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UK CL (Edition K) **G1N**
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(54) Touch sensitive switches

(57) A touch sensitive capacitive switch comprising a layer 11 of plastics material acting as a dielectric, a first electrode 17 which is on one side of the layer 11 and second and third electrodes 18, 19 on the other side eg carried by further plastics layers 12, 13, the second and third electrodes 18, 19 being spaced and in register with respective parts of the first electrode 17. The layer 11 of plastics material is adhered to a glass layer 10 so that the first electrode 17 is between the layer 11 of plastics material and the glass layer 10.

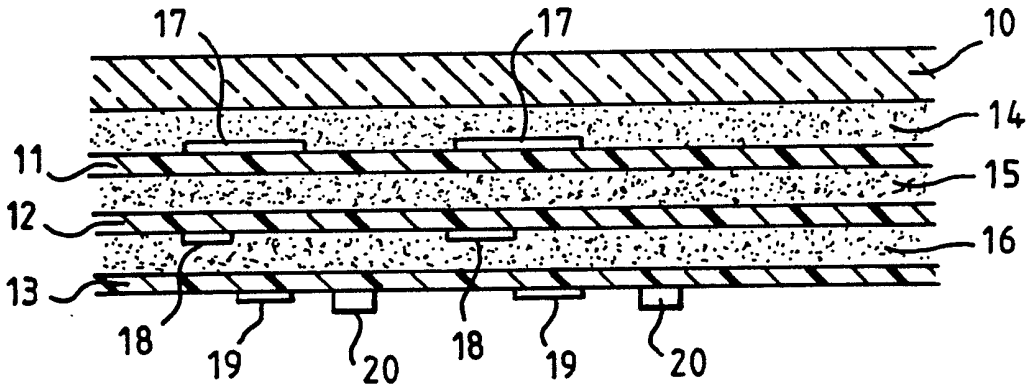

FIG.2

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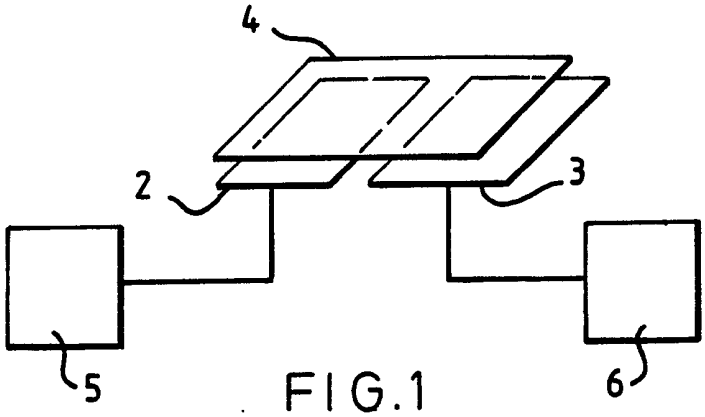

FIG.1

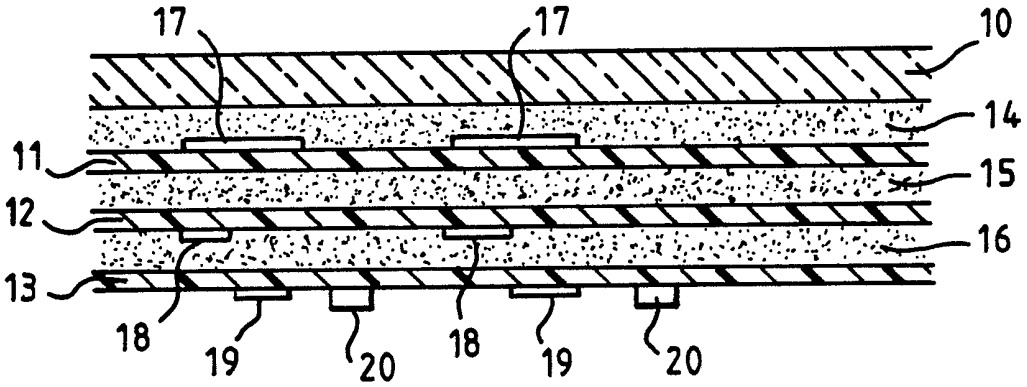

FIG.2

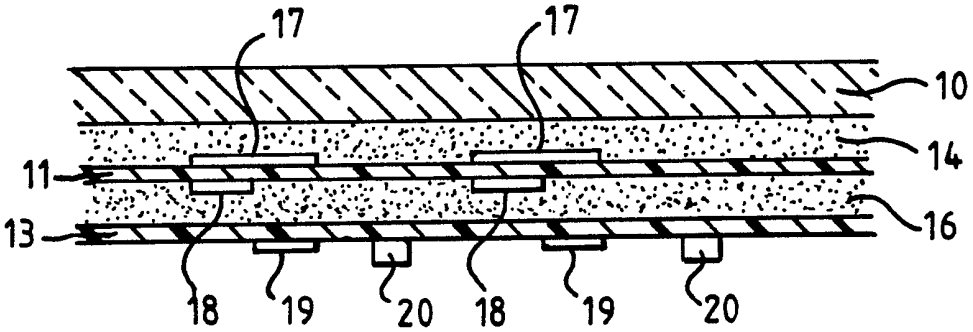

FIG.3

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TOUCH SENSITIVE SWITCHES

This invention relates to a touch sensitive switch.

It is known to provide a touch sensitive switch as illustrated in Figure 1 which has a glass sheet 1 on a first surface of which (the lower surface in Figure 1) there are formed spaced electrodes 2 and 3. On the opposite surface (the upper surface in Figure 1) there is formed another electrode 4 facing the electrodes 2 and 3; electrodes 2 and 3 are connected, respectively, to a signal source 5 and a signal detector 6. The capacitance between electrodes 2 and 3 is affected by the presence of the electrode 4 on the top surface of the glass sheet 1. The signal source 5 is connected to the signal detector 6 via this capacitance. When a person touches the electrode 4, he or she provides a capacitance between that electrode and ground and thereby changes the capacitance between the electrodes 2 and 3. As a result, the level of the signal received by the signal detector 6 changes and this is used to control some device.

The touch sensitive switch illustrated in Figure 1 has

been used successfully but is expensive to manufacture, firstly because it is necessary to deposit the electrodes 2, 3 and 4 on opposite sides of the glass. Moreover in order to connect the electrodes 2 and 3 to the signal source and signal detector 5 and 6 respectively, it is necessary to deposit tracks on the lower surface of the glass sheet 1 and this is of course normally done at the same time as the deposition of the electrodes 2 and 3. These deposition steps are, in practice, expensive and supplies of the glass sheets of the required dielectric characteristics are not entirely satisfactory.

As has already been explained, it is necessary to provide tracks on the lower surface of the glass sheet to provide connections to the electrodes or pads 2 and 3. The very presence of the tracks provides inter-track capacitance which affects the operation of the switch.

It is, in fact, possible to avoid providing tracks on the lower surface of the glass sheet 1 by providing spring contacts to the electrodes 2 and 3 but this is also an expensive design.

The capacitance between the electrodes 2 and 3 is

also changed when a person brings his finger sufficiently close to the electrode 4 (without actually touching the electrode 4) to provide capacitance for ground and to thereby operate the switch. The expression "touch" throughout the specification and claims is to be understood to include operation in this manner.

It is an object of this invention to provide an improved touch sensitive switch in which the problems associated with the known touch sensitive switch are at least alleviated.

According to this invention, there is provided a touch sensitive switch comprising a layer of plastics material acting as a dielectric, a first electrode which is on one side of the layer and second and third electrodes on the other side, the second and third electrodes being spaced and in register with the first electrode.

Preferably, the layer of plastics material is adhered to a layer of backing material so that the first electrode is between the layer of plastics material and the layer of backing material.

Preferably the layer of backing material is of glass.

In one arrangement in accordance with the invention, the second layer of plastics material is adhered to the first mentioned layer and a third layer of plastics material is adhered to the second layer of plastics material so that the first mentioned, the second and the third layers of plastics material are parallel, the first electrode being formed on the surface of the first mentioned plastics layer remote from the second and third layer of the plastics material, and the second and third electrodes being formed respectively on those surfaces of the second and third layers of plastics material remote from the first electrode, and the second and third electrodes being connected to metallic tracks formed on the respective surfaces of the second and third layers of plastics material respectively.

Preferably the third electrode is connected via its metallic track to a surface mounted component on the surface of the third layer remote from the first mentioned layer.

In another construction in accordance with this invention, a second layer of plastics material is

adhered by an adhesive material to the first mentioned layer of plastics material so that the first mentioned and the second layer of the plastics material are parallel, the first and second electrodes being formed on opposite surfaces of the first layer of plastics material with the first electrode on the surface remote from the second layer of plastics material, the third electrode being formed on the surface of the second layer of plastics material remote from the first layer of plastics material, the second and third electrodes being connected to metallic tracks formed on the respective surfaces of the first and second layers.

The third electrode is connected by its metallic track to a component mounted on the surface of the second layer of the plastics material remote from the first layer of the plastics material.

Preferably the layer or layers is or are in the form of a film.

Preferably the plastics layers are of polyester.

An embodiment of this invention will now be described, by way of example only, with reference to the accompanying drawings of which:-

Figure 1 is a schematic view of a known touch sensitive switch which has already been described;

Figure 2 is a sectional elevation of a first touch sensitive switch in accordance with this invention; and

Figure 3 is a sectional elevation of a second touch sensitive switch in accordance with this invention.

Referring to Figure 2 a glass sheet 10 has adhered to it plastic layers 11, 12 and 13 in that order by respective adhesive layers 14, 15 and 16. A plurality of switches have a common glass sheet 10 and common plastic layers 11, 12 and 13 and only one switch will be described. A touch pad or electrode 17 is formed on the surface of the plastics layer 11 adhered to the glass layer 10. The layer 12 has a source electrode 18 formed on it on the surface furthest from the glass sheet 10 and is connected, by a metallic track formed on the layer 12 to a signal source (not shown). The layer 13 has formed on it a detector electrode 19 and carries a surface mounted component 20 on the surface remote from the glass sheet 10; the electrodes 18 and 19 are in register with different parts of the touch electrode 17 on the layer 11. The electrode 19 is connected via a metallic track

and the surface mounted component 20 to a signal detector (not shown).

The electrodes 18 and 19 cannot be formed on the same plastics layer because of the connecting track path which need to cross.

The surface mounted components can be buffer transistor circuits which permit multiplexing of the switch matrix reducing the number of connections required. The connections may be brought out in tails in the same way as with membrane switch panels.

The glass layer 10 does not act as the dielectric for the capacitance between the electrodes 17, 18 and 19, which is provided by layers 11, 12 and 13 which may be of polyester. The capacitance between the source and detector electrodes 18 and 19 is made up of the capacitance between the electrodes 18 and 19 and that between the electrodes 17 and 19 and is altered when a person touches the glass sheet 10 above electrode 17.

It will be observed that in the embodiment illustrated in Figure 2, no conductive layers or electrode are printed on to glass sheet 10 which remove an expensive

process and enables standard inexpensive glass sheet to be used. Moreover as all the plastic layers are behind the glass sheet 10 they can be protected from adverse conditions. This is particularly useful on hob controls where previously the top pad was external and had to be resistant to heat and abrasion. In this connection reference is made to pad 4 of Figure 1 which is external and had to be protected.

Film layers of plastic material such as layers 11, 12 and 13 can be relatively cheap to produce.

It will be appreciated that in use the user merely touches the glass layer 10 in line with the electrode on layer 11. Although the user does not actually touch the electrode 17 on the layer 11, he changes the capacitance between the electrodes 18 and 19 sufficiently to change the signal applied between the signal source and the signal detector.

The embodiment of Figure 3 differs from that of Figure 1 in that the plastics layer 12 and adhesive layer 15 are eliminated and, instead, touch electrode 18 (and its track) are formed on the surface of the layer 14 furthest from the glass sheet 10. The layer 13 is adhered to layer 11 by the adhesive layer 16.

CLAIMS

1. A touch sensitive switch comprising a layer of plastics material acting as a dielectric, a first electrode which is on one side of the layer and second and third electrodes on the other side, the second and third electrodes being spaced and in register with the first electrode.

2. A touch sensitive switch according to Claim 1, wherein the layer of plastics material is adhered to a layer of backing material so that the first electrode is between the layer of plastics material and the layer of backing material.

3. A touch sensitive switch according to Claim 2, wherein the layer of backing material is of glass.

4. A touch sensitive switch according to any of claims 1 to 3, wherein the second layer of plastics material is adhered to the first mentioned layer and a third layer of plastics material is adhered to the second layer of plastics material so that the first mentioned, the second and the third layers of plastics material are parallel, the first electrode being formed on the

surface of the first mentioned plastics layer remote from the second and third layer of the plastics material, and the second and third electrodes being formed respectively on those surfaces of the second and third layers of plastics material remote from the first electrode, and the second and third electrodes being connected to metallic tracks formed on the respective surfaces of the second and third layers of plastics material respectively.

5. A touch sensitive switch according to Claim 4, wherein the third electrode is connected via its metallic track to a surface mounted component on the surface of the third layer remote from the first mentioned layer.

6. A touch sensitive switch according to any of claims 1 to 3, wherein a second layer of plastics material is adhered by an adhesive material to the first mentioned layer of plastics material so that the first mentioned and the second layer of the plastics material are parallel, the first and second electrodes being formed on opposite surfaces of the first layer of plastics material with the first electrode on the surface remote from the second layer of plastics material, the third

electrode being formed on the surface of the second layer of plastics material remote from the first layer of plastics material, the second and third electrodes being connected to metallic tracks formed on the respective surfaces of the first and second layers.

7. A touch sensitive switch according to Claim 6, wherein the third electrode is connected by its metallic track to a component mounted on the surface of the second layer of the plastics material remote from the first layer of the plastics material.

8. A touch sensitive switch according to any of claims 1 to 7, wherein the layer or layers is or are in the form of a film.

9. A touch sensitive switch according to any of claims 1 to 8, wherein the plastics layers are of polyester.

10. A touch sensitive switch substantially as hereinbefore described with reference to Figures 2 and 3 of the accompanying drawings.

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