TOUCH PANEL SWITCH ASSEMBLY

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ABSTRACT

A multi-layer touch panel switch assembly for particular application as a control panel for computers. The front panel is a smooth surface with no exposed switch handles. An operator depresses a selected area causing metallic surfaces to momentarily make contact, lighting a LED indicator located behind transparent areas in the panel. A silicone button having the desired flexibility and having excellent memory characteristics is used to transfer the pressure to close the electrical contacts. The front panel and switches may be inexpensively manufactured using printed circuit techniques and flow soldering operations.

4 Claims, 2 Drawing Figures
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TOUCH PANEL SWITCH ASSEMBLY

THE PRIOR ART

Control panel low profile keyboards, in general, use either true contacts or an elastomeric material which under compression reduces its resistance from $10^7$ ohms to $10^8$ ohms. In an article by Jerome Lyman entitled "Keyswitches and Keyboards", EEE, for November 1970, pages 64 through 73, an excellent summary of available switches is presented.

The biggest drawback to the known low profile touch switches is the lack of inherent feedback to a human operator who does not know when he has pushed enough to close the switch. One solution is to produce an audible click each time a switch is closed; another is to mount a key on the top of each low profile touch switch. The less costly "clicking" is preferred over the key. Further, it is desirable to provide a switch having a relatively long "life" — on the order of 10$^6$, or more, mechanical and electrical cycles. It is also desirable to provide a control panel switch, or the like, which is sealed from the elements as well as the operator and is easy to operate.

In summary, the present invention overcomes many of the shortcomings of the prior art by using a continuous non-perforated, flexible front panel on which the proper markings, characters, etc., are applied. Behind each marking, character, etc. is an elastomeric button which is sensitive to touch and yet has a high memory characteristic which returns it to its original position. Pressure on the button closes contacts to a grid pattern and a light emitting diode (LED) is energized to indicate the particular button which has been depressed.

Accordingly, it is a primary object of the invention to provide a touch panel assembly which is sensitive to the operator's touch and has high restoration characteristics.

Another object of the invention is to provide a low cost, highly reliable push button indicator switch.

A further object of the invention is to provide a sealed, low profile switch which is easy to operate at low cost.

The foregoing and other objects will become more apparent from the following description when taken with the accompanying drawings, in which:

FIG 1 is an exploded trimetric view of a computer control panel in accordance with the invention; and

FIG. 2 is a cross-sectional view of two switches of a control panel such as shown in FIG. 1.

Now, referring to the drawings, the exploded FIG. 1 shows the control panel assembly consisting of a printed circuit (PC) board 1, a shroud 3 and a front decorative panel 5. A resilient button 6 is mounted in the shroud 3, and strips 7 and 8 are mounted between the shroud 3 and printed circuit (PC) board 1, all to be explained hereinafter. It will be noted that the button 6 is retained in the aperture 3A of shroud 3 and the strips 7 and 8 are between the shroud 3 and the PC board 1, as will be more fully explained in connection with FIG. 2. The PC board 1 contains a grid pattern 1A, which may be arranged according to a standard format, the grid and interconnections (not shown) to the edge of the PC board being formed by well known "printing" techniques, or the equivalent. The PC board is positioned by means of spacers 9 from the back cover 10.

In FIG. 2, the back cover 10 and spacer have been omitted for clarity, only an enlarged cross-sectional view being shown. The strips 7 and 8 are positioned between the PC board 1 and the shroud 3 on alignment pins 3C at either end of the shroud 3, one being shown in FIG. 2. The strip 7 is made of an insulating plastic backing such as mylar or polyester, and has bonded thereto areas of a conductive material 7A, such as gold or the like, the conductive areas being positioned on the strip 7 to overlay the grid pattern 1A on the PC board. The strip 8 lies between the strip 7 and the PC board, and includes apertures 8A which are arranged to overlay the conductive area 7A. When the strips 7 and 8 are positioned between the shroud 3 and PC board 1, the aperture 3A in the shroud, the switch button 6, the conductive area 7A, the aperture 8A and the grid pattern 1A are all in alignment, as indicated in FIG. 2, so that pressure on the switch button 6 displaces the conductive area 7A into engagement with the grid pattern 1A.

Details of the switch button 6 are shown in FIG. 2, a general perspective view being seen in FIG. 1. The body of the button is preferably cylindrical in shape, although it is readily apparent that the cylindrical shape is selected for convenience, and not because of limitation. In the body 6 is an annular depression 6A, which will be referred to herein as an annular channel or groove 6A. It will be noted that the channel is approximately two-thirds of the height of the cylinder, leaving about one-third material in the flexible area (d); and the radius (r) of the outer annulus is about one-third that of the radius (R) of the switch button. Also, while the button material is not critical, it has been found that elastomers, such as silicone rubber, are highly satisfactory.

A plurality of switch assemblies, as illustrated in FIGS. 1 and 2, are arranged in a conventional format. The numerals (0 — 15), for register, address and data, characters or words, "reset", "write", "read", etc. are conveniently arranged in a plurality of rows, e.g., 4, and columns, e.g. 19. The numerals, legends, etc., are applied to the front decorative panel in any convenient manner.

However, on a preferred embodiment, the decorative panel 5 is made of a laminate of mylar and polyvinyl chloride (PVC), such as a 1 mil mylar film bonded to about a 14 mil base of polyvinyl chloride vinyl acetate, with the mylar film on the outer face of the panel. The back side of the panel is covered with an opaque coating, except for transparent areas for the numerals, characters, etc. Suitably colored strips may be applied to the back side of the panel, so that certain numerals may be illuminated in one color and others in different colors. For example, front panel functions (inputs) such as "write", "read", "load", etc. may be in one color, while machine states, such as "busy", "idle", "done", etc. are preferably in a different color. Above each numeral, character or legend in a transparent area 12. Behind the transparent area 12 is a light emitting diode 11 (LED), or equivalent, which is mounted on the PC 1 adjacent to the grid 1A (connections to the grid are omitted as being obvious), so that the LED is illuminated when the switch is energized, thereby providing a visual feedback to the operator or programmer. As is apparent from FIG. 1, the LED projects into the aperture 3B in the shroud 3. The material of the shroud is preferably an opaque phenolic sheet, such as
to have very low or nil light transmitting qualities, to thereby concentrate the light of the LED on the transparent area 12.

The switch assembly as shown in FIGS. 1 and 2 and described above should be assembled so that when the operator or programmer presses an area designated by a number, character, etc., only the LED above that area will be illuminated. For example, in FIG. 2 the center-to-center distance between buttons 6 might be around ¾ inch, which results in a spacing between holes 3A in shroud 3 of about ¾ inch, thereby preventing pressure transfer to the next button(s).

Further, the dimensions and tolerances of the switch assembly as viewed in FIG. 2 are not critical, although it is regarded as important that certain conditions be met. The volume of the button 6 above the annular channel 6A should be such that the center portion of the button will be deflected under moderate pressure to force the conductive area 7A of strip 7 into electrical contact with the grid 1A, and still have adequate restoration characteristics for a long operation “life”. As an example, for less resilient materials the thickness d would be less.

What is claimed is:

1. A pressure sensitive switch assembly in combination with a control panel comprising:
   a. a printed circuit having a discontinuous grid pattern thereon;
   b. an apertured insulator having apertures positioned over said grid;
   c. an insulator having conductive areas on one side thereof, said areas being positioned over the afore-mentioned apertures;
   d. an apertured shroud having the apertures positioned over said conductive areas;
   e. flexible buttons located in the shroud apertures and in proximity with the other side of said second insulator contiguous to said conductive areas; and
   f. light emitting means mounted on said printed circuit and located adjacent said shroud aperture whereby depressing the control panel also depresses said button and causes a connection to be made across said grid, thereby energizing said light emitting means.

2. A pressure switch assembly as defined in claim 1, wherein the flexible button is made of an elastomer and having a channel therein spaced from its central axis.

3. A pressure switch assembly as defined in claim 2, and wherein the thickness of the button material remaining at the bottom of the channel is less than one-third the thickness of the material adjacent the channel.

4. A pressure actuated switch assembly as defined by claim 1, and wherein the control panel contains indicia and legends overlying said buttons to indicate to an operator computer inputs, functions and the like.

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