on the orientation of the actuator **100** with respect to the touch-sensitive panel **504**, haptic effects may excite either in-plane or out-of-plane motion with respect to the touch-sensitive panel **504**.

[0121] **FIG. 26** illustrates, in a somewhat exaggerated manner to improve visibility, a second equilibrium position of an actuator **600** in accordance with one embodiment of the present invention. Actuator **600**, which is similar to actuator **100**, includes two L-shaped pole pieces **110**, **112**, structural elements **102**, **104**, and biasing elements **602**, **604**. Pole pieces **110**, **112** are further coupled to coils **114***a*, **114***b* to form magnetic devices. Coils **114***a*, **114***b* are coupled to one or more current sources for generating magnetic flux in pole pieces **110**, **112**.

[0122] When power is off, the biasing elements **602**, **604** provide minimal force to keep the actuator **600** in the first equilibrium position as described and shown in **FIG. 20**. When power is on, the input current passes through the coils **114** and generates magnetic flux in the pole pieces **110**, **112**. Magnetic flux causes an attractive magnetic force between the pole pieces **110**, **112** across gaps **140**, **142**. The attractive magnetic force acts against the biasing elements **602**, **604** and pulls the pole pieces **110**, **112** closer together at the gaps **140**, **142**. Pole piece **110**, in this embodiment, may be secured to a case via the structural element **102**, while pole piece **112** is secured to a touch-sensitive panel via the structural element **104**. The attractive magnetic force causes the pole piece **112** to move from right to left (as indicated by **138**) toward the pole piece **110**. When the pole piece **110** is displaced enough distance, a second equilibrium position is reached as shown in **FIG. 25**. When power is reduced or removed, the biasing elements **602**, **604** force the pole piece **112** back to the first equilibrium position as discussed earlier.

[0123] **FIG. 26** illustrates a system configuration having an actuator in accordance with one embodiment of the present invention. The system configuration includes a touch-sensitive panel or touch screen **702**, a display panel **704**, and a case **706**. Touch-sensitive panel **702**, in one embodiment, is made of substantially transparent materials, and is capable of transmitting light so that objects or images displayed in the display **704** may be seen through the touch-sensitive panel **702**. The display **704** can be any type of display such as a cathode ray tube (CRT), liquid crystal display (LCD), plasma display, flat panel display or the like or could even be a static illustration. Both touch-sensitive panel **702** and display **704** may be installed in the case **706**. In an alternative embodiment, the touch-sensitive panel **702** and the display **704** may be located separately with the actuator mounted between the touch-sensitive panel 702 and a relatively fixed location so that haptic effects are provided to the touch-sensitive panel but the display is located elsewhere.

[0124] In one embodiment, touch-sensitive panel **702** is further divided into various regions **720** and the regions are further separated by borders **722**. Touch-sensitive panel **702** accepts a user's selection when only a region **720** is touched. Conversely, touch-sensitive panel **702** rejects a user's selection when a border **722** is touched. Touch-sensitive panel **702** further includes four actuators **710** and, depending on their orientation, actuators **710** can excite either in-plane or out-of-plane motion with respect to the touch-sensitive panel **702** for haptic sensation. Actuators **710** may be installed to move touch-sensitive panel for relative to display **704**.

[0125] **FIG. 27** is a flow diagram illustrating a method for generating a haptic effect in accordance with one embodiment of the present invention. A process for generating haptic sensation starts at block **802**. In one embodiment, the process can be activated by a user who touches a touch-sensitive panel possibly in a predetermined location or locations. In another embodiment, the process is activated by a touch signal or contact signal sent by the touch-sensitive panel, which indicates that a selection has been made by a user.

[0126] At block **804**, the process receives a contact signal from the touch-sensitive, which may be sent by a touch-sensitive panel according to a selection made by a user. In another embodiment, a computer or controller sends a contact signal. Upon receipt of the contact signal, the process moves to the next block **806**.

[0127] At block **806**, the process instructs a controller to provide an input current according to the contact signal. In one embodiment, the input current is passing through at least one electromagnet device of an actuator to generate magnetic flux in a pair of pole pieces.

[0128] At block **808**, the magnetic flux creates attractive magnetic force between the electromagnet devices which opposes a biasing force imparted by biasing elements arranged to counter the attractive magnetic force. The attractive magnetic force causes the pole pieces of the electromagnet devices to attract to each other. The process moves to the next block.

[0129] At block **810**, the attractive magnetic force creates a movement between the electromagnet devices. In one embodiment, one pole piece of one electromagnet device is physically moved closer to another pole piece of another electromagnet device.

[0130] At block **812**, the current is removed.

[0131] At block **814**, a biasing element provides a bias force or return force to control the movement between the electromagnet devices within a predefined range. When the power is reduced or turned off in block **812**, the pole pieces of electromagnet devices move back to their original positions.

[0132] With turning on and off the power continuously, a continuous movement between the electromagnet devices is created. Accordingly, the haptic effect is generated in response to the movement between the electromagnet devices. It should be noted that the frequency and amplitude of the movements between the electromagnet devices can be controlled by controlling the input current.

[0133] **FIG. 28** is a block diagram illustrating a system having an actuator in accordance with one embodiment of the present invention. The system includes a computer or central processing unit (CPU) **906** with appropriate interfaces **908** to a memory **910** for storing program steps for controlling the processor **906**, **912** for controlling a display device **914**, **916** for communicating with a touch-sensitive panel **918** and **920** for driving an amplifier circuit (if required) which in turn drives actuator **924**. Actuator **924** is arranged to create relative movement between display device **914** and touch-sensitive panel **918**. The relative movement may be in the plane of the touch-sensitive panel, out of the plane of the touch-sensitive panel, or same combination of the two. When the touch panel **904** is touched or depressed, it sends a contact signal to computer **906** via connection **926**. The contact signal indicates that the