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[33] Great Britain

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[54] **OILCAN PUSHBUTTON SWITCH**
3 Claims, 6 Drawing Figs.

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[51] Int. Cl..... H01h 3/12

[50] Field of Search..... 200/67 D,
67 DB; 74/100 P; 267/1, 159

ABSTRACT: An array of pushbuttons is formed as domes in a plate of springy material. The domes behave in the manner of the base of an oilcan—snapping in when pressure is applied to close pushbutton contacts and snapping out to open the contacts when pressure is released.

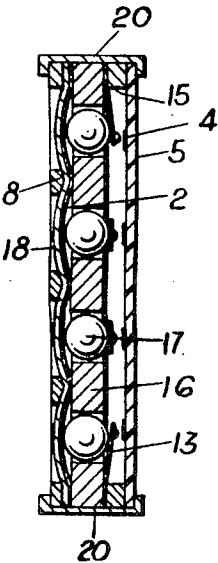


Fig. 1.

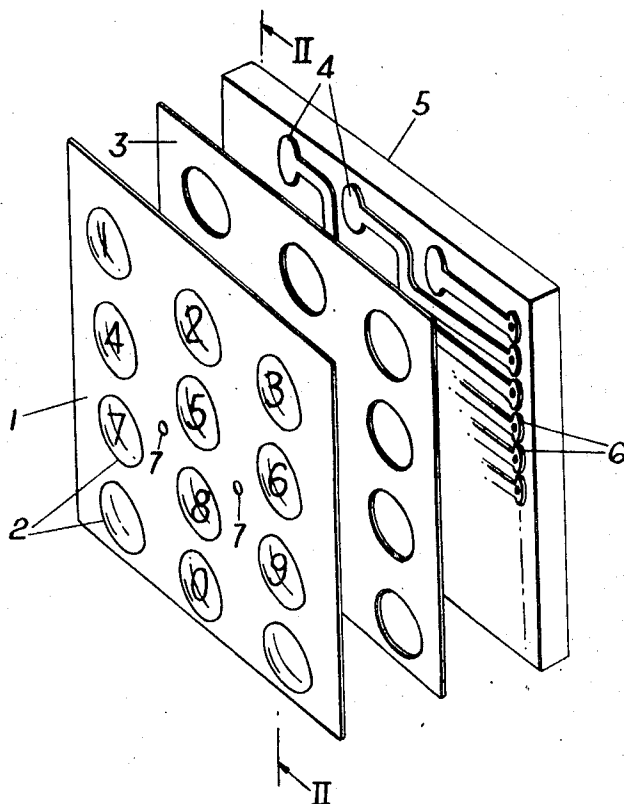


Fig. 5.

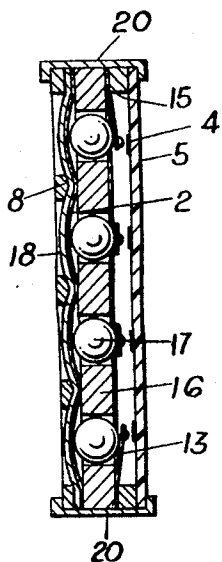
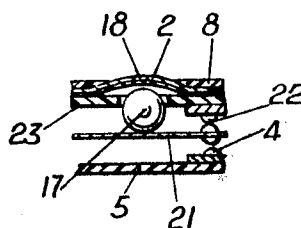


Fig. 6.



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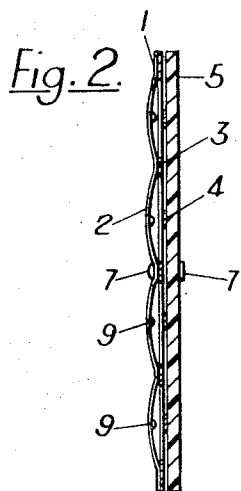
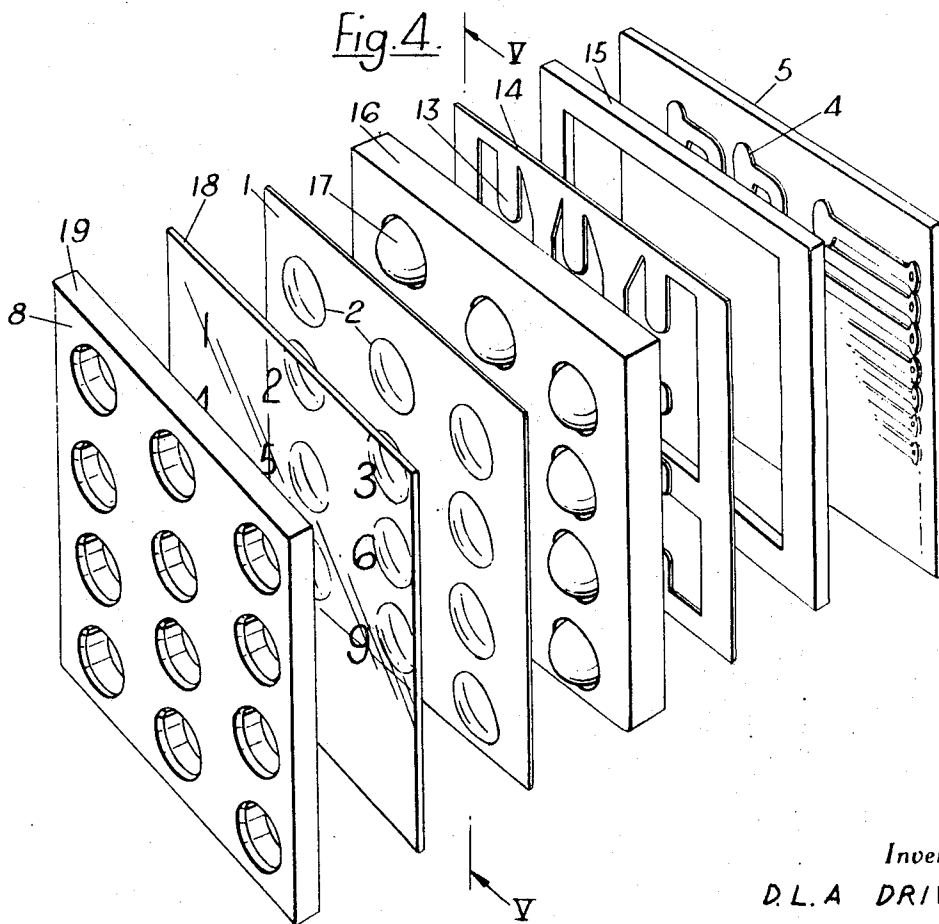
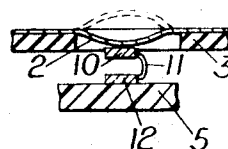


Fig. 3.



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OILCAN PUSHBUTTON SWITCH

The invention relates to pushbutton switches.

According to the present invention there is provided a pushbutton switch wherein the pushbutton is a dome-shaped projection on a fixed plate of springy material integral therewith, the arrangement being such that pressure on the dome causes a snap-action deformation thereof and the deformed material resumes its original shape with a snap action on release of the pressure.

Pushbutton switches according to the invention have a particularly useful field of application in connection with arrays of switches such as provided for dialling purposes on certain telephone subsets. In this connection the invention also provides an array of pushbutton switches including a plate of springy metal having integral dome-shaped projections thereon which provide the pushbuttons, each of the projections being such that, when the plate is held substantially rigid, pressure on the dome causes a snap-action deformation thereof and the deformed material resumes its original shape with a snap action on release of the pressure, a plate of insulating material carrying a set of electrical contacts in positions corresponding to the pushbuttons and means for spacing the plate of springy material in fixed relation to the plate of insulating material with a said contact located beneath each dome in such manner that when a dome snaps into its deformed position it makes connection with the said contact.

The springy plate having the deformable pushbutton domes thereon need not necessarily provide one of the electrical contacts for the switches and, in fact, for some applications it could be made of plastics. The invention provides furthermore, an array of pushbutton switches including a plate of springy material having integral dome-shaped projections thereon which provide the pushbuttons, each of the projections being such that, when the plate is held substantially rigid, pressure on the dome causes a snap-action deformation thereof and the deformed material resumes its original shape with a snap action on release of the pressure, a plate of insulating material carrying a set of fixed contacts in positions corresponding to the pushbuttons, a further plate carrying a set of movable contacts, at least one for each pushbutton and each resiliently biased against displacement, a mechanical coupling member for each pushbutton coupling it to its movable contact or contacts, means for locating the movable contacts with respect to their corresponding pushbuttons and means for clamping the assembly of plates and locating means together, the arrangement being such that when a dome is snapped into its deformed condition its associated movable contact, or each of them, is carried from its normal to its operated condition with respect to one or more of the fixed contacts.

Embodiments of the invention will be described by way of example with reference to the accompanying drawings in which:

FIG. 1 is an exploded view of an assembly of pushbutton switches in accordance with the invention,

FIG. 2 is a cross-sectional view taken in the plane II-II of FIG. 1;

FIG. 3 shows a modification of the contact arrangement shown in FIGS. 1 and 2;

FIG. 4 is an exploded view similar to FIG. 1 of another embodiment of the invention;

FIG. 5 is a cross-sectional view through the plane V-V of FIG. 4; and

FIG. 6 is a scrap view in partial cross section of a modification of the contact arrangements in the embodiment of FIGS. 4 and 5.

The principle of the invention is based upon that of the conventional oilcan in which, to eject a quantity of oil from the can, each of the sides, or the base, depending upon the type of can, is depressed and snaps inward into a deformed condition, which however is unstable, so that when pressure is released each side or the base, as the case may be, snaps back into its

previous undistorted condition. In applying this principle, a plate of springy material, such for example as nickel silver, is provided, by means of a stamping or press operation, with one or more dome-shaped projections such as shown at 2 in FIGS. 1 and 4. This domed projection provides a pushbutton. In analogy with the oilcan, when finger pressure is applied to the dome it becomes distorted and clicks inward as depicted in FIG. 3. When pressure is released the deformed material clocks out again into its original shape.

In the embodiment of FIG. 1 a set of 12 pushbutton domes 2 is provided upon a common springy metal plate 1. This plate is backed by a supporting insulator 3 apertured beneath each dome to allow the middle of the dome to be pressured into the associated hole and connect with a corresponding one of a set of contacts 4, mounted on an insulator 5. The insulator 5 may conveniently be a printed-circuit board carrying the contacts 4 and connections between them and a set of terminals 6. The plate 1 and insulators 3 and 5 are clamped together and bonded by epoxy resin, for example, at their edges.

For the pushbutton domes to function satisfactorily, it is necessary that the surrounding portions of the plate 1 be fixed to the support 3 sufficiently rigidly to avoid substantial movement of the flat portions of the plate 1 when a dome is depressed. To this end a pair of rivets 7, as shown in FIG. 1, may be used to clamp the plates 1, its support 3 and the plate of insulated material 5 together, as shown in FIG. 2. An alternative means of holding the springy plate 1 against its support may be provided by an apertured face plate 8 as shown in FIG. 4, which will be described further below.

Many metals tend to acquire a thin film of oxide which impairs electrical contact. In cases where the plate 1 is of such material, studs 9 (FIG. 2) of contact metal not so subject to oxidation are mounted on the undersides of the domes.

It is generally considered desirable in the design of switches to provide a wiping action between the contacts to ensure a clean connection. The contact arrangement shown in FIGS. 1 and 2 may be modified, if desired, to provide such wiping contact in the manner shown, by way of example, in FIG. 3. In this arrangement the printed-circuit board 5 carries connections for the fixed contacts, but the contacts themselves, instead of being rigid surfaces on the conductor lands, are small pieces of contact metal 10 mounted by means of resilient straps 11 to the respective conductor lands 12. When a pushbutton dome is depressed past its dead center position, it springs against the contact piece 10, causing a small displacement of this member and bowing of the strap 11, in consequence of which the contact surfaces wipe over one another to a limited but sufficient extent.

It is not necessary that the pushbutton domes themselves provide an electrical contact. Instead separate movable contacts actuated by the pushbutton domes may be provided and, in this case, the springy plate in which the domes are formed need not necessarily be metal but, for some applications, may be made of plastics. Again, it may be advisable, where the domes are of metal, to cover them with flexible insulating material so that a user is completely isolated from contact with any electrical circuit. In any event such a covering is useful for carrying indicia for the switches. The embodiment of FIGS. 4 and 5 illustrates the use of separate movable contacts and also an insulating covering for the pushbutton domes.

In the assembly of FIGS. 4 and 5 a printed-circuit board 5 carries fixed contacts and connections as in FIGS. 1 and 2 but movable contacts are provided on contact springs 13 formed in a metal plate 14 which is clamped over the printed-circuit board 5 with an insulating spacer 15 between them. A plate of springy material 1 with the pushbutton domes 2 as in the previous embodiment is clamped to a spacer 16 which is apertured to receive and locate a set of balls 17, one beneath each dome 2. When a dome is depressed beyond its dead center position, it forces its associated ball against the corresponding contact spring and the movable contact into connection with its fixed contact. The balls are preferably made of hard rubber or like resilient insulating material which not only provides in-

sulation, but permits the ball to deform slightly, so allowing a full click operation of the dome.

In the embodiment of FIG. 1 the domes 2 are shown numbered. In the embodiment of FIG. 4 the numbers, or alternative indicia for the pushbuttons are placed at the back of a transparent sheet of flexible insulating material 18 which has sufficient stretch to conform to the shape of the domes on the plate 1. As mentioned previously, in this embodiment a face plate 8 is provided with finger holes into which the domes protrude and by means of which the springy plate 1 is held firmly against the spacer 16. The assembly may be clamped up with the aid of clamps 20 fixed to opposite edges of the assembly as shown in FIG. 5.

It has been assumed, in the description of embodiments thus far, that all the contacts are simple "make" contacts. If desired provision can be made for other types of contact, such for example as a changeover arrangement as shown in FIG. 6. In this modification the movable contact 21 normally presses against a fixed contact 22 carried on a printed-circuit board 23 which also serves for locating an intermediate ball arrangement as in FIG. 5, the printed-circuit board 23 replacing the spacer 16. When actuated by deformation of the dome 2, contact 21 breaks from contact 22 and makes with a fixed contact 4 on the circuit board 5.

I claim:

1. An array of pushbutton switches including a plate of springy material having integral dome-shaped projections

thereon which provide the pushbutton, each of the projections being such that, when the plate is held substantially rigid, pressure on the dome causes a snap-action deformation thereof and the deformed material resumes its original shape with a snap action on release of the pressure, a plate of insulating material carrying a set of fixed contacts in positions corresponding to the pushbuttons, a further plate carrying a set of movable contacts, at least one for each pushbutton and each resiliently biased against displacement, a mechanical coupling member for each pushbutton coupling it to its movable contact or contacts, means for locating the movable contacts with respect to their corresponding pushbuttons and means for clamping the assembly of plates and locating means together, the arrangement being such that when a dome is snapped into its deformed condition its associated movable contact, or each of them, is carried from its normal to its operated condition with respect to one or more of the fixed contacts.

2. An array as claimed in claim 1 including a faceplate through which the pushbutton domes project and means for rigidly supporting the plate of springy material against the faceplate.

3. An array as claimed in claim 2 including flexible insulating material covering the domes and such further parts of the plate of springy material as may be exposed through the faceplate, the flexible insulating material carrying indicia for the respective pushbuttons.

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