Aug. 3, 1965 G. C. MAPELSDEN 3,198,893

SWITCH HAVING AN ARC PREVENTING CAM ARRANGEMENT

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Fig. 1.

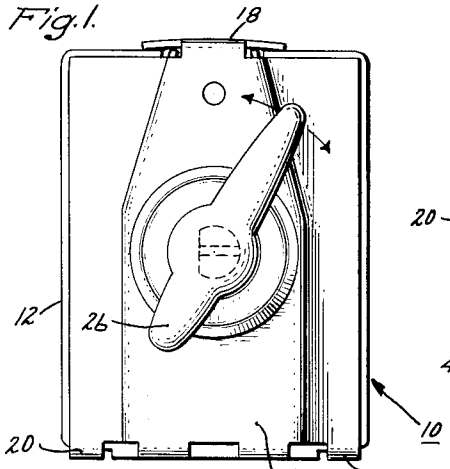


Fig. 2.

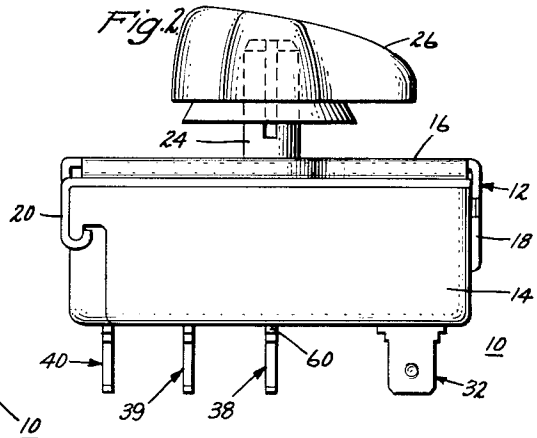


Fig. 4.

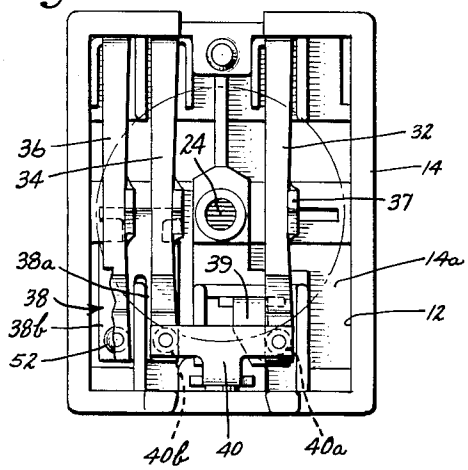


Fig. 3.

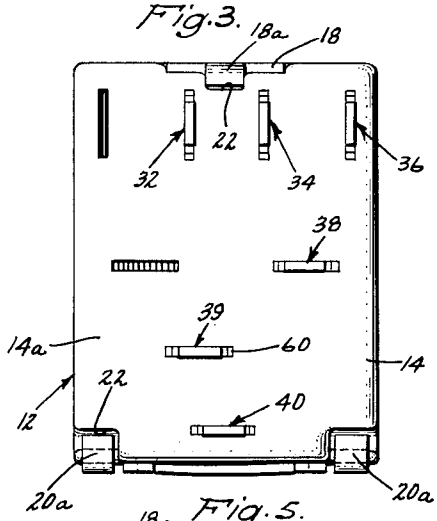


Fig. 5.

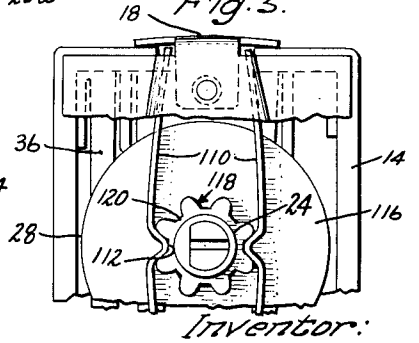
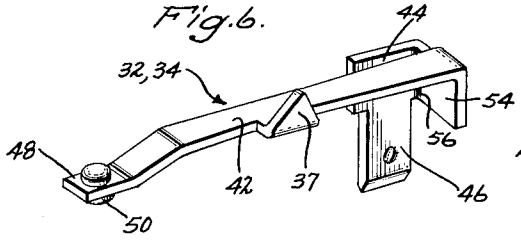


Fig. 6.



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SWITCH HAVING AN ARC PREVENTING CAM ARRANGEMENT

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Fig. 7.

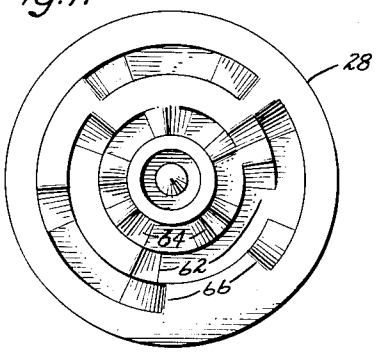


Fig. 8.

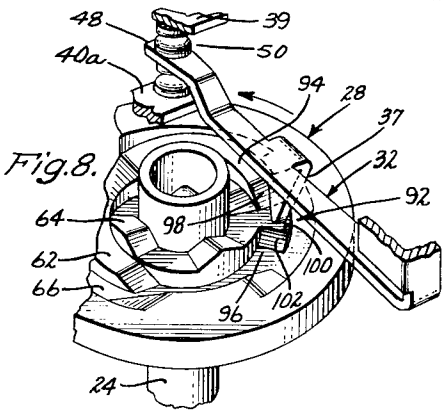
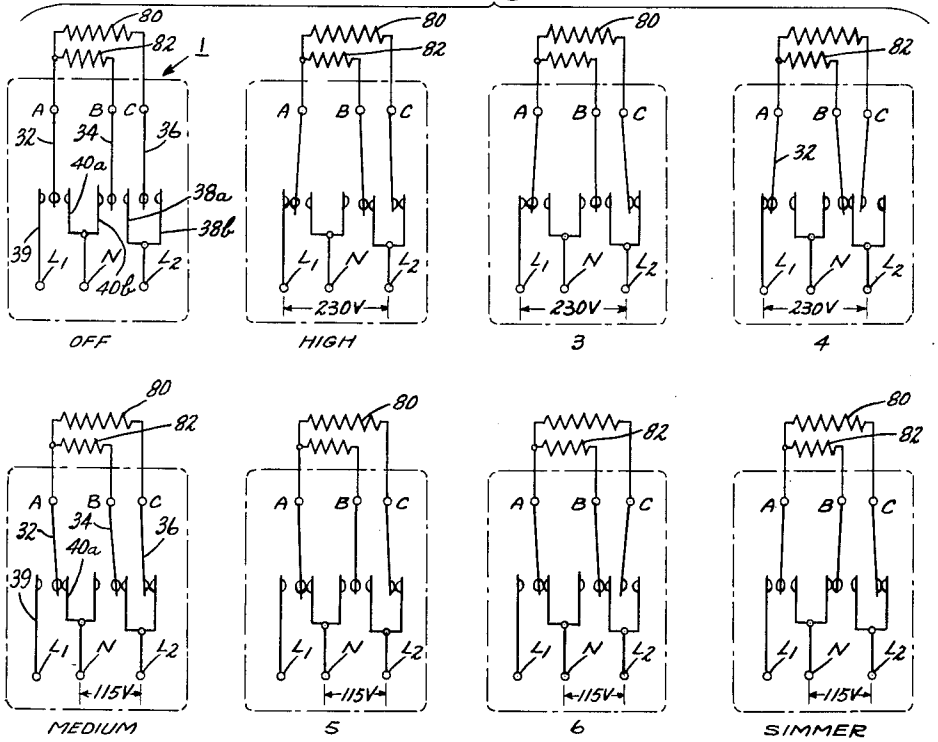


Fig. 10.



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SWITCH HAVING AN ARC PREVENTING CAM ARRANGEMENT

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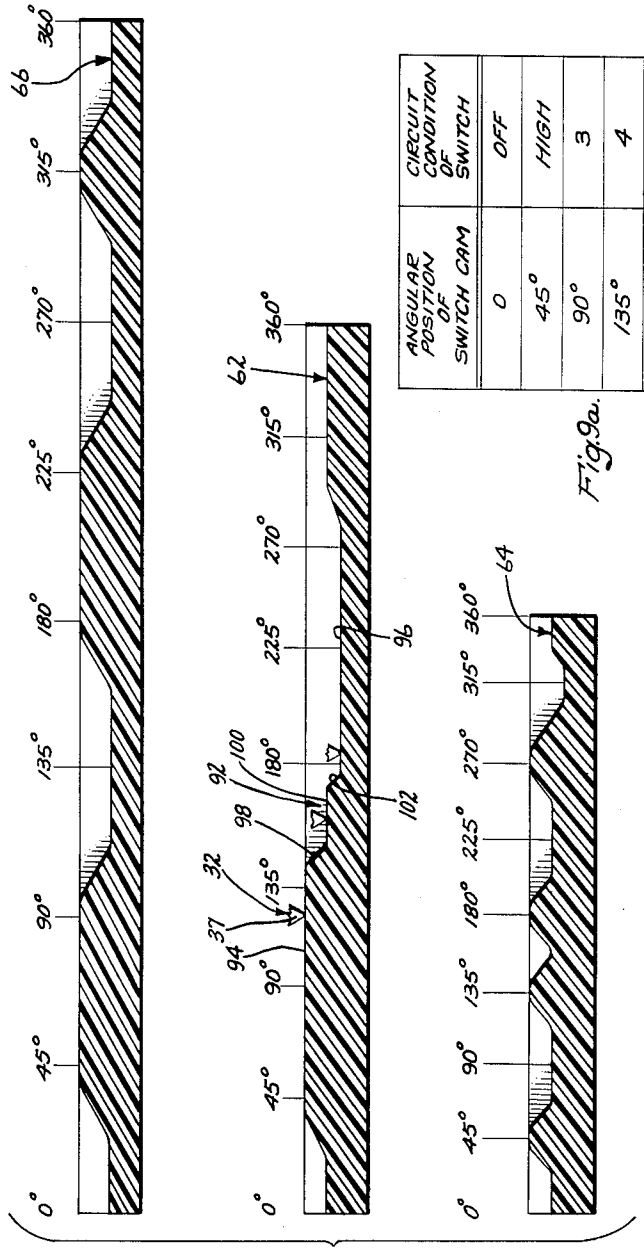


Fig. 9.

ANGULAR POSITION OF SWITCH CAM	CIRCUIT CONDITION OF SWITCH
0	OFF
45°	HIGH
90°	3
135°	4
180°	MEDIUM
225°	5
270°	6
315°	SIMMER

Fig. 9a.

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3,198,893

SWITCH HAVING AN ARC PREVENTING CAM ARRANGEMENT

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Filed Oct. 26, 1962, Ser. No. 233,270
3 Claims. (Cl. 200—6)

The present invention relates to switches and in particular to rotary switches of the type which are used to control alternating current circuits for such applications as electric ranges, etc.

The present invention is concerned with eliminating the possibility of flashover in rotary switches for electric ranges that operate on a three-wire 115/230 volt system. A flashover is defined as an electrical discharge or arc between conducting portions of the switch of differing line potentials and is, therefore, a short circuit established through the arc. This arc may be of low current magnitude and/or short time duration, in which case no damage is done to the switch. If, however, the current magnitude of the arc and/or the time duration are such as to cause melting of the current carrying switch parts due to high temperatures, the switch itself thereby may be destroyed or a fire may result. This phenomenon of flashover may occur in any switching action in which a movable contact connected to a common load is transferred very rapidly from a contact of one potential to a contact of ground or opposite potential.

In a switch used to control the heating of an electric range, flashover is most likely to occur when switching rapidly from a maximum heat position, with the range heating element across a 230 volt line, to a lower heat position, with the element across the 115 volt line. One typical rotary switch used for certain electric range applications is an 8-position switch, wherein seven different heating conditions are provided. For such a range application, each heating element usually includes two resistance units which are connected in various single, series, and parallel circuits operating at either 115 or 230 volts to give the different levels of heat desired for cooking. In the three higher heat positions of the switch, one or both of the resistance units are connected across the 230 volt line from one 115 volt terminal to the other of opposite polarity. In the next three lower heat positions, one or both of the resistance units are connected across the 115 volt line from one 115 volt terminal to neutral. In switching from any of the three higher heat positions to any of the next three lower heat positions, the load connection is transferred from one of the 115 volt line terminals to the neutral terminal. If the switching is done sufficiently rapidly, the arc at the 115 volt terminal may not have been interrupted prior to the switch blade having closed on the neutral terminal, and a short circuit is established through the arc between the 115 volt line and neutral, causing a flashover. Depending on the severity of the flashover, the temperature of the arc may be of such high intensity that it will weld the contacts together, destroying the usefulness of the switch.

The arc established between the contacts of a switch of this type operating in an alternating current circuit may be interrupted in one of two ways: first, by opening the contacts far enough so that the arc is extinguished, and secondly, in certain instances, by the alternating current of the arc going through a current zero as occurs at each half cycle. There is a practical limit to which the contacts can be separated to establish a long gap, thereby extinguishing the arc. This limit is imposed by factors of

size and cost of materials of the switch. It is therefore preferable to interrupt the arc by having the current reach a zero value on the sine curve of the alternating current. If the contact to be closed can be kept from closing for a full half cycle after the contact being interrupted is first opened, then flashover cannot occur since there is no arc to sustain the short circuit. As a practical matter, the contact transfer time can be considerably less than a half cycle since the available gap does help to interrupt the arc, and since flashover that occur late in the half cycle are of such short duration and of such low magnitudes of instantaneous current that the heat of the arc is not sufficient to cause damage.

For a common load, the contact transfer time or switching interval between opening a first pair of switch contacts connected to a line of one potential and closing a second pair of switch contacts connected to a line of neutral or opposite potential is a function of the speed of rotation of the switch actuating member that controls the positioning of the movable contact blades. The speed of angular rotation of this switch operating member may be affected by such factors as the dexterity and vigor of the operator of the switch, the size of the manually operable knob which is used by the operator, friction, detent action, and the coaction between the movable contact blade(s) of the switch and the switch operating member. The present invention is principally concerned with the protection of a rotary switch from flashover by controlling the coaction between a switch operating cam and a movable contact member in order to maximize the contact transfer time taken between opening one circuit and closing another circuit.

An important object of this invention is to provide an improved switch with a novel means for protecting certain contacts thereof from flashover.

Another object of the present invention is to provide an improved rotary switch structurally adapted to maximize the transfer time for movement of a cam operated contact from one position to another position in order to protect the switch from flashover.

A further object of this invention is to provide a new and improved rotary switch wherein flashover protection is expeditiously achieved by coaction between a switch operating cam and one or more movable contact blades.

In carrying out the present invention in one form thereof, I have provided an improved rotary switch which includes a novel means for protecting certain of its contacts from flashover. This switch includes a suitable hollow housing wherein there is located a contact means including at least one single-pole double-throw switch, and a rotatable cam for actuating this switch. The single-pole double-throw switch includes a movable contact blade having a cam follower portion between its ends and a double contact at its free ends for engagement with a fixed line contact and a fixed neutral contact. In accordance with the present invention, the switch operating cam includes an annular cam track with an improved actuating portion arranged to transfer the movable contact blade between the fixed line contact and the fixed neutral contact. In particular, this actuating portion comprises a first abrupt slope which acts upon the follower portion of the movable contact blade to rapidly engage or disengage the movable contact blade and the fixed line contact, and a second abrupt slope inclined in the same direction as the first slope, which acts upon the follower portion of the movable contact blade to rapidly engage or disengage the movable contact blade and the fixed neutral contact.

Interposed between the two slopes of the cam track actuating portion there is also formed a step. This step connects adjacent ends of the first and second slopes and acts upon the follower portion of the movable contact blade to maintain it in disengagement with both of its associated fixed contacts for a relatively long contact transfer time. With such an arrangement, by utilizing a cam actuating portion having a pair of abrupt slopes and an intermediate step therebetween, a maximal contact transfer time is achieved, thereby protecting the single-pole double-throw switch from flashover and enhancing its efficiency of operation.

Further aspects of my invention will become apparent hereinafter, and the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which I regard as my invention. The invention, however, as to organization and method of utilization, together with further objects and advantages thereof, may best be understood by reference to the following description when taken in conjunction with accompanying drawings in which:

FIG. 1 is a top view of a completely assembled rotary switch embodying my invention;

FIG. 2 is a side elevational view of the switch of FIG. 1;

FIG. 3 is a bottom view of the switch of FIG. 1;

FIG. 4 is a top view partially broken away of the rotary switch of FIG. 1;

FIG. 5 is a fragmentary view of the switch of FIG. 4, showing the detent arrangement for controlling the rotary movement of the cam;

FIG. 6 is a perspective view of one of the movable contact blades of the switch of FIG. 1;

FIG. 7 is a face view of the switch actuating side of the rotary cam;

FIG. 8 is a fragmentary perspective view of the cam of FIG. 7, showing an improved cam track in accordance with the present invention, and a movable contact blade operated thereby;

FIG. 9 is a layout of the various annular cam track surfaces of the switch actuating cam of FIGS. 7 and 8; and

FIG. 9*a* is a table illustrating the angular position of the switch cam in FIG. 9 relative to the circuit condition of the switch;

FIG. 10 represents typical circuit diagrams for each of the eight positions of the switch of FIG. 1.

Referring in detail to the drawings, and in particular to FIGS. 1–4, there is shown a rotary switch **10** wherein my invention has been advantageously employed. The housing **12** for switch **10** comprises a rectangularly configured recessed base **14** of molded phenolic or other suitable insulating material, and a cover plate **16**. To facilitate the convenient attachment of these two housing members together, the plate **16** includes a bent over section **18** at the center of its upper end (viewing FIG. 1) and two bent over sections **20** near the corners of its lower end (viewing FIG. 1). The section **18** is wrapped around the right end of base **14** (as shown in FIG. 2) and the sections **20** are wrapped around the left end of base **14** (as shown in FIG. 2) so that curled over extremities **18***a* and **20***a* of the sections **18** and **20** respectively (FIG. 3) cooperate with molded steps **22** of the base **14**. The engagement of extremities **18***a* and **20***a* with molded steps **22** thus securely attaches the plate **16** to base **14** in a simple manner for holding the switch parts in their assembled positions.

For selectively operating the various circuits controlled by switch **10**, a shaft **24** is rotatably mounted within housing **12** (see FIG. 2). Shaft **24** extends outwardly from the housing **12** through a suitable bearing aperture, and has a handle **26** secured to its slotted outer end (FIG. 2). The inner end of shaft **24** (FIG. 8) is suitably connected to a switch operating rotary cam **28** (FIGS. 7 and 8) which may be rotated in either direction for operating the switching elements. The structure and mode of operation of the cam **28** forms an important aspect of the present invention, as shall become apparent thereinafter.

Turning now to a further consideration of the interior of switch **10**, as shown in FIG. 4, there are three movable spring contacts **32**, **34** and **36**. The contact **32** is arranged on one side of shaft **24** and contacts **34** and **36** are arranged on the opposite side of shaft **24**.

The three spring contacts **32**, **34** and **36** are all fixed in the switch housing **12** at the upper end of base **14** (viewing FIG. 4). This mounting arrangement provides each spring contact with a cantilever action, while the force or load applied to the cantilever is determined by the cam **28** engaging a cam follower **37** on each contact adjacent the center thereof. The fixed contacts are arranged at the lower end of the base **14** (viewing FIG. 4) opposite the fixed ends of the spring contacts. There are three fixed contacts in all, namely contacts **38**, **39**, and **40**. Contacts **38** and **39** are arranged on the inner side of bottom wall **14***a* of base **14** and are engaged by contact buttons formed on the free ends of contacts **34**, **36**, and **32** respectively. The third fixed contact **40** is arranged above the free ends of the two inner spring contacts **32** and **34** (FIG. 4) and engaged by the contact buttons thereof. Hence, the outermost spring contact **36** is a single throw contact of a single-pole single-throw switch, while the innermost contacts **32** and **34** are double throw contacts of respective single-pole double-throw switches.

For a further explanation of the structure of the movable spring contacts **32**, **34** and **36**, attention is now directed to FIG. 6. As shown therein, each movable contact includes a spring blade **42**, a fixed intermediate portion **44**, and an integral tab type terminal **46**. The free end, or end **48**, opposite the fixed portion **44** of the contact carriers a silver contact button **50** which is adapted to make engagement with silver slugs **52** on the fixed contacts (FIG. 4). The cam follower **37**, mentioned previously, is merely a tab that extends from one side edge of the blade **42** and is upwardly directed (viewing FIG. 6) to engage with one of the cam tracks of cam **28** (FIG. 8). The end of the spring blade **42** that is remote from the silver contact button **50** is bent downwardly at a right angle as at **54**, and the tab terminal **46** is an extension of one side edge of the portion **54**. Actually, the terminal **46** is connected to the portion **54** by a right angle bend **56** so that the terminal **46** is perpendicular to the plane of the spring blade **42**, while being generally parallel with one side edge of the blade. The spring contacts are assembled in the base **14** by inserting the terminals through suitable slots, (as shown in FIG. 3), and the fixed portion **44** is staked therein by forming over the edges as at **60**.

To enable each of the movable contacts **32**, **34** and **36** to be operated by the switch operating cam **28**, each of these contacts has the aforementioned cam follower **37** which is directed toward the cam from the general plane of the blade **42** (FIGS. 4 and 8). The cam follower **37** of each of the movable contact blades **32**, **34** and **36** overlies an associated cam track and rides thereupon for selective actuation of its appropriate switch in response to the angular position of the switch operating cam **28**. The illustrated switch **10** includes three circular cam tracks **62**, **64**, and **66** (FIG. 7), one for operating each of the movable spring contacts **32**, **34**, and **36** respectively. Thus, more particularly, as shown illustratively in FIG. 8, the cam follower **37** of the movable contact blade **32** is, in general, operated by the sloped interruptions formed upon its associated cam track **62** and moves in a direction parallel to the axis of cam **28** to open and close into engagement with fixed contacts **39** and **40**. It will be understood further from viewing the cam track layouts of FIG. 9, and studying FIGS. 4 and 7 that the cam followers of blades **34** and **36** operate their associated switches in response to sloped interruptions of cam tracks **64** and **66**.

To protect the contacts **32**, **39** and **40** of switch **10** from the possibility of flashover, the present invention provides

an improved camming means for maximizing the contact transfer time involved in operating movable contact 32 between its two closed positions. The reason why it is important to provide such protection for contacts 32, 39, and 40 shall be better understood after a study is made of the circuit diagrams of FIG. 10. The diagrams of FIG. 10 show the various heating conditions which may be typically and selectively operated by my switch 10.

As shown in FIG. 10, the movable spring blades 32, 34 and 36 have terminal ends which are represented, respectively, as load terminals A, B, and C of the switch. The fixed contact 39 has its terminal end represented as line terminal L1; fixed contacts 40*a* and 40*b* of arm 40 have their terminal end represented as neutral terminal N; and fixed contacts 38*a* and 38*b* have their terminal ends represented as line terminal L2. The circuits of FIG. 10 are labeled in the order of decreasing temperature from "off," as "high," "3," "4," "medium," "5," "6," and "simmer." The switch 10 is supplied with a voltage of 115/230 from three conductors (not shown) that are joined to the load terminals L1, N and L2. Accordingly, any circuit across one of the line terminals L1 or L2 and the neutral terminal N would be operating at a voltage of 115 volts, while a circuit across the two line terminals L1 and L2 would be at a potential of 230 volts. The heating element that is to be controlled by the subject switch comprises two resistance heaters 80 and 82 which are used alone or together in series or in parallel circuits across either the low orthe high voltages to provide a wide range of available cooking temperatures.

In the "high" position, heating elements 80 and 82 are connected in parallel across the two line terminals L1 and L2 at a potential of 230 volts. For the position "3" of switch 10, as shown in the circuit immediately to the right of the "high" position circuit, resistance heater 80 is energized, and it is connected across the line terminals L1 and L2 at a potential of 230 volts. At position "4," only the resistance element 82 is energized and it is connected across the line terminals L1 and L2 at a potential of 230 volts. For the "medium" heat position of switch 10, the two resistance heaters 80 and 82 are again connected in parallel, as in the "high" heat position, but they are then across the line L2 and neutral N at a potential of 115 volts. At position "5," the heater 80 is the only element that is energized and it is operated at the low voltage of 115 volts. For position "6," only the resistance heater 82 is energized and it is across the line L2 and neutral N to provide it with 115 volts. Lastly, for the "simmer" position the resistance heaters 80 and 82 are connected in series across the line L2 and neutral N at 115 volts.

Flashover is known to occur in rotary switches of previous designs when the movable contact transfers from one side of the line to neutral in a time of less than one-half cycle (i.e., 0.0083 second for 60 cycle A.C.) so that the unextinguished arc is drawn across the gap and continues as a short circuit. In prior art switches of the general nature described, when the rotary switch is operated from the "4" position to the "medium" position, such as by changing the ultimate switch setting either from the "high," "3" or "4" heat positions to either the "medium," "5" or "6" heat positions, the occurrence of flashover has presented a problem. In particular, attention is drawn to the fact that in the "4" heat position, the contacts 32, 39 are closed between line L1 and load A, while the contacts 32, 40*a* are open between the neutral terminal N and load A. However, in the "medium" position, the contacts 32, 39 are open while the contacts 32, 40*a* are closed. Hence, it will be seen that if the circuit is closed by the contacts 32, 40*a* before the arc is extinguished in the gap formed by the opening of contacts 32, 39, a short circuit through the arc will develop as the switch mechanism performs its switching operation from the 230 volt settings to the 115 volt settings, or from the high to the low voltage condition. However, if a sufficient transfer time is given for the opening of the contacts 32, 39 before the contacts 32, 40*a* are closed, the arc in the air gap will be extinguished automatically.

To protect the contacts 32, 39 and 40*a* from the possibility of flashover, my invention provides a simplified and effective camming structure for maximizing the contact transfer time involved in operating the movable contact blade 32 from its line L1 to its neutral N positions. As previously mentioned, the movable spring contact 32 has its positioning controlled by means of the coaction of cam track 62 of the cam 28 with the follower 37 of the contact. As shown in FIG. 9 by the sectional layout or profile illustration of cam track 62, the camming surface of the track 62 includes a specially constructed actuating portion 92 (see also FIG. 8). The portion 92 is adapted to transfer the follower section 37 of movable contact 32 between upper surface 94 (viewing FIG. 9), where the blade 32 is cammed into engagement with fixed contact 39 (FIG. 8), and lower recessed surface 96 (FIG. 9), where the contact 32 is allowed to move by its internal biasing force into engagement with fixed contact 40*a* (FIG. 8).

To describe the actuating portion 92 of cam track 62 in greater detail, it comprises a first abrupt slope 98 which extends downwardly and to the right from horizontal upper surface 94 (viewing FIG. 9) and is conterminous at its lower end with an intermediate step 100. The slope 98 is preferably disposed at an angle of 45 degrees with the horizontal upper surface 94, and the intermediate step 100 is in parallel relationship with upper and lower surfaces 94 and 96. The right end of intermediate step 100 (viewing FIG. 9) is conterminous with a second abrupt slope 102 which extends downwardly and to the right, being conterminous at its lower end with horizontal lower surface 96. Abrupt slope 102 is also preferably disposed at a 45 degree angle relative to upper surface 94 and lower surface 96, and is therefore parallel to slope 98.

From a study of FIG. 9, it will be noted that the special actuating portion 92 is located on cam track 62 between the 135 degree and 180 degree reference positions, or in other words, between the "4" position and the "medium" position. The upper end of slope 98 (viewing FIG. 9) is spaced approximately 4 degrees from the 135 degree position of cam 28, and the lower end of slope 102 (viewing FIG. 9) is spaced approximately 4 degrees from the 180 degree position of the cam 28. With this arrangement, it will be further understood that the cam track 62 rotates in either direction relative to the follower section 37 of the movable switch contact 32.

For an understanding of how the special actuating portion 92 of cam track 62 coacts with movable contact 32, attention is now directed to FIGS. 8, 9 and 10. When the cam follower section 37 of movable spring contact 32 is riding upon the horizontal upper surface 94 of the cam track 62, the contacts 32 and 39 are engaged or closed and current flows through load terminal A and line terminal L1 at a potential voltage of 230 volts. This is the condition of the contacts 32 and 39 for switch positions "high," "3," and "4." When the cam 28 is rotated to its 135 degrees or "4" position, as shown schematically in FIG. 9, follower 37 of contact 32 is held upwardly or away from the actuating face of the cam against the internal biasing force of contact 32. After the came track 62 then moves rotatively relative to the follower 37 of blade 32 (i.e., in a direction from right to left viewing FIG. 9, and toward the 180 degrees or "medium" switch position) through a 4 degree arc, the follower then reaches the top of abrupt slope 98. The follower of contact 32 then rapidly drops to its open circuit position where contact 32 is disengaged from both of the fixed contacts 39 and 40 (FIG. 8). To be more specific, the biasing force of the blade section 42 of contact 32 normally urges it in a downward direction into engagement with cam track 62 (viewing FIG. 8). After the cam follower section 37 of the movable contact blade 32 has reached abrupt slope 98 of the actuating portion 92, the internal biasing force of the blade 32 causes it to ride downwardly along slope 98 (viewing FIGS. 8 and 9)

in response to further rotation of cam 28 (in a counterclockwise direction of rotation viewing FIG. 8) until follower 37 reaches intermediate step 100.

When the cam 28 is then rotated further in the same direction, with the blade 32 riding upon the intermediate step 100, it is in positive disengagement with its associated fixed contacts 39 and 40*a*. The blade 32 remains in this position until the follower section 37 of the movable contact blade 32 reaches the top of abrupt slope 102 (viewing FIGS. 8 and 9), and rides thereupon to allow the contact 32 to rapidly drop toward lower surface 96. Blade 32 then closes into engagement with movable contact 40*a* and establishes a circuit connection from load terminal A to Neutral terminal. After further rotation (in the same direction) of cam 28 through a 4 degree arc, the switch is at the 180 degree or "medium" position.

By using such a configuration for the actuating portion 92 of the cam track 62, maximum advantage has been taken of a relatively small angle of rotation of the cam 28 (e.g. 45 degrees) to control the movable contact 32 in an improved manner. Thus by subdividing the actuating portion 92 into two similar slopes 98 and 102 of a maximum practical steepness and separating these slopes by an elongated intermediate step 100 for positively holding the movable contact blade of a single-pole double-throw switch in its open position, a camming structure has been provided which very rapidly opens and closes the contacts and positively controls their separation. With such an arrangement, it has been found that the contact transfer time involved in movement of the movable contact blade 32 from its "4" position to its "medium" position is maximized, thereby effectively reducing flashover to a level of high improbability.

For controlling or detenting the rotation of the switch actuating cam 28 of switch 10, as shown in FIG. 5, a pair of elongated spring members 110 have been provided. Each of the members 110 is of elongated bladelike configuration and has a curved projection 112 facing sideways from between its ends. The members 110 are fitted into appropriate recesses of cover plate 16, with each member 110 located on one side of shaft 24 and the projections 112 facing inwardly toward each other and toward the axis of the cam (as shown in FIG. 5). The back side 116 of cam 28 has an annular hub 118 integrally formed upon it. Hub 118 includes a radially arranged series of detent notches 120 formed on the periphery thereof. The opposed projections 112 of the members 110 cooperate in spring-like fashion with the notches 120, as shown in FIG. 5, to index or control the rotary movement of cam 28 as well as its associated shaft 24 and knob 26.

It will be understood from viewing the arrangement of the spring members 110 in FIG. 5, that the cam 28 is rotatable in either a clockwise or counterclockwise direction of rotation.

It will now therefore be seen that my new and improved switch arrangement as illustrated herein provides a simplified and effective means for protecting a cam operated rotary switch from flashover. It will further be understood that such an approach involves only a minimum number of parts and is relatively inexpensive to manufacture.

While in accordance with the patent statutes, I have described what at present is considered to be the preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from my invention and I, therefore, aim in the following claims to cover all such equivalent variations as fall within the true spirit and scope of this invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A manually operated switch comprising a housing, a manually operable shaft extending into said housing, a rotatable cam in said housing and attached to said shaft for rotation thereby, detent means engaging said shaft to releasably hold said shaft in two spaced positions of rotation and to prevent said shaft from stopping between said positions, a movable contact operable between a first fixed contact and a second fixed contact, a follower section on said movable contact, said cam including at least one annular cam track formed on one surface thereof for operating said follower section between said two fixed contacts in a continuous operation controlled by said detent means, said cam track having a switching surface portion including a first abruptly sloped arcuate section arranged to coact with said follower section for rapidly disengaging said movable contact from said first fixed contact, an arcuate step section at the disengaging end of said first section for holding said movable contact in positive disengagement with said first and second contacts for a finite period and a second abruptly sloped arcuate section facing in the same general direction as said first slope at the opposite end of said step portion and arranged to coact with said follower section for rapidly engaging said movable contact with said second fixed contact, said cam being positioned on said shaft so that said switching surface portion moves quickly past said follower section as said shaft passes between the two spaced positions determined by said detent means, whereby a single switching action is performed and the flow of arcing current between said first and second fixed contacts through said movable contact is prevented.

2. A manually operated switch comprising a housing, a manually operable shaft extending into said housing, a rotatable cam in said housing and attached to said shaft for rotation thereby, a rotatable detent indexing member attached to said shaft for rotation by said shaft to control bidirectional rotary movement of said cam, said detent member releasably holding said shaft in two spaced positions of rotation and preventing said shaft from stopping between said positions, a movable contact operable between a first fixed contact and a second fixed contact, a follower section on said movable contact, said cam including at least one annular cam track formed on one surface thereof for operating said follower section, said cam track having a switching surface portion including a first inclined arcuate section arranged to coact with said follower section for rapidly disengaging said movable contact from said first fixed contact, an arcuate step portion at the disengaging end of said first section for holding said movable contact in positive disengagement with said first and second contacts, said step being disposed in a plane perpendicular to the axis of rotation of said cam, and a second inclined arcuate section inclined in the same general direction as said first slope at the opposite end of said step portion and arranged to coact with said follower section for rapidly engaging said movable contact with said second fixed contact, said cam being positioned on said shaft so that said switching surface portion moves quickly past said follower section in one continuous operation as said shaft passes between the two spaced positions determined by said detent means, whereby a single switching action is performed and the flow of arcing current between said first and second fixed contacts through said movable contact is prevented.

3. A manually operated switch for use in a control circuit wherein a common load terminal is selectively switched from a first power terminal of high potential to a second power terminal of ground potential, a movable contact connected to said load terminal, a first fixed contact connected to said first power terminal, a second fixed contact connected to said second power terminal, a cam, said cam including a cam track arranged thereon for operating said movable contact between said first and second fixed contacts, said cam track having a switching surface portion including a first abrupt slope coacting with said movable contact for rapidly disengaging said movable contact from said first fixed contact, a second abrupt slope inclined in the same direction as said first slope and coacting with said movable contact for rapidly engaging

said movable contact with said second fixed contact, and a step interposed between said first and second slopes for transferring said movable contact between said first and second slopes and holding said movable contact in positive disengagement with said first and second fixed contacts, and a detent means connected to said cam to releasably hold said cam in two spaced positions of rotation and to prevent said cam from stopping between said positions, said switching surface portion of said cam coacting continuously with said movable contact as said cam passes between the two spaced positions determined and controlled by said detent means whereby a single switching action is performed and the flow of arcing current between said first and second fixed contacts through said movable contact is prevented.

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