

April 7, 1953

H. W. BATCHELLER

2,634,340

PUSH-BUTTON SWITCH

Filed May 8, 1950

3 Sheets-Sheet 1

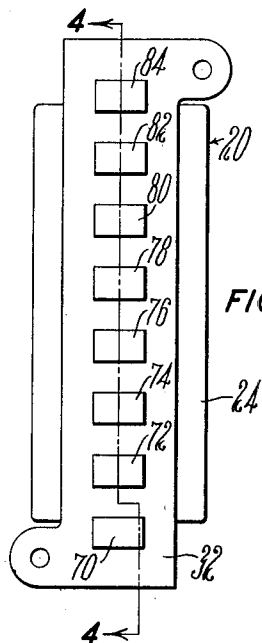


FIG. 1

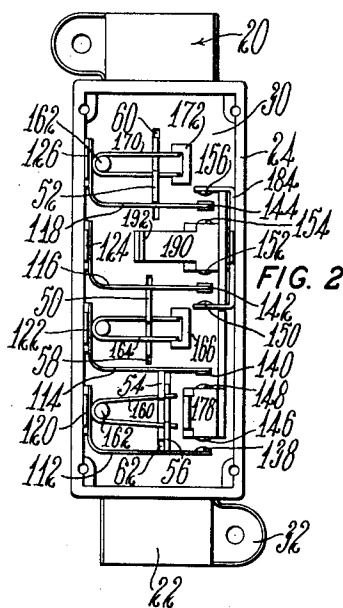


FIG. 2

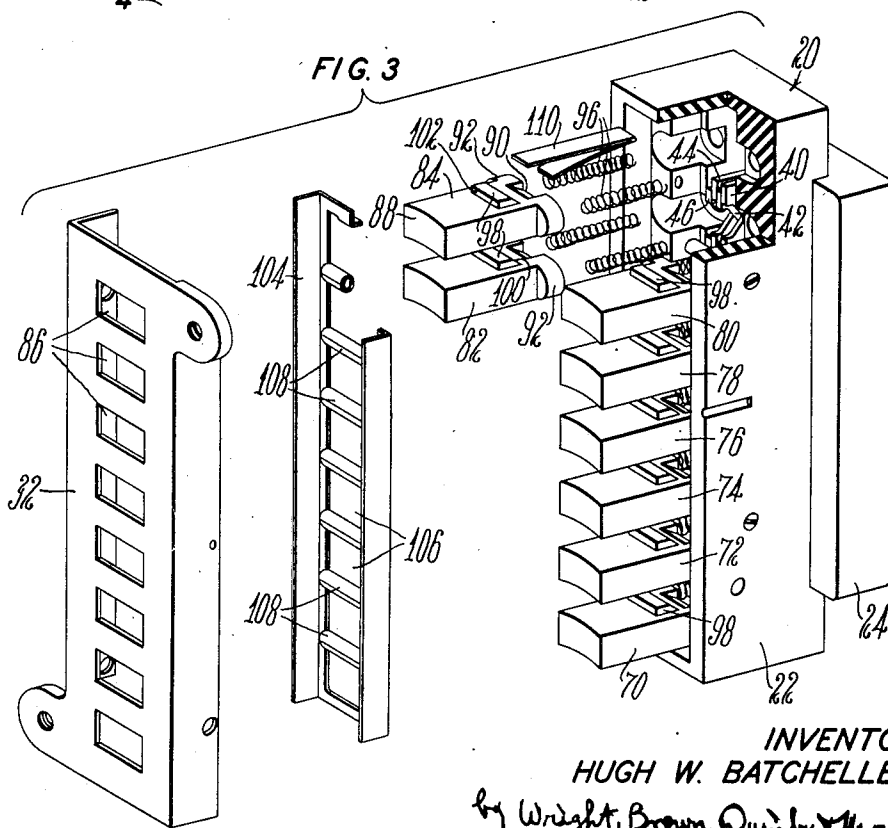


FIG. 3

INVENTOR
HUGH W. BATCHELLER
by Wright, Brown, Quinby & May
ATTYS.

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3 Sheets-Sheet 3

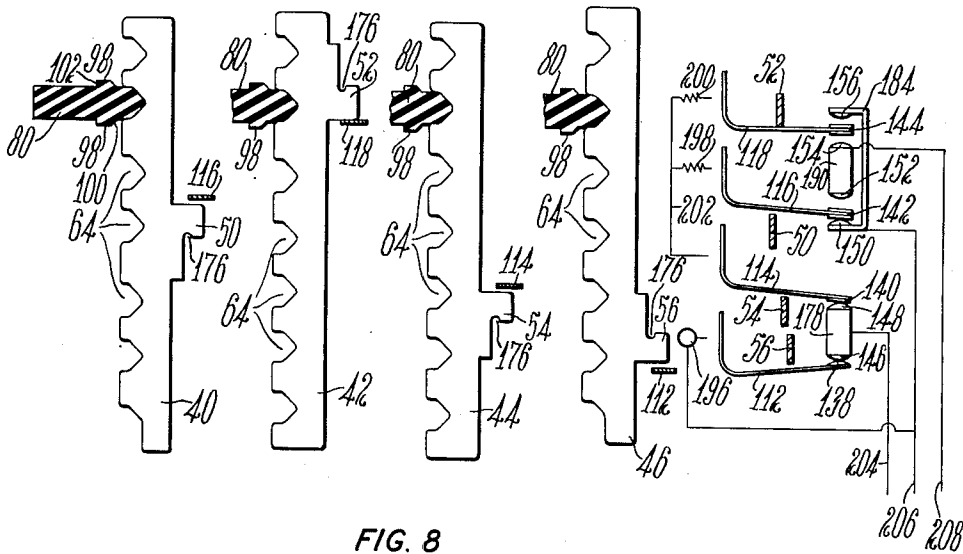


FIG. 8

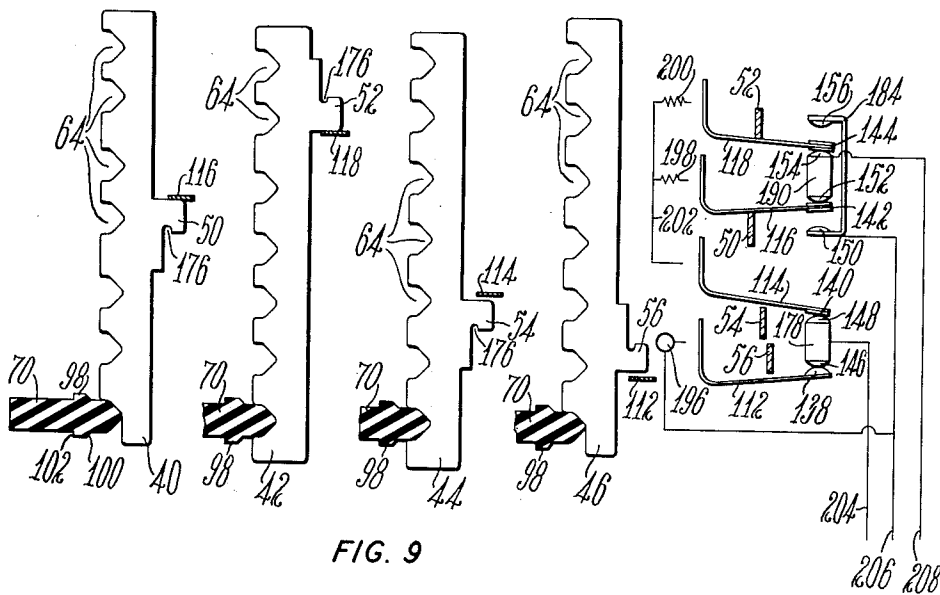


FIG. 9

INVENTOR
HUGH W. BATCHELLER
by Wright, Brown, Quincy May
ATTYS

UNITED STATES PATENT OFFICE

2,634,340

PUSH-BUTTON SWITCH

Hugh W. Batcheller, Newton, Mass.

Application May 8, 1950, Serial No. 160,667

4 Claims. (Cl. 200—5)

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This invention relates to a push-button switch of a type which is sometimes used on electric ranges or similar apparatus having a plurality of circuits to be connected in different combinations. It is an object of the invention to provide a push-button switch which operates easily and positively, which is composed of relatively simple and easily manufactured parts, which can be readily assembled, and which is reliable and durable in operation.

In the embodiment of the invention herein shown and described, a set of eight push-buttons is included in a switch designed for use with a range unit consisting of two elements adapted to be connected to a three-wire power circuit in various ways to give seven degrees of heating according to which of seven of the buttons is pressed, the eighth button being a release button to restore to the "off" position any button which has been pushed in to close a circuit through one or both of the heating elements in the unit.

For a more complete understanding of the invention reference may be had to the following description thereof and to the drawing, of which—

Figure 1 is a front elevational view of a push-button switch embodying the invention;

Figure 2 is a rear elevation of the same;

Figure 3 is an exploded perspective view of the switch, portions being broken away to show in section;

Figure 4 is a section on the line 4—4 of Figure 1;

Figure 5 is a section on the line 5—5 of Figure 4;

Figure 6 is a perspective view of the rear portion of the switch, the cover being shown as removed;

Figure 7 is a fragmentary exploded view of one of the fixed terminals and bridging conductors;

Figure 8 is a diagrammatic view of the slides in one position of operation and the corresponding circuits; and

Figure 9 is a diagrammatic view of the slides in another position of operation and the corresponding circuits.

The switch may include a molded casing member 20 which is elongated and is shown in the drawings and hereinafter described as in a vertical or erect position. This casing, which may be molded in one piece if desired, has a front portion 22 and a rear portion 24, the former being longer, narrower and deeper than the latter. These two portions have a common partition wall 26 which defines front and rear chambers 28 and 30. A front cover 32 closes the chamber 28, a rear

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cover 34 closing the rear chamber 30. The casing member 20 is of moldable insulating material, the front cover 32 being of sheet metal or any other suitable material. The rear cover 34 is preferably a plate of insulating material. The switch elements themselves are enclosed in the rear chamber 30. The front chamber 28 encloses the actuating means by which the movable switch elements are operated. For this purpose, a plurality of slides 40, 42, 44, and 46 are mounted side by side in a central channel in the front chamber 28 and are adapted to slide vertically a limited distance therein. The extent of sliding movement of each of these slides is positively limited by lugs 50, 52, 54, and 56 respectively. These lugs project through slots in the partition wall 26. Thus the lug 50 projects through a slot 58. The lug 52 projects through a slot 60. The lugs 54 and 56 project through a slot 62. Each of these slots is of limited length so that the portion of each lug which rides in a slot engages one end or the other of the slot when the corresponding slide reaches its limits of movement. Each lug has a longer portion immediately adjacent to the slide and a shorter portion projecting into the rear chamber 30 to engage switch elements as hereinafter described. In the forward edge of each slide is a series of V-notches 64 adapted to be entered by corresponding buttons which have wedge ends for this purpose. In the switch illustrated on the drawings, eight such buttons are provided as at 70, 72, 74, 76, 78, 80, 82, and 84. As these buttons are preferably of identical shape and construction, the description of one will serve for all. The button 84 shown in Figure 3 is preferably a molded plastic member which is somewhat elongated and may have a rectangular cross section slidably fitted through one of the rectangular apertures 86 in the front cover plate 32. The button 84 may be slightly dished as at 88 at its forward end to receive a finger tip of the operator when the button is to be pushed in for operation of the switch. Each button has at its rear end a central wedge 90 which is adapted to enter and fit in corresponding V-notches 64 in the several slides. On either side of the wedge 90 at the rear end of the button is a semi-cylindrical projection 92 having a bore 94 extending therein to receive the end of a compression spring 96. There are thus two springs 96 provided for each button, these springs being normally compressed so as to press the button forward. The semi-cylindrical projections 92 of each button extend beyond the side walls of the rectangular portion and thus serve as stops to limit the forward or outward movement of the

button. On two opposite side faces of the rectangular portion of each button are a pair of locking lugs 98, the purpose of which is to retain any of the seven active buttons in its rearward position until the locking means is released, the uppermost button 84 being simply for releasing any of the other buttons which may be pushed in to its rearward position. Each lug 98 has an inclined cam face 100 at its rear end and a front face 102 on which a latch element can catch. Cooperating with these locking lugs is a locking plate 104, this plate having a series of openings 106 large enough to receive a button and its lugs 98. The locking plate 104 may conveniently be made of sheet metal which can be punched and stamped to shape. A portion of the metal which is cut away to form the apertures 106 is preferably rolled into a cylinder 108, one such cylinder being between each pair of successive apertures 106. These cylinders are the latch elements which engage lugs 98 on the push-buttons. When a button is pushed in, the cam face 100 of its upper lug 98 engages the corresponding latch element 108 and cams the locking plate 104 upward. The weight of the locking plate 104 tends to move it down so that when a button is pushed further in and the latch element 108 moves beyond the lug 98, the plate then drops so that the latch element 108 catches on the lug 98 and maintains the button in its rearward position. In Figure 4 the button 82 occupies such position, its upper lug 98 being caught behind a cylinder 108 of the locking plate 104. In order to insure the proper operation of the locking plate 104 when the switch is mounted in any desired position, a suitable leaf spring 110 is mounted in the upper end of the front chamber 20 so as to bear resiliently against the upper end of the locking plate 104. It may be observed that whenever any one of the buttons is pushed in, the locking plate 104 is lifted so that if another button is in its "in" position, it is thereupon released and is pushed forward to its "out" position by its springs 96. The only function of the uppermost button 84 is thus to release any of the other buttons which may be locked in its "in" position. The notches 64 in the several slides are approximately in line with the wedge ends of corresponding buttons but are for the most part slightly offset up or down so that when any one of the seven active buttons is pressed inward, its wedge end 90 cams one or more of the slides so as to move such slides longitudinally and thus to operate one or more of the movable switch elements in the rear chamber 30. The notches 64 are so arranged that when any one of the seven active buttons is pushed all of the way in so as to line up the corresponding notches in the four slides, then at least one of the notches opposite each of the other six active buttons is out of alignment with the wedge end of its corresponding button. Hence not more than one button can be pushed all the way in at the same time.

The four lugs which project through the partition wall 26 into the rear chamber 30 move up and down with their respective slides and press against corresponding resilient elements which, as shown on the drawings, are bridging conductors carrying contact points. As indicated in Figure 2, four such resilient bridging conductors 112, 114, 116, and 118 are mounted in the rear chamber 30. These bridging conductors are secured at one end to respective terminal members 120, 122, 124, and 126, so that the free end of each conductor swings in a plane parallel to

the direction of movement of the slides. A typical bridging conductor and its terminal member are illustrated in Figure 7. As therein shown, conductor 112 consists of a strip of spring metal such as bronze which is bent to an L shape except that the bend is curved. The short leg of the L is permanently secured to the terminal member 120 by any suitable means such as extruded eyelets 130 which pass through holes 132 in the conductor and are clinched. The terminal member 120 is preferably made of heavy strip metal, a portion of which is a blade projecting through the rear cover plate 34 as indicated in Figure 4. The other end of the member 120 fits into a suitable recess 134 in the partition wall 26. The short leg of the L-shaped conductor 112 is thus firmly fixed. The free end portion 136 of the conductor is provided with a contact point or element 138 which is clinched in a hole in the end portion 136 and moves therewith when the long leg of the L is pushed back and forth, the motion of the movable contact element 138 being in a direction substantially parallel to the sliding movement of the four slides. As shown in Figures 2, 8, and 9, the conductors 112 and 114 are provided with single contact elements 138 and 140 but the conductors 116 and 118 are provided with double contact elements 142 and 144 respectively. All of these elements move in paths which, while slightly arcuate, are substantially parallel to the direction of movement of the slides. Fixed contact elements 146, 148, 150, 152, 154, and 156 are mounted within the chamber 30 in positions to be engaged by corresponding movable contact elements. For the operation of the bridging conductor 112, the lug 56 bears against it at an intermediate point between the bend and the free end which carries the contact element 138. In like manner the conductor 114 is engaged by an edge of the lug 54, the conductor 116 is engaged by the lug 50, and the conductor 118 is engaged by the lug 52. The lugs are pressed toward the respective bridging conductors by springs which are in the rear chamber, these springs being preferably in the shape of hairpins. Thus a spring 160 is mounted against the partition wall 26 with the bend of the spring engaging on a short pin 162 which is integral with and projects from the wall 26. The legs of the spring 160 diverge when unstressed but are sprung together to engage the lugs 56 and 54 respectively so as to press the lug 56 against the conductor 112 and to press the lug 54 against the conductor 114. In like manner a spring 164 is mounted against the partition wall 26, one of the lugs of this spring being arranged to press against the lug 58 so as to press this lug against the conductor 116. The legs of the spring 164 diverge at a considerable angle when the spring is unstressed. These legs are held in approximately parallel position by a stop member 166 which may be integral with the partition wall 26 and has a C shape, the arms of which confine the legs of the spring 164 in a state of tension so that when the lug 50 is moved downward by its slide, it is resisted by a considerable initial tension of the spring 164. When the slide is released, the spring 164, being stronger than the resilient conductor 116, moves the lug 50 and its slide upward until the spring is stopped by the stop member 166. At this point the double contact element 142 is in a neutral position between the fixed elements 150 and 152. The slide carrying the lug 50 is movable by certain of the push-buttons to an active position in which it causes the contact

element 142 to bear against the fixed element 152, as shown in Figure 9. Other push-buttons move the lug 50 in the other direction against the pressure of the spring 164, permitting the conductor 116, which is under tension, to press the contact element 142 against the fixed point 150.

In like manner a hairpin-shaped spring 170 is mounted against the partition wall 26, the legs of this spring being confined under tension by a stop member 172 which may be similar to the stop member 166. A leg of the spring 170 bears against the lug 52 when the parts are in the positions shown in Figure 2, the lug 52 being pressed in the opposite direction by the weaker spring of the conductor 118. The movable contact element 144 is then midway between the fixed elements 154 and 156 and is out of contact with both of these elements. Movement of the lug 52 downward brings the contact element 144 into contact with the fixed element 154. Movement of the lug 52 upward from the position shown in Figure 2 permits the resilient element 118 to spring upward to press the element 144 against the element 156.

In order to maintain the springs 160, 164, and 170 in place during the operation of the switch, the lugs 50, 52, 54, and 56 may each be notched as at 175 so as to receive a leg of one of the springs and to hold the spring against working away from the wall 26.

The fixed contact elements are electrically connected with suitable terminals which project from the rear cover of the switch. Thus the elements 146 and 148 are mounted in a metal strip 178 which is bent to a U-shape so that the contact elements face in opposite directions for engagement by corresponding movable elements, and a blade 180 projects up through a suitable slot 182 in the rear cover of the switch so as to receive a complemental electric connector member when the switch is connected in a circuit. Likewise the fixed contact elements 150 and 156 are mounted on a metal member 184 having a blade 186 projecting through a notch 188 in the rear cover plate 34. The fixed elements 152 and 154 are connected by a metal member 190 to which they are secured, this member having a blade 192 projecting up through a slot 194 in the rear cover 34.

Two representative operating conditions of the switch are diagrammatically illustrated in Figures 8 and 9. Figure 8 shows the positions of the four slides when the button 80 is pushed in so as to align the four notches opposite to this button. In aligning the notches the wedge of the button 80 moves the slides 40 and 44 downward and the slide 46 upward, the slide 42 not being moved since the notch in that slide is normally in alignment with the wedge end of the button 80. Downward movement of the slide 40 and its lug 50 permits the conductor 116 to press the movable contact element 142 against the fixed element 150. Downward movement of the slide 44 with its lug 54 permits the conductor 114 to press the movable contact element 140 against the fixed element 148. Upward movement of the slide 46 with its lug 56 permits the conductor 112 to press the movable element 138 against the fixed element 146. As indicated in the diagram in Figure 3, the conductor 112 is permanently connected to a pilot light 196, the conductor 116 is permanently attached to a low heating element 198 and the conductor 118 is permanently attached to a high heating element 200, the low and high heating elements consti-

tuting a heating unit for a range. The conductor 114 is permanently connected to a return wire 202 from both of the heating elements 198 and 200.

When the switch is properly connected in service, the fixed contact elements 146 and 148 are connected to the low potential wire 204 of a three-wire power circuit. The fixed elements 150 and 156 are connected to the ground wire 206 and the fixed elements 152 and 154 are connected to the high potential wire 208. In ordinary power supply sources, there is a voltage of approximately 110-115 volts maintained between the wires 204 and 206 and between the wires 206 and 208, the voltage between the low wire 204 and the high wire 208 being approximately 220-230 volts. Thus when the button 80 is pushed in as indicated in Figure 8, the low element 198 is connected between the ground wire 206 and the low potential wire 204, the high unit 200 not being connected. Thus low heat is obtained from the unit.

When the button 70 is pushed in, the slides take the relative positions diagrammatically indicated in Figure 9, the slides 40 and 46 being cammed upward, the slides 42 and 44 being cammed downward. As a result of the upward movement of the slide 40, the lug 50 pushes against the conductor 116 so as to press the contact element 142 against the fixed element 152. The downward movement of the slide 42 with its lug 52 pushes against the conductor 118 so as to press the contact element 144 against the fixed element 154. The downward movement of the slide 44 with its lug 54 permits the conductor 114 to press the element 140 against the fixed element 146. The upward movement of the slide 46 and its lug 56 permits the conductor 112 to press the element 138 against the fixed element 146. Thus the heating elements 198 and 200 are each connected in parallel between the low potential wire 204 and the high potential wire 208 thus getting the maximum amount of heat from the heating unit. In like manner the notches in the slides 40, 42, and 44 are so arranged that when the button 82 is pressed in, the two heating elements 198 and 200 are connected in series in a 110-volt circuit, this giving the lowest degree of heat obtainable from the unit. When the button 78 is pressed in, the high element 200 is connected in a 110-volt circuit. The button 76 connects both heating elements in parallel in a 110-volt circuit. The button 74 connects the low element 198 in a 220-volt circuit, and the button 72 connects the high element 200 in a 220-volt circuit. The notches in the slide 46 are so located that the pilot light is connected in a circuit every time any of the seven active buttons is pushed in.

I claim:

1. A push-button switch comprising a casing, an elongated slide longitudinally movable in said casing, said slide having a series of V-notches in its forward edge and a lug projecting from its rear edge, a resilient member pressing against said lug in a direction parallel to the movement of the slide, a spring element engaging said lug and opposing a stronger force to the pressure of said resilient member, a fixed stop element against which said spring element normally presses, and an actuating member carried by said casing to move said slide and its lug, said actuating member having a wedge portion arranged to enter one of said V-notches to cam said slide.
2. A push-button switch comprising a casing, a

slide longitudinally movable in said casing, actuating means operable to move said slide from a normal position, a lug projecting from an edge of said slide, a strip of spring metal mounted at one end in said casing and swingable in a plane parallel to the direction of movement of said slide, said strip normally pressing against an edge of said lug, a hair-pin-shaped spring mounted in said casing, stop elements engaging the ends of said spring to hold them closer together than their normal spacing, one leg of said spring bearing against the edge of said lug opposite to said strip to oppose movement of said lug and slide in a direction away from said strip, a contact element carried by the free end of the strip, and a fixed contact element engageable by the movable contact element when said strip is swung.

3. A push-button switch comprising a casing, a plurality of parallel slides in said casing, actuating means operable to move said slides lengthwise selectively, a lug projecting from the rear edge of each said slide, resilient members mounted at one end only in said casing to swing in a plane parallel to the direction of movement of the slides, each said resilient member being normally engaged at an intermediate point by a corresponding lug, springs mounted in said casing and arranged to press respective lugs and resilient members toward each other, a contact element mounted at the free end of each said resilient member for movement therewith in a direction parallel to the direction of movement of the slides, and fixed contact elements mounted in said casing for contact by corresponding movable contact elements.

4. A push-button switch comprising a casing having a partition wall defining front and rear chambers, said wall having short narrow slots therethrough, a plurality of slides slidably mounted in said front chamber, each slide having a lug extending through one of said slots, a plurality of resilient conductors mounted at one end in said rear chamber, each conductor having a contact element at its free end and engaging one of said lugs to be swung thereby when the corresponding slide is moved, fixed contact elements mounted in said rear chamber for engagement by respective movable contact elements, hair-pin-shaped springs mounted on said wall, stop elements on said wall engaging the legs of said springs to hold them under tension, said springs bearing against respective lugs in opposition to pressure by said resilient conductors against the lugs, and actuating means in the front chamber operable to move said slides selectively.

HUGH W. BATCHELLER.

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