[0034] FIG. **2** shows a basic electrical stimulation procedure utilizing an electrode array arranged in the form of a two-dimensional matrix. Each electrode can be selectively connected to a current source and to ground using two switches S**1** and S**2** in a configuration known as a half-bridge circuit. Each electrode can be electrically connected to a current source or to ground by switching the switches S**1** and S**2**. In the example of FIG. **2**, each electrode is electrically connected to a current source via upper switch S**1** of the switching circuit to operate as a current source electrode (anode electrode) A, while being electrically connected to ground via a lower switch S**2** of the switching circuit to operate as a ground electrode G. A current path is then formed with underneath the skin by connecting an electrode of a location for stimulation to a current source and connecting other electrodes to ground and nerves are then stimulated. Then, by switching a stimulation point (selection of an electrode at a position for stimulation) over time, surface information can be presented with the arrayed electrodes.

[0035] The electrode array carrying out this electro-tactile sense presentation is configured by densely arraying a plurality of electrodes. This means that the distance between a current source electrode and a ground electrode is short and the current path formed below the skin is shallow. A problem therefore occurs where nerve axons N that are at deep sections cannot be sufficiently stimulated. Specifically, in the case of the skin of a fingertip, human tactile resolution is in the order of 1.5 mm and it is therefore wished to arrange electrodes at approximately 1.5 mm. However, an appropriate distance between the current source electrode and ground electrode in order to stimulate nerves underneath the skin is 2 to 3 mm. The problem described above is therefore extremely important.

[0036] If a high impedance mode is possible, as shown in the right side of FIG. **3**, it is possible to broaden the distance between the current source and ground by making an electrode of a region in the vicinity of the current source electrode A a high impedance electrode H, and adopting a ground electrode G in a slightly distanced location. With regards to this, the present invention sets out to resolve this problem without using a high-impedance mode.

[0037] Here, a method can be adopted as one resolving means where rather than there being one current source electrode, a plurality of current source electrodes are prepared as shown in FIG. **4** and the current source electrodes become larger in an equivalent manner so that current reaches to deep sections of the skin. This technique gives superior nerve stimulation without using high-impedance electrodes. The reason for this is as follows.

[0038] The impedance (resistance) from the current source electrode to the ground electrode can be considered to be divided into a component passing through shallow sections of the skin and a component passing through deep sections of the skin. That relating to the shallow sections of the skin can be substantially modeled as shown in FIG. **5**. When a resistance R is placed at a shallow section of the skin across a neighboring pair of a current source electrode and a ground electrode, the resistance of the whole of the shallow section of the skin across the current source and ground is inversely proportional to the number of pairs of current source electrode-ground electrode. In the case of FIG. **5**, this is R/4 when there is one current source electrode, and is R/8 when four electrodes are used as the current source electrode. Typically, when the number of current source electrodes is N, the number of surrounding electrodes is proportional to the square root of N. The resistance of the shallow section of the skin is then inversely proportional to the square root of N and therefore falls. On the other hand, it is clear that the resistance of the path passing through the deep section of the skin is directly proportional to the contact surface, i.e. the number N of current source electrodes, and therefore falls. As a result of these two facts, the resistance of the path passing through the deep sections of the skin falls relatively when the current source electrodes increase. Deep sections of the skin therefore become the main current path as a result. The nerve axons N can therefore be considered to be more easily stimulated (here, the case of a two-dimensional electrode matrix is considered but the same also applies for a one-dimensional array).

[0039] This method does, however, have one drawback. This is that, because a plurality of electrodes are used as a current source at the same time, it is difficult to make use of this high electrode density and spatial resolution of tactile stimulation presented deteriorates.

[0040] Resolving means is therefore proposed in the following. The proposed resolving means is a method for providing a plurality of electrodes as a current source and switching selected electrodes at high-speed as shown in FIG. **6**. In the X-state of FIG. **6**, electrodes **2** and **3** of the five electrodes are taken as current sources, while in the Y-state, electrodes **3** and **4** are taken as current sources. This switching is at a higher speed than the electrode switching for presenting the surface pattern shown in FIG. **2**. Specifically, switching for the switching in FIG. **2** is carried out at an interval of 500 μs to 10 ms but here this switching is carried out at an interval of 10 μs to 1 ms. The switching may take place one time or a number of times.

[0041] Considering the influence that this high-speed localized switching of electrodes has on nerve axons, the switching takes place at a speed that is in the order of the time constant of the nerve axons or more. This is therefore the equivalent of the nerve axons being subjected to the average electrical field of the electrical fields occurring at states X and Y to act. Considering electrodes **2** and **4**, electrodes **2** and **4** are connected to ground for just half of the time, and are connected to the current sources for the remaining half of the time. Averaging over time, as shown in the right drawing in FIG. **6**, there is no current going in or out and this can be seen as a high-impedance state. This state is the ideal state shown in the right side of FIG. **3**.

[0042] An example of a high-speed switching procedure for the case of a two-dimensional electrode matrix is shown in FIG. **7**. FIG. **7**A shows the positional relationship between one electrode being an electrode (current source electrode) S at a position for stimulation, and electrodes in the vicinity of the electrode (current source electrode) S at the position for stimulation. Here, neighboring electrodes **1** to **8** are four electrodes **2**, **4**, **5** and **7** above, below, to the left and to the right of the electrode (current source electrode) S at the position for stimulation and four diagonal electrodes **1**, **3**, **6** and **8**, giving "eight neighboring" electrodes.

[0043] FIG. **7**B shows high-speed switching between "a first state where three electrodes, an electrode S at the position for stimulation and electrodes **2** and **7** neighboring above and below, are connected to a current source" and "a second state where three electrodes, the electrode S at the position for stimulation and electrodes **4** and **5** neighboring to the left and right, are connected to a current source". The electrodes **2**, **4**,