Oct. 4, 1949. D. F. ILLIAN 2,483,831

ELECTRIC SWITCH

Filed Feb. 10, 1948 2 Sheets-Sheet 1

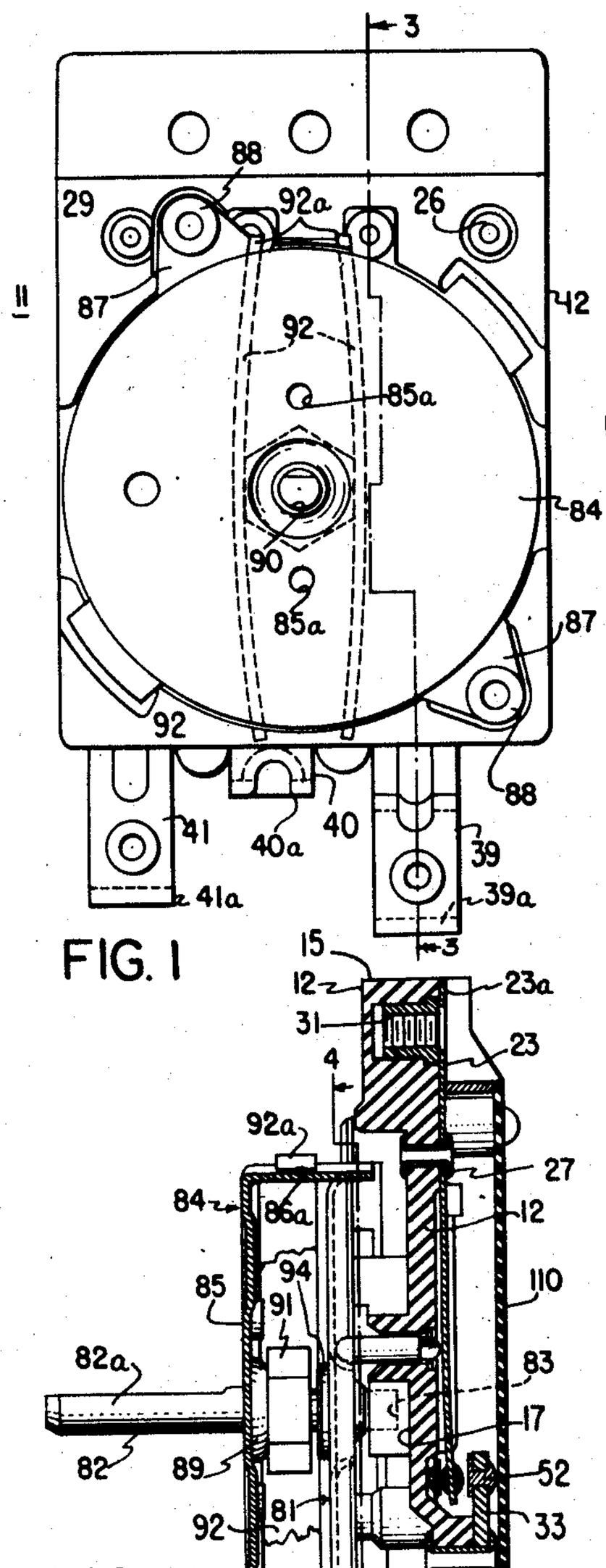

FIG. 1

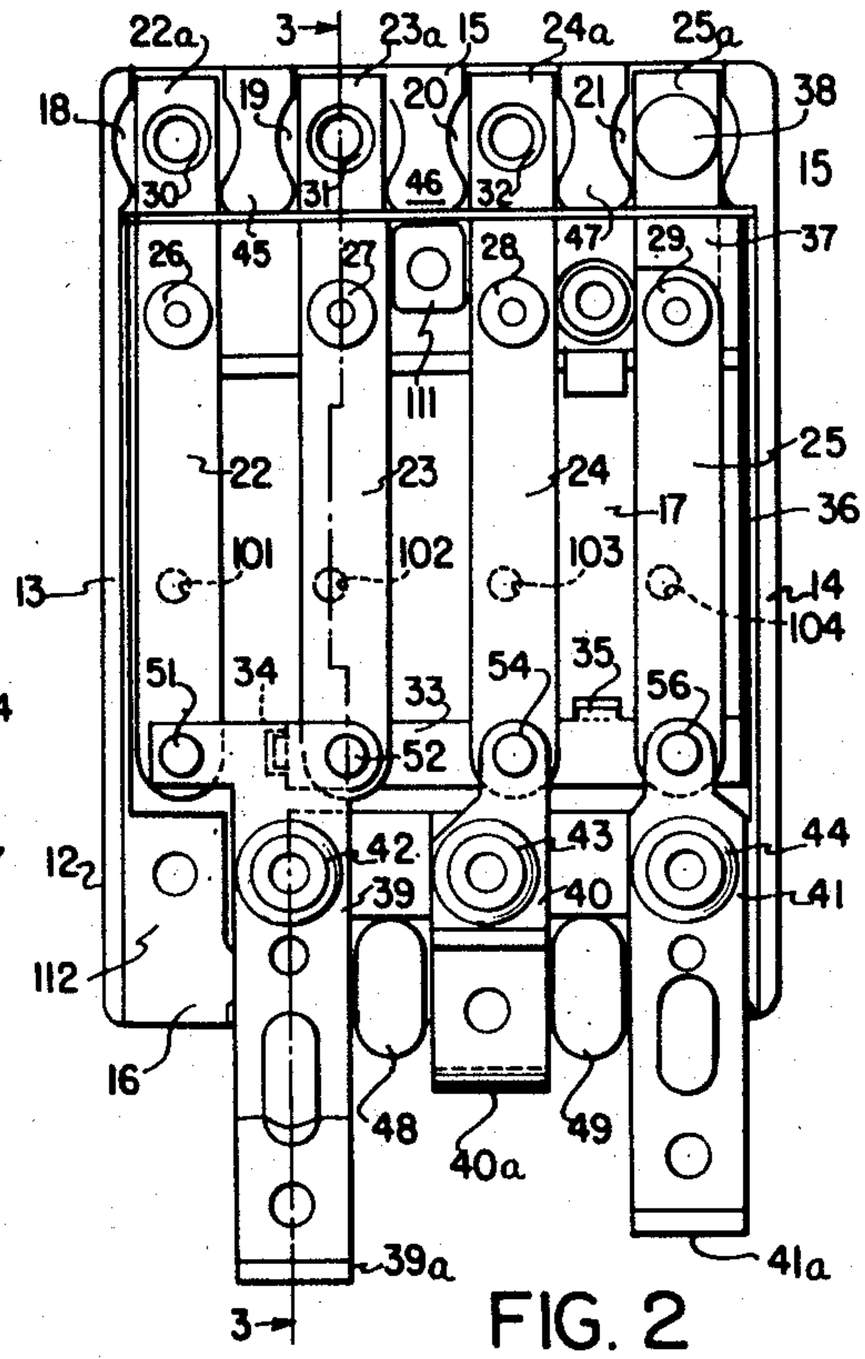

FIG. 2

FIG. 3

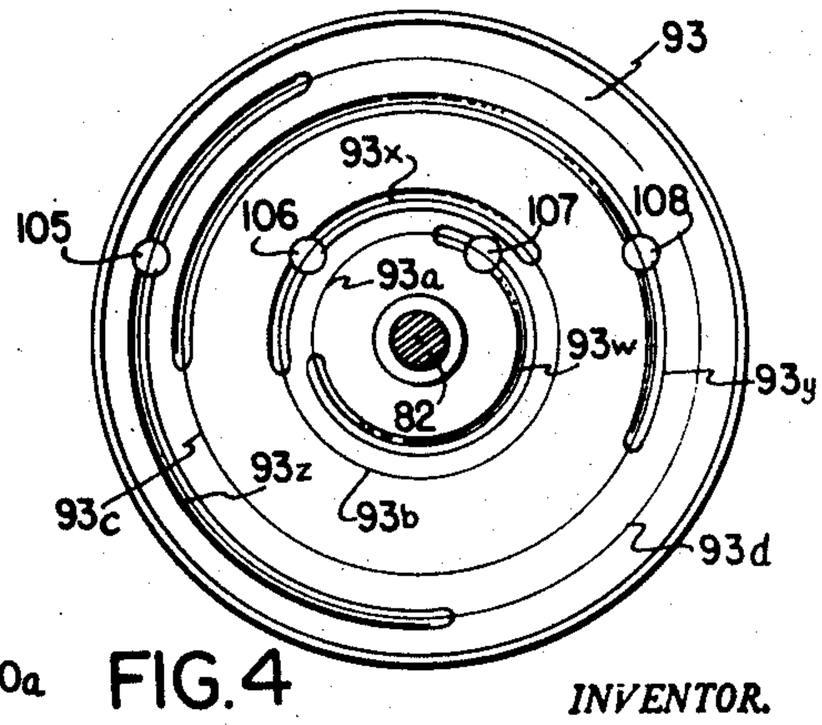

FIG. 4

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ELECTRIC SWITCH

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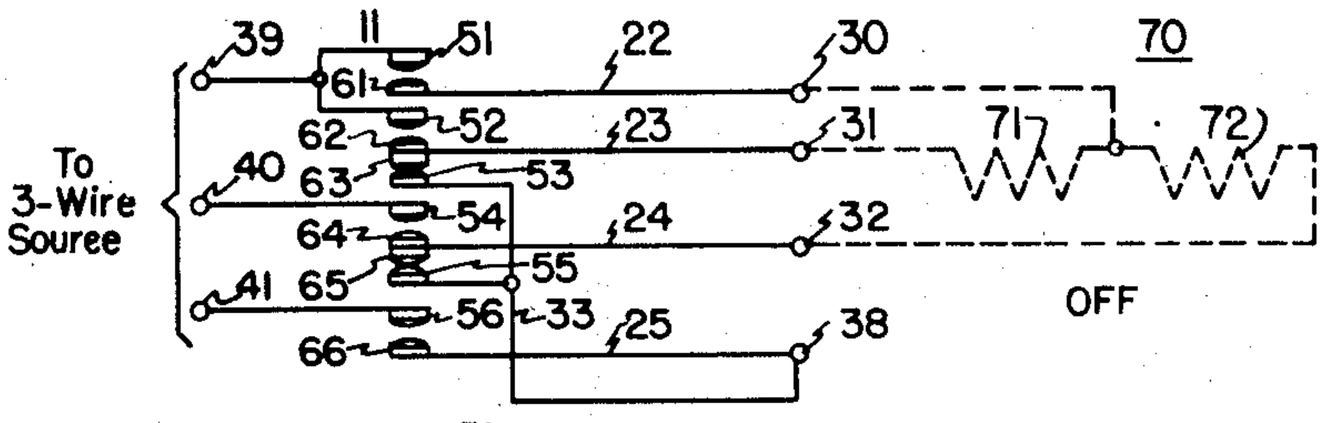

FIG. 5

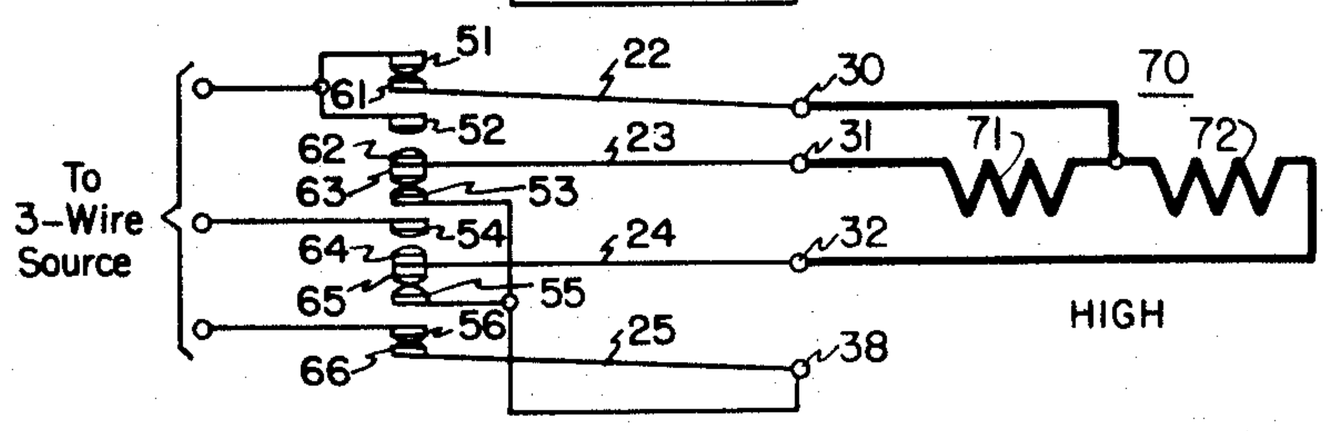

FIG. 6

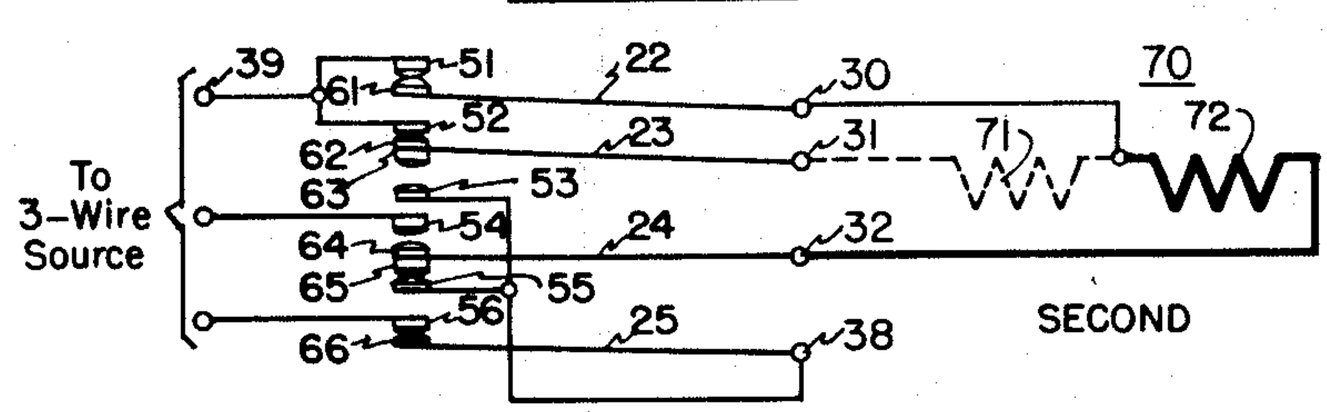

FIG. 7

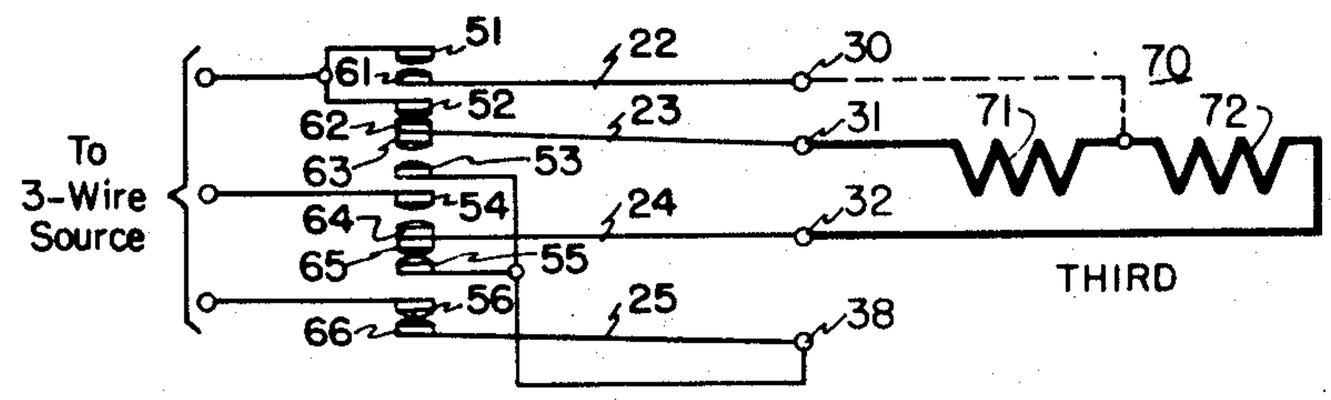

FIG. 8

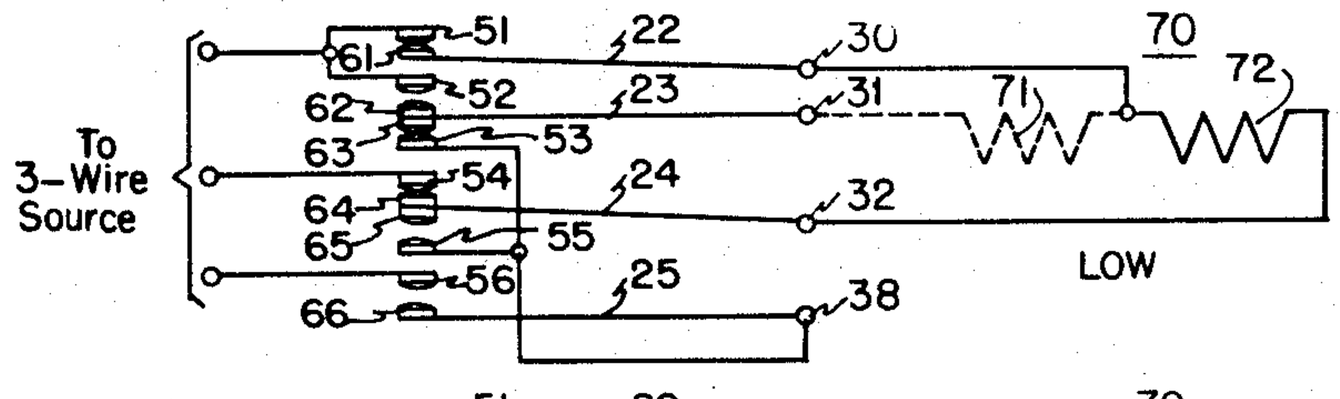

FIG. 9

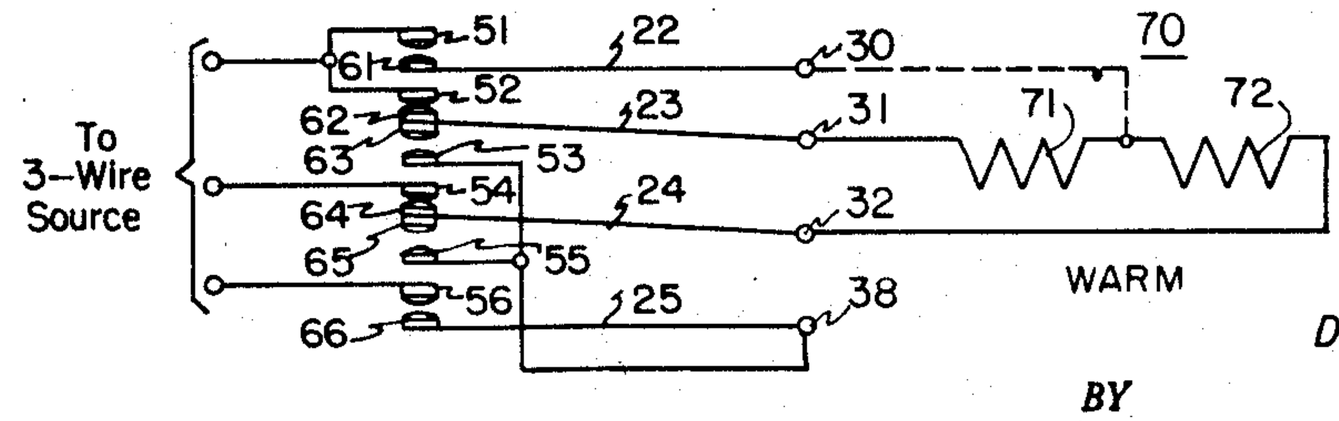

FIG. 10

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ELECTRIC SWITCH

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Application February 10, 1948, Serial No. 7,420

4 Claims. (Cl. 200—6)

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The present invention relates to electric switches; and more particularly, to improvements in switches of the character of that disclosed in U. S. Patent No. 2,203,236, granted on June 4, 1940, to Charles P. Randolph et al.

While not limited thereto, the electric switch is especially applicable to the control of electric range heating elements to provide a plurality of heating effects or degrees of heat. For example, the switch can be used to control the surface hot plates to provide various degrees of heat ranging from comparatively high to relatively low heat intensities; and also to control the heating elements of an oven to provide preheat, bake and broiling heats.

In multi-position electric switches employed in 'ectric heating systems of the character noted, that have been used heretofore, a hazard exists in the possibility of short-circuits within the internal structure of the switch in the event that a contact pair stick or welds together. In the event such a fault develops a short-circuit is produced incident to operation of the switch to another circuit controlling position; which short-circuit is usually severe due to the fact that such systems ordinarily utilize a three-wire source of current supply having a line-to-line voltage of approximately 236 volts.

Accordingly, it is an object of the present invention to provide an improved electric switch that is so constructed and arranged that the possibility of a short-circuit within the internal structure of the switch is greatly minimized and substantially eliminated.

Another object of the invention is to provide a multi-position electric switch capable of a large number of distinct control positions and incorporating a minimum number of movable contact fingers.

A further object of the invention is to provide a multi-position electric switch of the rotary type of improved and simplified construction and arrangement.

In accordance with one feature of the invention an electric switch of the rotary type is provided that comprises an off control position and five individual heating control positions, which six distinct control positions are obtained by only four contact fingers incorporated in the switch.

Further features of the invention pertain to the particular arrangement of the elements of the electric switch, whereby the above-outlined and additional operating features thereof are attained.

The invention, both as to its organization and

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method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawings, in which Figure 1 is a front view of an electric switch embodying the present invention; Fig. 2 is a rear view of the switch shown in Fig. 1, with the rear cover removed; Fig. 3 is a sectional view of the switch taken both in the direction of the arrows along the line 3—3 in Fig. 1 and in the direction of the arrows along the line 3—3 in Fig. 2; Fig. 4 is a sectional view of the switch taken in the direction of the arrows along the line 4—4 in Fig. 3; and Figs. 5 to 10, inclusive, are diagrammatic illustrations of the combination of the switch and a two-section heating unit and a three-wire source of current supply.

More particularly, Figs. 5 to 10, inclusive, respectively illustrate the corresponding six heating control positions of the switch.

Referring now to Figs. 1 to 4, inclusive, the electric switch 11 there illustrated, and embodying the features of the present invention, comprises a supporting base or panel 12 formed of a suitable electrical insulating material, such as a phenol condensation product. Preferably, the panel 12 is of unitary molded construction and is provided with rearwardly projecting side walls 13 and 14 and rearwardly projecting top and bottom walls 15 and 16 defining a shallow centrally disposed chamber 17 in the rear face thereof. The top wall 15 has four longitudinally extending substantially parallel spaced-apart shallow grooves 18, 19, 20 and 21 formed therein and positioned between the side walls 13 and 14. Four longitudinally extending strips or contact fingers 22, 23, 24 and 25 are secured to the panel 12 adjacent the upper ends thereof and projecting over the chamber 17. More particularly, the four contact fingers 22, 23, 24 and 25 are respectively secured to the panel 12 by four hollow eyelets 26, 27, 28 and 29 and are respectively provided with upwardly directed extensions or tails 22*a*, 23*a*, 24*a* and 25*a* respectively disposed in the grooves 18, 19, 20 and 21.

Three integrally threaded hollow sleeves 30, 31 and 32, constituting load terminals, are arranged in three corresponding cavities formed in the top wall 15 and respectively underlying the contact fingers 22, 23 and 24. More particularly, the extensions 22*a*, 23*a* and 24*a* have respective openings formed therein arranged in registry with the hollow threaded openings formed in the respective load terminals 30, 31 and 32 so that three load fixtures may be directly secured in place in con-

tact with the respective extensions 22*a*, 23*a* and 24*a* by the respective load terminals 30, 31 and 32 utilizing three screws, not shown.

A laterally extending bus 33 is secured to the bottom wall of the chamber 17 by an arrangement including two integral tabs 34 and 35 carried thereby and projecting into corresponding openings formed in the panel 12. The bus 33 is provided with a longitudinally directed extension 36 lying adjacent to the side wall 14; which extension 36, in turn, is provided with a tab 37 overlying the extension 25*a* and extending into the groove 21. Finally, a fixture 38 extends through aligned openings formed in the tab 37 and in the extension 25*a* and is anchored in place in an aligned opening formed in the top wall 15. Accordingly, the bus 33 is directly electrically connected via the extension 36, the tab 37 and the fixture 38 to the extension 25*a* and consequently to the contact finger 25.

Three longitudinally extending line terminals 39, 40 and 41 are secured to the panel 12 adjacent the upper ends thereof and projecting over the chamber 17. More particularly, the three line terminals 39, 40 and 41 are arranged in spaced-apart relation between the side walls 13 and 14 and respectively secured to the panel 12 by three hollow eyelets 42, 43 and 44 and are respectively provided with downwardly directed extensions or tails 39*a*, 40*a* and 41*a* projecting over the bottom wall 16. The extension 41*a* projects substantially straight downwardly from the rear face of the panel 12; the extension 39*a* projects downwardly from the rear face of the panel 12 and is then offset toward the front face thereof; while the extension 40*a* projects downwardly from the rear face of the panel 12 and is then offset further toward the rear; whereby the extreme outer ends of the extensions 39*a*, 40*a* and 41*a* are spread apart in order to accommodate the connection thereof to the respective three line terminals of a three-wire source of current supply.

The four contact fingers 22, 23, 24 and 25 are secured to the panel 12 adjacent to the upper end thereof; and the four extensions 22*a*, 23*a*, 24*a* and 25*a* are suitably mutually insulated from each other and from the exterior by three interposed barriers 45, 46 and 47 and by the upper ends of the side walls 13 and 14. Similarly, the three line terminals 39, 40 and 41 are secured to the panel 12 adjacent to the lower end thereof; and the three extensions 39*a*, 40*a* and 41*a* are suitably mutually insulated from each other and from the exterior by two interposed barriers 48 and 49 and by the lower ends of the side walls 13 and 14. Preferably, the barriers 45, 46 and 47 are molded integrally with the top wall 15; and the barriers 48 and 49 are molded integrally with the bottom wall 16.

Preferably, the contact fingers 22, 23, 24 and 25 are formed of a resilient spring material, such as a suitable copper alloy; and are biased toward the panel 12 and adjacent to the bottom wall of the chamber 17 due to their inherent resiliency; while the line terminals 39, 40 and 41 are formed of relatively heavy rigid metal stock, such for example, as copper or the like. Also it is preferable that the bus 33 be formed of fairly heavy rigid metal stock, such for example as copper or the like. The extreme lower ends of the contact fingers 22 and 23 underlie the extreme upper end of the line terminal 39; and the extreme lower ends of the contact fingers 24 and 25 underlie the respective extreme upper ends of the line terminals 40 and 41. Also the extreme lower ends of the contact fingers 23, 24 and 25 overlie the bus 33.

As best shown in Figs. 2, 3 and 5 to 10, inclusive, in the switch 11, a first stationary contact 51 is carried on the left-hand upper inner end of the first line terminal 39 and cooperates with a first movable contact 61 carried on the lower outer end of the first contact finger 22; a second stationary contact 52 is carried on the right-hand upper inner end of the first line terminal 39 and cooperates with a second movable contact 62 carried on the lower outer end of the second contact finger 23; a third stationary contact 53 is carried on the left-hand outer face of the bus 33 and cooperates with a third movable contact 63 carried on the lower inner end of the second contact finger 23; a fourth stationary contact 54 is carried on the upper inner end of the second line terminal 40 and cooperates with a fourth movable contact 64 carried on the lower outer end of the third contact finger 24; a fifth stationary contact 55 is carried on the central outer face of the bus 33 and cooperates with a fifth movable contact 65 carried on the lower inner end of the third contact finger 24; and a sixth stationary contact 56 is carried on the upper inner end of the third line terminal 41 and cooperates with a sixth movable contact 66 carried on the lower outer end of the fourth contact finger 25. Preferably, the six stationary contacts 51 to 56, inclusive, and the six movable contacts 61 to 66, inclusive, are formed of precious metal, such for example, as silver or a suitable alloy thereof and are suitably secured to the responsive line terminals 39, 40 and 41 and to the respective contact fingers 22, 23, 24 and 25, and to the bus 33 in the manner indicated. As previously noted, the four contact fingers 22, 23, 24 and 25 are biased inwardly toward the adjacent bottom wall of the chamber 17 into first positions and are movable outwardly away from the bottom wall of the chamber 17 into second positions. Accordingly, when the four contact fingers 22, 23, 24 and 25 occupy their normal first positions, the contacts 51 and 61 are disengaged, the contacts 52 and 62 are disengaged, the contacts 53 and 63 are engaged, the contacts 54 and 64 are disengaged, the contacts 55 and 65 are engaged, and the contacts 56 and 66 are disengaged, as clearly illustrated in Fig. 5. On the other hand, when the four contact fingers 22, 23, 24 and 25 occupy their operated second positions, the contacts 51 and 61 are engaged, the contacts 52 and 62 are engaged, the contacts 53 and 63 are disengaged, the contacts 54 and 64 are engaged, the contacts 55 and 65 are disengaged, and the contacts 56 and 66 are engaged. Of course, when the contact fingers 22, 23, 24 and 25 are released, after they have been operated to their second positions, they are returned to their normal first positions as illustrated in Fig. 5, due to their inherent resiliency.

Also, as illustrated in Figs. 5 to 10, inclusive, the switch 11 is adapted to be employed in an electric control system for use in the heating circuit of an electric range. More particularly, the system comprises a two-section heating unit 70, including the sections 71 and 72; which heating unit 70 may comprise one of the surface heating units of the electric range. The two sections 71 and 72 of the heating unit 70 respectively include two outside terminals and a common intermediate terminal; the common intermediate terminal being connected to the first load terminal 30, the outside terminal of the first section 71 being connected to the second load terminal 31 and

the outside terminal of the second section 72 being connected to the third load terminal 32. The sections 71 and 72 may have the same or different heat-producing ratings, but it is preferable, in order to obtain flexibility in the production of different degrees of heat, that the two sections 71 and 72 have different heat-producing ratings. For example, the two sections 71 and 72 may have the respective wattage ratings of 840 and 1260, when they are connected directly across a 236 volts A. C. source of current supply.

Also the system comprises a source of current supply of the Edison three-wire type, which may be either A. C. or D. C., although an A. C. source is normally employed. The source of current supply comprises first and second main terminals respectively connected to the first and third line terminals 39 and 41 and a neutral terminal connected to the second line terminal 40. For example, the source of current supply may provide an approximate voltage of 236 volts between the two main terminals and a voltage of approximately 118 volts between either of the main terminals and the neutral terminal.

As illustrated in Figs. 5 to 10, inclusive, the switch 11 comprises six indexed positions, including an off heat position shown in Fig. 5, a high heat position shown in Fig. 6, a second heat position shown in Fig. 7, a third heat position shown in Fig. 8, a low heat position shown in Fig. 9, and a warm heat position shown in Fig. 10.

When the switch 11 is operated to its first or off heat position shown in Fig. 5, the contact fingers 22, 23, 24 and 25 are moved to their first positions; whereby the contact pairs 51, 61 and 52, 62 and 54, 64 and 56, 66 are disengaged; and the contact pairs 53, 63 and 55, 65 are engaged. Accordingly, the two sections 71 and 72 are short-circuited in multiple circuit relation, as shown by the broken lines, via the second and third contact fingers 23 and 24 and the bus 33.

When the switch 11 is operated to its second or high heat position shown in Fig. 6, the contact fingers 23 and 24 are moved to their first positions and the contact fingers 22 and 25 are moved to their second positions; whereby the contact pairs 51, 61 and 53, 63 and 55, 65 and 56, 66 are engaged; and the contact pairs 52, 62 and 54, 64 are disengaged. Accordingly, the two sections 71 and 72 are connected in multiple, as shown in the heavy lines, across the 236 volts source.

When the switch 11 is operated to its third or second heat position shown in Fig. 7, the contact finger 24 is moved to its first position and the contact fingers 22, 23 and 25 are moved to their second positions; whereby the contact pairs 51, 61 and 52, 62 and 55, 65 and 56, 66 are engaged; and the contact pairs 53, 63 and 54, 64 are disengaged. Accordingly, the section 72 is connected, as shown in heavy lines, across the 236 volts source and the section 71 is short-circuited via the contact fingers 22 and 23 and the first line terminal 39.

When the switch 11 is operated to its fourth or third heat position shown in Fig. 8, the contact fingers 22 and 24 are moved to their first positions and the contact fingers 23 and 25 are moved to their second positions; whereby the contact pairs 51, 61 and 53, 63 and 54, 64 are engaged; and the contact pairs 52, 62 and 55, 65 and 56, 66 are disengaged. Accordingly, the section 72 is connected, as shown in light lines, across the 118 volts source and the section 71 is as shown in broken lines, open circuited.

When the switch 11 is operated to its fifth or low heat position, shown in Fig. 9, the contact fingers 23 and 25 are moved to their first positions and the contact fingers 22 and 24 are moved to their second positions; whereby the contact pairs 51, 61 and 53, 63 and 54, 64 are engaged; and the contact pairs 52, 62 and 55, 65 and 56, 66 are disengaged. Accordingly, the section 72 is connected, as shown in light lines, across the 118 volts source and the section 71 is as shown in broken lines, open circuited.

Finally, when the switch 11 is operated to its sixth or warm heat position shown in Fig. 10, the contact fingers 22 and 25 are moved to their first positions and the contact fingers 23 and 24 are moved to their second positions; whereby the contact pairs 51, 61 and 53, 63 and 55, 65 and 56, 66 are disengaged; and the contact pairs 52, 62 and 54, 64 are engaged. Accordingly, the sections 71 and 72 are connected, as shown in light lines, in series circuit relation across the 118 volts source.

Now assume that the switch 11 occupies its off heat position shown in Fig. 5 and that it is progressively operated through its high heat position, its second heat position, its third heat position, its low heat position and its warm heat position respectively shown in Figs. 6 to 10, inclusive, and then back into its off heat position shown in Fig. 5. When the switch 11 is moved from its off heat position shown in Fig. 5 to its high heat position shown in Fig. 6, the contact fingers 22 and 25 are moved from their first positions to their second positions; while the contact fingers 23 and 24 remain in their first positions. When the switch 11 is moved from its high heat position shown in Fig. 6 to its second heat position shown in Fig. 7, the contact finger 22 is first moved from its second position to its first position, the contact finger 23 is then moved from its first position to its second position and then the contact finger 22 is moved from its first position to its second position. When the switch 11 is moved from its second heat position shown in Fig. 7 to its third heat position shown in Fig. 8, the contact finger 22 is first moved from its second position to its first position, then the contact finger 25 is moved from its second position to its first position and then the contact finger 25 is moved from its first position to its second position. When the switch 11 is moved from its third heat position shown in Fig. 8 to its low heat position shown in Fig. 9, the contact finger 25 is moved from its second position to its first position, then the contact finger 23 is moved from its second position to its first position, then the contact finger 24 is moved from its first position to its second position and then the contact finger 22 is moved from its first position to its second position. When the switch 11 is moved from its low position shown in Fig. 9 to its warm position shown in Fig. 10, the contact finger 22 is moved from its second position to its first position and then the contact finger 23 is moved from its first position to its second position. When the switch 11 is moved from its warm heat position shown in Fig. 10 to its off heat position shown in Fig. 5, the contact finger 23 is moved from its second position to its first position and then the contact finger 24 is moved from its second position to its first position.

In view of the foregoing it will be understood that as the switch 11 is moved from one of its indexed positions to the adjacent indexed position, it is moved through one or more intermediate positions in order positively to insure in-

terruption of the circuit established in the one indexed position before completion of the circuit established in the adjacent indexed position. Also from an examination of Figs. 5 to 10, inclusive, it will be observed that by virtue of the arrangement of the six contact pairs 51, 61 to 56, 66, inclusive, it is impossible to produce a short-circuit upon either the 236 volts source or upon the 118 volts source through the internal structure of the switch 11. This arrangement is very advantageous in view of the fact that in switches of this general character, occasionally a contact pair will stick or weld together. When this fault appears in prior switches of this general type there has always been the possibility of a short-circuit in the internal structure of the switch as the switch is subsequently operated to another position, resulting in considerable damage to the switch and the general alarm of a person utilizing the electric range. However, in the improved circuit controlling system disclosed above, there is no possibility of a short-circuit even though the fault mentioned develops since the sticking or welding together of any contact pair therein cannot possibily produce a short-circuit within the internal structure of the switch 11 as it is operated to the various indexed positions thereof.

For the purpose of operating the switch 11 to each of its six indexed positions, a mechanism 81 is provided that is of the general character of that disclosed in the previously mentioned Randolph patent. As best shown in Fig. 3, the mechanism 81 is carried by the central portion of the front face of the panel 12 and comprises a rotatable operating shaft 82, the inner end of which is journaled in a bearing 83 formed in the front face of the panel 12 and the outer end of which is provided with a flat surface 82*a* which is adapted to receive an operating handle or knob, not shown. The operating shaft 82 is secured in place by an arrangement including a front cover 84, formed of metal, that is secured to the front face of the panel 12. More particularly, the front cover 84 is substantially cup-shaped including a front wall 85 and a marginal wall 86 carrying two outwardly extending tabs 87. The two tabs 87 are directly secured to the front face of the panel 12 by two hollow eyelets 88; and the front wall 85 is provided with a centrally disposed inwardly extending boss 89 having an opening 90 formed therein through which the outer end of the operating shaft 82 extends. The mid-section of the operating shaft 82 is provided with a spline upon which a nut or fixture 91 of hexagon shape is rigidly secured; the six faces provided on the fixture 91 establishing the six indexed positions of the operating shaft 82 and consequently of the switch 11 as explained more fully hereinafter. The inner end of the boss 89 engages the adjacent face of the fixture 91 in order securely to return the operating shaft 82 in position for rotary movement; whereby the front cover 84 cooperating with the front face of the panel 12 houses the mechanism 81. Further, two flexible springs 92 formed of steel or the like are arranged within the front cover 84 and positioned on opposite sides of the fixture 92. More particularly, the opposite ends of the springs 92 carry lugs 92*a* projecting through cooperating openings 86a formed in the marginal wall 86. More particularly, the springs 92 extend substantially diametrically across the interior of the front cover 84, the intermediate sections thereof engaging the opposite faces of

the fixture 91 in order to establish the six indexed positions thereof in an obvious manner.

Finally, the mechanism 81 comprises a disk 93 rigidly secured to the operating shaft 82 against a collar 94 affixed to the operating shaft 82 and disposed intermediate the fixture 91 and the front face of the panel 12. Accordingly, the disk 93 is rotatable with the operating shaft 82 and is disposed closely adjacent to the front face of the panel 12. Further, four laterally spaced-apart and aligned openings 101, 102, 103 and 104 are formed through the panel 12 and positioned below the respective four contact fingers 22, 23, 24 and 25. The four openings 101, 102, 103 and 104 are arranged between the lower ends of the respective four contact fingers 22, 23, 24 and 25 and the respective eyelets 26, 27, 28 and 29, and carry four slidably mounted operating pins or plungers 105, 106, 107 and 108. The four slidable plungers 105, 106, 107 and 108 respectively cooperate with the four contact fingers 22, 23, 24 and 25 and commonly cooperate with the disk 93; whereby rotation of the disk 93 to its six indexed positions may selectively control movement of the respective four contact fingers 22, 23, 24 and 25 as explained more fully below.

More particularly, the four openings 101, 102, 103 and 104 formed in the panel 12 are arranged above and offset with respect to the center line of the bearing 83; whereby the plungers 107, 106, 108 and 105 are disposed at four progressively greater radii with respect to the center line of the bearing 83 and the operating shaft 82 as clearly shown in Fig. 4. Accordingly, the inner rounded ends of the four plungers 107, 106, 108 and 105 respectively cooperate with the adjacent surfaces of the four operating fingers 24, 23, 25 and 22; while the outer rounded ends of the four plungers 107, 106, 108 and 105 respectively cooperate with four adjacent arcuate surfaces 93*a*, 93*b*, 93*c* and 93*d* provided on the disk 93. Specifically, the four arcuate surfaces 93*a*, 93*b*, 93*c* and 93*d* provided on the disk 93 are concentrically arranged and have progressively increasing radii. The innermost arcuate surface 93*a* provided on the disk 93 comprises a combination of outwardly extending depressions, one of which is indicated at 93*w*, and intervening flat surfaces cooperating with the outer end of the plunger 107. Likewise, the next outermore arcuate surface 93*b* provided on the disk 93 comprises a combination of outwardly extending depressions, one of which is indicated at 93*x*, and intervening flat surfaces cooperating with the outer end of the plunger 106. Likewise, the next outermore arcuate surface 93*c* provided on the disk 93 comprises a combination of outwardly extending depressions, one of which is indicated at 93*y*, and intervening flat surfaces cooperating with the outer end of the plunger 108. Finally, the outermost arcuate surface 93*d* provided on the disk 93 comprises a combination of outwardly extending depressions, one of which is indicated at 93*z*, and intervening flat surfaces cooperating with the outer end of the plunger 105.

When the operating shaft 82 occupies its first indexed position the depressions 93*w*, 93*x*, 93*y* and 93*z* formed in the disk 93 respectively overlie the adjacent outer ends of the four plungers 107, 106, 108 and 105; whereby the four plungers 107, 106, 108 and 105 are respectively slid in the respective openings 103, 102, 104 and 101 toward the front face of the panel 12 into the respective depressions 93*w*, 93*x*, 93*y* and 93*z* due to the resiliency of the respective four contact fingers 24, 23, 25 and

22 causing the four contact fingers 24, 23, 25 and 22 to be moved to their first positions as previously explained. Subsequently, as the operating shaft 82 is rotated from its first indexed position to its second indexed position, it being assumed that the operating shaft 82 is rotated in the clockwise direction as viewed in Fig. 1, the disk 93 is rotated approximately 60° in the counterclockwise direction as viewed in Fig. 4. At this time the outer ends of the plungers 108 and 105 are moved out of cooperating relation with respect to the respectively associated depressions 93*y* and 93*z* formed in the disk 93 onto the adjacent flat surfaces of the disk 93; whereby the plungers 108 and 105 are slid inwardly in the respective openings 104 and 101 formed in the panel 12; whereby the inner ends of the respective plungers 108 and 105 move the respectively associated contact fingers 25 and 22 from their first positions to their second positions. At this time the inner ends of the plungers 107 and 106 still ride in the respective depressions 93*w* and 93*x* formed in the disk 93; whereby the plungers 107 and 106 remain in their original positions retaining the respective contact fingers 24 and 23 in their first positions.

In view of the foregoing description of the mechanism 81, it will be understood that the combination of depressions 93*w*, etc., formed in the arcuate surface 93*a* are angularly spaced apart and are of the required arcuate lengths in order correspondingly to control the position of the associated plunger 107 in order selectively to operate the associated contact finger 24. Of course, the combinations of depressions formed in the other arcuate surfaces 93*b*, 93*c*, and 93*d* of the disk 93 are appropriate in order selectively to control the associated plungers 106, 108 and 105 and consequently the contact fingers 23, 25 and 22. Thus it will be understood that the required circuit combinations in the six indexed positions of the switch 11 are predetermined by the combination of depressions formed in the four arcuate surfaces 93*a*, 93*b*, 93*c* and 93*d* of the disk 93. Further it will be understood that the resiliency of any contact finger 22, etc., is sufficient to return it from its second position back to its first position and to restore the associated plunger 105, etc., in the associated depression 93*z*, etc., formed in the disk 93 when the disk 93 is rotated in order again to align the depressions 93*z*, etc., with the inner end of the associated plunger 105, etc., after the disk 93 has been rotated to bring a flat surface thereon into cooperating relation with respect to the outer end of the associated plunger 105, etc.

Finally, the switch 11 comprises a rear cover 110 formed of insulating material, such for example, as a phenol condensation product and suitably secured to a number of bosses 111 and 112 projecting rearwardly from the rear face of the panel 12. Accordingly, the rear cover 110 cooperates with the rear face of the panel 12 in order to house the four contact fingers 22, 23, 24 and 25, the bus 33 and the inner ends of the line terminals 39, 40 and 41, as well as the six stationary contacts 51, etc., and the six movable contacts 61, etc. Further it is noted that the three line terminals 30, 31 and 32 are arranged exteriorly of the rear cover 110 adjacent to the top of the panel 12 so that they are readily accessible; while the tails 39*a*, 40*a* and 41*a* of the line terminals 39, 40 and 41, respectively, are arranged exteriorly of the rear cover 110 and adjacent to the bottom of the panel 12 so that they are readily accessible. Finally, the front

wall 85 of the front cover 84 has two openings 85*a* formed therein that are adapted to receive screws carried by an associated supporting panel, not shown; whereby the switch 11 as a whole may be removably secured to the supporting panel mentioned. Finally, the outer end of the operating shaft 82 projects through an opening formed in the supporting panel, not shown, and carries the operating handle or knob, not shown, previously mentioned. Ultimately, the supporting panel, not shown, may be provided with indicia cooperating with the operating handle or knob, not shown, and indicating the six indexed positions of the operate shaft 82 and the switch 11 and consequently the six indexed heat positions thereof. Of course, the three load terminals 30, 31 and 32 are connected to the appropriate terminals of the heating unit 70; and the tails of the line terminals 39, 40 and 41 are appropriately connected to the terminals of the source of current supply; all in the manner previously explained.

While the switch 11 has been described as comprising six indexed positions, it will be readily understood that any one or more of these indexed positions may be eliminated if not required in the control of the associated heating circuit.

In view of the foregoing it is apparent that a multi-position electric switch has been provided which is of improved construction and arrangement facilitating ready and convenient control of the heating positions of an associated heating unit and substantially eliminating the hazards of short-circuits.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A switch comprising three load terminals, a bus, three line terminals, four movable contact fingers, a first of said contact fingers being connected to a first of said load terminals and movable between first and second positions respectively disengaging and engaging a first of said line terminals, a second of said contact fingers being connected to a second of said load terminals and movable between a first position respectively disengaging said first line terminal and engaging said bus and a second position respectively engaging said first line terminal and disengaging said bus, a third of said contact fingers being connected to a third of said load terminals and movable between a first position respectively disengaging a second of said line terminals and engaging said bus and a second position respectively engaging said second line terminal and disengaging said bus, a fourth of said contact fingers being connected to said bus and movable between first and second positions respectively disengaging and engaging a third of said line terminals, and mechanism for selectively moving in a predetermined order each of said contact fingers between its first and second positions.

2. A switch comprising three load terminals, a bus, three line terminals, four resilient contact fingers, a first of said contact fingers being connected to a first of said load terminals and mounted for pivotal movement between normal and operated positions respectively disengaging and engaging a first of said line terminals, a second

of said contact fingers being connected to a second of said load terminals and mounted for pivotal movement between a normal position respectively disengaging said first line terminal and engaging said bus and an operated position respectively engaging said first line terminal and disengaging said bus, a third of said contact fingers being connected to a third of said load terminals and mounted for pivotal movement between a normal position respectively disengaging a second of said line terminals and engaging said bus and an operated position respectively engaging said second line terminal and disengaging said bus, a fourth of said contact fingers being connected to said bus and mounted for pivotal movement between normal and operated positions respectively disengaging and engaging a third of said line terminals, each of said contact fingers being biased into its normal position by its inherent resiliency, and mechanism for selectively moving in a predetermined order each of said contact fingers from its normal position into its operated position and for selectively releasing in a predetermined order each of said contact fingers for return movement from its operated position back into its normal position.

3. A switch comprising three load terminals, a bus, three line terminals, four movable contact fingers, a first of said contact fingers being connected to a first of said load terminals and movable between first and second positions respectively disengaging and engaging a first of said line terminals, a second of said contact fingers being connected to a second of said load terminals and movable between a first position respectively disengaging said first line terminal and engaging said bus and a second position respectively engaging said first line terminal and disengaging said bus, a third of said contact fingers being connected to a third of said load terminals and movable between a first position respectively disengaging a second of said line terminals and engaging said bus and a second position respectively engaging said second line terminal and disengaging said bus, a fourth of said contact fingers being connected to said bus and movable between first and second positions respectively disengaging and engaging a third of said line terminals, and a six-position mechanism for selectively moving said contact fingers between their first and second positions, said mechanism being operative into a first of its positions to move each of said contact fingers into its first position, said mechanism being operative into a second of its positions to move said first and fourth contact fingers into their second positions and to move said second and third contact fingers into their first positions, said mechanism being operative into a third of its positions to

move said first and second and fourth contact fingers into their second positions and to move said third contact finger into its first position, said mechanism being operative into a fourth of its positions to move said first and third contact fingers into their first positions and to move said second and fourth contact fingers into their second positions, said mechanism being operative into a fifth of its positions to move said first and third contact fingers into their second positions and to move said second and fourth contact fingers into their first positions, said mechanism being operative into a sixth of its positions to move said first and fourth contact fingers into their first positions and to move said second and third contact fingers into their second positions.

4. A switch comprising three load terminals, a bus, three line terminals, four movable contact fingers, a first of said contact fingers being connected to a first of said load terminals and movable between first and second positions respectively disengaging and engaging a first of said line terminals, a second of said contact fingers being connected to a second of said load terminals and movable between a first position respectively disengaging said first line terminal and engaging said bus and a second position respectively engaging said first line terminal and disengaging said bus, a third of said contact fingers being connected to a third of said load terminals and movable between a first position respectively disengaging a second of said line terminals and engaging said bus and a second position respectively engaging said second line terminal and disengaging said bus, a fourth of said contact fingers being connected to said bus and movable between first and second positions respectively disengaging and engaging a third of said line terminals, mechanism including a single rotary operating cam for selectively moving in a predetermined order each of said contact fingers between its first and second positions, and means including an insulating panel for supporting each of said elements named.

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