April 19, 1938. E. G. PARVIN 2,114,400

STRAND WRAPPING MACHINE

Filed March 1, 1937 4 Sheets-Sheet 1

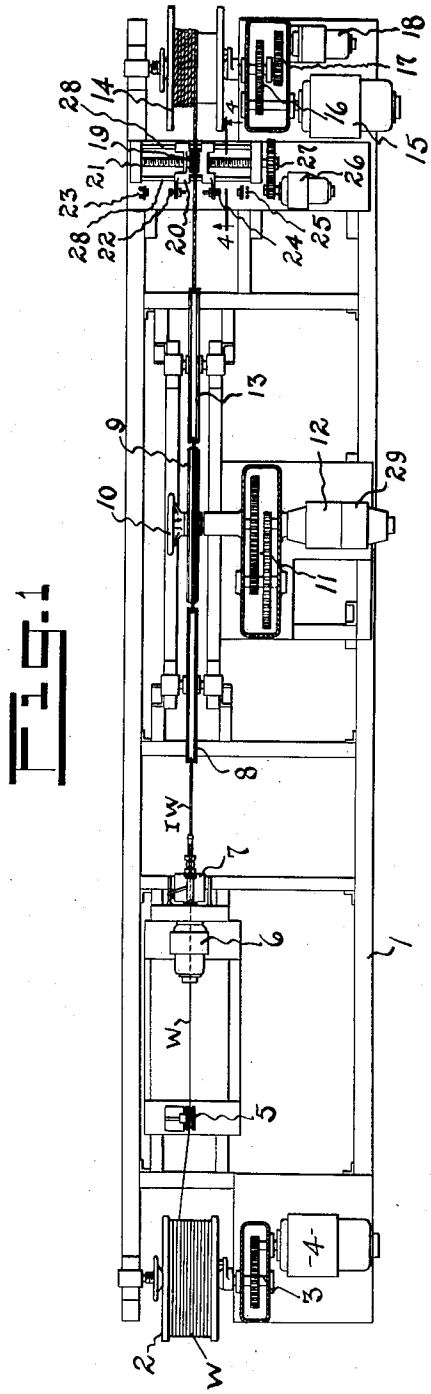


Fig. 1

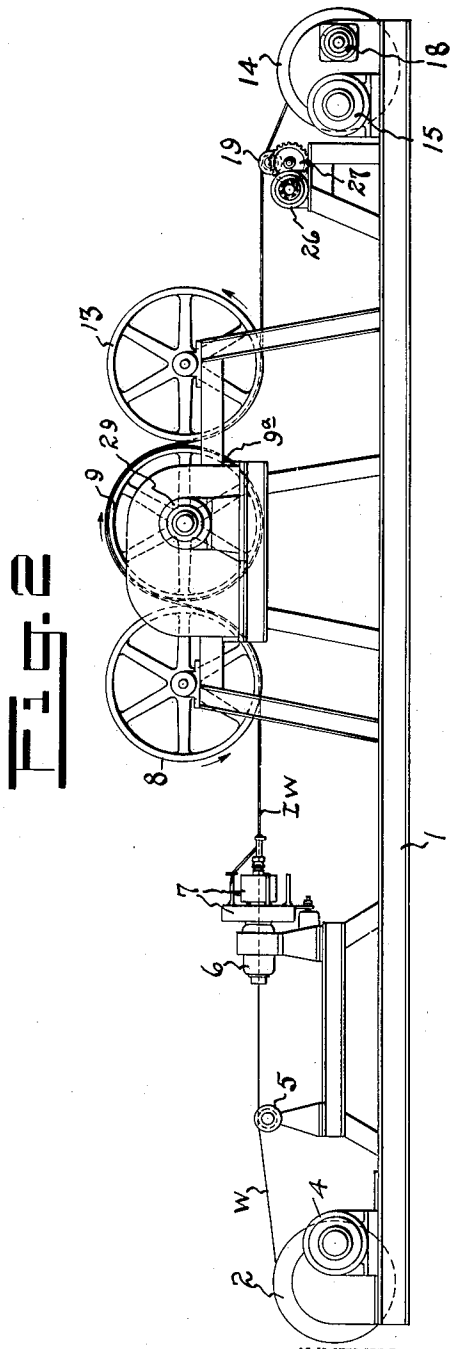


Fig. 2

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Fig. 3

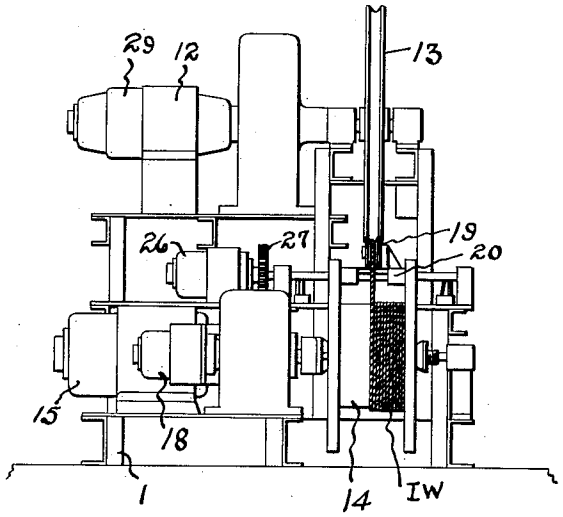
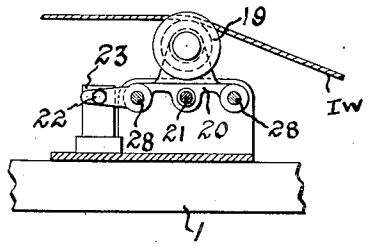


Fig. 4



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STRAND WRAPPING MACHINE

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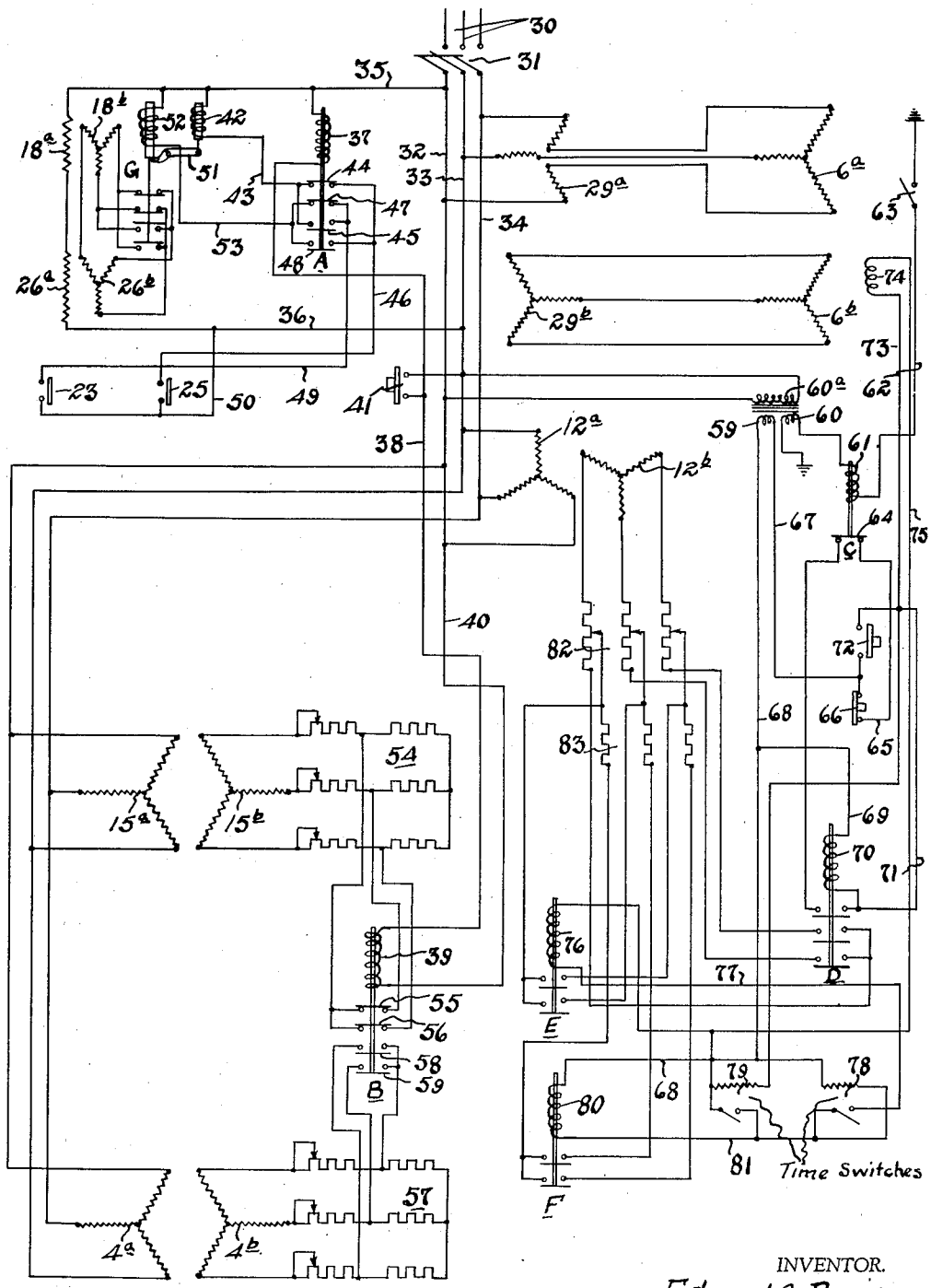


Fig. 5.

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STRAND WRAPPING MACHINE

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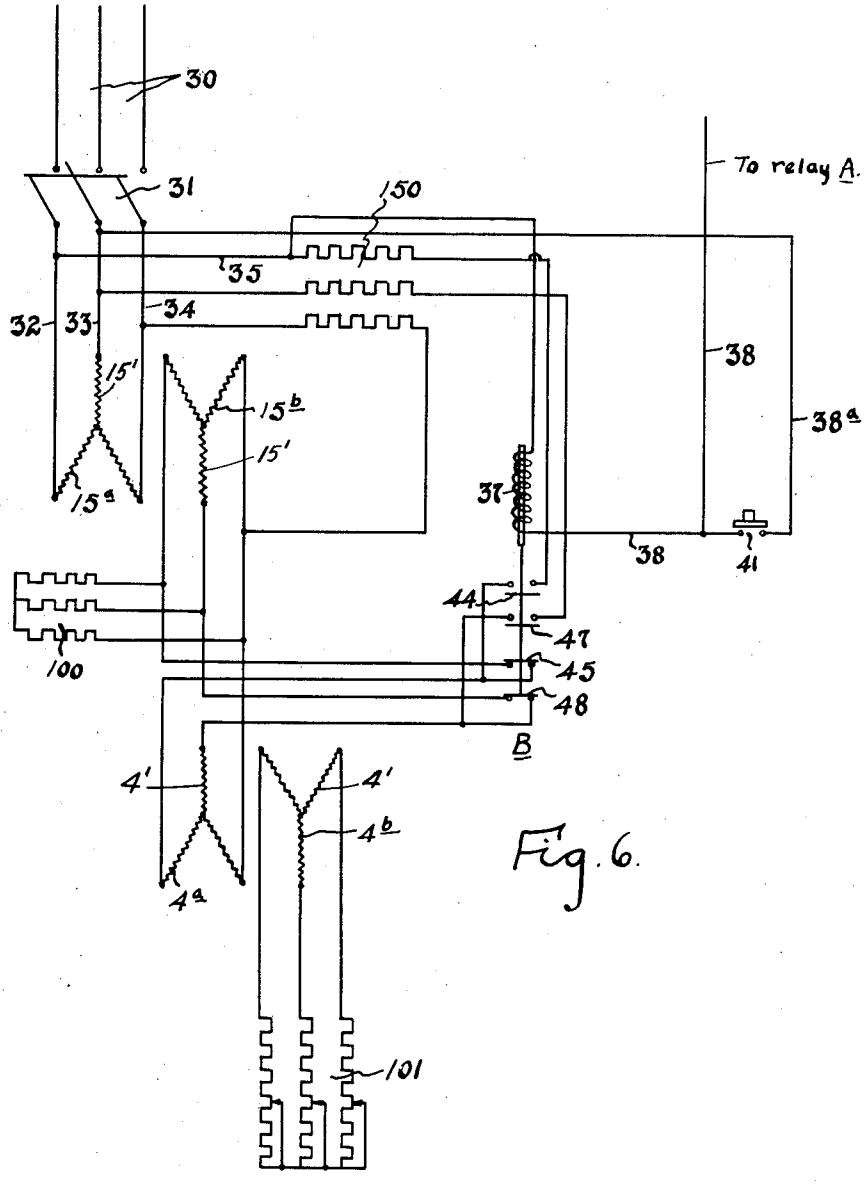


Fig. 6.

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Patented Apr. 19, 1938 2,114,400

UNITED STATES PATENT OFFICE

2,114,400.

STRAND WRAPPING MACHINE

Edward G. Parvin, Roselle, N. J., assignor, by mesne assignments, to Syncro Machine Company, Newark, N. J., a corporation of New Jersey

Application March 1, 1937, Serial No. 128,384

23 Claims. (Cl. 117—34)

This invention relates to improvements in machines for applying wrapper coverings to heavy strands.

More specifically, an object of the invention is to provide a machine for applying an insulating covering composed of a plurality of adjacent abutting or overlapping helical convolutions of a strip of insulating material onto a heavy electrical conductor.

Another object of this invention is to provide a synchronized mechanism by means of which the covering may be applied as a uniform helical wrap of either adjacent or overlapping convolutions.

An important object of this invention is to provide a mechanism of this type which will insulate extremely heavy conductors irrespective of cross-section.

A further object of the invention is to provide a novel interconnected motor driving connection for a mechanism of this type which will insure a relatively timed and synchronized movement of the strand in the direction of its length and the insulating strip to insure a uniform application thereof to the conductor.

A further object of this invention is to provide an electrically interconnected motor drive system for the distributor which lays the finished product onto the take-up reel in uniform layers to insure a synchronous movement of the distributor for either direction of movement of the wire.

A more specific object in accordance with the above object is to provide a generator moving in timed relation with the movement of the wire, which in turn operates the distributor operating motor to insure this timed relation.

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

This invention resides substantially in the combination, construction, arrangement and relative location of parts, all in accordance with the following description.

In the accompanying drawings,

Figure 1 is a top plan view of one form of mechanism in accordance with this invention;

Figure 2 is a side elevational view thereof;

Figure 3 is a right hand end elevational view thereof;

Figure 4 is a cross-sectional view taken on the line 4—4 of Figure 1;

Figure 5 is a circuit diagram of the motive power equipment for the machine and the control mechanism therefor; and

Figure 6 is a circuit diagram of a portion of the diagram of Figure 5 showing that portion modified.

Presently known mechanism or machines for insulating relatively heavy electrical conductors larger than, for example, No. 18 wire, and particularly the larger sizes approaching bar or rod like form, are not entirely satisfactory in use. For example, in the insulation of very heavy electrical conductors it has been found difficult from a commercial viewpoint to properly feed the heavy conductors in the proper timed relation with respect to the feeding of the covering strip thereto to insure either abutting convolutions thereof or overlapping convolutions of uniform overlap. For example, at the present time in order to feed it, it is common to wrap it several times around the capstan wheel which pulls it. This is undesirable. Furthermore, present methods of feeding the wrapping strip do not make it possible to maintain the desired synchronism betwen the movement of the wire and strip. Among the broader objects of this invention are those of eliminating these difficulties.

An even greater difficulty with the present day insulating machines is found in the distributing mechanism which lays the finished product on to the take-up reel in uniform layers. All types of mechanical and electrical mechanisms have been devised for this purpose, none of which have been entirely satisfactory. An important object of this invention is to provide a new form of drive for the distributor to insure its correct direction of movement always synchronized with any movement of the wire in either direction. In a broad view this is accomplished by providing an A. C. generator which is driven simultaneously with any movement of the wire to operate a motor connected thereto, which in turn operates the distributor motor.

The particular form of mechanism shown in the drawings for the purpose of illustrating the invention comprises any suitable form of framework 1 forming a bed or support for the machine. At one end thereof is rotatably supported in suitable journals a supply reel 2 on which the strand, as for example a wire W, to be covered is coiled. The reel or drum 2 in normal operation is slowly revolved in a clockwise direction (Figure 2) resisted by the drag or tongue motor 4 connected thereto through the gear train 3. At 5 is a guide pulley over which the wire W passes to the serving head 7 through the hollow shaft of the serving head motor 6. This mechanism is well known in the art in a number of forms, for example as

shown in United States Patent No. 2,003,354, issued June 4, 1935. The details of construction of the serving head form no part of this invention. It is noted that as illustrated the rotating parts of the serving head are directly connected to the shaft of moor 6 for rotation therewith.

The wrapped or insulated wire IW coming from the serving head passes around a portion of the periphery of a large guide wheel 8 journaled on the frame and, if desired, grooved as indicated. The wheel 8 is caused to revolve by reason of its engagement with the moving wire IW. From the wheel 8 this wire passes over a portion of the periphery of wheel 9, rotatably supported, and from there it passes to and engages with a portion of a wheel 13 freely journaled on the base. The wheel 9 is mounted on a shaft which is rotated by means of a motor 12 through a gear train 11. The hand wheel 10 illustrates any suitable form of mechanism by means of which the wheel 9 may be locked to the shaft driven by the motor 12. When the hand wheel is released it frees wheel 9 of the shaft, so that it may be rotated independently thereof. Wheel 9 is preferably provided with a covering or facing 9^a of a suitable material such as rubber, rubberized fabric, and the like.

From the wheel 13, which likewise may be grooved as indicated, the insulated wire passes over a guide pulley 19 on a transversely movable distributor carriage 20. This carriage is slidably mounted on a pair of guide rods 28 and is threadedly engaged by means of a screw 21 rotatably mounted in suitable bearings. The threaded rod 21 is reversibly rotated by means of a reversible motor 26 through a gear train 27.

The wire IW then passes onto a take-up reel 14 journaled on the base 1 and connected through a gear train 16 with a driving motor 15 which causes the reel to rotate in a clockwise direction. Figure 2. Connected with the shaft which drives the reel 14 through a gear train 17 is a generator 18. Thus this generator is driven in timed relation with the movement of the reel 14.

On projecting arms on the carriage 20 are a pair of adjustable screws 22 and 24 which are positioned to engage and operate a pair of switches 23 and 25 respectively at the end of the movement of the carriage in each direction. The details of construction of these switches have not been given but they may be of any suitable form which operate when engaged by the screws to momentarily close a circuit connected thereto, but which again immediately open as soon as the screws move out of engagement therewith.

At 29 is an A. C. generator built into and as a part of the motor structure 12 to provide what may be termed a motor-generator, the rotors of the two being mounted preferably on the same axle.

The motors and control circuits therefor are illustrated in Figure 5. A multi-phase system is illustrated fed from the circuit wires 30 through a main switch 31 which connects the wires 30 to the circuit conductors 32, 33 and 34. The single phase stator windings 18^a and 26^a of the generator 18 and the motor 26 are connected in series by means of the wires 35 and 36 across one phase of the power circuit comprising the wires 32 and 33. The operating winding 37 of relay A is connected to wire 35 at one terminal and at the other terminal by wire 38 to one terminal of the operating winding 39 of relay B. The other terminal of this winding is connected to wire 32 by wire 40. Wire 38, which is common to the windings 37 and 39, may be connected to wire 33 by means of a switch 41 so that these windings are connected across one phase of the power circuit when switch 41 is closed.

A magnet winding 42 is connected by wire 43 between wire 35 and one of the contacts of each of the pairs controlled by the movable contacts 44 and 45 of relay A. The operating winding 52 of relay G is connected by wire 53 between wire 35 and one contact of each of the pairs of relay A controlled by the movable contacts 47 and 48. The other contact of each of the pairs controlled by the movable contacts 44 and 48 are connected by wire 46 to one contact of switch 25. The other contact of each of the pairs controlled by the movable contacts 47 and 45 are connected by wire 49 to one of the contacts of switch 23. The other contact of the switches 23 and 25 are connected by a common wire 50 to the wire 36. At 51 is a pivotally mounted latch lever pivotally connected to the movable armature or plunger controlled by the winding 42 and positioned to engage the armature or movable plunger of relay G to hold it in the position shown in the drawings.

The multi-phase rotor windings 18^b and 26^b of the generator 18 and the motor 26 are connected with the four movable contacts of the relay G in a manner so that in one position of the contacts as shown these windings are connected in one direction and in the other position their connections are reversed.

The stator windings 15^a of the motor 15 are connected to the polyphase circuit wires 32, 33 and 34, as are the stator windings 4^a of the motor 4. The rotor windings 15^b are connected to a two-section resistance bank 54, a portion of which is adjustable, as indicated, by the movable contacts. In a similar manner the rotor windings 4b are connected to a two-section resistance bank 57, a portion of which is adjustable. The common terminals of the two sections of the resistance bank 54 are interconnected with the two pairs of contacts controlled by the movable contacts 55 and 56 of the relay B, so that the right hand section of the resistance bank is short-circuited when relay B is in the position shown. In a similar way, the common terminals of the two sections of the resistance bank 57 are connected to the two lower pairs of contacts of relay B controlled by the movable contacts 58 and 59 so that the right hand section of the resistance bank 57 is short-circuited when the winding 39 of relay B is energized to interconnect the lower pairs of contacts.

The primary 60^a of a low voltage transformer is connected across one phase of the power circuit comprising the wires 32 and 33 as shown. This transformer has a secondary comprising the parts 59 and 60. One terminal of the portion 60 is grounded and the other terminal is connected to the operating winding 61 of relay C, the other terminal of which is connected by wire 62 to the automatic stop switch 63, the other terminal of which is grounded. This stop switch forms a part of the serving head and is arranged to close should the insulating strip being applied to the wire break during the operation of the machine. One form of this switch as applied to serving heads is illustrated in the patent mentioned above.

The relay C has a single movable contact which cooperates with a pair of fixed contacts. One of these contacts is connected by wire 65 to a normally closed switch 66. The other contact of this switch is connected to one contact of a normally open switch 72 and by wire 67 to the secondary portion 59 of the transformer. The other

terminal is connected by wire 68 to one terminal of each of the time switches 78 and 79 and to one terminal of the operating winding 80 of relay F. Wire 68 is connected by wire 69 to one terminal of the operating winding 70 of relay D and to the contact of the relay D, which is connected by wire 71 to the other contact of switch 72. The other contact of this pair of relay D is connected to the other contact of relay C. Wire 71 is connected by wire 73 to a brake magnet winding 74, the other terminal of which is connected by wire 75 to wire 68 and to one terminal of the operating winding 76 of relay E. A suitable form of brake as employed with the serving head, of which the winding 74 is a part, is illustrated in the patent noted before. The other terminal of winding 80 is connected by wire 81 to one of the contacts of each of the time switches 79 and 80, and to one terminal of the operating winding of the time switch 78. The other terminal of the operating winding of time switch 79 is connected by wire to wire 71 and the other contact of time switch 78 is connected by wire 77 to the other terminal of winding 76.

Stator windings 29^a and 6^a of the generator 29 and the serving head motor 6 are connected in series across the power circuit wires 32, 33 and 34. The rotors 29^b and 6^b thereof are connected together as shown. The stator 12^a of the motor 12 is connected across the power circuit wires 32, 33 and 34. The rotor is connected to a two-section resistance bank comprising the portions 82 and 83, of which the portion 82 is adjustable. One set of terminals of the portion 82 are connectible together by the two lower movable contacts of relay D when it is operated. Likewise, one set of terminals of the portion 83 of the resistance bank are connectible together by means of the pair of movable contacts of the relay F when its winding is energized.

The operation of the apparatus will now be described. It will be assumed that a strand or conductor to be insulated is threaded through the machine and attached to the take-up reel in the manner indicated in Figure 1. To set the machine in operation the main power switch 31 is first closed. This energizes the stators 29^a, 6^a, 12^a, 15^a and 4^a. The rotor circuits corresponding thereto are however, by reason of the position of the various relays as indicated, in such condition that the machine does not operate. Similarly the stators 18^a and 26^a are energized. To start the machine in operation normally open start switch 72 is momentarily closed. Current then flows from the secondary 59, which is preferably proportioned to deliver current at 100 to 125 volts, through switch 72 to wire 71, winding 70, and back to 59 by wire 68. Relay D is thereby operated setting up a holding circuit for the winding 70 through the upper movable contact, relay C, wire 65, normally closed switch 66, and wire 67. The momentary closing of start switch 72 also supplied current by wire 73 to the brake coil 74, wire 75, and wire 68. Thus the main brake on the serving head is released and held released because a holding circuit for this brake coil is also set up through the upper contact of relay D. The operating winding of the first time switch 79 is also energized through the start switch 72 when it is momentarily closed, and is maintained energized over that switch and through the holding circuit set up for the winding 70 of relay D. Thus this time switch begins to operate, and at the end of a predetermined period, say ten seconds, the switch thereof closes.

Prior to the closing of this switch, however, motor 12 is started in operation by the operation of relay D, the lower pair of contacts of which connect the ends of the resistances 82 together, completing the circuit of rotor 12^b. All of the resistance of section 82 representing a maximum amount of resistance is shunted across the rotor circuit. Thus this motor starts up and attains a maximum speed corresponding to the value of this resistance. The rotation of motor 12 by the energization of its windings operates generator 29, which in turn immediately supplies current to the motor 6, so that the serving head immediately begins to apply wrapping to the wire W, which also immediately begins to move in the direction of its length when motor 12 begins to operate. Motor 15 is energized causing the take-up reel 14 to rotate. At the same time motor 4 is energized to exert a drag on the rotation of reel 2. This motor is really a torque motor in which the rotor is driven against the reaction of the stator followed by the withdrawal of the wire from the reel.

This device provides means for applying a substantially uniform tension on the wire which may be varied by adjusting the variable resistances 57 in the rotor circuit. The operation of the motor 12 causes the rotation of wheel 9, which by reason of its frictional engagement with the wire, effects a feeding movement thereof in a longitudinal direction. The operation of reel 14 contributes sufficient pulling force to the wire so as to substantially counterbalance the braking action of the motor 4, so that the motor 12 and drive wheel 9 merely supply the energy to effect a movement of the more or less balanced wire. The torque exerted by the motor 15 may also be varied by adjusting the value of the resistance 54 in the rotor circuit. As shown, with relay 39 de-energized, which is its normal condition, the right hand portion of resistance 54 is short circuited, and at the same time all of the resistance 57 is in the circuit as determined by the adjustable contacts.

As indicated in Figure 1, it will be assumed that the carriage 20 is moving downwardly towards switch 25, it having previously momentarily closed switch 23 to energize winding 52 to operate relay G to the position shown, the latch 51 holds it there. In this position the rotors 18^b and 26^b have been connected together for a direction of rotation of generator 18, and carriage motor 26 to operate the screw 21 to cause the carriage to move downwardly. The speed of rotation of the reel 14 determines the speed of rotation of the generator 18, and hence the speed of rotation of motor 26. Any change in speed of rotation of reel 14 will effect through this interconnection a corresponding change in the speed of movement of the carriage 20, because of the series connection between the stators of the generator and the motor. By this arrangement a correct time movement of the carriage is insured. As noted above, and as disclosed in the patent mentioned above, a similar synchronized movement of the serving head 7 is effected by reason of the series interconnection between the serving motor 6 and the generator 29.

The system operates as thus described until time switch 79 closes its switch. At this time winding 80 is energized, closing relay F to interconnect the ends of resistances 83. When this occurs resistances 83 in series with the portions of resistances 82 between the movable contacts and the rotor winding 12^b are connected to the rotor 12^b. This represents a less amount of resistance

than was in the rotor circuit when all of resistances 82 were in circuit. Thus the drive motor 12 increases its speed of rotation, thereby feeding the wire to the reel 14 more rapidly, with the result that the speed of motor 15 picks up, the load thereon being light; the increased speed of rotation of the reel 14 of course increases the speed of rotation of generator 18, and hence carriage motor 26, so that the distributor likewise speeds up the proper amount. The increase in speed of motor 12 increases the speed of rotation of the generator 29, which in turn causes the serving head motor 6 to operate the serving head at the new rate. Thus synchronism throughout is maintained to insure a helical wrap of insulating material with the convolutions abutting or overlapping without variation.

At the end of a predetermined period of time, as for example ten seconds, the operating winding of time clock 78 closes its switch, which completes a circuit to the winding 76 of relay E. This relay operates to interconnect all of the adjustable contacts together of resistances 82, so that only those portions of that resistance between the adjustable contacts and the rotor 12^b are in circuit. The motor 12 therefore speeds up and all of the other equipment again speeds up as previously described. This represents the normal operating speed which can be initially predetermined by the position of the adjustable contacts of resistances 82. The machine is now in full operation.

When the carriage 20 moves down so that switch 25 is momentarily closed a circuit is established from wire 33 through wire 36, wire 50, switch 25, wire 46, contact 44 of relay A, wire 43, winding 42, and wire 35 to wire 32. The energization of winding 42 moves latch 51 to a position to release the plunger of relay G. It immediately drops down to reverse the interconnections between the rotors 18^b and 26^b so that the motor 26 immediately reverses its direction of rotation to drive the carriage 20 in the opposite direction. The other operating conditions remain the same and the carriage returns towards the other end of its stroke. Switch 25 is only momentarily closed, so that winding 42 is again deenergized. When the carriage moves over to close switch 23 a circuit is established to winding 52 from wire 33 through wire 36, wire 50, switch 23, wire 49, contact 47 of relay A, wire 53, winding 52, and wire 35 to wire 32. When this occurs relay G is operated to again reverse the connections between the rotors 18^b and 26^b to start the carriage in the opposite direction. Latch 51 holds relay G in the operated position (the one shown) even though switch 23 is but momentarily closed.

The mechanism may be stopped in several ways. It is normally stopped by opening switch 66, which breaks the holding circuit to winding 70 of relay *d*. Relay D then returns to the position shown, at which time all circuits are killed and the apparatus stops. Simultaneously with the breaking of the circuit to winding 70, the circuit to the brake coil 74 is broken so that the brake is applied on the serving head as shown in the above mentioned patent, immediately bringing it to a stop. The machine may also be automatically stopped by the closing of switch 63, the equivalent of which is shown in the above mentioned patent. This switch closes when the web or strip of insulating material being wrapped on the conductor breaks. Upon the breaking of the web and the closing of switch 63, a circuit is completed from the low voltage secondary 60 to the winding 61 of relay C. This causes relay C to open and break the holding circuit to winding 70 and brake coil 74, so that the machine stops as before.

A very important feature of this invention is the fact that the machine is reversible without disturbing the relationship of any of the parts. It is sometimes desirable to reverse the machine to run the wire backwards, and to do this without disturbing the relationship of the parts, and particularly the distributor. To do this it is necessary to energize motor 4 to drive reel 2 and to energize motor 15 to convert it to a torque motor drag.

For reverse movement of the wire motor 12 is not used. The hand wheel 10 is released freeing wheel 9 on its shaft. The serving head of course is not operated during the reverse movement of the wire, and therefore it is immaterial that the generator 29 does not move as the wire moves. From a control viewpoint to effect this operation hand wheel 10 is released and switch 41 is closed. The closing of switch 41 completes a circuit to the winding 39 of relay B. The operation of relay B takes the short circuit off of the right hand section of resistance 54 and places it on the right hand section of resistances 57. Thus the torque drag motor 4 becomes the driving motor for reel 2 and the driving motor 15 becomes the torque drag motor for reel 14. Motor 4 then causes the wire to move in a reverse direction. As this occurs generator 18 is rotated in a reverse direction.

Going back now the closing of switch 41 completes a circuit to winding 37 operating relay A. The result is that the connections from the windings 52 and 42 to the switches 23 and 25 are reversed by the movement of the contacts thereof. Contacts 44 and 47 break the circuits controlled thereby, while contacts 45 and 48 make the circuits controlled by them. Wire 53 is then connected to wire 46 instead of to wire 49, and wire 43 is connected to wire 49 instead of to wire 46. Switches 23 and 25 are then properly interconnected to control the windings 52 and 42 to reverse movement of the mechanism. The result is that the carriage continues to move even under these reverse conditions in exact timed relation with the movement of the wire and reels. The mechanism otherwise operates the same.

An important feature of this invention is that as the diameter of the coil on reel 14 builds up the reel 14 of course revolves more slowly, and it is necessary that the carriage 20 move more slowly. This results because the slower movement of this reel effects a correspondingly slower speed of rotation for the generator 18, and hence the motor 26.

A modified connection for a portion of this circuit is illustrated in Figure 6. This modified portion applies only to the connections for the motors 15 and 4. The circuit of Figure 6 shows a modification of the manner of connecting motors 4 and 15 to the power source to effect a reversal of functions when the machine is reversed. Except for these modifications the circuit remains as illustrated in Figure 5.

In Figure 6 the rotor 15^b and the stator 4^a are connected together by the contacts 45 and 48 when the winding 37 is de-energized, and are shunted by the resistance 100. This is the normal connection for so-called normal or forward operation of the machine. With this arrangement the currents circulating in the rotor circuit 15^b are delivered to the stator circuit 4^a so that the motor 4' is energized under the control of the motor 15'.

This insures that the drag torque on the reel 2 is properly proportioned in relation to the speed of rotation of reel 14 and motor 15' to produce a correct corresponding drag torque. The fundamental or initial torque exerted by the motor 4' can be varied as before by adjusting the resistances 101 in its rotor circuit.

When it is desired to reverse the machine as previously described, switch 41 is closed, energizing the winding 37 by placing it across one phase of the power circuit represented by the wires 32 and 33, through the wires 35, 38 and 38a, including switch 41. Wire 38 extends as before to the winding of relay A, so that the necessary reversal of connections is effected in the distributor motor generator circuit.

The energization of winding 37 operates relay B so as to separate the stator winding 15b and the rotor winding 4a from each other and to connect the stator 4a across the power circuit through resistance 150 by contacts 44 and 47. The disconnection of the rotor 15b from the stator 4a by the contacts 45 and 48 places the resistance 100 across the rotor 15b only. Under these conditions the torque motor 4' becomes a driving motor energized in a reverse direction, as will be seen, to cause rotation of the spool 2 in the opposite direction. At the same time the motor 15' becomes a torque drag motor acting on the spool or reel 14 to perform the function of maintaining a substantially uniform tension on the wire for its reverse direction of movement. In other words the motor 15' now maintains a substantially uniform tension on the wire, whereas previously, that is for normal operation, the motor 4' does this.

It may be here noted that in both of the systems shown the switch 41 is normally not closed for a very long period, but is intermittently closed to produce a sort of "inching" action, that is the wire is only moved in a reverse direction in relatively short increments corresponding to periods of closure of the switch 41. Thus this switch may be termed what is known as an "inching switch".

From the above description it will be apparent to those skilled in the art that this invention is adapted to wide variation in the details of construction and arangements of the parts and circuit connections without departure from the true scope thereof. I do not, therefore, desire to be strictly limited to the disclosure as given for purposes of illustration, but rather to the scope of the appended claims.

What is claimed is:

1. In a machine of the type described the combination comprising a strand supply reel, a motor driven take-up reel, a distributor for guiding the strand onto the take-up reel in uniform layers, a motor for operating the distributor, a generator operated by movements of the take-up reel, and connections between the generator and motor whereby the distributor movement is governed by the movements of the take-up reel.

2. In a machine of the type described the combination comprising a strand supply reel, a motor driven take-up reel, a distributor for guiding the strand onto the take-up reel in uniform layers, a motor for operating the distributor, a generator operated by movements of the take-up reel, connections between the generator and motor whereby the distributor speed is governed by the movements of the take-up reel, said distributor comprising a guide carriage axially movable with respect to the take-up reel, and means driven by said motor for effecting said movement of the carriage.

3. In a machine of the type described the combination comprising a strand supply reel, a power driven take-up reel, a distributor for guiding the strand onto the take-up reel in uniform layers, a generator operated by movements of the take-up reel, a motor for operating said carriage, connections between the generator and said motor, and means operated as the carriage reaches the end of its travel in either direction for reversing the connections between the motor and generator.

4. In a machine of the type described the combination comprising a strand supply reel, a power driven take-up reel, a distributor for guiding the strand onto the take-up reel in uniform layers, a generator operated by movements of the take-up reel, a motor for operating said carriage, connections between the generator and said motor, and means operated by the distributor at the end of its stroke in either direction to reverse the connections from the generator to the motor.

5. In a machine of the type described the combination comprising a strand supply reel, a power driven take-up reel, a distributor for guiding the strand onto the take-up reel in contiguous convolutions, a generator connected to the take-up reel and operated thereby, a motor for operating the distributor, connections between the generator and the motor, and means connected with the supply reel for maintaining a tension on the strand.

6. In a machine of the type described the combination comprising a strand supply reel, a power driven take-up reel, a distributor for guiding the strand onto the take-up reel in contiguous convolutions, a generator connected to the take-up reel and operated thereby, a motor for operating the distributor, connections between the generator and the motor, and a torque motor connected to the supply reel for maintaining a tension on the strand.

7. In a machine of the type described the combination comprising a strand supply reel, a power driven take-up reel, a distributor for guiding the strand onto the take-up reel in contiguous convolutions, a generator connected to the take-up reel and operated thereby, a motor for operating the distributor, connections between the generator and the motor, and means connected with the supply reel for maintaining a tension on the strand, and means for applying a helically wrapped covering to the strand.

8. In a machine of the type described the combination comprising a strand supply reel, a power driven take-up reel, a distributor for guiding the strand onto the take-up reel in contiguous convolutions, a generator connected to the take-up reel and operated thereby, a motor for operating the distributor, connections between the generator and the motor, a torque motor connected to the supply reel for maintaining a tension on the strand, and means for applying a helically wrapped covering to the strand.

9. In a machine of the type described the combination comprising a strand supply reel, a power driven take-up reel, a distributor for guiding the strand onto the take-up reel in contiguous convolutions, a generator connected to the take-up reel and operated thereby, a motor for operating the distributor, connections between the generator and the motor, means connected with the supply reel for maintaining a tension on the

strand, and means engaging the strand intermediate the reels for effecting movement of the strand in the direction of its length.

10. In a machine of the type described the combination comprising a strand supply reel, a power driven take-up reel, a distributor for guiding the strand onto the take-up reel in contiguous convolutions, a generator connected to the take-up reel and operated thereby, a motor for operating the distributor, connections between the generator and the motor, a torque motor connected to the supply reel for maintaining a tension on the strand, and means engaging the strand intermediate the reels for effecting movement of the strand in the direction of its length.

11. In a machine of the type described the combination comprising a strand supply reel, a power driven take-up reel, a distributor for guiding the strand onto the take-up reel in contiguous convolutions, a generator connected to the take-up reel and operated thereby, a motor for operating the distributor, connections between the generator and the motor, a torque motor connected to the supply reel for maintaining a tension on the strand, means engaging the strand intermediate the reels for effecting movement of the strand in the direction of its length, motor driven means for applying a helical wrap to the strand, a generator operated in accordance with the movement of the strand, and connections between the generator and said last mentioned motor.

12. In a machine for wrapping heavy strands the combination comprising a strand supply reel, a power driven take-up reel, a torque motor connected to the supply reel for maintaining a tension on the strand, and means intermediate said reels and engaging said strand for effecting longitudinal movement thereof.

13. In a machine for wrapping heavy strands the combination comprising a strand supply reel, a power driven take-up reel, a torque motor connected to the supply reel for maintaining a tension on the strand, means intermediate said reels and engaging said strand for effecting longitudinal movement thereof, said last mentioned means comprising a large motor driven wheel and a pair of idler wheels disposed on opposite sides thereof, the strand engaging but a portion of the periphery of each of said wheels.

14. In a machine for wrapping heavy strands the combination comprising a strand supply reel, a power driven take-up reel, a torque motor connected to the supply reel for maintaining a tension on the strand, means intermediate said reels and engaging said strand for effecting longitudinal movement thereof, said last mentioned means comprising a large motor driven wheel and a pair of idler wheels disposed on opposite sides thereof, the strand engaging but a portion of the periphery of each of said wheels, motor driven means for applying a helically wrapped covering to the strand, a generator operated with the large motor driven wheel, and connections between the generator and said motor driven means.

15. In a machine for wrapping heavy strands the combination comprising a strand supply reel, a power driven take-up reel, a torque motor connected to the supply reel for maintaining a tension on the strand, means intermediate said reels and engaging said strand for effecting longitudinal movement thereof, said last mentioned means comprising a large motor driven wheel and a pair of idler wheels disposed on opposite sides thereof, the strand engaging but a portion of the periphery of each of said wheels, motor driven means for applying a helically wrapped covering to the strand, a generator operated with the large motor driven wheel, connections between the generator and said motor driven means, a distributor for guiding the strand onto the take-up reel, a motor for operating the distributor, a generator operated with the take-up reel, and connections between the generator and said last mentioned motor.

16. In a machine for wrapping heavy strands the combination comprising a strand supply reel, a power driven take-up reel, a torque motor connected to the supply reel for maintaining a tension on the strand, means intermediate said reels and engaging said strand for effecting longitudinal movement thereof, said last mentioned means comprising a large motor driven wheel and a pair of idler wheels disposed on opposite sides thereof, the strand engaging but a portion of the periphery of each of said wheels, motor driven means for applying a helically wrapped covering to the strand, a generator operated with the large motor driven wheel, connections between the generator and said motor driven means, a distributor for guiding the strand onto the take-up reel, a motor for operating the distributor, a generator operated with the take-up reel, means between the generator and said last mentioned motor, and means controlled by the distributor for reversing the connections between the generator and the motor at the end of the movement of the distributor in either direction.

17. In a machine of the type described the combination comprising a strand supply reel, a motor driven take-up reel, a torque motor connected to the supply reel to maintain a tension on the strand, a distributor for guiding the strand onto the take-up reel, a motor for operating the distributor, a generator driven with the take-up reel, connections from the generator to said last mentioned motor, means in said connections and controlled by the movements of the distributor to effect reversal of the connections to the motor at the end of the stroke of the distributor in either direction, and manually controlled means in said connections for completely reversing them when the strand is operated in the reverse direction.

18. In a machine of the type described the combination comprising a strand supply reel, a motor driven take-up reel, a torque motor connected to the supply reel to maintain a tension on the strand, a distributor for guiding the strand onto the take-up reel, a motor for operating the distributor, a generator driven with the take-up reel, connections from the generator to said last mentioned motor, means in said connections and controlled by the movements of the distributor to effect reversal of the connections to the motor at the end of the stroke of the distributor in either direction, manually controlled means in said connections for completely reversing them when the strand is operated in the reverse direction, and means for changing the connections to the torque motor on the supply reel and the driving motor on the take-up reel whereby the torque motor drives the supply reel in a reverse direction and the driving motor for the take-up reel becomes a torque motor.

19. In a machine of the type described the combination comprising a strand supply reel, a motor driven take-up reel, a torque motor connected to the supply reel to maintain a tension on the strand, a distributor for guiding the strand onto the take-up reel, a motor for operating the distributor, a generator driven with the take-up

reel, connections from the generator to said last-mentioned motor, means in said connections and controlled by the movements of the distributor to effect reversal of the connections to the motor at the end of the stroke of the distributor in either direction, manually controlled means in said connections for completely reversing them when the strand is operated in the reverse direction, and means for changing the connections to the torque motor on the supply reel and the driving motor on the take-up reel whereby the torque motor drives the supply reel in a reverse direction and the driving motor for the take-up reel becomes a torque motor, a motor driven wheel interposed between said reels and engaging the strand to effect longitudinal movement thereof, said wheel being disconnectable from said motor when the direction of movement of the strand is reversed.

20. In a strand feeding machine the combination comprising means for supporting a strand between spaced points for movement in the direction of its length, oppositely acting motive means connected to said means for placing the strand under tension, and means engaging the strand between said spaced points for effecting movement thereof in the direction of its length.

21. In a machine for advancing a strand in the direction of its length, the combination comprising supply and take-up means between which the strand extends, opposed motor means connected to said means for adjustably tensioning the strand, and means engaging the strand intermediate the supply and take-up means for effecting movement of the strand.

22. In a machine of the type described the combination including a strand supply reel, a motor driven take-up reel, a distributor for guiding the strand onto the take-up reel in uniform layers, a motor for operating the distributor, a generator operated in conjunction with the take-up reel, and connections between the generator and motor whereby the distributor moves in proper relation to the movement of the take-up reel.

23. In a machine of the type described the combination including a strand supply reel, a motor driven take-up reel, a distributor for guiding the strand onto the take-up reel in uniform layers, a motor for operating the distributor, a generator operated at a speed proportional to the speed of movement of the take-up reel, and connections between the generator and motor.

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