[0074] Meanwhile, FIG. **8**A illustrates that the lower electrode **32***b* partially contacts the metal dome **55**, and at least part of the electro-active polymer **31** forms a horizontal layer on the lower electrode **32***b*. However, a structure in which the lower electrode **32***b* contacts an upper curve of the metal dome **55** may be considered, and at least part of the electro-active polymer **31** contacts the lower electrode **32***b* at the upper curve of the metal dome **55**. FIG. **8**F illustrates a haptic button **107** minimizing a distance between an electro-active polymer **42** and the metal dome **55**, as a modification of the haptic button **100** illustrated in FIG. **8**A. When the distance between the electro-active polymer **42** and the metal dome **55** is minimized, stimulation can be continuously provided to a user by the electro-active polymer **42** and the metal dome **55**. Here, the fixing portion **33** also suppresses the horizontal motion of the electro-active polymer **42**.

[0075] FIGS. **9**A and **9**B are cross sectional views illustrating the detailed structure of the haptic button **110** according to the second exemplary embodiment of the present invention. In the second exemplary embodiment of the present invention, a plurality of the notches **34** are formed in the upper side of the electro-active polymer **31**, i.e., the side contacting the upper electrode **32***a*. The fixing portion **33** is disposed between the electro-active polymer **31** and the contacts **58** and **59** to maintain a predetermined distance therebetween and suppress the horizontal motion of the electro-active polymer **31**.

[0076] When a voltage is applied to the two electrodes **32***a* and **32***b*, the electro-active polymer **31** protrudes upward. Here, the notches **34** open, thereby providing a rough texture to a user contacting a contact surface **61**. The roughness of texture increases when the amount of a crack in each notch **34** increases, that is, when the height of protrusion of the electro-active polymer **31** increases. Accordingly, the texture of the haptic button **110** can be controlled by controlling the voltage applied to the two electrodes **32***a* and **32***b*.

[0077] The haptic button **110** illustrated in FIGS. **9**A and **9**B may further include a metal dome in space maintained by the fixing portion **33**.

[0078] FIGS. **10**A through **10**F are diagrams for explaining the detailed structures of haptic buttons **120**, **125**, and **130** according to the third exemplary embodiment of the present invention. FIG. **10**A illustrates the detailed structure of the haptic button **120** including the single separator **35**. The separator **35** fixes a portion of the electro-active polymer **31** so that the portion contacting the separator **35** does hot have displacement in the horizontal direction, like the fixing portion **33**, and also divides the haptic button **120** into a plurality of regions. A pair of the two electrodes **32***a* and **32***b* are disposed per region in the haptic button **120**. Accordingly, the height of protrusion of the electro-active polymer **31** can be separately controlled in each of the regions by controlling a voltage applied to the pair of the two electrodes **32***a* and **32***b* in each region.

[0079] FIG. **10**B is a top view of the haptic button **120**. The fixing portion **33** is formed along the edge of the haptic button **120** to fix the electro-active polymer **31**. The separator **35** is formed extending in the widthwise and lengthwise directions from a center of the haptic button **120**. The top side of the fixing portion **33** may contact and fix the electro-active polymer **31** and the bottom side thereof may be fixed to the spacer **53**.

[0080] A pair of the electrodes **32***a* and **32***b* is disposed in each of four regions defined by the separator **35**. When the height of protrusion is separately controlled in the four regions by controlling a voltage applied to each pair of the electrodes **32***a* and **32***b*, the transformed shape of the haptic button **120** can be controlled, as illustrated in FIGS. **10**C and **10**D. In addition, stiffness of the haptic button **120** in the four regions can be separately controlled. FIG. **10**C shows a transformed state of the haptic button **120** in which two upper regions and a lower left region are activated. FIG.**10**D shows a transformed state of the haptic button **120** in which an upper left region and a lower right region are activated.

[0081] When the haptic button **120** is used as a telephone number input button illustrated in FIG. **7**, if input buttons are controlled such that different regions are protruded, a user can identify a button just by touching the button. For example, when there are four regions that can be independently protruded or not in the haptic button **120**, a total of **16** cases are made. Accordingly, **12** number input buttons illustrated in FIG. **7** can be identified through the sense of touch.

[0082] When a user identifies a wanted haptic button **120** through the sense of touch and presses the haptic button **120**, the upper contacts **58** become in contact with the lower contact **59** and a button input is sensed. Actually, when the haptic button **120** is not much larger than the user's finger as in a mobile telephone or when a stroke of the haptic button **120** is very small, even if the user presses the center of the haptic button **120**, at least a part of the four regions is pressed, and therefore, there is no problem in button input.

[0083] The haptic button **120** may be used to provide the sense of touch to a user in an application such as a video game. When the four regions of the haptic button **120** have the same frequency, the user will feel a single stimulation. However, when at least one of the four regions has a different frequency than the other regions, the user will feel a plurality of stimulations from the single haptic button **120**. Such various oscillations can be generated by controlling the waveform of a voltage applied to a pair of the electrodes **32***a* and **32***b*.

[0084] The haptic button **120** illustrated in FIGS. **10**A and **10**B is divided into the four regions in uniform size and shape. Unlikely, if the haptic button **125** includes a plurality of separators **36***a*, **36***b*, **36***c*, and **36***d* capable of moving in the widthwise or lengthwise direction, as is illustrated in FIG. **10**E, the size of each region can be increased or decreased. In a state where a certain stimulation is provided to a user through four regions, if the size of the regions is changed, the user will feel a different stimulation from one moment.

[0085] FIG. **10**F illustrates the haptic button **130** including two separators **35***a* and **35***b*. The haptic button **130** just includes one more separator than the haptic button **120** illustrated in FIGS. **10**A and **10**B. Accordingly, the haptic button **130** is divided into nine regions. In the present invention, the number of separators can be arbitrarily selected during manufacturing. In addition, the number of separators extending in the widthwise direction may be different from the number of separators extending in the lengthwise direction in a single haptic button.

[0086] FIG. **11** is a block diagram of a haptic device **200** according to an exemplary embodiment of the present invention. The haptic device **200** includes a micro processor **215**, a memory **210**, an application module **220**, a display