branch are thinner than at least some of the segments of the flex circuit that are adjacent to the electrical cable.

[0015] There is also disclosed an electrode apparatus configured for affixation to a patient's skin. The second apparatus comprises a flex circuit having a trunk region that extends in a longitudinal direction and a plurality of branches that extend laterally from the trunk region, each of the branches having a free distal end and a proximal end that is connected to the trunk region, with a plurality of branches extending on at least one lateral side of the trunk region, the flex circuit having an inner skin-facing side and an outer side. The second apparatus also comprises a plurality of electrode elements disposed on the inner side of the flex circuit along the branches of the flex circuit, each of the electrode elements having a conductive plate that is connected to the flex circuit in an electrically conducting manner, and a dielectric layer positioned to face the skin of the patient. The second apparatus also comprises a foam layer disposed on the inner side of the flex circuit, wherein the foam layer is configured to cover at least a portion of the trunk region of the flex circuit and at least a portion of the branches of the flex circuit, and leave the electrode elements uncovered. The second apparatus also comprises a skin-level adhesive layer disposed on a skin-facing side of the foam layer. The second apparatus also comprises a top, covering layer disposed on the outer side of the flex circuit, the covering layer being sized to cover the branches of the flex circuit and to overlap spaces between the branches, the covering layer having adhesive on a skin-facing side thereof by means of which the covering layer can be adhered to the patient's skin through the spaces between the branches.

[0016] Some embodiments of the second apparatus further comprise a plurality of conductive hydrogel discs, wherein each of the conductive hydrogel discs is attached to a skin-facing side of a respective electrode element. Some of these embodiments further comprise a plurality of gel barriers, wherein each of the gel barriers surrounds a respective one of the hydrogel discs.

[0017] In some embodiments of the second apparatus, more electrode elements are attached to branches of the flex circuit that are closer to the longitudinal center of the trunk than are attached to branches of the flex circuit that are farther from the longitudinal ends of the trunk.

WHAT IS CLAIMED IS:

1. An electrode apparatus configured for affixation to a patient's skin, comprising:

a flex circuit having a trunk region that extends in a longitudinal direction and a plurality of branches that extend laterally from the trunk region, each of the branches having a free distal end and a proximal end that is connected to the trunk region, with a plurality of branches extending on at least one lateral side of the trunk region, the flex circuit having an inner skin-facing side and an outer side;

a plurality of electrode elements disposed on the inner side of the flex circuit along the branches of the flex circuit, each of the electrode elements having a conductive plate that is connected to the flex circuit in an electrically conducting manner, and a dielectric layer positioned to face the skin of the patient; and

a top, covering layer disposed on the outer side of the flex circuit, the covering layer being sized to cover the branches of the flex circuit and to overlap spaces between the branches, the covering layer having adhesive on a skin-facing side thereof by means of which the covering layer can be adhered to the patient's skin through the spaces between the branches,

wherein the covering layer is slotted to define a plurality of fingers overlying the branches of the flex circuit so that the fingers of the covering layer can move independently of each other as branches of the flex circuit flex independently of each other.

2. The electrode apparatus of claim 1, further comprising a plurality of conductive hydrogel discs wherein each of the conductive hydrogel discs is attached to a skin-facing side of a respective electrode element.

3. The electrode apparatus of claim 2, further comprising a plurality of gel barriers, wherein each of the gel barriers surrounds a respective one of the hydrogel discs.

4. The electrode apparatus of claim 1, further comprising a foam layer disposed on the inner side of the flex circuit, wherein the foam layer is configured to cover at least a portion of the trunk region of the flex circuit and at least a portion of the branches of the flex circuit, and leave the electrode elements uncovered.

5. The electrode apparatus of claim 4, further comprising a skin-level adhesive layer disposed on a skin-facing side of the foam layer.

6. The electrode apparatus of claim 5, wherein the skin-level adhesive layer has a configuration that follows the configuration of the flex circuit, with branches and trunk portions of the skin-level adhesive layer being wider than corresponding portions of the flex circuit so as to overlap spaces between the branches of the flex circuit.

7. The electrode apparatus of claim 1, wherein more electrode elements are attached to branches of the flex circuit that are closer to the longitudinal center of the trunk than are attached to branches of the flex circuit that are farther from the longitudinal ends of the trunk.

8. The electrode apparatus of claim 1, wherein the trunk shifts back and forth in the lateral direction as it extends in the longitudinal direction.

9. The electrode apparatus of claim 1, wherein the trunk extends in the longitudinal direction in a straight manner.

10. The electrode apparatus of claim 1, further comprising a skin-level adhesive layer disposed on the inner side of the flex circuit.

11. The electrode apparatus of claim 10, wherein the skin-level adhesive layer has a configuration that follows the flex circuit, with branches and trunk portions of the skin-level adhesive layer being wider than corresponding portions of the flex circuit so as to overlap spaces between the branches of the flex circuit.

12. The electrode apparatus of claim 10, wherein the skin-level adhesive layer is attached directly to the inner side of the flex circuit.

13. The electrode apparatus of claim 1, wherein the flex circuit has a plurality of branches extending on each lateral side of the trunk region.

14. The electrode apparatus of claim 1, wherein the flex circuit is configured so that no more than three paths emanate from any intersection on the flex circuit.

15. The electrode apparatus of claim 1, wherein the flex circuit is configured so that all segments of the flex circuit are straight.

16. The electrode apparatus of claim 1, further comprising an electrical cable that terminates on the flex circuit, wherein segments of the flex circuit near the distal end of each branch are thinner than at least some of the segments of the flex circuit that are adjacent to the electrical cable.