

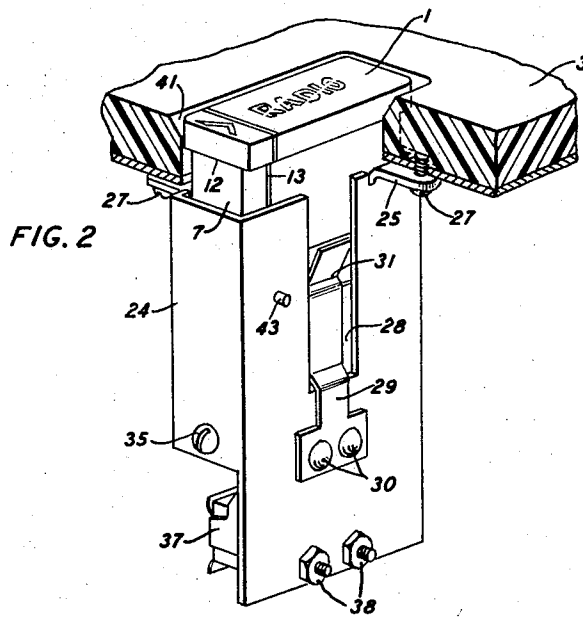
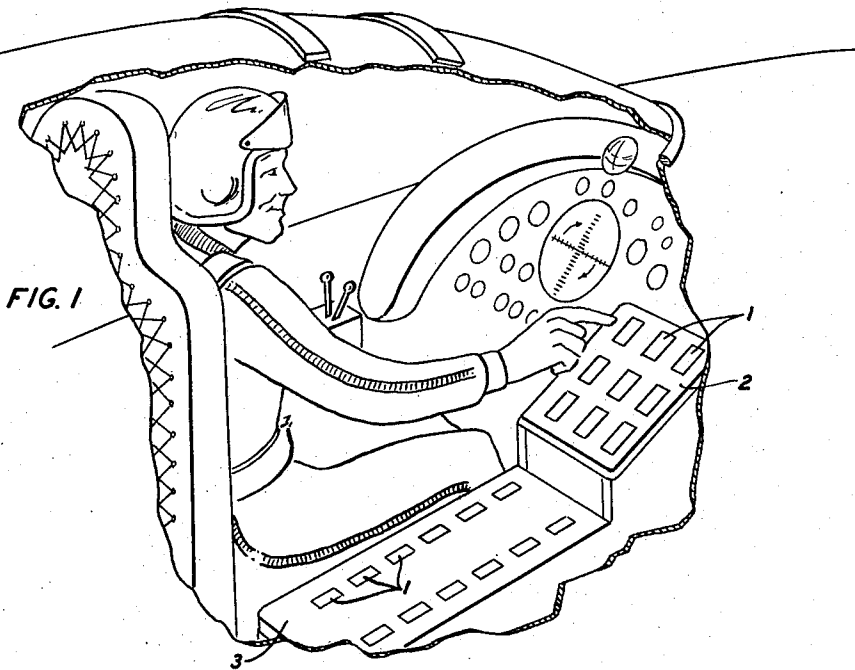
Sept. 15, 1959

C. H. F. SPRING
CIRCUIT CONTROLLER

2,904,662

Filed Dec. 30, 1957

2 Sheets-Sheet 1



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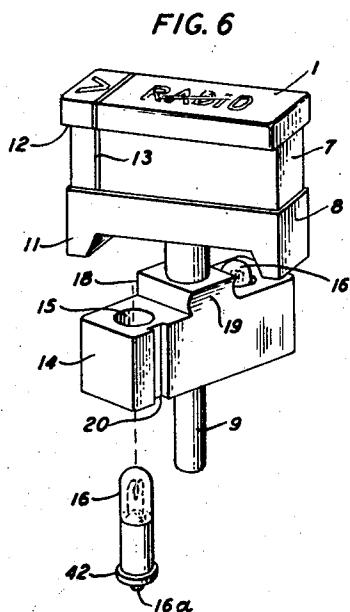
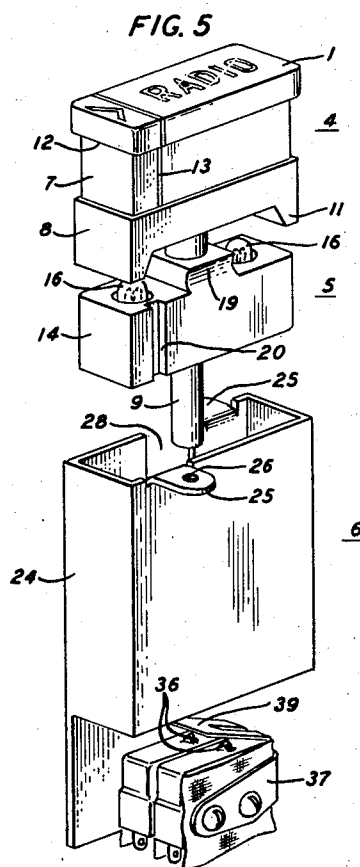
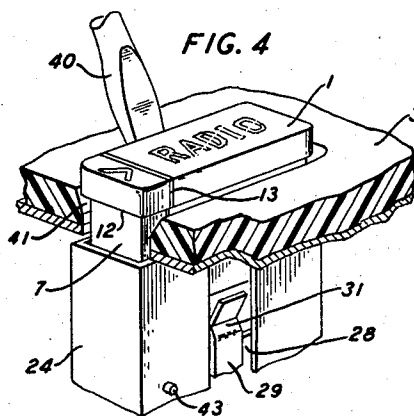
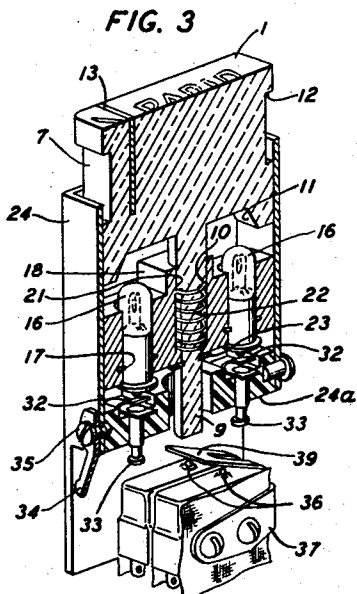
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2 Sheets-Sheet 2



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CIRCUIT CONTROLLER

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9 Claims. (Cl. 200—167)

This invention relates to circuit controllers and, more particularly, to a circuit controller having means for separately indicating different conditions of a controlled circuit.

In certain types of equipment, it is necessary to employ circuit controllers, such as push buttons, mounted in a panel in such manner that the front or top surface of each of the push buttons is normally flush with the surface of the panel. It is also required that the circuit controllers or push buttons be so constructed as to provide visual indications of the different conditions of a controlled circuit, such as the nature of the function to be performed, whether it is available, and whether the function has been performed. This can be conveniently accomplished by means of lamps located beneath the operating surfaces of the push buttons. When this has been done, it then becomes desirable that quick, convenient access to the lamps should be available so that, when a lamp burns out, it can immediately be removed and replaced with another lamp.

Accordingly, it is an object of this invention to provide an improved circuit controller.

It is also an object of this invention to provide a circuit controller with improved means for separately indicating different conditions of a controlled circuit.

An additional object of the invention is to provide a circuit controller of the push button type with a plurality of indicating lamps mounted beneath the operating surface of the push button in an improved manner for permitting quick removal and substitution of the lamps.

These and other objects of the invention are attained by constructing a push button of light-transmitting material and slidably mounted within a housing or casing. A plunger is attached to the push button for reciprocal movement therewith for the purpose of operating circuit-controlling contacts attached to the casing. In order to indicate the different conditions of the circuit controlled by the contacts, separate portions of the face of the push button are independently illuminated by a plurality of lamps which are slidably retained in recesses formed in a holder which is rotatably mounted on the plunger.

These and other features of the invention are more fully discussed in connection with the following detailed description of the drawing in which:

Fig. 1 illustrates one environment in which the flush-mounted, panel-supported circuit controllers of this invention are useful;

Fig. 2 is a three-dimensional view of a circuit controller in accordance with this invention and having its operating surface flush with the surface of a supporting panel;

Fig. 3 is a three-dimensional view partly in section of the circuit controller of this invention;

Fig. 4 illustrates the manner in which the push button and its lamp assembly can be readily extracted from its supporting panel;

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Fig. 5 is an exploded three-dimensional view of the circuit controller; and

Fig. 6 shows the lamp holder rotated on its supporting plunger for the purpose of removing a defective lamp.

In Fig. 1, the invention is represented as being applied to airborne equipment and is shown in the form of a plurality of push button circuit controllers 1 mounted in control panels 2 and 3 in such a manner that the operating surfaces 1 of the push buttons are flush with the top surfaces of the panels 2 and 3. The invention is particularly useful in this environment where, due to limited space and weight allocations, the ordinary conglomeration of rotary switches, toggle switches, knobs, and lamps is undesirable. Furthermore, such heterogeneous clusters of equipment do not meet the need for simplified manual controls which are essential for reducing mental and physical loads imposed upon people who operate high-speed, complex equipment. These requirements are fulfilled by the present invention which is a simple, compact, manual control device containing all necessary features, such as illumination sources, identification of the control function, and identification of different operational conditions of the control function.

As can be best seen in Fig. 5, the circuit controller of this invention comprises three principal components: a push button unit 4, a lamp holder unit 5, and a casing unit 6. In Fig. 5, the casing unit 6 is shown to be rotated 180 degrees with respect to the push button unit 4 and the lamp holder unit 5 in order to illustrate more clearly certain of its components. Considering firstly the push button unit 4, it includes an operating top surface 1, a middle recessed portion 7, a base portion 8, and a plunger 9 which extends downward from the middle of the base 8. All of these parts are integral with each other and are formed from any suitable light-transmitting material. The lower portion of the plunger 9 is of smaller diameter than the upper portion, as is best seen in Fig. 3, thereby providing a stop 10. The bottom edges of the base portion 8 project downward in such a manner as to form stops 11. The top portion 1 is slightly wider and longer than the middle portion 7 so as to form protruding edges 12 for a purpose described hereinafter.

The operating surface 1 is divided in two parts by a partition member 13 which extends downwardly through the recessed portion 7 toward the base portion 8. This partition 13 is made of any suitable opaque material. One of the divided parts of the operating surface 1 bears an appropriate legend and the other part is marked with suitable indicia. These markings may be opaque or, if desired, the operating surface 1 may be painted black and the markings may be formed by unpainted areas on the surface 1.

The lamp holder unit 5 includes a body member 14 made of any suitable electrically conductive material and is provided with two vertical bores 15 near each end. Each of the bores 15 is of suitable size for receiving a lamp 16 which is retained therein by a small circular spring 17 mounted in a groove formed in the wall of its associated bore 15. The springs 17 are made of electrically conductive material and, therefore, may be considered as being equivalent to electrical contacts embedded in the body member 14 for the purpose of completing electrical connections to the lamps 16. The top surface of the body member 14 has a raised portion 18 which functions as a stop. One side of this raised portion 18 has a transverse groove 19 formed therein. A keying slot 20 is cut vertically in one side wall of the body member 14.

The body member 14 is further provided with a vertical bore 21 through its middle portion for slidably receiving the plunger 9. The upper part of the bore 21 has a diameter which is slightly larger than the diameter of the upper part of the plunger 9 so as to permit the plunger 9 to slide freely therein. The lower part of the bore 21 has a diameter which is slightly larger than the diameter of the lower part of the plunger 9 so that this part of the plunger 9 can move freely therein. Thus, the lamp holder unit 5 is rotatably mounted or supported on the plunger 9.

The wider part of the bore 21 extends nearly to the bottom of the body member 14 thereby forming a recessed portion around part of the lower portion of the plunger 9 for receiving therein a coiled spring 22 which encircles this part of the lower portion of the plunger 9. The lower end of the coiled spring 22 rests on a seat formed by the top of the narrow portion of the bore 21 and the upper end of the coiled spring 22 presses against the stop 10 formed by the bottom of the thicker portion of the plunger 9.

In addition, the lamp holder unit 5, through the medium of the coiled spring 22, supports the push button unit 4 in such a manner as to permit reciprocal movement thereof. The extreme downward end of this reciprocal motion is limited by the engagement of the stops 11 with the top surface of the body member 14 and by the engagement of the raised portion 18 with the underneath surface of the base portion 8. The extreme upward end of this reciprocal motion is limited by the engagement of a small snap ring 23 with the underneath surface of the body member 14, this snap ring 23 being mounted in a circumferential groove in the lower part of the plunger 9. Any extended upward movement of the plunger 9 would cause the lamp holder unit 5 to move upward with it as is described hereinafter.

The casing unit 6 includes a receptacle member 24 of suitable dimensions for snugly and slidably receiving the lamp holder unit 5, the base portion 8 of the push button unit 4, and the lower part of the middle recessed portion 7 of the push button unit 4. The receptacle member 24 has two flanges 25 on opposite sides thereof. Each of the flanges 25 has a hole 26 drilled therein for the purpose of admitting a screw 27. These screws 27 serve to fasten the casing unit 6 to the underneath surface of one of the control panels, such as the panel 3, as is represented in Fig. 2.

One side of the receptacle member 24 is provided with a vertical slot 28. A leaf spring 29 has its lower end fastened by means of rivets 30 to the casing unit 6 at such a location that the upper part of the leaf spring 29 is received within the slot 28 as is shown in Fig. 2. The leaf spring 29 is crimped transversely near its upper end as is indicated by the reference numeral 31 in Fig. 2. The crimped portion 31 is so located on the leaf spring 29 that, when the push button unit 4 is inserted in the receptacle member 24, the crimped portion 31 snaps into the transverse groove 19 in the raised portion 18 of the body member 14 of the lamp holder unit 5. This enables the receptacle member 24 to hold or retain both the lamp holder unit 5 and the push button unit 4 subject to their removal therefrom in a manner described hereinafter.

As can be seen in Fig. 3, two conventional spring contact members 32 are mounted on insulating material which forms the bottom 24a of the receptacle member 24. The contact members 32 are properly located for the purpose of engaging conventional button contacts 16a on the ends of the lamps 16. Each of the spring contacts 32 has a terminal post 33 extending through the bottom 24a of the receptacle member 24 and protruding therefrom in order to facilitate their connection to separate electrical circuits which, since they form no part of the present invention, are not shown in the drawing. A contact clip 34 is secured to the lower part of an end wall of

the receptacle member 24 by one of a pair of screws 35 which also serve to hold the bottom member 24a in place. The contact clip 34 is provided for the purpose of completing electrical connections to the lamps 16.

Thus, one side of the lighting circuits of the lamps 16 extends from the terminal posts 33 to the spring contacts 32 and then to the bottom button contacts 16a of the lamps 16. The other side of the lighting circuit extends from the contact clip 34 to the body member 14 of the lamp holder unit 5. Since the body member 14 is made of electrically conductive material, this side of the lighting circuit continues through the body member 14 to the circular springs 17 and then to the shells of the lamps 16.

A pair of conventional circuit-controlling mechanical contacts 36 are secured to the lower part of the casing unit 6 by a clamp 37 which is fastened thereto by bolts 38. The clamp 37 is provided with an integral spring operating member 39 for operating the contacts 36. This spring operating member 39 is positioned immediately beneath the bottom end of the plunger 9.

When the operating surface 1 of the push button unit 4 is manually depressed, it actuates the plunger 9 and causes it to move downward through the central bore 21 in the body member 14 of the lamp holder unit 5 thereby compressing the coiled spring 22. In moving downward, the bottom end of the plunger 9 engages the spring member 39 and pushes it down against the contacts 36. As was stated above, the extent of the downward travel of the plunger 9 is limited by the stops 11 on the base portion 8 of the push button unit 4 and also by the stop constituted by the raised portion 18 on the top of the body member 14 of the lamp holder unit 5.

Upon release of the manually exerted pressure, the coiled spring 22 causes the plunger 9 and its push button unit 4 to move upward to their normal, or unoperated, positions. The extent of this upward movement is limited, as was explained above, by the engagement of the snap ring 23, which is on the lower part of the plunger 9, with the underneath surface of the body member 14 of the lamp holder unit 5. This upward movement of the plunger 9 allows the spring operating member 39 to return to its normal position.

It can be understood that, for certain types of equipment, it is desirable to use a large number of circuit controllers, as is indicated in Fig. 1. As each of these push button circuit controllers includes two lamps 16, it can be seen that, with such a large number, it is probable that one or more of them will burn out from time to time. When this happens, it is imperative that they be immediately removed and replaced. Since the top surface 1 of the push button unit 4 is flush with the surface of its associated control panel 3, as is shown in Fig. 2, it is not possible to remove it by manually grasping it. Furthermore, in some instances, the person who is attempting to replace a defective lamp 16 might be wearing gloves which would render the procedure still more difficult. In addition, the push button unit 4 is, at this time, being held in the receptacle member 24 due to the engagement of the crimped portion 31 of the leaf spring 29 with the groove 19 in the raised portion 18 of the body member 14 of the lamp holder unit 5.

However, due to the fact that the top operating face 1 has protruding edges 12 produced by the recessed portion 7 of the push button unit 4, the problem is greatly simplified. All that is necessary is to insert a thin, flat edge of a tool 40, such as a screw driver, into the space between the panel 3 and the operating surface 1 of the push button unit 4. When this is done, the operating surface 1 can be readily pried, or raised up, as is shown in Fig. 4, thereby disengaging the crimped portion 31 of the leaf spring 29 from the groove 19 in the raised portion 18 of the body member 14. The insertion of the tool 40 can be simplified if the surrounding area of the

panel 3 is provided with beveled edges as is indicated by the reference numeral 41 in Fig. 4.

After the operating surface 1 has been thus raised up, it can be firmly grasped so that the push button unit 4 can be readily pulled out, bringing with it the lamp holder unit 5 due to its above-described engagement with the snap ring 23 on the plunger 9. Next, by simply rotating the lamp holder unit 5 about the plunger 9, convenient access to the defective lamp 16 may be had. The lamp 16 can now be easily pushed out of its retaining bore 15 as is shown in Fig. 6. A new lamp 16 can quickly be inserted into the bore 15 and pushed up until a flange 42 at the bottom of the lamp 16 engages the underneath surface of the body member 14 of the lamp holder unit 5.

The push button unit 4 and its attached lamp holder unit 5 can now be readily inserted into the receptacle member 24 of the casing unit 6 and pushed down until the crimped portion 31 of the leaf spring 29 snaps into place in the groove 19 in the raised portion 18 of the lamp holder unit 5.

In order to insure that the units 4 and 5 are inserted into the correct receptacle 24, the receptacle member 24 is provided with a keying pin 43 which is so positioned as to slide in the keying slot 20 in the body member 14 of the lamp holder unit 4. Each of the circuit controllers has a similar keying pin and slot placed at a different location so as to obtain individual identification. If desired, more than one keying pin and slot may be used to identify any one of the circuit controllers.

As was stated above, this circuit controller provides separate visual indications of the different conditions of a controlled circuit, such as function not available, function is available, and function has been performed or is operating. For example, when neither of the lamps 16 is illuminated, this could serve as an indication that the particular function identified by the legend at the right on the operating surface 1 is not available. When the lamp 16 as the right side of the plunger 9 is illuminated, its rays will light the above-mentioned legend but, due to the barrier constituted by the partition 13, the indicia at the left on the operating surface 1 will not be illuminated. This condition could signify that the function is available. When both of the lamps 16 are illuminated, such as after the plunger 9 has effected the operation of the mechanical contacts 36, both the indicia and the legend will be illuminated. This lighting of the entire operating surface 1 could signify that the particular function has been performed or is operating.

What is claimed is:

1. A circuit controller comprising in combination circuit-controlling contacts, a plunger for operating said contacts, an actuator attached to said plunger for effecting movement thereof, a lamp for illuminating said actuator, and a lamp holder rotatably mounted on said plunger and formed with an opening therein for receiving said lamp.

2. A circuit controller in accordance with claim 1 and further comprising a receptacle member for receiving therein said lamp holder, and means for facilitating the removal of said lamp holder from said receptacle member, said means including an instrumentality attached to said plunger for forcing said rotatably mounted lamp holder to follow an extended movement of said plunger.

3. In combination, a control panel having a top surface, a circuit controller comprising a push button unit having a top operating surface, a casing unit for receiving therein said push button unit, and instrumentalities for fastening said casing unit to said control panel with said operating surface of said push button unit flush with said top surface of said control panel, said push button unit having means forming at least one protruding edge on said operating surface for facilitating its extraction from said casing unit, said means including a recessed

portion of said push button unit located immediately beneath said operating surface and attached thereto.

4. A circuit controller comprising a push button unit having an actuating surface, a base portion attached to the bottom of said actuating surface, a lamp holder unit having a bore formed therein and extending completely through said lamp holder unit near one end thereof and adapted to slidably receive a lamp, said lamp holder unit having another bore formed therein and extending completely through the middle of said lamp holder unit, and a plunger attached to the middle of the bottom of said base portion of said push button unit for actuation by said top actuating surface, said plunger extending downward therefrom through said second-mentioned bore for rotatably supporting said lamp holder unit thereon.

5. A circuit controller in accordance with claim 4 and further comprising a coiled spring encircling a portion of said plunger and seated within said second-mentioned bore for supporting said push button unit for reciprocal movement thereof.

6. A circuit controller in accordance with claim 4 and further comprising means in said lamp holder unit for supporting said push button unit for reciprocal movement thereof, and instrumentalities for limiting the extent of the reciprocal movement of said push button unit in one direction, said instrumentalities including stop members formed integrally at each end of said base portion of said push button unit and adapted to engage said lamp holder unit, and means for limiting the extent of the reciprocal movement of said push button unit in another direction, said last-mentioned means including a member positioned beneath said lamp holder unit and attached to said plunger.

7. A circuit controller comprising a push button unit having a top actuating surface, a base portion attached to the bottom of said actuating surface, a lamp holder unit having two bores formed therein, each of said bores extending completely through said lamp holder unit near a respectively different end thereof and adapted to slidably receive a lamp, said lamp holder unit having a third bore formed therein and extending completely through the middle of said lamp holder unit, and a plunger attached to the middle of the bottom of said base portion of said push button unit for actuation by said top actuating surface, said plunger extending downwardly through said third bore for rotatably supporting said lamp holder unit thereon.

8. A circuit controller in accordance with claim 7 and further comprising means in said lamp holder unit for supporting said push button unit for reciprocal movement thereof, and instrumentalities for limiting the extent of the reciprocal movement of said push button unit, said instrumentalities including a raised portion formed integrally on said lamp holder unit and adapted to engage said push button unit, said third bore extending through said raised portion, and said raised portion being spaced apart from said two end bores.

9. A circuit controller in accordance with claim 8 and further comprising a receptacle member for slidably receiving therein said lamp holder unit and at least a portion of said push button unit, means for retaining said units in place in said receptacle, said means including a slot formed in said receptacle member, a leaf spring having a first part fastened to said receptacle member and having a second part received within said slot, said second part of said leaf spring having a crimped portion, and a groove formed in said raised portion of said lamp holder unit for engaging and retaining therein said crimped portion of said leaf spring.

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