single coil **206**. Pole pieces **202**, **204** may be made of any suitable ferromagnetic materials as discussed above.

[**0112**] C-shaped pole piece **202** is placed adjacent to pole piece **204** with two gaps **208**. The width of the gap **208** is approximately 0.5 mm. When the input current passes through the coils **206**, a magnetic flux **210** is generated. Magnetic flux **210** generates the attractive magnetic force between the pole pieces **202**, **204**. The attractive magnetic force causes the pole piece **204** to move closer to the pole piece **202**. Alternatively, the attractive magnetic force can cause pole piece **202** to move closer to pole piece **204** if pole piece **204** is relatively fixed. Haptic effects may be generated by the movements caused by the attractive magnetic force between the pole pieces **202**, **204**.

[**0113**] Electromagnet component **220** includes an E-shaped pole piece **222**, an I-shaped pole piece **224**, and a coil **226**. Pole pieces **222**, **224** may be constructed as discussed above. E-shaped pole piece **222** is placed adjacent to the I-shaped pole piece **224** with a gap **228**. The width of the gap **228** is approximately 0.5 mm. When the input current passes through coils **226**, magnetic flux lines **230** are generated. Magnetic flux lines **230** cause an attractive magnetic force between pole pieces **222**, **224**. The attractive magnetic force causes pole piece **224** to move closer to pole piece **222** and effectively narrow the width of the gap **228**. In another embodiment, the attractive magnetic force causes the pole piece **222** to move closer to pole piece **224** if pole piece **224** is fastened to housing. A haptic effect may be generated by movements between the pole pieces.

[**0114**] **FIG. 22** is an actuator **300** illustrating an alternative embodiment of the actuator illustrated in **FIG. 20** in accordance with one embodiment of the present invention. Actuator **300** includes two L-shaped pole pieces **110**, **112**, structural elements **102**, **104**, and biasing element **302**. 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 causing magnetic flux in pole pieces **110**, **112**.

[**0115**] Actuator **300** further includes structural elements **102**, **104** and biasing element **302** to form a frame. It should be noted that structural elements **102**, **104** and biasing element **302** can be manufactured at the same time and on a single frame. Alternatively, structural elements **102**, **104** and biasing element **302** may be formed as separate structures that are then assembled together. Structural elements **102**, **104** are fabricated or discussed above to provide physical support for the pole pieces **110**, **112**. Biasing element **302**, which may be formed as described above, is made of an elastic material that may be compressed or stretched within a predefined range. Referring to **FIG. 22**, it should be noted that biasing element **302** may be located anywhere as long as it is coupled with structural elements **102**, **104** and provides its biasing or spring function in opposition to the attractive gap-closing magnetic force of the magnetic devices.

[**0116**] **FIG. 23** is an alternative embodiment of an actuator **400** in accordance with one embodiment of the present invention. Actuator **400** includes two L-shaped pole pieces **110**, **112**, structural elements **102**, **104**, and biasing elements **402**, **404**. 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 creating magnetic flux in pole pieces **110**, **112**.

[**0117**] Actuator **400** further includes structural elements **102**, **104** and biasing elements **402**, **404** to form a frame that allows some movements between the structural elements **102**, **104**. It should be noted that structural elements **102**, **104** and biasing elements **402**, **404** are manufactured separately and they need to be assembled to form a frame. Structural elements **102**, **104** are made of rigid materials, such as plastic, steel, aluminum, and so forth, to provide physical support for the pole pieces **110**, **112**. Biasing elements **402**, **404** may be implemented as discussed above and may be made of elastic materials that can be compressed or stretched within a predefined range. Referring to **FIG. 23**, it should be noted that any type of biasing element may be used as long as it facilitates movement between the pole pieces **110**, **112** and may be arranged to counter the attractive gap-closing force of the magnetic devices.

[**0118**] **FIG. 24** illustrates a system having an actuator **100** in accordance with one embodiment of the present invention. The system includes a case **502**, a touch-sensitive panel **504**, and an actuator **100**. Actuator **100** includes two L-shaped pole pieces **110**, **112**, structural elements **102**, **104**, and biasing elements **106**, **108**. 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 creating magnetic flux in pole pieces **110**, **112**. Biasing elements **106**, **108** may be implemented as discussed above and may be made of elastic materials that may be compressed or stretched within a predefined range.

[**0119**] Referring to **FIG. 24**, one side of actuator **100** is coupled to the case **502** while another side of actuator **100** is coupled to the touch-sensitive panel **504**. Structural element **102**, as shown in **FIG. 24**, is fastened to the case **502**. In this embodiment, the case **502** is rigid and does not move easily. In one embodiment, apertures **120**, **122** may be used by fasteners to couple the structural element **102** to the case **502**. Structural element **104** is, in turn fastened to a touch-sensitive panel **504**. Touch-sensitive panel **504**, in one embodiment, may be made of relatively flexible transparent materials. In one embodiment, holes **124**, **126** may be used to fasten the structural element **104** to the touch-sensitive panel **504**.

[**0120**] When power is applied and input current begins to pass through the coils **114***a*, **114***b*, the attractive gap-closing force between pole pieces **110** and **112** starts to increase. The attractive force causes the pole piece **112** to be attracted to the pole piece **110** where pole piece **110** is held fixed. Pole piece **112** begins to move toward the pole piece **110** to close the gaps **140**, **142** until it reaches a second equilibrium position as illustrated in **FIG. 25**. When power is reduced or removed, the attractive force between pole pieces **110** and **112** begins to reduce and consequently, the pole piece **112** begins to move back to its original position in response to the return force provided by the biasing elements **106**, **108**. The biasing elements **106**, **108** continue to force the pole piece **112** to move back until it reaches the first equilibrium position as shown in **FIG. 20**. The movements between the pole pieces **110**, **112** cause similar movements between the structural elements **102**, **104**. In one embodiment, the movements between the structural elements **102**, **104** generate haptic effects or haptic sensation. Since touch-sensitive panel **504** is fastened to structural element **104**, haptic effects on the touch-sensitive panel **504** occur when the movement between the structural elements **102**, **104** occurs. Depending