

**3,099,771**

2 Sheets-Sheet 1

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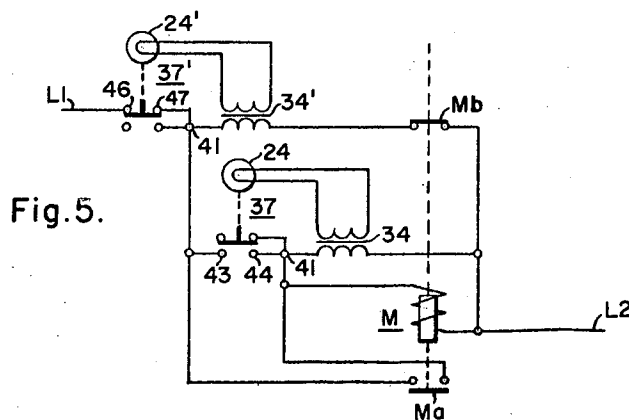
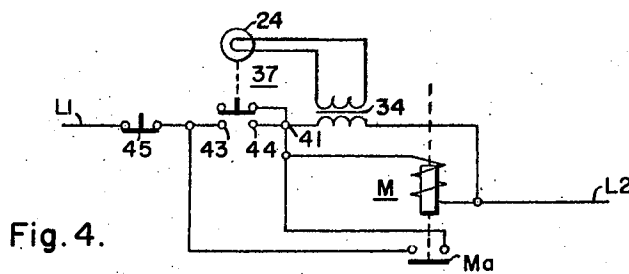
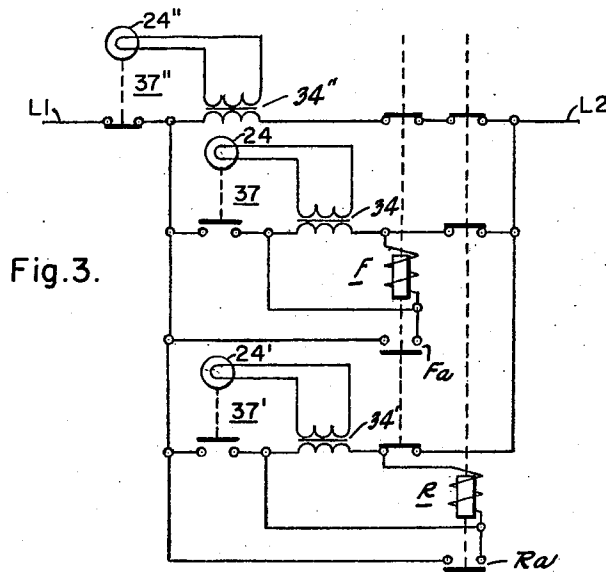
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ELECTRIC SWITCH AND CONTROL SYSTEM

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## ELECTRIC SWITCH AND CONTROL SYSTEM

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This invention relates generally to electric switches and, more particularly, to push-button switches of the self-indicating type.

The operation of electrically driven machines, such as machine tools, is frequently controlled by push-button switches which are located remotely from motor starters for controlling the energization of the driving motors. Indicating lamps are provided on switchboards and control panels to provide an indication of the functioning of apparatus located remotely from a switchboard or control panel. In order to save time in isolating control system troubles, indicating lamps are so constructed that the lamp can be tested for burn out by merely pushing on the lens for the lamp. When the lens is depressed, the lamp is connected to a test circuit, thereby determining if the lamp is burned out or if the trouble is elsewhere in the control system.

An object of this invention is to provide a simplified and improved indicating lamp unit of the self-testing type.

Another object of the invention is to provide a combined indicating lamp and push-button switch.

A further object of the invention is to provide an improved control system utilizing a combined push-button switch and indicating lamp.

Other objects of the invention will be explained fully hereinafter or will be apparent to those skilled in the art.

In accordance with one embodiment of the invention, a spring-return snap-action switch is actuated by a combined indicating lamp and push button. The contact members of the switch are so connected in a control circuit that the combined lamp and push button is depressed momentarily to energize a motor starter. The lamp is energized and the starter is held closed by means of a holding circuit established through auxiliary contact members on the starter. The lamp may be tested for burn out by again depressing the lamp to connect its energizing circuit directly across the power source through contact members of the switch.

For a better understanding of the nature and objects of the invention, reference may be had to the following detailed description taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a view, partly in section and partly in elevation, of a combined indicating lamp and switch unit embodying the principal features of the invention;

FIG. 2 is a view, in bottom plan, of the structure shown in FIG. 1;

FIG. 3 is a diagrammatic view of a reversing system utilizing three of the combined indicating lamp and switch units;

FIG. 4 is a diagrammatic view of a control system utilizing the combined indicating lamp and switch unit; and

FIG. 5 is a diagrammatic view of another control system utilizing two of the combined indicating lamp and switch units.

Referring to the drawings, and particularly to FIG. 1, the structure shown therein comprises a supporting sleeve 10, preferably composed of a cast metal, and having a flange 11 at the inner end thereof for engaging the

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inner side of a supporting panel 12. A sealing disc 13, preferably composed of rubber or the like, is interposed between the flange 11 and the inner surface of the panel 12. The outer end of the sleeve 10 is externally threaded for receiving a clamping ring 14 which is adapted to secure the sleeve to the panel 12 when the clamping ring is drawn down tightly. A metal washer 15 may be provided between the clamping ring 14 and the outer surface of the panel 12.

The supporting sleeve 10 is provided with a transversely extending web 16 having an opening 17 therein. A housing 18 is slidably disposed in the opening 17. The upper end of the housing 18 is enlarged and threaded internally to receive a lens 19 which may also be used as a push button. A sealing washer 21 is provided between a shoulder 22 on the lens 19 and the top of the housing 18. A lamp receptacle 23 is disposed inside the housing 18 and a lamp bulb 24 is disposed in the receptacle 23. The bulb 24 is protected by the lens 19. The receptacle 23 is retained in the housing 18 by projections 25 which extend through an opening in the bottom of the housing 18 and also extend through an opening in an operating member 26 which is attached to the bottom of the housing 18 by riveting the projections 25 where they extend through the member 26.

A compression spring 27 surrounds the housing 18 between a shoulder 28 on the housing 18 and a metal washer 29. A sealing disc or washer 31 is provided around the housing 18 between the metal washer 29 and the web 16 of the sleeve 10 to prevent oil or other material from passing through the opening 17. The spring 27 compresses the sealing disc 31 and biases the housing 18 outwardly. The outward movement of the housing 18 is limited by the operating member 26 which engages the bottom of the sleeve 10.

One leg of an L-shaped bracket 32 is attached to projections 33 on the bottom end of the sleeve 10 by screws 30. A transformer 34 is attached to the bracket 32 by means of screws 35, as shown in FIG. 2. The transformer has a secondary winding which is connected to the lamp receptacle 23 by means of conductors 36 which extend through the openings in the operating member 26 and the housing 18. The transformer has a primary winding which is connected to a source of alternating current in a manner described hereinafter. A resistor may be utilized in place of the transformer or the lamp may be connected across the line voltage.

An enclosed switch 37 is attached to the other leg of the bracket 32 by means of screws 38. The switch 37 is preferably of a double-throw spring-return snap-action type, such as, for example, the switch described in Patent No. 1,960,020. The switch 37 is provided with an operating plunger 39 which is engaged by the operating member 26 to actuate the switch when the lens 19 is depressed. The switch 37 is provided with contact members which control the energization of the lamp 24, as will be described more fully hereinafter. As shown, a terminal 41 of the switch 37 is connected to terminal 42 of the primary winding of the transformer 34.

As shown in FIG. 4, the combination indicating lamp and push-button switch may be utilized in a control system to control the energization of the actuating coil of a contactor M which contactor may be utilized to control the operation of an electric motor (not shown). When the indicating lamp 24 is depressed, the switch 37 is operated to establish a circuit through contact members 43 and 44 of the switch, thereby connecting the coil of the contactor M across line conductors L1 and L2 through the contact members of a push-button switch 45. When auxiliary contact members Ma are closed, the lamp 24 may be released. A holding circuit for the coil of the

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contactor M is established through the auxiliary contact members Ma. This holding circuit also energizes the primary winding of the transformer 34, thereby causing the lamp 24 to be lighted, which indicates that the contactor M is in the closed position.

If it is desired to test the lamp 24 for burn out, the lamp is again depressed, thereby re-establishing the circuit through contact members 43 and 44 which connects the primary winding of the transformer 34 directly across the line conductors L1 and L2 through the push-button switch 45. Thus, the combination unit may be utilized as a switch for controlling the operation of a motor starter, as well as an indicating light to indicate the functioning of the motor starter. When it is desired to de-energize the contactor M, the switch 45 is depressed to open the circuit through the contact members of this switch.

As shown in FIG. 5, two of the combination switch and lamp units, which are designated by the reference characters 37 and 37', may be utilized to control the de-energization as well as the energization of the actuating coil of a contactor M. The unit 37 functions in the manner previously described to control the energization of the contactor M and, also, the lamp 24.

The unit 37' functions to control the deenergization of the coil of the contactor M and the energization of the lamp 24' which indicates when the contactor M is in the open position. When the contact members of the switch 37' are in the position shown a circuit is established through contact members 46 and 47 of the switch 37' and auxiliary contact members Mb of the contactor M to energize the transformer 34', thereby energizing the lamp 24'. Thus, the lamp 24' indicates that the contactor M is in the open position. When the contactor M is closed, in the manner previously described, the lamp 24 is lighted and the lamp 24' is dark. The opposite condition exists when the contactor M is open.

If it is desired to test the lamp 24' for a burn out, the lamp is depressed, thereby causing the contactor M to open after which the lamp 24' is released. If the lamp does not light at this time, it indicates that it is burned out, since an energizing circuit is established through the contact members of the switch 37' and the auxiliary contact members Mb.

As shown in FIG. 3, three combination units 37, 37' and 37'' may be utilized to control the forward and the reverse operation of a motor and to stop the motor. When the unit 37 is actuated, the actuating coil of a forward contactor F is energized and a holding circuit for the coil is established through auxiliary contact members Fa of the contactor in the manner previously described. The lamp 24 is lighted to indicate that the forward contactor is closed.

If it is desired to reverse the motor, the unit 37'' is actuated to stop the motor, after which the unit 37' is actuated to energize the actuating coil of the reversing contactor R. A holding circuit for this contactor is established through auxiliary contact members Ra and the lamp 24' is lighted to indicate that the reverse contactor is closed. As previously stated, the motor may be stopped by actuating the unit 37'', thereby interrupting the holding circuits for the contactors. The lamp 24'' is lighted when the forward and the reverse contactors are both open. The respective bulbs may be tested for burn out at any time by depressing the lens of the lamp unit.

From the foregoing description, it is apparent that the invention provides a combination switch and indicating light unit which may be utilized to replace two separate units such as a push-button switch and a separate indicating lamp. The present unit performs the functions of the two separate units, thereby reducing the amount of space required to mount the units on a control panel, as well as reducing the cost of the equipment. Furthermore,

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a lamp may be tested at any time by merely depressing the lens for the lamp unit. Thus, the operator is enabled to determine readily if the lamp is functioning properly.

Since numerous changes may be made in the above-described construction and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all the matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim as our invention:

1. A combined indicating lamp and push-button switch comprising a supporting sleeve having a transverse web with an opening therein, a housing slidably disposed in said opening, a lamp bulb in said housing and movable therewith with respect to the sleeve, a lens removably disposed in the housing over said lamp bulb, a spring for biasing the housing outwardly in the sleeve, an operating member attached to the bottom of the housing to limit the outward movement of the housing, a unitary spring-return snap-action switch disposed exteriorly of the sleeve and supported by the sleeve, an operating plunger on said switch actuated by said operating member when said lens is depressed, and contact members in said switch for controlling the energization of said lamp.

2. In a control system, in combination, an electrically operated device having an actuating coil, a switch movable independently of the device and having contact members for controlling the energization of said coil, a lamp for indicating the functioning of said device, said lamp being movable to actuate said switch, and auxiliary contact members actuated by said device and cooperating with the switch contact members in controlling the energization of said lamp, and said lamp being movable to establish a testing circuit for the lamp independently of said auxiliary contact members.

3. In a control system, in combination, an electrically operated device having an actuating coil, a spring-return snap-action switch movable independently of the device and having contact members for controlling the energization of said coil, a lamp for indicating the functioning of said device, said lamp being movable to actuate said switch, and normally open auxiliary contact members actuated by said device and cooperating with the switch contact members in controlling the energization of said lamp and said coil, and said lamp being movable to establish a testing circuit for the lamp independently of said auxiliary contact members.

4. In a control system, in combination, an electrically operated device having an actuating coil, a switch having contact members for establishing an energizing circuit for said coil, a lamp for indicating when said device is in one position, said lamp being movable to actuate said switch to establish said energizing circuit, auxiliary contact members actuated by said device for establishing a holding circuit for said coil, said auxiliary contact members cooperating with said switch contact members in controlling the energization of said lamp, an additional switch having contact members for opening said holding circuit, an additional lamp for indicating when said device is in a different position, said additional lamp being movable to actuate said additional switch to interrupt said holding circuit, and additional auxiliary contact members actuated by said device and cooperating with said additional switch contact members in controlling the energization of said additional lamp.

5. In a reversing system, in combination, a forward contactor having an actuating coil, a first switch having contact members for establishing an energizing circuit for said coil, a first lamp for indicating when the forward contactor is closed, said lamp being movable to actuate said first switch, auxiliary contact members actuated by said forward contactor for establishing a holding circuit for said coil, said auxiliary contact members cooperating

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with said first switch contact members in controlling the energization of said first lamp, a reverse contactor having an actuating coil, a second switch having contact members for establishing an energizing circuit for said reverse contactor coil, a second lamp for indicating when the reverse contactor is closed, said second lamp being movable to actuate said second switch, additional auxiliary contact members actuated by said reverse contactor for establishing a holding circuit for said reverse contactor coil, said additional auxiliary contact members cooperating with said second switch contact members in controlling the energization of said second lamp, a third switch having contact members for interrupting said holding circuits, a third lamp for indicating when said contactors are open, said third lamp being movable to actuate said third switch, and other additional auxiliary contact members actuated by said contactors and cooperating with said third switch contact members in controlling the energization of said third lamp.

6. A combined indicating lamp and push-button switch comprising a supporting sleeve having a transverse web with an opening therein, a housing slidably disposed in said opening, a lamp receptacle in said housing, a lamp bulb in said receptacle, a lens screwed into the housing to cover the lamp bulb, a spring surrounding the housing for biasing the housing outwardly in the sleeve, an operating member attached to the bottom of the housing by said receptacle to limit the outward movement of the housing, an enclosed switch disposed exteriorly of the sleeve and supported by the sleeve, an operating plunger on said switch actuated by said operating member when said lens is depressed, and contact members in said switch for controlling the energization of said lamp.

7. A combined indicating lamp and push-button switch comprising a supporting sleeve having a transverse web with an opening therein, a housing slidably disposed in said opening, a lamp receptacle in said housing, a lamp bulb in said receptacle, a lens screwed into the housing to cover the lamp bulb, a spring surrounding the housing for biasing the housing outwardly in the sleeve, an operating member attached to the bottom of the housing by said receptacle to limit the outward movement of the housing, a bracket attached to the sleeve, a transformer attached to the bracket, said transformer having a secondary winding connected to said lamp, an enclosed switch also attached to said bracket, an operating plunger on said switch actuated by said operating member when said lens is depressed, a primary winding on the transformer, and contact members in said switch for controlling the energization of said primary winding.

8. A combined indicating lamp and push-button switch comprising a supporting sleeve having a transverse web with an opening therein, a housing slidably disposed in said opening, a lamp receptacle in said housing, a lamp bulb in said receptacle, a lens screwed into the housing to cover the lamp bulb, a spring surrounding the housing for biasing the housing outwardly in the sleeve, an operating member attached to the bottom of the housing by said receptacle to limit the outward movement of the housing, an L-shaped bracket having one leg attached to the sleeve, a transformer attached to said one leg, said transformer having a secondary winding connected to said lamp, an enclosed switch attached to the other leg of said bracket, an operating plunger in said switch actuated by said operating member when said lens is depressed, a primary winding on the transformer, contact members in the switch for controlling the energization of said primary winding, and a terminal on said switch connected to one terminal of the primary winding.

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9. In a control system, in combination, an electrically operated device having an actuating coil, a first switch having contact members for controlling the energization of the coil, a second switch having contact members for controlling the deenergization of the coil, a lamp for indicating the functioning of said device, said lamp being movable to actuate one of said switches, and auxiliary contact members actuated by said device and cooperating with the contact members of one of the switches in controlling the energization of the lamp.

10. In a control system, in combination, an electrically operated device having an actuating coil, a first switch having contact members for controlling the energization of the coil, a second switch having contact members for controlling the deenergization of the coil, a lamp for indicating the function of said device, said lamp being movable to actuate one of said switches, auxiliary contact members actuated by said device and cooperating with the contact members of one of the switches in controlling the energization of the lamp, and said lamp being movable to establish a testing circuit for the lamp independently of said auxiliary contact members.

11. In a control system, in combination, an electrically operated device having an actuating coil, a first switch having contact members for controlling the energization of the coil, a second switch having contact members for controlling the deenergization of the coil, a lamp for indicating the functioning of said device, said lamp being movable to actuate said first switch, auxiliary contact members actuated by said device to control the energization of the lamp, and said lamp being movable to establish a testing circuit for the lamp independently of said auxiliary contact members.

12. A combined indicating lamp and push-button switch comprising a supporting sleeve having an external mounting flange formed integrally therewith, a housing slidably disposed in the sleeve, a lamp bulb in the housing and movable therewith with respect to the sleeve, a lens disposed over the bulb and movable with the housing, a spring for biasing the housing outwardly in the sleeve, an operating member actuated by said housing when said lens is depressed, a unitary separately enclosed spring return switch supported by said sleeve, a transformer supported by said flange, and said switch having contact members actuated by said operating member to control the energization of said lamp through said transformer.

13. A combined indicating lamp and push-button switch comprising a supporting sleeve having an external mounting flange formed integrally therewith, a housing slidably disposed in the sleeve, a lamp bulb disposed interiorly of the housing and movable therewith with respect to the sleeve, a lens disposed over the bulb and movable with the housing, a spring for biasing the housing outwardly in the sleeve, an operating member actuated by said housing when said lens is depressed, a unitary separately enclosed spring return switch disposed exteriorly of the sleeve and supported by the flange, a transformer supported by said flange, and said switch having contact members actuated by said operating member to control the energization of said lamp through said transformer and to perform additional switching operations.

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