April 13, 1943. C. T. EVANS 2,316,678

CIRCUIT CONTROLLER

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Fig. 1

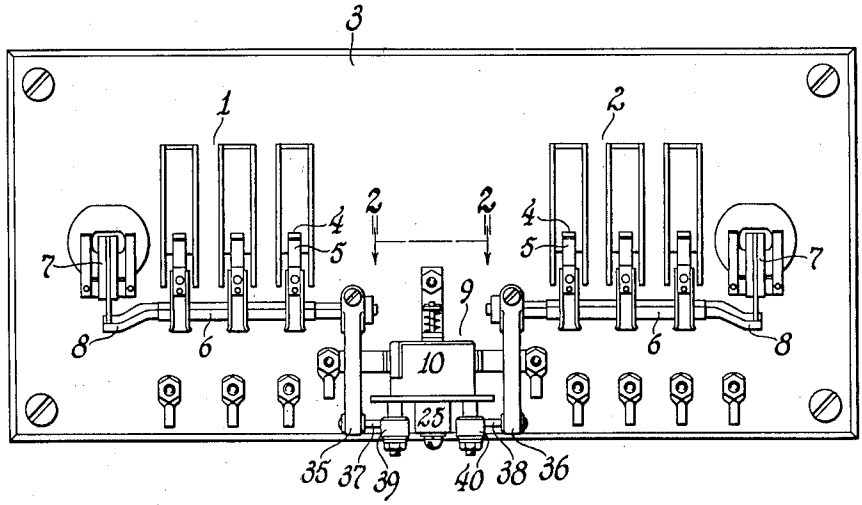


Fig. 2

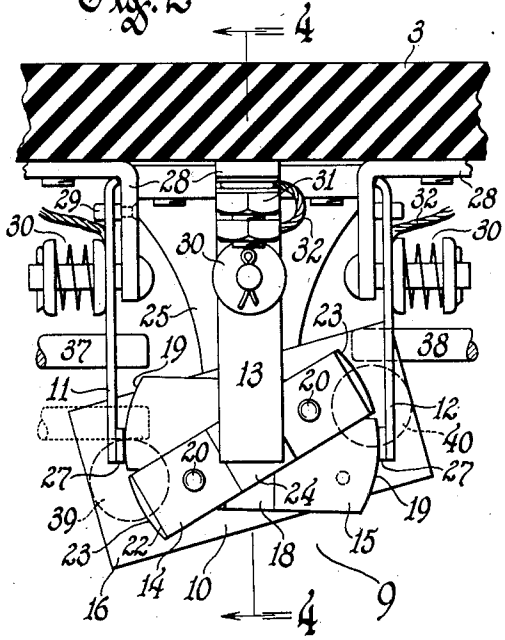
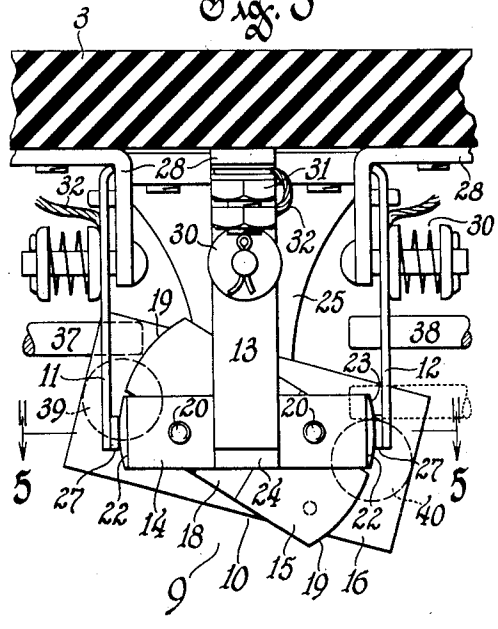


Fig. 3



Inventor
Clarence T. Evans.
By Frank H. Hubbard
Attorney

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Fig. 4

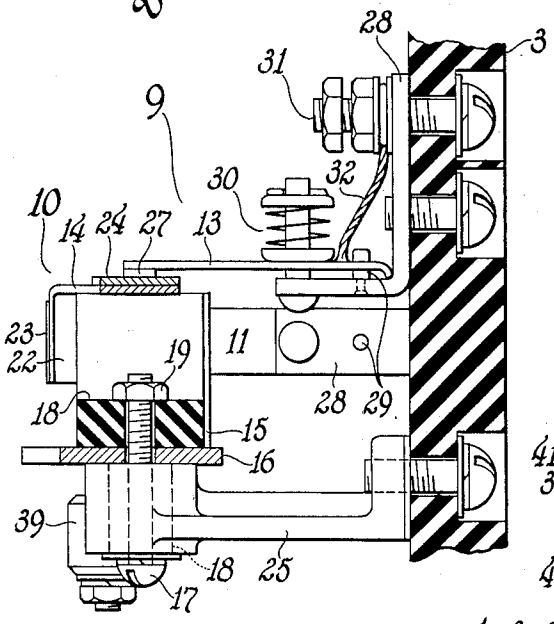


Fig. 5

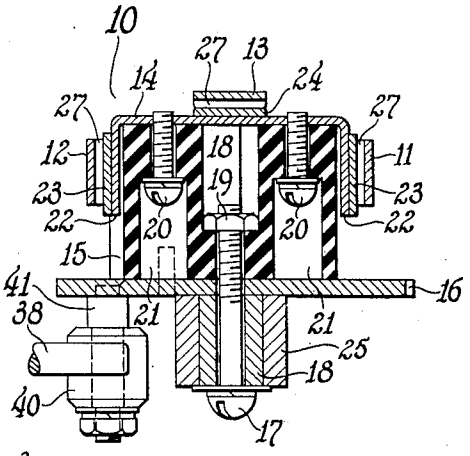
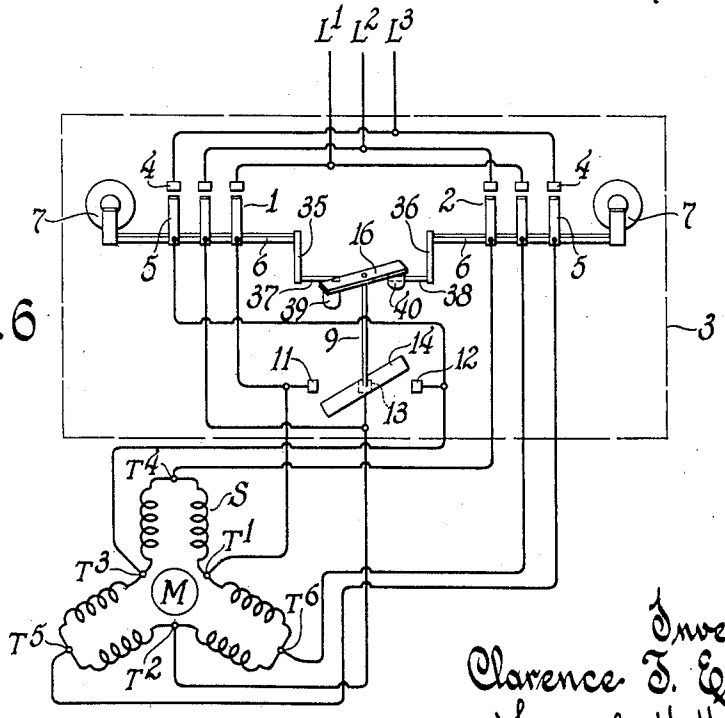


Fig. 6



Inventor
Clarence T. Evans
By Frank H. Hubbard
Attorney

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UNITED STATES PATENT OFFICE

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CIRCUIT CONTROLLER

Clarence T. Evans, Wauwatosa, Wis., assignor to Cutler-Hammer, Inc., Milwaukee, Wis., a corporation of Delaware

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4 Claims. (Cl. 200—5)

This invention relates to circuit controllers, and while not limited thereto is particularly applicable to motor controllers of the type having a pair of separately operable line switches for selectively establishing different power connections for a motor.

It is commonly necessary in motor controllers of the aforesaid type to mechanically interlock the line switches against simultaneous closure and to also associate with the line switches a means for establishing a transfer circuit or circuits prior to closure of one of the line switches and for interrupting such circuit or circuits prior to closure of the other line switch.

The present invention has among its objects to provide a novel mechanical interlock and transfer switch mechanism for use with controllers of the aforesaid type which meets the above noted requirements.

Another object is to provide a combined mechanical interlock and transfer switch for use in controllers of the aforesaid type which is exceedingly simple in design, rugged in construction, and reliable in operation.

Another object is to provide a combined mechanical interlock and transfer switch which is so constructed that the same may be applied to controllers of the aforesaid type without entailing alteration of the line switches.

Various other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate an embodiment of the invention which will now be described, it being understood that various modifications may be made in the embodiment illustrated without departing from the spirit and scope of the appended claims.

In the drawings,

Figure 1 is a front elevational view of a controller illustrating the combined mechanical interlock and transfer switch of this invention applied thereto;

Figs. 2 and 3 are sectional views taken on line 2—2 of Fig. 1, illustrating the transfer switch in open and closed circuit controlling positions;

Fig. 4 is a sectional view on line 4—4 of Fig. 2;

Fig. 5 is a sectional view on line 5—5 of Fig. 3, and

Fig. 6 is a diagrammatic view illustrating a control system embodying the controller shown in Fig. 1.

Referring to Fig. 1, the same illustrates a controller including two horizontally spaced electromagnetically operated contactors 1 and 2 mounted upon an insulating panel 3. Contactors 1 and 2 are of a conventional 3-pole type each having cooperating stationary and movable contacts 4 and 5, the former being mounted upon panel 3, and the latter being mounted upon a square insulated section of a horizontally arranged shaft 6 which is rotatably supported by suitable bearings secured to the front face of said panel. Each of the contactors 1 and 2 is biased to move to open position under the action of gravity and is movable into closed position by an operating magnet 7 which is mounted upon panel 3 and is connected to its associated operating shaft 6 by an arm 8. In the embodiment illustrated the shafts 6 of contactors 1 and 2 are arranged in axial alignment, and the operating magnet 7 of contactor 1 is arranged to the left of its associated contacts while the operating magnet 7 of contactor 2 is arranged to the right of its associated contacts.

In accordance with the present invention a transfer switch 9 having a rotatable bridging contact element 10 and cooperating stationary contact fingers 11, 12 and 13 is mounted upon panel 3 between the contactors 1 and 2. As hereinafter set forth contact element 10 is operatively connected to contactors 1 and 2 to be moved into circuit opening position upon initial movement of contactor 1 out of open position, and into circuit closing position upon initial movement of contactor 2 out of open position. Also as hereinafter set forth the operating connections between said contact element and contactors 1 and 2 serve as a mechanical interlock to insure opening of either of said contactors prior to closure of the other.

Bridging contact element 10 includes a bridging contact 14 which is carried by a horizontally disposed insulating block 15 of oblong shape secured to the upper face of an elongated plate 16 by a bolt 17. Bolt 17 also serves to secure a cylindrical bearing bushing 18 to the lower face of said plate. Bolt 17 is located midway between the ends of block 15 and plate 16 and the upper face of block 15 is recessed as shown at 18 (Fig. 5) to receive a securing nut 19 associated with the upper end of said bolt. The end faces of block 15 are formed to provide vertically disposed cylindrical surfaces 19—19 having a common axis in alignment with the axis of bearing bushing 18. Bridging contact 14 extends diagonally across the upper face of block 15 and is secured to said block by screws 20 (Fig. 5) having their heads located within recesses 21 formed on the under side of said block. Bridging contact 14 has downwardly extending projections

22 formed on opposite ends thereof which engage within recesses formed on opposite ends of the block 15. Projections 22 of bridging contact 14 have silver contact strips 23 fixed thereto and as shown in Figs. 2 and 3 said strips are provided with curved faces which are flush with the cylindrical end surfaces 19—19 on block 15. Bridging contact 14 also has a flat silver contact strip 24 fixed to its upper face midway between the ends thereof.

Block 15, plate 16 and bearing bushing 18 form an assembly which is removably mounted upon a forwardly extending bracket 25 fixed to the front face of panel 3. The front end of bracket 25 is provided with a bearing portion having an opening therein for receiving bearing bushing 18, and as shown in Figs. 4 and 5 plate 16 rides upon the upper face of said bearing portion.

The stationary contact fingers 11, 12 and 13 extend forwardly from the front face of panel 3 and fingers 11 and 12 are located on opposite sides of contact element 10 to cooperate with the contact strips 23 on opposite ends of bridging contact 14 and the finger 13 is located above said element for engagement with the contact strip 24 of said bridging contact. Said contact fingers are of like construction, each having a silver contact tip 27 fixed to the front end thereof and each having its inner end fulcrumed upon an L-shaped bracket 28 fixed to the front face of panel 3. Each of the brackets 28 is provided with a pin 29 which extends into an opening in its associated contact finger to prevent displacement thereof and each of said brackets is also provided with a spring pressure device 30 for yieldingly holding its associated contact finger in engagement with bridging contact 14. Also each of the brackets 28 is provided with a binding post 31 which is connected by a flexible lead 32 to its associated contact finger.

Bridging contact element 10 is operatively connected to the operating shafts 6 of contactors 1 and 2 through the medium of vertically disposed levers 35 and 36 located on opposite sides of said element. Lever 35 has its upper end fixed to the operating shaft of contactor 1 and has a pin 37 secured to the lower end thereof, and arm 36 has its upper end fixed to the operating shaft of contactor 2 and has a pin 38 secured to the lower end thereof. Pins 37 and 38 are located to the rear of rollers 39 and 40, respectively, which are mounted upon pins 41—41 located adjacent opposite ends of plate 16 and secured to the underside thereof.

The operation of the aforedescribed controller will now be more fully set forth. Contact element 10 is rotatable in opposite directions between the extreme positions shown in Figs. 2 and 3. In the extreme position shown in Fig. 2 bridging contact 14 is out of engagement with its associated contact fingers 11 and 12 and in the extreme position shown in Fig. 3 said bridging contact engages said fingers to connect both of the same to contact finger 13.

With contactors 1 and 2 in open position the pins 37 and 38 carried by arms 35 and 36 occupy the positions shown in full lines in Figs. 2 and 3. Assuming that contact element 10 is in the position shown in Fig. 2 roller 40 is located adjacent pin 38 and roller 39 is spaced forwardly with respect to the pin 37 to permit operation of contactor 1 without operation of said contact element. However, upon energization of contactor 2 pin 38 engages roller 40 and moves into the position shown in dotted lines to move contact element 10 out of the position shown in Fig. 2. Bridging contact 14 establishes circuit between contact fingers 11, 12 and 13 prior to closure of contactor 2 and upon full movement of said contactor into closed position contact element 10 is moved into the position shown in Fig. 3. As is apparent, with contact element 10 in the position shown in Fig. 3 contactor 2 may be opened and reclosed without operation of said element. With contact element 10 in the position shown in Fig. 3, roller 39 is located adjacent the pin 37 on lever 35 and upon closure of contactor 1 said pin engages said roller and moves into the position shown in dotted lines to return said contact element to the position shown in Fig. 2.

When contact element 10 is in the position shown in Fig. 2 rollers 39 and 40 cooperate with their associated pins 37 and 38 to prevent closure of contactor 2 except upon opening of contactor 1, and when said contact element is in the position shown in Fig. 3 said rollers and their associated pins cooperate to prevent closure of contactor 1 except upon opening of contactor 2.

The above described controller may be connected as shown in Fig. 6 to control a 3-phase two speed alternating current motor M to be supplied with current from a supply circuit indicated by lines L^1, L^2 and L^3. The motor shown is provided with a stator winding S having two groups of taps T^1, T^2 and T^3 and T^4, T^5 and T^6. Upon closure of contactor 1 circuit is established from lines L^1, L^2 and L^3 to taps T^1, T^2 and T^3, respectively, of winding S to provide for low speed operation of the motor. Contact fingers 11, 12 and 13 of transfer switch 9 are permanently connected to taps T^1, T^3 and T^2, respectively, of stator winding S. Upon closure of contactor 2 transfer switch 9 short-circuits the taps T^1, T^2 and T^3, and said contactor establishes circuit from L^1, L^2 and L^3 to taps T^6, T^4 and T^5, respectively, of winding S to provide for high speed operation of the motor. Upon transfer from low speed to high speed transfer switch 9 acts to short-circuit taps T^1, T^2 and T^3 prior to establishment of high speed power connections by contactor 2, and upon transfer from high speed to low speed said transfer switch interrupts the short-circuit between said taps prior to establishment of low speed power connections by contactor 1 and subsequent to opening of contactor 2. The operating magnets 7 may be provided with any suitable control means for effecting selective operation of contactors 1 and 2, and as hereinbefore set forth the above described operating mechanism for transfer switch 9 insures opening of each of said contactors prior to closure of the other.

What I claim as new and desire to secure by Letters Patent is:

1. In a control device, in combination, an insulating base, two normally open electromagnetic switches mounted in spaced relation upon said base, and auxiliary control switch mounted upon said insulating base and located between said main switches, said auxiliary switch including a rotatable circuit controlling member, and a mechanism operatively connecting said circuit controlling member to said main switches to provide for movement of said member in opposite directions between given extreme positions upon alternate closure of said main switches, said circuit controlling member providing for establishment of circuit prior to closure of one of said main switches and for interruption of circuit

prior to closure of the other of said main switches, and said mechanism permitting opening of either of said main switches without operation of said circuit controlling member and also insuring opening of either of said main switches prior to closure of the other.

2. In a control device, in combination, an insulating base, two vertically disposed normally open electromagnetic switches mounted in spaced relation upon said insulating base, an auxiliary control switch mounted upon said insulating base and located between said main switches, said auxiliary control switch including a plurality of stationary contacts and a cooperating rotatable bridging contact, and a mechanism operatively connecting said bridging contact to said main switches to provide for movement of said bridging contact in opposite directions between given extreme positions upon alternate closure of said main switches, said bridging contact providing for establishment of circuit between said stationary contacts prior to closure of one of said main switches and for interruption of circuit between said stationary contacts prior to closure of the other of said main switches, and said mechanism permitting opening of either of said main switches without operation of said bridging contact and also insuring opening of either of said main switches prior to closure of the other.

3. In a controller for electric motors having two main power circuits requiring selective establishment and a third circuit requiring establishment prior to establishment of one of said power circuits and interruption prior to establishment of the other of said power circuits, in combination, two normally open separately operable main switches for selectively controlling said main power circuits, an auxiliary switch for controlling said third circuit, said auxiliary switch being movable in opposite directions between given extreme positions and being effective upon initial movement out of one of said extreme positions to establish said third circuit and to maintain the same during movement into its opposite extreme position, and an operating mechanism connecting said auxiliary switch to said main switches to provide for movement thereof into one extreme position upon closure of one of said main switches and into its opposite extreme position upon closure of the other of said main switches, said mechanism insuring opening of either of said main switches prior to closure of the other and permitting opening of either of said main switches without operation of said auxiliary switch.

4. A controller for electric motors having two main power circuits requiring selective establishment, and a third circuit requiring establishment prior to establishment of one of said power circuits and interruption prior to establishment of the other of said power circuits, comprising, an insulating base, two vertically disposed normally open electromagnetic switches mounted in spaced relation upon said insulating base and operable selectively to control said main power circuits, an auxiliary control switch mounted upon said insulating base between said main switches and including a plurality of stationary contacts and a cooperating rotatable bridging contact for controlling said third circuit, and a mechanism operatively connecting said bridging contact to said main switches to provide for movement of said bridging contact in opposite directions between given extreme positions upon alternate closure of said main switches, said bridging contact providing for establishment of circuit between said stationary contacts prior to closure of one of said main switches and for interruption of circuit between said stationary contacts prior to closure of the other of said main switches and said mechanism permitting opening of either of said main switches without operation of said bridging contact and also insuring opening of either of said main switches prior to closure of the other.

CLARENCE T. EVANS.