[0050] It should be noted that a plasma channel at the contact point can be established almost instantaneously at the time the contact is made. The electro-mechanical representation of instantaneous plasma channel at the time of contact is similar to the representation of a "plasma lightning lamp." For example, when a finger touches the plasma lightning lamp, a reaction of plasma is that it is being drawn to and concentrated at the points of contact. It should be noted that the speed of aggregation of plasma is as quick as static-electric discharge. An advantage of using plasma actuators instead of conventional haptic devices is that the plasma actuator is simple, small, and light.

[0051] FIG. **2**(*c*) is a diagram **240** illustrating a cross section view of haptic device capable of generating haptic feedback using plasma actuator in accordance with one embodiment of the present invention. Diagram **240** shows a device **256** in an off-state and a device **258** in an on-state. The off-state indicates an inactive state and the on-state means an active state. In one embodiment, device **256** or **258** is a plasma actuator. It should be noted that the underlying concept of the exemplary embodiment of the present invention would not change if additional layer were added to or removed from diagram **240**.

[0052] Device **256** includes a touch surface **242**, a substrate **244**, and a separation gap **246**, wherein gap **246** is configured to facilitate actuation. In one aspect, touch surface **242** is a deformable touch-sensitive surface capable of detecting an event. Event includes a contact, a depression, a motion, a surrounding condition, or the like. Gap **246**, in one embodiment, is situated between touch surface **242** and substrate **244** for housing plasma. In one example, gap **246** is divided into multiple air pockets **252** for housing a portion of plasma in each pocket **252**. The concentration of plasma, for instance, can be different between the pockets within gap **246**. Plasma is facilitated and generated by substrate **244**, which is also known as a plasma substrate. To facilitate and increase plasma, substrate **244** is connected with a power supply, which can either be a battery or an AC (alternating current) power outlet or a wireless power supply.

[0053] Device **258** includes multiple finger contacts **248**, a deformable touch surface **242**, a substrate **244**, and a separation gap **246** wherein gap **246** is configured to facilitate actuation. It should be noted that device **258** is an active or on-state of device **256**. When multiple fingers **248** press on the top of touch surface **222**, touch surface **222** deforms in response to finger pressures **248**. Note that finger pressures **248**, in one embodiment, activate device **258**. When touch surface **242** deforms at points of finger pressures **242**, distances at regions **264** of separation gap **246** are reduced. The reduced or shortened distances at regions **264** cause energy transfers **250** from substrate **244** to touch surface **242** via plasma channels in gap **246**. It should be noted that the energy transfer at each region **264** is independent from an adjacent energy transfer. As such, multiple haptic responses acknowledging finger pressures **248** are generated in response to energy transfers **250**.

[0054] Depending on chemical compositions of plasma in gap **246**, amount of energy transferred can vary. Different level of energy transfer to touch surface **242** renders different types of haptic response. It should be noted that gap **246** can be just one single air pocket for housing plasma.

[0055] Referring back to FIG. **2**(*c*), a mechanical representation of a deformable surface **242** is similar to snap-dome button switch, which triggers a reaction when the surface of the button is deformed enough to actuate the switch. In one aspect, plasma or plasma cloud is capable of moving from one side of the switch or device (the plasma generator) across to the other side (to the actuation surface) directly under the user points of surface contacts for energy transfer and/or static discharge. The haptic actuation can vary based on the amount of pressure placed on the touch surface and/or the amount of surface area covered by the users' interaction. It should be noted that variation of actuation in the resultant of haptic response (such as increased effect amplitude) is not necessary for device **258** to work.

[0056] FIG. **2**(*d*) is a diagram **260** illustrating a cross section view of haptic device capable of generating haptic feedback using plasma generator in accordance with one embodiment of the present invention. Diagram **260** shows a device **276** in an off-state and a device **278** in an on-state, wherein the off-state indicates an inactive state and the on-state means an active state. It should be noted that the underlying concept of the exemplary embodiment of the present invention would not change if additional layer were added to or removed from diagram **260**.

[0057] Device **276**, similar to diagram **246** illustrated in FIG. **2**(*c*), includes a touch surface **262**, a substrate **264**, and a separation gap **266**, wherein gap **266** is configured to facilitate actuation. In one aspect, touch surface **262** is a capacitive sensitive or a capacitive pressure-sensing surface capable of detecting one or more events. Gap **266**, in one embodiment, is situated between touch surface **262** and substrate **264** for housing plasma. In one example, gap **266** is divided into multiple air pockets for housing plasma. The concentration of plasma, for instance, can be different between the pockets within gap **266**. Substrate **264** is capable of facilitating as well as generating plasma cloud, and is connected with a power supply.

[0058] Device **278** includes multiple finger pressures **268**, a solid capacitance sensitive touch surface **262**, a substrate **264**, and a separation gap **266** wherein gap **266** is configured to facilitate actuation. In one aspect, touch surface **262** can also be a resistive sensitive touch surface, a temperature sensitive touch surface, a motion sensitive touch surface, and so forth. It should be noted that device **278** is an active state or on-state of device **276**. When finger pressures **268** touch, contact, or press on the top of touch surface **262**, touch surface **262** detects multiple capacitance changes in response to the finger capacitances at contacts or interactive points **272**. One finger contact, for instance, can activate device **278**. Upon detecting finger capacitances or contact capacitances at touch surface **222**, conductive carriers within plasma are drawn to contact points **272**.

[0059] When sufficient conductive carriers in gap **226** are aggregated at contact region **272** in response to finger contacts **268**, plasma conductive channels are formed at regions **272**. After formation of the plasma conductive channels, energy transfers **270** take place. When energy or current travels from substrate **224** to touch surface **222** through plasma channels, multiple haptic responses acknowledging finger contacts are generated. Depending on the chemical compositions of plasma and the concentration of the plasma in gap **266**, different types of haptic feedback can be generated. It should be noted that gap **266** can be divided into multiple air pockets for housing plasma, wherein plasma at each pocket can transfer energy independent from plasma located at the adjacent pocket(s).

[0060] FIG. **3**(*a*) is a diagram **300** illustrating a top view of haptic device capable of generating haptic feedback using