May 7, 1940. R. B. HUNTER 2,199,563

CIRCUIT CONTROL PANEL

Filed Jan. 16, 1939

Fig. 1

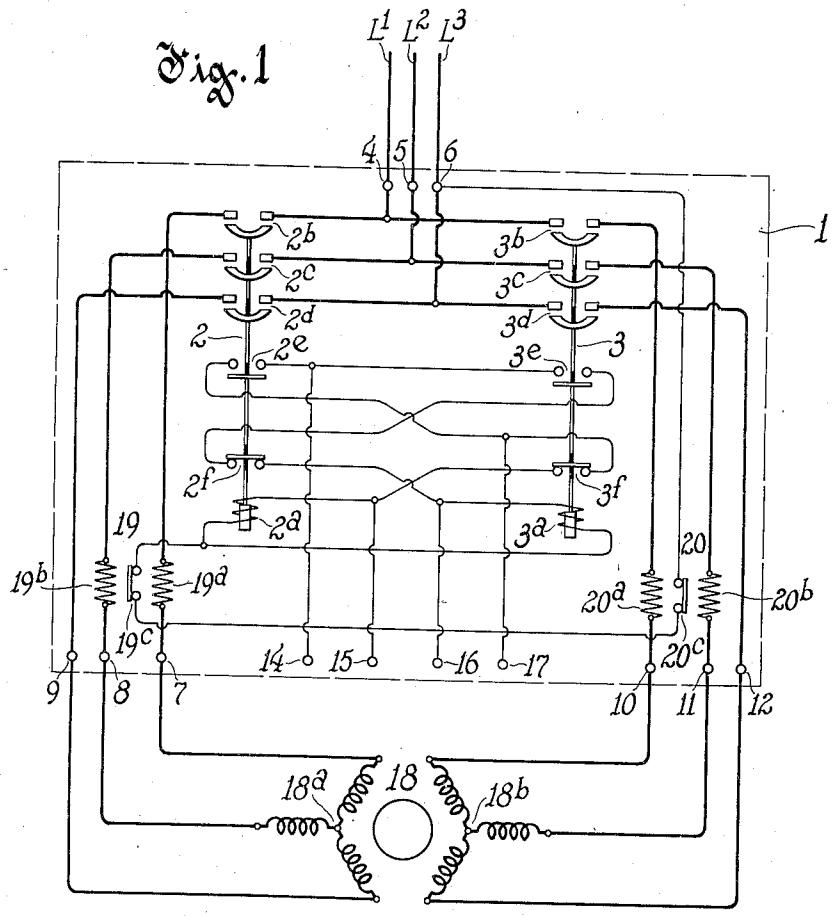


Fig. 2

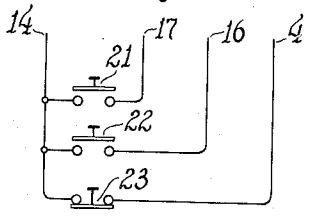


Fig. 3

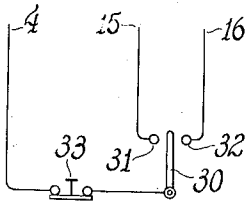
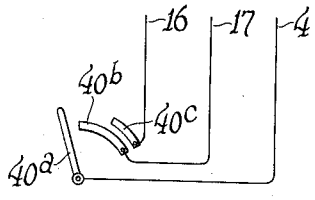


Fig. 4



Inventor

Richard B. Hunter

By [illegible]

Attorney

Patented May 7, 1940 2,199,563

UNITED STATES PATENT OFFICE

2,199,563

CIRCUIT CONTROL PANEL

Richard B. Hunter, Shorewood, Wis., assignor to Cutler-Hammer, Inc., Milwaukee, Wis., a corporation of Delaware

Application January 16, 1939, Serial No. 251,183

9 Claims. (Cl. 172—179)

This invention relates to circuit control panels, and while not limited thereto is especially applicable to panels for commutation of multi-speed motors provided with windings which are commutatable for different speeds and which are to be controlled from one or more pilot stations.

An object of the invention is to provide a panel of the aforementioned tppe which is adapted to be used with any of a variety of pilot control stations having operating cycles differing from one another.

Another object is to provide a panel having a simple wiring system including interlocking and maintaining means so as to be adapted without modification for use for a variety of operating cycles.

Another object is to provide a panel to which any of a variety of different pilot control stations may be very easily connected.

Other objects and advantages will hereinafter appear.

The accompanying drawing is illustrative of an embodiment of the invention.

In the drawing,

Figure 1 is a diagram of a panel for controlling a multi-winding, multi-speed 3 phase motor, and Figs. 2 to 4, inclusive, illustrate diagrammatically several of the numerous different pilot stations which may be used in connection with the panel illustrated in Fig. 1.

Referring to Fig. 1, the system shown therein comprises a mounting panel 1 on which are mounted two electromagnetic main switches 2 and 3 having respectively energizing windings 2^a and 3^a, main contacts 2^b, 2^c, 2^d and 3^b, 3^c 3^d, maintaining contacts 2^e and 3^e and interlocking contacts 2^f and 3^f. Line terminals 4, 5 and 6 are adapted to be connected to the supply lines L^1, L^2 and L^3, respectively, of a polyphase supply circuit. Certain poles of the pairs of contacts 2^b and 3^b, 2^c and 3^c, 2^d and 3^d are connected together and also to the terminals 4, 5 and 6, respectively. The other poles of contacts 2^b, 2^c, 2^d, 3^b, 3^c and 3^d are respectively connected to load terminals 7 to 12, inclusive. Maintaining and interlocking means are completed by the following connections. One pole of each set of maintaining contacts 2^e and 3^e is connected to a control terminal 14. The other pole of contacts 2^e has a connection to a control terminal 17, a second connection to and through interlocking contacts 3^f to one lead of the winding 2^a and a third connection to and through contacts 3^f to a control terminal 15. The second pole of contacts 3^e is connected to and through interlocking contacts 2^f to one lead of the winding 3^a and to a control terminal 16. The other leads of windings 2^a and 3^a are connected together.

The panel also comprises overload relays 19 and 20. These relays may be of any suitable type. Overload relay 19 is shown as provided with two operating coils 19^a and 19^b which are respectively included in the connection of contacts 2^b with terminal 7 and in the connection of contacts 2^c with terminal 8. The overload relay 19 is shown as provided with normally closed contacts 19^c. Overload relay 20 is similarly provided with operating coils 20^a and 20^b which are respectively included in the connection of contacts 3^b with terminal 10 and in the connection of contacts 3^c with terminal 11, and said relay is provided with normally closed contacts 20^c. The normally closed contacts 19^c and 20^c are connected in series between the common lead of coils 2^a and 3^a and terminal 6.

In service the terminals 7, 8, 9 are connected to the low speed winding 18^a of a multi-speed motor 18, while the terminals 10, 11, 12 are connected to the high speed winding 18^b of said motor.

The panel described may be used in cooperation with any one of a variety of pilot control stations some of which will now be described.

Referring to the station illustrated in Fig. 2, the same comprises a normally open low speed push button switch 21, a normally open high speed push button switch 22, and a normally closed stop push button switch 23. All three switches are biased to their respective normal positions. For facilitating understanding of the connections of said switches their lead wires are numbered correspondingly to the panel terminals to which they are to be respectively connected. One pole of each of the three switches is connected to a common wire for connection to terminal 14 on the panel 1. The second pole of switch 21 has a lead wire for connection to terminal 17. The second pole of switch 22 has a lead wire for connection to terminal 16. The second pole of switch 23 has a lead wire for connection to terminal 4.

With the station of Fig. 2 thus connected and with the lines L^1, L^2, L^3 energized the control afforded is as follows: If it is desired to start the motor, the button 21 is depressed which closes a circuit from line L^1 over terminal 4, through normally closed stop push button switch 23, to and through push button switch 21, to terminal 17, and thence to and through contacts 3^f, winding 2^a, overload contacts 19^c and 20^c to terminal 6 and line L^3. Thereupon switch 2 is energized and connects the low speed winding 18^a through its main contacts and the overload windings 19^a and 19^b to the supply line. Switch 2 also completes a maintaining circuit by closure of its maintaining contact 2^e, thus paralleling through interlocking contacts 3^f the switch 21 which then may be released without deenergizing the main switch 2. If it should be desired

to operate the motor at high speed, either from standstill or after it has been started on low speed, it is only necessary to depress the push button switch 22, to complete circuit therethrough from terminal 4 to terminal 16 and thence to and through winding 3^a. This energizes main switch 3, which in turn opens the interlocking contacts 3^f, thereby deenergizing the main switch 2 and disconnecting the low speed winding of the motor. Swith 3 in closing completes a maintaining circuit by closure of its maintaining contacts 3^e, thus paralleling through interlocking contacts 2^f the switch 22. It will be observed that the maintaining and interlocking circuits of the switches 2 and 3 are so arranged that after the high speed winding is energized it will not be possible to again connect the motor to the low speed winding without first deenergizing the high speed winding by returning switch 3 to its inoperative position, as main switch 2 cannot close while the interlocking contacts 3^f are open. Return of switch 3 is accomplished by pushing the stop switch 23, which interrupts the current supply to the energizing winding 3^a of main switch 3.

If it is desired to provide for transfer from high speed to low speed without prior operation of the stop switch 23 it is only necessary to transfer the connection of push button switch 21 from terminal 17 to terminal 15. This connection shunts the interlocking contacts 3^f, so that winding 2^a is directly energized upon closure of switch 21 regardless of the position of main switch 3. Under these conditions, upon energization of main switch 2 the interlocking contacts 2^f thereof are opened, thereby deenergizing the main switch 3 and disconnecting the high speed winding of the motor.

If an overload should occur while the low speed or the high speed winding of the motor is energized, the windings of the overload relays 19 or 20 function to open contacts 19^c or 20^c. This interrupts the current supply to the winding 2^a or to the winding 3^a, and thus disconnects the motor from the supply. To restart the motor, the pilot station is again operated in the manner aforedescribed. It is obvious that a number of control stations similar to that shown in Fig. 2 may be installed and connected so that the panel may be controlled at will from any of said stations. This will entail no modifications of the internal wiring of the panel.

Referring now to pilot station Fig. 3, the same comprises a double throw pivoted contact lever 30 having a center position, a low speed position in which it engages a contact 31 and a high speed position in which it engages a contact 32. The contact 31 has a lead wire for connection to terminal 15 on the panel and contact 32 has a lead wire for connection to terminal 16, while the lever has a lead wire for connection to terminal 4. A separate stop switch 33 which may be operated manually or automatically, as for instance, by a pressure or speed responsive device, is preferably connected in the wire between the lever 30 and the terminal 4. The lever 30 may also be actuated manually or by some automatically operated mechanism. The control afforded by such a station with the connections described will be apparent from the explanation given in connection with the station of Fig. 2.

Fig. 4 illustrates still another pilot station. The same comprises a pivoted contact lever 40^a which has a lead wire for connection to terminal 4, a contact segment 40^b which has a lead wire for connection to terminal 17 and a shorter segment 40^c which has a lead wire for connection to terminal 16. When the lever is rotated clockwise, the low speed switch on the panel is energized, while further rotation energizes the high speed switch which in responding deenergizes the low speed switch. If now the lever is rotated counterclockwise, the high speed switch is deenergized and the low speed switch is again energized as soon as the high speed switch 3 upon its return to the "off" position closes the contact 3^f. Further counterclockwise rotation again deenergizes the low speed switch. Assuming use of the station of Fig. 3 or that of Fig. 4, if an overload occurs, the motor connections upon release of the overload relays and normal positioning of the overload contacts 19^c and 20^c will be automatically reestablished to those prevailing before such occurrence unless in the meantime the station has been set to prevent restarting.

As will be understood, the panel shown and described is not limited to use with the control stations selected for illustration or to the control of that type of motor selected for illustration.

It will further be understood that the invention is applicable to panels adapted for the control of other types of multi-speed motors, which panels are to be arranged for alternative operating cycles to be obtained by the selective employment of one of a variety of control stations.

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

1. A circuit control panel comprising first and second electroresponsive switches and control terminals to be used in different groups to adapt said panel to different pilot switches, said switches each having a control winding and main and auxiliary contacts, the latter including maintaining contacts and interlocking contacts and said control terminals comprising terminals having direct connection to the control windings of said switches respectively, another control terminal to which the aforementioned control terminals are connected each through the maintaining contacts of its respective switch and the interlocking contacts of the other switch, and another control terminal connected to a point between the maintaining contacts of said first switch and the interlocking contacts of said second switch.

2. A circuit control panel comprising electroresponsive switches to be energized selectively for establishment of different load circuits selectively, each of said switches having a control winding and auxiliary contacts including maintaining contacts and interlocking contacts, and said panel further comprising control terminals to be utilized in different groups to adapt said panel to different types of pilot switches, said control terminals including terminals having direct connection to the windings of said switches respectively, and another control terminal to which both aforementioned control terminals are connected each through the maintaining contacts of its respective switch and the interlocking contacts of another of said switches.

3. A circuit control panel comprising first and second electroresponsive switches to be energized selectively for establishment of different load circuits selectively, each of said switches having a control winding and auxiliary contacts including maintaining contacts and interlocking contacts, and said panel further comprising control terminals to be used in different groups to adapt said panel to different types of pilot switches, said control terminals including terminals having

direct connection to the windings of said switches respectively, another control terminal to which the aforementioned terminals are connected each through the maintaining contacts of its respective switch and the interlocking contacts of the other switch, and another control terminal connected to a point between the maintaining contacts of said first switch and the interlocking contacts of said second switch.

4. A circuit control panel comprising first and second electroresponsive switches to be energized selectively for establishment of different load circuits selectively, each of said switches having a control winding and auxiliary contacts including maintaining contacts and interlocking contacts, and said panel further comprising control terminals to be used in different groups to adapt said panel to different types of pilot switches, said control terminals including a terminal connected to the winding of said first switch through the maintaining contacts thereof and the interlocking contacts of said second switch and a terminal connected to the winding of said second switch through the maintaining contacts thereof and the interlocking contacts of said first switch, another control terminal connected to a point between the winding of said second switch and the interlocking contacts of said first switch, and another control terminal connected to a point between the maintaining contacts of said first switch and the interlocking contacts of said second switch.

5. A circuit control panel comprising line terminals, load terminals, first and second electroresponsive switches to be energized selectively for establishment of different connections between said line terminals and said load terminals, each of said switches having auxiliary contacts including maintaining contacts and interlocking contacts and having a control winding connected on one side to one of said line terminals and said panel further comprising current responsive means to control said line connections of said windings and control terminals to adapt said panel to different types of pilot switches, said control terminals including terminals having direct connection to said windings respectively to include the same in circuit between their respective control terminals and line terminals, another control terminal to which the aforementioned control terminals are connected each through the maintaining contacts of its respective switch and the interlocking contacts of the other switch and another control terminal connected to a point between the maintaining contacts of said first switch and said interlocking contacts of said second switch.

6. A control panel adapted to provide alternative low speed or high speed connections for a motor circuit, comprising low speed and high speed switches, separate operating windings for such switches, means for establishing maintaining circuits for said windings, means for interlocking said windings, and control terminals having permanent connections with said windings, said maintaining means and said interlocking means, which terminals may be used in different groups to adapt said panel to different pilot control stations for control of said switches, to establish low and high speed connections selectively in all cases and to change from high to low speed connections, or from high speed connections to off position according to the terminals employed.

7. A control panel adapted to provide alternative low speed or high speed connections for a motor circuit, comprising low speed and high speed switches, separate operating windings for such switches, means for establishing maintaining circuits for said windings, means for interlocking said windings, and control terminals having permanent connections with said windings, said maintaining means and said interlocking means, which terminals may be used in different groups to adapt said panel to different pilot control stations for control of said switches with or without said maintaining means according to the terminals employed, to establish low and high speed connections selectively in all cases.

8. A panel for control of the circuit of a two speed two winding motor, comprising line terminals, motor circuit terminals, an electroresponsive switch to connect certain of said motor circuit terminals to said line terminals for a first speed, an electroresponsive switch to connect certain of said motor circuit terminals to said line terminals for a second speed, each of said switches having maintaining contacts and interlocking contacts and having a control winding one side of which is connected to a line terminal, said panel further comprising control terminals including terminals respectively connected to said switch windings to include each between its respective control and line terminals, another control terminal to which both aforementioned control terminals are connected each through the maintaining contacts of its respective switch and the interlocking contacts of the other switch, and another control terminal connected to a point between the maintaining contacts of said switch for first speed and the interlocking contacts of said switch for second speed.

9. A panel for control of the circuit of a two speed two winding motor, comprising line terminals, motor circuit terminals, an electroresponsive switch to connect certain of said motor circuit terminals to said line terminals for a first speed, an electroresponsive switch to connect certain of said motor circuit terminals to said line terminals for a second speed, current responsive relays having control windings included in the connections established by said switches between said motor circuit terminals and said line terminals, each of said switches having maintaining contacts and interlocking contacts and each also having an operating winding connected on one side to a line terminal through the contacts of said relays, said panel further comprising control terminals including terminals respectively connected to said switch windings to include each between its respective control and line terminals, another control terminal to which both first mentioned control terminals are connected each through the maintaining contacts of its respective switch and the interlocking contacts of the other of said switches, and another control terminal connected to a point between the maintaining contacts of said switch for first speed and the interlocking contacts of said switch for second speed.

RICHARD B. HUNTER.