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ELECTRIC CONTROL SYSTEM

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Fig. 1.

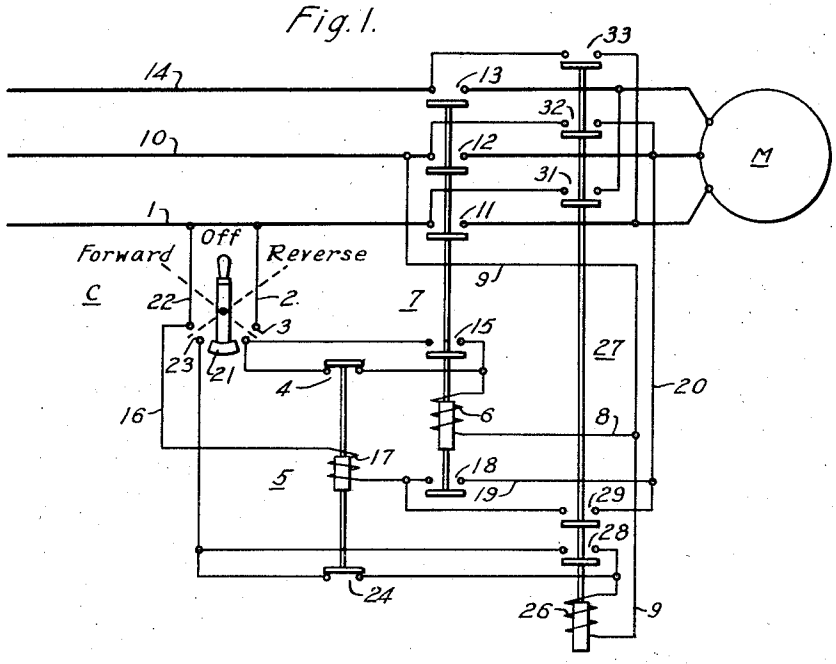
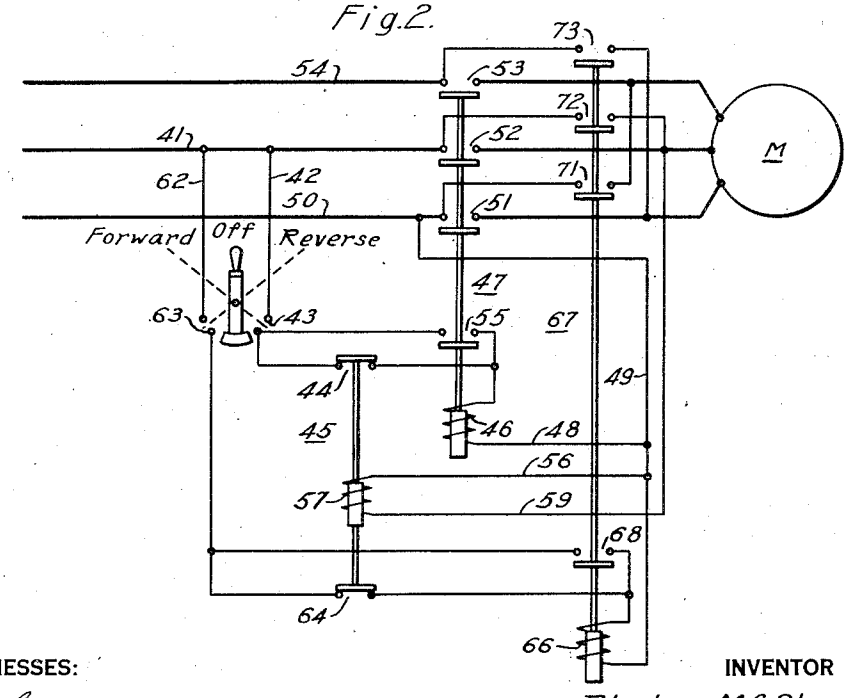


Fig. 2.



WITNESSES:

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ELECTRIC CONTROL SYSTEM

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My invention relates to electric control systems and more particularly to systems of control for preventing the closing of a contactor while an arc exists across its contacts, and also for preventing the closing of one contactor while an arc exists between the contacts of another contactor.

Electromagnetic contactors which are subject to frequent operation, as in inching or reversing service, rupture arcs frequently and thus are apt to become quite hot and are thus prone to weld. This tendency to weld is even augmented if the operating coil of the contactor is re-energized before the arc is fully extinguished.

Further, with reversing contactors, serious short circuits have occurred due to the closing of one directional contactor prior to the extinguishment of the arc between the contacts of the other directional contactor.

It is, therefore, desirable to provide means for preventing the energization of the operating coils of line, directional or accelerating contactors until the power contacts are fully separated and the arc is extinguished.

One object of my invention is to very much minimize the chances of having contactors weld.

Another object of my invention is to prevent short circuits, in the event of welding of one of a pair of main directional contactors.

A still further object of my invention is to provide for preventing the energization of the operating coils of main line contactors, directional contactors, or accelerating contactors until the power contactors of a system are fully separated and the arc extinguished.

A further object of my invention is the provision of means for preventing the re-energization of the contactor operating coils until the arc, resulting from the separation of their contact members, is extinguished.

The objects hereinbefore recited are merely illustrative and other objects will become more apparent from a study of the following specification when done in conjunction with the accompanying drawing, in which:

Figure 1 shows diagrammatically a reversing control system embodying my invention; and

Fig. 2 shows diagrammatically a preferred modification of my invention as included in a reversing control system.

I show my invention in conjunction with a reversing control for an induction motor M (see Figs 1 and 2). In Fig. 1, the forward and reverse electromagnetic directional contactors are designated by 7 and 27 respectively. The reversing controller C is utilized to selectively cause actuation of the respective directional contactors, whereas the control relay 5, as interconnected with the reversing control system and in coaction with it produces the novel results of my invention. A full understanding of my contribution to the art can probably be had from a study of the operation of the system.

To start the motor in the forward direction, the handle of the controller C is moved counterclockwise whereupon a circuit is established from bus 1 through conductor 2, contact fingers 3 bridged by controller segment 21, contact members 4 of control relay 5, actuating coil 6 of the forward directional contactor 7 and conductors 8 and 9 to bus 10. Operation of contactor 7 closes the main contact members 11, 12, and 13 to connect the motor M directly to buses 1, 10, and 14. Contact members 15 are also closed and contactor 7 thus remains energized through the holding circuit for coil 6 through contact members 15.

The operation of forward directional contactor 7 also closes contact members 18 to establish a circuit from bus 1 through conductors 22 and 16, actuating coil 17 of control relay 5, contact members 18, conductors 19 and 20 and contact members 12 to bus 10. The operation of control relay 5 opens the contact members 4 and 24. The importance of this last mentioned operation will be pointed out hereinafter.

If the motor is now to be reversed, the controller arm is moved to the reverse position. The circuit for coil 6 is thus broken at contact fingers 3 and regardless of the circuit made at contact fingers 23, coil 26 is not energized, because contact members 24 are open, until contact members 18 are definitely open and the armature of control relay 5 has had time to drop to close contact members 24. The arc at contact members 11, 12, and 13 thus has had time to be extinguished before the reverse directional contactor 27 can be energized and thus actuated by its coil 26. A simultaneous closed position of both directional contactors and the consequent short circuit of the power buses is thus positively prevented, and, since the arc at the main contactors is given a time to be extinguished, the chances of having the contact members 11, 12, and 13, or 31, 32, and 33, as the case may be, weld is very much minimized.

The greatest danger is, of course, a short circuit of the line. If contact members 11, 12, and 13 do weld closed, the contact members 18 also remain closed with the result that contact mem-

bers 4 and 24 remain open. The possibility of energizing coil 26 is thus positively prevented.

Of course if the reversing proceeds normally, a circuit is established from bus 1 through conductor 22, contact fingers 23 bridged by controller segment 21, contact members 24, actuating coil 26 of reverse directional contactor 27, and conductor 9 to bus 10.

Contactor 27 holds itself in through contact members 28, energizes coil 17 of control relay 5 through contact members 29, and connects the motor M to buses 1, 10 and 14 through contact members 31, 32, and 33.

The benefits and new results of relay 5 are of course obtained for both directions of motor operation and line short circuits are prevented regardless of which group of main contact members, that is, 11, 12, and 13, or 31, 32 and 33 may weld closed.

In the showing in Fig. 2, the sequence of operation is as follows:

If the controller arm is moved to the forward position, a circuit is established from bus 41 through conductor 42, contact fingers 43, contact members 44, actuating coil 46, conductors 48 and 49 to bus 50. By the operation of contactor 47, contact members 51, 52 and 53 are closed to connect motor M to buses 50, 41 and 54 and the contactor holds itself in through contact members 55.

A circuit is also established from bus 50, through conductors 49 and 56, coil 57 of relay 45, conductor 59 and contact members 52 to bus 41. It will be noted that coil 57 is only energized when either contact members 52 or 72 are closed. This is important, first because contact members 44 and 64 will only open after the respective directional contactors have operated and, second, will remain open as long as the main contact members 51, 52 and 53 or 71, 72, and 73 as the case may be, are closed. Further, as long as an arc exists at the main contact members coil 57 remains energized. This is an advantage over the showing in Fig. 1. In the event of welding of the main contact members of one directional contactor, coil 57 remains energized indefinitely, thus positively preventing the operation of the other directional contactor and thus positively preventing a short circuit of the time.

For reverse operation, the controller arm is moved to the reverse position thereby establishing a circuit from bus 41 through conductor 62, contact fingers 63, contact members 64, coil 66 of reverse directional contactor 67 and conductor 49 to bus 50. Contactor 67 holds itself in through contact members 68 and also closes contact members 71, 72, and 73. Coil 57 is now energized by the same circuit already traced except contact members 72 instead of contact members 52 are now included in the circuit.

The showing of my specially arranged control relay with a reversing controller is merely illustrative. My invention is applicable to accelerating contactors, main line switches, and many other starting as well as reversing controls. I, therefore, do not wish to be limited to the exact showing but only by the scope of the claims hereto appended.

I claim as my invention:

1. In a system of control for an electric motor, in combination, a source of supply of electric energy for said motor, a directional contactor for connecting the motor to said source of supply for one direction of operation; a directional contactor for connecting the motor to said source of supply for another direction of operation; a control relay, energized by the operation of either of said directional contactors, adapted to prevent operation of one directional contactor as long as any current flows to the motor by reason of operation of the other directional contactor.

2. In a system of control for an electric motor, in combination, a source of supply of electric energy for said motor, a pair of directional contactors each having an actuating coil, a control relay having a switch in the circuit of the coil of one directional contactor and a switch in the circuit of the coil of the other directional contactor, said directional contactors each having switches for closing the circuit for the control relay, whereby said control relay is operated and thus prevents operation of the directional contactor not having the switch for energizing the circuit for the control relay closed.

3. In a system of control for an electric motor, in combination, a source of supply of electric energy for said motor, a reversing controller, having a neutral position and two operating positions, a directional contactor, energized through operation of said controller to one operating position, adapted to connect said motor to said source of supply for one direction of operation, a second directional contactor, energized through operation of said controller to its other operating position, adapted to connect said motor to said source of supply for another direction of operation, and a control relay, energized by the operation of one directional contactor to thus remain energized as long as the contact members of the said one directional contactor is in operated position, adapted to prevent energization of the other directional contactor as long as said control relay remains energized.

4. In a system of control for an electric motor, in combination, a source of supply of electric energy for said motor, a reversing controller having a neutral position, a forward position and a reverse position, a control relay having two back contact members, a forward directional contactor energized by the movement of the controller to the forward position through one back contact member of the control relay, hold-in contact members on the forward directional contactor shunting the said one of the back contact members of the control relay, switching means on the contactor for energizing the control relay to thus cause opening of both back contact members, a reverse directional contactor in the circuit of the other back contact member, whereby the reverse directional contact member cannot be energized as long as said control relay remains energized.

PHELAN McSHANE.