May 29, 1956 E. E. FORSTROM 2,748,205

SWITCH

Filed Dec. 14, 1951 4 Sheets-Sheet 1

Fig.1.

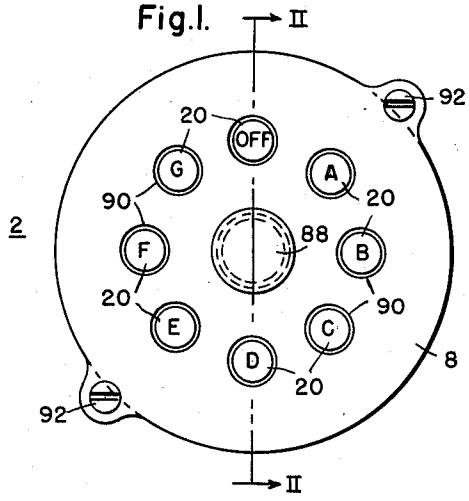
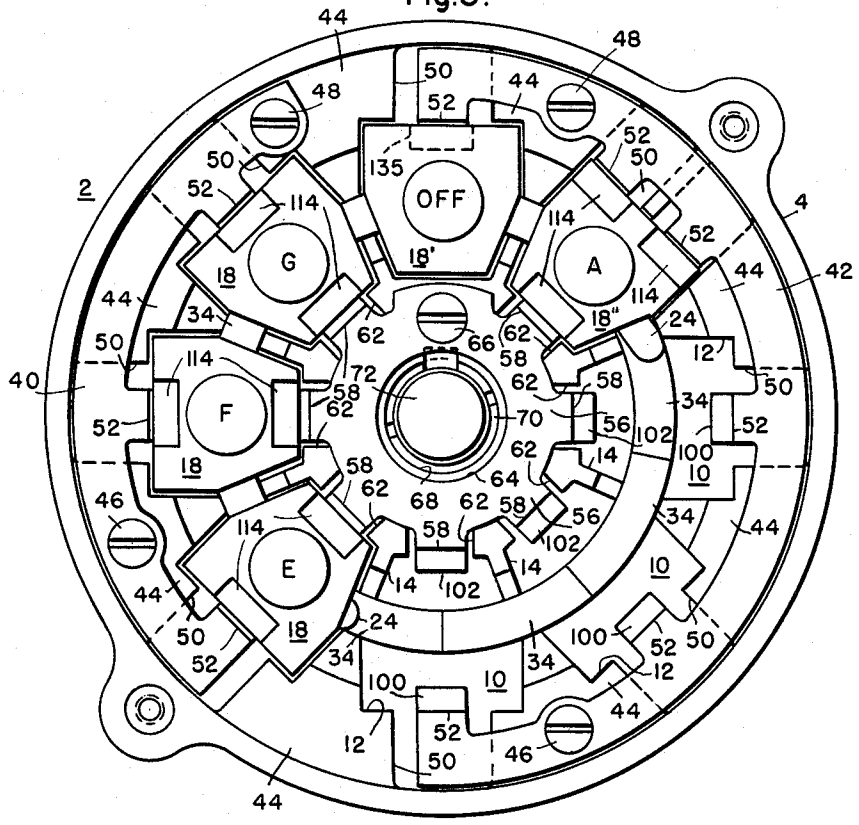


Fig.3.



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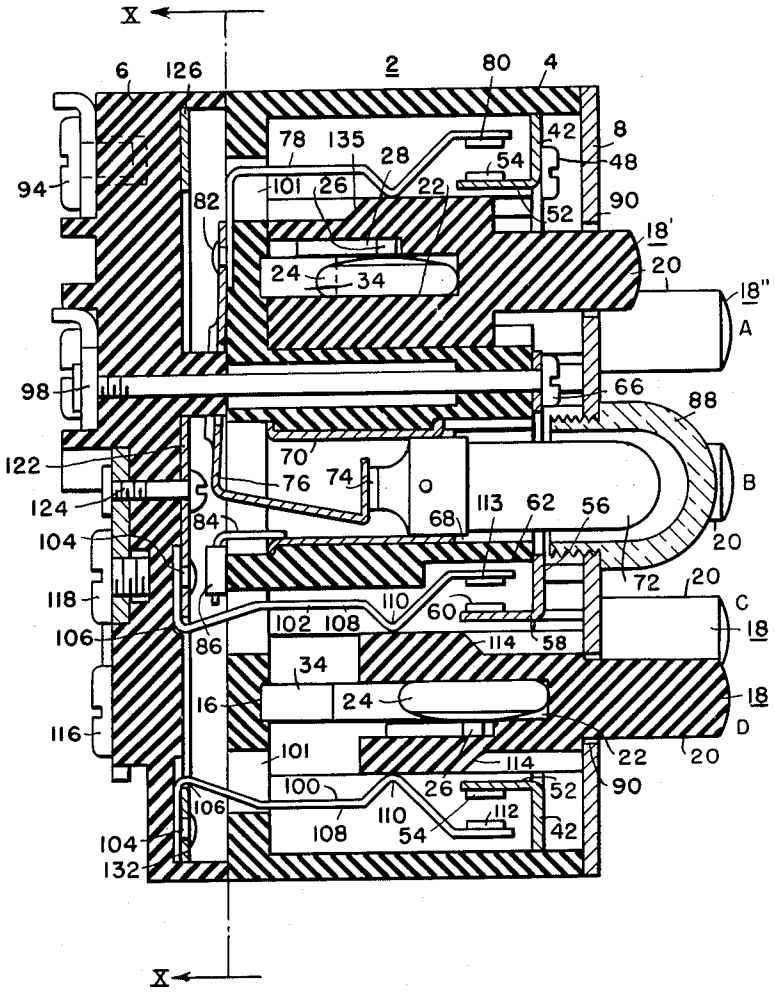
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May 29, 1956 E. E. FORSTROM 2,748,205

SWITCH

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Fig.2.



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May 29, 1956 E. E. FORSTROM 2,748,205

SWITCH

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Fig.4.

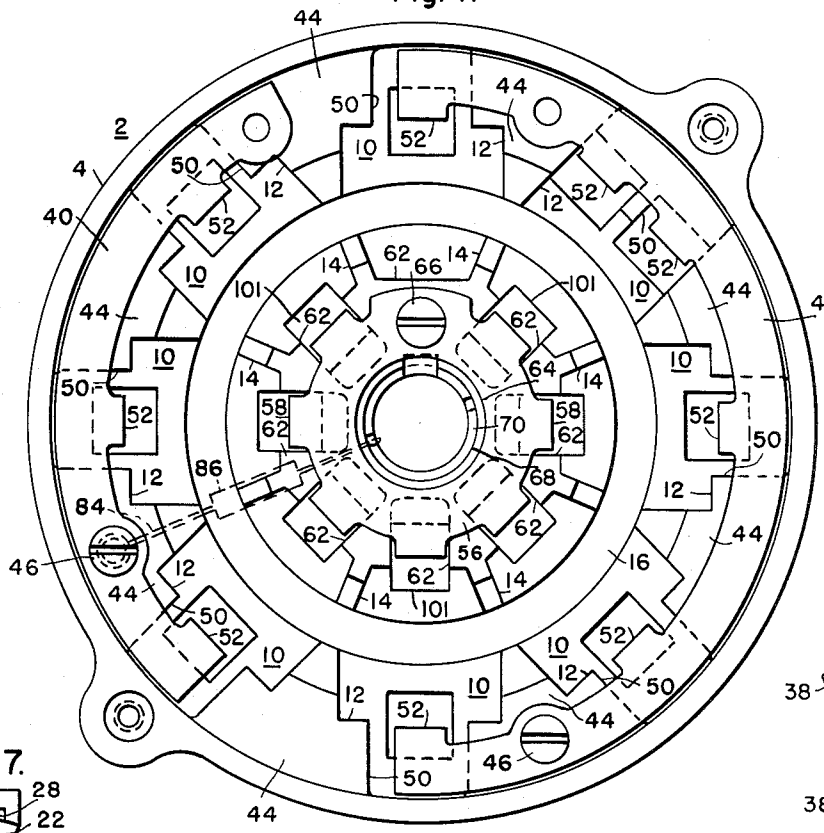


Fig.8.

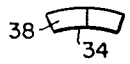


Fig.9.

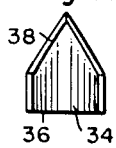


Fig.7.

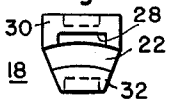


Fig.5.

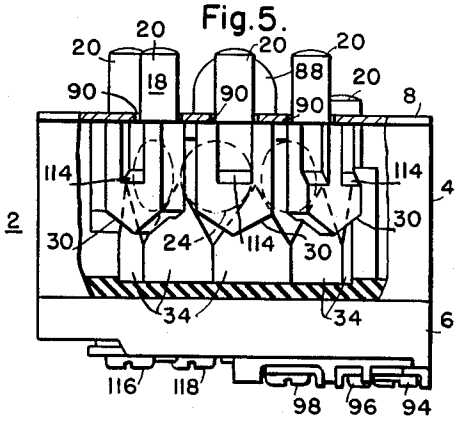
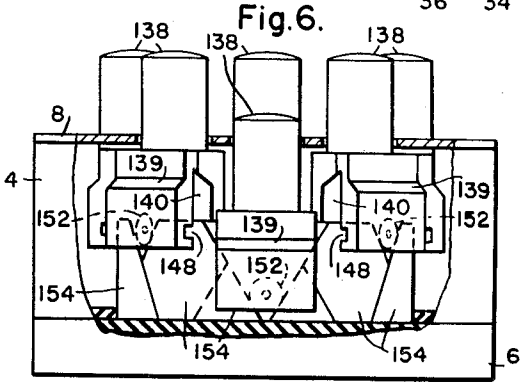


Fig.6.



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SWITCH

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Fig.10.

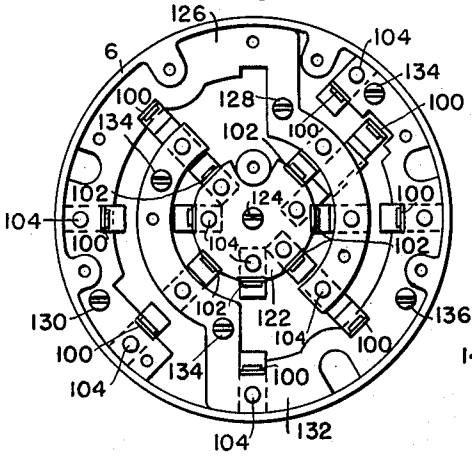


Fig.11.

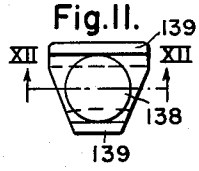


Fig.14.

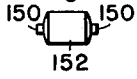


Fig.15.

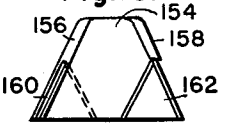


Fig.12.

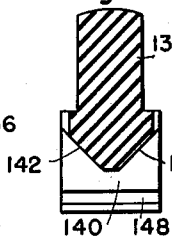


Fig.13.

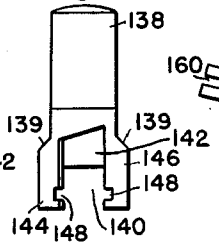


Fig.16.

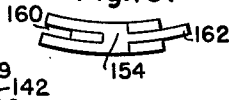
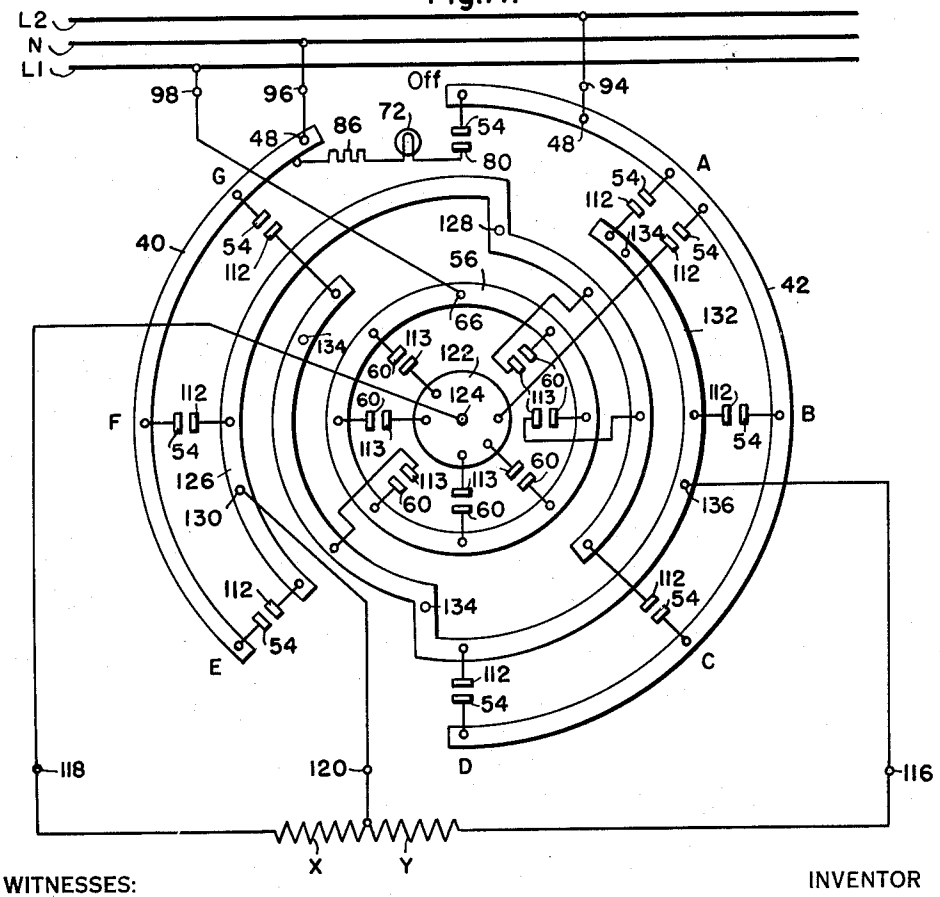


Fig.17.



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United States Patent Office 2,748,205 Patented May 29, 1956

2,748,205

SWITCH

Edward E. Forstrom, Bridgeport, Conn., assignor to The Bryant Electric Company, Bridgeport, Conn., a corporation of Connecticut

Application December 14, 1951, Serial No. 261,723

15 Claims. (Cl. 200—5)

This invention relates generally to electric switches, and more specifically to multiple pushbutton switches.

For certain applications, such as for the control of surface units for electric ranges, where a number of multiposition switches are required and only a relatively small space is available for mounting the switches, it is necessary that the switches conform in size to the available mounting space and yet be capable of efficiently performing a number of different switching operations, and at the same time be capable of segregation to be identifiable with the respective devices controlled thereby.

One object of this invention, therefore, is to provide a novel type of multiple pushbutton switch which is small in size, yet is efficient in operation and capable of economical manufacture.

Another object of this invention is to provide a pushbutton switch construction wherein a plurality of pushbuttons are arranged in a circle and have novel interlocking means so that only one button may be operated at a time.

Another object of this invention is to provide a switch having a plurality of pushbutton operating members with a novel cooperative arrangement of switches to be operated by the pushbuttons.

Still another object of this invention is to provide a switch of the type described having a plurality of supply and load terminals and a plurality of pushbuttons and switches operated thereby, associated with said terminals in a novel manner.

These and other objects of this invention will become more apparent upon consideration of the following detailed description of preferred embodiments thereof, when taken in connection with the attached drawings in which:

Figure 1 is a top plan view of a switch constructed in accordance with this invention;

Fig. 2 is an enlarged transverse sectional view of the switch shown in Fig. 1 taken substantially on the line II—II thereof;

Fig. 3 is an enlarged top view of the switch shown in Figs. 1 and 2 with the cover and three of the pushbuttons removed;

Fig. 4 is also a top view of the switch shown in Figs. 1 to 3, being similar to Fig. 3 except that all of the pushbuttons, and their interlocking means together with the base and movable contacts are removed;

Fig. 5 is a side elevation view of the switch shown in Figs. 1 and 2 with a part of the side wall and cover being broken away and shown in section;

Fig. 6 is a view similar to Fig. 5, but shows a modified form of pushbutton interlocking means;

Fig. 7 is a bottom view of one of the pushbuttons employed with the switch shown in Figs. 1 to 5;

Fig. 8 is a top view of one of the interlock members employed in the switch illustrated in Figs. 1 to 5;

Fig. 9 is an elevation view looking at the inner side of the interlock member shown in Fig. 8;

Fig. 10 is a top plan view of the base for the switch shown in Figs. 1 to 5 taken substantially along the line X—X of Fig. 2;

Fig. 11 is a top view of one of the pushbuttons used in the modified form of switch shown in Fig. 6;

Fig. 12 is a cross-section view of the pushbutton shown in Fig. 11 taken substantially on the line XII—XII thereof;

Fig. 13 is a side elevation view of the pushbutton shown in Figs. 11 and 12;

Fig. 14 is an elevation view of the roller which is employed with the pushbutton shown in Figs. 11 to 13;

Fig. 15 is an elevation view looking at the inner side of an interlock member employed in the switch shown in Fig. 6;

Fig. 16 is a bottom view of the interlock member shown in Fig. 15; and

Fig. 17 is a schematic view of the switch illustrating one circuit in which the switch may be employed.

The multiple pushbutton operated switch illustrated on the drawings and specifically hereinafter described is specifically designed for controlling a pair of heating elements, such as the heating elements which are employed in the surface heating unit of an electric range. However, the invention is not limited to the control of these or other heating units, nor it is limited to the precise number of switches or pushbutton operating members specifically disclosed herein. As the description proceeds, it will be apparent that a greater or lesser number of pushbutton operating members and switch contacts to be operated thereby may be employed while retaining important features of this invention, although as will be pointed out, the particular switch described has certain novel features which are particularly adapted for the control of heating units for electric ranges.

The specific switch shown on the drawings has eight pushbutton operating members comprising an "Off" button and seven operating buttons A through G, with the latter being employed to operate switch contacts to provide various degrees of heat from a multiple unit heating element, as will be described.

The switch shown on the drawings is enclosed within a switch casing 2, comprising a housing 4 adapted to be removably secured to a base 6, and with the housing having an open top adapted to be closed by a removable cover plate 8. The housing 4 and base 6 are preferably formed of insulating material such as molded insulating material, whereas the cover 8 may be a metal plate if desired. The base 6 has a plurality of line and load terminals mounted on the bottom thereof, there being three line terminals and three load terminals in the illustrative embodiment of the invention herein particularly disclosed. At the inner side of base 6 there are mounted a plurality of movable switch contacts which are adapted to cooperate with stationary contacts mounted in the housing 4. The housing 4 also carries the pushbutton operating members and their interlocking means, together with a central indicating lamp 72, and the cover 8 has a plurality of circularly spaced openings for receiving the pushbutton operating members, respectively, and a central opening for receiving a lens 38 through which light from the indicating lamp is transmitted.

The housing 4 has an open top, as previously explained, and is formed interiorly with a plurality of circumferentially spaced pushbutton guideways 10 for receiving each of the pushbutton operating members. Each pushbutton guideway 10 comprises an outer part 12 and an inner part 14 separated by a circular track 16 on which the interlocking members are adapted to be movably mounted, as will be hereinafter described.

The pushbutton operating members 18, 18' and 18'' are preferably formed of an insulating material, such as a molded insulating material, and for convenience the

pushbuttons are labeled A, B, C, D, E, F, G and "Off." Each pushbutton includes an outer operating part 20 which is circular in cross-section and an enlarged inner part which has a slot 22 of arcuate form disposed in the inner end thereof. Each pushbutton is adapted to receive in its slot 22 a roller 24 which has a central pin 26 projecting from one side thereof to be received in a recess 28 formed at one side of slot 22 and which extends longitudinally of each pushbutton a predetermined distance from the inner end thereof. Since the slot 22 of each pushbutton is only slightly wider than the thickness of a roller 24, it will be apparent that the roller can have a substantial lateral movement relative to the pushbutton limited only by engagement with the sides of recess 28 with roller pin 26, and that the rollers are also freely movable longitudinally of each pushbutton throughout the length of the pushbutton slot 22 and can be assembled with the pushbutton by merely dropping them into the slot 22 from the inner end of the pushbutton, with the roller pin 26 being received in recess 28.

It will be apparent from Fig. 7 of the drawing that the inner end of each pushbutton 18, 18' and 18'' has a relatively wide portion 30 at the outer side of slot 22 which is adapted to be received in the outer part 12 of a pushbutton guideway 10, and the pushbutton has a relatively narrow part 32 at the other side of notch 22 which is adapted to fit into the inner part 14 of a pushbutton guideway 10. The inner ends of the bushbuttons are guided by the respective guideways 10 for longitudinal reciprocating movement of the pushbuttons to depressed and extended positions relative to the switch cover 8 by their relatively close sliding fit in the respective pushbutton guideways 10.

The rollers 24 of each pushbutton are adapted to cooperate with interlock members 34 (Figs. 8 and 9) which are formed to be arcuate in cross-section to correspond to the curvature of the circular track 16 formed in the bottom of housing 4, and these interlock members have a flat bottom edge 36 which is adapted to seat on the housing track 16 to be slidable along the track. The top of each interlock member 34 is tapered upwardly substantially to a point as shown at 38, and are adapted to be assembled in the switch so that there is an interlock member 34 located between adjacent rollers 24 of the pushbuttons, and with portions of the interlock members received in slots 22 of the pushbuttons.

The switch shown in Figs. 1 to 5 is illustrated at its off position with the "Off" pushbutton depressed. This has caused the roller 24 mounted in the "Off" pushbutton to move downwardly and separate the interlock members 34 at opposite sides thereof. This causes the interlock members 34 to be forced into close proximity with each other except for the two in engagement with the roller 24 of the "Off" pushbutton, to thus force the rollers 24 of all of the other buttons outwardly by their engagement between the upper tapered portions 38 of adjacent interlock members 34 (Fig. 5), and thus cause all of the other buttons A to G to move to their extended positions. In the event any of the other pushbuttons at locations A to G are depressed, it will cause the two interlock members 34 in contact with its roller 24 to be separated circumferentially and thus force these interlock members into engagement with all the rest to ultimately take up the space between the interlock members contacting the roller of the "Off" pushbutton and force the latter outwardly. The width of interlock members 34 and diameter of rollers 24 are so arranged that but a single pushbutton may be depressed at one time, and depression of any given pushbutton causes all the remainder of the pushbuttons to assume their extended positions, and prevents depression of the other buttons so long as the aforesaid one is held depressed. The arrangement described above thus forms an effective interlock between the pushbuttons which permits but a single pushbutton to be depressed at any given time, and causes movement of all the remaining pushbuttons to extended positions whenever any one of them is depressed.

Reciprocating movement of the pushbuttons 18, 18' and 18'' is utilized to operate switches, and except for the switch operated by the "Off" pushbutton, parts of each switch are mounted in the housing 4, and other latter outwardly. The width of interlock members 34 illustrative form of the invention herein specifically disclosed, a switch is provided at each of the inner and outer sides of each of the operating pushbuttons at locations A to G, with the stationary contacts of these switches being mounted in the housing 4, and the movable contacts thereof being mounted on the base 6.

For supporting the stationary switch contacts, the housing 4 is provided with a relatively short arcuate terminal strip 40 which spans pushbuttons E, F and G, and with a longer arcuate terminal strip 42 which spans operating pushbuttons A, B, C and D and the "Off" pushbutton. These arcuate terminal strips 40 and 42 are located adjacent the outer periphery of housing 4 close to the open side thereof, being supported on a plurality of spaced ledges 44 which may be formed integral with the casing, and are located between each of the pushbuttons and form part of the pushbutton guideways 10. The arcuate terminal strips 40 and 42 may be secured in fixed position by any desired means, for example, as by screws 46 which secure the terminal strips directly to the ledges 44, and by connecting screws 48 which will be hereafter more particularly described.

Each of the pushbutton guideways 10 has a notch 50 extending outwardly thereof for substantially the entire depth of housing 4, and the terminal strips 40 and 42 having integral spaced tongues 52 which depend from the inner edges thereof into the notches 50 for supporting contact buttons 54, which face outwardly and form stationary switch contacts.

A centrally located terminal disc 56 is carried by the housing adjacent the open side thereof, and this disc has integral downwardly extending tongues 58 located opposite each of the pushbuttons except the "Off" pushbutton 18', with these tongues having contact buttons 60 mounted thereon and facing inwardly of a notch 62 provided at the inner side of each pushbutton guideway 10, except the guideway 10 for the "Off" pushbutton. The terminal disc 56 has a central opening 64 and is adapted to be secured in position by a screw 66 which extends through an opening provided in the housing in a manner to be hereinafter referred to.

The housing 4 has a central opening 68 aligned with the central opening 64 in terminal disc 56, and in this opening there is mounted a contact sleeve 70 which is provided with a suitable means, such as a bayonet slot, for receiving an indicating lamp 72 in a manner to make contact with the terminal sleeve of the lamp and hold the lamp with its central terminal 74 in engagement with a resilient conducting strip 76 centrally disposed at the inner end of central opening 68 of housing 4. The resilient conducting strip 76 which makes contact to the central lamp terminal extends to the inner side of housing 4 where it is bent to extend along the base of the housing and be secured to the inner end of a resilient switch blade 78 having a contact button 80 at the outer end thereof located opposite the fixed contact 54 which is adjacent the "Off" pushbutton. The resilient conducting strip 76 is secured in engagement with the inner end of switch blade 78 and they are both secured to the bottom of housing 4 by any desired securing means, such as by a rivet 82. The contact sleeve 70 for the indicating lamp is connected by a conductor 84 which extends out of the central opening 68 of housing 4 and across the bottom of the housing to the securing screw 46 with which it is electrically connected, and is thereby electrically connected with the arcuate terminal strip 40. The conductor 84 for the indicating lamp may include a resistor 86 to limit current flowing through the lamp.

The cover 8 for the housing 4 is provided with a central opening in which a cup-shaped lens 88 may be threadedly mounted to fit over the outer end of lamp 72. The openings 90 for the pushbuttons are circumferentially spaced about the central opening in cover plate 8, for freely slidably receiving the operating portions 20 of the pushbuttons. The cover may be removably secured in place in any desired way, for example, as by screws 92 threaded into housing 4.

The base 6 of the switch carries a plurality of line terminals, there being three in the illustrative embodiment of the invention comprising line terminals 94 and 98 and a line neutral terminal 96. The line terminal 94 is electrically connected to the arcuate terminal strip 42 adjacent the open side of housing 4 by the screw 48 which extends through the housing and carries a nut which holds terminal 94 in place at the underside of the base 6 in an appropriately formed groove in the material of the base. The neutral line terminal 96 is electrically connected with the arcuate terminal strip 40 in a similar way, namely, by the screw 48 cooperating with terminal strip 40 and extending through housing 4 and having a nut in engagement with terminal 96 at the underside at base 6 to hold it in position on the base 6. The other line terminal 98 is held in position and electrically connected to the terminal disc 56 near the open end of housing 4 by the screw 66 which extends from terminal disc 56 through a bore provided in housing 4 and has a nut at its outer end which engages terminal 98 to hold it in place on base 6. The screws 48 and 66 thus serve not only to electrically connect their associated terminals and terminal strips, but also assist in securing the terminal strips 40 and 42 and terminal disc 56 to the housing and at the same time secure the terminals to the housing base, as well as holding the base 6 and housing 4 in assembled relation.

As previously mentioned, the movable contacts of each of the switches except the one for the "Off" pushbutton are carried by the base 6, and by reference to Figs. 2 and 10 of the drawing, it will be observed that these movable contacts are carried by switch blades formed of a resilient conducting material such as a copper alloy, and comprise an outer row circularly spaced blades 100, and an inner circularly arranged row of spaced blades 102. Each of the switch blades 100 and 102 are secured at their inner end to a terminal strip mounted at the inner side of the base which will be hereinafter specifically described, by a suitable securing means such as a rivet 104 or the like. The switch blades 100 and 102 are then substantially reversely bent at an acute angle as at 106, and their outer portions then continue outwardly as at 108 in a direction substantially at right angles to the base 6, being provided with an angularly bent cam follower portion 110 adjacent their outer ends, and with an extreme outer end offset contact portion carrying a contact button 112 and 113 mounted so as to face the adjacent pushbutton and stationary contact. The outer and inner sides of each pushbutton may be formed with a cam surface 114 which is engageable with the cam follower portion 110 of an adjacent switch blade 100 or 102 to cam the switch blade away from its opposed stationary contact 54 or 60, as the case may be, when the pushbutton is at an outer extended position. When a pushbutton is depressed, the switch blades may move inwardly so that their contact buttons 112 and 113 engage their respective stationary contacts. Preferably, the blades 100 and 102 are mounted on the base 6 so that their normal bias is into engagement with the fixed contacts to close the circuit. A contributing factor to the bias of switch blades 100 and 102 to their closed circuit positions is the cooperation of these blades with the openings 101 provided in the bottom wall of housing 4 for individually receiving the blades when the base 6 and housing 4 are assembled together. These openings are adapted to engage the blade in the vicinity of inner blade portions 106 and 108 to form, in effect,

a fulcrum for bending of the blades when the upper portions are moved to open circuit positions by the cam portions 114 of the respective pushbuttons, thus relieving the extreme inner part of the blades from substantial bending stress and confining the bending stress to the part of each blade 100, 102 to the portion thereof extending from a point at the bottom wall of housing 4 outwardly to the free end thereof.

The switch base 6 also carries a number of load terminals, there being three in the illustrative embodiment of the invention, for connection (Fig. 17) to a two-part heating element X, Y. As illustrated, the load terminal 116 is adapted for connection to one end of one part Y of the load resistance, the load terminal 118 is adapted to be secured to one end of the other part X of the load resistance, and the load terminal 120 is adapted to be connected in common to the remaining ends of the two parts X and Y of the load resistance. At the upper face of base 6, there is a terminal disc 122 secured thereto, as by a bolt 124 which passes through the base in contact with the terminal disc 122 and with terminal 118 to thereby electrically connect terminal 118 with the terminal disc 122, as well as mechanically secure these parts to the base 6. A terminal strip 126 having offset arcuate portions is also mounted on the inner surface of base 6, being secured thereto by a securing screw 128 and a connecting screw 130 which extends through the base 6 and serves to mount the terminal 120 on the rear of base 6 and electrically connect it and terminal strip 126. A second terminal strip 132 having offset arcuate portions is also mounted at the inner side of base 6, being secured thereto by a plurality of securing screws 134 and by a connecting screw 136 which extends through the base 6 and load terminal 116 to secure these parts to the base and electrically connect them.

It will be noted that each of the pushbuttons except the "Off" pushbutton 18' operates its movable switch blades 100, 102 to open the circuit when the pushbutton is at an extended position, and permits its switch blades 100 and 102 to close the circuit when the pushbutton is at a depressed position. The "Off" pushbutton 18' has but a single switch blade 78 located at the outer side of this button, and a single cam portion 135 is provided on the "Off" pushbutton which opens the switch blade 78 when the pushbutton is depressed, and permits it to move to closed circuit position when the "Off" pushbutton is at an extended position. Accordingly, it will be apparent that all of the switches are opened when the "Off" pushbutton is depressed.

Referring now to the schematic showing of this switch and the circuit with which it may be used shown in Fig. 17 of the drawings, it will be apparent that when the pushbutton A is depressed, it will cause the "Off" pushbutton to move to an extended position which will cause its movable contact 80 to engage stationary contact 54 and thus establish a circuit from line conductor L2, through terminal 94 of the switch, terminal strip 42, the closed contacts 54 and 80 of the switch operated by the "Off" pushbutton, lamp 72, resistance 86, terminal strip 40, and switch terminal 96, to the neutral line conductor, thus energizing the indicating lamp at a voltage of 110 volts, assuming the supply current to be one which supplies 220 volts between conductors L1 and L2, and 110 volts between either of conductors L1 or L2 and N. At the same time, depression of pushbutton 18'' closes the movable contacts 112 and stationary contacts 54, as well as movable contact 113 and stationary contact 60 at location A. In this regard, it will be noted that there are two outer contacts 54 at location A and pushbutton 18'' has two outer cam surfaces 114 for operating the two outer switch blades 100, so that with the three switches at this location closed, a circuit will be established from supply conductor L2 to terminal 94 of the switch, and through terminal strip 42 and the upper outside contacts 54, 112 as viewed in Fig. 17, to terminal

strip 132, load terminal 116, and the free end of resistance Y. The circuit may then be traced through resistance Y to load terminal 120 of the switch, terminal strip 126, the inner contacts 113, 60 at location A, terminal strip 56 and line terminal 98 to line conductor L1, thus subjecting resistor Y to 220 volts. The free end of resistance X is connected to load terminal 118 of the switch and to terminal disc 122, through the lower outside contacts 112, 54, thence by way of terminal strip 42, and line terminal 94 to line conductor L2, to thereby also subject the resistor X to 220 volts. Accordingly, depression of push button 18 at location A acts to connect resistors X and Y in parallel across a 220 volt circuit.

Depression of the pushbuttons at locations B and C connect the resistors Y and X, respectively, across supply conductors L1 and L2 as will be apparent, and depression of the pushbutton at location D acts to connect resistors X and Y in series across supply conductors L1 and L2. Depression of the pushbuttons at locations E, F and G act to connect resistor X, Y and X and Y in series, respectively, across a 110 volt circuit. Thus, tracing the circuit which is established when the pushbutton at location E is depressed, it will be observed, that the circuit extends from supply conductor N to line terminal 96 of the switch, then by way of terminal strip 40, the outer contacts 54, 112 at location E, terminal strip 126, and load terminal 120 of the switch to the common connection of resistors X and Y. From there the circuit proceeds through resistor Y to load terminal 116 of the switch, terminal strip 132, the contacts 113, 60 at location E to terminal strip 56 and line terminal 98 of the switch, to supply conductor L1, to thereby subject resistor X to 110 volts.

It can thus be seen that if resistors X and Y are made to be of unequal value, they will be connected singly or in combination in various ways so that each of the seven different operative positions of the switch provide seven different wattages, and thus seven different degrees of the heat from the resistors X and Y. Moreover, when each of the pushbuttons at the seven operative positions A through G are depressed, the "Off" pushbutton is at an extended position to energize the circuit for the indicating lamp to thus provide an indication that one or both of the resistors are energized. The indicating lamp 72 is extinguished only when the "Off" pushbutton is depressed to thus indicate that neither of resistors X and Y are energized.

A modified form of interlocking means is illustrated in Fig. 6, with certain details thereof shown in Figs. 11 to 16. This type of interlock is similar to that previously disclosed in that the switch has pushbuttons 138 adapted to operate switches (not shown) by cam portions 139 thereof in the same manner as the pushbuttons 18 previously described. The pushbuttons 138 also have slots 140 extending into their inner ends which are curved in conformity with the curvature provided by a circular track for slidably supporting interlock members. However, the slot 140 at the inner end of each pushbutton 138 has a top wall with inclined ends 142, and outer side 146 of the material of the pushbutton forming slot 140 is longer than the inner side 144, and each of these sides have formed therein opposed slots 148 for receiving central pintle parts 150 of rollers 152, the rollers 152 thus have substantially no movement longitudinally of a pushbutton 138, but are permitted to move laterally thereof along the lengths of slots 148.

The pushbutton rollers 152 are adapted to cooperate with interlock members 154 which are transversely curved to conform to the curvature of the circular track on which these interlock members are adapted to slide. Opposite ends of each interlock member are tapered upwardly as at 156 and 158, with one end 156 being formed with a notch 160, and the opposite end being formed with a tongue 162 of reduced thickness which is adapted to fit into the notch 160 of the interlock member adjacent thereto.

The advantage of the interlocking arrangement for the pushbuttons shown in Figs. 6 and 11 to 16 is that the individual interlock members 154 have essentially tongue (162) and groove (160) interfitting parts so that there can be no substantial relative lateral movement of the interlock members 154 while permitting free edge-wise movement in a circular path in conformance with the circular track formed in the switch housing similar to the track 16 in the embodiment of invention shown in Figs. 1 to 5. In all other respects, the interlock function is the same in the embodiment of the invention shown in Figs. 6 and 11 to 16, in that when one of the pushbuttons is depressed, it separates the two interlock members 154 with which its roller 152 engages, and thus moves the other interlock members more closely adjacent each other to force the rollers of the other pushbuttons upwardly and cause such other pushbuttons to move to an extended position.

Having described preferred embodiments of the invention in accordance with the patent statutes, it is desired that the invention be not limited to the specific forms thereof herein specifically disclosed because it will be obvious that switches constructed in accordance with this invention may be used for the control of loads other than resistance heating loads, the number of pushbuttons may be varied, and different types of interlocking provisions may be employed with the same arrangement for the pushbutton operation of switches. It will also be apparent that other features of the invention, will also have certain novel features of cooperation with the illustrative embodiment of the invention herein specifically described, may also be useful apart from this specific switch or be useful with other types of switches. Such a feature is the assembly feature of this invention, namely, the separate base and housing, having terminals and portions of switches mounted on the base, and having pushbutton operating members and the remaining parts of the switches mounted in the housing, to provide separate subassemblies which may be merely brought together and assembled by means which both mechanically and electrically connect the separate base and housing units comprising the switch according to one aspect of this invention. Accordingly, it is desired that this invention be interpreted as broadly as possible and that it be limited only as required by the prior art.

I claim as my invention:

1. A switch comprising, a switch casing, a plurality of pushbutton operating members projecting through openings in one wall of said casing, respectively, a plurality of switches mounted in said casing each of which includes a stationary contact and a movable contact, there being at least one switch for each pushbutton, means on each pushbutton for operating the movable contact of its switch in response to pushbutton movement, a plurality of cam members slidably mounted in said casing in a direction substantially at right angles to the movement of said pushbuttons and located at the inner ends of said pushbuttons, rollers mounted on the inner ends of said pushbuttons by a connection having lost motion in the direction of the sliding movement of said cam members to permit both rotational movement and translatory movement of the rollers in the direction of the sliding movement of said cam members, and each of said rollers being located between adjacent cam members so as to be engageable therewith and to cause sliding movement thereof in opposite directions upon depression of its associated pushbutton and thereby to cause elevation of the other pushbuttons.

2. A switch comprising, a plurality of pushbutton operating members, a plurality of switches mounted in said casing each of which includes a stationary contact and a movable contact, there being at least one switch for each pushbutton, means on each pushbutton for operating

the movable contact of its switch in response to movement of the pushbutton, a plurality of cam members slidably mounted in a direction substantially at right angles to the movement of said pushbuttons and located at the inner ends of said pushbuttons, the inner ends of said bushbuttons being slotted, a roller mounted in the slot of each pushbutton by a connection having lost motion in the direction of the sliding movement of said cam members to permit both rotational movement and translatory movement of the rollers in the direction of the sliding movement of said cam members, and each of said rollers being located between adjacent cam members so as to be engageable therewith and to cause sliding movement thereof in opposite directions upon depression of its associated pushbutton and thereby to cause elevation of the other pushbuttons.

3. A switch comprising, a plurality of pushbutton operating members arranged substantially in a circle, a plurality of switches each of which includes a stationary contact and a movable contact, there being at least one switch for each pushbutton, means on each pushbutton for operating the movable contact of its switch in response to movement of the pushbutton, a plurality of curved cam members slidably mounted in a circular direction substantially at right angles to the movement of said pushbuttons and located at the inner ends of said pushbuttons, the inner ends of said pushbuttons being slotted, a roller mounted in the slot of each pushbutton by a connection having lost motion in the direction of the sliding movement of said cam members to permit both for rotational movement and translatory movement of the rollers in the direction of the sliding movement of said cam members, and each of said rollers being located between adjacent cam members so as to be engageable therewith and to cause sliding movement thereof in opposite directions upon depression of its associated pushbutton and thereby to cause elevation of the other pushbuttons.

4. A switch comprising, a plurality of pushbutton operating members, a plurality of switches each of which includes a stationary contact and a movable contact, there being at least one switch for each pushbutton, means on each pushbutton for operating the movable contact of its switch in response to movement of the pushbutton, a plurality of cam members slidably mounted in a direction substantially at right angles to the movement of said pushbuttons and located at the inner ends of said pushbuttons, said cam members having slidably interfitting tongue and groove portions which extend in the direction of sliding movement of said cam members, said tongue and groove portions being of an extent to remain in interfitting engagement throughout the extent of movement of said cam members, rollers rotatably mounted on the inner ends of said pushbuttons, and each of said rollers being engageable with at least one of the adjacent cam members to cause sliding movement thereof upon depression of its associated pushbutton and to thereby cause elevation of the other pushbuttons.

5. A switch comprising, a plurality of pushbutton operating members, a plurality of switches each of which includes a stationary contact and a movable contact, there being at least one switch for each pushbutton, means on each pushbutton for operating the movable contact of its switch in response to movement of the pushbutton, a plurality of cam members slidably mounted in a direction substantially at right angles to the movement of said pushbuttons and located at the inner ends of said pushbuttons, said cam members having slidably interfitting tongue and groove portions which extend in the direction of sliding movement of said cam members, said tongue and groove portions being of an extent to remain in interfitting engagement throughout the extent of movement of said cam members, rollers mounted on the inner ends of said pushbuttons by a connection having lost motion in the direction of the sliding movement of said cam members to permit both rotational movement and translatory movement in the direction of the sliding movement of said cam members, and each of said rollers being located between adjacent cam members so as to be engageable therewith and to cause sliding movement thereof in opposite directions upon depression of its associated pushbutton and thereby to cause elevation of the other pushbuttons.

6. A switch comprising, a plurality of pushbutton operating members, a plurality of switches each of which includes a stationary contact and a movable contact, there being at least one switch for each pushbutton, means on each pushbutton for operating the movable contact of its switch in response to movement of the pushbutton, a plurality of cam members slidably mounted in a direaction substantially at right angles to the movement of said pushbuttons and located at the inner ends of said pushbuttons, the inner ends of said pushbuttons being slotted, a roller mounted in the slot of each pushbutton for rotational movement, projection and recess means on said roller and at least one side of said slot, respectively, permitting limited translatory movement of the rollers in the direction of the sliding movement of said cam members, and each of said rollers being located between adjacent cam members so as to be engageable therewith and to cause sliding movement thereof in opposite directions upon depression of its associated pushbutton and to thereby cause elevation of the other pushbuttons.

7. A switch comprising, a plurality of pushbutton operating members, a plurality of switches each of which includes a stationary contact and a movable contact, there being at least one switch for each pushbutton, means on each pushbutton for operating the movable contact of its switch in response to movement of the pushbutton, a plurality of cam members slidably mounted in a direction substantially at right angles to the movement of said pushbuttons and located at the inner ends of said pushbuttons, the inner ends of said pushbuttons being slotted, a roller mounted in the slot of each pushbutton, each roller having pintle portions at opposite sides slidably received in grooves provided in opposite sides of its pushbutton slot which extend in the direction of movement of said cam members to permit both rotation and translatory movement of the rollers in the direction of the sliding movement of said cam members, and each of said rollers being located between adjacent cam members so as to be engageable therewith and to cause sliding movement thereof in opposite directions upon depression of its associated pushbutton and to thereby cause elevation of the other pushbuttons.

8. A switch comprising, a switch casing including an enclosure and a separable base, a plurality of pushbutton operating members slidably mounted in said enclosure and projecting through openings in one wall thereof, a plurality of switches mounted in said casing and each including relatively fixed and movable contacts, a plurality of line and load terminals on said base, one contact of each switch also being mounted on said base to be separable therewith and with said terminals as a unit from said enclosure and said pushbutton operating members, the bottom of said enclosure to which said base is secured being open to permit access of the interior of the enclosure to the contact carried by the base, said base being solid to close the bottom of said enclosure when assembled therewith, at least one of said switches for each pushbutton with the movable contact thereof located adjacent one side of its pushbutton when said base and enclosure are secured together, at least one other contact of each switch being secured to and mounted within said enclosure so as to be cooperable with said one contact of each switch, means on the aforesaid one side of each pushbutton for operating the movable contact of its switch in response to movement of the pushbutton, and means in said enclosure mechanically engageable by said pushbuttons for interlocking them so that their operation is confined to a predetermined mode.

9. A switch comprising, a switch casing including an enclosure and a separable base, a plurality of pushbutton operating members slidably mounted in said enclosure and projecting through openings in one wall thereof, a plurality of switches mounted in said casing and each including relatively fixed and movable contacts, a plurality of line and load terminals mounted on said base, the movable contact of each switch also being mounted on said base to be separable therewith and with said terminals as a unit from said enclosure and said pushbutton operating members, the bottom of said enclosure to which said base is secured being open to permit access to the interior of the enclosure by the movable contacts carried by the base, said base being solid to close the bottom of said enclosure when assembled therewith, at least one of said switches for each pushbutton with the movable contact thereof located adjacent one side of its pushbutton when said base and enclosure are secured together, at least one fixed contact of each switch being secured to and mounted within said enclosure so as to be cooperable with said movable contact of each switch, means on the aforesaid one side of each pushbutton for operating the movable contact of its switch in response to movement of the pushbutton, and means in said enclosure mechanically engageable by said pushbuttons for interlocking them so that their operation is confined to a predetermined mode.

10. A switch comprising, a switch casing, a plurality of pushbutton operating members arranged substantially in a circle and projecting through openings in one wall of said casing, respectively, a plurality of switches mounted in said casing, there being at least one switch for each pushbutton, means operable by movement of each pushbutton for operating its switch, each pushbutton except one causing the contacts of its switch to open when the pushbuttons are elevated and closed when the pushbuttons are depressed, a signal light mounted in said casing behind a central opening in said one casing wall and electrically connected in series circuit with the switch of said one pushbutton the contacts of which are open when said one pushbutton is depressed and closed when it is elevated, a light transmitting member secured to said cover so as to extend over said central opening whereby said signal light transmits light therethrough beyond said cover when energized, and interlocking means in said casing for permitting only one of said pushbuttons to be depressed at a time.

11. A switch comprising, a switch casing, a plurality of pushbutton operating members arranged substantially in a circle and projecting through openings in one wall of said casing, respectively, a plurality of switches mounted in said casing, there being at least two switches for each pushbutton except one, means operable by movement of each pushbutton for operating its switches, each pushbutton except the said one causing the contacts of its switches to open when the pushbuttons are elevated and closed when the pushbuttons are depressed, a signal light mounted in said casing behind a central opening in said one casing wall and electrically connected in series circuit with the switch of said one pushbutton the contacts of which are open when said one pushbutton is depressed and closed when it is elevated, and interlocking means in said casing for permitting only one of said pushbuttons to be depressed at a time.

12. A switch comprising, a switch casing, a plurality of operating pushbuttons and an "Off" pushbutton projecting through spaced openings arranged in a circle in one wall of said casing, respectively, switches mounted in said casing at the inner and outer sides of said circle, there being switches at both inner and outer sides of each operating pushbutton for operation thereby, a plurality of line and load terminals for said casing, means electrically connecting one of said line terminals to one contact of each of the inner switches, the other contacts thereof being connected to said load terminals, respectively, means electrically connecting others of said line and load terminals to the contacts of each of the outside switches, respectively, means responsive to depression of each of the operating pushbuttons for closing its switches and for opening its switches when the pushbutton is extended, and interlocking means in said casing for permitting only one of said pushbuttons to be depressed at a time.

13. A switch comprising, a switch casing, a plurality of operating pushbuttons and an "Off" pushbutton projecting through spaced openings arranged in a circle in one wall of said casing, respectively, switches mounted in said casing at the inner and outer sides of said circle, there being switches at both inner and outer sides of each operating pushbutton for operation thereby, three line terminals, one of which is a neutral terminal, and three load terminals for said casing, means electrically connecting one of said line terminals to one contact of each of the inner switches, the other contacts thereof being connected to said load terminals, respectively, means electrically connecting one contact of some of the outer switches to the neutral terminal, with the other contacts of said some outer switches being electrically connected to two of said load terminals, respectively, the remainder of said outer switches having one contact thereof electrically connected to the remaining line terminal and the other contacts thereof electrically connected with said load terminals, respectively, means responsive to depression of each of the operating pushbuttons for closing its switches and for opening its switches when the pushbutton is extended, and interlocking means in said casing for permitting only one of said pushbuttons to be depressed at a time.

14. A switch comprising, a plurality of pushbutton operating members, a plurality of switches each of which includes a stationary contact and a movable contact, there being at least one switch for each pushbutton, means on each pushbutton for operating the movable contact of its switch in response to movement of the pushbutton, a plurality of cam members slidably mounted in a direction substantially at right angles to the movement of said pushbuttons and located at the inner ends of said pushbuttons, said cam members having slidably interfitting tongue and groove portions which extend in the direction of sliding movement of said cam members, said tongue and groove portions being of an extent to remain in interfitting engagement throughout the extent of movement of said cam members, the inner ends of said pushbuttons being slotted in the direction of the sliding movement of said cam members, a roller rotatably mounted in said slot of each of said pushbuttons, respectively, each of said cam members having a portion thereof located within at least one of said slots of said pushbuttons at all times, and each of said rollers being engageable with at least one of the adjacent cam members to cause sliding movement thereof upon depression of its associated pushbutton and to thereby cause elevation of the other pushbuttons.

15. A switch comprising, a plurality of pushbutton operating members, a plurality of switches each of which includes a stationary contact and a movable contact, there being at least one switch for each pushbutton, means on each pushbutton for operating the movable contact of its switch in response to movement of the pushbutton, a plurality of cam members slidably mounted in a direction substantially at right angles to the movement of said pushbuttons and located at the inner ends of said pushbuttons, each of said cam members having a tongue portion at one end and a groove portion at its other end which portions extend in the direction of sliding movement of said cam members and which are slidably interfitting with said tongue and groove portions on the other of said cam members, said tongue and groove portions on interfitting cam members each having opposed sloping cam surfaces, rollers rotatably mounted on the inner ends of said pushbuttons and each of said rollers

being engageable with at least one of said opposed cam surfaces to cause sliding movement of one of said cam members upon depression of its associated pushbutton and thereby to cause elevation of the other pushbuttons.

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