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ELECTRICAL SWITCH CONSTRUCTION

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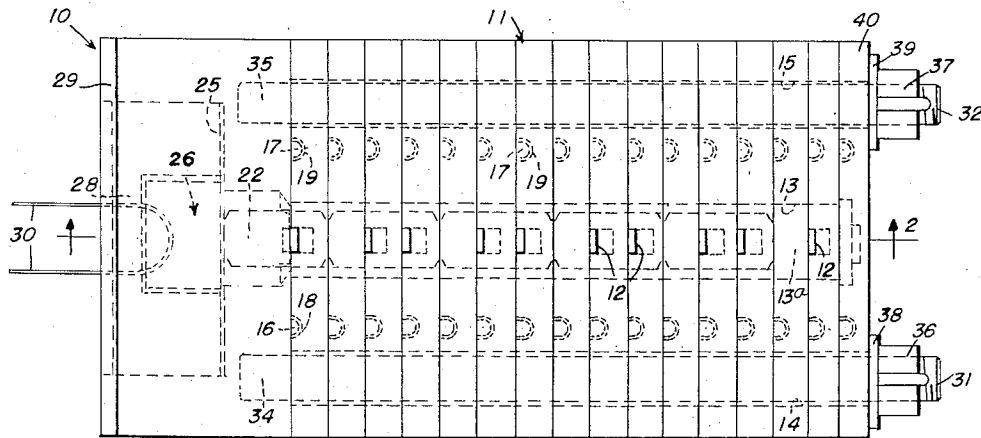


FIG. 1

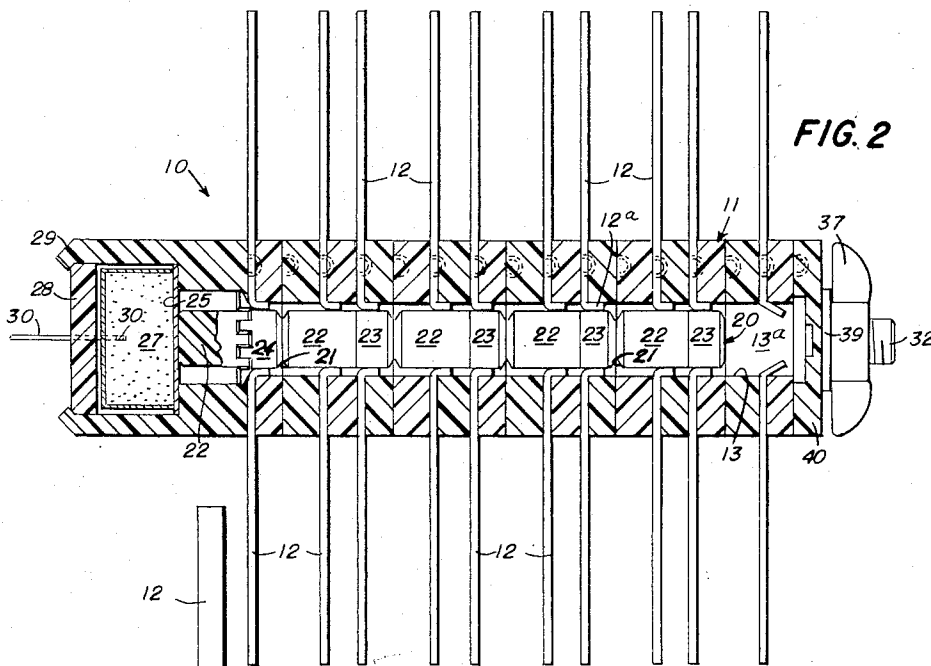


FIG. 2

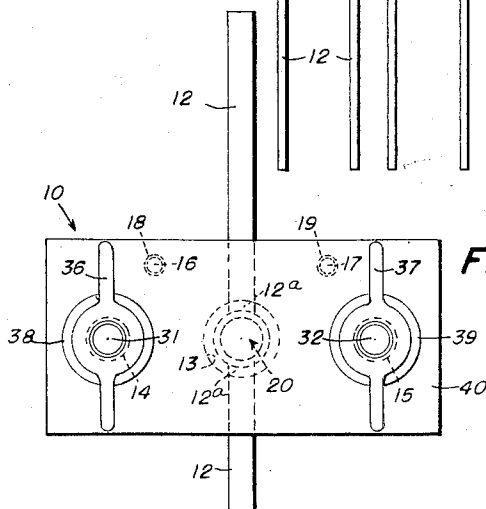


FIG. 3

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1

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ELECTRICAL SWITCH CONSTRUCTION

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(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates generally to the construction of an explosively-actuated electrical switch. More particularly, this invention relates to an improved explosively-actuated electrical switch construction which makes possible the mass production of a switch which can readily be reassembled so that the switch when finally used in the circuit will have only those electrical contact elements which are actually needed.

In many applications, explosively-actuated switches are required which have a number of contact elements. In the manufacture of these switches, it has been the usual practice to construct a single type of switch, with each switch having a considerable number of available contact elements. The same switch thus can be used throughout the circuit and those contacts which are not needed can be left unconnected. While the use of one type of switch permits utilization of mass production techniques, the size of the switch will often be considerably larger than necessary at many circuit points. In military applications it is important that the size of the switch be kept at a minimum.

Accordingly, it is a broad object of this invention to provide an improved explosively-actuated switch construction so that the resulting switch can easily be reassembled to the size required by the particular circuit point to which it is connected.

More specifically, it is an object of this invention to provide a switch having contact elements which can be easily and rapidly removed from the switch if not needed for a particular circuit application.

According to a typical embodiment of this invention, the improved switch uses in combination: a series of removable plastic wafers which hold a series of contact elements embedded therein, and a rod-like contact member which electrically connects the ends of some of the contact elements, excess lengths of which can also be easily removed from the switch. The switch is thereby capable of being reduced to only the number of electrical contacts required for the particular circuit.

The specific nature of the invention, as well as other objects, uses and advantages thereof, will clearly appear from the following description and from the accompanying drawing, in which:

Figure 1 shows a plan view of the switch in accordance with this invention.

Figure 2 is a sectional side view taken through line 2—2 of Figure 1.

Figure 3 is an end elevation of the switch as viewed from the right of Figure 1.

Referring now to Figures 1 and 2 in particular, there is shown a switch 10 composed of a series of flat, substantially rectangular wafers 11 having a series of contact elements 12 embedded therein. Wafers 11 are composed of any suitable insulating material such as Bake-

2

lite or an epoxy resin. Each wafer 11 has three bores therethrough which are designated by numerals 13, 14 and 15, respectively. Bores 13 are located in the center of each rectangular wafer 11, while bores 14 and 15 are located nearer the extremities of the wafers 11 as shown in Figure 1.

The extremities of wafers 11 are provided with pins 16 and 17 which are designed to fit snugly into holes 18 and 19, respectively, the latter being in that side of the wafer opposite the side from which pins 16, 17 protrude. Pins 16 and 17 when inserted into holes 18 and 19 of adjacent wafers 11 align the wafers 11 so that the individual wafer bores 13, 14, and 15 are aligned coaxially.

When the wafers 11 are stacked together as shown in Figures 1 and 2 bores 13 form a common bore 13a which has a diameter large enough to house the cylindrical rod-like member 20. The wafers 11 are held clamped in the stacked position by means of studs 31, 32 which are threaded on both ends. The threaded ends 34, 35, are screwed into one end of the switch 10 thereby fixing studs 31, 32 in switch 10. The opposite ends of studs 31, 32 have wing nuts 36, 37, respectively, which can be tightened down by hand so that washers 39 can press on retaining plate 40 which in turn compresses the stack of wafers 11.

Contact members 12 are composed of any suitable electrical conducting metal such as brass, and extend outwardly of the wafers 11 so as to contact or be connected with other electrical leads or connections (not shown). The ends 12a of contact members 12 extend into bore 13a and are substantially parallel to the longitudinal axis of bore 13a. Ends 12a serve to position rod 20 coaxially of bore 13a and also serve to make contact with certain portions of rod 20.

Rod 20 is composed of Bakelite or suitable plastic, and comprises a number of segments 22 which are separated by grooves 21 cut in rod 20. Portions of segments 22 are covered by metallic sleeve 23 which act as electrical connections between those ends 12a which are perpendicularly opposed to each other as shown in Figure 2. That portion of each segment 22 not covered by metallic sleeves 23 will present an insulating surface between the remaining rod ends 12a which are opposed to each other and therefore no current will pass between those contact elements 12.

At one end of switch 10 is container 26 made of thin metal in which is explosive 27 capable of igniting and exploding when predetermined voltage is applied to leads 30. Container 26 is housed between plates 25 and 28. Plate 25 is positioned adjacent one end of the segment 22 which has the metal skirt 24 thereon.

Metal skirt 24 is flared at one end and the flare is large enough to prevent the skirt from passing into bore 13a so that rod 20 is prevented from moving longitudinally towards the retaining plate 40 at the other end of switch 10. Plate 25 prevents the rod 20 from moving towards the other end of switch 10 which houses explosive 27. Plate 28 is considerably thicker than plate 25 and is held fixed in switch 10 by bent-over or crimped ends 29.

When current is passed through leads 30, explosive 27 will ignite and explode deforming plate 25 so that it pushes the segment 22 which has skirt 24 thereon, thereupon driving the rod 20 towards retaining plate 40. The metallic sleeves 23 thus are moved to a position where they serve as electrical connections for those ends 12a which were initially separated by the insulated portion of segments 22. Those contact ends 12a which were initially connected electrically by sleeves 23 are now separated by the insulated portions on segments 22. The above-described operation is conventional as illus-

trated in the device disclosed in U.S. Patent No. 2,721,240 to Filbert, Jr.

As pointed out above, oftentimes the manufacturer will not know exactly how many contact elements 12 will finally be required for a particular application. Excess contact members 12 are therefore provided and the switch 10 is made longer than is likely to be necessary for most applications.

Switch 10 is uniquely constructed so that excess contact elements 12, wafer 11, and excess lengths of rod segments 22 can be easily removed. Wing-nuts 36, 37, can be removed from the threaded ends of studs 31, 32, and retaining plate 40 along with washers 39 and excess wafers 11 can be slid off the studs 31, 32. Excess contact elements 12 which are embedded in wafers 11 are thereby removed. If several wafers 11 are removed lengths of rod 20 may extend beyond the surface of the last wafer left on the studs 31, 32. The excess lengths of rod can be removed by simply pressing down on the excess length and it will break off at a groove 21. The retaining plate 40 is then replaced along with washers 39 and the wing-nuts 36, 37 are turned until they press against washers 39. Studs 31, 32, are composed of a soft metal such as brass, and will then be the only parts extending beyond the body of the switch 10. The lengths extending beyond the wing-nuts 36, 37 can be broken off by any suitable means.

It should be evident that a relatively simple switch construction is provided which can be easily reassembled to eliminate lengths of switch which are not required when the switch is finally placed in the electrical circuit.

It will be apparent that the embodiments shown are only exemplary and that various modifications can be made in construction and arrangement within the scope of the invention as defined in the appended claims.

I claim as my invention:

1. An explosively-actuated switch having a series of contacts which can be readily reassembled so that the switch when finally used in the circuit will have only those electrical contacts which are actually needed, said switch comprising: a series of flat, substantially rectangular, plastic wafers having bores therein, said wafers being stacked together and forming a coaxial bore through the stack; a coaxial cylindrical rod in said bore, said rod being composed of a series of plastic, detachable segments of approximately equal size, one portion of each segment provided with a metallic sleeve; a series of metal contacts embedded between adjacent plastic wafers and having ends extending into said bore to hold said segments coaxially of said coaxial bore, the ends of said contacts extending into said bore also contacting respective plastic and metallic portions of each segment, the other ends of said contacts extending beyond the surfaces of said wafers so as to join with other electrical leads; explosive means housed in one end of said switch adjacent one end of said rod, said explosive means adapted to drive said rod relative to said bore when actuated so that said plastic and metallic portions of each segment contact different contact ends which extend into said bore; and clamping means adapted to press said wafers together, said clamping means also being releasable so that wafers, segments, and associated contacts can be removed from the switch.

2. An explosively-actuated switch having a series of contacts which can be readily reassembled so that the switch when finally used in the circuit will have only those electrical contacts which are actually needed, said switch comprising: a series of flat, substantially rectangular, plastic wafers, said wafers being provided with means to align one wafer relative to another wafer; a

bore through each wafer, said bore being perpendicular to the longitudinal axis of said wafer, said wafers being aligned and stacked together thereby creating a coaxial bore; a substantially coaxial cylindrical rod in said bore having a series of equi-spaced grooves therein, said rod being composed of an insulating material; said equi-spaced grooves defining between them a series of cylindrical segments composed of insulating material which can be readily broken off from said rod at said grooves; one portion of each segment being provided with a metallic sleeve; a series of metal contacts embedded between adjacent plastic wafers and having ends extending into said coaxial bore in order to hold said rod coaxially of said coaxial bore, the ends of said contacts extending into said bore also contacting respective insulated and metallic portions of each segment, the other ends of said contacts extending beyond the surfaces of said wafers so as to join with other electrical leads; explosive means housed in one end of said switch adjacent one end of said rod, said explosive means adapted to drive said rod relative to said bore when actuated so that said plastic and metallic portions of each segment contact different contact ends which extend into said bore; and clamping means adapted to press said wafers together, said clamping means also being releasable so that wafers, segments, and associated contacts can be removed from the switch when there are excess contacts extending from the switch.

3. An explosively-actuated switch having a series of contacts which can be readily reassembled so that the switch when finally used in the circuit will have only those electrical contacts which are actually needed, said switch comprising: a series of flat, substantially rectangular, plastic wafers, said wafers being provided with means to align one wafer relative to another wafer; a bore through each wafer, said bore being perpendicular to the longitudinal axis of said wafer, said wafers being aligned and stacked together thereby creating a coaxial bore; a substantially coaxial cylindrical rod in said bore having a series of equi-spaced grooves therein, said rod being composed of an insulating material; said equi-spaced grooves defining between them a series of cylindrical segments composed of insulating material which can be readily broken off from said rod at said grooves; one portion of each segment being provided with a metallic sleeve; a series of metal contacts embedded between adjacent plastic wafers and having ends extending into said coaxial bore in order to hold said rod coaxially of said coaxial bore, the ends of said contacts extending into said bore also contacting respective insulated and metallic portions of each segment, the other ends of said contacts extending beyond the surfaces of said wafers so as to join with other electrical leads; explosive means housed in one end of said switch adjacent one end of said rod, said explosive means adapted to drive said rod relative to said bore when actuated so that said plastic and metallic portions of each segment contact different contact ends which extend into said bore; clamping means adapted to press said wafers together, said clamping means also being releasable so that wafers, segments, and associated contacts can be removed from the switch when there are excess contacts extending from the switch; and means to restrain longitudinal movement of said rod in said coaxial bore.

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