April 8, 1969 J. C. MABBETT 3,437,973

ELECTRICAL SWITCH

Filed March 15, 1967

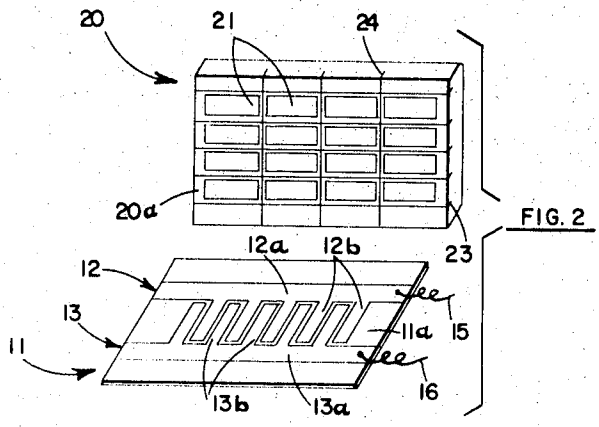

FIG. 2

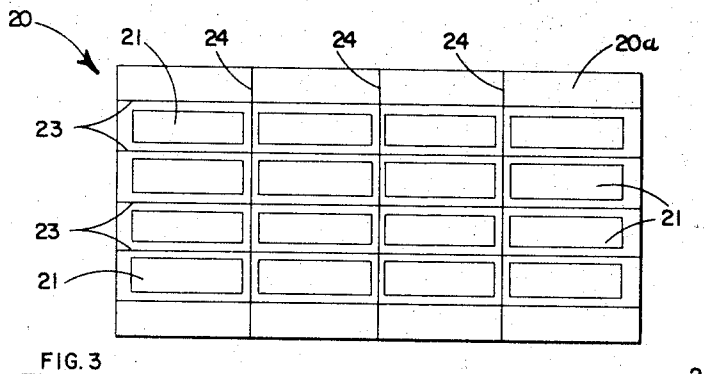

FIG. 3

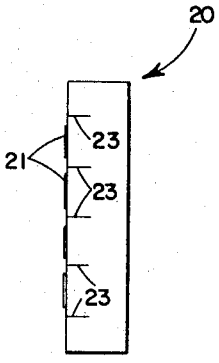

FIG. 5

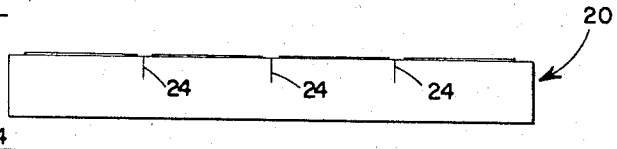

FIG. 4

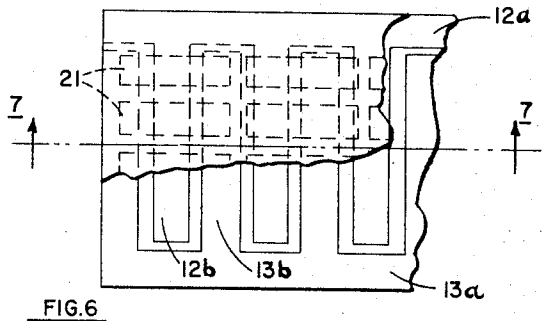

FIG. 6

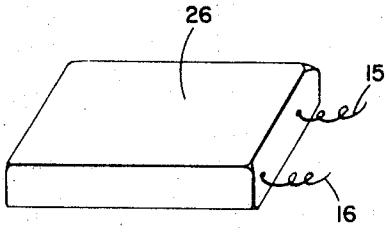

FIG. 1

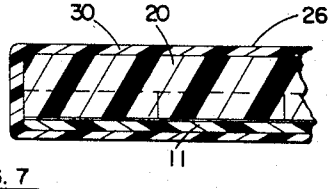

FIG. 7

INVENTOR
JOHN C. MABBETT
BY Edward A. Sokolski
ATTORNEY

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ELECTRICAL SWITCH

John C. Mabbett, Hollywood, Calif., assignor to Crosby Research, Inc., Los Angeles, Calif., a corporation of California

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ABSTRACT OF THE DISCLOSURE

A pair of switch contact elements are formed on the surface of a first substrate member, each of such elements having a plurality of finger portions. The finger portions of the switch contact elements are interleaved with each other. Contact bridging elements are formed on the surface of a second substrate member. The two substrate members are placed against each other with the bridging elements making light surface contact with the switch contact elements. When pressure is applied to bring the bridging element into intimate contact with the switch contact elements, a low resistance electrical path is provided between the switch contact elements.

This invention relates to an electrical switch and more particularly to such a switch providing momentary electrical contact in response to the touch of the operator. Switches which respond to momentary contact pressure, which are often known as touch switches and which generally operate in conjunction with latching devices of the electronic or electromechanical variety, are used extensively for normal switching operations as well as in warning devices such as burgular alarms and the like. In most of such devices of the prior art, a pair of switching contact elements are utilized which are physically separated from each other by a resilient separator device such as a spring or a rubber like material, the switch being closed by bringing the two switch contact elements into close contact with each other. Such devices often lack the economy of construction to be desired. Further, it is sometimes difficult to obtain a very high degree of sensitivity to the touch compatible with immunity from erroneous actuation by ambient vibrations and the like.

The device of this invention provides a simple and highly economical touch switch device of extremely high sensitivity to the touch yet substantially non-responsive to ambient vibrations, thus providing a significant improvement over prior art touch switches.

Briefly described, the device of the invention is formed from a first unit comprising a substrate member having a broad surface on which electrically conductive switch contact elements are formed, and a second unit comprising a substrate member having a broad surface on which electrically conductive switch contact bridging elements are formed. The switch contact elements of the first unit have finger portions which interleave with each other. The aforementioned broad surface of the second substrate member is placed against the aforementioned broad surface of the first member with the bridging elements in light surface contact across the finger portions of the switch contact elements. When pressure is applied to bring the bridging elements into intimate contact with the contact element finger portions, the switching action is achieved.

It is therefore an object of this invention to provide an improved momentary contact electrical switch.

It is therefore an object of this invention to provide an momentary contact touch switch of highly economical construction.

It is still another object of this invention to provide a momentary contact touch switch which has high sensitivity and which is substantially immune to extraneous vibration signals.

Other objects of this invention will become apparent from the following description taken in connection with the accompanying drawings, of which:

FIG. 1 is a perspective view of one embodiment of the device of the invention.

FIG. 2 is an exploded view showing the two component units of the embodiment of FIG. 1,

FIG. 3 is a top plan view of the unit carrying the bridging elements of the embodiment of FIG. 1,

FIG. 4 is a side elevation view of the unit shown in FIG. 3,

FIG. 5 is an end elevation view of the unit shown in FIG. 3,

FIG. 6 is a top plan view with partial cutaway section of the embodiment of FIG. 1, and

FIG. 7 is a cross sectional view taken along the plane indicated by 7—7 in FIG. 6.

Referring now to the figures, formed on the surface **11***a* of substrate unit **11**, which is fabricated of an electrically insulating material such as a suitable plastic, are electrically conductive switch contact elements **12** and **13**. Contact elements **12** and **13** which may be formed by etched circuit board techniques or by electrodeposition, preferably are of copper with a flashed gold surface. Switch contact elements **12** and **13** include bar portions **12***a* and **13***a* from which extend a plurality of finger portions **12***b* and **13***b* respectively. Finger portions **12***b* and **13***b* are interleaved with each other. The bars and finger portions of contact elements **12** and **13** while in close proximity to each other make neither physical nor electrical contact. Connected to bar portion **12***a* and **13***a* respectively are lead wires **15** and **16** which carry the switching signal to the circuits being controlled, when switching is accomplished as to be explained hereinafter.

Substrate unit **20** has a plurality of electrically conductive contact bridging elements **21** formed in the broad surface **20***a* thereof. Bridging elements **21** may be formed in the same manner as contact elements **12** and **13**, by etched circuit board techniques or electrodeposition. These bridging elements are also preferably fabricated of a highly conductive material, such as copper with a flashed gold surface. Substrate unit **20** is preferably fabricated of a flexible electrically insulating material such as a suitable resilient plastic and is segmented by longitudinal slots **23** and transverse slots **24** which provide a separation between the individual bridging elements **21** and give these elements some independence of motion relative to each other. This provides a significant advantage in that it enables reliable switch operation in response to light finger pressure on any portion of the switch operating surface **26**, this by virtue of the fact that the individual bridging elements **21** are not significantly restrained in their motion by the adjoining portions of unit **20**.

In the fully assembled device, the broad surfaces **11***a* and **20***a* of units **11** and **20** are placed against each other with bridging elements **21** bridging adjoining finger portions **12***b* and **13***b*. While there is light surface contact between the bridging element and the finger portions, this affords only an extremely high resistance electrical path between finger portions **12***b* and **13***b*, thus not permitting any significant electrical current flow therebetween. It is to be noted that there may be a very small separation between the opposing surfaces of the substrate members in the construction of the assembled unit but that such actual physical separation is not necessary to the proper operation of the device.

Substrate units **11** and **20** are encapsulated in a jacket

30 which may be fabricated of a suitable flexible material such as a resilient plastic.

The switch is actuated by the application of a small amount of pressure on any portion of surface 26 which brings one or more of bridging elements 21 into intimate bridging contact with a pair of fingers 12*b* and 13*b*, thereby providing the desired momentary electrical path.

The switching units 11 and 20 can readily be manufactured by mass production techniques, such units being fabricated in a large sheet which then can be cut up to form the units for individual switches. This makes for great economy of fabrication. The individutl switches can also be of relatively small size and by virtue of their complete encapsulation are substantially moisture proof. This type of switching device is primarily designed to provide a current path in a relatively low voltage low current circuit which may if so desired be utilized to control a high voltage high current device.

The device of this invention thus provides a simple highly economical momentary contact touch switch which has high touch sensitivity combined with high reliability of operation.

While the device of the invention has been described and illustrated in detail, it is to be clearly understood that this is intended by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of this invention being limited only by the terms of the following claims.

I claim:

1. An electrical switching comprising:

a first unit comprising an electrically insulating substrate member, said first unit having a broad surface with a plurality of electrically conductive bridging elements formed thereon, and

a second unit comprising an electrically insulating substrate member, said second unit having a broad surface with a pair of electrically conductive switch contact elements formed thereon, said switch contact elements each comprising a bar portion with a plurality of finger portions extending therefrom,

said first and second units being assembled to form an integral switch assembly with said aforementioned broad surfaces opposite each other and with said bridging elements of said first unit substantially in surface contact with the finger portions of both of the switch contact elements of said second unit whereby when pressure is applied bringing a portion of said two units closer together at least a pair of said finger portions are bridged by at least one of said bridging elements and low resistance electrical contact is provided between said contact elements.

2. The device as recited in claim 1 and further including a flexible jacket for encapsulating said units.

3. The device as recited in claim 1 wherein said first unit is segmented to separate said bridging elements from each other thereby facilitating the independent movement of said bridging elements.

4. The device as recited in claim 1 wherein the bar portions of said switch contact elements run substantially parallel to each other and said finger portions extend substantially perpendicularly from said bar portions.

5. The device as recited in claim 4 wherein said bridging elements run in a direction substantially parallel to the bar portions of said switch contact elements.

6. The device as recited in claim 1 wherein said first unit is fabricated of a flexible material.

7. The device as recited in claim 1 wherein the finger portions of one of said switch contact elements interleave with the finger portions of the other of said switch contact elements.

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ROBERT K. SCHAEFER, *Primary Examiner.*

D. SMITH, JR., *Assistant Examiner.*

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