ates such that the electrode **106** and the sensitive member **120** (see FIG. **1**) form a capacitor over the insulator **108**, and in that capacitor the oscillating Coulomb forces are converted to mechanical vibrations which are sensed by mechanoreceptors, including the Pacinian corpuscles. The inventors have also studied an alternative hypothesis wherein the Pacinian corpuscles are stimulated by current flowing through them, but this hypothesis does not explain the observations as well as the one which is based on Coulomb forces acting on the Pacinian corpuscles. However, the technical CEI described herein does not depend on the correctness of any particular hypothesis attempting to explain why the CEI operates the way it does.

[0067] FIG. **6** is a graph which further clarifies the operating principle of the CEI and the interpretation of frequencies in connection with the present CEI. Reference numeral **61** denotes the low-frequency input signal to the modulator **110** (shown as item **114** in FIG. **2**). Reference numeral **62** denotes the output of the modulator, ie, the high-frequency input signal as modulated by the low-frequency input signal.

[0068] Reference numerals **63** and **64** denote the resulting Coulomb forces in the capacitive coupling between the electrode **106** and the body member **120** over the insulator **108**. Because the two sides of the capacitive coupling have opposite charges, the Coulomb force between the two sides is always attractive and proportional to the square of the voltage. Reference numeral **63** denotes the actual Coulomb force while reference numeral **64** denotes its envelope. The envelope **64** is within the range of frequencies to which the Pacinian corpuscles are sensitive, but because the Coulomb force is always attractive, the envelope **64** has two peaks for each cycle of the modulator output signal **62**, whereby a frequency-doubling effect is produced. Because the Coulomb force is proportional to the square of the voltage, any exemplary voltages disclosed herein should be interpreted as effective (RMS) values in case the voltages are not sinusoidal.

[0069] The statement that the two sides of the capacitive coupling have opposite charges whereby the Coulomb force is always attractive holds for a case in which the apparatus and the body member to be stimulated are at or near the same potential. High static charges can cause deviations from this ideal state of affairs, which is why some form of grounding connection between a reference potential of the high-voltage source and the body element other than the one(s) to be stimulated is recommended, as the grounding connection helps to lower the potential differences between the apparatus and its user.

[0070] The CEI can be implemented as part of an input/output peripheral device which is connectable to a data processing equipment. In such a configuration the data processing equipment can provide prompting and/or feedback via electrically-controllable electrosensory sensation.

[0071] FIGS. **7**A and **7**B show implementations of the CEI wherein the strength of the capacitive coupling is adjusted by electrode movement. Generation of the electric field, and its variation as necessary, is effected via a set of electrodes **704** which comprises individual electrodes **703**. The individual electrodes **703** are preferably individually controllable, wherein the controlling of an electrode affects its orientation and/or protrusion. FIG. **7**A shows an implementation wherein a group of electrodes **703** are oriented, via the output signal from the controller **216**, such that the electrodes **703** collectively form a plane under the insulator **702**. In this situation the high-voltage current (DC or AC) from the high-voltage amplifier **100** to the electrodes **703** generates an opposite-signed charge of sufficient strength to a body member (eg the finger **120**) in close proximity to the apparatus. A capacitive coupling between the body member and the apparatus is formed over the insulator **702**, which may give rise to a sensory stimulus.

[0072] FIG. **7**B shows the same apparatus shown in FIG. **7**A, but in this case the strength of the capacitive coupling generated with the current from the high-voltage amplifier **100** is minimized by orienting the electrodes (now shown by reference numeral **714**) such that they do not form a plane under the insulator **702**. In some implementations of the present invention, the electric field alternating with a low frequency can be generated by alternating the state of the apparatus between the two states shown in FIGS. **7**A and **7**B. The frequency of the state alternation can be in the order of several hundred, eg 200 to 300 full cycles per second.

[0073] FIG. **8** shows an implementation of the CEI wherein the individual electrodes **803** in the set of electrodes **804** may have charges of opposite signs. The charges of individual electrodes **803** may be adjusted and controlled via the controller **216**. The individual electrodes **803** may be separated by insulator elements **806**, so as the prevent sparking or shorting between the electrodes. The capacitive coupling between the CEI and the body member proximate to it may give rise to areas having charges with opposite signs **801**. Such opposing charges are mutually attractive to one another. Hence it is possible that Coulomb forces stimulating the Pacinian corpuscles may be generated not only between the CEI and the body member but between infinitesimal areas within the body member itself.

[0074] FIG. **9** shows an implementation of the CEI wherein a group of individually controllable electrodes **910***a* through **910***i* are organized in the form of a matrix. Such a matrix can be integrated into a touch screen device, for example. Since the CEI described above does not require direct connection (touching) between the CEI and a body member of its user, the electrodes of the CEI apparatus can be positioned behind the touch screen, wherein "behind" means the side of the touch screen opposite to the side facing the user during normal operation. Alternatively, the electrodes can be very thin and/or transparent, whereby the electrodes can overlay the touch screen on the side normally facing the user. The electric charges, which are conducted from the high-voltage amplifier **100** to the electrodes **910***a* through **910***i* via the switch array **217**, may all have similar signs or the charges conducted to different electrodes may have different signs, as illustrated in connection with FIG. **8**. For instance, the controller **216** may control the switches in the switch array individually, or certain groups may form commonly-controllable groups. The surface of an individual electrode and/or its associated insulator can be specified according to the intended range of operations or applications. The minimum practical area is about 0.01 cm^2, while the practical maximum is roughly equal to the size of a human hand. It is expected that surface areas between 0.1 and 1 cm^2 will be found most usable in practice.

[0075] The matrix of electrodes **910***a* through **910***i* and the switch array **217** provide a spatial variation of the electrosensory stimulation. In other words, the sensory stimulation provided to the user depends on the location of the user's body member, such as a finger, proximate to the CEI apparatus which is integrated to the inventive touch screen. The spa-