[0026] FIGS. **21***b* and **21***c* are schematic views of the display of a dial pad aligned with the first cavity array and a QWERTY keyboard aligned with the second cavity array, respectively.

[0027] FIGS. **22***a* and **22***b* are schematic views of one version of the support in accordance with another preferred embodiment of the present invention.

[0028] FIGS. **23***a* and **23***b* are schematic views of another version the support member in accordance with another preferred embodiment of the present invention.

[0029] FIG. **24** is a schematic view of another version of the support member in accordance with another preferred embodiment of the present invention.

[0030] FIGS. **25***a* and **25***b* are schematic views of one version of the displacement device in accordance with another preferred embodiment of the present invention.

[0031] FIGS. **26***a* and **26***b* are schematic views of another version of the support member in accordance with another preferred embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0032] The following description of the preferred embodiments of the invention is not intended to limit the invention to these preferred embodiments, but rather to enable any person skilled in the art to make and use this invention.

1. First Preferred Embodiment

[0033] As shown in FIGS. **1** and **2**, the user interface system **100** of the preferred embodiment includes: a layer **110** defining a surface **115**, a substrate **120** supporting the layer **110** and at least partially defining a cavity **125**, a displacement device **130** coupled to the cavity **125** and adapted to expand the cavity **125** thereby deforming a particular region of the surface **115**, a touch sensor **140** coupled to the substrate **120** and adapted to sense a user touch proximate the particular region of the surface **115**, and a display **150** coupled to the substrate **120** and adapted to output images to the user.

[0034] The user interface system **100** of the preferred embodiments has been specifically designed to be incorporated into an electronic device, such as the display of an automotive console, a desktop computer, a laptop computer, a tablet computer, a television, a radio, a desk phone, a mobile phone, a PDA, a personal navigation device, a personal media player, a camera, or a watch. The user interface system may, however, be incorporated in any suitable device that interfaces with a user in both a visual and tactile manner.

1A. The Layer and Substrate

[0035] As shown in FIG. **2**, the layer **110** of the preferred embodiment functions to provide the surface **115** that interfaces with a user in a tactile manner. The surface **115** is preferably continuous, such that when swiping a finger across the surface **115** a user would not feel any interruptions or seams. The surface **115** is also preferably planar. The surface **115** is preferably arranged in a flat plane, but may alternatively be arranged in a curved plane. The layer **110** also functions to deform upon an expansion of the cavity **125**, and to preferably "relaxes" or "un-deforms" back to a normal planar state upon retraction of the cavity **125**. The layer **110** is preferably elastic. In one version, the layer **110** is relatively more elastic in specific areas and relatively less elastic in other areas and is deformed in the relatively more elastic areas. In another version, the layer **110** is generally uniformly elastic. In yet another version, the layer **110** includes or is made of a smart material, such as Nickel Titanium (commonly referred to as "Nitinol"), that has a selective and/or variable elasticity. The layer **110** is preferably optically transparent, but may alternatively be translucent or opaque. In addition to the transparency, the layer **110** preferably has the following properties: a high transmission, a low haze, a wide viewing angle, a minimal amount of back reflectance upon the display **150** (if the display **150** is coupled with the user interface), scratch resistant, chemical resistant, stain resistant, and relatively smooth (not tacky) to the touch. The layer **110** is preferably made from a suitable elastic material, including polymers and silicon-based elastomers such as poly-dimethylsiloxane (PDMS) or RTV Silicon (e.g., RTV Silicon **615**). The layer **110** may, however, be made of any suitable material that provides the surface **115** and that deforms. In one version, the layer **110** is a single homogeneous layer less than 1 mm thick (preferably 50 to 200 microns). In another version, the layer **110** may be constructed using multiple layers or coatings from the same material or from different suitable materials.

[0036] The substrate **120** of the preferred embodiments functions to support the layer **110** and to at least partially define the cavity **125**. In one version, as shown in FIGS. **3***a* and **3***b*, the layer **110** is directly attached to the substrate **120** using an adhesive, ultra-sonic bonding, oxygen plasma surface treatment, or any other suitable techniques known to one skilled in the art. The substrate **120** and the layer **110**, in this version, cooperately define the cavity **125** (with the substrate **120** defining a "container" and the layer **110** defining a "membrane" over the "container"). In another version, as shown in FIGS. **4***a* and **4***b*, the layer **110** is indirectly attached to the substrate **120** with another element, such as the touch sensor **140** and/or the display **150** located between the layer **110** and the substrate **120**. The substrate **120** and the intervening element define the cavity **125** in this version. In yet another version, as shown in FIGS. **5***a* and **5***b*, the layer **110** and the substrate **120** are formed as a singular structure, which fully defines the cavity **125**. In yet one more version, as shown in FIGS. **6***a* and **6***b*, the substrate **120** may include a lattice-like support member **160** under the particular region of the surface **115**. When the cavity **125** is expanded and the deformation is present in the surface **115**, the support member **160** functions to prevent a user from "pressing too far" into the deformation below the plane of the surface **115**. When the cavity **125** is not expanded and the deformation is not present in the surface **115**, the support member **160** functions to reduce (or potentially eliminate) the user from feeling "divots" in the surface **115** when swiping a finger across the surface **115**. As shown in FIG. **6***c*, the support member **160** preferably includes holes or channels that allow for the expansion of the cavity **125** and the deformation of the surface **115**. The support member **160** is preferably integrally formed with the substrate **120**, but may alternatively be formed with the layer **110** or may be separately formed and later attached to the substrate **120**. Finally, as shown in FIG. **6***d*, the support member **160** may alternatively partially define the cavity **125**. The substrate **120** is preferably rigid, but may alternatively be flexible in one or more directions. The substrate **120**—if located above the display **150**—is preferably optically transparent, but may—if located below the display **150** or if bundled without a display **150**—be translucent or opaque. The substrate **120** is preferably made from a material including polymers or glass, for