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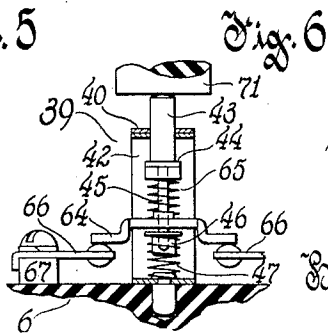
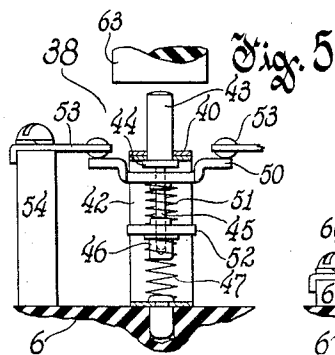
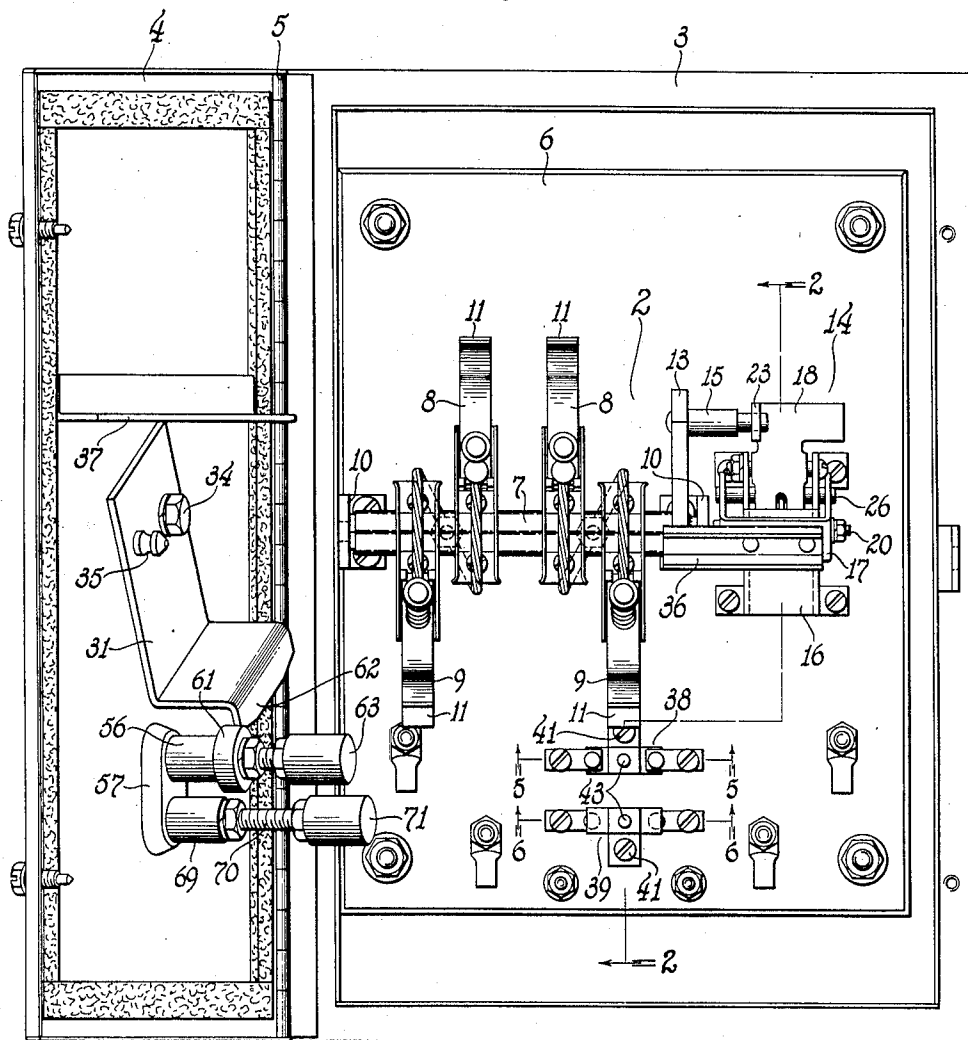
C. T. EVANS ET AL
CIRCUIT CONTROLLING DEVICE

2,312,243

Filed July 1, 1940

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Fig. 1



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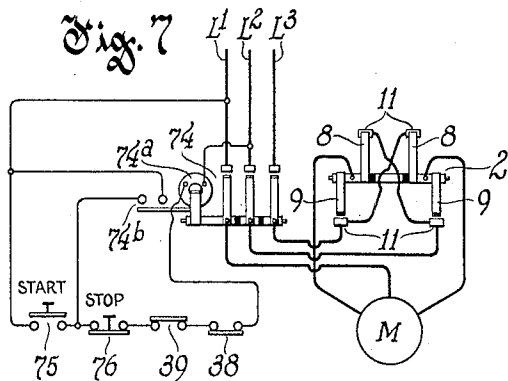
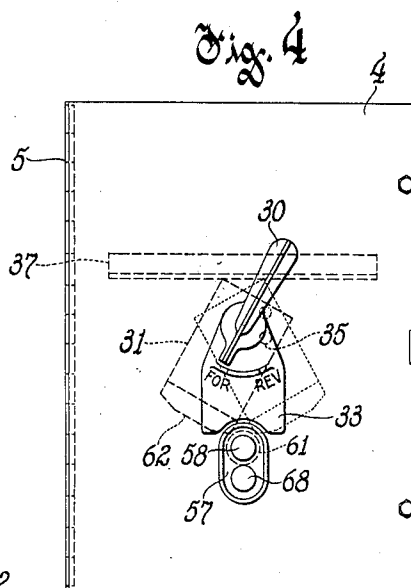
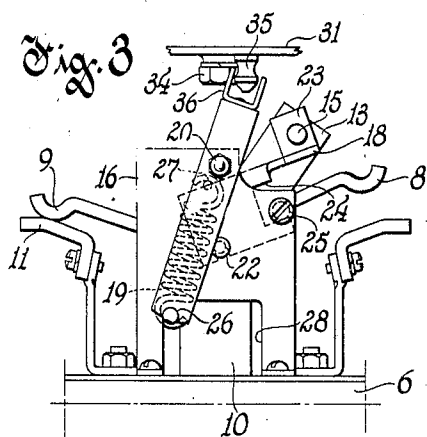
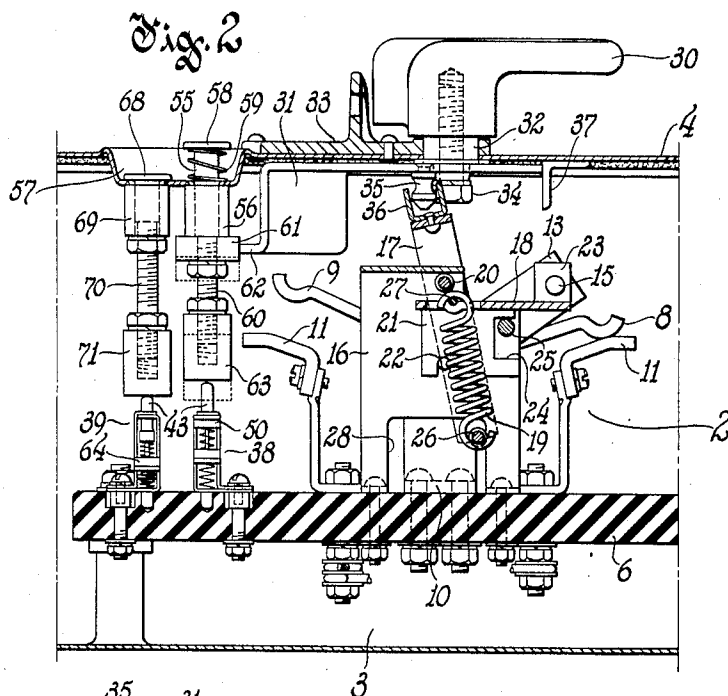
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UNITED STATES PATENT OFFICE

2,312,243

CIRCUIT CONTROLLING DEVICE

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Application July 1, 1940, Serial No. 343,366

10 Claims. (Cl. 172—179)

This invention relates to circuit controlling devices and while not limited thereto is particularly applicable to manually operated reversing switches for use in motor control systems which employ an electromagnetically operated main switch for establishing and interrupting power connections for the motor.

The invention has among its objects to provide an enclosed manually operated reversing switch for systems of the aforesaid character having safety means associated therewith for preventing operation of the reversing switch except upon opening of the electromagnetically operated main switch.

Another object is to provide a reversing switch of the aforesaid character having safety means associated therewith which insures opening of the main switch upon opening of a door or cover associated with the enclosing casing of the reversing switch.

Another object is to provide safety means of the aforesaid type which is simple and rugged in construction and exceedingly safe and reliable in operation.

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 an enclosed reversing switch embodying the invention, a door for the enclosing casing of the switch being shown in open position;

Fig. 2 is a fragmentary sectional view on line 2—2 of Fig. 1;

Fig. 3 is a side elevational view of certain of the switch operating parts shown in Fig. 2;

Fig. 4 is a front elevational view on a reduced scale of the door for the enclosing casing of the switch;

Figs. 5 and 6 are detail sectional views taken on lines 5—5 and 6—6, respectively of Fig. 1, and

Fig. 7 is a diagrammatic view illustrating the circuit connections of a control system employing the reversing switch shown in Fig. 1.

Referring to Figs. 1 and 2, the invention is shown in connection with a manually operated reversing switch 2 which is mounted within a box shaped enclosing casing 3 having a front cover or door 4 which is hinged at 5. Reversing switch 2 is carried by an insulating panel 6

which is mounted upon the rear wall of casing 3 and said switch includes an operating shaft 7 which carries a pair of upwardly extending insulated contact fingers 8—8 and a pair of downwardly extending insulated contact fingers 9—9. Shaft 7 is rotatably supported at opposite ends by bearing members 10—10 mounted upon the front face of insulating panel 6 and said panel also carries a plurality of stationary contacts 11, each of which is associated with one of said contact fingers. As is apparent from Figs. 2 and 3, the contact arrangement is such that when either pair of contact fingers 8—8 or 9—9 is moved into circuit closing position the other pair of contact fingers is moved into circuit opening position.

As shown in Fig. 1, the right hand end of shaft 7 has a lever 13 fixed thereto which is operatively connected to a snap operating mechanism 14 by a pin 15 fixed to the free end of said lever. The operating mechanism 14 is carried by a forwardly extending U-shaped supporting bracket 16 secured to the front face of panel 6 and said mechanism includes levers 17 and 18 and an over-center spring 19. Lever 17 is U-shaped and the side arms thereof straddle bracket 16 and are pivoted at an intermediate point upon a pin 20 mounted adjacent the front end of bracket 16. Lever 18 is arranged between the side arms of bracket 16 and the same is provided with spaced side projections 21 having openings therein for receiving pivot pins 22 fixed to the side arms of said bracket. Pivot pins 22 are spaced inwardly with respect to pivot pin 20 and are aligned with shaft 7. Lever 18 is provided with a projecting arm 23 having an opening therein for receiving the pin 15 on lever 13 and the side projections 21 of said lever are recessed as shown at 24 to receive a stop pin 25 mounted upon bracket 16. As is apparent from Figs. 2 and 3, stop pin 25 limits movement of lever 18 in opposite directions between the positions illustrated in Figs. 2 and 3. The over-center spring 19 has one end connected to a pin 26 mounted upon the inner end of lever 17 and the opposite end of said spring is connected to a pin 27 carried by lever 18 and located intermediate the pivot pins 20 and 22. The side arms of bracket 16 are recessed as shown at 28 to receive pin 26 and said pin engages within said recesses to limit movement of lever 17 in opposite directions, as shown in Figs. 2 and 3.

With lever 17 in the position shown in Fig. 2 the axis of spring 19 is located to the right of pivot pins 22 and said spring thus acts to bias lever 18 in a clockwise direction to hold contact

fingers 8 in circuit closing position and contact fingers 9 in circuit opening position. With operating lever 17 in the position shown in Fig. 3 the axis of spring 19 is located to the left of pivot pins 21 and lever 18 is thus biased to move in a counterclockwise direction to hold contact fingers 9 in circuit closing position and contact fingers 8 in circuit opening position. As is apparent, when lever 17 is moved in either direction between the positions illustrated in Figs. 2 and 3 the axis of spring 21 is moved across the axis of pivot pins 22 to effect operation of shaft 7 and its associated contact fingers with a snap action.

The above described switch mechanism is provided with an operating handle 30 which is mounted upon the outside of door 4 and is associated with a crank plate 31 mounted upon the inside of said door. As shown in Fig. 2, crank plate 31 is provided with a hub projection 32 which is journaled within an opening extending through door 4 and through an indicating plate 33 fixed to the front face of said door. Handle 30 is secured to hub projection 32 by a screw 34 and crank plate 31 has a drive pin 35 fixed thereto which is spaced with respect to said hub projection and engages within a channel member 36 fixed to the front end of lever 17. Upon movement of handle 30 into "Rev." position indicated in Fig. 4 drive pin 35 acts to move the reversing switch mechanism into the position shown in Fig. 3. Upon movement of handle 30 into the "For." position shown in Fig. 4 drive pin 35 acts to move the reversing switch mechanism into the position shown in Fig. 2. As shown in Figs. 1 and 2 an angle member 37 is secured to the rear face of door 4 and the upper end of crank plate 31 cooperates with said member to limit movement of handle 30 in opposite directions beyond the extreme positions illustrated in Fig. 4.

The above described reversing switch has two normally closed auxiliary switches 38 and 39 associated therewith, such switches being mounted upon insulating panel 6 and being arranged below the above described reversing switch mechanism. Auxiliary switch 38 is provided with push button operating means which interlocks with crank plate 31 to prevent operation of the reversing switch except upon opening of said auxiliary switch. Auxiliary switch 39 is provided with operating means which is associated with door 4, such operating means providing for opening of said auxiliary switch upon opening of said door.

More specifically each of the auxiliary switches 38 and 39 is provided with a supporting bracket 40 which is secured to the front face of insulating base 6 by a screw 41. Said brackets are each provided with forwardly extending parallel side portions 42-42 having overlapping projections on the front end thereof which are drilled to receive a switch operating rod 43. Each of the operating rods 43 has a stop projection 44 formed on the rear end thereof for engaging the front end of its associated bracket 40, and each of said operating rods also has a pin extension 45 on the rear end thereof which engages within an opening in a spring thrust member 46. Also each of the operating rods 43 is biased to move forwardly by a coil spring 47 which is held under compression between its associated thrust member 46 and the rear end of its associated bracket 40.

As shown in Fig. 5, auxiliary switch 38 is pro-

vided with a movable bridging contact 50 which is guided between the side portions 42 of its associated bracket 40 and is movable upon the pin extension 45 of its associated operating rod 43. Bridging contact 50 is biased to move forwardly upon pin projection 44 by a spring 51 which is held under compression between said bridging contact and a guide member 52 which rides upon thrust member 46 and is slidably mounted upon bracket 40. Bridging contact 50 cooperates with a pair of stationary contacts 53-53 which are arranged in front of said bridging contact and are carried by contact posts 54 secured to the front face of insulating panel 6.

The parts of auxiliary switch 38 are normally held in the position shown in Fig. 5. As shown in this figure stop projection 44 on operating rod 43 is normally held in engagement with the front end of bracket 40 under the action of spring 47 and contact 50 is yieldingly held in engagement with its cooperating stationary contacts 53 under the action of spring 51. As is apparent from Fig. 5, upon inward movement of operating rod 43 against the action of spring 47 stop projection 44 engages bridging contact 50 to move the same out of engagement with its cooperating stationary contacts 53.

Auxiliary switch 39 is provided with a manual operating member 55 which is slidably mounted within a bushing 56 secured within an opening in a well 57 provided in the front face of door 4. Operating member 55 has an enlarged head 58 on the front end thereof, and said operating member is biased to move forwardly by a spring 59 which is held under compression between said head and cover 4. Operating member 55 also has a threaded extension 60 of reduced diameter on the inner end thereof which carries a cylindrical stop 61. Stop 61 engages the inner end of bushing 56 to limit outward movement of operating member 55 under the action of spring 60 and said stop also cooperates with an offset extension 62 on the lower end of crank plate 31. An insulating push member 63 is secured to the inner end of threaded extension 60 for engagement with the front end of operating member 43 of auxiliary switch 38.

As is apparent from Fig. 2, when door 4 is in closed position operating member 55 is movable inwardly to effect opening of auxiliary switch 38. Also as is apparent from Figs. 1 and 4, when operating handle 30 is in either of its extreme positions the same is normally locked against movement out of such position by engagement of stop 61 with the offset extension 62 on crank plate 31. However, upon depression of operating member 55 to effect opening of auxiliary switch 38 stop 61 is moved out of the path of the offset extension 62 on crank 31 to permit movement of operating handle 30 between extreme positions. During movement of operating handle 30 between extreme positions extension 62 on crank plate 31 is located in front of stop member 61 to thereby prevent reclosure of auxiliary switch 38 until full movement of said operating handle into one or the other of its extreme circuit closing positions.

Auxiliary switch 39 is provided with a movable bridging contact 64 which is guided between the side portions 42 of its associated bracket 40 and is movable upon the pin extension 45 of its associated operating rod 43. Bridging contact 64 is biased to move inwardly toward spring thrust member 46 by a spring 65 which is held under compression between said contact and stop pro-

jection 44. Bridging contact 64 cooperates with a pair of contacts 65-66 which are arranged to the rear of said bridging contact and are carried by contact posts 67 secured to the front face of insulating panel 6.

Auxiliary switch 39 is controlled by an operating member 68 which is secured within a bushing 69 mounted within an opening in a well 57 in the front of door 4. The inner end of operating member 68 is provided with a threaded extension 70 of reduced diameter which carries an insulating push member 71 for engaging the front end of operating member 43 of the auxiliary switch 39. When cover 4 is in closed position push member 71 acts to hold the auxiliary switch 39 in the circuit closing position shown in Fig. 6. With the parts in the position shown in Fig. 6 bridging contact 64 is yieldingly held in engagement with its cooperating stationary contacts 65-66 under the action of spring 65. Upon opening of cover 4 to expose the reversing switch mechanism 2 push operating member 71 is moved out of engagement with rod 43 of auxiliary switch 39 and as is apparent said switch is then moved to circuit opening position under the action of spring 47.

Referring now to Fig. 7 the same illustrates the circuit connections of a control system embodying the above described reversing switch 2. This figure illustrates a motor M to be supplied with current from a 3-phase alternating current supply circuit indicated by lines L¹, L², L³. The system includes a normally open electromagnetically operated line switch 74 for establishing circuit from said supply lines to reversing switch 2, and as shown said reversing switch is arranged to selectively control forward and reverse power connections between said line switch and motor M. Line switch 74 is provided with an operating winding 74^a, and as hereinbefore set forth said operating winding is controlled by the auxiliary switches 38 and 39 associated with reversing switch 2, a normally open start push button 75 and a normally closed stop push button 76 and also by normally open auxiliary contacts 74^b associated with said line switch.

Assuming that door 4 of reversing switch 2 is in closed position and that the operating handle 30 of said reversing switch is locked in one of its extreme circuit controlling positions, auxiliary switches 38 and 39 are then in circuit closing position and upon depression of start push button 75 the operating winding 74^a of line switch 74 is connected across lines L¹, L² by a circuit extending through said start push button, through stop push button 76 and auxiliary switches 38 and 39. Upon response of line switch 74 the auxiliary contacts 74^b thereof shunt the start push button 75 to maintain operating winding 74^a energized upon release of said start push button. As hereinbefore set forth, before reversing switch 2 can be moved out of either of its extreme circuit controlling positions it is necessary to depress operating member 55 and thereby open auxiliary switch 38. Opening of auxiliary switch 38 interrupts the maintaining circuit for operating winding 74^a to insure opening of line switch 74 during manual operation of reversing switch 2. Also upon opening of door 4 auxiliary switch 39 is opened to interrupt the maintaining circuit for line switch 74 and thereby insure opening of said line switch until said cover is returned to closed position. As is apparent, start push button 75 is operative to effect reclosure of line

switch 74 only upon reclosure of auxiliary control switches 38 and 39.

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

1. In a control system for electric motors, in combination, an electromagnetically operated line switch, a manual reversing switch movable in opposite directions between given extreme circuit controlling positions to selectively control forward and reverse power connections between said line switch and the motor, an enclosure for said reversing switch having an openable cover, and means associated with the cover of said enclosure for insuring deenergization of said line switch prior to movement of said reversing switch out of either of its circuit controlling positions and for also insuring deenergization of said line switch upon opening of said cover.

2. In a control system for electric motors, in combination, an electromagnetically operated line switch, a reversing switch movable in opposite directions between given extreme circuit controlling positions to selectively control forward and reverse power connections between said line switch and the motor, an enclosure for said reversing switch having an openable cover, a manual operating element for said reversing switch mounted upon said cover, a device carried by said cover for normally locking said operating element to prevent operation of said reversing switch out of either of its extreme circuit controlling positions, said device having manual releasing means associated therewith, means associated with said manual releasing means for insuring opening of said line switch upon release of said locking device, and means associated with said cover for insuring opening of said line switch upon opening of said cover.

3. In combination, a manual control switch movable in opposite directions between given extreme circuit controlling positions, an enclosing casing therefor having a cover which is openable when said switch is in either extreme circuit controlling position and means for controlling power connections to said switch, said means insuring interruption of power connections to said switch prior to movement of said switch out of either of its extreme circuit controlling positions and also insuring interruption of power connections to said switch upon opening of said cover.

4. In combination, a manual control switch movable in opposite directions between given extreme circuit controlling positions, an enclosing casing therefor having an openable cover and means for controlling power connections to said switch including two normally closed auxiliary control switches, each being effective upon opening to interrupt power connections to said switch, one of said auxiliary switches being mechanically interlocked with said control switch to provide for opening thereof prior to movement of said control switch out of either of its extreme circuit controlling positions and the other of said auxiliary switches being associated with said cover to provide for opening thereof upon opening of said cover.

5. In a motor controller, in combination, a reversing switch for the motor movable in opposite directions between given extreme circuit making positions, an enclosing casing therefor having an openable cover, an operating handle for said switch mounted upon said cover and releasably connected to said switch to permit opening of said cover, and means for controlling power connections to said switch including two normally closed

auxiliary control switches mounted within said enclosing casing and each being effective upon opening to interrupt power connections to said switch, one of said auxiliary switches being mechanically interlocked with said control switch to insure opening thereof prior to movement of said control switch out of either of its extreme circuit controlling positions and the other of said auxiliary switches being associated with said cover to provide for opening thereof upon opening of said cover.

6. In a motor controller, in combination, a reversing switch for the motor movable in opposite directions between given extreme circuit making positions, an enclosing casing therefor having an openable cover, an operating handle for said switch mounted upon said cover and releasably connected to said switch to permit opening of said cover, an electroresponsive line switch for establishing power connections to said reversing switch, and means associated with said cover for controlling said line switch to insure opening thereof prior to movement of said reversing switch out of either of its extreme circuit controlling positions and for also insuring deenergization of said line switch upon opening of said cover.

7. In a motor controller, in combination, a reversing switch for the motor movable in opposite directions between given extreme circuit making positions, an enclosing casing therefor having an openable cover, an electroresponsive line switch for establishing power connections to said reversing switch, and a pair of normally closed auxiliary control switches mounted within said enclosing casing and each being effective upon opening to deenergize said line switch, one of said auxiliary switches being mechanically interlocked with said reversing switch to insure opening thereof prior to movement of said control switch out of either of its extreme circuit controlling positions and the other of said auxiliary switches being associated with said cover to insure opening thereof upon opening of said cover.

8. In a motor controller, in combination, a manual reversing switch for the motor movable in opposite directions between given extreme circuit making positions, an enclosing casing therefor having an openable cover, an electroresponsive line switch for establishing power connections to

said reversing switch, a pair of normally closed auxiliary switches mounted within said enclosing casing and each effective upon opening to deenergize said line switch, a member carried by said cover and having means associated therewith for normally locking said reversing switch to prevent operation thereof when the same is in either of its extreme circuit controlling positions, said member being movable out of a given normal position to release said reversing switch and to also effect opening of one of said auxiliary control switches, and means associated with said cover for opening the other of said auxiliary control switches upon opening of said cover.

9. In a motor controller, in combination, an electromagnetically operated line switch, a manual reversing switch movable in opposite directions between given extreme circuit controlling positions to selectively control forward and reverse power connections between said line switch and the motor, an enclosure for said reversing switch having an openable cover, means associated with the cover of said enclosure for insuring deenergization of said line switch prior to movement of said reversing switch out of either of its extreme circuit controlling positions, and means associated with the cover of said enclosure for insuring deenergization of said line switch upon opening of said cover.

10. In combination, a control switch movable in opposite directions between given extreme circuit controlling positions, an enclosing casing therefor having an openable cover, an operating handle for said switch mounted upon said cover and releasably connected to said switch to permit opening of said cover when said control switch is in either of its extreme circuit controlling positions, an electroresponsive line switch for establishing power connections to said control switch, means associated with said cover for controlling said line switch to insure opening thereof prior to movement of said control switch out of either of its extreme circuit controlling positions, and means associated with said cover for insuring deenergization of said line switch upon opening of said cover.

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