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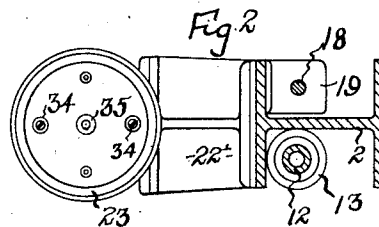
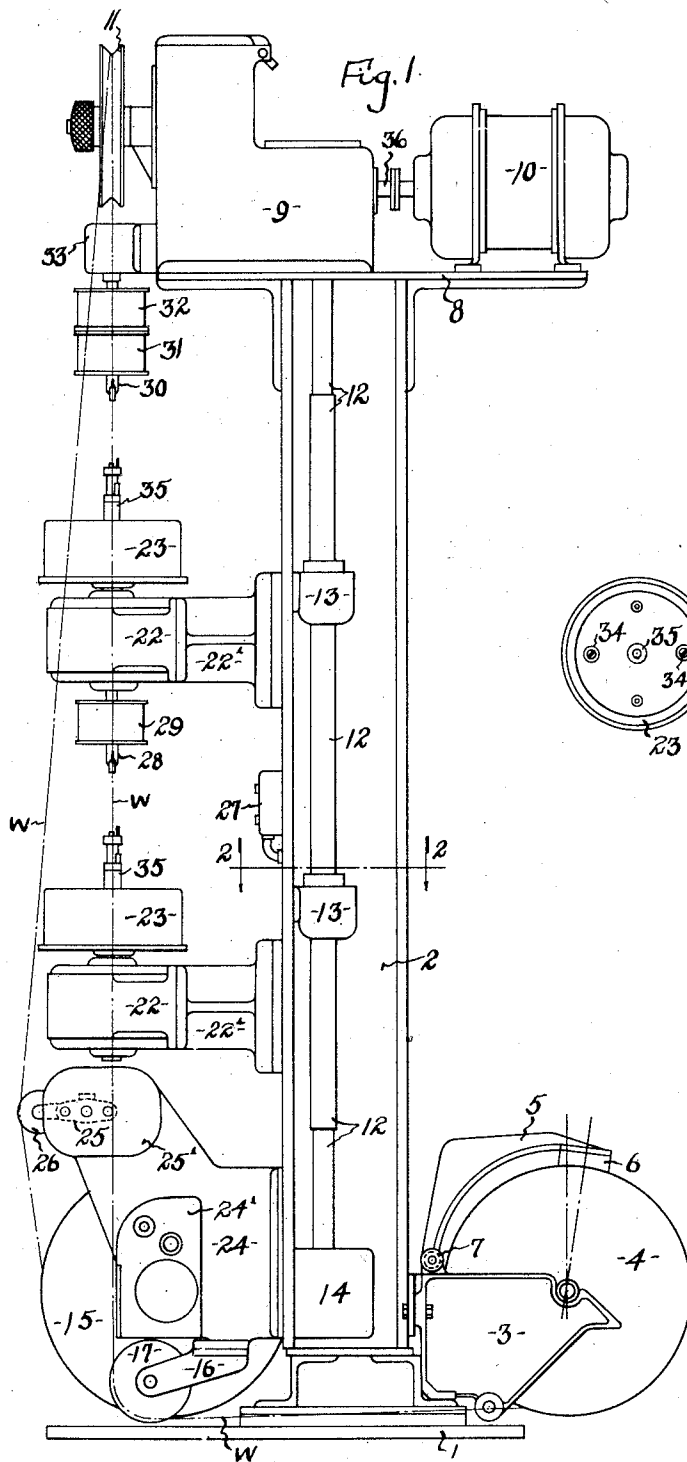
C. B. FANTONE ET AL

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METHOD AND APPARATUS FOR APPLYING WEB COVERINGS TO STRANDS

Filed Sept. 22, 1932

4 Sheets-Sheet 1



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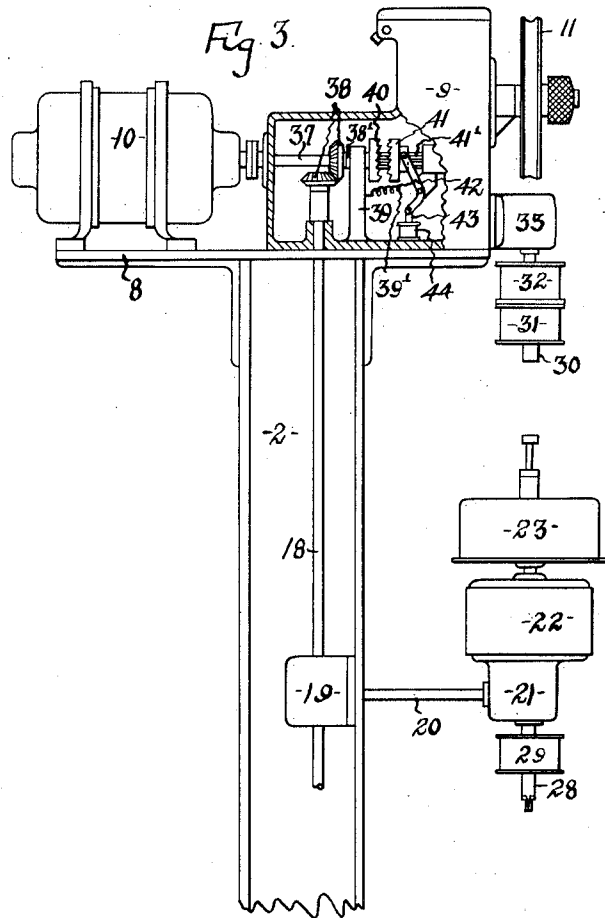
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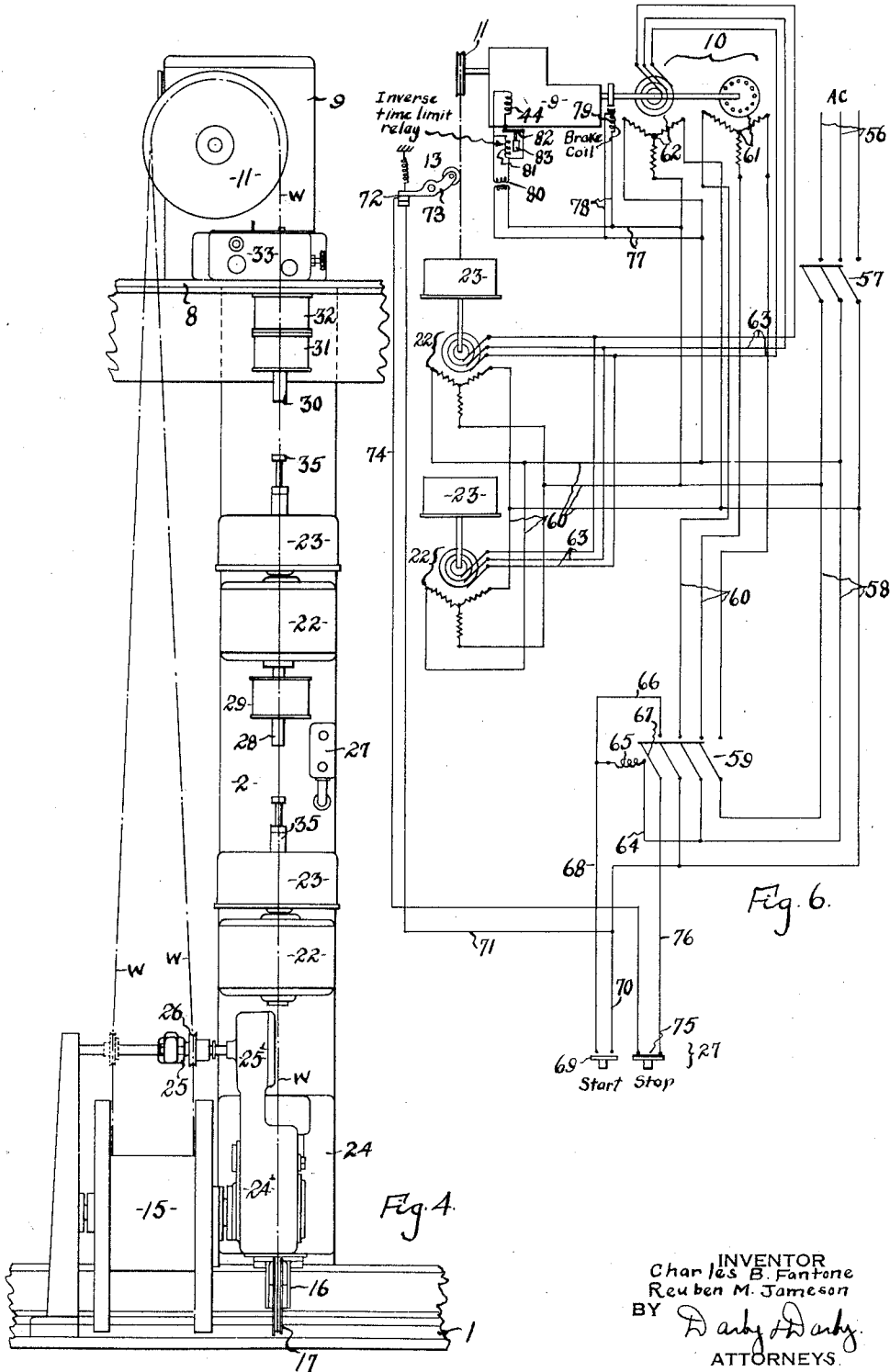
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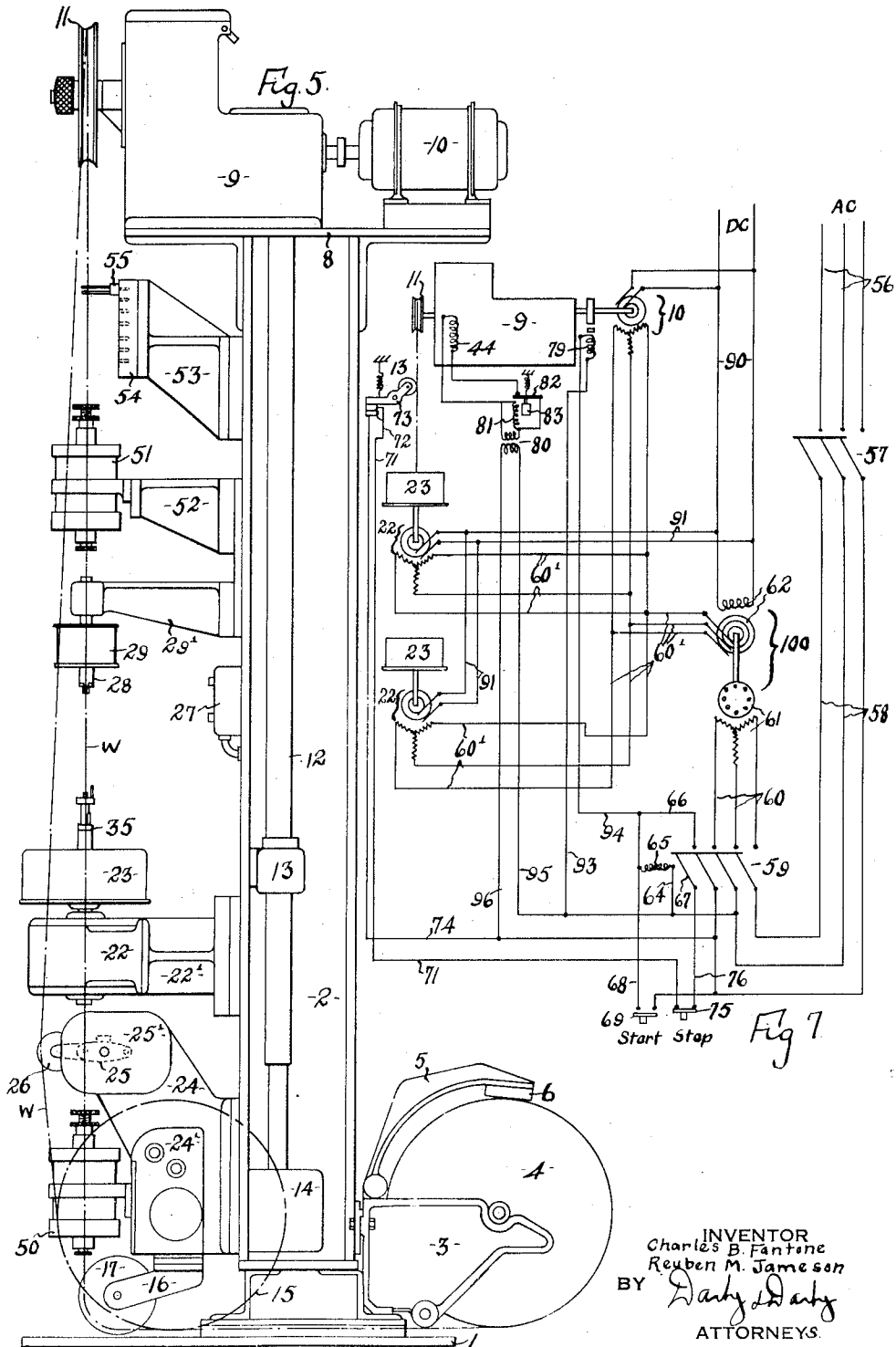
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

1,955,908

METHOD AND APPARATUS FOR APPLYING
WEB COVERINGS TO STRANDS

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Application September 22, 1932, Serial No. 634,350

18 Claims. (Cl. 117—2)

This invention relates to improvements in methods and apparatus for applying spirally wrapped webs to strands in the form of layers of overlapping spiral turns.

More specifically, the objects of this invention are to provide an improved method and apparatus for applying insulating layers of overlapping spiral turns of insulating material to wire.

One of the objects of this invention is to provide an improved form of apparatus for applying the insulating layer to the wire as it advances longitudinally along its axis.

A further object of the invention is to provide a machine in which an adhesive or insulating material may be applied to the wire beneath the insulating layer and to the wire after the insulating layer has been applied thereto.

A further object of this invention is to provide in the same machine means for rapidly drying the adhesive or insulating coating so that the finished product may be equally and continuously wound on a spool.

A still further object of this invention is to provide a machine in which the serving heads for applying one or more layers of insulating web are separately driven and independently of the driving mechanism for operating the take-up spool and the capstan.

A still further object of the invention is to provide an automatic apparatus for insuring synchronism of all the parts during starting and stopping of the machine.

A further object of this invention is to provide improved methods for applying in a continuous operation one or more webs of insulating material with or without the application of an adhesive and insulating coating under, between and over the layers of insulating material.

These and many other objects as will appear from the following disclosure are secured by means of this invention.

This invention resides substantially in the combination, construction, arrangement, relative location of parts, steps and series of steps all as will appear more fully hereinafter.

Referring to the drawings—

Figure 1 is a side elevational view of one form of machine in accordance with this invention;

Fig. 2 is a cross-sectional view taken on the line 2—2 of Fig. 1 with some parts omitted;

Fig. 3 is an enlarged side elevational view of an upper portion of the machine with a part of the capstan casing broken away and some of the parts omitted;

Fig. 4 is a front elevational view of the machine;

Fig. 5 is a side elevational view of a modified form of machine adapted to apply an adhesive or insulating coating and to dry it coincidentally with the application of the insulating web;

Fig. 6 is a circuit diagram for the operating motors; and

Fig. 7 is a modified form of circuit diagram for the operating motors.

There are at present known machines for applying one or more strips of insulating material to a longitudinally advancing wire in the form of spiral overlapping turns to provide a flexible insulating cover for the wire. Such machines, at the present time, comprise generally a power driven take-up reel or spool, a capstan and one or more serving heads, all driven from a single motor. One of the important features of the present invention is to provide a similar machine in which the capstan and take-up spool or reel are driven from the same motor and the serving heads which apply the insulating webs are each driven with independent motors which receive their current from a generator driven by the motor which operates the take-up reel and capstan. One of the very important advances of such a combination is that the serving head motors may be independently controlled as to speed so that the insulating webs may be applied at the correct speed with respect to the longitudinal advance of the wire to insure the correct application of the webs with the correct overlapping of adjacent turns. In addition, where several webs are applied the successive serving head motors may be given a compensatory speed to compensate for the increase in over-all diameter resulting from the application of previous webs.

A further feature of this invention is the provision of automatic means for connecting the take-up reel, the capstan and the serving heads altogether into a single unit during starting and stopping to eliminate any difference in speed of the various parts originating during starting and stopping of the apparatus.

In addition, the invention contemplates novel methods of applying one or more insulating webs to wire either with or without coatings of insulating and adhesive material under, between and over the webs.

While the present invention has been shown as applied to a wire insulating machine, it is quite obvious that the principles thereof may readily be applied to any mechanism in which it is de-

sired to drive several members at a desired speed ratio which is to remain constant.

Referring to the drawings and particularly to Figs. 1 to 4 inclusive, one unit of a machine in accordance with this invention is shown. It is usual to employ such machines in gangs but since a gang of machines is only a duplication of a single machine only one machine is shown and will be described. The machine comprises a support 10 having mounted thereon a suitable vertical standard 2 and shown in the form of an I beam. Attached to the lower rear end of the standard 2 are the brackets 3 on which the wire supply reel 4 is mounted for rotation. At 5 is a brake arm 15 pivotally mounted on the brackets and provided with a shoe 6 which bears on the rim of the reel 4. A spring 7 is arranged to normally urge the brake arm 5 to such a position that the brake shoe 6 engages the reel. This structure is well known in the art, the only improvement being the position of the brake shoe as indicated in Fig. 1. The brake shoe is shown having its center of bearing beyond the vertical center of the reel with regard to the direction of rotation so that the rotation of the wheel with relation to the brake shoe causes a drag thereon. This insures a correct tension on the wire as it is fed from the reel.

Mounted on the upper end of the standard 2 is a transverse supporting plate 8 on which the capstan casing 9 is mounted as well as the driving motor and generator 10. The motor of the motor generator drives a series of gears through the motor shaft 36 which gears are mounted within the capstan casing and are connected to the spindle on which the capstan pulley 11 is mounted. A telescoping shaft 12 extends from the capstan casing and comprises a number of sections which are coupled together by means of couplings within the bearing casings 13. The lower end of the shaft 12 is connected by suitable gears within the casing 14 to the necessary gears and shafting within the casing 24', which shafting causes the rotation of the take-up reel or spool 15. The gear casing 24' is mounted on a bracket 24 secured to the front lower end of the standard 2. Another gear casing 25' is secured to the bracket 24 and operates the guide mechanism 25 which causes the guide pulley 26 to oscillate back and forth parallel to the axis of the take-up reel so as to feed the wire onto the take-up reel in smooth layers. All of this driving mechanism so far described is likewise well known in the art and need not be described in further detail. The capstan includes novel features which will be described in detail later.

At this point it may be noted that this invention deviates from the prior art in that the serving heads are not operated from the shaft 12, as is the case of the prior art. At 27 is diagrammatically shown the start and stop switch for the machine. A guide pulley 17 is journaled on the bracket 16 secured to the lower surface of the bracket 24. The machine of these figures is shown with two serving heads although, of course, one or more than two may be employed within the scope of this invention. Brackets 22' secured to the front edge of the standard 2 have mounted thereon the individual serving head motors 22. The shafts of these motors are connected to the serving heads 23 which serving heads are of well known construction. The important feature is that each serving head is driven independently of the other by its own motor. In accordance with standard practice a cop magazine 28 is mounted below the motor and supports a spare

cop 29 of insulating web. Although not material to the invention the insulating web may be in the form of a thread or a narrow strip of thin insulating material such as paper, "Cellophane", and the like. Mounted near the top of the machine is a casing 33 in which an automatic stop switch is mounted as will be described later. Depending from this casing is a second cop magazine 30 on which several cops 31 and 32 of insulating material are mounted. The serving heads are provided with the web guides 34 and the spindle 35 through which the wire passes and adjacent which the web is applied to the wire. The dot dash line W indicates the path of travel of the wire. It is fed from the supply reel 4 around the guide pulley 7 through an aperture in the shaft of the serving head motors and through a passage in the serving heads as well as through passages in the magazines to the capstan pulley 11 and from thence over the oscillating guide 26 to the take-up reel 15. As will be apparent the guide pulley 17, the serving heads and the motors, the cop magazines and the capstan pulley are all in vertical alignment so that the wire will travel in a straight path longitudinally of its length from the guide pulley 17 to the capstan pulley 11.

Referring particularly to Fig. 3 the interior of the capstan is shown to illustrate the novel parts thereof. The motor of the motor generator 10 is connected by its shaft 37 to the capstan pulley 105 shaft in accordance with well known practice. A sleeve 38' is freely mounted on the shaft 37 and is journaled in the standard 39. To one end of sleeve 38' is secured a beveled gear 38 which meshes with another beveled gear attached to the vertical shaft 18. The shaft 18 is connected by beveled gears within the casings 19 to short shafts 20 which, in turn, are connected by beveled gears to the shafts of the serving head motors. There will be as many of these connections from the shaft 18 as there are serving heads. Since the invention may be employed without this auxiliary connection the casings 21 have not been shown in Figs. 1 and 4 although by means of Fig. 3 their application to the machine of Figs. 1 and 4 will be apparent to those skilled in the art.

To the other end of the sleeve 38' is secured a clutch member 40. Thus the sleeve 38' and the beveled gear 38 and clutch member 40 secured thereto rotate freely as a unit on shaft 37. In other words, shaft 37 will normally rotate without driving shaft 18 but will cause a rotation of the capstan pulley 11. The right hand portion 41' of shaft 37 is splined as shown and has slidably mounted thereon the other clutch element 41. A bell crank lever 42 is pivotally connected to the clutch element 41 and is pivotally mounted on a support as shown. The other end of the bell crank lever 42 is pivotally connected to a plunger 43 of the solenoid 44. Shaft 12 is connected by gears, not shown, in accordance with well known practice to shaft 37 so that whenever shaft 37 revolves shaft 12 will likewise be revolved. This shaft 18 will not be driven until clutch element 41 moves over to engage clutch element 40 at which time the gears 38 will be connected to shaft 37.

The modified machine of Fig. 5 differs in that there is shown only one serving head and, in addition, adhesive and insulating means have been applied as well as a heating means. Those parts which are a duplication of the parts previously described will not again be mentioned. At 50 there is shown attached to the bracket 24 a device for applying an adhesive or insulating

coating to the wire before it reaches the serving head. There are a number of forms of adhesive applying devices known in the art and no further detailed description is necessary, except to point out that, preferably, a device as disclosed in our copending application Serial No. 628,536 filed Aug. 13, 1932 is used. The wire merely passes through the device and has applied thereto a thin even coating of adhesive or insulating material. In this case the cop magazine 28 is mounted on a special standard 29' in view of the fact that there is no second serving head. A second bracket 52 is attached to the standard 2 and has mounted thereon another device 51 for applying an insulating compound to the wire over the insulating covering which has been previously applied. The construction of this adhesive applying device is likewise preferably that of our copending application mentioned above. A third bracket 53 supported on the standard 2 serves to support an electrical outlet fixture 50 in which the plug-in electric heating coils 55 may be mounted in the necessary number to provide sufficient heat to dry the adhesive before it reaches the capstan wheel 11. These heating coils consist of loops of resistance wire between the coils of which the coated wire passes.

In Fig. 6 is shown one suitable circuit arrangement for operating the device. The wires 56 represent the alternating current input wires of a three phase system which are connected to the contacts of a single throw triple pole switch 57. The other side of this switch is connected by the wires 58 to three poles of a four pole single throw switch 59. The corresponding contacts of this switch are connected by wires 60 to the field windings of the induction motor 61. Wires 58 are connected by wires 60' to the field coils of the serving head motors 22, which are likewise three phase induction motors, and to the field coils of the induction generator 62. The slip rings of the generator 62 are connected by wires 63 to the slip rings of the motors 22. Thus the field coils of the induction motors 61 and 22 are supplied from the same source, while the rotor windings of the motors 22 are supplied with current from the slip rings of the generator 62. The induction motor 61 is of the squirrel cage type. The connections are such that when the current is turned off, by opening switch 59, the fields of the generator 62 and of the motors 22 remain energized so that all parts of the machine rotate in the proper timed relation during starting and stopping. Switch 57 need only be opened when the machine is shut down for a period of time, such as overnight, as distinguished from stopping to change reels and to replenish with cops. Furthermore if any part of the machine is moved by hand, with this arrangement all parts move in unison. Thus the proper synchronism of the operating parts is insured. It is of course understood that synchronism of the parts actually involves operation thereof in a desired timed relation which may or may not involve actual synchronism. If desired, or if necessary, the circuits to the rotors of the motors 22 may be provided with speed adjusting devices so that the motors too may be varied in speed with respect to each other and with respect to the speed of operation of the parts driven from the capstan. One of the wires 58 is connected by wire 64 to one terminal of the relay coil 65 which operates to close the switch 59 and to hold it closed. The other terminal of the solenoid coil 65 is connected by wire 66 to

a contact controlled by the fourth pole of switch 59. The fourth pole 67 is connected by wire 76 to one terminal of a normally closed push button switch 75. Wire 66 is connected by wire 68 to one contact of the normally open push button switch 69. The other contact of this switch is connected by wire 70 to the wire 58 which is the other wire of this phase. Wire 70 is connected by wire 71 to a fixed contact of the switch 13. The movable contact of this switch is mounted on a pivotally supported lever 23 which has a roller bearing on the wire and holding the contacts 72 closed when the machine is in normal operation. The movable contact is connected by wire 74 to the other contact of switch 75. The same phase on the other side of switch 59 is connected by wires 77 to a transformer 80, the secondary of which is connected on one side to one terminal of the clutch operating magnet 44 to one terminal of the solenoid winding 81 of the delayed action relay. The other terminal of this relay winding 81 is connected to the other terminal of the secondary of the transformer 80 and to the switch arm 82. The contact controlled by the switch arm is connected to the other terminal of the clutch operating winding 44. The usual dash pot of such a switch is indicated at 83. The wires 77 are connected by wires 78 to the brake coil 79.

The modified circuit of Fig. 7 is in some respects similar to that just given but varies in that the motor generator 10 is replaced by a motor generator 100, and the motor 10 is a simple induction driven motor for the capstan. The wires 56 extend, as before from the current source through switch 57 and wires 58 to switch 59. In this case the wires 60 supply current to the field coils in the induction motor 61 only. This motor drives an alternating current generator having direct current excitation for the field coil. The direct current is supplied through the wires 90. Direct current is likewise supplied through the wires 91 through to the rotors of the serving head motors 22. The alternating current output from the generator 62 is supplied through the wires 60' to the field of the capstan motor 10 and to the fields of the serving head motors 22. As before, the automatic stop switch 13 is provided as well as the start and stop switches 69 and 75. The operating and hold-in solenoid 65 for the switch 69 is also provided. In this case the wire 64 is connected by wire 93 to one terminal of the brake coil 79, and the other terminal thereof is connected by wire 79 to wire 66. Wire 64 is also connected by wire 95 to the primary of the transformer 80, and the other terminal is connected by wire 96 to wire 74. The circuit for the clutch coil 44 and the delayed action relay 81 is the same.

The operation of the machine itself will first be described. With regard to Figs. 1 and 4, when the machine is running motor 10 is causing the capstan wheel 11 to revolve, shaft 12 to revolve, and take-up reel 15 to revolve through the gears and shaftings in casing 14 and 24' and the wire guiding device 25 through gears and shafting in casing 25. In other words, the take-up reel 15 and the guide 25 are all driven from shaft 12. Supply reel 14 revolves under the pull of the wire. Thus the wire is fed through the machine longitudinally of its length. As it passes through the serving heads the strips of insulating material are applied thereto in spiral overlapping layers. As the cops on the serving heads run out of ma-

terial fresh cops may be fed to them from the magazines in an obvious manner without breaking the wire. To start the machine with the circuit of Fig. 6 switch 57 will be closed energizing the fields of generator 62 and motors 22. Push button switch 69 is closed momentarily. Current flows from one of the wires 58 through wire 70, switch 69, wire 68, solenoid 65, and wire 64 back to the other wire 58 of this phase. This energizes the coil 65 causing switch 59 to close and to remain closed. A holding circuit for the coil is supplied as follows: From wire 64 through coil 65, wire 66, pole 67, wire 76, closed switch 75, wire 74, contacts 72, wire 71, and back to the other wire 58 of this phase. Thus solenoid 65 remains energized and switch 59 remains closed, and the parts will remain in this position either until switch 75 is opened or contacts 72 are separated by the breakage of the wire or insulation and the movement of lever 73 under the action of the tensed spring. The closing of switch 59 supplies current to the field of motor 61. Motor 61 being a squirrel cage induction motor it begins to operate. At the same time brake coil 79 is energized and the brake is released. The operation of the generator 62 supplies alternating current to the rotors of the serving head motors 22 with the result that the serving heads begin to revolve in timed relation with all the other parts of the machine. The parts are now all in operation with the serving heads revolving and wrapping the insulation spirally around the longitudinally advancing wire in accordance with well known practice. In accordance with this invention it is preferable in starting to positively connect the serving heads with the drive for the capstan and the take-up reel in order to insure synchronism or correct timing both during starting and stopping. This occurs as follows: When switch 59 is closed wires 77 are energized from one phase of the alternating current circuit with the result that relay winding 81 is energized pulling the lever 82 downwardly, breaking the circuit to the clutch magnet 44. As a result clutch magnet 44 is deenergized and spring 39' (Fig. 3) causes the clutch elements 40 and 41 to engage, thereby connecting shaft 18 to shaft 37. As a result the serving heads are mechanically connected to the motor which drives the capstan and take-up reel so that all of the parts are positively driven from the same power source during starting which insures absolute synchronism until the generator 62 is up to full speed as well as all of the operating parts. In the meantime, the dash pot 83 which includes a spring, as is well known with such devices, is slowly permitting switch 82 to close so that within a predetermined time, namely, when the parts are up to speed, the circuit to the clutch magnet 44 is completed and clutch element 41 disengages clutch element 40. The serving head motors are then independently operating both of each other and of the capstan and the take-up reel insofar as direct mechanical connection is involved. If at any time the wire breaks contacts 72 separate and hold-in coil 65 is deenergized so that switch 59 opens and the machine stops. As soon as switch 59 opens clutch magnet 44 is deenergized and the clutch elements again engage to mechanically connect all the parts during stopping. This temporary mechanical connection of all the parts during starting and stopping is desirable in order that the insulating layers be applied in the proper overlapping relation and at

the proper speed, otherwise during starting and stopping a considerable length of wire would have to be thrown away or, worse still, a length of wire intermediate the ends of a finished spool would be defective. It is important to note that the electro-mechanical clutch and the circuit connections supplement each other in securing synchronism during starting and stopping, but it is within the intended scope of this invention to use either to the exclusion of the other as well as to use them simultaneously.

The operation is substantially the same for the machine of Fig. 5 with the exception that only one layer of insulation is applied to the wire. If the device 50 is employed an adhesive coating is applied to the wire over which the insulating strip is wound, and if the device 51 is employed an adhesive and insulating coating is applied over the insulating layer and the coating is dried by passing through one or more heating coils 55.

From the above description it will be apparent that this invention resides in certain principles of construction and operation and certain steps and series of steps all as will be apparent to those skilled in the art, which features of novelty may likewise be carried out without departing from the scope of this invention by those skilled in the art. We, therefore, do not desire to be strictly limited to this disclosure as given for purposes of illustration but rather to the scope of the appended claims.

What we seek to secure by United States Letters Patent is:

1. A machine as described comprising a support, a take-up reel rotatably mounted on the support, a capstan wheel rotatably mounted on the support, motive means including connections simultaneously driving the take-up reel and capstan wheel, at least one serving head, a separate motive means for driving the serving head, and means for mechanically connecting the serving head to the take-up reel and capstan wheel during starting and stopping.

2. A machine as described comprising a support, a wire supply reel rotatably mounted adjacent the support, a take-up reel rotatably mounted on the support, a capstan having a capstan wheel, driving connections between the capstan and the take-up reel, motive means for driving the capstan, a serving head, independent motive means for driving the serving head, and means for automatically connecting the serving head to the capstan during starting and stopping of the machine.

3. A machine as described comprising a take-up reel, a capstan guide wheel, motive means including connections for simultaneously driving the take-up reel and the capstan guide wheel, a serving head, motive means for operating the serving head independently of the take-up reel and the capstan wheel, and electro-magnetic means for automatically connecting the serving head with the take-up reel and capstan wheel during starting and stopping of the machine.

4. A machine as described comprising a plurality of serving heads mounted in alignment, independent motors for driving the serving heads, means for supplying and guiding wire to and through the serving heads, a take-up reel, a capstan wheel, motor means for driving both the take-up reel and the capstan wheel, means operated by the motor means for controlling the independent motors and means for applying an adhesive to the wire before it reaches the serving head.

5. A machine as described comprising a plurality of serving heads mounted in alignment, independent motors for driving the serving heads, means for supplying and guiding wire to and through the serving heads, a take-up reel, a capstan wheel, separate motor means for driving both the take-up reel and the capstan wheel, means for applying adhesive over the insulation on the wire after it leaves the serving head, and means for drying the coating before it reaches the capstan wheel.

6. A machine as described comprising a take-up reel, a capstan wheel, connections between the reel and wheel for effecting simultaneous operation thereof, an electric motor for driving them, a serving head, an electric motor for driving the serving head, circuits for said motors, and electro-magnetic means for connecting the serving head to the take-up reel and capstan wheel for a predetermined period of time when the circuits to said motors are closed.

7. In a machine as described, an alternating current capstan motor, an alternating current serving head motor, an alternating current generator driven by the capstan motor, means for supplying alternating current to the fields of all of said motors and said generator, and circuits from the rotor of the generator to the rotors of the serving head motors.

8. In a machine for applying insulation to a wire comprising an electric motor driven take-up reel and capstan wheel, an electric motor driven serving head, circuits for said motors, a relay switch in said circuits, push button control means for closing said switch and holding it closed, and a switch in said circuit for deenergizing said means for holding said switch closed when the wire breaks to open said switch.

9. In a machine as described, the combination comprising a capstan, an induction motor for operating the capstan, at least one serving head, an induction motor for operating the serving head, a generator driven by the capstan motor, an alternating current supply circuit, connections from said circuit to the fields of the serving head motor and the generator, connections from the rotor of the generator to the rotor of the serving head motor, and connections from the alternating current circuit to the field of the capstan motor including a normally open switch whereby the fields of the generator and the serving head motor are normally energized so that any movement of the capstan or the serving head effects concurrent movement of the other.

10. A machine as described including a wire guiding and advancing wheel, an electric motor for driving said wheel, a serving head, an electric motor for driving the serving head, and a generator driven by one of said motors and connected to supply current to the other of said motors whereby said wheel and serving head are operated at any predetermined speed ratio.

11. A machine as described including a wire guiding and advancing wheel, an electric motor for driving said wheel, a serving head, an electric

motor for driving the serving head, a generator driven by one of said motors and connected to supply current to the other of said motors whereby said wheel and serving head are operated at any predetermined speed ratio, a take up reel, and means for driving the take up reel.

12. A machine as described including a wire guiding and advancing wheel, an electric motor for driving said wheel, a serving head, an electric motor for driving the serving head, a generator driven by one of said motors and connected to supply current to the other of said motors whereby said wheel and serving head are operated at any predetermined speed ratio, a take up reel, a distributor, and means for driving the take up reel and distributor.

13. In a machine of the type described, a capstan, means for driving the capstan, a serving head, means for driving the serving head, and automatically acting means for mechanically connecting the capstan and serving head during starting and stopping.

14. In a strand wrapping machine as described, a rotatable strand supply reel, a rotatable take-up reel, a rotatable strand feeding wheel, power means for conjointly operating the take-up reel and the feeding wheel, a rotatable serving head, a separate motive device for operating the serving head, and means controlled by said power means for determining the speed of rotation of the serving head.

15. In a machine as described the combination with a strand feeding wheel, a take-up reel and means for operating them conjointly of a plurality of serving heads for applying web layers to a strand, a separate motive device for driving each serving head and means controlled by and in accordance with the operation of the feeding wheel for maintaining a desired feeding ratio between the strand and the webs.

16. In a machine as described the combination with a strand feeding wheel, a take-up reel and means for operating them conjointly of a serving head for wrapping a web around the strand, a separate motive device for operating the serving head, and means controlled by and in accordance with the feeding wheel for maintaining a desired feeding ratio between the strand and the web.

17. In a machine as described the combination with a strand feed wheel and an electric motor for driving the same of a serving head for applying a web layer to the strand, an electric motor for operating the serving head and means controlled by and in accordance with the feeding wheel for maintaining a desired feeding ratio between the strand and the web.

18. A method as described which consists in advancing a strand longitudinally of its length, feeding a web to the strand, wrapping it therearound to form a spirally wrapped covering, and controlling the speed at which the web is fed by and in accordance with the feeding speed of the strand.

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