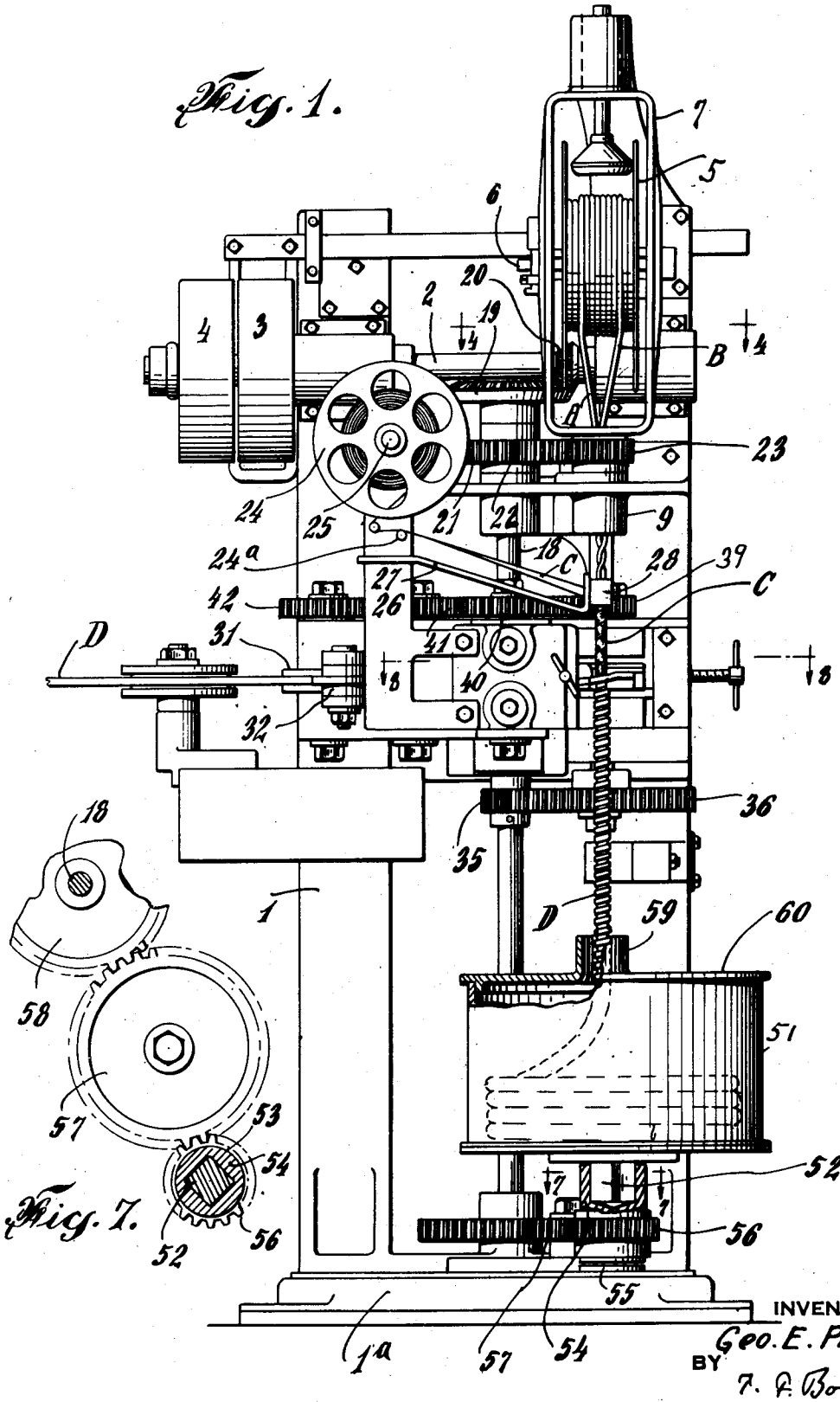


Fig. 7.

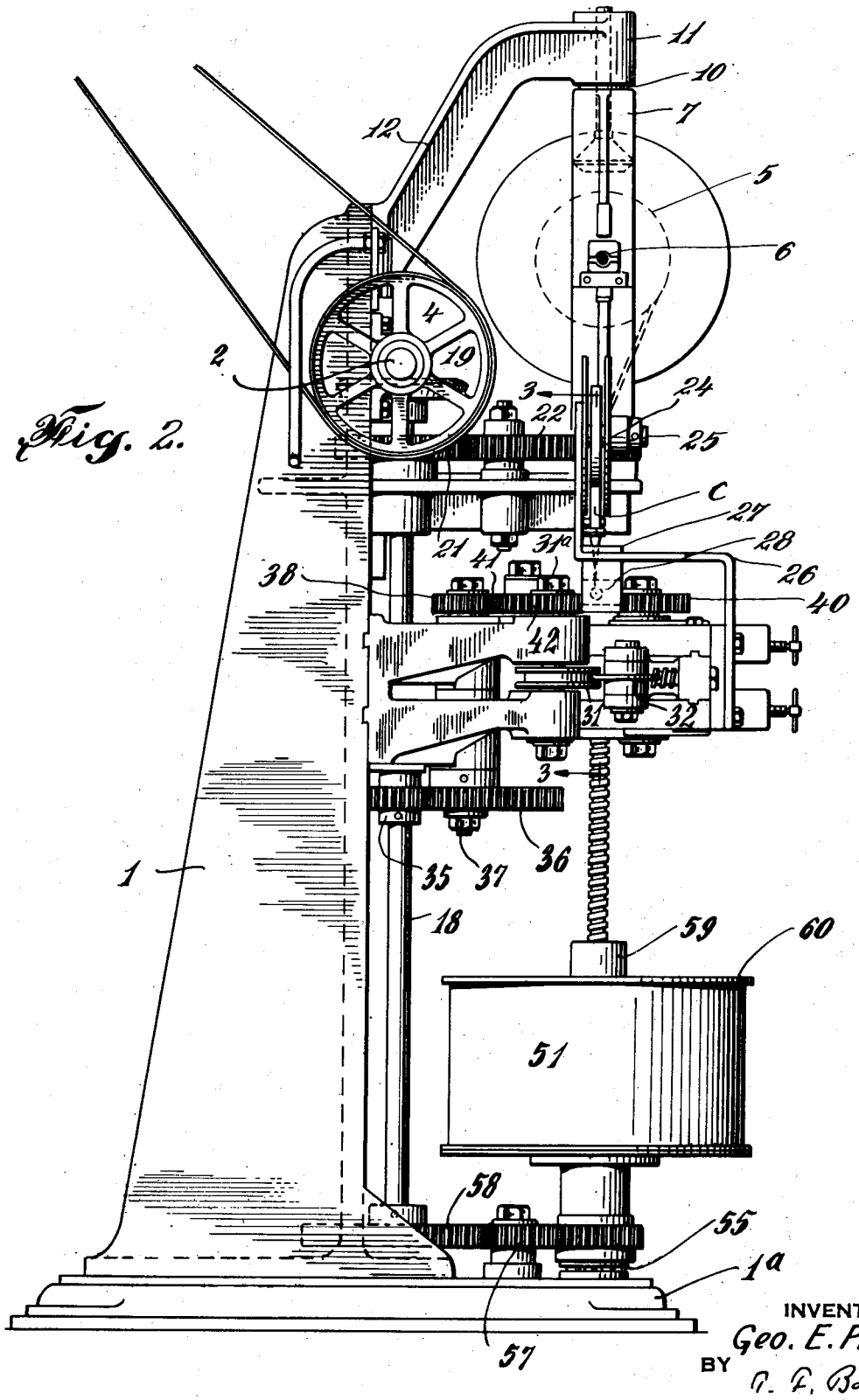
INVENTOR
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BY
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METHOD OF AND MEANS FOR MAKING ARMORED CABLES

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Fig. 2.



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Fig. 4.

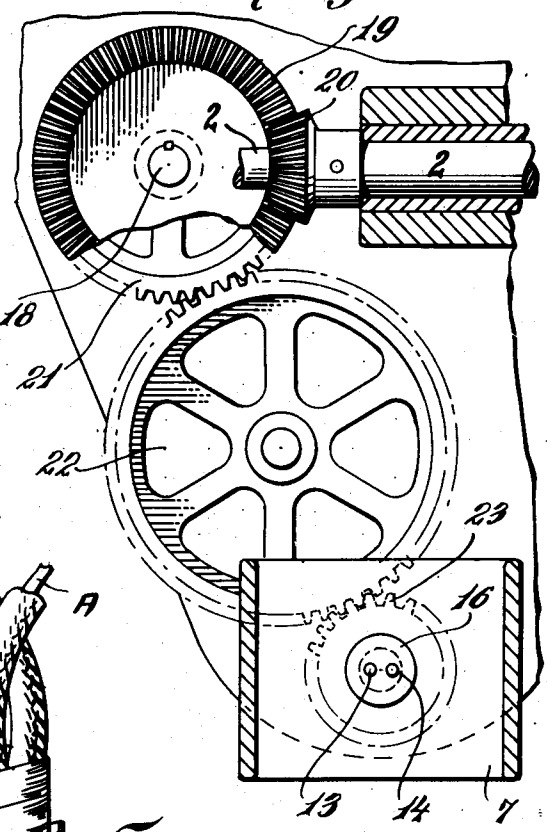


Fig. 3.

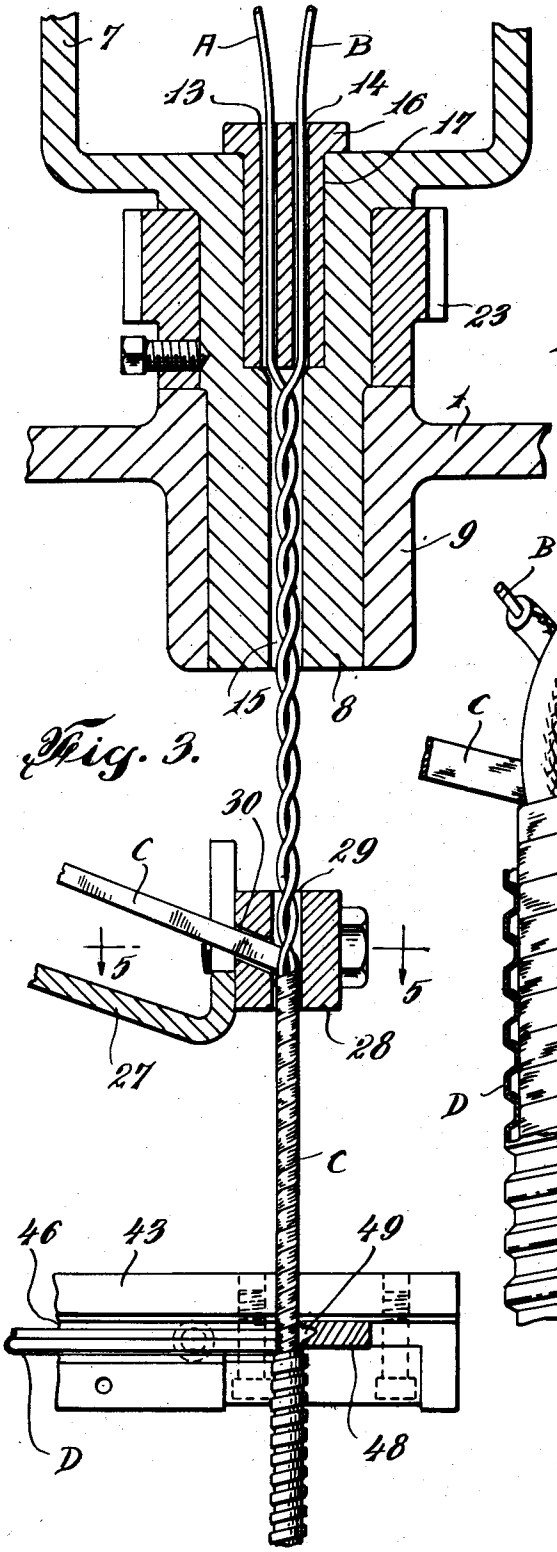
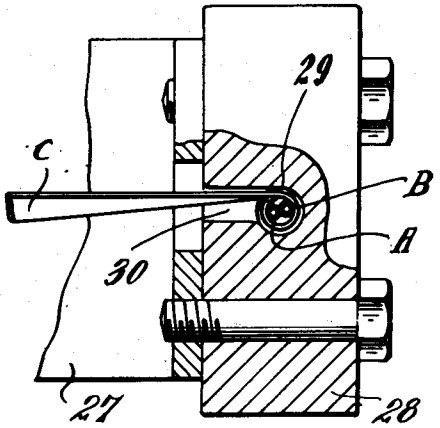


Fig. 6.

Fig. 5.



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METHOD OF AND MEANS FOR MAKING ARMORED CABLES

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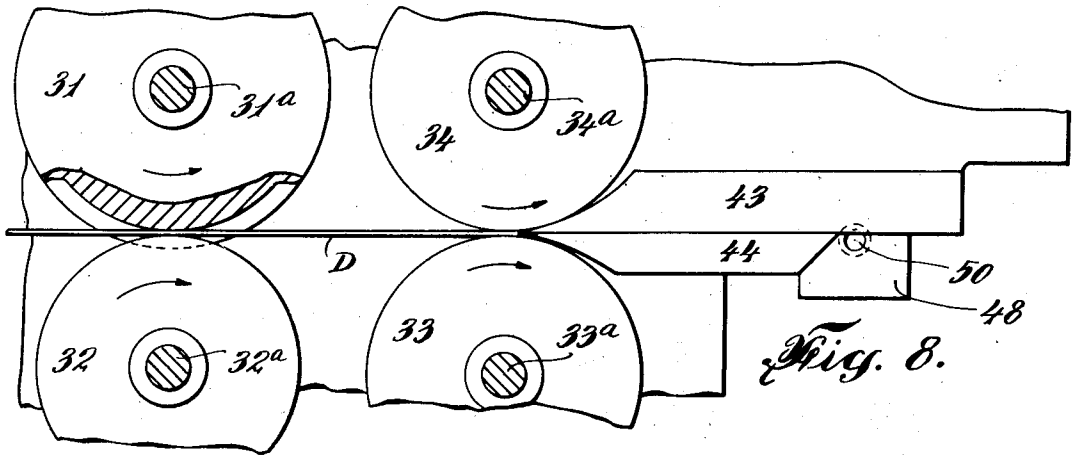


Fig. 8.

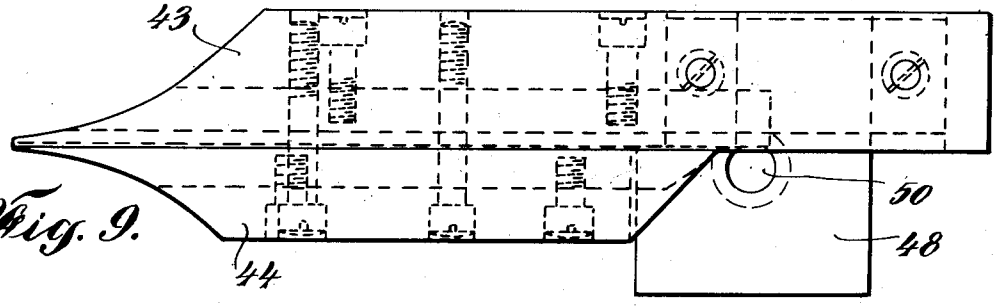


Fig. 9.

Fig. 10.

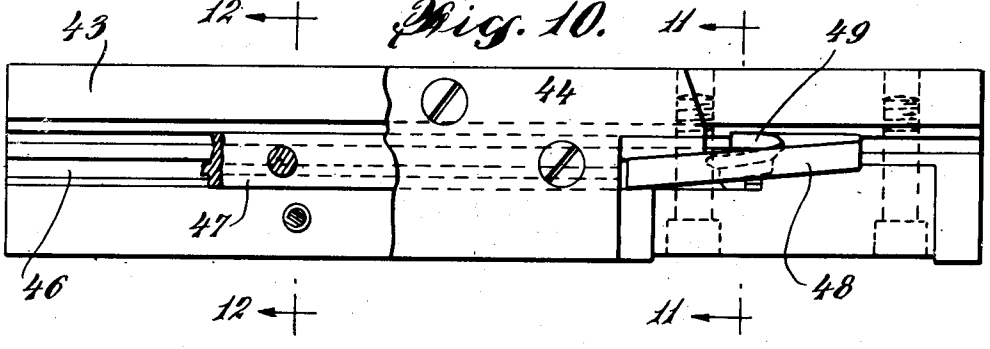


Fig. 11.

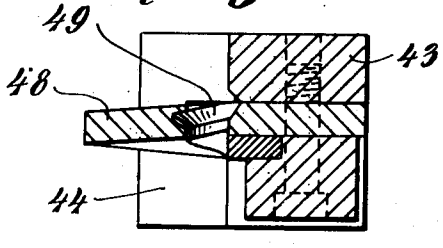
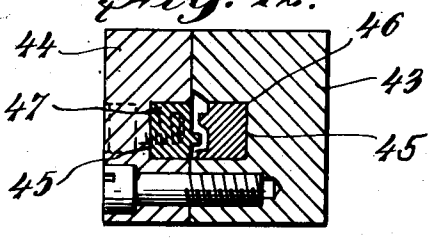


Fig. 12.



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METHOD OF AND MEANS FOR MAKING ARMORED CABLES

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Fig. 13.

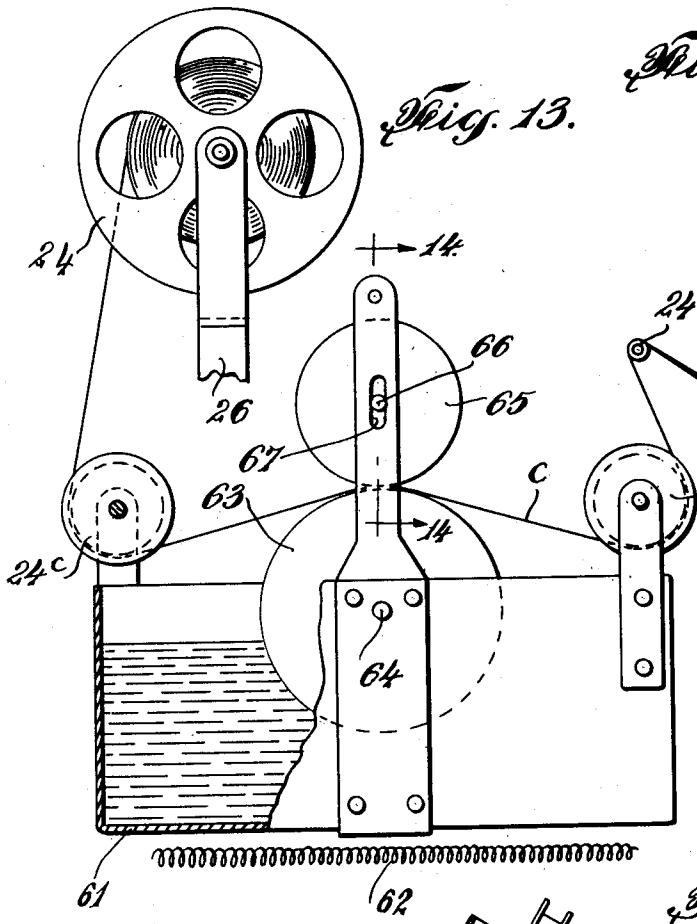


Fig. 14.

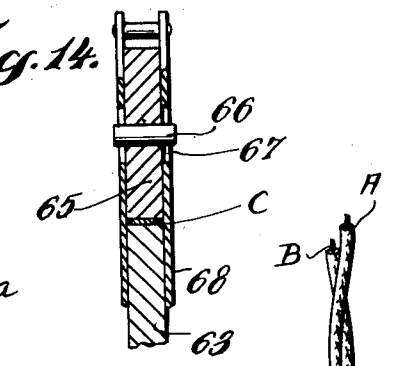


Fig. 16.

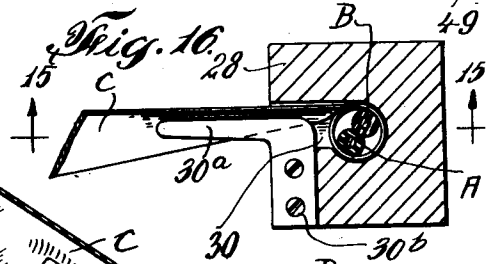


Fig. 18.

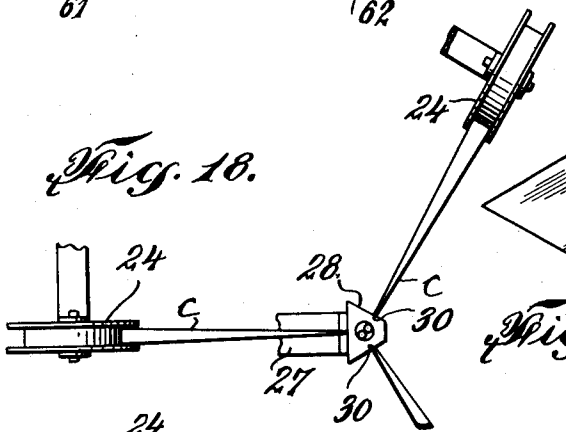


Fig. 17.

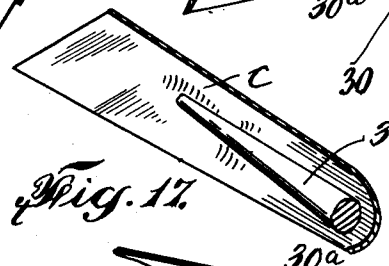


Fig. 19.

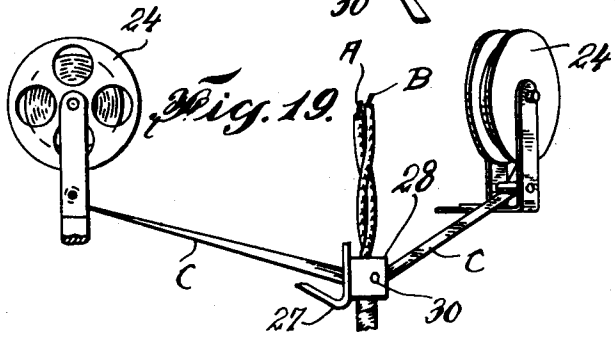
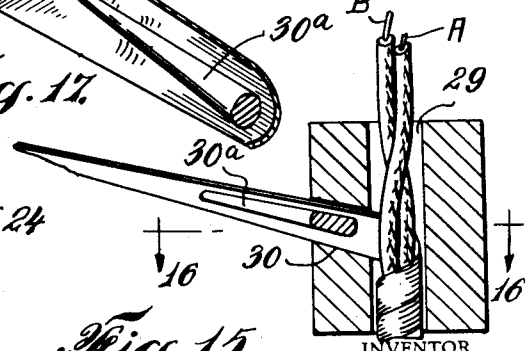


Fig. 15.



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Patented July 17, 1934 1,966,516

UNITED STATES PATENT OFFICE

1,966,516

METHOD OF AND MEANS FOR MAKING ARMORED CABLES

George Ernest Phillips, Ben Avon, Pa., assignor to National Electric Products Corporation, Wilmington, Del., a corporation of Delaware

Application February 12, 1930, Serial No. 427,737

10 Claims. (Cl. 113—35)

My invention relates to improvements in the method of and in means for making so-called armored cables, and has particular reference to the class of armored cables comprising one or more insulated conductors inclosed within an insulated covering that is surrounded by a protecting metallic flexible armor or sheath. In some cables of the class referred to the insulated conductors are twisted together before the covering or armor is placed around the same.

In carrying out my invention I propel or feed the insulated conductor or conductors, wrap the same in an insulating material, such as a paper strip, and form a flexible armor tube around said material, all simultaneously while the conductors are being fed or propelled, said conductor or conductors being rotated for the purpose of laying the said insulating strip and armor around the same. The conductors may be twisted together while they are being fed and before the insulating material is wound thereon, the twisting of the conductors, the laying thereon of the insulating material and the enveloping of the insulated conductors within the armor strip, all being effected simultaneously as the work proceeds, whereby the armored cable is made and delivered in a continuous manner.

For some classes of cable I coat the insulating material or strip with a moisture proof saturating liquid simultaneously with the operations of winding the said saturated strip around the conductor or conductors.

My invention includes a machine comprising means to support one or more insulated conductors, means to supply a strip of insulating material to be wound upon the same, means to wind a metallic armor strip around said insulation and to cause rotation of the conductor or conductors for laying said insulating strip therearound and propelling the finished cable simultaneously. Means for twisting a plurality of conductors together before the insulating strip is wound thereon, and simultaneously with such winding and with the winding of the metallic armor around the insulating strip are also included in my invention.

My invention also comprises novel detail of improvement that will be more fully hereinafter set forth and then pointed out in the claims.

Reference is to be had to the accompanying drawings forming part hereof, wherein:

Fig. 1 is a front elevation of a machine embodying my invention;

Fig. 2 is a side elevation;

Fig. 3 is an enlarged detail section substantially on the plane of line 3, 3, in Fig. 2;

Fig. 4 is an enlarged detail section on line 4, 4, in Fig. 1;

Fig. 5 is an enlarged detail section on line 5, 5, in Fig. 3;

Fig. 6 is an enlarged detailed view of the armored cable, partly in section;

Fig. 7 is an enlarged detail section on line 7, 7, in Fig. 1;

Fig. 8 is a partly sectional detail plan view substantially on line 8, 8, in Fig. 1, parts being omitted, illustrating devices for applying armor to the insulated conductors;

Fig. 9 is an enlarged detail plan view of part of Fig. 8;

Fig. 10 is a partly broken edge view of Fig. 9;

Fig. 11 is a section on line 11, 11, in Fig. 10;

Fig. 12 is a section on line 12, 12, in Fig. 10;

Fig. 13 is a partly broken side view of means for applying a moisture proof liquid to the insulating strip;

Fig. 14 is a section on line 14, 14, in Fig. 13;

Fig. 15 is a sectional detail, on line 15, 15 in Fig. 16, of means for folding or crinkling the insulating strip while being applied to the conductor;

Fig. 16 is a section on line 16, 16 in Fig. 15;

Fig. 17 is an enlarged detail perspective of part of Fig. 15;

Fig. 18 is a detail plan illustrating means for applying a plurality of insulating strips simultaneously to the conductor; and

Fig. 19 is a side view of Fig. 18.

Similar characters of reference indicate corresponding parts in the several views.

The numeral 1 indicates a suitable frame provided with a drive shaft 2, having fast and loose pulleys 3 and 4, which may be operated from any suitable source of power. At 5 is a reel or spool having supporting shaft 6, journaled in an axially rotative frame 7, supported by the main frame 1. The reel is adapted to carry one or more conductors. The frame 7 is shown provided with a tubular hub 8, journaled in a bearing 9, carried by frame 1, (Fig. 3), and having a hub 10, journaled in a bearing at 11, on bracket 12, (Fig. 1). Conductors A and B, are shown carried by spool or reel 5, and the frame 7 is shown provided with spaced guideways 13 and 14 for said conductors, the hub 8, being provided with bore 15 through which the conductors pass from said guideways (Fig. 3). The guideways 13 and 14 are shown in the form of bores in a plug 16, secured in an enlargement 17 of the bore 15, whereby the conductors may pass through the

latter from the guideways. The frame 7 may be rotated in any desired way. I have illustrated a vertical shaft 18, that is journaled in suitable bearings in frame 1, and shown provided with gear 19, in mesh with gear 20, on shaft 2 for rotating shaft 18. The shaft 18, is shown provided with a gear 21, in mesh with an idle gear 22, journaled on the main frame, the gear 22, being in mesh with a pinion or gear 23, secured to the hub 8, Figs. 3 and 4. The gearing described will rotate the frame 7 and the reel 5, the conductors, and the guideways 13 and 14, through which the conductors, pass at uniform desired speed, whereby the conductors will be twisted together when properly restrained or rotated below the hub 8, independently of the bodily rotation of the conductors with the reel.

At C is a strip of insulating fibrous material, which may be of paper, to be wound or laid spirally around the conductor or conductors. The strip C is shown in the form of a coil carried by a spool or reel 24, supported by a stud or shaft 25, shown carried by a bracket 26, supported by the main frame (Fig. 1). An arm 27, extending from bracket 26, carries a guide 28 for the strip C, Figs. 3 and 5. The guide 28 is provided with a vertical bore 29, through which the conductors pass, and said guide is also provided with a laterally extending, angularly disposed guideway 30, for strip C. The guideway 30 is shown extending from the bore 29, in an upwardly disposed angular direction to direct the strip C edgewise in a spiral direction to the conductors so that the strip will be wound or laid in a spiral direction around said conductors, (Fig. 3), as the latter travel. The spool 24 and guide 24*a*, are shown located above the plane of guide 28, (Fig. 1) so that the strip C will pass to the conductors at an angle to the plane of the latter to facilitate winding the strip spirally upon the conductors.

The conductors are to be rotated in a desired direction to cause the winding thereon of the insulating strip or material C, and such rotation of the conductors has the effect of retarding the conductors in such a manner that they may be twisted between the guide 28 and the reel 5, by rotating the reel bodily at a suitable speed faster than the rotation of the twisted conductors on their longitudinal axis. I cause the desired rotation of the conductors by and with the application of the armor strip D to the insulated conductors. The strip D may be a flat strip of suitable metal of desired gage and width supplied in continuous lengths, as from a reel (not shown) and feed into the machine by any desired number of feeding rollers, shown arranged in pairs, at 31, 32, and 33, 34, suitably journaled on the main frame (Figs. 1, 2, and 8). Said feed rollers may be driven in any desired way. I have shown the shaft 18, provided with a pinion 35 in mesh with a gear 36, carried by a shaft 37, journaled in bearings on the main frame and provided with a gear 38 that drives a gear 39, on the shaft 34*a* of feed roller 34 the gear 39 meshes with a gear 40, on the shaft 33*a* of drive roller 33. The gear 39 also meshes with an idle gear 41, that meshes with a gear 42, on the shaft 31*a* of the roller 31. The feed rollers are intended to forcibly feed the metal strip D through suitable means for shaping said strip and interlocking its edge portions, and for causing said strip to be helically wound around the insulated conductors as a flexible armor for the latter. I have illustrated die-means located between feed rollers 33, 34 and the conductors, shown comprising two die-blocks 43 and 44, which may be secured together by screws, as illustrated in Figures 9 to 12. The die-blocks 43 and 44 are shown provided with longitudinal opposing grooves 45, in which are secured, as by screws, hardened dies 46, 47, having opposing faces shaped to produce the desired cross-sectional form of the strip D, as the latter is pushed between said dies. At the delivery end of the dies is a guide or coiler member 48, having a curved surface at 49, helically disposed around bore 50, less than a complete circle, through which bore the insulated conductors pass. The coiler member 48 causes the strip D, as said strip is fed forwardly by feed rollers through the dies, to be helically wound around the insulated cable, to give the desired pitch to the coils of the armor. The winding of the metal strip around the insulated conductors causes contact of the latter with the winding armor, and thereby corresponding rotation of the conductors on a longitudinal axis is caused, and such rotation of the conductors causes the simultaneous winding or laying of the insulating material or strip C around the conductors.

The rotation of the conductors by and with the armor is at less speed than the bodily rotation of the conductor coils on and with the reel 5, hence the armored portion of the conductors is retarded relatively to the bodily rotation of the conductors, so that the conductors will be twisted together above the guide 28 as the conductors are being fed by the laying or winding of the armor thereon. The ratio of rotation of the armored portion of the conductors relatively to the bodily rotation of the conductors on reel 5 may be such as to produce the desired twisting of the conductors, such as with respect to their pitch.

The armored cable, as it passes and is fed from the armoring means, may be coiled or accumulated in any desired way. I have shown a cable-receiving receptacle or drum 51, rotatively mounted below the armoring means and preferably axially disposed thereunder, to receive the armored cable and to rotate therewith for coiling the cable in the receptacle. The receptacle 51, is shown provided with a depending angular stud 52, detachably received in a socket 53, in a rotative member 54 journaled at 55, in the base 1*a*, of frame 1, (Figs. 1 and 7). The member 54 is shown provided with a gear 56, in mesh with an idle gear 57, journaled on base 1*a*, gear 57 being shown in mesh with the drive gear 58 on shaft 18. The gearing is so organized that the receptacle 51 will be rotated at a suitable speed commensurate with the delivery of the armored cable from the armoring means, so that as said cable progresses it will be coiled in the receptacle. The receptacle 51, may be provided with a guide 59, at its top, axially disposed, shown carried by detachable cover 60, on the receptacle for guiding the armored cable into the receptacle. When the cable has been coiled in the receptacle to a desired length the cable between the receptacle and the armoring means may be quickly severed so that the charged receptacle may be removed and replaced by an empty receptacle to receive the cable without interrupting the making of the latter, so that continuous insulating and armoring of the conductors may proceed.

For some classes of cables it is desirable to coat the insulating material or strip with a moisture proof saturating liquid or the like, such as a wax or similar material well known in the art. For such purpose I provide means for applying said coating to the strip C while it is being drawn

for winding on the conductor or conductors. In Figs. 13 and 14 I have illustrated a tank 61 to contain the desired liquid, which may be kept warmed by any suitable heater, indicated at 62. The tank and heater may be supported on the main frame in any desired way, or in any other suitable place. A roller 63 is journaled on the tank at 64 and an opposing roller 65 is shown loosely journaled above the roller 63. The shaft 66 of roller 65 is mounted slidably vertically in slots 67 in uprights 68 carried by the tank, so that the idle roller 65 will press the strip C into contact with the moistened roller 63 that dips into the liquid in the tank, to apply said liquid to the strip as the latter is drawn between said rollers, causing the latter to rotate. Guides 24*b* and 24*c* for the strip C cause the latter to travel properly between the rollers, and for guiding the strip to the conductor or conductors. As the strip C is wound on the conductor or conductors, whether they be twisted together or not, the strip will be coated on the roller 63, whereby the simultaneous coating and winding of the insulating strip facilitates the manufacture of the product.

While the strip C may be wound flatwise on the conductor or conductors, as by means of the guideway 30, illustrated in Fig. 3, in which said guideway is wider than the strip, it is also advantageous, for some classes of insulation, to cause constriction or reduction of the width of the strip upon itself before winding upon the conductor or conductors. In Figs. 15 and 16 the guideway 30 is narrower than the width of the strip C, so that as the latter is drawn through said guideway the strip will fold or crinkle upon itself, to be wound in a reduced condition upon the conductor or conductors. A guiding-finger 30*a*, shown secured at 30*b* to guide 28 and projecting outwardly. The strip C slides along said guiding finger to aid in bending the strip C as it advances into the guideway 30, to aid in causing the lapping, folding or crinkling of the latter.

Instead of applying a single insulating strip C on the conductor or conductors, a plurality of said strips may be simultaneously wound on the latter. In Figs. 18 and 19 I have illustrated a plurality of reels 24, suitably mounted upon the machine in desired angular relation, and the guide 28 is provided with a corresponding number of spaced guideways 30 for the several strips, to lead the latter to the bore 29 to be guided to the conductor or conductors. By the means described the several insulating strips may be laid in overlapping or other relation around the conductor or conductors as the latter are rotated and fed, in the manner described with respect to the single strip.

The steps utilized in forming the armored cable described all occur simultaneously and are continuous, that is to say, the conductors are twisted, the insulating strip C is wound on the twisted conductors, and the armored strip D is wound on the insulating covering of the conductors, simultaneously, the feed of the armoring strip D through the armoring dies not only causing the armored cable to advance from said dies but simultaneously causing rotation of the conductors, whereby the winding of the strip C thereon is effected in an expeditious and accurate manner.

While I have set forth that the conductors may be twisted together before the insulating strip C is wrapped or laid thereon it will be understood that the strip C and the metal armor may be wrapped around the conductors without first twisting the latter, since the gearing for rotating the unarmored conductors may have such ratio that they will rotate at the speed of rotation of the conductors caused by the application of the armor strip D around the wrapping C.

It will, also, be understood that the conductors may be rotated suitably with or without twisting them, by the rotation of reel 5, without winding the armored strip around said insulation.

While I have illustrated a plurality of insulated conductors to be inclosed within the insulating material C, it will be understood that a single conductor may be supplied on reel 5, and the ratio of gearing for rotating the latter conductor coil thereon bodily will be commensurate with the axial rotation of the conductor to receive the material C, with or without the application of the armor thereon.

In Letters Patent to me No. 1,471,057, granted October 16, 1923, I have set forth a method for armoring a cable by impelling a strip of metal forwardly into contact with a fixed surface to convert the strip into a series of helical coils, steps of which I utilize in connection with my present invention. In accordance with my present invention I may twist a plurality of conductors together and apply armor thereon simultaneously whether the insulating strip is first applied on the conductors or not.

None of the claims herein is limited to a method of, or machine for, twisting cable or conductors simultaneously with the application of insulating wrapping and armoring. In my copending application Serial No. 580,582, filed December 12, 1931, I have claimed a machine for, and method of, simultaneously twisting wire, applying insulating wrapping thereto, and armoring the same. In other words, certain features of invention disclosed herein are claimed in my said copending application Serial No. 580,582.

Having now described my invention what I claim is:—

1. The method of making flexible armored cable which comprises forming, impelling, and causing metallic armor strip helically to surround, with interlocking turns, wire including one or more individually insulated electrical conductors and thereby, by the application of the armor, to produce rotation and longitudinal advance of the wire, and supplying, prior to armoring, paper strip to the rotating longitudinal advancing wire and causing the rotation and longitudinal advance of the wire, produced by the application of the armor strip, to wrap the paper strip helically around the wire prior to armoring.

2. The method of making flexible armored cable which comprises forming, impelling, and causing metallic armor strip helically to surround, with interlocking turns, wire including one or more individually insulated electrical conductors and thereby, by the application of the armor, to produce rotation and longitudinal advance of the wire, supplying, prior to armoring, paper strip to the rotating longitudinally advancing wire and causing the rotation and longitudinal advance of the wire, produced by the application of the armor strip, to wrap the paper strip helically around the wire prior to armoring, and, prior to application of the paper strip, rotating the wire about its longitudinal axis to cause it to keep up with the rotation produced by the application of the armor strip to such an extent as to prevent undesired twisting.

3. A machine for making flexible armored cable comprising, in combination, means for ap-

plying flexible, helical armor, with interlocking turns, to, in contact with, and around, an unarmored cable and, by the application of the armor simultaneously rotating said cable about its longitudinal axis and advancing it longitudinally, means supplying insulating strip to the unarmored cable prior to armoring and causing the insulating strip to wrap helically around the cable by the rotation and longitudinal advance of the cable produced by the application of the armor, and means for rotating the cable, prior to wrapping and armoring, at such angular velocity as to prevent objectionable twisting.

4. In a machine of the character described, the combination of a rotary means for supplying and also rotating the wire about a longitudinal axis as it moves through the machine, a stationary die having a central bore and an opening in its wall extending laterally into the bore and through which a strip of paper is pulled and compressed on the wire as it rotates and moves longitudinally through said bore, and a stationary die immediately following the paper applying die which covers the wire and paper with armor.

5. In a machine of the character described, the combination with a rotary means for supplying the wire, a die which applies fibrous material to the wire, said die having a central bore through which the rotating wire moves longitudinally and also an opening which is substantially tangentially arranged with respect to the bore and through which a strip of fibrous material is pulled by the combined rotary and longitudinal movements of the wire to form a covering therefor, and a die for applying an armor around the wire and its covering.

6. A machine for simultaneously applying a fibrous wrapping and armor to wire to form a cable which comprises a rotary carrier for the wire, means for feeding the wire through the machine, a means for crinkling fibrous strip material and applying the same to the wire as it rotates and after it leaves the carrier, and a die for applying the armor about the wire and fibrous material immediately after said material is applied.

7. A machine for simultaneously applying a paper wrapping and armor to wires to form a cable which comprises a carrier for the wires, means for continuously feeding the wires longitudinally through the machine, a means which compresses a strip of paper sidewise to crinkle it longitudinally and wrap the same about the wires, and a die for continuously applying an armor over the wires and crinkled paper immediately after the paper is applied.

8. In a machine of the character described, the combination of a rotary means for supplying the wire, a means for twisting fibrous covering, a die which applies the covering to the wire after it leaves said means, and a die for applying armor to the wire after it is covered.

9. In a machine of the character described, the combination of a rotary means for supplying the wire, a die through which the wire from said means passes and which applies a fibrous covering to the wire as it rotates, a source of covering supply, guiding means for the covering located between the source and the die which maintains a twist in the covering prior to its entrance into the die, and a die which immediately follows the first named die for applying armor to the wire.

10. An insulating and armoring machine comprising in combination, means for applying armor to a cable and thereby rotating and advancing the cable, means for rotating the cable supplied to the armoring means, and means for wrapping insulation around the cable while it is advancing to and being rotated by the armoring means.

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