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(54) Capacitive touch control switch panels and method of manufacturing them

(57) In a touch control switch panel comprising a dielectric sheet 1 carrying a touch switch which comprises a first touchable electrode 2 on one side of the sheet and second and third mutually separated electrodes 7, 8 on the opposite side of the sheet 1 and in capacitive relation to the first electrode, there are conflicting requirements as to high switch capacitance, small switch area and scratch and impact resistant dielectric sheet.

This difficulty is remedied by forming the dielectric sheet 1 of glass which has been chemically tempered and by constituting at least one electrode 2, 7 or 8 by a coating deposited on the sheet 1. The electrode 2 is preferably a tin oxide or indium oxide coating while the electrodes 7 and 8 are preferably of conductive enamel. The dielectric sheet 1 may be provided with an opaque coating layer 5 and/or bonded to a backing support e.g. of synthetic plastics material.

FIG.1

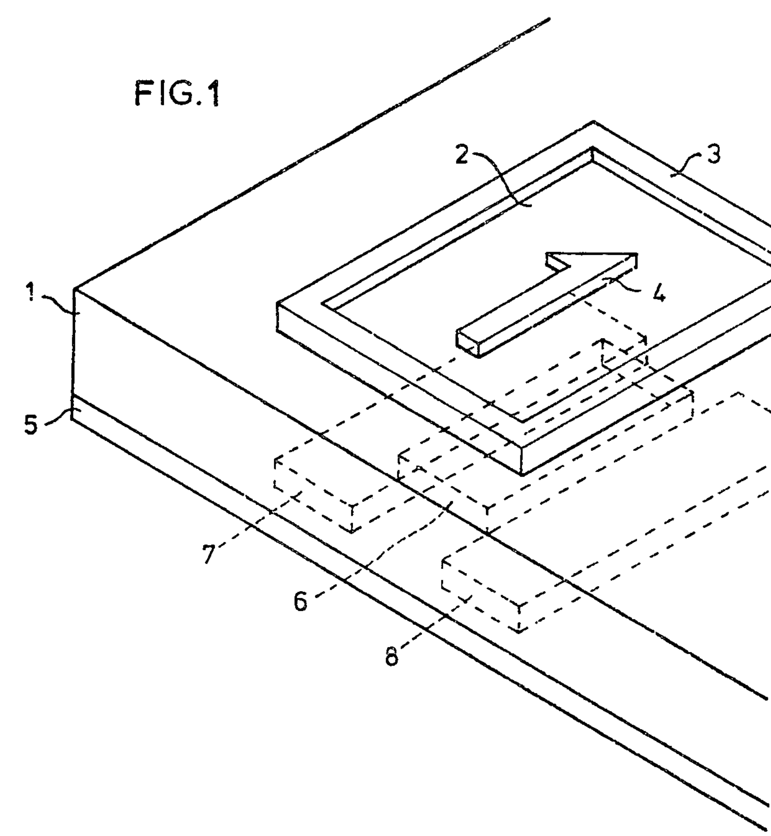

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FIG.1

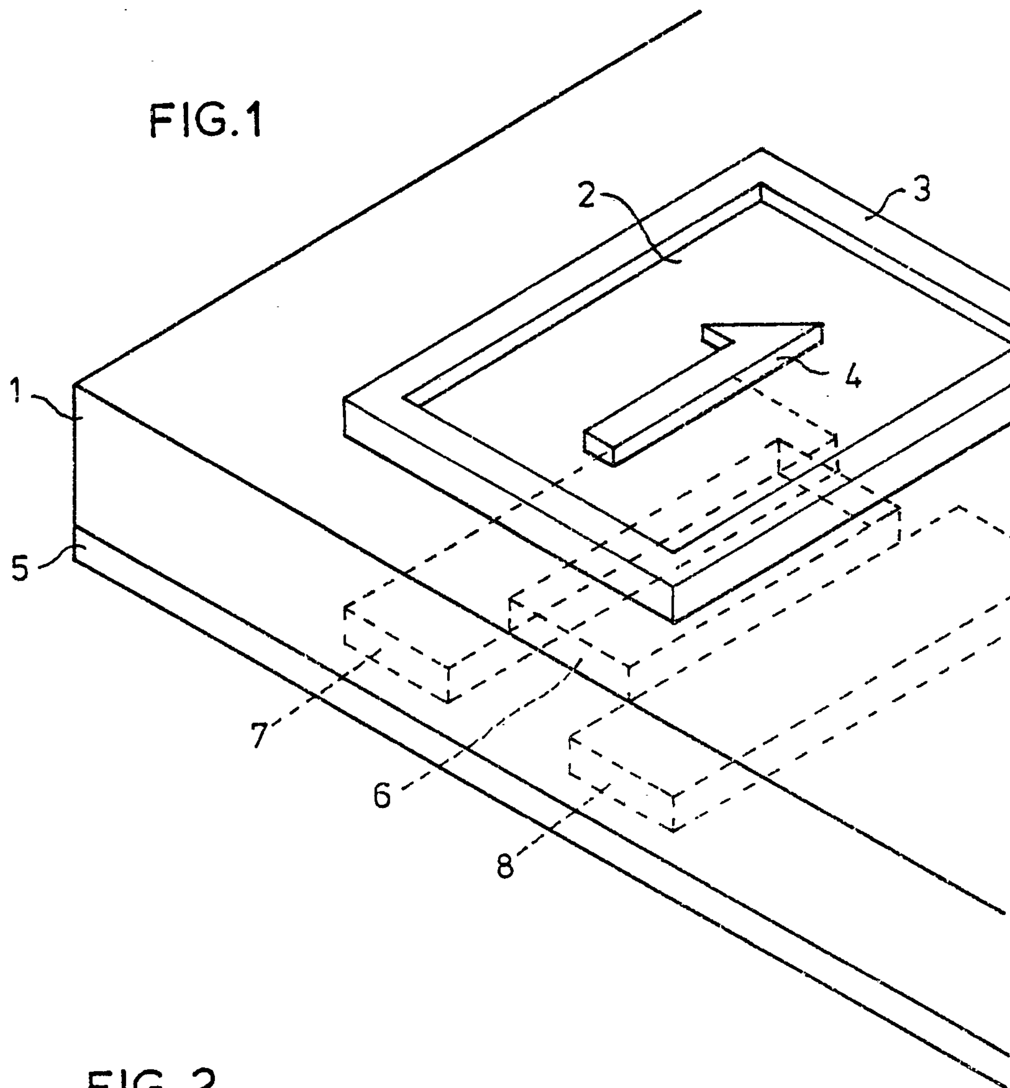
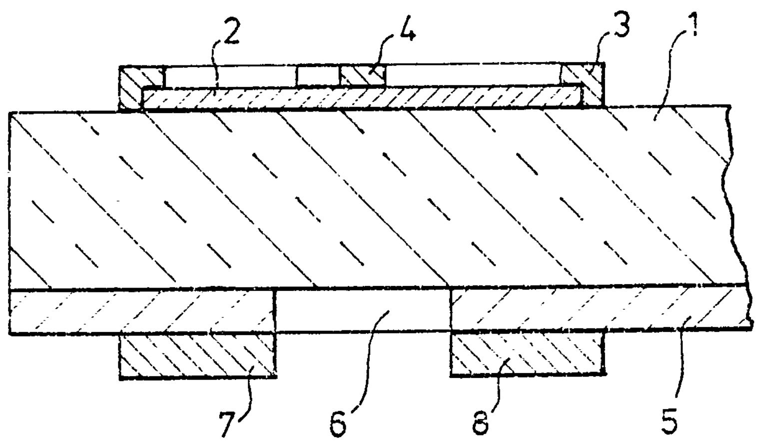
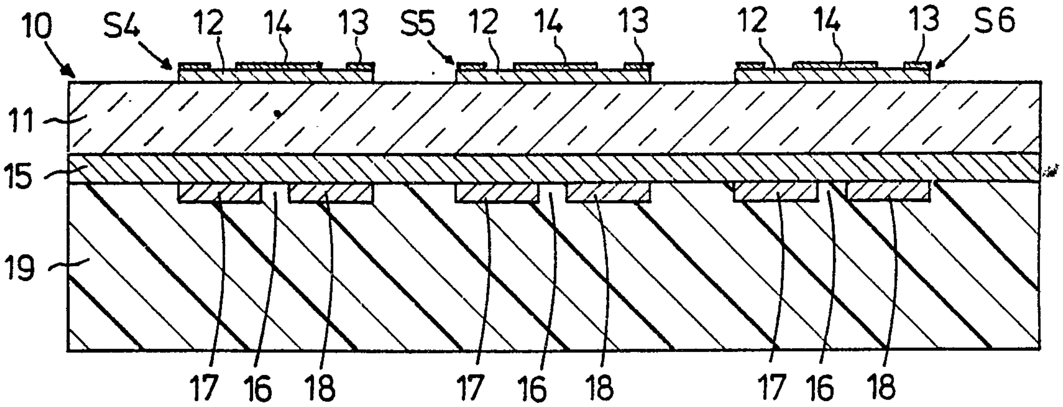


FIG. 2

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S4
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S5
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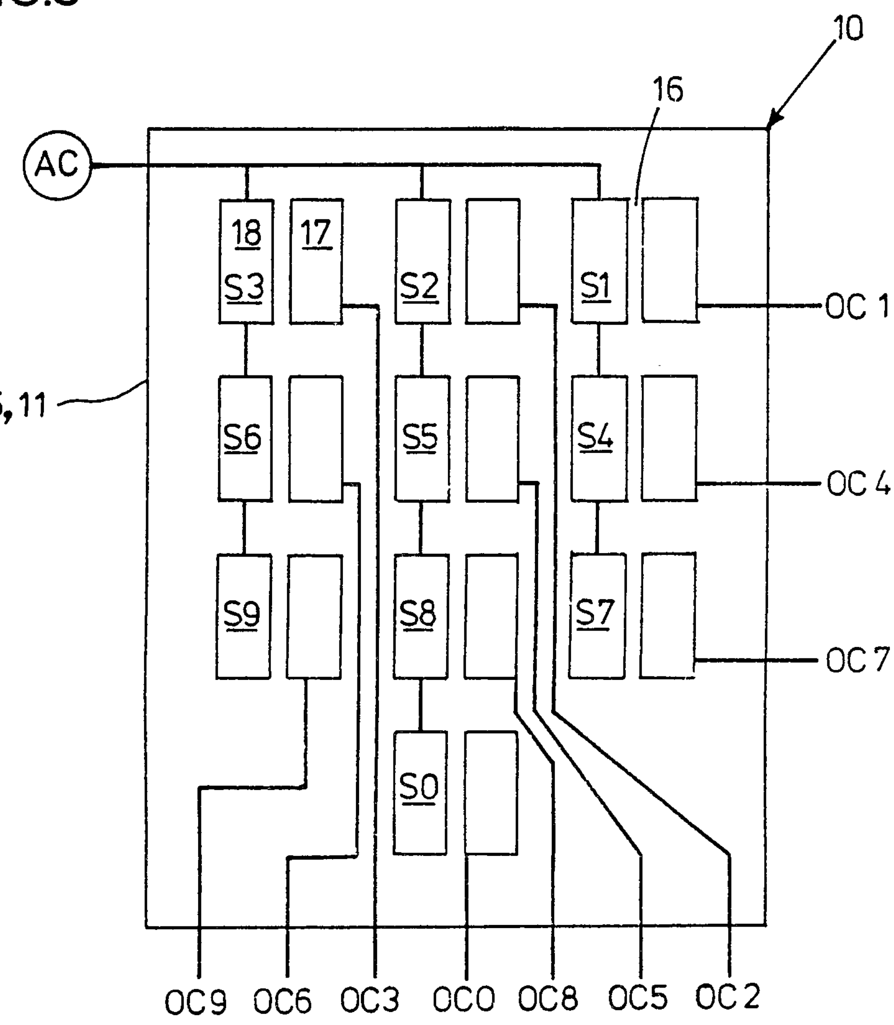
FIG.3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OC 1
15,11
S6
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OC9
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OC3
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OC8
OC5
OC2

FIG.4

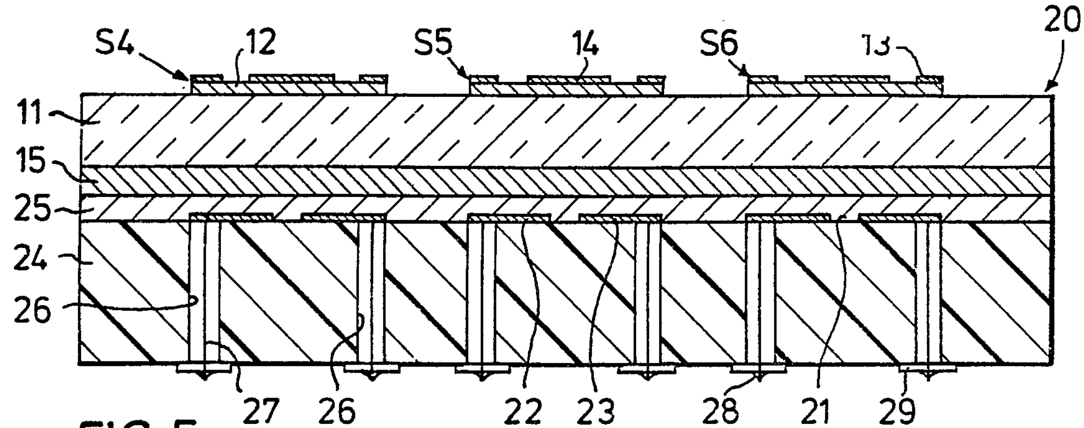


FIG.5

FIG.6

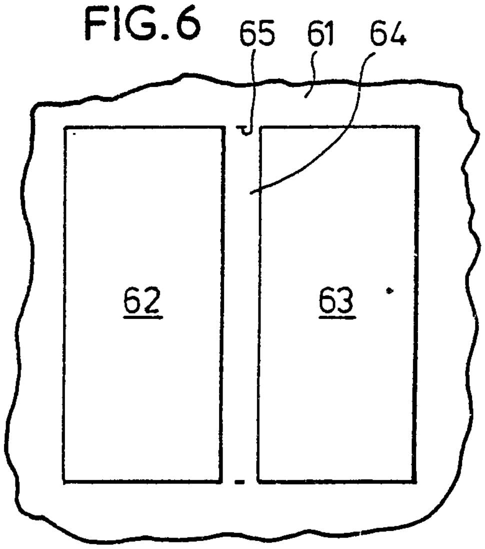


FIG.7

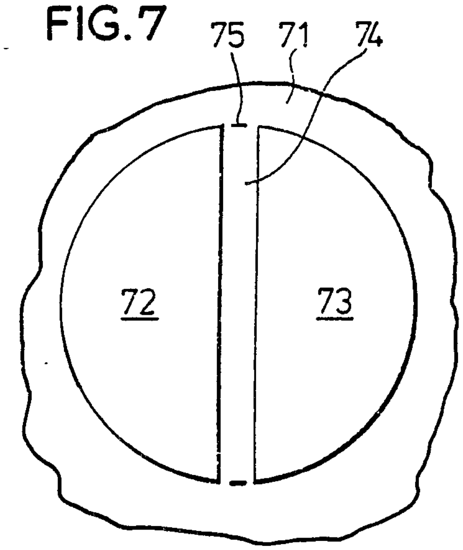


FIG.8

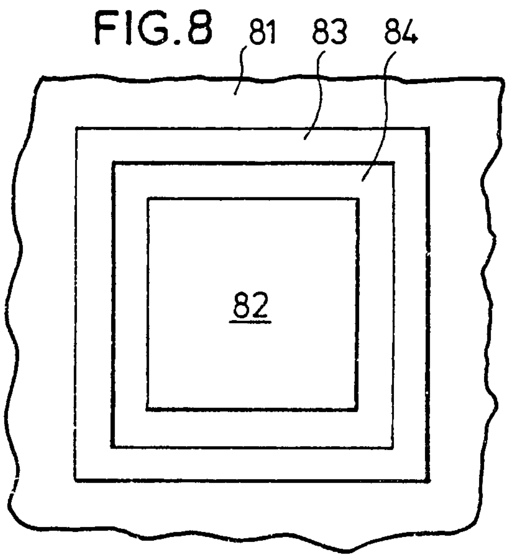
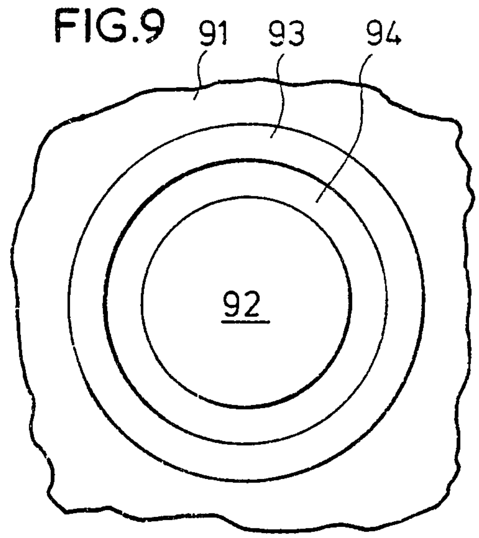


FIG.9



SPECIFICATION

Capacitive touch control switch panels and method of manufacturing them

This invention relates to touch control switch panels comprising a dielectric sheet carrying at least one touch switch, the or each switch comprising a first, touchable electrode on one side of said sheet, and second and third mutually separated electrodes on the opposite side of the sheet in capacitive relation to the first electrode.

The three electrodes combine to form two capacitors connected in series. In use, an AC signal is applied to one of the second and third electrodes while the other of them is connected to an output monitoring circuit. When the first electrode is touched with a finger, the signal passed to the input of the monitoring circuit is significantly decreased, and this decrease in signal is used to effect switching.

Such switches may be used in many fields, for example as elevator control switches, as domestic appliance switches (e.g. for cookers) and in switch arrays for example as a telephone "touch dial" or as a computer input keyboard.

To effect reliable switching such a switch should have a capacitance which is as high as possible. The reason for this is that the signal applied by a pulse generator to the electrode should keep the highest level possible when entering the detection circuit taking account of the capacity of the input impedance. The higher this level the easier it will be to reject noise signals by means of a threshold circuit incorporated into the detection circuitry. For some commercially available detection circuits which have been especially developed for capacitive touch control switching systems a typical value to be achieved for the capacitance of the system of 3 pF may be cited.

Especially in the case of panels bearing an array of switches, it is desirable that each switch should occupy a small area. This desideratum is to some extent in conflict with the requirement for a capacitance above a given threshold value since, according to the well known classical formula, the capacitance of a flat plate capacitor is proportional to its area.

According to the same formula, the capacitance is inversely proportional to the thickness of the dielectric material, so it would of course be possible to reduce both the area of the switch and the thickness of the panel while maintaining the same capacitance.

It is also possible to affect the capacitance by a choice of the dielectric material, but this may lead to an apparent conflict with other requirements. For example, natural dielectric materials such as mica do not lend themselves to high volume series production. Plastics materials are easily abraded and are generally flexible when thin, so that a touch control switch panel incorporating a touchable electrode deposited on a plastics dielectric sheet could soon wear to the point where it became unreliable in operation. The use of ordinary soda-lime glass as dielectric is satisfactory for scratch-resistance, but the glass sheet must be made sufficiently thick for impact resistance. This limits the size to which a switch can be reduced while maintaining its capacitance above a threshold value.

It is an object of the present invention to remedy this difficulty.

According to the present invention there is provided a touch control switch panel comprising a dielectric sheet carrying at least one touch switch, the or each switch comprising a first, touchable electrode on one side of said sheet and second and third mutually separated electrodes on the opposite side of the sheet in capacitive relation to the first electrode, characterised in that said dielectric sheet is of glass which has been subjected to a chemical tempering treatment, and in that at least one said electrode is constituted by a coating deposited on the sheet.

A touch control switch panel according to the invention is more impact resistant than a known panel, by virtue of the tempering treatment to which the glass dielectric has been subjected, so that the thickness of the glass sheet can be reduced while retaining sufficient impact resistance. This in turn enables the area of the or each switch to be reduced while maintaining its capacitance at a sufficient level.

Preferably each said electrode is constituted by a coating deposited on said sheet.

The chemical tempering of glass is well known per se. The most current type of tempering involves an exchange of alkali metal ions from a contacting medium with alkali ions from the glass while the glass is heated. This ionic interchange takes place in surface layers of the glass which are several microns or tens of microns thick. In one process, the ion exchange is performed at a temperature sufficiently high for stress relaxation to occur in the glass and the ions entering the glass are such as to confer a lower coefficient of thermal expansion on the surface layers of the glass. As an example, lithium ions are substituted into the glass for sodium ions. High lithium glass has a lower coefficient of expansion so that when the treated glass is cooled, compressive surface stresses are induced therein. In another process, ions in the surface of the glass are replaced by larger ions and the ion exchange is effected at a temperature below the annealing point (corresponding to a viscosity of $10^{13.2}$ poises) so that stress relaxation will not occur. In an example, potassium ions are substituted into the glass e.g. from a bath of molten potassium nitrate maintained at 470°C. Potassium ions are larger than sodium ions, so again compressive surface stresses are induced in the treated glass.

Advantageously, said dielectric sheet is at most 3mm thick, and preferably it is at most 1.5mm thick. A 1mm thick tempered glass sheet is especially suitable for use as a said dielectric sheet.

In preferred embodiments of the invention, the maximum dimension of the sheet area occupied by the or a said switch is 30mm or less, and advantageously such dimension is 25mm or less.

Preferably, the sheet area occupied by the or a said switch is $450mm^2$ or less, and advantageously such area is $250mm^2$ or less.

Various coating materials may be used to form a said electrode, such as metals, conductive metal oxides, and conductive (or metal containing) enamels.

As far as the first, touchable electrode is concerned it is preferred that the coating be a conductive metal oxide coating formed of tin oxide or indium oxide and containing a doping agent. Tin oxide is especially preferred because of its hardness and chemical stability, and also for reasons of economy. The reason for preferring a metal (especially tin) oxide is as follows. It is extremely difficult, if not impossible, to uniformly chemically temper a glass sheet on which a coating has been deposited. Accordingly, in practice when performing the present invention, the sheet must be tempered before the electrodes are deposited. If the tempered sheet is subsequently heated to a temperature at which any substantial stress relaxation may occur, much of the additional strength imparted to the glass will be lost. Metal oxide coatings of satisfactory hardness and conductivity can readily be deposited at lower temperatures. It would of course be equally possible to make the first, touchable electrode from a conductive (e.g. silver containing) enamel of a composition selected to have a relatively low melting point. However, in general, the lower the melting point of an enamel, the lower is its hardness and thus its resistance to abrasion and its resistance to corrosion is also generally lower.

The requirement of abrasion resistance is not marked for the second and third electrodes since these will not normally be exposed for touching, and it is in fact preferred that said second and third electrodes be formed by deposits of conductive enamel. The use of conductive enamel coatings on the unexposed surface of the switch panel has a number of advantages. Firstly, a paste of enamel forming ingredients can readily be applied to the dielectric in a desired pattern for example by a silk-screen printing technique. Interconnecting conductor leads can also be deposited at the same time if this is desired. Secondly, soldered connexions can easily be made to the enamel.

In some preferred embodiments of the invention an opaque coating is deposited on a face of the tempered glass sheet prior to the deposition of the electrode or electrodes on that face. Such an opaque coating masks any electrical circuitry located behind the panel and is preferably applied to the unexposed face thereof. If desired such coating may be provided with windows associated with a said switch and behind which a light may be provided to indicate the state of the switch circuit.

Preferably, a backing support is applied and bonded to the unexposed face of said panel. This provides added rigidity to the panel so that is becomes more resistant to flexure. Advantageously said backing support is of synthetic plastics material. Such a support may for example be moulded on to the panel. In some embodiments of the invention, the support is a solid block, but in other embodiments of the invention the support is of cellular form. For example the support has a honeycomb structure. The support may also be made of expanded materials, such as foamed glass, and it may comprise a printed circuit board.

The present invention includes a method of manufacturing a touch control switch panel comprising a dielectric sheet carrying at least one touch switch, the or each switch comprising a first, touchable electrode on one side of said sheet and second and third mutually separated electrodes on the opposite side of the sheet in capacitive relation to the first electrode, characterised in that a sheet of glass is selected as said dielectric sheet and is subjected to a chemical tempering treatment at elevated temperature and in that at least one conductive coating is deposited on the tempered sheet to constitute one or more said electrode while the temperature of the sheet is below the annealing point (corresponding to a glass viscosity of $10^{13.2}$ poises) and so as substantially to avoid stress relaxation.

This is a very simple method of forming a touch control switch panel according to the invention, and it avoids any difficulties which could arise in tempering the glass sheet after deposition of the conductive coating(s).

Preferably, said first, touchable electrode is formed by depositing a metal oxide coating on said one side of the sheet. Advantageously said metal oxide coating includes a doping agent in order to increase its conductivity. Suitable doping agents are ions of one or more of antimony, arsenic, cadmium, chlorine, fluorine and tellurium. Said metal oxide may for example be indium oxide, but it is preferably tin oxide.

In some preferred embodiments of the invention, a said oxide coating is formed by pyrolysis of a metal salt for example sprayed onto said sheet as a solution in an organic solvent. As examples of such a solution may be cited tin dibutyldiacetate in ethyl alcohol and $SnCl_4.5H_2O$ in dimethylformamide with optional amounts of trifluoroacetic acid to provide doping fluorine ions.

In other preferred embodiments, a said oxide coating is formed by sputtering.

In order to limit the coating to the required areas different techniques may be used.

According to a first preferred method a mask is serigraphically applied to the sheet to cover the areas which are not to be coated in the finished panel and the mask is removed after applying a said conductive coating to the whole area of the tempered sheet. This leaves only the required areas with a coating.

According to a second preferred method, an oxide coating is deposited over the whole surface of the tempered sheet. Then an acid resist mark is serigraphically applied to mask the areas of the or each electrode, and the unwanted coating is etched away.

Said second and third electrodes are preferably formed by depositing a conductive enamel on said opposite side of the glass sheet. Such conductive enamel is preferably deposited by applying an enamel paste to the tempered glass sheet and melting it in situ. Such enamel paste is preferably applied by a serigraphic technique. A silver containing enamel, in particular an enamel of the organic type, is especially suitable.

Advantageously, said tempered glass sheet is opacified, preferably the application to one of its faces of a non-conductive opaque enamel coating. Such a coating is preferably applied to the unexposed face of the sheet, advantageously prior to the deposition thereover of said second and third electrodes.

Said first electrode is preferably deposited on said sheet prior to the deposition of said second and third electrodes, and also prior to the deposition of a said opaque enamel coating when the latter is present. This avoids problems due to remelting of the enamel coatings during deposition of the oxide coating.

Preferably a backing support is applied and bonded to the unexposed face of the panel. Such support may for example be of a synthetic plastics material and it may be formed in situ by moulding the panel.

In some embodiments of the invention, one of said second and third electrodes is shaped so as to surround at least the greater part of the periphery of the other. Preferably, the area of the inner of such electrodes is at least one quarter of the area of the outer electrode. Such electrode arrangements allow a beneficial compromise to be reached as regards the total capacitance of the system, the change in capacitance when the first electrode is touched, and the amount of material to be used in forming the second and third electrodes.

In this connexion, attention is drawn to our copending application No. of even date in which there is described: A capacitive system comprising a dielectric sheet having a first electrode on one side thereof, and on the other side thereof in capacitive relation with the first electrode, second and third electrodes which are mutually spaced, characterised in that of said second and third electrodes, one (hereinafter called "the outer electrode") is shaped to surround at least the major part of the periphery of the other (hereinafter called "the inner electrode") and in that the ratio of the area of the inner electrode to the area of the outer electrode is greater than 0.25 to 1.

Preferred embodiments of the invention will now be described with reference to the accompanying drawings in which:

Figure 1 is a detail perspective view of a touch control switch panel,

Figure 2 is a cross section through part of the panel of Fig. 1;

Figure 3 is a cross section of another embodiment of panel;

Figure 4 is an underplan of the panel of Fig. 3;

Figure 5 is a cross section of a third embodiment of panel; and

Figures 6 to 9 are underplan views of switches showing various arrangements of electrodes.

In Figs. 1 and 2, a sheet 1 of tempered soda-lime glass has applied to its upper or exposed face, a square first electrode 2 of doped SnO_2. The first electrode is surrounded by a border 3, and carries an index 4, here shown as the digit "1", serving to indicate the function to be performed by the switch of which the electrode 2 is a part. The lower or unexposed face of the tempered glass sheet 1 is covered with an opaque, non-conducting enamel layer 5 having a window 6 in register with the index 4. Second and third electrodes 7, 8 are deposited on the unexposed face of the tempered glass sheet 1 over the opaque enamel layer 5 to either side of the window 6 in capacitive relation with the first electrode 2. These electrodes are of a silver containing enamel.

Figs. 3 and 4 show a touch control switch panel generally indicated at 10 which has ten touch control switches S1 to S0 deposited on a tempered glass sheet 11. As described with reference to Figs. 1 and 2, each switch includes a first, touchable electrode 12 deposited on an exposed face of the glass sheet 11 and on which in turn are deposited a border 13 and a reference index 14. Each index 14 may for example be constituted as the reference digit of the switch S with which it is associated. On the rear face of the tempered glass sheet 11 there is deposited an opacifying layer 15 of a non-conductive material. This layer may if desired be provided with windows such as the window 6 shown in Figs. 1 and 2. Each switch further includes second and third electrodes respectively 17, 18 spaced apart by a gap 16. As will be seen in Fig. 4, the third electrodes 18 of the switches S1 to S0 are connected to a common A.C. source, while the second electrode 17 of each switch S1 to S0 is connected to an output circuit respectively OC1 to OC0.

The second and third electrodes are suitably of silver-containing material, and they may all be applied in a single operation by serigraphic techniques. Wire conductors for connecting the electrodes to the A.C. source and the Output Circuits may be soldered to the electrodes, or printed conductors may be applied in the same or subsequent serigraphic technique.

After the necessary electrical connexions have been made, a backing support 19 is applied to the rear of the panel. This serves to protect the second and third electrodes and their associated conductors against wear or corrosion during handling prior to installation, but its main function is to brace the panel against flexure while it is being used.

In order to manufacture a panel as shown in the drawings, a glass sheet 1 or 11 e.g. of ordinary soda-lime glass of a desired thickness is polished and then tempered in any convenient known manner, for example by immersing it for 8 hours in a bath of molten potassium nitrate mantained at 470°C to allow potassium ions to diffuse into surface layers of the glass in substitution for sodium ions previously forming part of the glass.

After tempering the glass is washed and the first electrodes 2 or 12 are deposited on one surface thereof. It is especially suitable to form the first electrodes of a metal oxide, e.g. SnO_2. Such an oxide coating may be deposited by a cathode sputtering technique, but it is preferred to deposit such a coating by pyrolysis of a salt e.g. by a spraying technique using a solution in an organic solvent. Suitable solutions are: tin dibutyldiacetate in ethanol with doping amounts of ammonium bifluoride or tin tetrachloride in dimethylformamide with doping amounts of trifluoroacetic acid. Such a solution may be sprayed onto the tempered glass sheet heated to 450°C to form a uniform coating of the desired thickness, for example 50 to 70nm. Such a coating has a grey tint in reflection, and indeed its colour may be used to indicate when to stop spraying. A coating formed in this way is as abrasion resistant as glass.

According to a variant, the coating may be deposited by pyrolysis of a salt in the vapour phase. The coating may also be obtained by immersion of the tempered sheet in an alcoholic solution of a tin compound followed by a baking operation. A further possible way is to form a coating starting from a paste containing a tin organic compound deposited by serigraphy and followed by baking.

After the application of such a uniform coating, an acid resist mask is applied serigraphically to the areas to be occupied by the electrodes 2 or 12, and the remaining areas of the coating are etched away.

The front face of the tempered glass is then coated with decorating material to form the borders 3, 13 and the indexes 4, 14. As an optional step the rear face of the tempered glass sheet is then covered with an opacifying layer 5 or 15. In both cases these coatings may be of a low melting point enamel. Preferably however use is made of a synthetic plastics material which is polymerised in situ to form an opaque coating. For example use may be made of an epoxy type lacquer the polymerisation temperaure of which is below 120°C.

The second and third electrodes are then applied to the rear face of the panel. The second and third electrodes may be of a conductive enamel or lacquer unless there is a polymeric opacifying layer present, in which case those electrodes should be of lacquer. These materials may be applied serigraphically and heated to fuse the enamel to the glass or to promote rapid setting of the lacquer. In a specific case silver containing lacquer No. 4929 of Dupont de Nemours was used for the second and third electrodes. After coating the lacquer was baked for one hour at 100°C. Another lacquer which may be used for the same purpose is lacquer No. 245 of Degussa.

Conductors may also be applied for the necessary electrical connections in the same serigraphic printing step, but in order to keep the size of the panel small, wire connectors are preferably soldered to the second and third electrodes. This soldering may for example be effected by applying a paste of solder and flux to the electrodes and melting it with a jet of hot air. The solder used may have the following composition: Sn : 62%; Pb : 36%; Ag : 2%. When use is made of a soldering iron its temperature should be limited to 250°C.

After making the necessary electrical connections the panel may be rigidified (and the conductors on its rear face protected) by moulding on a backing support 19. This may be done by causing a fluid resin to polymerise in situ.

One suitable fluid medium is a resin having the following composition by weight:

PLEXIMON 705 or 706	98.6%
Butyl monoterpermaleinate	0.2%
Benzoyl peroxide	0.1%
Triethyl phosphate	0.7%
Rohm activator 17 (maleic naphthanate)	0.4%

PLEXIMON 705 and 706 (Trade Marks) are methyl methacrylate resins produced by Rohm.

This resin composition will polymerise in 8 hours at a temperature of between 20°C and 30°C.

Another resin, which may be used for forming the backing support is a polyester resin such as "Polyester GTS" sold by the firm Vosschemie.

Fig. 5 illustrates a variant of the embodiment shown in Figs. 3 and 4 in which like elements are designated by like reference numerals. As described with reference to Figs. 3 and 4, the switch panel, now indicated at 20, comprises a tempered glass sheet 11 on which are formed a plurality of switches such as S4, S5, S6 comprising first touchable electrodes 12, borders 13 and reference indices 14, and on which is deposited an opacifying layer 15.

Each switch includes second and third electrodes 22, 23 spaced apart by a gap 21, but these are deposited not on the opacifying layer 15, but on a printed circuit board 24 which is bonded to the opacifying layer 15 by a layer of adhesive 25 to serve as a support for the glass sheet 11. The second and third electrodes 22, 23 are conveniently of metallic copper deposited as is well known in the printed circuit art. The printed circuit board 24 is pierced with a plurality of holes 26 via which the various second and third electrodes 22, 23 are connected by wires 27 soldered at 28 to appropriate parts 29 of a printed circuit.

Fig. 6 illustrates a touch control switch similar to that shown in Figs. 1 to 4. In Fig. 6, a sheet 61 of tempered soda-lime glass has applied to its unexposed face a pair of electrodes (the second and third electrodes) 62, 63 which are rectangular in form and are separated by a gap 64. The electrodes 62, 63 and the gap 64 between them together occupy a square on the unexposed face of the sheet 61. A first electrode is deposited on the exposed face of the sheet 61. Part of the boundary of the first electrode is indicated at 65. The first electrode is square and in register with the square formed by the second and third electrodes 62, 63.

Fig. 7 illustrates a circular touch control switch formed on a tempered glass sheet 71. Part circular second and third electrodes 72, 73 separated by a diametral gap 74 are deposited on the unexposed face of the sheet 71. A circular first electrode, part of whose circumference is shown at 75 is deposited on the exposed face of the sheet 71 in register with the circle formed by the second and third electrodes 72, 73 and the gap 74 between them.

Fig. 8 illustrates a touch control switch in which a tempered glass sheet 81 carries a square second electrode 82 surrounded by a square annular third electrode 83. The second and third electrodes are separated by a square annular gap 84. A first electrode (not shown) is deposited on the other face of the sheet 81 with its boundary in register with the periphery of the third electrode 83.

Fig. 9 illustrates a touch control switch in which a tempered glass sheet 91 carries a circular second electrode 92 surrounded by an annular third electrode 93. The second and third electrodes are separated by an annular gap 94. A first electrode (not shown) is deposited on the other face of the sheet 91 with its boundary in register with the circumferences of the third electrode 93.

Various particular touch control switches will now be described by way of example.

Example I (Fig. 6)

A sheet 61 of glass 1mm in thickness is tempered and a first electrode 12mm square is deposited on one of its faces. This first electrode is of doped tin oxide. Second and third electrodes 62, 63 each measuring 12 × 5mm are then formed on the opposite face of the glass sheet 61. These electrodes are spaced apart by a 2mm gap 64, and they are formed of a silver containing enamel. The total area of the sheet occupied by the switch is 144mm^2.

In a first variant, the tempered glass sheet 61 is 2.8mm thick, and in a second variant it is 4.9mm thick.

Example II (Fig. 8)

A sheet of glass 81, of thickness 1mm, is tempered and a first electrode 12mm square of doped tin oxide is deposited on one face. Second and third electrodes 82, 83 are deposited on the opposite face of the sheet in register with the first electrode. The second electrode 82 is 6mm square and it is separated by a square annular gap 84 which is 1mm in width from the third electrode 83 which is a square annulus 2mm in width. The second and third electrodes are formed from silver containing enamel. The total switch area is 144mm^2.

In variants, the tempered glass sheet 81 is 2.8mm thick and 4.9mm thick.

Example III (Fig. 8)

In variants of Example II the second electrode 82 is 4mm square and is separated by a 2mm wide square annular gap 84 from the third electrode 83 which is 2mm wide. Such switches are formed on tempered glass having the following thicknesses: 1mm, 2.8mm and 4.9mm. The total switch area is again $144mm^2$.

Example IV (Fig. 7)

A sheet of glass 71, of thickness 1mm, is tempered and a first circular electrode 13.5mm diameter of doped tin oxide is deposited on one face. On the opposite face are deposited part circular second and third electrodes 72, 73 of silver containing enamel. These electrodes are separated by a gap 74, 2mm wide. The second and third electrodes together with the gap separating them occupy a circular area 13.5mm in diameter which is in register with the first electrode. The total switch area is $143mm^2$.

In variants, the switch is formed on tempered glass 2.8mm and 4.9mm thick.

Example V (Fig. 9)

A sheet of glass 91, of thickness 1mm, is tempered and a first circular electrode 13.5mm in diameter of doped tin oxide is deposited on one face. On the opposite face are deposited, in register with the first electrode, second and third electrodes 92, 93 of silver containing enamel. The second electrode occupies circular area 7.5mm in diameter and is separated by an annular gap 94, 1mm wide from the third electrode which is an annulus 2mm wide. Again the total switch area is $143mm^2$.

In variants, the switch is formed on tempered glass 2.8mm and 4.9mm in thickness.

Example VI (Fig. 9)

In variants of Example V, the second electrode 92 is 5.5mm in diameter, and the annular gap 94 is 2mm wide. Again the switch is formed on tempered glass of the following thicknesses: 1mm, 2.8mm and 4.9mm.

Since the total areas occupied by these switches are similar, their capacitances when not touched, and the change in their capacitances when touched, may be directly compared, as in the following table.

Example	Total capacitance when untouched 1mm glass pF	2.8mm glass pF	4.9mm glass pF	Capacitance change when touched 1mm glass pF	2.8mm glass pF	4.9mm glass pF	Active surface area %
I	3.1	1.9	1.4	2.4	1.0	0.6	83.3
II	3.0	2.2	2.2	2.1	0.7	0.5	80.6
III	2.1	1.8	1.3	1.6	0.7	0.3	66.7
IV	3.2	1.9	1.5	2.4	1.0	0.6	81.2
V	3.6	3.0	2.5	2.5	0.9	0.5	81.0
VI	2.4	2.0	1.6	1.6	0.7	0.5	67.1

The column active surface area indicates the proportion of the first electrode which is in register with one or other of the second and third electrodes.

The capacitance values where indicated in this application are obtained by measurement with a universal bridge WAYNE KERR, type B224. The measurements are effected under normal ambient conditions. The capacitive switching system is disposed horizontally with the SnO_2 coating located on top. Standard connecting wires are connected by means of terminal clamps fixed to wires 5mm in length soldered to the second and third electrodes.

CLAIMS

1. A touch control switch panel comprising a dielectric sheet carrying at least one touch switch, the or each switch comprising a first, touchable electrode on one side of said sheet and second and third mutually separated electrodes on the opposite side of the sheet in capacitive relation to the first electrode, characterised in that said dielectric sheet is of glass which has been subjected to a chemical tempering treatment, and in that at least one said electrode is constituted by a coating deposited on the sheet.

2. A panel according to Claim 1, characterised in that each said electrode is constituted by a

coating deposited on said sheet.

3. A panel according to Claims 1 or 2, characterised in that said dielectric sheet is at most 3 mm thick.

4. A panel according to Claim 3, characterised in that said dielectric sheet is at most 1.5 mm thick.

5. A panel according to any preceding claim, characterised in that the maximum dimension of the sheet area occupied by the or a said switch is 30 mm or less.

6. A panel according to Claim 5, characterised in that the maximum dimension of the sheet area occupied by the or a said switch is 25 mm or less.

7. A panel according to any preceding claim, characterised in that the sheet area occupied by the or a said switch is 450 mm^2 or less.

8. A panel according to Claim 7, characterised in that the sheet area occupied by the or a said switch is 250 mm^2 or less.

9. A panel according to any preceding claim, characterised in that the or at least one said first, touchable electrode is constituted by a conductive metal oxide coating formed of tin oxide or indium oxide and containing a doping agent.

10. A panel according to any preceding claim, characterised in that a backing support is applied and bonded to the unexposed face of said panel.

11. A panel according to Claim 10, characterised in that said backing support is of synthetic plastics material.

12. A panel according to Claims 10 or 11, characterised in that said backing support comprises a printed circuit board.

13. A method of manufacturing a touch control switch panel comprising a dielectric sheet carrying at least one touch switch, the or each switch comprising a first, touchable electrode on one side of said sheet and second and third mutually separated electrodes on the opposite side of the sheet in capacitive relation to the first electrode, characterised in that a sheet of glass is selected as said dielectric sheet and is subjected to a chemical tempering treatment at elevated temperature and in that at least one conductive coating is deposited on the tempered sheet to constitute one or more said electrodes while the temperature of the sheet is below the annealing point (corresponding to a glass viscosity of $10^{13.2}$ poises) and so as substantially to avoid stress relaxation.

14. A method according to Claim 13, characterised in that the or at least one said first, touchable electrode is formed by depositing a metal oxide coating on said one side of the sheet by pyrolysis of a metal salt.

15. A method according to Claims 13 or 14, characterised in that a mask is serigraphically applied to the sheet to cover the areas which are not to be coated in the finished panel and the mask is removed after applying a said conductive coating to the whole area of the tempered sheet.

16. A method according to any one of Claims 13 to 15, characterised in that said second and third electrodes are formed by depositing a conductive enamel on said opposite side of the glass sheet.

17. A method according to Claims 14 and 16, characterised in that said first electrode is deposited on said sheet prior to the deposition of said second and third electrodes.

18. A method according to any of Claims 13 to 17, characterised in that a backing support is applied and bonded to the unexposed face of the panel.

19. A method of manufacturing a touch control switch panel substantially as herein described with reference to any of Figs. 1 to 7 of the accompanying drawings.

20. A touch control switch panel manufactured by a method according to any of Claims 13 to 19.

21. A touch control switch panel substantially as herein described with reference to any of Figs. 1 to 7 of the accompanying drawings.

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