

touching the touch-surface 22a. FIG. 4 shows a section of the cell phone 10 and a second exemplifying tactile touchscreen 20b seen in the direction indicated by the arrows A-A in FIG. 3a. The second tactile touchscreen 20b in FIG. 4 comprises, in the same or similar manner as the first tactile touch screen 20a in FIG. 3b, a display function 24 and a touch-surface 22a arranged above the display 24.

[0074] However, in contrast to the first exemplifying touchscreen 20a the touchscreen 20b in FIG. 4 comprises another second exemplifying actuator 30b that is attached to the display 24 or to the body 10' or similar of the cell phone 10 and to the underside surface of the touch-surface 22a facing the display 24. Moreover, it is preferred that the touch-surface 22a is arranged so that it can be actuated by the actuator 30b1 e.g. movably arranged so that it can be moved by the actuator 30b e.g. moved up and down as indicate by the two opposite arrows in FIG. 4.

[0075] The second exemplifying actuator 30b is preferably the same or similar as the first exemplifying actuator 30a discussed above. Hence, in the same or similar manner as for the first exemplifying actuator 30a mentioned above it is preferred that the second exemplifying actuator 30b is implemented by means of an electroactive polymer 30bc and a first electrode 30ba and a second electrode 30bb, where the electrodes 30ba1 30bb are preferably arranged on substantially opposite sides of the intermediate region of the electroactive polymer 30bc. However, other mutual arrangements of the electrodes 30aa, 30ab and the electroactive polymer 30ac are conceivable as mentioned above in connection with the description of the first exemplifying actuator 30a. In addition, in the same or similar manner as for the first actuator 30a it is preferred that the electrodes 30ba, 30bb in the second exemplifying actuator 30b are connected or at least controlled by the tactile control 42, and that the tactile control 42 is arranged to operatively apply a voltage to the electrodes 30aa, 30ab as a response to a touch on the touch-surface 22a.

[0076] In operation, it is preferred that the electroactive polymer 30bc and hence the second exemplifying actuator 30b is actuated—e.g., repeatedly deformed by being contracted and returned to its original position as described above for the first exemplifying actuator 30a—so as to repeatedly move and/or oscillate the touch-surface 22a up and down, e.g. in a direction substantially orthogonally to the extension of the touch-surface 22a as indicated by the two opposite arrows in FIG. 4. Persons skilled in the art realize that the exemplifying actuator arrangement 30b in the tactile touchscreen 20b is preferably designed so that the deformation of the actuator 30b causes movements in the touch-surface 22a that can be perceived by a user of the cell phone 10 touching the touch-surface 22a. The actuator 30b may e.g., cause the touch-surface 22a to vibrate in a manner that can be felt by a user touching the touch-surface 22a.

[0077] As a general remark it should be added that the vibrations or similar movements in the touch-surface as described herein caused by an actuator as described herein may be a wave or similar that propagates in the touch-surface with the effect that there may be stationary nodes in the touch-surface that do not move, e.g. in case a standing wave or similar. Hence, every part of the touch-surface must not necessarily move when the touch-surface is actuated by an actuator as described herein. It follows that some embodiments of the touch-surface or similar may be substantially rigidly attached to the cell phone 10, e.g., at the edges of the touch-surface, whereas the touch-surface itself can move and/or to

oscillate under the influence of an actuator as described herein. This may be so in particular when the touch-surface itself is capable of vibrate, e.g. move in the middle whereas the edges of the touch-surface are substantially still, which may occur even if there is no standing wave present.

[0078] FIG. 5 shows a section of the cell phone 10 and a third exemplifying tactile touchscreen 20c seen in the direction indicated by the arrows A-A in FIG. 3a. The third tactile touchscreen 20c in FIG. 5 comprises, in the same or similar manner as the first tactile touch screen 20a in FIG. 3b, a display function 24 and a touch-surface 22a arranged above the display 24.

[0079] However, in contrast to the first exemplifying touchscreen 20a the touchscreen 20c in FIG. 5 comprises third exemplifying actuator 30c. It is preferred that the third exemplifying actuator 30c is attached to the rear surface being arranged substantially opposite to the front surface of the touch-surface 22a and facing the display 24. In addition, it is preferred that the actuator 30c is attached to a movable body and/or mass 30cd. It is also preferred that the touch-surface 22a is arranged so that it can be actuated by the actuator 30c, e.g., movably arranged so that the body and/or mass 30cd can be moved by the actuator 30c e.g., moved up and down as indicate by the two opposite arrows in FIG. 5. It should be added that the mass and/or body 30cd may be an integral part of the actuator 30c. In some embodiments the mass of the actuator 30c alone may be sufficient to actuate the touch-surface 22a when the actuator 30c is repeatedly deformed as described below.

[0080] In the same or similar manner as for the first exemplifying actuator 30a mentioned above it is preferred that the third exemplifying actuator 30c is implemented by means of an electroactive polymer 30cc and a first electrode 30ca and a second electrode 30cb, where the electrodes 30ca, 30cb are preferably arranged on substantially opposite sides of the intermediate region of the electroactive polymer 30cc. However, other arrangements of the electrodes 30ca, 30cb and the electroactive polymer 30cc of the third exemplifying actuator 30c are clearly conceivable, as mentioned above in connection with the description of the first exemplifying actuator 30a.

[0081] Moreover, in the same or similar manner as for the first actuator 30a it is preferred that the electrodes 30ca, 30cb in the third exemplifying actuator 30c are connected or at least controlled by the tactile control 42, and that the tactile control 42 is arranged to operatively apply a voltage to the electrodes 30ca, 30cb as a response to a touch on the touch-surface 22a.

[0082] In operation, it is preferred that the electroactive polymer 30cc and hence the third exemplifying actuator 30c is actuated—e.g. repeatedly deformed by being contracted and then returned to its original position as described above for the first exemplifying actuator 30a—so as to repeatedly move and/or oscillate the touch-surface 22a up and down, e.g., in a direction substantially orthogonally to the extension of the touch-surface 22a, as indicated by the two opposite arrows in FIG. 5. Persons skilled in the art realize that the exemplifying actuator arrangement 30c of the tactile touchscreen 20c in FIG. 5 is designed so that the deformation of the actuator 30c causes movements in the touch-surface 22a that can be perceived by a user of the cell phone 10 touching the touch-surface 22a. The actuator 30c may e.g. cause the touch-surface 22a to vibrate in a manner that can be felt by a user touching the touch-surface 22a.