[0012] **FIG. 3** is a frontal view of the tactile touch-sensing system shown in **FIG. 2**;

[0013] **FIG. 4** is a cross-sectional view of an exemplary tactile button; and

[0014] **FIG. 5** is another cross-sectional view of the exemplary button shown in **FIG. 4**.

[0015] The drawings are schematic and illustrative, indicating functional relationships of various elements, and not necessarily particular spatial relationships among the various elements. While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0016] **FIG. 1** is a schematic representation of one implementation of the present invention, showing an exemplary tactile touch-sensing system **100**. Tactile touch-sensing system **100** enables a user to enter inputs to an electronic device, such as computer **160**, and provides the user with tactile feedback. Typically, tactile touch-sensing system **100** enables computer **160** to display information for interacting with the user.

[0017] Tactile touch-sensing system **100** may include many components, which will be discussed in more detailed in conjunction with **FIG. 2**. Typically, tactile touch-sensing system **100** includes a touch sensor configured to generate signals in response to a touch on the touch sensor. For tactile touch-sensing system **100**, a user can touch the touch sensor directly or indirectly through a touch-generating pad, which will be discussed in detail in conjunction with **FIG. 2**. Tactile touch-sensing system **100** may also include a control circuit that is configured to process the signals and transmit the results to computer **160** for further processing.

[0018] **FIG. 2** is an exploded view of an exemplary embodiment of tactile touch-sensing system **100**. **FIG. 2** only illustrates principle components of tactile touch-sensing system **100**. Other components may be added without deviating from the principles of the invention.

[0019] Tactile touch-sensing system **100** enables an electronic device to display information to users and to receive inputs from the user. In this embodiment, tactile touch-sensing system **100** includes a display screen **110**, a touch sensor **115**, touch-generating pads **121-126**, and tactile buttons **131-136**. Tactile touch-sensing system **100** may also include a control circuit (not shown).

[0020] Display screen **110** is a component of tactile touch-sensing system **100** for displaying information to users. For example, display screen **110** may be a cathode-ray tube (CRT), liquid crystal display (LCD), plasma display, OLED, or any other suitable display. Display screen **110** enables tactile touch-sensing system **100** to display information from the electronic device. The information may include selections of inputs that the user may make through tactile touch-sensing system **100**. Although **FIG. 2** shows a configuration where display screen **110** is viewed through touch sensor **115**, the present invention is also applicable to configurations where the touch sensor is not transparent or is not disposed over a display.

[0021] Touch sensor **115** is a component of tactile touch-sensing system **100** for detecting a touch. Touch sensor **115** may be one of the many types of touch-sensitive screen technologies. For example, touch sensor **115** may be a capacitive touch sensor (for example, an analog capacitive sensor or a projected capacitive sensor), a resistive touch sensor, an optical touch sensor, an acoustic touch sensor, a force sensor, a vibration touch sensor, or any other suitable touch sensor whether now known or later developed. Various of these technologies are described briefly below.

[0022] A capacitive touch sensor includes at least one conductive layer. The conductive layer is usually energized by an oscillator circuit. When a user touches the display screen, a signal is generated as a result of a capacitive coupling between the user and the conductive layer. The signal is converted to the location of the touch by a sensing circuit.

[0023] A resistive touch sensor typically includes two transparent conductive layers separated by spacer dots. When a touch forces the two conductive layers to come into contact, the resulting voltage is sensed and the location of the touch is computed.

[0024] Optical touch sensor generally includes arrays of light emitters and photo detector pairs. The light emitters and the photo detectors are mounted at the edge of a display screen on opposite sides. Each of the light emitters emanates a light beam across the display screen to a corresponding photo detector on the opposite side. When a user touches the display screen, one or more of the light beams are blocked, causing signals to be generated. The position of the touch is calculated from the signals.

[0025] Surface and guided acoustic wave touch sensors utilize acoustic waves traveling over the surface of a screen at precise speeds in straight lines. Transmitting transducers are located along the horizontal and vertical edges of the screen. Corresponding receiving transducers are located at the opposite edges of the screen. A reflective array is printed along the edges of the screen. In operation, the transducer generates a surface acoustic wave that travels along the axis of the reflector array. At each reflector element, a small amount of the energy in the wave is deflected orthogonal to the direction of the wave, travels over the surface of the glass and is again orthogonally deflected toward the receiving transducer by a mirror image reflector. Since the energy in the wave is reduced as it travels the length of the reflective array, the reflector elements are placed increasingly closer together to compensate for the decreasing energy level. When a user touches the screen, a portion of the energy is absorbed by the touch. This reduced energy level is detected and, by comparing the speed of the received signal with the known speed of the surface acoustic waves on the screen, the touch location is calculated.

[0026] Vibration-sensing touch sensors use vibration-sensing elements such as piezoelectric sensors to detect vibrations generated by the impact of a touch. A touch input can cause vibrations in the touch plate that propagate from the location of the touch to the vibration sensors. From