tion in which reference is made to the accompanying drawings in which:

[0031] FIG. **1** is a cross-section of the first preferred embodiment of the invention;

[0032] FIG. **2** is a cross-section of the second preferred embodiment of the invention;

[0033] FIG. **3** is a cross-section of the third preferred embodiment of the invention;

[0034] FIG. **4** is a general example of an electronic device with housing incorporating a user input zone;

[0035] FIG. **5** shows one advantageous example of the electrode patterns for the fourth embodiment of the housing of the present invention;

[0036] FIG. **6** shows a typical signal vs. force chart; and

[0037] FIG. **7** shows various deflection contour maps with same level of force and contact area.

DETAILED DESCRIPTION OF THE INVENTION

[0038] Product design for electronic devices have become a very important criteria for sales success. Such popular electronic devices as the Ipod are greatly simplified and have a clean industrial design. For certain applications where the product designer wants to place a user input fuction on the device housing, but does not want to change or affect the product housing apperance, a capacitance sensing electrode can be used in conjunction with a metalized or metal housing that deflects under applied force. Since the amount of deflection is very small, on the order of about 0.001 of an inch, conventional electronic device housing can be converted to incorporate a user input zone using the fact that many of these types of housings are typically made from a polymer material and are plated with a conductive metal already present for electro-magnetic emissions and susceptibility requirements. Another more recent trend is to use metal as the housing structure. When this housing is connected to the ground reference of a circuit that measures capacitance, a deflection of the housing relative to the capacitance electrode can form a basis for a user input device.

[0039] FIG. **1** shows a first preferred embodiment of the invention where the deformable contact force-sensitive zone of the electronic housing **110** is shown suspended by a linear support means protruding therefrom such as a ridge **112** at an offset distance from the rigid non-deformable base **120** forming a gap. The design of the linear support means can outline a predetermined selection and size of buttons and switches for each particular application as needed. The first conductive layer **116** is formed on the inside surface of the housing. As an example, the inside surface **116** of the contact force-sensitive user input housing zone **110** can be metalized, printed, vacuum-deposited, sprayed or painted with a conductive material if the housing isn't made entirely from a conductive material such as metal in the first place. It is then connected to the ground reference of a circuit that can measure the capacitance between the inside surface **116** of the first conductive layer and a second conductive layer **122**. The electrode of the second conductive layer **122** can be formed by printed circuit board **120** etching method or by printing a conductive paint over a rigid base **120**. Since the first conductive layer is separated from the second conductive layer with a predefined gap distance, a capacitance sensor is therefore formed therebetween and incorporated into the housing itself. The user input zone of the housing body contains the housing sections between the linear support means which are all made relatively thin and deformable under pressure. When a user applies force on that section, the housing deflects down proportionally to the force applied as shown from the normal undeflected state indicated by a pair of dashed lines **114**. This deflection changes the capacitance between the two conductive layers, which can be measured by the above described circuit and interpreted as an input signal for the electronic device at a particular location on the housing. Moreover, the degree of deflection can also be detected by the same circuit such that the input device can detect the level of force applied to the housing.

[0040] Various dielectric compressible structures can be placed optionally between the two conductive layers to fill the air gap and to form a more comprehensive capacitance sensor.

[0041] FIG. **2** shows a second embodiment of the invention where the electronic housing **210** has a contact force-sensitive deformable zone made sufficiently thin such that when a user applies force over that zone, the housing deflects as shown from the normal undeflected state indicated by a pair of dashed lines **214**. The capacitance sensor is formed between the inside conductive surface **216** of the housing **210** (first conductive layer) and the second conductive layer **222** of the rigid base **220**. The thin housing could be made from plastic or metal and is supported by a linear support means such as columns **224** with an air gap separating it from the rigid base **220**. In this embodiment, linear support means are incorporated into the rigid base **220** as opposed to being a part of the housing **210**. The sections between the support means form the buttons of the user input zone.

[0042] As with the first embodiment, the inside surface of the housing **210** is metalized or painted with a conductive material if it isn't made entirely from a conductive material already. It is then connected to the ground reference of a circuit that can measure the capacitance between by the first conductive layer **216** and second conductive layer **222**. The second conductive layer **222** can be formed by printed circuit board **220** etching method or by printing a conductive paint over the base **220**.

[0043] In a further development of that concept, the linear support means can be made rigid or compressible and can also be optionally made as a separate part altogether, such as for example a plurality of rubber strips. Further, more than one of such linear support means can be used together to resist deflection of the housing over a single button area (not shown).

[0044] FIG. **3** shows a third embodiment of the invention where the electronic housing **310** is suspended in a cantilever fashion away from the opening in the housing such that when a user applies force on a user input zone **310**, the housing deflects as shown from the nominal non-compressed state indicated by dashed lines **314**. The thin housing could be made from plastic or metal. This embodiment shows an element **330** protruding from the rigid base **320** through the opening in the housing **310**. This element may be a display module, a high resolution input device or may serve other function for the electronic device.

[0045] The inside surface of the housing **310** is again metalized or painted with a conductive material if it isn't made from a conductive material and connected to the ground reference of a circuit that can measure the capacitance formed by **316** and electrode **322**. The electrode **322** can be formed by printed circuit board **320** etching method or by printing a conductive paint over a base **320**.