

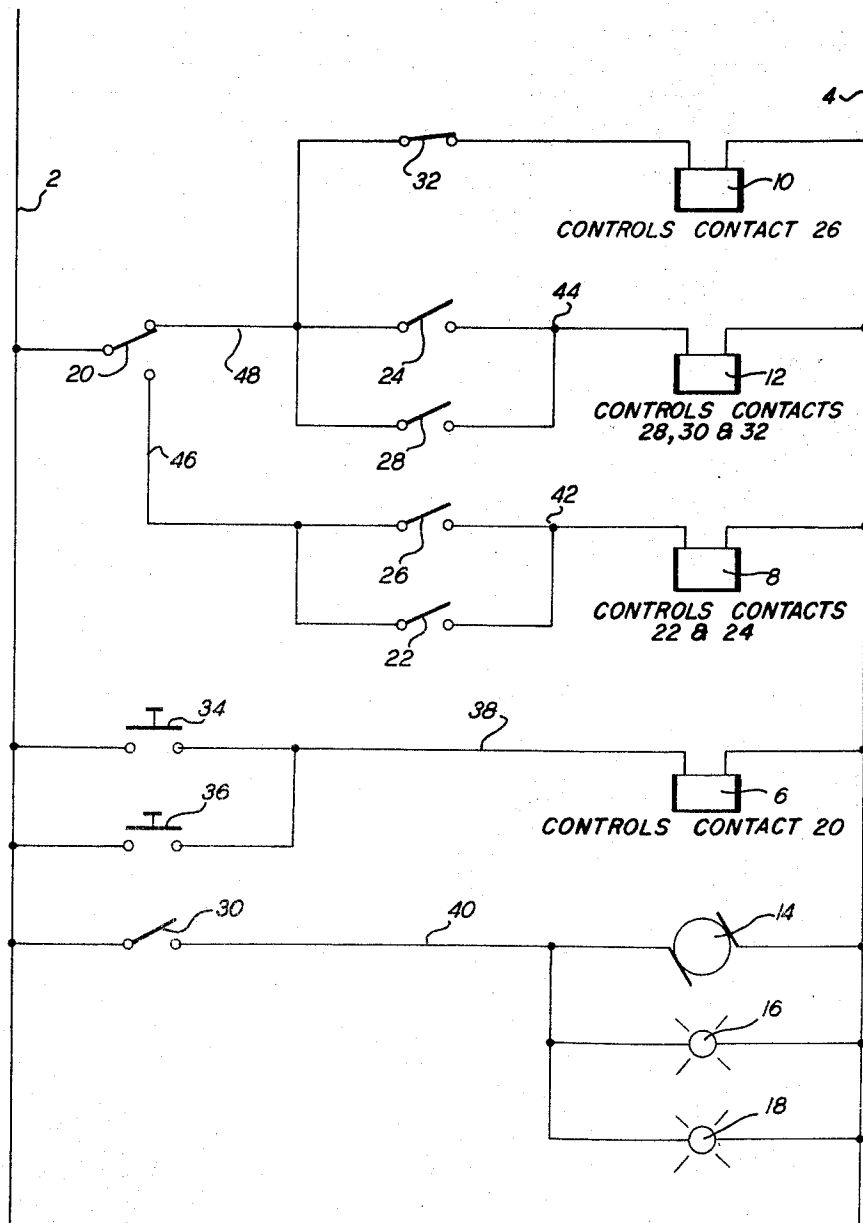
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SINGLE PUSH BUTTON MOTOR STARTER

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SINGLE PUSH BUTTON MOTOR STARTER

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This invention relates to control apparatus and more particularly to a single push button control apparatus circuit. This apparatus uses a spring loaded or momentary type switch with a relay arrangement so as to provide a means for controlling the conduction of electrical power to a device by means of a single switch.

In many industrial applications in order to control the large currents necessary to activate motors or other apparatus large circuit breaker type switches are necessary to safely activate the apparatus. Of the multitude of motor starting circuits the majority are of the selector switch type, circuit breaker arrangement or systems utilizing two pushbuttons. These have disadvantages in that more space is required than with a single station. The apparatus described herein provides a single push button start stop station for starting and stopping electric motors or controlling other apparatus. The circuit could also be utilized for any application requiring sequential actuation and deactuation by means of a single momentary contact push button. If desired many single push buttons can be used with this circuit for remote control. The use of the single momentary contact push button saves space with those applications where space is critical such as on graphic instrument panels. This apparatus minimizes the number of elements required to be operated or monitored by a system operator.

It is therefore a broad object of this invention to provide a control apparatus operative by a single momentary contact push button.

It is a further object of this invention to provide a single station control to operate a by-stable apparatus and provide a circuit energized light directly with the single station control.

It is a further object of this invention to provide a single push button start stop station for starting and stopping electric motors.

It is a further object of this invention to provide a relay arrangement for use in conjunction with a single momentary switch whereby a first activation of the switch will energize associated apparatus and where a subsequent activation of the same switch will deactivate the apparatus.

It is a still further object of this invention to provide a starting and stopping circuit for electrical systems wherein a single momentary push button when used in conjunction with electrical relays will alternately activate and deactivate the motor apparatus.

The novel features of the invention are set forth in the appended claims and the invention as to its organization and its mode of operation will best be understood from a consideration of the following detailed description of the preferred embodiment, when used in connection with the accompanying drawing which is hereby made a part of the specification and in which:

The figure is a schematic representation of the control circuit.

The preferred embodiment of this invention provides a circuit for controlling the activation and deactivation of

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electrical apparatus by means of a single momentary switch when connected as shown in the figure with a plurality of relays.

In the following detailed description of the apparatus by which the objects of the invention are realized the motor 14 and lights 16 and 18 represent the apparatus or system to be controlled by the operation of a single momentary contact push button such as 34 or 36. Four relay coils 6, 8, 10 and 12 are provided with their associated contacts to switch the voltage or power which appears across the electrical bus connectors 2 and 4. Contact 20 shown in its de-energized position is activated only when relay coil 6 is energized so as to swing the arm of relay contact switch 20 down to make connection with conductor 46. The fixed contact connected to conductor 48 is the normally closed contact of switch 20 of relay 6 while the contact associated with conductor 46 will be referred to as the normally open contact of switch 20 of relay 6. Relay coil 8 has two sets of contacts associated with it, namely, 22 and 24 which close whenever voltage is applied to the coil 8. Relay coil 10 has one contact 26 associated with it which closes whenever relay coil 10 is energized. Relay coil 12 has three sets of contacts associated with it and operable when coil 12 is energized. These contacts are 28, 30 and 32, the first two being normally open and closing only upon the energizing of relay coil 12 while contact 32 is normally closed and will open whenever relay coil 12 is energized.

The contact switch 20 associated with relay 6 has the characteristic of making before breaking. That is, when relay coil 6 is energized the arm 20 will swing down and make connection with conductor 46 before it breaks connection with conductor 48 and likewise upon the de-energizing of relay 6 the arm 20 will swing up and make contact with conductor 48 before it breaks contact with conductor 46. Relays having contacts with this characteristic are common and are well known in the art.

The operation of the control circuit is as follows. In its quiescent off condition the circuit contacts are as shown in the figure except for 26 which is closed. Under these conditions contact 32 of relay 12 is closed, switch 20 is against its normally closed contact so that voltage is conducted from the bus line 2 through the switch 20 to conductor 48 through contact 32 to energize the coil 10 which has a ground return to conductor 4. The energizing of relay 10 closes the contact 26 so as to complete a conductive path between conductor 46, junction 42 and relay coil 8. Since the remainder of the switches are open only relay coil 10 is energized and only the two contact switches 32 and 26 are closed. Since switch 36 is in parallel with switch 34 and is shown only to indicate that remote control switching may be obtained if desired, this description will be limited to the operation of the single momentary push button control 34 which is biased to an open position.

By depressing the push button 34 conduction from the bus lead 2 through switch 34 to the conductor 38 and to relay 6 energizes relay 6 which in turn closes the relay contact 20 so as to energize conductor 46. Since switch 20 makes connection with conductor 46 before it breaks connection with conductor 48 relay 8 will be energized through the switch 26 and relay 8 will instantly close the relay switch contacts 22 and 24. Relay coil 8 will remain energized as long as the push button 34 is depressed. Upon release of the push button 34 the arm 20 will make contact with conductor 48 before it breaks contact with conductor 46 thereby applying a potential through switch 20, conductor 48, switch 24 and junction 44, to energize the coil 12 which closes relay switch contacts 28 and 30 and opens relay contact switch 32. In closing contact 28 it is seen that relay 12 will be held

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in by its own contact 28 and will remain energized until further operation of a switch.

By depressing momentary switch 34 a second time relay 6 is again energized so as to close the switch 20 to break the connection between the power bus 2 and relay 12. In so doing relay 12 de-energizes and since switches 22 and 26 are already open relay 8 will not become energized. This condition will exist as long as the push button 34 is held in a depressed position and upon release of this push button switch 20 will open so as to make contact with its normally closed contact and conductor 48. As relay 12 has dropped out its associated contact switches 28, 30 and 32 have assumed their inactivated position. Since the normally de-energized position of contact 32 is closed, power will again be conducted through it to relay 10, thereby energizing switch 26. The inactivation of relay 12 has caused switch 30 to open thereby removing power from the motor 14 and the indicator lights 16 and 18. It is seen that at this time the control circuit is in the same condition as at the beginning of the operation and the circuit is now ready to again control the motor apparatus 14 by merely depressing the switch 34 once again.

It is thus seen that the operation of the single momentary push button control contact 34 will control the by-stable or two conditions of operation of motor 14. This allows the use of a single push button for on and off control of high current apparatus and is especially useful in those applications of limited space where reliable operation of heavy duty equipment is desired. This control apparatus is fail-safe in that a loss of control power deactivates the control circuit and the switch has to be pushed again before the circuit is reactivated after power is restored.

It should be understood that this invention is not limited to specific details of construction and arrangement thereof herein illustrated and that changes and modifications may occur to one skilled in the art without departing from the spirit of the invention; the scope of the invention being set forth in the following claims:

What is claimed is:

1. Control apparatus to be activated from a power bus comprising a switch member, a member to be controlled, a first relay having its activating portion connected in series relationship with said switch member across the said power bus and having a contact arrangement of at least one movable and two fixed contacts associated therewith having the characteristic upon activation or deactivation that the movable arm contact makes connection with one fixed contact before breaking connection with the second fixed contact, a conductor interconnecting the movable arm contact and the power bus, second, third and fourth relays having respectively at least two, one and three contacts associated therewith and operative upon energizing of said relays, at least one of the contacts of the fourth relay being normally closed while the remainder of the contacts are normally open, wiring means connecting across the power bus the series relationship of one contact of said fourth relay with said member to be controlled whereby the member to be controlled will have the power bus connected to it when the fourth relay contact is closed by activation of the fourth relay, a first parallel arrangement of a second relay contact with the third relay contact, said first parallel arrangement being connected in series arrangement with the second relay activating portion and the normally open contact of the first relay contact whereby the second relay is held energized by one of its own contacts if the third relay was energized at the time the first relay arm moved from its normally closed to its normally open contact, a second parallel arrangement made up of the series combination of the third relay with the normally closed contact of the fourth relay and the series-parallel combination of the fourth relay in series with the paralleled contacts of the second

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and fourth relay, said second parallel arrangement connected between the normally closed contact of the first relay and the ground side of the power bus whereby the third relay is energized through the normally closed contacts of the first and fourth relays until activation of the switch member activates the first relay so as to activate the second relay which provides for the activation of the fourth relay when the switch member is returned to its original position, said fourth relay contact in turn activating said member to be controlled which is thereafter deactivated upon the subsequent repetition of movement of the switch member by deactivating the fourth relay and activating the third relay so as to place the control apparatus in a position such that subsequent operation of the switch member would repeat the activation of the member to be controlled.

2. Control apparatus comprising a first circuit comprising first and second switches parallel connected and a means serially connected therewith for controlling said second and a third and fourth switch; a second circuit comprising said third switch serially connected to a means for controlling a fifth switch; said first and second circuits being parallel connected between a bus and one contact of a make before break switch, said last named switch having a movable element connected to a second bus; a third circuit comprising said fifth switch and a sixth switch parallel connected and means serially connected therewith for controlling said first and said sixth switches; and means connecting said third circuit between said first bus and a second contact on said make before break switch; a controlled member serially connected with said fourth switch between said first and second buses, and a seventh switch serially connected between said buses with a means for controlling said make before break switch.

3. Control apparatus comprising a first circuit comprising first and second switches parallel connected and a means serially connected thereto for controlling said second and a third and fourth switches; a second circuit comprising said third switch serially connected to a means for controlling a fifth switch; said first and second circuits being parallel connected between a bus and one contact of a make before break switch, said last named switch having a movable element connected to a second bus; a third circuit comprising said fifth switch and a sixth switch parallel connected and means serially connected therewith for controlling said first and said sixth switches; and means connecting said third circuit between said first bus and a second contact on said make before break switch; a controlled member serially connected with said fourth switch between said first and second buses, a seventh switch serially connected between said buses with a means for controlling said make before break switch, said third switch being normally closed and said movable element of said make before break switch being normally connected to said one contact.

4. Control apparatus comprising a first circuit comprising first and second switches parallel connected and a relay winding serially connected thereto for controlling said second and a third and fourth switch; a second circuit comprising said third switch serially connected to a relay winding for controlling a fifth switch; said first and second circuits being parallel connected between a bus and one contact of a make before break switch said last named switch having a movable element connected to a second bus; a third circuit comprising said fifth switch and a sixth switch parallel connected and a relay winding serially connected therewith for controlling said first and said sixth switches; and means connecting said third circuit between said first bus and a second contact on said make before break switch; a controlled member serially connected with said fourth switch between said first and second buses, and a seventh switch serially connected with

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a relay winding for controlling said make before break switch between said buses.

5. Control apparatus comprising a first circuit comprising first and second switches parallel connected and a relay winding serially connected thereto, for controlling said second and a third and fourth switch; a second circuit comprising said third switch serially connected to a relay winding for controlling a fifth switch; said first and second circuits being parallel connected between a bus and one contact of a make before break switch, said last named switch having a movable element connected to a second bus; a third circuit comprising said fifth and a sixth switch parallel connected and a relay winding serially connected therewith for controlling said first and said sixth switches; and means connecting said third circuit between said first bus and a second contact on said make before break switch; a controlled member serially connected with said fourth switch between said first and second buses, and a manually operated switch serially connected with a relay winding for controlling said make before break switch between said buses.

6. Control apparatus comprising first, second, third and fourth circuits, each of said circuits including serially connected control means and controlled means, and a fifth circuit including a pair of serially connected controlled means, said first and second circuits being parallel

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connected between a first bus and a first contact of a make before break switch means said switch means having a controlled element connected to a second bus, said third circuit being connected between said first bus and a second contact on said switch means, said fourth and fifth circuits being connected between said first and second buses, said control means of said first circuit controlling said controlled means of said third circuit, said control means of said second circuit controlling said controlled means of each of said first and second circuits and one of said controlled means of said fifth circuit, said control means of said third circuit controlling said controlled means of said second and third circuits, said control means of said fourth circuit controlling said controlled element of said switch means, said controlled means of said fourth circuit being a manually operable switch.

7. The control apparatus of claim 6 wherein said controlled means of said second and third circuits includes a pair of parallel connected switches.

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