A switch apparatus for simultaneously or sequentially actuating a plurality of magnetic reed switches. The apparatus includes a manually manipulatable control element having a plurality of cam surfaces thereon for moving an actuator connected to a magnet to actuate and deactivate the magnetic reed switches in response to rotation of the control element.

This invention relates to switching apparatus and more particularly to a programmable switch mechanism.

In the operation of certain electrical devices, it is important that multiple switching functions occur at times simultaneously and at other times in a controlled sequence. An example of such an operative environment for the subject invention would be a selector switch for household appliances, or possibly a television receiver, wherein electrical circuitry must be actuated contemporaneously with, or in sequence to, the energization of indicia setting forth visually the mode selected.

It is the object of the present invention to provide an improved switching device which sequentially operates multiple electrical switches whose operation must necessarily be related.

It is another object of the present invention to provide an improved switching device which responds to rotational movement to bring about a programming of electrical apparatus.

It is still another object of the present invention to provide an improved switching device for operation of reed switches in a controlled sequence by programming a switch actuator to respond to rotative movement.

It is a further object of the present invention to provide an improved switching device which moves magnetic material between reed switches in a controlled manner to bring about sequential operation of said switches, sometimes such operating occurring simultaneously while other switches associated with the mechanism are operated sequentially.

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

In the drawings:

FIGURE 1 is a partial sectional view of one embodiment of the subject invention;

FIGURE 2 is a partial sectional view of a second embodiment of the subject invention;

FIGURE 3 is a partial sectional and diagrammatic view of a third embodiment of the subject invention; and

FIGURE 4 is a sectional view taken along line 4—4 of FIGURE 3.

Referring to FIGURE 1, an actuator 10, rotatable on shaft 12, has cam surfaces 14 integrally formed therewith. A housing 16 supports reed switches 18 and 20 therein so that reed switches 18 and 20 are proximate one another.

Slide element 22 has integrally formed therewith magnet 24 which is adapted to be slidable in bore 26 formed in housing 16. An extension 28 of slide element 22 engages cam surfaces 14 so that when actuator 10 is rotated successive cam surfaces 14 engage extension 28 to translationally move slide element 22 in bore 26. Spring 30 biases slide element 22 toward the cam surfaces 14. Reed switches 18 and 20 are interruptable means disposed in electrical circuits diagrammatically shown but which are designed to control current flow through related electrical circuits.

The operation of the switch shown in FIGURE 1 is controlled by actuator 10. Actuator 10 would be typically rotated manually from a position on the opposite side of the actuator from which cam surfaces 14 are formed. As the cam surfaces 14 successively engage extension 28, slide 22 moves back and forth in bore 26 a predetermined distance which is desired to move the magnet 24 into an operative position relative to reed switches 18 and 20 to actuate said switches. It is understood that magnet 24 can be a casting or any well known magnetic material.

The dimensions of slide element 22 are chosen by the designer of the system to allow the amount of movement in magnet 24 which would simultaneously or sequentially operate the reed switches 18 and 20 as desired. The exact positioning on the slide element 22 of the magnet 24 is left to the designer of the particular system so that the sequential circuit energization suits the purpose of the designer.

Referring to FIGURE 2, another embodiment of the present invention is shown with certain modifications to the actuating mechanism. Housing 116 carries reed switches 118 and 120 in proximate relationship to one another with slide element 122 disposed therebetween in much the same manner as presented in the embodiment of FIGURE 1. Slide element 122 is movable translationally in bore 126 in response to movement generated therein by bellcrank lever 132. Spring element 130 biases the lower end of lever 132 against the face of cam surfaces 114 so that any rotation of actuator 110 results in the movement of bellcrank lever 132 and a proportionate amount of sliding movement in element 122. The lengths of the arms of bellcrank lever 132 are selected by the designer of the subject switch to allow a proportionally greater movement of slide element 122 than would ordinarily be generated by the variation in height of the cam surfaces 114.

The embodiment of FIGURE 2 functions similarly to the embodiment of FIGURE 1 in that magnet material 124 is carried by, or by choice integrally formed with, slide element 122 to move between reed switches 118 and 120 to a position wherein these switches are controllably operated in a manner corresponding to the contouring of cam surfaces 114.

Referring to FIGURE 3, the third embodiment of the present invention is illustrated wherein several reed switches 218 and 219, as operative pairs, and 220, acting alone, are actuated by a cam mechanism to be hereinafter described. Actuator 210 has cam grooves 234 and 236 formed on one face thereof. Pivotal elements 238 and 240 include pins 239 and 241, respectively, which cooperate with cam grooves 234 and 236, respectively. This embodiment eliminates the need for springs in that the pins carried by pivotal elements 238 and 240 are positively driven by the cam grooves 234 and 236 into positions depending on the contouring of the cams wherein reed switches 218, 219 and 220 are selectively sequential and at some points in the cycle simultaneously energized. It should be noted that pivotal elements 238 and 240 can be adapted to either carry magnets or can have magnets integrally formed there-
with depending on the particular environment in which the apparatus is to be used.

In operation, actuator 210 is rotated to a desired position in the same manner as in the previous embodiments, it being understood that the side of the actuator facing the switch operator would most preferably have indicia thereon indicating the selected mode at any point in the rotational movement. As actuator 210 is rotated, pins 239 and 240 follow the cam grooves 234 and 236 respectively, bringing about a seashaw type movement to elements 238 and 240. Electrical circuits diagrammatically shown in FIGURE 3 would then be made or broken, depending on where the grooves were formed in the actuator 210. It is understood that any programming can be placed in these cam grooves adapting the subject switching apparatus for utility in a multitude of environments. FIGURE 4 more clearly sets forth the relationship of the grooves to the actuator itself and makes it readily apparent that the space saving with this type of arrangement makes it adaptable for use in places where space is at a premium.

Utility of the subject invention as set forth herein is not restricted to the environments suggested but might be particularly adaptable for use in other apparatus, such as testing equipment wherein a desired sequence of circuit energizations must be accomplished in order to bring about a complete testing of circuitry. Another feature of the subject invention lending to its utility is the indexing capability demonstrated by the embodiments of FIGURES 1 and 2 most particularly, wherein a spring loaded element acts against the cam surfaces thereby providing a slight resistance to accidental rotation. It would be well within the knowledge of one skilled in the art to provide a similar indexing arrangement for the embodiment of FIGURE 3. It is clear also that the embodiments of FIGURES 1 and 2 readily adapt themselves for remote actuation through mechanical or electrical means wherein it is deemed convenient in a given environment to have an actuator at a remote point from the physical positioning of the reed switches.

While the embodiments of the present invention, as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is:

1. Switching apparatus comprising: a rotatable element having a generally undulating cam groove formed therein; a reed switch located adjacent said rotatable element; a magnet, means pivotally supporting said magnet for movement about a given axis toward and from said reed switch to operate the same; a cam follower having one end disposed within said cam groove and its other end connected with said magnet, said cam follower when following the contour of said cam groove when said rotatable element is rotated causing said magnet to be pivoted toward and from said reed switch to operate the same.

2. Switching apparatus comprising: a rotatable element having an undulating cam groove formed thereon; a plurality of reed switches connected adjacent said rotatable element; magnet means, means pivotally supporting said magnet means respectively for movement about a given axis toward and from respective ones of said reed switches to operate the same; a cam follower means having one end disposed within said cam groove and its other end connected with said magnet means, said cam follower means when following the contour of said undulating cam groove when said rotatable element is rotated causing said magnet means to be pivoted toward and from respective ones of said reed switches to operate the same.

3. Switching apparatus comprising: a rotatable element having an end face, said end face having a plurality of radially spaced, concentric cam grooves formed therein, at least one of said cam grooves being undulated in form; a plurality of reed switches located adjacent said rotatable element; a plurality of magnet means, means pivotally supporting said magnet means for movement about given axes toward and from respective ones of said reed switches to operate the same; a plurality of cam followers each having one end disposed within one of said cam grooves and its other end connected with one of said magnet means, said cam followers following the contours of said cam grooves when said rotatable element is rotated to cause said magnet means to be pivoted toward and from respective ones of said reed switches to operate the same.

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