June 17, 1930. C. F. LINKENHELD 1,764,636

CONTROLLING SYSTEM

Filed Dec. 29, 1924 2 Sheets-Sheet 1

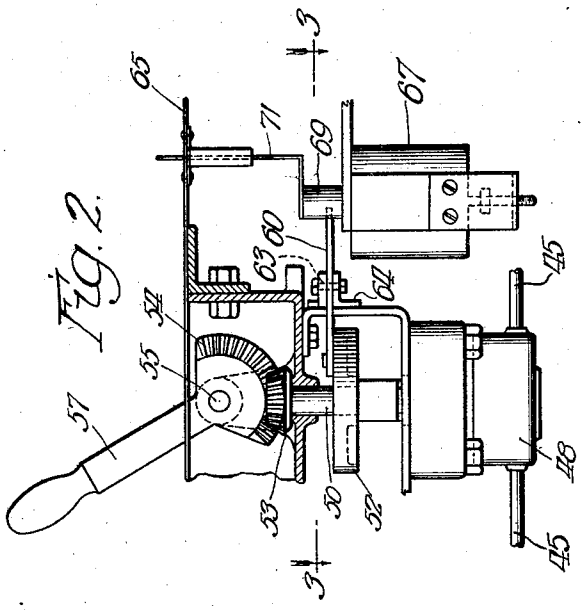


Fig. 2.

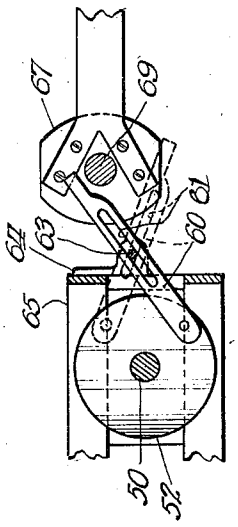


Fig. 3.

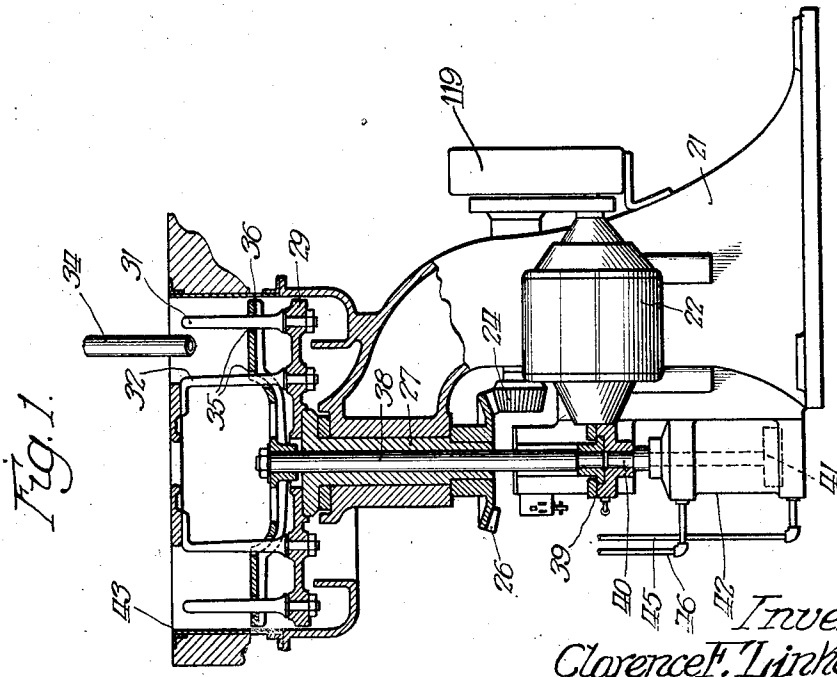


Fig. 1.

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Filed Dec. 29, 1924 2 Sheets-Sheet 2

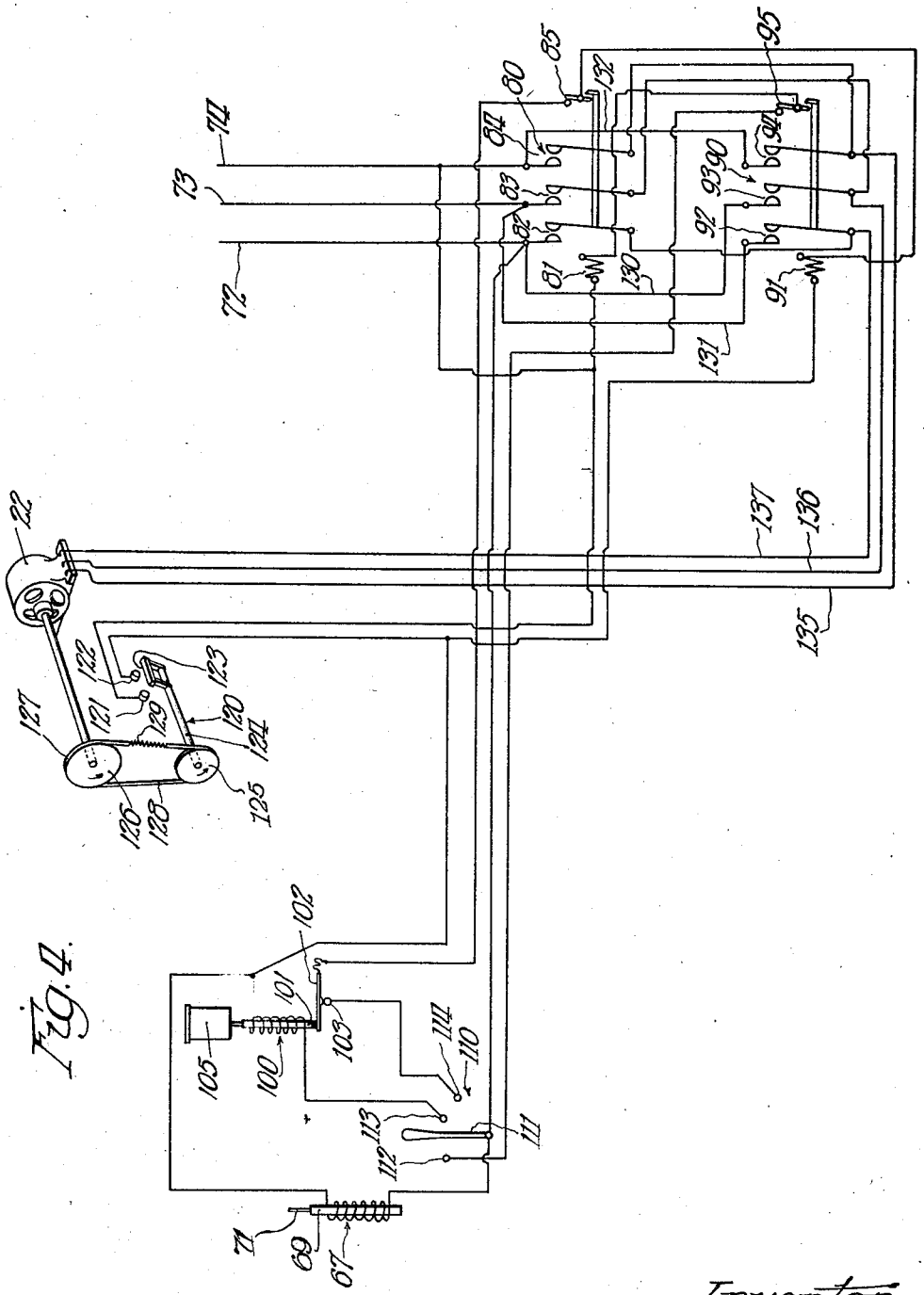


Fig. 4.

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UNITED STATES PATENT OFFICE

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CONTROLLING SYSTEM

Application filed December 29, 1924. Serial No. 758,571.

This invention relates to a controlling system, and more particularly to a system for controlling the operation of a coiling machine.

The object of the invention is to provide improved controlling apparatus.

One form of the invention is embodied in apparatus for coiling rod wherein the circuit of an electric motor driving the coiling element is opened when the rod has been coiled and contemporaneously therewith a circuit is momentarily closed through a solenoid, the restoration of which is delayed so that the motor may coast for a definite period of time before the solenoid reaches its normal position to close a circuit for reapplying the current to the motor in a reverse direction, a switch operating to again remove the current from the motor as soon as it starts reversing. A solenoid control prevents the actuation, before the coiling element stops, of a pneumatically operated stripper for removing the coiled rod.

Other features of the invention will become apparent as the following detailed description progresses, reference being had to the accompanying drawings, wherein

Fig. 1 is a central section through a coiling machine controlled by means embodying the invention;

Fig. 2 is a fragmentary section through the control apparatus;

Fig. 3 is a section taken on line 3—3 of Fig. 2, and

Fig. 4 shows a circuit for controlling the operation of the apparatus shown in Figs. 1, 2, and 3.

Referring to Fig. 1, 21 is the base of a coiling machine upon which is mounted a three-phase motor 22 adapted to drive a pinion 24 meshing with a bevel gear 26, the bevel gear 26 being secured to a sleeve 27 which is journaled in the base 21 and has rigidly secured to it a disk 29. Projecting upwardly from the disk 29 are pins 31 and 32 adapted to coil rod guided into the space between the pins by a movable tube 34. The pins 31 and 32 pass through apertures 35 in a stripping plate 36 secured to a rod 38 which is slidably journaled in the sleeve 27 and is connected by a coupling 39 to a piston rod 40 fixed to a piston 41 disposed within a pneumatic cylinder 42. The cylinder 42 is connected by pipes 45 and 46 to a supply (not shown) of fluid under pressure so that a fluid, such as air, may be admitted to the cylinder to reciprocate the piston 41. This permits the stripping plate 36 to be moved upwardly in such manner that rod coiled upon the pins 32 will be stripped therefrom and raised to the level of a floor 43. The flow of fluid under pressure through the pipe 46 is controlled by any suitable means (not shown), the flow of fluid under pressure through the pipe 45 being controlled by a valve 48 (Figs. 2 and 3).

The valve 48 is conveniently disposed with respect to the coiling machine and comprises a valve stem 50 which has secured thereto a disk 52 and a bevel gear 53. The bevel gear 53 meshes with a segmental bevel gear 54 journaled upon a stud shaft 55, a lever 57 being formed integrally with the segmental gear 54 so that it may be oscillated to open and close the valve 48. Pivotally secured to the disk 52 is a bar 60 having a slot 61 which accommodates a pin 63 projecting from a bracket 64, the bracket 64 being mounted in a housing 65 in which the valve 48 is also mounted. When the valve 48 is closed, the bar 60 will occupy the position wherein it is shown in full lines in Fig. 3 and when the handle 57 is moved in a clockwise direction (Fig. 2) to open the valve, the bar 60 will be brought into the position wherein it is shown in dotted lines in Fig. 3. Mounted in the housing 65 is a solenoid 67 having a core 69 which is movable into the path of the bar 60 to prevent the valve 48 from being opened when the disk 29 and the pins 31 and 32 are being rotated. Secured to the upper end of the core 69 is a bent pin 71 which projects from the housing 65 when the core is in the path of the bar 60. This is to apprise the operator that the valve 48 is locked in its closed position.

Referring to Fig. 4, the motor 22 is connected to a source (not shown) of electrical energy by a three-phase circuit comprising

mains 72, 73, and 74, switches 80 and 90, the solenoid 67, a solenoid 100, and electrical switches 110 and 120.

The switch 80 comprises a winding 81, normally open contacts 82, 83, and 84 and a normally closed contact 85. The construction of the switch 90 is substantially identical with the construction of the switch 80 and it comprises a winding 91, normally open contacts 92, 93, and 94, and a normally closed contact 95.

The solenoid 100 comprises a movable core 101 carrying a contacting member 102 which normally engages a contact 103, but which is disengaged from the contact 103 when the winding of the solenoid is energized. The restoration of the contacting member 102 to its normal position is delayed by a dash pot 105 for a purpose which will presently appear.

The switch 110 is manually operable and is conveniently placed with respect to the coiling machine. It comprises a contacting member 111 movable into engagement with any one of a plurality of contacts 112, 113, and 114.

The switch 120 is disposed in a housing 119 and comprises stationary contacts 121 and 122 adapted to be bridged by a contacting member 123 which is secured to a rotatably journaled shaft 124. Secured to the shaft 124 is a sheave 125 operatively connected to a sheave 126 by a belt 127 which comprises a strip 128 of leather or the like and a spring 129 connecting the ends of the strip. The sheave 126 is constrained to rotate with the armature of the motor 22 and when the armature is rotating in the proper direction to cause the pins 31 and 32 to coil rod delivered to them, the sheave 126 will rotate the sheave 125 through the belt 128 until the contacting member 123 engages the contacts 121 and 122. The contacting member 123 then prevents further rotation of the sheave 125 whereupon the belt 128 slips upon the sheave 126. When the motor 22 is reversed the contacting member 123 is immediately disengaged from the contacts 121 and 122 and the motor 22 is brought to a full stop in a manner hereinafter described.

The mains 72, 73, and 74 are connected to the contacts 82, 83, and 84, respectively, and by the conductors 130, 131, and 132, respectively, to the contacts 93, 92, and 94, respectively. The contacts 94, 93, and 92 are connected by conductors 135, 136, and 137, respectively, to the three terminals of the motor 22, the conductors 135, 136, and 137 being connected to the contacts 84, 83, and 82, respectively. The contact 85 is connected to the contacting member 102 and to one terminal of the winding 91, which winding has its other terminal connected to the contact 122, to one terminal of the winding of the solenoid 100, and to one terminal of the winding of the solenoid 67. The other terminals of the windings of the solenoids 67 and 100 are connected to the contacting member 111 and the contact 113, respectively. The contact 103 is connected to the contact 114. The contact 95 is connected to the contact 112 and to one terminal of the winding 81, the other terminal of which is connected to the main 74 and to the contact 121. The main 72 is connected to the contacting member 111.

In the operation of the apparatus the contacting member 111 is manually brought into engagement with the contact 112 to close a circuit which may be traced as follows: From the main 72, through the contacting member 111, the contact 112, the contact 95, and through the winding 81 to the main 74. This energizes the winding 81 and causes it to close the contacts 82, 83, and 84 and to open the contact 85, whereupon the three-phase current is applied to the motor 22 as follows: From the main 72, through the contact 82, and through the conductor 137 to one terminal of the motor; from the main 73, through the contact 83, and through the conductor 136 to a second terminal of the motor; from the main 74, through the contact 84, and through the conductor 135 to a third terminal of the motor. The motor 22 is then driven in its forward direction and causes the pins 31 and 32 to coil rod supplied to them through the tube 34. As the motor 22 commences to revolve the contacting member 123 engages the contacts 121 and 122 to close a circuit which may be traced as follows: From the main 72, through the winding of the solenoid 67, through the contact 122, the contacting member 123, and through the contact 121 to the main 74. When the winding of the solenoid 67 is so energized the core 69 is brought into the path of the bar 60 to prevent the operator from opening the valve 48. This is advantageous in that if partially or completely coiled rod were brought to the level of the floor 43 before the stripping plate 36 has ceased to revolve, the rod would be forcibly thrown from the plate constituting a source of danger. After a length of rod has been completely coiled, the contacting member 111 is brought into engagement with the contact 114, it being understood that when the contacting member 111 is disengaged from the contact 112, the contacts 82, 83, and 84 open and the contact 85 closes to disconnect the motor 22 from the mains 72, 73, and 74. The contact 113 is momentarily engaged by the contacting member 111 as it passes to the contact 114 so that current flows from the main 72 through the contacting member 111, the contact 113, the winding of the solenoid 100, the contact 122, the contacting member 123,

and through the contact 121 to the main 74. The energization of solenoid 100 during this momentary flow of current disengages the contacting member 102 from the contact 103 and such member is prevented by the dash pot 105 from again engaging this contact until a predetermined period of time has elapsed. This is to permit the motor 22 to coast before the current is re-applied to the motor in a reverse direction, for if the current were immediately reversed, it would cause injury to the motor and to the coiling machine. When the contacting member 102 again engages the contact 103 upon the re-opening of the circuit through the solenoid 100 and the functioning of the dash pot 105, current will flow through a circuit which may be traced as follows: from the main 72, through the contact member 111, the contact 114, the contact 103, the contacting member 102, the contact 85, the winding 91, the contact 122, the contacting member 123, and through the contact 121 to the main 74. The winding 91 is then energized to close the contacts 92, 93, and 94, and to open the contact 95. The three-phase current is then applied to the motor 22 as follows: through the main 72, the conductor 130, the contact 93 and the conductor 136 to the second terminal of the motor; through the main 73, the conductor 131, the contact 92 and the conductor 137 to the first terminal of the motor; through the main 74, the conductor 132, the contact 94, and the conductor 135 to the third terminal of the motor. The current thus applied to the motor 22 first applies a braking effort to the armature thereof and then tends to reverse the motor. When the motor 22 actually reverses, the contacting member 123 is disengaged from the contacts 121 and 122 and the winding of the solenoid 67 and the winding 91 are de-energized. When the winding 91 is de-energized the contacts 92, 93, and 94 open and the contact 95 closes to bring the motor 22 to a full stop. When the winding of the solenoid 67 is de-energized, the core 69 is withdrawn from the path of the bar 60 and the valve 48 may be opened to actuate the above described mechanism which strips the coiled rod from the pins 31 and 32.

The switches 85 and 95 form what may be called an electrical interlock between the contacts 82, 83, and 84 on the one hand and contacts 92, 93, and 94, on the other hand; that is, they function to prevent both sets of contacts from being closed at the same time, which would result in a short circuit from main 72 through contacts 82, contacts 92, lead 131, and back to main 73. Such short circuit is prevented by the fact that contacts 82, 83, and 84 can be retained in closed position only so long as contacts 95 are closed to maintain the circuit through winding 81, and contacts 95 can remain closed only so long as contacts 92, 93, and 94, are opened.

What is claimed is:

1. In a system for controlling a coiling mechanism operatively connected with an electric motor, means for applying an electric current to the motor to cause the rotation thereof in one direction, means for disconnecting the supply of current from the motor, and means operating a predetermined period of time thereafter for reapplying the current to the motor to produce a braking torque sufficient to arrest the rotation of the motor.

2. In a system for controlling a coiling mechanism operatively connected with an electric motor, means for applying an electric current to the motor to cause the rotation thereof in one direction, means for disconnecting the supply of current from the motor, means operating a predetermined period of time thereafter for re-applying the current to the motor to produce a torque in a reverse direction, and means for disconnecting the last applied current when the initial rotation of the motor has been overcome.

3. In a system for controlling a coiling mechanism operatively connected with an electric motor, means for applying an electric current to the motor to cause the rotation thereof in one direction, means for disconnecting the supply of current from the motor, and means controlled by the electric current for re-applying the electric current to the motor to cause the motor to experience a braking torque sufficient to arrest the rotation thereof.

4. In a system for controlling a coiling mechanism operatively connected with an electric motor, means for applying an electric current to the motor to cause the rotation thereof in one direction, means for disconnecting the supply of current from the motor, means controlled by the electric current for re-applying the electric current to the motor to cause the motor to experience a torque in a reverse direction and arrest the rotation thereof, and means controlled by the motor for disconnecting the second mentioned supply of current from the motor.

5. In a system for controlling a coiling mechanism including an associated coil stripping means operatively connected with an electric motor, means for applying current to the motor to cause the rotation thereof in one direction, means for disconnecting the supply of current from the motor, means for re-applying the current to the motor to produce a braking torque, means for actuating the stripping means, and means controlled by the electric current for preventing the actuation of the stripping means while the coiling mechanism is operated.

6. The combination with means for coiling an element, of an electric motor for driv-

ing the coiling means, means for applying a magnetic field in one direction to cause the motor to rotate in a predetermined direction, means for discontinuing the magnetic field of the motor, means for re-applying the magnetic field of the motor in a reverse direction when a predetermined period of time has elapsed after the last mentioned means has been actuated and means for disconnecting the supply of current to the motor when the motor starts to rotate in the reverse direction.

7. In a control system for a coiling mechanism having a coil stripping means associated therewith, driving means connected to the coiling mechanism, means for rendering the driving means inoperative, means for applying a braking torque to the coiling mechanism, and means preventing the operation of the stripping means while the coiling mechanism is in motion.

8. In a control system for a coiling mechanism having a coil stripping means associated therewith, a driving member for actuating the coiling mechanism, means for actuating the driving member, means for arresting the movement of the driving member and of the coiling mechanism, and means preventing operation of the stripping means while the coiling mechanism is in motion.

9. In a control system for a rotary coiling mechanism having a coil stripping means associated therewith, a driving member connected to the coiling mechanism to actuate the same, means for actuating the driving member, means for rendering said last mentioned means inoperative, means for arresting the movement of the driving member and of the coiling mechanism, and means for preventing operation of the stripping means while the coiling mechanism is rotating.

10. In a control system for a coiling mechanism having a coil stripping means associated therewith, means for operating the stripping mechanism, means for operating the coiling mechanism to coil an element, and means controlled by the operating means for the coiling mechanism to prevent the operation of the stripping mechanism while the coiling mechanism is operating.

11. In a control system for a rotary coiling mechanism having associated therewith means for elevating the coiled material to permit it to be removed from the coiling mechanism, a motor connected to the coiling mechanism to drive the same, means for energizing and de-energizing the motor, means for applying a braking torque to the motor to thereby decelerate the coiling mechanism, and means operative during rotation of the motor to prevent the operation of the stripping means while the coiling mechanism is rotating.

12. In a control system for a coiling mechanism having associated therewith means for elevating the coiled material to permit it to be removed from the coiling mechanism, a motor connected to the coiling mechanism to drive the same, means for controlling the energization of the motor, means for braking the motor to thereby decelerate the coiling mechanism, and means normally operative to lock the elevating means in inoperating position, said locking means being rendered inoperative upon stopping of the motor.

13. In a control system for a coiling mechanism having associated therewith means for elevating the coiled material to permit it to be removed from the coiling mechanism, a motor connected to the coiling mechanism to drive the same, means for controlling the energization of the motor, braking means tending to reverse the direction of rotation of the motor and operative to decelerate the coiling mechanism, and a locking member adapted to prevent operation of the elevating means, said locking member being arranged to be moved into operative position by the closing of the motor circuit and to be moved to inoperative position after said braking means becomes operative.

In witness whereof, I hereunto subscribe my name this 19th day of December, A. D. 1924.

CLARENCE FRANCIS LINKENHELD.