May 27, 1941. D. G. KIMBALL 2,243,566

ELECTRIC SWITCH

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Fig. 1.

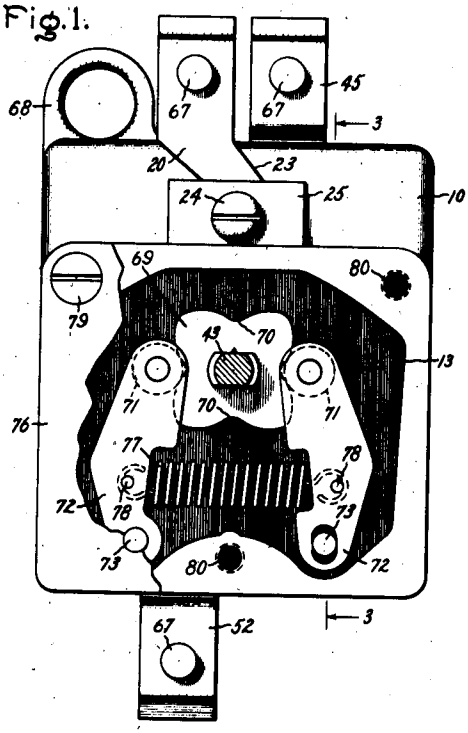


Fig. 2.

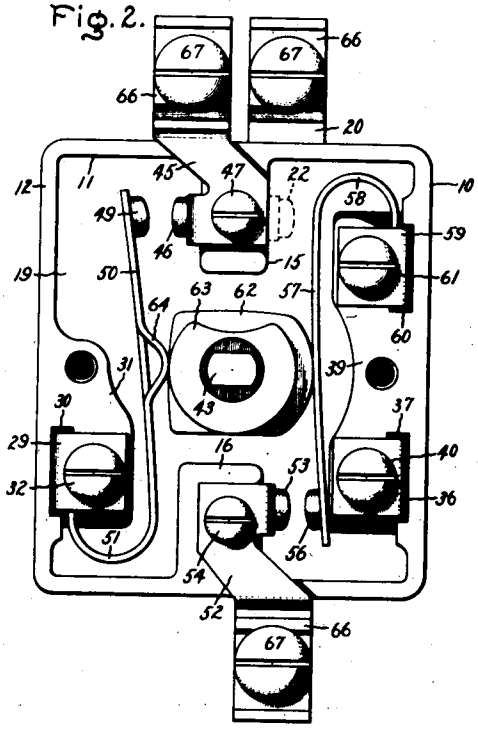


Fig. 3.

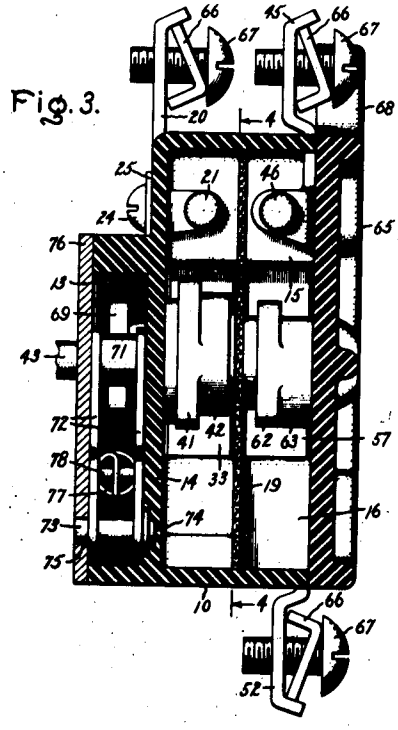
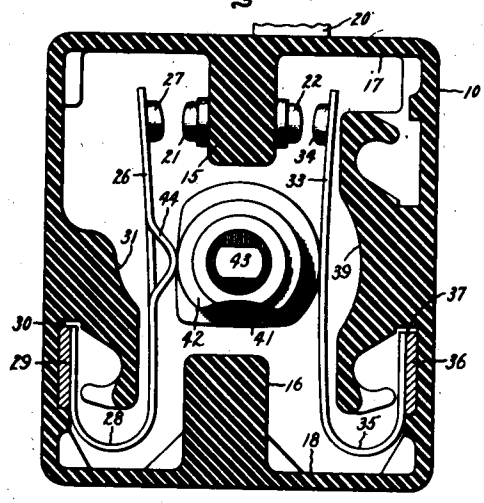


Fig. 4.



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Fig. 5.

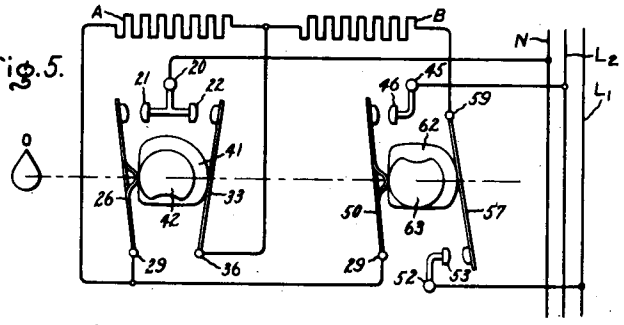


Fig. 6.

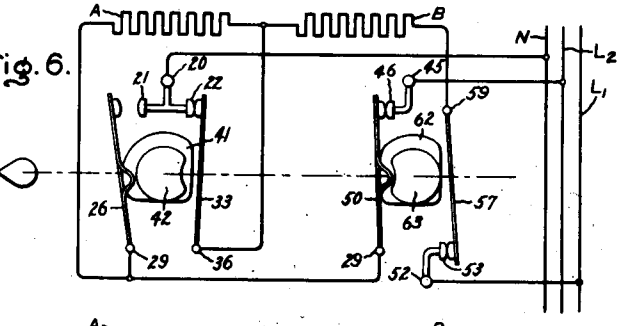


Fig. 7.

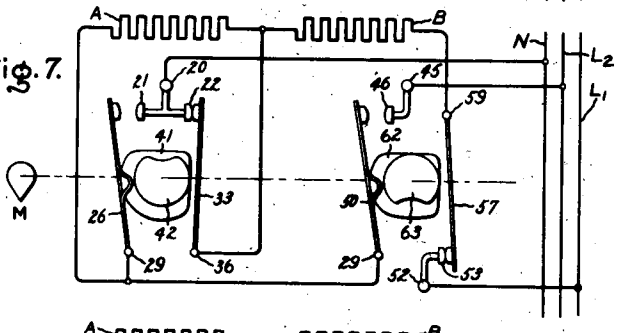
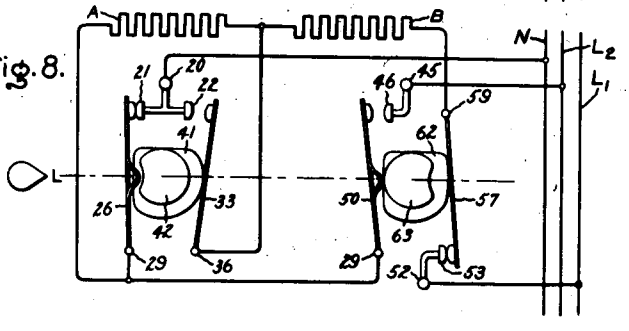


Fig. 8.



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UNITED STATES PATENT OFFICE

2,243,566

ELECTRIC SWITCH

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Application April 13, 1939, Serial No. 267,567

3 Claims. (Cl. 200—6)

This invention relates to electric switches, and more particularly to switches for controlling electric heating systems, for example, electric ranges.

The object of the invention is the provision of an improved construction and arrangement in switches of the type described composed of relatively few parts, which are easily assembled and manufactured at low cost.

In the accompanying drawings Fig. 1 is a view of the front of the switch with a portion of the casing removed to show the positioning mechanism; Fig. 2 is a view of the rear of the switch with the closure plate removed showing the interior of the switch; Fig. 3 is a sectional view through the switch along the line 3—3 of Fig. 1; Fig. 4 is another view of the interior of the switch similar to the showing of Fig. 2 but taken along the line 4—4 of Fig. 3; and Figs. 5 to 8, inclusive, are diagrammatic showings of the switch connected to control a two-part heater system such as is used on electric ranges.

Referring to the drawings the switch is provided with a base member 10 of insulating material, such as a phenolic condensation product and filler, formed on one side with a recess 11 extending from the rear face 12; a second recess 13 extends from the front face of the base member and the two recesses 11 and 13 are separated by a partition 14. The recess 11 provides a housing for mounting the switch mechanism while the recess 13 forms a housing for a positioning mechanism.

The switch mechanism includes a plurality of fixed and movable contacts which are moved into engagement with one another in predetermined sequence in accordance with the requirements of the heater system with which the switch is to be used. The recess 11 is provided with two bosses 15 and 16 extending from the opposite walls 17 and 18 thereof and these bosses serve to divide the recess generally into right- and left-hand compartments, as shown by Figs. 2 and 4. The fixed and movable contacts are arranged generally at two different levels within the recess 11 and the levels are defined by a plate or partition 19 which may be formed of insulating material, for example, sheet fiber. The two different levels will be referred to as an "upper" level located between the partition 19 and the outer edge 12 of the base member and a "lower" level located between the partition 19 and the partition 14 forming the bottom of the recess 11.

Turning now to the switch mechanism which occupies the lower level, as shown by Figs. 3 and 4, a terminal member 20 is provided with an integral U-shaped contact structure having the contact arms 21 and 22 of the U located within the recess 11 on each side of the boss 15 in engagement with the walls thereof. As shown by Fig. 1, the body of the terminal member 20 is seated within a groove 23 formed in the outer wall of the base member and the terminal member is held in position by means of a screw 24 threaded into the base member. A plate of insulating material 25, such as sheet fiber, is disposed between the head of the screw 24 and the terminal member 20 and serves to close the opening in the base member provided for insertion of the fixed contacts 21 and 22 within the recess 11. Cooperating with the fixed contact member 21, is a movable contact blade 26, in this case the first movable contact member shown to the left in Fig. 4, which is formed of spring material and normally biased into engagement with the fixed contact. At one end, the contact blade is provided with a contact surface or button 27 cooperating with the corresponding fixed contact 21 and, at the other end, the contact member is reversely bent, as shown at 28, and spot welded, or otherwise secured, to a leg of a terminal member 29. The terminal member 29 is formed of flat strip stock with the leg disposed in a groove 30 formed in the wall of the recess, while another portion of the terminal is bent at an angle to the leg to form a terminal head for receiving a terminal screw 32. The bent end of the terminal member rests upon a support 31 extending from the side wall of the recess 11. This means that the terminal member and contact blade 26 may be placed in position within the switch housing simply by inserting the leg of the terminal member 29 in the corresponding groove in the housing so that the contact blade 26 is positioned within the left-hand compartment of the recess 11, in the manner shown by Fig. 4.

Another movable contact member 33, which may be termed the second contact blade, is likewise disposed within the recess 11 on the side opposite the contact blade 26 and cooperates with the other fixed contact member 22. At one end the contact blade 33 is provided with a contact surface or abutment 34 cooperating with the fixed contact 22, and at the other end the contact blade is bent, as shown at 35, and spot welded, or otherwise secured, to a leg of a terminal member 36. The terminal is formed of flat strip stock and the leg is positioned within a groove 37 formed in the side wall of the housing, while another portion of the terminal member is bent at an angle to the leg to form a terminal head

resting upon a support 39 extending from the wall of the housing. A terminal screw 40 cooperates with the terminal for connecting an electric conductor thereto. The contact blade and terminal member are assembled in the housing simply by inserting the leg 36 of the terminal member in the groove 37 so that the bent end rests upon the supporting surface 39 and the contact blade is positioned at the "lower" level of the recess, in the manner shown by Fig. 4.

The operating mechanism for the movable contact blades 26 and 33 includes two cam disks 41 and 42 secured to a shaft 43 pivotally mounted in the casing. The cam 41 is provided with two flat surfaces and an arcuate surface for cooperation with each of the contact blades 26 and 33, while the cam 42 is provided with an arcuate surface and a single depression for cooperation with a projection 44 on the contact blade 26. The projection 44 is formed by lancing out the upper portion of the contact blade, so that it engages the upper cam 42 only. It will be manifest that the circular portions of the cams 41 and 42 hold the respective contact blades 26 and 33 in open position, while the flat portions of the cam elements permit the contact blades to close. The sequence in which the movable contact blades are opened and closed by the cam members will be described later in connection with a description of one use of the switch.

After the movable contact blades and cam members 41 and 42 have been seated in position, the separating plate 19 is inserted in the recess to form a partition as shown in Figs. 2 and 3. The separating plate rests directly upon the cam member 42 and is of a configuration such that it fits snugly within the recess 11 on each side of the bosses 15 and 16. In this position the separating disk insulates the contact structure thus far described from the contacts disposed at the "upper" level of the recess.

The contact mechanism in the "upper" portion of the recess includes a terminal member 45 having an integral fixed contact member 46. The terminal is mounted on the upper portion of the boss 15 by means of a screw 47 and the fixed contact extends at an angle to the terminal member into the recess 11 for cooperation with a contact button 49 secured to a movable contact blade 50. The contact blade 50, in this case the third movable contact member, is bent at one end, as shown at 51, and is spot welded or otherwise connected, to the leg of the terminal member 29 in which position it is normally biased into engagement with the fixed contact 46. This means that the contact blades 50 and 36 are electrically interconnected and lie one above the other but are separated by the insulating plate 19. Inasmuch as both of these contact blades are connected to the single terminal member 29, the blades are positioned simultaneously within the recess and the separating plate 19 is then slipped into the recess between the contact blades in the manner described in the preceding paragraph. The movable contact blade 50 is disposed in the left-hand portion of the recess, as shown in Fig. 2.

Another terminal member 52 having an integral fixed contact 53 is mounted at the other end of the recess on the boss 16 by means of a screw 54, and the contact 53 is bent at an angle to the terminal member for cooperation with a contact button 56 formed on a movable contact blade 57. The movable contact blade, in this case the fourth movable contact member, is bent at one end, as shown at 58 and spot welded, or otherwise secured, to the leg of a terminal member 59. The leg extends into a recess 60 in the base in order to mount the terminal member in the same manner as the terminal members 29 and 36. The terminal member is provided with a bent end forming a head portion resting on the supporting surface 39 and provided with a terminal 61 screw for securing an electrical conductor to the terminal member. In this manner the contact blade is positioned in the right-hand portion of the recess, as shown by Fig. 2, and is normally biased into engagement with the contact 53.

The second series of contact blades 50 and 57 are operated by two cam elements 62 and 63 disposed one above the other within the "upper" level of the recess 11. The cam 62 is provided with three flat contact engaging surfaces and a fourth arcuate portion for cooperation with each of the contact blades 50 and 57 while the cam member 63 is provided with a circular portion having a recess therein for cooperation with a projection 64 lanced from the upper portion of the contact blade 50. The cam elements are likewise mounted on the shaft 43 and are rotated simultaneously with the cams 41 and 42 upon rotation of the shaft by means of a handle (not shown). The sequence of operation of the contact blades under rotation of the cams will be described later.

The recess 11 is closed by means of a plate 65 which extends completely around the upper wall 12 of the base member and provides a housing which completely encloses the contact mechanism. The closure plate is provided with a plurality of openings (not shown) for exposing the terminal screws 32, 40 and 62, so that electrical conductors may be connected to the movable contact mechanism.

Each of the terminal members 20, 45 and 52 is provided with conductor clamping means comprising an angularly shaped clamping plate 66 mounted on the respective terminals by means of a screw 67, and which is adapted to clamp a conductor between itself and the terminal member. A bracket 68 formed integrally with the closure plate 65 and having an opening therein is provided as a ready means of mounting the switch upon a supporting plate.

In order to assist in correctly positioning the cam-operating elements for operation of the switch, a positioning mechanism is located within the front part of the housing within the recess 13. This mechanism includes a star wheel 69 having indentations 70 corresponding to the number of positions of the switch mechanism, in this case four, which is mounted upon the shaft 43 for rotation therewith. The indentations in the star wheel are engaged by rollers 71 rotatably supported on spaced levers 72 disposed in pairs on opposite sides of the star wheel. The levers 72 are pivotally supported on pins 73, one end of each pin being located in a bearing recess 74 molded into the partition 14 and the other end of each pin being supported in a bearing 75 formed in a cover plate 76 closing the recess 13. In order to maintain the rollers 71 releasably within the depressions within the star wheel a spring 77 is connected at each end to a pair of the levers by means of pins 78 disposed between the spaced levers. Upon rotation of the switch-operating mechanism by means of the shaft 43 the star wheel will move the pivoted levers outwardly away from one another against the action of the spring 77 permitting the contact

rollers to roll into the next adjacent indentations in the star wheel. In this manner the operating positions of the cam elements are clearly defined by means of the positioning mechanism. The positioning mechanism is held securely within the recess 13 by means of the cover plate 76 which is secured to the base member by screws 79 seated in openings 80 in the walls of the base member. By the construction described the positioning mechanism is separated from the switch mechanism by the partition 14.

In one use of the device shown by Figs. 5 to 8, inclusive, the switch is connected to control a two-part heater system such, for example, as an electric range unit and the switch is connected to a three-line power supply. In the diagrammatic showing of these figures, the switch is connected to give four heating values to the range unit. In connecting the switch to the two-part heater system the terminal 29 is connected to one end of the part A of the two-part heater system, while the terminal 59 is connected to one end of the other part B of the system. The other ends of the parts A and B are placed in series and connected to the terminal 36. A three-line power supply designated N, L_1 and L_2 is connected to the switch. To this end, the terminal 20 is electrically connected to the neutral line, the terminal 52 to the line L_1 and the terminal 45 to the line L_2. The diagrammatic showing of Figs. 5 to 8, inclusive, is looking at the back of the switch where the terminal members are located. This means that the switch handle appears to be rotated counterclockwise whereas actually the switch is rotated clockwise.

In the "off" position of the switch shown by Fig. 5, the cam elements 41, 42, 62 and 63 are so positioned that each of the movable contact blades 26, 33, 50 and 57 is out of engagement with the corresponding fixed contacts, so that no current flows through the two parts A and B of the heater system. By rotating the switch mechanism counterclockwise through an angle of approximately 90 degrees, the switch is turned to "high" position, as shown by Fig. 6. In this position of the switch, current flows from the line L_1 to the terminal member 52, through the fixed contact 53, movable contact blade 57, terminal 59, and thence to one end of the unit B of the heater system. At the same time, current flows from the line L_2 to the terminal 45, fixed contact 46, movable contact blade 50, terminal 29 to one end of the other unit A of the heater system. The current thus flows through each of the parts A and B of the heater system through a common line to the terminal 36, movable contact blade 33, fixed contact 22, terminal member 20, and thence to the neutral line N. In this manner each part of the heater system is placed in parallel across the power lines L_1, L_2 and N and a maximum output of the heater system is attained.

In the "medium" position of the switch, shown by Fig. 7, the cam elements have been rotated through an angle of approximately 90° from the showing of Fig. 6 so that the movable contact blades 33 and 57 are in closed position. Current from the power line L_1 now flows through the terminal 52, fixed contact 53, movable contact blade 57, terminal 60, to one end of the unit B of the heater system, thence through the unit B to the terminal 36, movable contact blade 33, fixed contact 22, terminal member 20 to the neutral power line N. In this manner one part of the heater system, i. e., the heater unit B, is placed across the power lines L_1 and N.

To place the switch in the low position as shown in Fig. 8 the switch mechanism is rotated counterclockwise through an angle approximately 90 degrees from the showing of Fig. 7, so that the cam elements close the contact blades 26 and 57. In this position of the switch mechanism current flows from the line L_1 to the terminal member 52, fixed contact 53, movable contact blade 57, terminal member 59, to one end of the heater unit B through the connection between the heater units to the heater unit A and thence to the terminal 29, movable contact blade 26, fixed contact 21, terminal member 20 to the neutral line N. This means that the two parts A and B of the heater system are connected in series across the power lines L_1 and N and a minimum output from the heater system is attained.

In order to place the switch mechanism in the "off" position it is rotated through an angle of approximately 90 degrees counterclockwise from the showing of Fig. 8.

While the switch has been shown as connected to a two-part heater system, it will be apparent to one skilled in the art that the switch may be adapted for other uses. An advantage of the structure described is that the switch may be rotated either clockwise or counterclockwise to any one of the heat positions shown.

The arrangement of the stationary and movable contacts is such as to provide a switch of compact construction and one in which the elements are easily and quickly assembled. The movable blades are mounted within the recess simply by slipping the terminal members in the grooves provided in the wall of the recess. In this manner two of the contact blades are disposed in parallel relationship in the left-hand compartment of the recess while two others of the contact blades are disposed in reversed parallel relationship in the right-hand compartment. This means that the pairs of blades are adequately separated from one another electrically by the cam members which are located centrally between the blades.

I claim:

1. In an electric switch, a base of insulating material having a recess therein, bosses extending into said recess from opposite walls thereof, a U-shaped terminal member straddling one of said bosses and having fixed contacts secured to each arm of the U on opposite sides of said boss, movable contact blades in said recess engaging said fixed contacts on opposite sides of said boss, another terminal member having a fixed contact mounted on said one boss above said U-shaped terminal, a movable contact blade co-operating with said last-mentioned fixed contact and being electrically connected to one of said first-mentioned contact blades, a terminal having a fixed contact mounted on the other of said bosses and co-operating with still another movable contact blade, and cam means for operating all of said movable contact blades in predetermined sequence for co-operation with the fixed contacts to control a plurality of electric circuits connected to said switch.

2. In an electric switch, a base of insulating material having a recess therein, bosses extending into said recess from opposite walls thereof, a U-shaped terminal member having contacts on opposite sides of one of said bosses, movable contact blades in said recess on opposite sides of said one boss and co-operating with a respective fixed

contact, another terminal member having a fixed contact mounted on said one boss above said U-shaped terminal, a movable contact blade co-operating with said last-mentioned fixed contact and being electrically connected to one of said first-mentioned contact blades, a terminal having a fixed contact mounted on the other of said bosses, another movable contact blade co-operating with the contact mounted on the other boss, and cam means within said recess between said bosses for operating said switch contacts, said cam means including a plurality of cam members each co-operating with a respective pair of contact blades.

3. In an electric switch, a base having a recess therein, bosses extending into said recess from opposite walls thereof and forming two compartments, cam operating means, two movable contact blades disposed in parallel relationship in one of said compartments on one side of said cam means, a terminal connected to the ends of both of said blades whereby said blades are electrically interconnected, two movable contact blades disposed in reversed parallel relationship in the other of said compartments on the other side of said cam means, spaced terminal members, one being connected to each of said reversed contact blades and stationary contacts mounted on said bosses for co-operation with said movable contact blades.

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