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ARRANGEMENTS FOR ELECTRICAL SWITCHES

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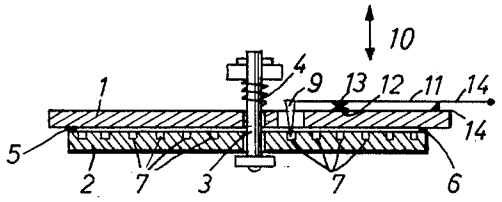


Fig.1.

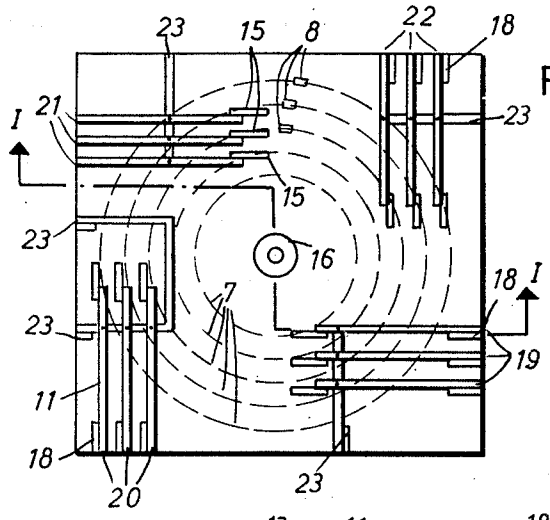


Fig.2.

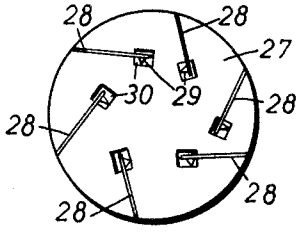


Fig.6.

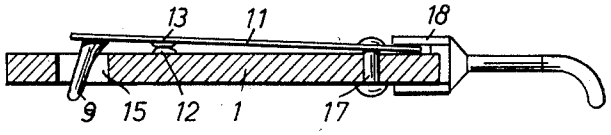


Fig.3.

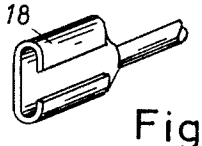


Fig.5.

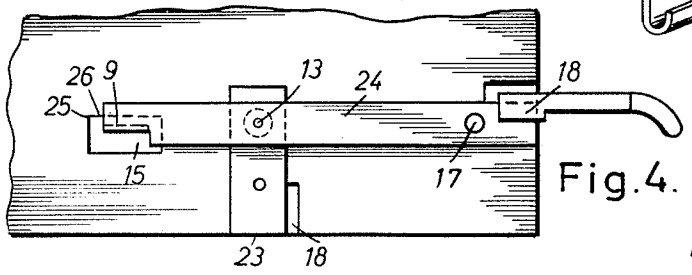


Fig.4.

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ARRANGEMENTS FOR ELECTRICAL SWITCHES

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This invention relates to an electromechanical switching apparatus.

The principal object of the invention is to provide an improved construction of electric switches, that lends itself to use in an arrangement having a relatively large number of contacts to be operated. The construction is to be susceptible of compact arrangement and efficient operation, while being also capable of economic manufacture.

In the past, switch structures have been suggested, comprising contact carriers disposed on cylindrical members, operated by a plurality of cam surfaces. These constructions have however been bulky and have not permitted the use of as many contact arrangements as are likely to be required in certain applications. For example, in automatically operating washing machines it may arise that large number of contact arrangements are necessary and the present invention can be applied with advantage to a switch for this duty.

Broadly, the present invention consists of an electric switch comprising two adjacent and relatively movable members, the first of said members being formed with cam surfaces, the second of said members carrying contacts and contact operating means. A contact operating means comprises cam followers extending through openings in the said second member and engaging co-operating cam surfaces carried by the other member. In the preferred construction in accordance with the invention two insulating plate members are used, mounted for relative rotation, the two plates being pressed resiliently one against the other. With such a construction, it is possible to provide a large number of contacts operated by means of the cams disposed in concentric grooves in one of the adjacent surfaces, and the contacts being operated by means of simply formed parts, carried on the other member and having portions, providing cam followers, which extend through openings in the one member and engage the cam surfaces. The openings in the one member can serve as guides and supports for the cam follower members.

This construction has the advantage that the danger of mechanical damage to the plates which are engaged by the freely disposed contacts is minimized. Also, the risk of voltage flash over is reduced. As guides are provided for the contact movement, adjustment is simpler, and it is also advantageous that all the contact making portions are on one face of the plate, and remote from the side on which the camming operation takes place. This is especially advantageous when a switch of this kind is used in the washing machine, as it improves the reliability of the switch in circumstances where it may be subjected to moisture or vibration. Also, contact members are disposed on a flat plate, it is possible for this plate to be manufactured as a printed circuit member.

In order to enable the larger number of contacts to be accommodated on the switch, it is advantageous if the contact-operating members are arranged on edge, with the cam follower portions arranged in groups, and for the groups to be disposed at different angles for example at 90°, with respect to each other around the plates. Also, if desired, the contact operating members can be arranged radially on edge.

It is convenient if the fixed and moving plates are held together by means of a central spring, with interposed spacing means, which permit the desired relative movement of the plates. An assembly of this kind is very simple. Spacing means can be used which, while permitting the desired relative rotating or reciprocating movement of the plates, ensure a constant and predictable distance between the adjacent faces of the plates, with constant reliability of operation.

The invention will be better understood from the following description of embodiments thereof, in conjunction with the accompanying drawing, in which:

FIGURE 1 is a diagrammatic vertical section of a switch in accordance with the invention;

FIGURE 2 is a plan view of a switch of FIGURE 1, and shows the line 1—1 on which the section of FIGURE 1 is taken;

FIGURE 3 is a fragmentary section showing one of the insulating plates of the switch and an operating lever;

FIGURE 4 is a plan view of parts shown in FIGURE 3;

FIGURE 5 is a detail view of a plug-type connector and

FIGURE 6 is a diagram showing an alternative construction, with a different arrangement of the operating levers.

The switch constructions which are shown in these drawings are suitable for controlling the programme of operation of a fully automatic domestic appliance such as a washing machine or dish-washing machine. The switch shown in FIGURES 1 and 2 comprises two plates, a fixed plate 1 and a movable plate 2. Both plates are formed of insulating material, preferably by moulding a plastic material. The two plates are relatively movable; in this example the plates are mounted for relative rotation, but alternatively can be arranged to slide one over the other in a reciprocatory fashion. As shown, the two plates 1 and 2 are mounted upon a common spindle 3 and are resiliently pressed towards each other by means of a compression spring 4 which can be arranged above, as shown, or below the fixed plate 1. Between the two plates are arranged spacing means indicated at 5, 6, to ensure uniform separation between the adjacent surfaces of the two plates. The spacing means can be formed, for example, as balls running in grooves formed in one or other of the adjacent faces, or they can be arranged as fixed spacers, which where considerable pressure is imposed between the adjacent faces can be made of material which is self-lubricating.

The moving plate 2 has a series of concentric grooves indicated at 7, in the base of which are provided a series of cam surfaces. The cam surfaces are not shown in detail, but their position is indicated diagrammatically at 8 in FIGURE 2. These cams co-operate with cam followers of which one is shown at 9 in FIGURE 3, the cam followers being carried by actuating arms 11, the arms being held each by a rivet such as 17 to the plate 1. Each arm carries a moving contact 13, which co-operates with a stationary contact 12 mounted on the plate 1. In response to the cam follower moving over the cam projection, the bar will move vertically, in the direction indicated by arrow 10, and thereby engagement of contacts of 12 and 13 is made and broken. Arrow 10 also denotes the axial direction of spindle 3. The cam followers 9 extend through apertures arranged in the fixed insulating plate 1. The apertures also act to guide the cam followers in their axial, vertical movement.

Electrical connection can be made to the arms 11 by any suitable means, and one such means is indicated at 18, consisting of spring contact members which embrace the end of the bar and also the plate 1.

As shown in FIGURE 2, it is advantageous if the cam followers such as 9 are arranged in groups, indicated at 19, 20, 21 and 22 which are radially arranged, and disposed at angles of 90° about the shaft 3. As will be apparent from FIGURE 2, the contacts such as 12 can be connected together, in groups, by means of cross bar connectors 23. It is possible also to arrange these in a variety of manners, on the insulating or fixed plate 1. Alternatively, instead of cross bars 23, a printed circuit can be used, and the corresponding switching operation is then effected with contacts 13, which are moved by the cams 9, and which may also be arranged in the form of rollers.

When a printed circuit construction is adopted, the stationary contacts can be provided as a metal foil which is applied to the fixed or insulating plate 1. At the same time insulating plate 1 is provided with apertures 15 and in general, reliable operation, even where complicated switching operations are concerned, is possible with minimum adjustment.

FIGURE 4 indicates an advantageous way of forming the cam followers 9. As shown, a contact spring 24, has the end turned downwardly to pass through and be guided by the aperture 15, for example, by close engagement against one surface 25 of the aperture. The apertures 15 can then accordingly be of lesser size. In the position of rest, the contact spring 24 bears against the shoulder 26 of the insulating plate, and it is thus possible to provide an appropriate initial spring tension.

FIGURE 6 is a diagram indicating an alternative method of arranging the contacts. In FIGURE 6 the insulating plate 27, on which the contact operating bars 28 are arranged radially, or substantially tangentially, are disposed with cam followers 29 extending through apertures 30; in a similar manner, operation of the co-operating contacts, not shown, is effected.

By means such as those described, it is possible to provide a switch which, with one operating plate, can control a large number of electrically oscillated switching operations, to be carried out at different contact positions: this is very desirable in the case of the control of a complicated programme such as may be followed in the operation of a washing machine or dish-washing machine. With the construction described it is a simple matter to exchange the individual insulating discs or plates such as 1, and use discs carrying different printed circuits, thus affording the means of providing a variety of programmes. To facilitate dismantling, for the purposes of replacement, servicing or repair it is desirable that the contact means should be disposed on the true upper side of the respectively fixed insulating plate 1, and for the connections to the contacts 12 or 23 to be made by detachable connections such as plug-type, screw-type or soldered connections.

It is also possible for the arrangement to be such that plate 1 carrying the cam means be fixed, while plate 1 supporting the contacts is movable. It is also possible for both plates to be movable, one plate being arranged to be movable through a manually adjustable angle, while the other plate is driven by a driving means at, for example, a uniform speed; the rotating plate can then be

driven by means of a peripheral toothed ring, engaged by a driving pinion. Other driving means can, of course, be adopted, and another plate, running at a different speed, can also be disposed in the rotatable plate.

The invention can be applied generally to a variety of cases where it is desired to effect relatively complicated switching operations by means that can be cheaply manufactured, while reliable operation is ensured. The invention makes this possible, without the use of complicated contact arrangements, by the use of the actuating bars disposed on edge, and moved in a direction parallel to the pivot axis.

I claim:

1. An apparatus for switching electric circuits comprising, a stationary plate having a plurality of spaced contacts on one face thereof, a rotary disc, means resiliently holding said disc in spaced relation to the other face of said plate, the adjacent face of said disc having concentric grooves having camming surfaces therein; said stationary plate carrying on said one face a group of resiliently actuated arms having cam followers on the ends thereof, openings in said plate opposite the respective grooves, said cam followers projecting through the respective openings and into the grooves, each of said arms having a contact normally in engagement with one of said first-named contacts, said camming surface in said grooves operating to break the engagement of said contacts, and said contacts being connected to electric terminals.

2. The invention as defined in claim 1, wherein the contacts on the stationary plate are carried by metallic cross-bar connectors, and the actuating arms with contacts thereon are provided with resilient frictional couplings.

3. The invention as defined in claim 1, wherein the contacts on the stationary plate are provided by a printed circuit section.

4. The invention as defined in claim 1, wherein spacers are provided between the stationary plate and disc and the disc is spring-urged toward the plate and against the spacers, and wherein printed circuit sections are superimposed with the actuating arms extending therethrough.

5. The invention as defined in claim 1, wherein electric connections with the contacts are made on top of the stationary plate.

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