July 3, 1956 G. B. LONG ET AL 2,753,432

ELECTRICAL APPARATUS

Filed April 17, 1952 2 Sheets-Sheet 1

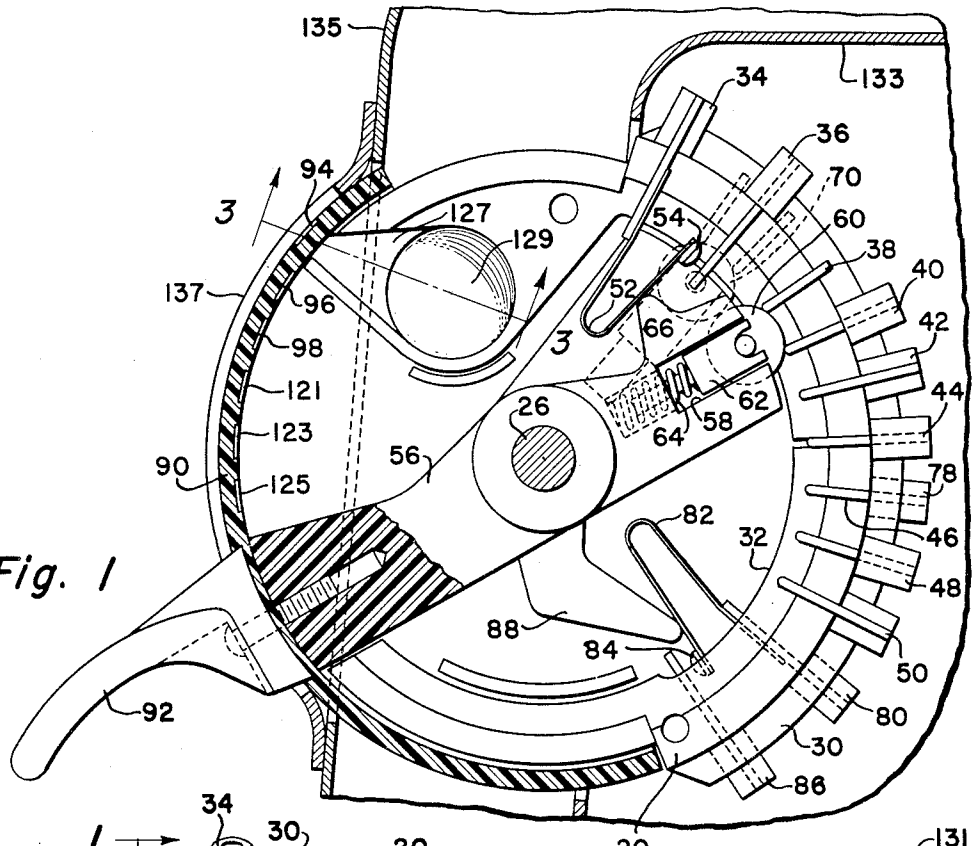


Fig. 1

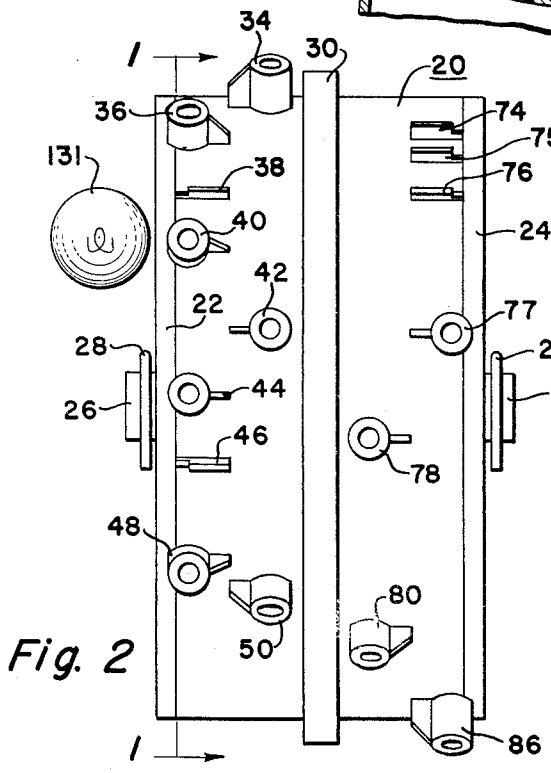


Fig. 2

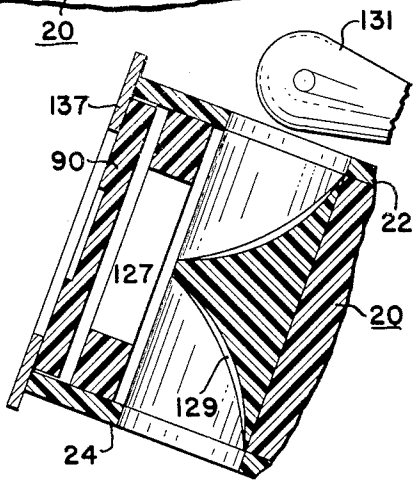


Fig. 3

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ELECTRICAL APPARATUS

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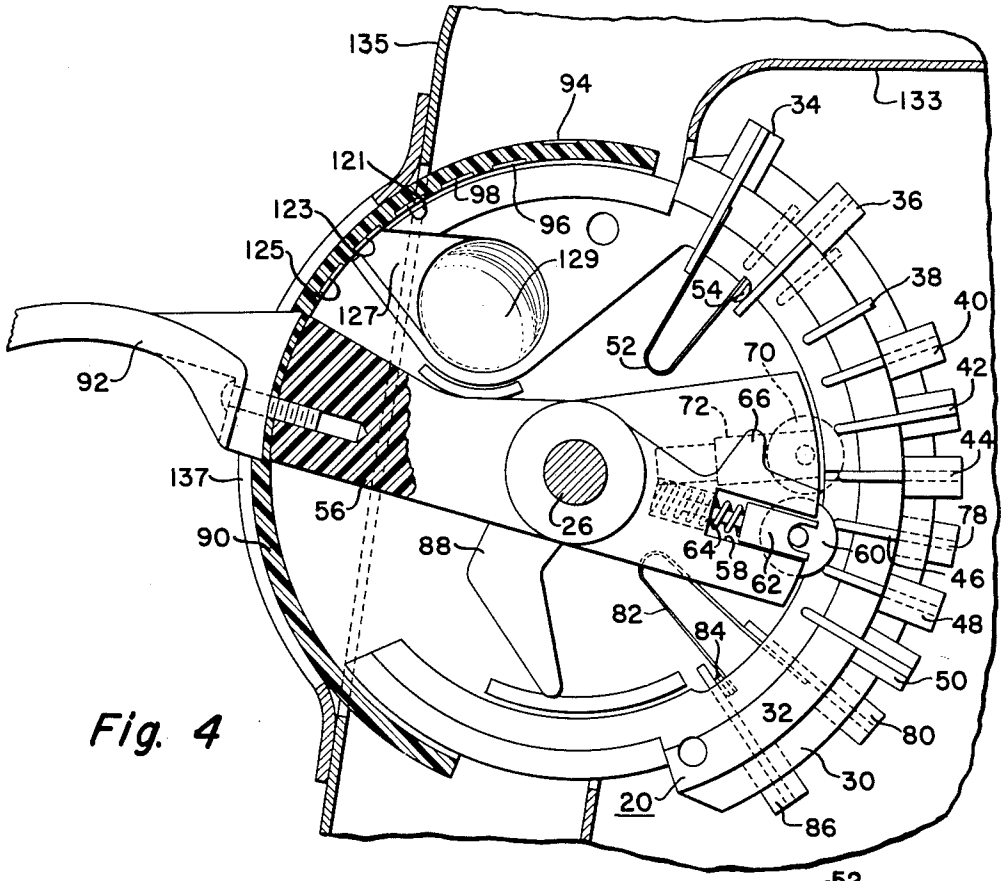


Fig. 4

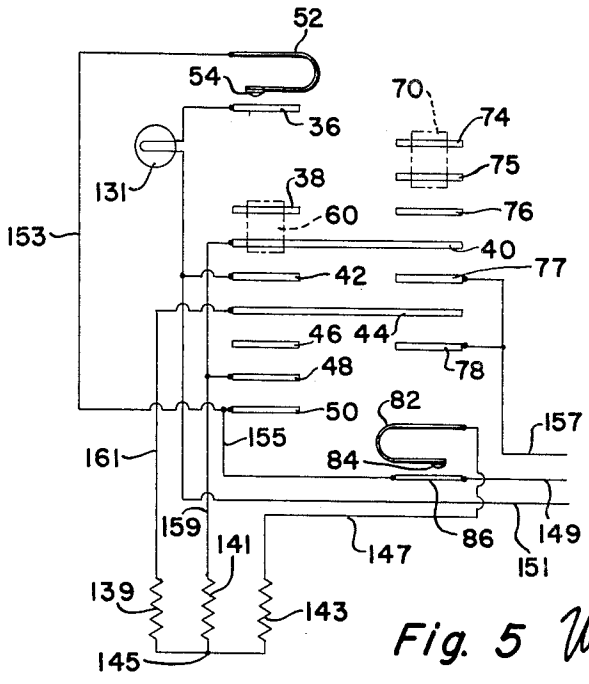


Fig. 5

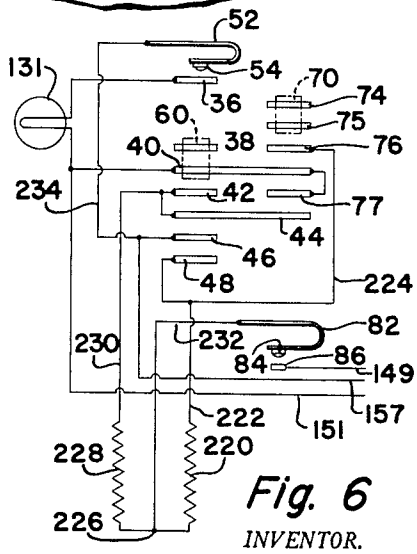


Fig. 6

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United States Patent Office 2,753,432
Patented July 3, 1956

2,753,432

ELECTRICAL APPARATUS

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Application April 17, 1952, Serial No. 282,868

5 Claims. (Cl. 219—20)

This invention relates to electrical apparatus and more particularly to improved switch and circuit arrangements.

At present, it is customary for multi-position switches for the surface heaters of electric ranges to be made with a delay arrangement so that it is impossible to operate them rapidly from one position to another. The purpose of this is to prevent arcing or flashover from one live contact to another.

It is an object of our invention to provide a circuit arrangement and a simple multi-position switch which can be rapidly actuated to and from any positions without any danger of flashover.

It is another object of our invention to provide an improved rotary bridging type roller switch.

It is another object of our invention to provide a dual rotary bridge type roller switch having two sets of spaced stationary contacts and a bridging roller for each set of contacts.

It is another object of our invention to provide a bridging type switch and circuit arrangement which is arranged so that contacts connected to supply conductors are always separated by contacts which are either connected to the electrical load or are unconnected.

It is another object of our invention to provide an improved dial illuminating system for a control wherein the light source is located at one side of the control and reflecting and guiding means are provided for directing the rays of light onto the dial.

These objects are obtained by providing a switch having a generally cylindrically shaped housing with plate-type contact members extending radially through the walls of the housing in substantially uniformly spaced relationship in two separate series. A roller-type contact member carrying two separate spring mounted roller contacts is rotatably mounted upon a pivot shaft coaxial with the housing. The roller-type contact member also is provided with an operating handle and a translucent dial. In addition to the roller contacts, the housing is provided with a set of spring pressed contacts which are spring actuated to a closed position and which are engaged and forced into the open position in the off position of the contact member.

To prevent the drawing of the arc from one live supply conductor to another, the radial contact members are connected to the circuit in such an arrangement that between the radial contacts connected to the live supply conductors there is always provided one or more radial contacts which are either connected to the electrical load or are unconnected. To make it unnecessary to have a transformer to make it possible to use a small illuminating light, the illuminating light is placed at one side of the control so that it may use full voltage current and its rays are transmitted to the translucent dial through a light transmitting reflecting system formed directly in the walls of the housing for illuminating the translucent dial.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Figure 1 is a vertical sectional view taken substantially along the line 1—1 of Figure 2 illustrating one embodiment of our improved control in the off position. The control is shown located on the front of an electric range;

Figure 2 is a right side view of the control shown in Figure 1 with the remaining parts of the range omitted;

Figure 3 is a sectional view taken along the lines 3—3 of Figure 1 showing the light reflecting and guiding system;

Figure 4 is a sectional view similar to Figure 1 but with the control shown in the next to high heat position;

Figure 5 is a diagrammatic view of the contact arrangement together with a wiring diagram applied to a three element heating circuit such as may be found in Figure 11 of Patent Number 2,456,343; and

Figure 6 is a diagrammatic view of the contact arrangement and wiring diagram such as may be used with a two element heater such as is shown in Figure 3 of the aforesaid patent.

Referring now to the drawings and more particularly to Figure 2, there is shown a substantially cylindrical housing 20 of a suitable electrical insulating plastic. This housing 20 has side plates 22 and 24 also of a suitable plastic having electrical insulating properties. Supported by these side walls 22 and 24 is a coaxially located pivot shaft 26 which is prevented from axial movement by forked spring clips 28 which are lodged in grooves in the ends of the shaft 26. The cylindrical portion of the housing 20 is divided by a central spacing rib 30 which projects outwardly to provide a sufficient long path between the two sides of the housing to prevent surface arcing. A corresponding internally extending rib 32 may be provided within the cylindrical housing 20 to prevent arcing on the interior surface.

Extending radially through the wall of the housing 20 on one side of the rib 30 are the contacts members 34, 36, 38, 40, 42, 44, 46, 48 and 50. The contact members 38 and 46 are unconnected. The contact 34 is in the form of a radial plate having a terminal connection on its outer end and upon the inner end there is provided the anchored end of the spring mounting 52 of the contact 54. The spring mounting 52 is provided with a spring force which urges the contact 54 toward engagement with the adjacent contact 36 which is in the form of a plate extending through the wall of the housing 20 a sufficient distance so that its inner end is in the path of movement of contact 54. Its outer end is provided with a terminal.

The contact member 56 is formed of suitably molded plastic material having electrical insulating properties. It is rotatably mounted upon the coaxial shaft 26. This contact member 56 is provided with an extending portion having a slot 58 carrying a metal roller 60 of some good electrical contact material. The roller 60 is provided with integral coaxial pins on its opposite sides which are held within the notch bearings provided in the yoke 62. This yoke 62 is slidably mounted in the slot 58 and has a pin projecting radially inwardly on which is mounted a small coil spring 64 extending radially inwardly into a recess provided in the contact member 56. The spring 64 presses the yoke 62 and the roller 60 radially outwardly so as to yieldingly hold the roller 60 in bridging engagement between any adjacent two of the contact plate members 38, 40, 42, 44, 46, 48 and 50. The contact member 56 also has a projection 66 which in the off position engages the spring mounting 52 to hold the contact 54 away from the contact 36 as shown in Figure 1.

The aforementioned contacts beginning with 38 and ending with 50 are in the form of plates arranged radially with respect to the shaft 26 a substantially uniform

distance apart. Their inner edges are rounded and preferably are provided with a silver coating. The remaining portions of the plates may be made of copper or other suitable conducting material. All of the aforementioned contacts are arranged in a radial row on one side of the ribs 30 and 32.

Upon the opposite side of the ribs 30 and 32, the contact member 56 is provided with a second roller 70 similar to the roller 60 which cooperates with a yoke and spring identical to the yoke 62 and the spring 64 in the slot 58. This roller 70 and the slot 72 are on the opposite side of the dividing rib 32 from the roller 60 and the slot 58. The roller 70 cooperates with the unconnected contacts 74, 75 and 76. The connected contact 40 extends across the dividing ribs 30 and 32 in-between the contact 76 and the connected contact 77. The contact 44 likewise extends across the dividing ribs 30 and 32 in-between the connected contacts 77 and 78.

The contact plate 80 extends radially through the housing 20 and carries a spring mounting 82 for the contact 84. The spring mounting 82 yieldingly urges the contact 84 toward contact plate 86 extending radially through the housing 20. With the exception of the contacts 54 and 84, all the contacts are formed of thin plates of copper or other suitable electrical conductor extending radially through the housing 20 and having, if connected, a suitable terminal at their outer ends. Those contacts which are bridged between the rollers 60 or 70 are uniformly spaced in the radial direction. That is they are located at equal angular distances and project inwardly the same distance from the axis of the shaft 26. The contact 84 in the off position is held in the open position by an integral projecting arm 88 extending from the body of the contact member 56 as shown in Figure 1.

Fastened to the opposite end of the contact member 56 from the rollers 60 and 70 are a semicircular translucent dial 90 and a handle or finger grip 92. The dial 90 is provided with transparent figures with the reference character 94 indicating the off figure, the reference character 96 indicating 1/10 heat, the reference character 98 indicating 1/7 heat, the reference character 121 indicating 1/3 heat, the reference character 123 indicating 1/2 heat and the reference character 125 indicating high heat. These figures designated by the reference characters 94 to 108 and 121 to 125 cooperate with the light reflecting and guiding system which includes the converging light channel 127. This channel 127 converges into a narrow outlet slot directly behind the aforementioned figures as they are moved into position covering this slot as the contact member is moved to various corresponding positions. The converging reflecting passage 127 connects to a curved reflecting surface 129 positioned generally at an angle of about 45° so that the illumination from the light bulb 131 located at the side of the plate 22 can be transmitted to the dial 90. This makes it possible to use a light bulb sufficiently large to carry full voltage current such as 117 volts making a transformer unnecessary.

The control may be mounted upon a support member 133 in front of the surface heaters upon an electric range. The range top and front member 135 is provided with an opening through which projects a portion of the housing 20. An escutcheon member 137 covers the edge portions of the opening and the dial 90 and the adjacent portions of the side plates 22 and 24.

In Figure 5 there is shown one example of a circuit arrangement for this control. As shown, there are provided three resistances 139, 141 and 143. Theses resistances may indicate three electrical devices or one complete electrical device. As one specific example, they may indicate a three coil surface heater of an electric range such as is shown in Figure 11 of Patent Number 2,456,343, issued December 14, 1948. The three resistances 139, 141 and 143 each have a terminal joined at a common point 145. The second terminal of the resistance 143 is connected by the conductor 147 to the spring mounting 82 of the contact 84 which cooperates with the contact 86. The contact 86 is connected to one of the live supply conductors 149 of a three wire Edison supply circuit. The neutral wire 151 of the Edison supply circuit is connected to one terminal of the light bulb 131.

The second terminal of the light bulb 131 is connected to the contact 36. The contact 36 is adapted to be contacted in all but the off position by the contact 54 which is mounted upon the spring mounting 52. The spring mounting 52 is connected by the conductor 153 to the contact 50. The contact 50 as well as the conductor 153 are connected by the conductor 155 to the contact 86 and the supply conductor 149.

The second live supply conductor 157 is connected to both the contacts 77 and 78. The contacts 40 and 48 are connected by the conductor 159 to the second terminal of the resistance 141. The contact 44 is connected by the conductor 161 to the second terminal of the resistance 139.

As shown in Figure 5 as well as Figure 1, in the off position the roller 69 bridges the unconnected contact 38 and the load contact 40 while the roller 70 bridges the unconnected contact 74 and 75. In the series of contacts which are contacted by the roller 60 only the contacts 50 and 42 are connected to the supply conductors. In-between these contacts 42 and 50 are the contacts 44 and 48 which are connected to the second terminals of the resistances 139 and 141 and the contact 46 which is unconnected. On the opposite side of contact 42 is the contact 40 which is likewise connected to the second terminal of the resistance 141. Therefore, the roller 60 can never draw an arc from one contact connected to a supply conductor to another contact connected to another supply conductor because the distance is too great. Any arc forming when the roller 60 leaves either the contact 42 or 50 will be discharged through one of the contacts 40, 44 or 48 connected to one of the resistances.

On the opposite side, the live contacts 77 and 78 are connected to the same supply conductor 157 so that no arc will be drawn between them. However, between these contacts 77 and 78 is the contact 44 while the contact 40 extends on the opposite side. Therefore, any tendency for an arc to form at either of the contacts 77 and 78 will cause the current to be conducted either of the contacts 40 or 44 to the resistances 141 or 139 so that any tendency for an arc to form will be suppressed by reason of the fact that the arcing current would have to pass these resistances to reach a different live contact. The distance is too great for such an arc to cross.

In Figure 6, there is shown another application to show another possible circuit arrangement for a different load. In this particular arrangement, the contacts 50 and 78 are not used and therefore are not shown in Figure 6. In Figure 6 any electrical device with three terminals or two electrical devices with one terminal joined served to indicate generally a type of electric load. As one specific example, this load may be a two coil surface heater such as is shown in Figure 3 of Patent Number 2,456,343, issued December 14, 1948. In this form, the resistance 220 is connected by conductors 222 and 224 with the contacts 76 and 48. The opposite terminal of the resistance 220 is connected at a common point 226 with the second terminal, the adjacent terminal of a resistance 228. The second terminal of the resistance 228 is connected by the conductor 230 to the contacts 42 and 44. The common terminal 226 is connected by the conductor 232 to the spring mounting 82 of the contact 84 which is adapted to

make contact in all but the off position with the contact 36 connecting with the supply conductor 149.

The neutral conductor 151 connects with contact 40 which is also connected to the contact 77 as shown. The neutral conductor 151 is also connected to the one terminal of the lamp 131. The second terminal of the lamp 131 is connected to the contact 36 which cooperates with the contact 54 on the spring mounting 52. The spring mounting 52 is connected by the conductor 234 to the supply conductor 157. This supply conductor 149 is also connected to the contact 46. It will therefore be seen that the live contacts 40, 77 and 46 are properly protected from arcing. In the series of contacts cooperating with the roller contact 60, the contacts 40 and 46 are separated by the load connected contacts 42 and 44 while on the other flank of the contacts 40 and 46 are the neutral contacts 38 and the load connected contact 48. The contacts 40 and 77 are connected together and are therefore at the same potential. They are flanked by the load connected contacts 76 and 44 so that no arc will be formed in the movement of the roller contact 70.

Therefore this switch and circuit arrangement operating upon the principle of bridging contacts arranges the contacts so that those contacts between the contacts connected to the supply conductors are always either connected to the load or are unconnected. This therefore insures that arcing and flashover are suppressed and rapid operation of the switch may be permitted without any restraint. Therefore the contact member 56 may be operated as rapidly as desired. It is much more convenient to operate than a rotatable knob of the conventional type and it is much more simple and comprehensible than push button arrangements. It is not limited to any particular type of electrical load but may have broad application whenever it is desired to switch to and from different circuit arrangements.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. An electrical system adapted to be connected to a three wire supply source including three electrical devices each having one terminal joined in common, a first contact connected to the second terminal of the first device, a second contact connected to a first wire of the supply source, a third contact connected to the second terminal of the second device, a fourth contact connected to the second terminal of the first device, a fifth contact connected to the second wire of the supply source, a sixth contact means connected to the third wire of the supply source, a bridging contact means having a first position in which none of the contacts and contact means are bridged, said bridging contact means having a second position bridging the first and second contacts, said bridging contact means having a third position bridging the first contact and the sixth contact means, said bridging contact means having a fourth position bridging the third contact and the sixth contact means, said bridging contact means having a fifth position bridging the fourth and fifth contacts, the second terminal of the third device being connected to the third wire of the supply source, an operating and indicating means for said bridging contact means including a light source, means including a reflecting surface and a slot for transmitting light from the light source, and an indicating shield movable over said slot and having illuminable indices located successively over the slot in accordance with the movement of the shield.

2. An electrical system adapted to be connected to a plural wire supply source including a first contact connected to a first wire of said supply source, an electrical device having two terminals, a second contact connected to one of the terminals of said device, a third contact connected to a second terminal of said device, a fourth contact connected to a second wire of said supply source,

a supporting arrangement, each of said contacts protruding from said supporting arrangement, a first spring pressed roller having only sufficient diameter to span the protruding surfaces of the first and second contacts, a second spring pressed roller having only sufficient diameter to span the protruding surfaces of the third and fourth contacts, and means for moving said rollers into and out of engagement with said contacts.

3. An electrical system adapted to be connected to a plural wire supply source including a first contact connected to a first wire of said supply source, an electrical device having two terminals, a second contact connected to one of the terminals of said device, a third contact connected to a second terminal of said device, a fourth contact connected to a second wire of said supply source, a supporting arrangement, each of said contacts protruding from said supporting arrangement, a first spring pressed roller having only sufficient diameter to span the protruding surfaces of the first and second contacts, a second spring pressed roller having only sufficient diameter to span the protruding surfaces of the third and fourth contacts, and a structure pivoted to said supporting arrangement provided with means for holding and moving said spring pressed rollers into and out of bridging arrangement with their respective contacts.

4. An electrical system adapted to be connected to a plural wire supply source including electrical means having three terminals, six spaced contact members arranged in a first series, a second series of spaced contact members including two alternate spaced contact members connected respectively to the first and third of said six members, one spaced contact member between the two alternate members being connected to a first wire of the supply source, the first and fifth of said six members being connected to the second terminal of said means, the second of said six members being connected to the second wire of the supply source, the third of said six members being connected to the third terminal of said means, the sixth of said six members being connected to a third wire of the supply source, a first movable bridging contact means movable into bridging contact with and having such a span as to bridge only any two adjacent contact members in said first series, and a second movable bridging contact means movable into bridging contact with and having such a span as to bridge only any two adjacent contact members in said second series, an additional contact means connecting the first terminal with the third wire of said power source, and means for closing said additional contact means when said first bridging means spans any adjacent two of said six members and for opening said additional contact means when said first bridging means is beyond one end of the range of spanning any adjacent two of said six members.

5. An electrical system adapted to be connected to a plural wire supply source including electrical means having three terminals, six spaced contact members arranged in a first series, a second series of spaced contact members including two alternate spaced contact members connected respectively to the first and third of said six members, one spaced contact member between the two alternate members being connected to a first wire of the supply source, the first and fifth of said six members being connected to the second terminal of said means, the second of said six members being connected to the second wire of the supply source, the third of said six members being connected to the third terminal of said means, the sixth of said six members being connected to a third wire of the supply source, a first movable bridging contact means movable into bridging contact with and having such a span as to bridge only any two adjacent contact members in said first series, a second movable bridging contact means movable into bridging contact with and having such a span as to bridge only any two adjacent contact members in said second series, and means connecting said first and second bridging contact means for

simultaneous movement in a relationship in which the first bridging means bridges the third and fourth contact means of the first series when the second bridging means bridges the first and second contacts of the second series.

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