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(54) **HAIR STRAIGHTENING BRUSH**

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(Continued)

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See application file for complete search history.

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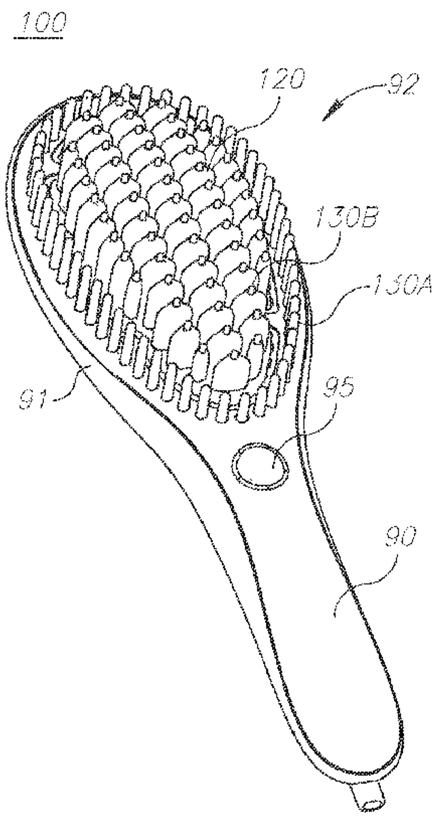
(57) **ABSTRACT**

A brush is provided herein, the brush having heating elements dispersed on and protruding from its face and spacers arranged to maintain a specified distance between protruding ends of the heating elements and a scalp of a head that is being brushed. The spacers are dispersed on the brush's face at a specified density that assures maintaining the specified distance with respect to a resilience of the spacers.

20 Claims, 5 Drawing Sheets



(51) **Int. Cl.**

A46B 9/06	(2006.01)
A46B 15/00	(2006.01)
A45D 20/48	(2006.01)
A45D 2/00	(2006.01)
A46D 99/00	(2006.01)
A46D 3/00	(2006.01)

(52) **U.S. Cl.**
CPC ***A46B 15/003*** (2013.01); ***A46D 3/00*** (2013.01); ***A46D 99/00*** (2013.01); *A45D 2200/152* (2013.01); *A46B 2200/104* (2013.01)

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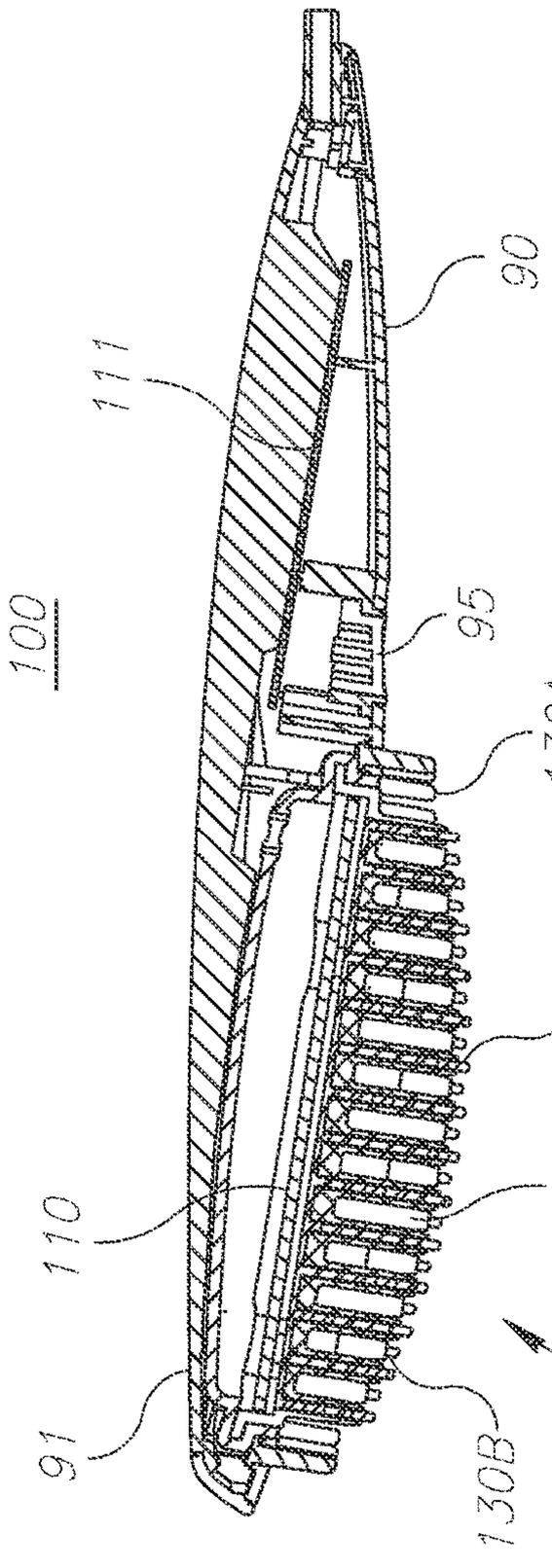

Figure 1B

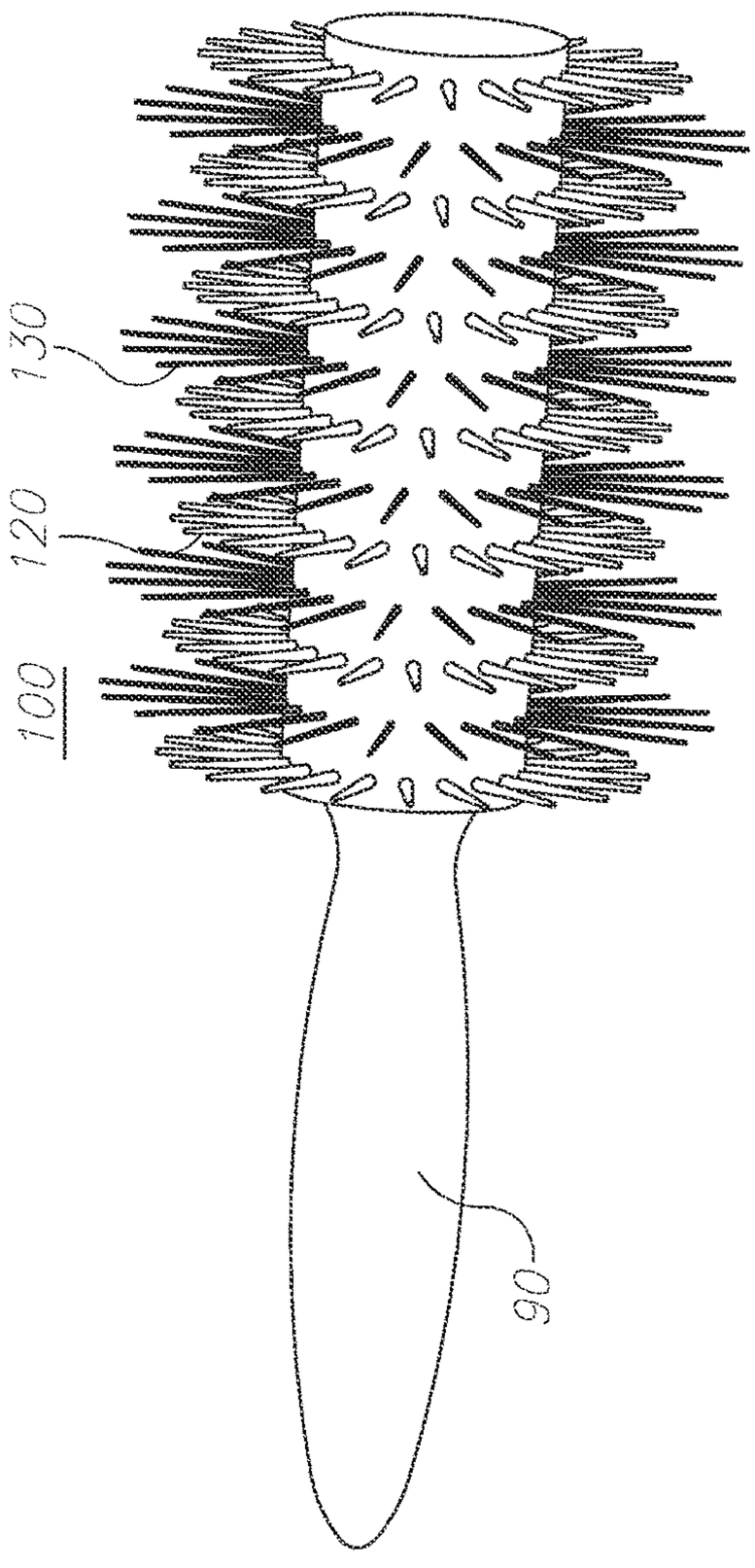

Figure 1C

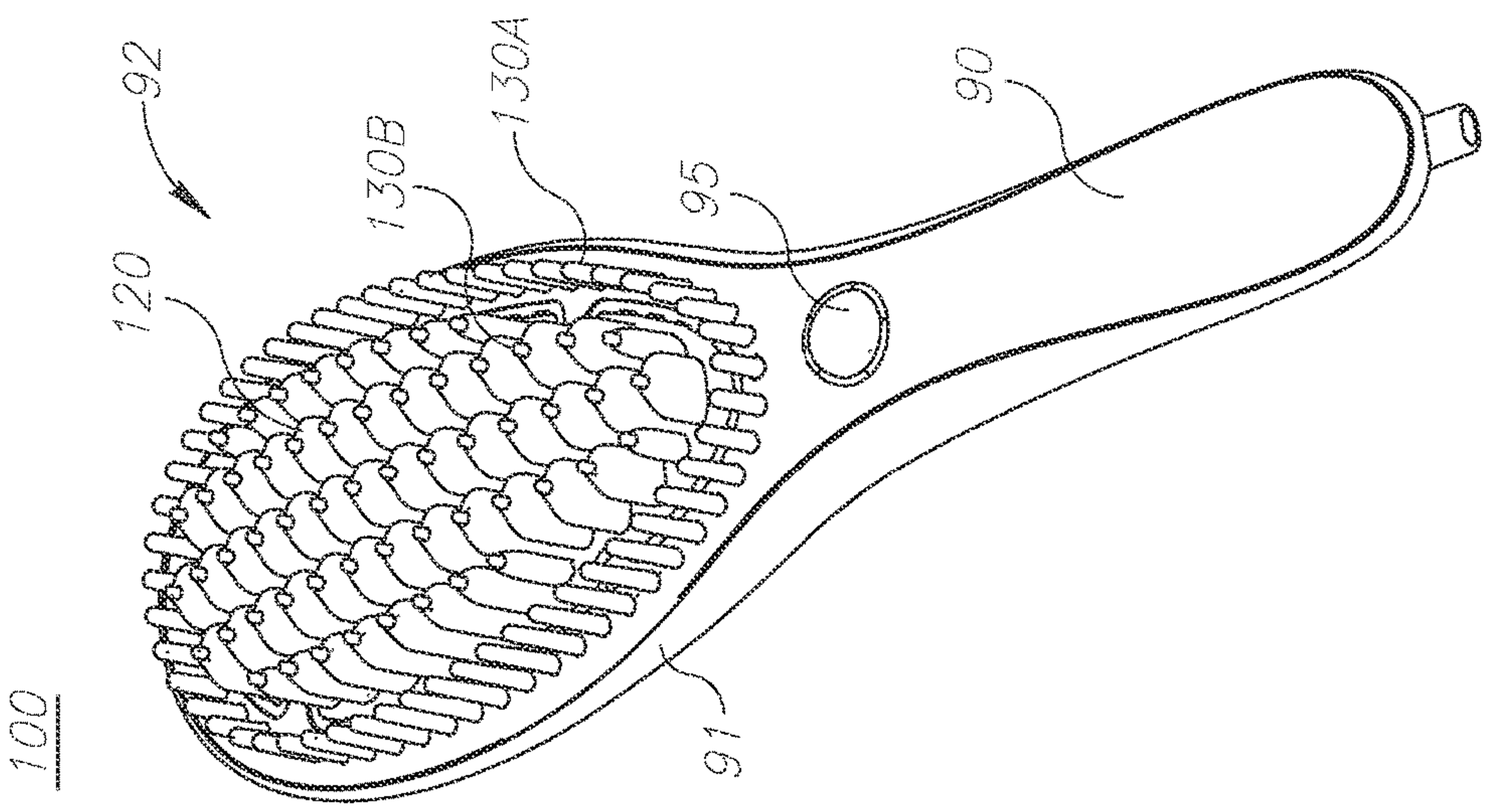

Figure 1A

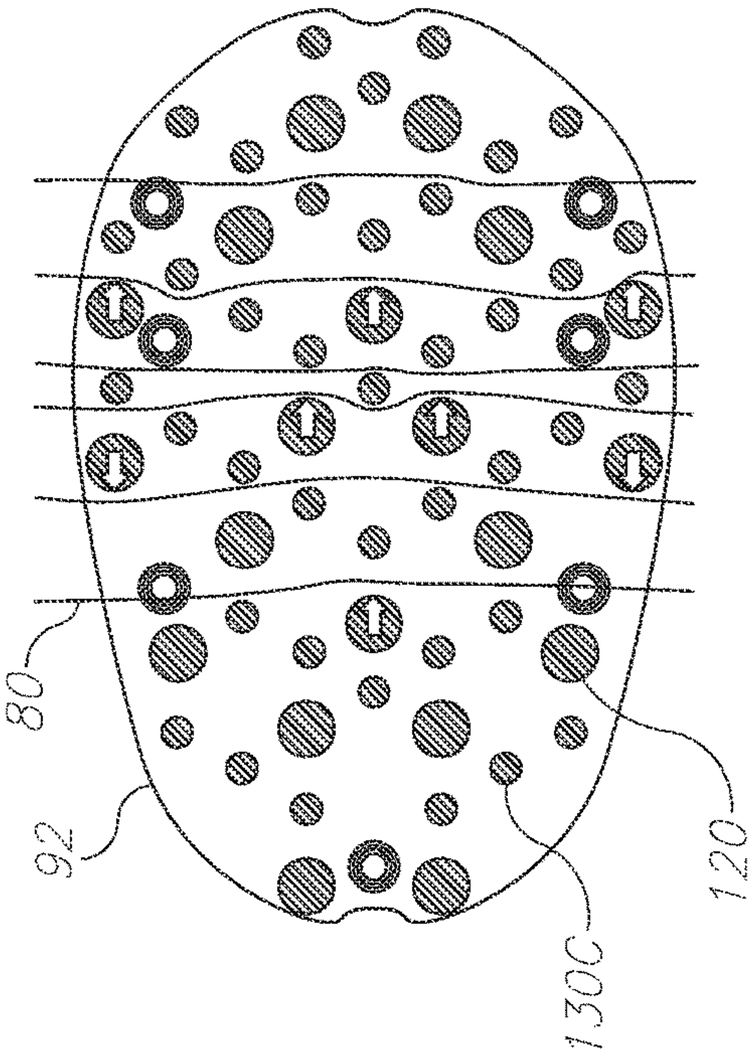

Figure 2A

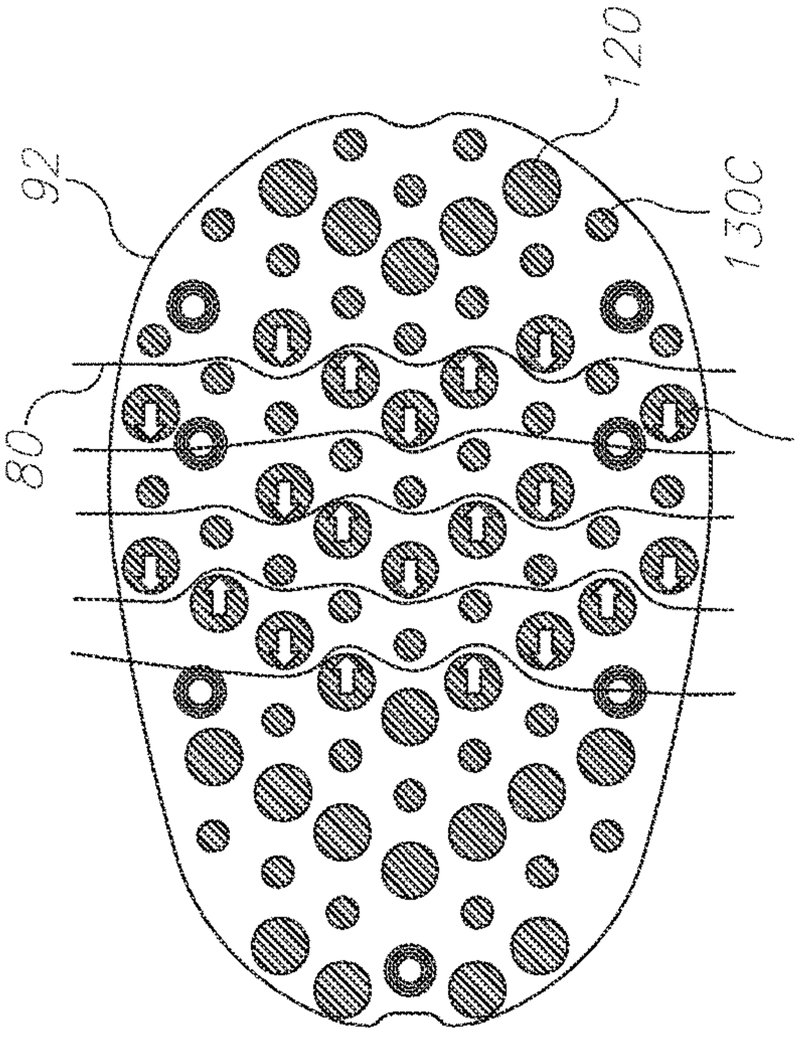

Figure 2B

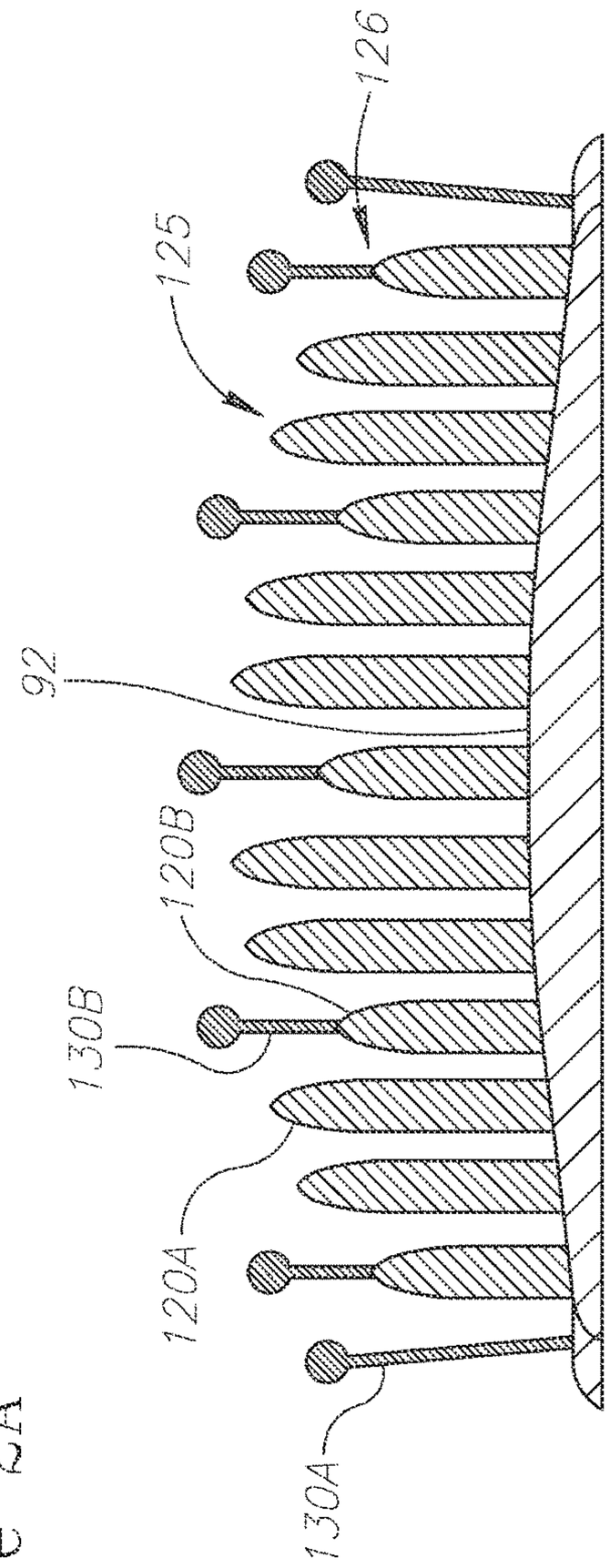

Figure 2C

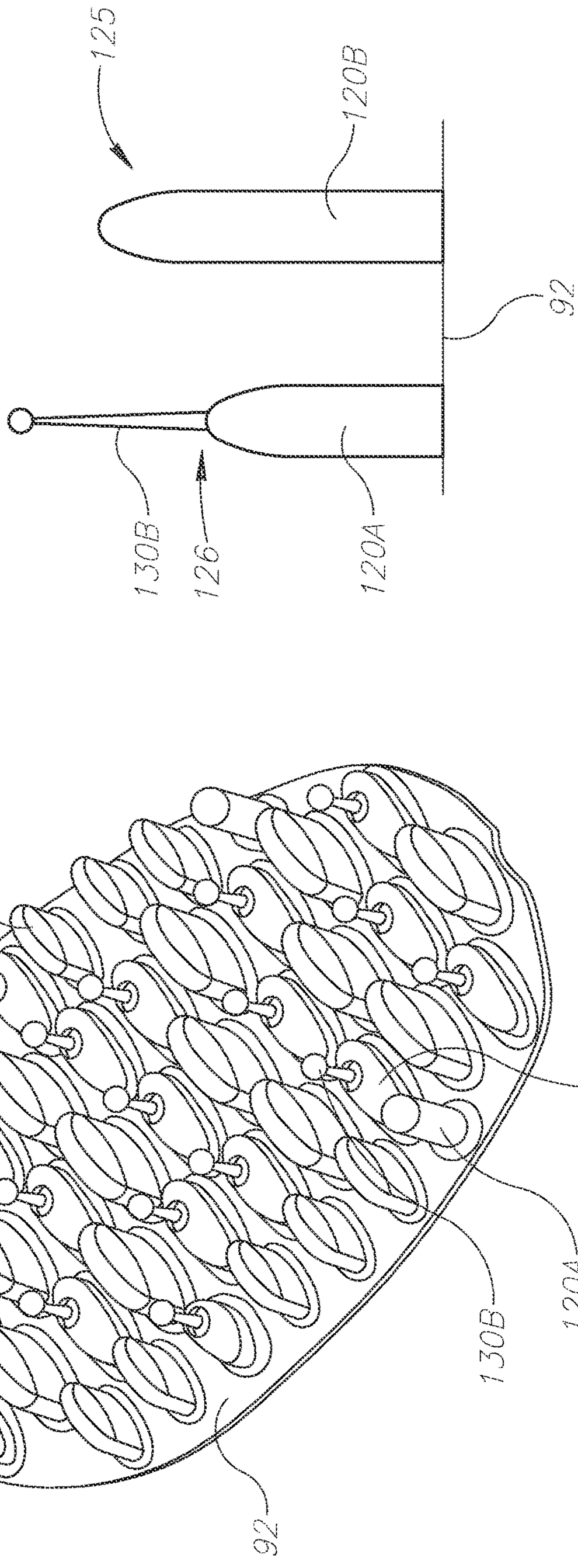

Figure 3B

Figure 3A

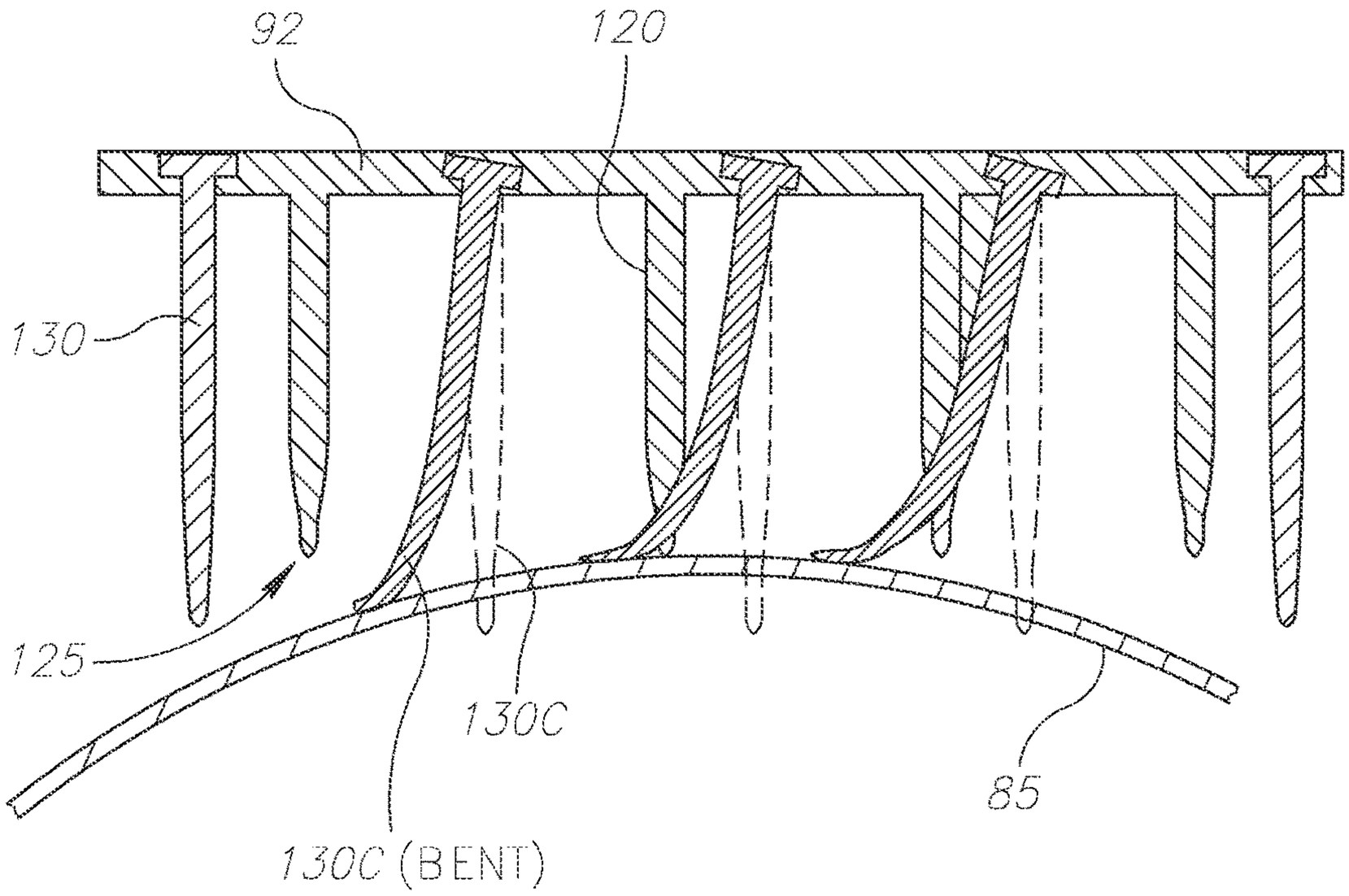

Figure 3C

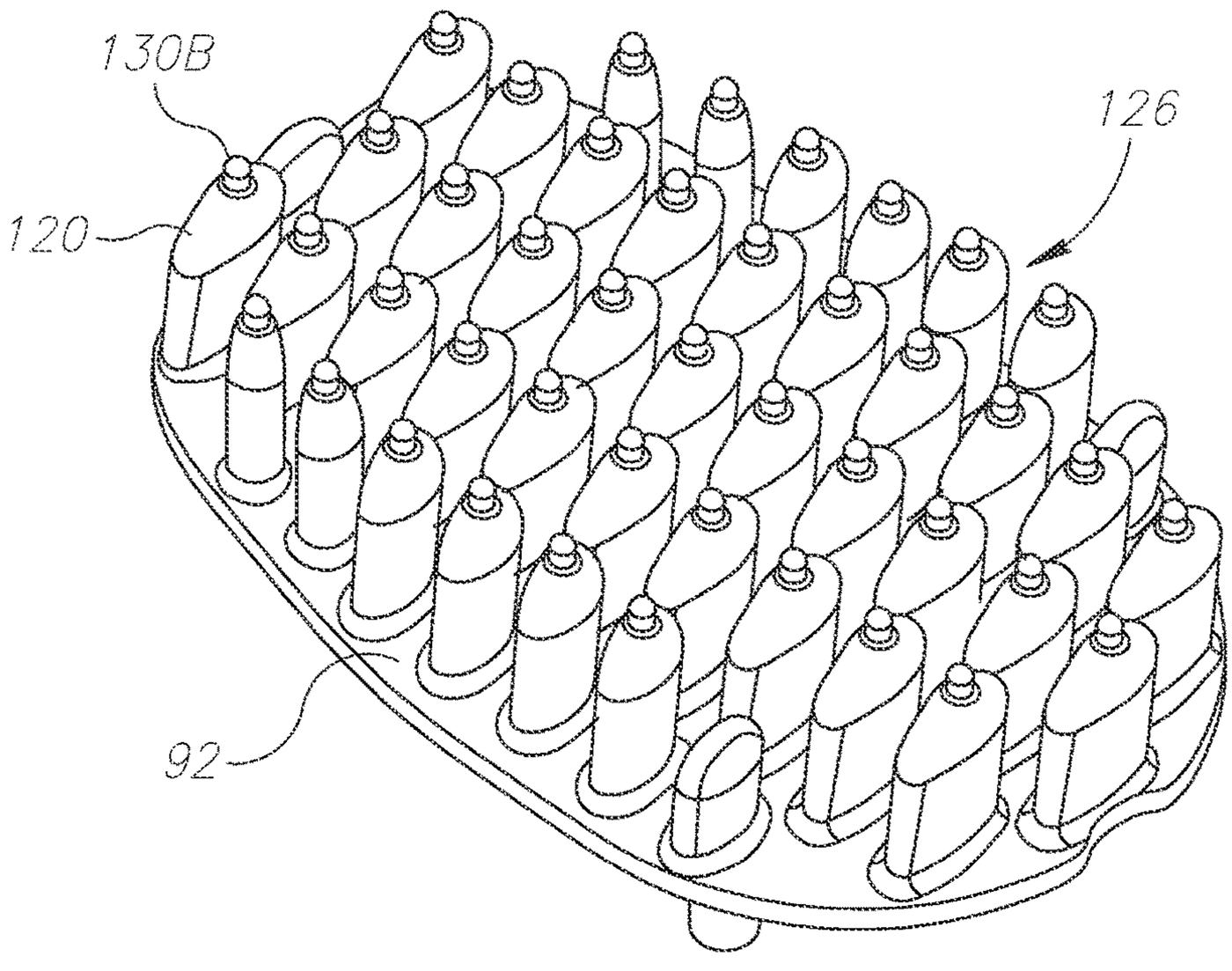

Figure 3D

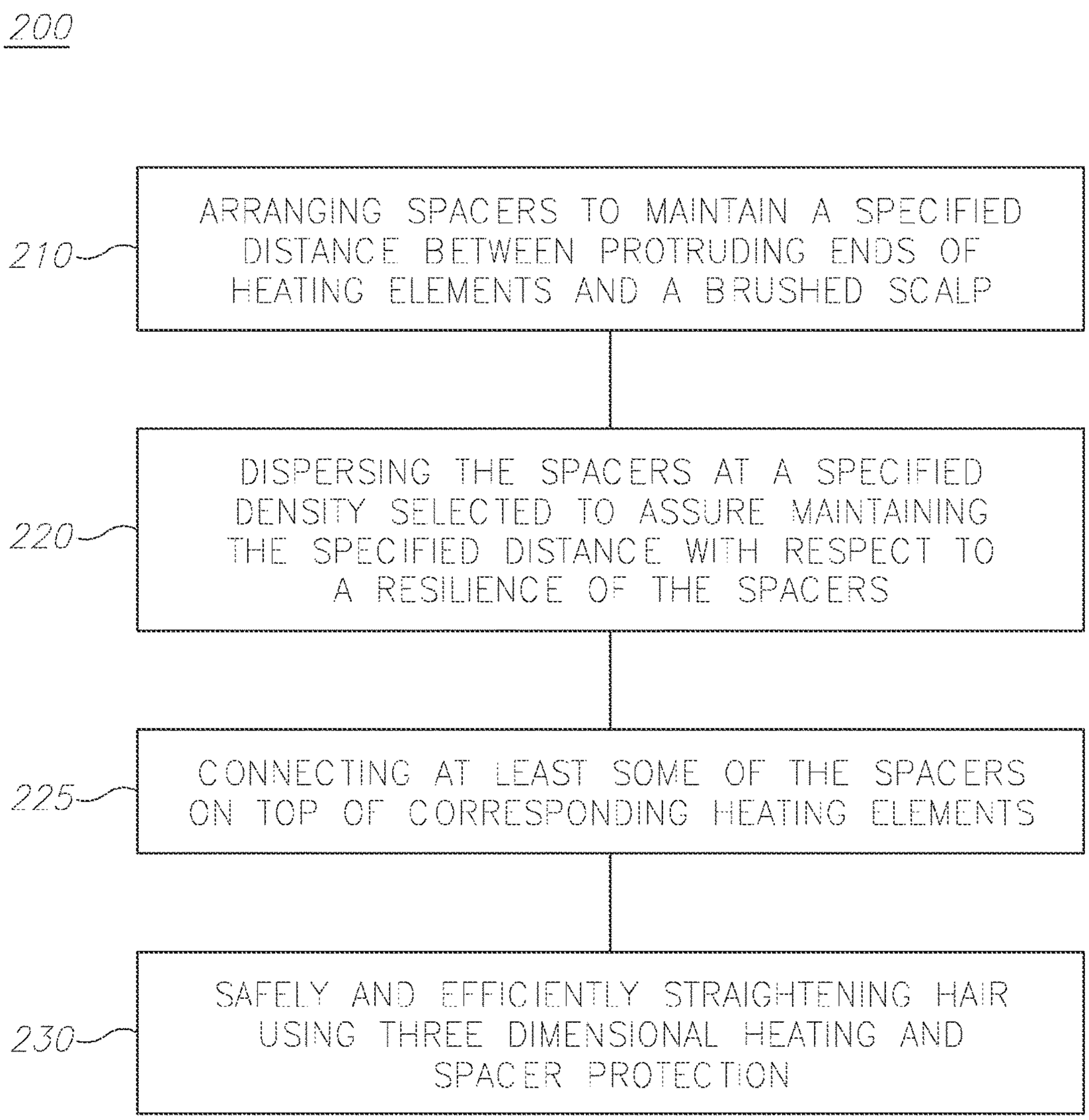
200
210
ARRANGING SPACERS TO MAINTAIN A SPECIFIED DISTANCE BETWEEN PROTRUDING ENDS OF HEATING ELEMENTS AND A BRUSHED SCALP
220
DISPERSING THE SPACERS AT A SPECIFIED DENSITY SELECTED TO ASSURE MAINTAINING THE SPECIFIED DISTANCE WITH RESPECT TO A RESILIENCE OF THE SPACERS
225
CONNECTING AT LEAST SOME OF THE SPACERS ON TOP OF CORRESPONDING HEATING ELEMENTS
230
SAFELY AND EFFICIENTLY STRAIGHTENING HAIR USING THREE DIMENSIONAL HEATING AND SPACER PROTECTION

Figure 4

HAIR STRAIGHTENING BRUSH

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a National Phase Application of PCT International Application No. PCT/IL2013/050420, International Filing Date May 16, 2013, claiming priority of PCT Patent Application No. PCT/IL2013/050017, filed Jan. 6, 2013, and Israeli Patent Application No. 219875, filed May 17, 2012, all of which are hereby incorporated by reference.

BACKGROUND

1. Technical Field

The present invention relates to the field of hair heat treatment, and more particularly, to brush-like hair straighteners.

2. Discussion of Related Art

Hot combs have been used since the late 19^{th} century, however operational considerations and safety requirements have been limiting their applicability.

BRIEF SUMMARY

One aspect of the present invention provides a brush comprising a plurality of heating elements protruding from a face of the brush, the heating elements dispersed on the brush's face at a specified density; and a plurality of spacers arranged to maintain a specified distance between protruding ends of the heating elements and a scalp of a head that is being brushed, the spacers dispersed on the brush's face at a specified density that assures maintaining the specified distance with respect to a resilience of the spacers.

These, additional, and/or other aspects and/or advantages of the present invention are set forth in the detailed description which follows; possibly inferable from the detailed description; and/or learnable by practice of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of embodiments of the invention and to show how the same may be carried into effect, reference will now be made, purely by way of example, to the accompanying drawings in which like numerals designate corresponding elements or sections throughout.

In the accompanying drawings:

FIGS. **1**A-**1**C are high level schematic illustrations of a brush according to some embodiments of the invention;

FIGS. **2**A-**2**C and **3**A-**3**D are high level schematic illustrations of various arrangements of the heating elements and spacers of the brush according to some embodiments of the invention; and

FIG. **4** is a high level schematic flowchart illustrating a method according to some embodiments of the invention.

DETAILED DESCRIPTION

Prior to setting forth the detailed description, it may be helpful to set forth definitions of certain terms that will be used hereinafter.

The term "heating element" as used herein in this application refers to any type of heat conductive element, in particular metal (e.g. aluminum) heat conductors. Heating elements may have any shape, e.g. elongated, flat, conical, have a cross section that is round, elliptic or flat etc. Heating elements may have a cross section that varies in shape, and heating elements of varying forms may be combined on a single brush.

The term "spacer" as used herein in this application refers to any structure arranged to keep a clearance or a specified distance between heating elements of the brush and the scalp of the user's head. Spacers may have any form and may be positioned on the brush and/or on the heating elements. Spacers may be made of any material, preferable a heat insulating material. Different types of spacers may be used at different regions of the brush.

With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of the preferred embodiments of the present invention only, and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the invention. In this regard, no attempt is made to show structural details of the invention in more detail than is necessary for a fundamental understanding of the invention, the description taken with the drawings making apparent to those skilled in the art how the several forms of the invention may be embodied in practice.

Before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention is applicable to other embodiments or of being practiced or carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein is for the purpose of description and should not be regarded as limiting.

FIGS. **1**A-**1**C are high level schematic illustrations of a brush **100** according to some embodiments of the invention. FIG. **1**A is a perspective view, FIG. **1**B is a cross sectional view and FIG. **1**C is a side view. FIGS. **2**A-**2**C and **3**A-**3**D are high level schematic illustrations of various arrangements of heating elements **120** and spacers **130** of brush **100** according to some embodiments of the invention. Brush **100** comprises heating elements **120** dispersed on and protruding from its face and spacers **130** arranged to maintain a specified distance between protruding ends of heating elements **110** and a scalp of a head that is being brushed. Spacers **130** are dispersed on the brush's face at a specified density that assures maintaining the specified distance with respect to a resilience of spacers **130**.

FIGS. **1**A and **1**B illustrate flat, essentially one-sided brush **100**, having a back **91**, a handle **90**, an operation button **95** and optionally an operation indicator and a heating level selector (not shown). In the cross sectional view of FIG. **1**B, heat source **110** is visible, as well as the internal structure of elements in handle **90**. FIG. **1**C illustrates a cylindrical brush **100** having dispersed heating elements **120** and spacers **130**. In these embodiments, some of spacers **130** may be connected on top (**126**) of some of heating elements **120** (**130**B) or among heating elements **120** (**130**C).

FIGS. **2**A and **2**B illustrate two configurations of heating elements **120** and spacer **130** on brush's face **92**. FIG. **2**A illustrates a dense arrangement of heating elements **120** and spacer **130** in which there is a high probability of each hair **80** contacting at least one heating element **120** and each hair **80** is likely to be extensively heated. FIG. **2**B illustrates a less dense arrangement of heating elements **120** and spacers **130** in which heating elements **120** are spread apart in respect to FIG. **2**A. As heating elements **120** are more remote from each other, there is a lower probability of each

hair **80** contacting at least one heating element **120** and each hair **80** is likely to be heated more mildly than in the embodiment illustrated in FIG. **2**A. In general, the configuration of heating elements **120** and spacers **130** is selected according to operative and safety requirements to provide an effective and safe brush.

Brush **100** comprises a plurality of heating elements **120** protruding from a face **92** of brush **100**. Heating elements **120** may be elongated with any shape of cross section (e.g. round in FIG. **2**A, elliptic in FIG. **1**A, variable in FIG. **3**A etc.). Heating elements **120** are made of heat conductive material, as a non-limiting example, aluminum. In embodiments, the heat conductive material may have a thermal conductivity which is comparable to high quality aluminum (over 200 W/m° K.), lower conductivity of 50-200 W/m° K. or even low thermal conductivity between 20-50 W/m° K. The thermal conductivity may be selected with respect to overall efficiency and safety requirements.

Heating elements **120** conduct heat from a heat source **110** such as a heating body, which may receive energy from a battery in brush **100** or from an external source. Good thermal contact may be established between heat source **110** and heating elements **120**, e.g. using a thermal paste, or by constructing heat source **110** and heating elements **120** as a single body. In embodiments, heating elements **120** may comprise internal heat sources (not shown) such as small resistors to improve the heating efficiency. The internal heat sources may replace or enhance a central heat source. In embodiments, heating elements **120** may comprise electrical heating wires. Brush **100** may further comprise a control unit **111** arranged to control heating elements **120** and/or heat source **110**. Control unit **111** may be positioned in handle **90** of brush **100**.

Heating elements **120** may reach temperature between 140-240° C., which are useful for straightening hair. Heating elements **120** may be arranged and constructed to minimize hair damages during the straightening process, e.g. avoid scratching the hair, avoid excessive stretching of the hair, avoid scalp injuries etc.

Heating by heating elements may be carried out in all directions or in specified directions (see e.g. direction **122** in FIGS. **2**A and **2**B) in cooperation with the arrangement of heating elements **120** on the brush's face. Brush **100** thus provides three dimensional heating of the hair. The spacer configuration ensures a safe and efficient straightening effect.

Brush face **92** may comprise a heat source connected to heating elements **120**. Heating elements **120** are dispersed on at least a part of brush's face **92** at a specified density. The specified density may vary between different regions of face **92**, as explained below. Heating elements **120** provide a large heating surface area for straightening hairs. For example, while a surface of a heat may be 40 cm^2 (generally between 10-80 cm^2, depending on the brush size), the overall surface of heating elements **120** may be twenty-fold, or between 5 and 70 times the area of face **92**. Such increase in the contacting surface area increases the efficiency of heat delivery to the hair.

Protruding ends **125** of heating elements **120** may be smooth or rounded to prevent accidental injury, protect the hair, allow easy brushing of the hair and ensure uniform heat delivery.

Brush **100** further comprises a plurality of spacers **130** arranged to maintain a specified distance or a clearance between protruding ends **125** of heating elements **120** and a scalp of a head that is being brushed (see below, FIG. **3**A). Spacers **130** may have any form and may be positioned on brush **100**, on heating elements **120**, among heating elements **120** (see e.g. **130**C in FIG. **3**C) or in a combination thereof (see e.g. FIG. **1**A, where different types of spacers **130** are used at different regions of brush **100**). Spacers **130** located on the brush's face **92** are marked **130**A, spacers **130** located on top of heating elements **120** are marked **130**B and spacers **130** located among the heating elements **120** are marked **130**C. In embodiments, some or all of heating elements **120** may be surrounded by spacers **130**.

Spacers **130** may be made of any material, preferable a heat insulating material, e.g. plastic or silicon. In embodiments, the heat insulating material may have a thermal conductivity which is lower than 10 W/m° K.

For example, spacers **130** may comprise flexible bristles arranged to protect the scalp from a temperature of heating elements reaching 140° C. or more.

Spacers **130** are dispersed on brush **100**'s face **92** at a specified density that assures maintaining the specified distance with respect to a resilience of spacers **130**, as explained below.

In a non-limiting example, heating elements **120** may be 3 mm-50 mm high, and may vary in height across face **92**. Spacers **130** may be higher than adjacent heating elements **120** by 1 mm-30 mm depending on their density (and the intervals between adjacent spacers **130**), resilience, density and dimensions of heating elements **120** and application scenarios (e.g. type and length of hair, applies heat, user sensitivity etc.). The distribution and forms of spacers **130** may be adapted to the distribution of heating elements **120** (e.g. a region with taller or denser heating elements **120** may have taller or denser spacers **130**). The distribution of heating elements **120** may also be adapted to application scenarios, e.g. denser hair may be treated with longer and possibly less dense heating elements **120** (e.g. 25 mm long) while thinner hair may be treated with shorter and possibly denser heating elements **120** (e.g. 10 mm long).

FIG. **3**C illustrates the relation between the resilience of spacers **130** and the height difference between spacers **130** and heating elements **120**. Spacers **130**C are illustrated in their upright position (hatched) and in a bent position during application of brush **100**. Additional spacer types (**130**A, **130**B) may also be present in this configuration (not shown). The height difference may be large enough to provide a safety distance to scalp **85** even in the most aggressive application scenario, or the height difference and spacer resilience may be configured to assure safe application in normal or other scenarios.

In embodiments, the specified densities of heating elements **120** and of spacers **130** may be variable across the face of brush **100** and be related to maintain the specified distance between protruding ends **125** of heating elements **120** and scalp **85** under at least one usage scenario.

As illustrated in FIGS. **2**C, **3**A and **3**B, spacers **130**A and/or **130**C may protect the sides of brush **100** while spacers **130**B may be connected on top (**126**) of some or all of heating elements **120** (see FIGS. **3**A, **3**D). Some of heating elements **120** may be lower than other heating elements **120** and some of heating elements **120** may hold spacers **130**B attached to their tops **126**. In embodiments, spacers **130** may be connected to sides of heating elements **120**. In embodiments, heating elements **120** may vary in shape and size across face **92** (FIGS. **3**A, **3**D) and spacers **130** may be designed accordingly to enhance safety. Face **92** may be bended to further increase the effective heat application area (see FIG. **2**C).

One non-limiting example for brush **100** is illustrated in FIGS. **3**A and **3**B. In this example, brush face **92** is 55

mm×85 mm. Connected to face **92** are heating elements **120**B which are 12 mm high and heating elements **120**A which are 8 mm high and have spacers **130** which are 16 mm high connected on top. The specified distance which is kept between heating elements **120** and scalp **85** in an non-bended state of spacers **130** is hence 4 mm. Spacers **130** may be short and stiff bristles which do not bend mush during application, to maintain the specified safety distance quite constant. In an example, brush **100** uses 500 W and provides a heated area of 520 cm^2.

In embodiments, the specified distance between heating elements and scalp **85** may be between 1 and 30 mm.

Another non-limiting example for brush **100** is illustrated in FIG. **3**D. In this example, all heating elements **120** are protected with soft silicon spacers **130**, which may extend also to sides of heating elements **120** (not shown). In an example illustrated in FIG. **3**A, some of heating elements **120** may comprise spacers **130** as caps **130**B and others as bristles **130**B.

Another non-limiting example for brush **100** is illustrated in FIG. **3**C. In this example, resilient spacers **130**C both protect scalp **85** and provide a pleasant feel while using brush **100**, due to their bending upon contacting scalp **85**.

In embodiments, spacers **130** may be positioned on any of brush face (**130**C), brush face periphery (**130**A in FIG. **1**A) or on top of heating elements **120** (**130**B). Different spacers **130** may be arranged to provide scalp protection under different usage scenarios. For example, some spacers **130** may be stiffer to protect the scalp during forceful brushing and other spacers **130** may by compliant to provide protection as well as a pleasant feel during smooth brushing.

In embodiments, the specified density of heating elements **120** may be between 0.2 and 15 per cm^2. For example, heating elements **120** may be 3 mm wide (at their base) and 1-2 mm apart. In embodiments, heating elements **120** may be 4-5 mm apart (measured between base centers of heating elements **110**). In another example heating elements **120** may be 20 mm wide and 10 mm apart. Intermediate examples may be selected according to the required application.

FIG. **4** is a high level schematic flowchart illustrating a method according to some embodiments of the invention.

Method **200** comprises arranging spacers to maintain a specified distance between protruding ends of heating elements and a brushed scalp (stage **210**), dispersing the spacers at a specified density selected to assure maintaining the specified distance with respect to a resilience of the spacers (stage **220**) and thereby safely and efficiently straightening hair using three dimensional heating and spacer protection (stage **230**). In embodiments, method **200** further comprises connecting at least some of the spacers on top of corresponding heating elements (stage **225**) and generally arranging the spacers in a way that keeps the heating elements at a safety distance from the scalp under any usages scenario.

In the above description, an embodiment is an example or implementation of the invention. The various appearances of "one embodiment", "an embodiment" or "some embodiments" do not necessarily all refer to the same embodiments.

Although various features of the invention may be described in the context of a single embodiment, the features may also be provided separately or in any suitable combination. Conversely, although the invention may be described herein in the context of separate embodiments for clarity, the invention may also be implemented in a single embodiment.

Embodiments of the invention may include features from different embodiments disclosed above, and embodiments may incorporate elements from other embodiments disclosed above. The disclosure of elements of the invention in the context of a specific embodiment is not to be taken as limiting their used in the specific embodiment alone.

Furthermore, it is to be understood that the invention can be carried out or practiced in various ways and that the invention can be implemented in embodiments other than the ones outlined in the description above.

The invention is not limited to those diagrams or to the corresponding descriptions. For example, flow need not move through each illustrated box or state, or in exactly the same order as illustrated and described.

Meanings of technical and scientific terms used herein are to be commonly understood as by one of ordinary skill in the art to which the invention belongs, unless otherwise defined.

While the invention has been described with respect to a limited number of embodiments, these should not be construed as limitations on the scope of the invention, but rather as exemplifications of some of the preferred embodiments. Other possible variations, modifications, and applications are also within the scope of the invention. Accordingly, the scope of the invention should not be limited by what has thus far been described, but by the appended claims and their legal equivalents.

What is claimed is:

1. A hairbrush, comprising:

a plurality of heating elements protruding from a face of the hairbrush, the plurality of heating elements defining a hair treating area dispersed on at least a part of the hairbrush's face at a specified density;

a plurality of heat insulating spacers each of which includes an end spaced from the face of the hairbrush, the plurality of heat insulating spacers configured on top of at least some of the plurality of heating elements, thereby giving rise to a space between the plurality of heating elements and a user's scalp during use; and

a plurality of heat insulating elongate peripheral spacers disposed at least around a portion of the hair treating area of the hairbrush, each of the plurality of heat insulating elongate peripheral spacers including an end spaced from the face of the hairbrush, at least some of the ends of the plurality of heat insulating elongate peripheral spacers located closer to the face than the ends of the plurality of heating insulating spacers.

2. The hairbrush of claim **1**, wherein the plurality of heating elements are arranged to maintain a specified distance between protruding ends of the plurality of heating elements and the user's scalp at between 1 mm and 30 mm.

3. The hairbrush of claim **1**, wherein the specified density of the plurality of heating elements is between 0.2 per cm^2 and 15 per cm^2.

4. The hairbrush of claim **1**, wherein at least some of the plurality of heat insulating spacers that are connected on top of corresponding ones of the plurality of heating elements comprise silicon caps.

5. The hairbrush of claim **1**, further comprising a heat source arranged to heat the plurality of heating elements.

6. The hairbrush of claim **1**, wherein at least some of the plurality of heating elements comprise internal heat sources.

7. The hairbrush of claim **1**, further comprising a control unit arranged to control the plurality of heating elements.

8. The hairbrush of claim **1**, configured as a one-sided brush.

9. The hairbrush of claim **1**, wherein the specified density of the plurality of heating elements and a specified density of the plurality of heat insulating spacers are variable across the face of the hairbrush and the specified densities are

related to maintain the specified distance between protruding ends of the plurality of heating elements and the user's scalp under at least one usage scenario.

10. The hairbrush of claim **1**, wherein the plurality of heat insulating elongate peripheral spacers are stiff and extend around at least a portion of the hair treating area.

11. The hairbrush of claim **1**, wherein the plurality of heat insulating elongate peripheral spacers are integrated with the face of the hairbrush around the heating area.

12. The hairbrush of claim **1**, wherein the plurality of heating elements are arranged in a pattern resulting in a plurality of substantially parallel undulating paths in at least one direction of hair strand entry.

13. The hairbrush of claim **1**, wherein the plurality of heating elements are arranged in a pattern resulting in a plurality of substantially parallel undulating paths in at least one direction of hair strand entry, and wherein the plurality of heating elements are disposed in a pattern offering a smooth path extending at an orientation other than the plurality of substantially parallel undulating paths in at least one direction of hair strand entry.

14. The hairbrush of claim **1**, wherein the plurality of heating elements are arranged in a pattern such that, along one axis, the plurality of heating elements are equally spaced.

15. The hairbrush of claim **1**, further comprising:

a heating plate extending over the face of the hairbrush;

wherein the plurality of heating elements are integrated with and thermally coupled to the heating plate;

wherein the heating plate and the plurality of heating elements collectively define the hair treating area.

16. The hairbrush of claim **15**, wherein the heating plate is curved.

17. The hairbrush of claim **15**, wherein the heating plate is convexly curved.

18. A method, comprising:

arranging a plurality of spacers to maintain a specified distance between protruding ends of a plurality of heating elements protruding from a face of a hairbrush and a scalp of a head that is being brushed, the hairbrush further including a plurality of heat insulating elongate peripheral spacers disposed at least around a portion of the plurality of spacers and the plurality of heating elements with ends of the plurality of heat insulating elongate peripheral spacers being closer to the face of the hairbrush than ends of the plurality of spacers;

wherein the plurality spacers are dispersed on at least a part of the hairbrush's face at a specified density selected to assure maintaining the specified distance with respect to a resilience of the plurality of spacers.

19. The method of claim **18**, further comprising connecting at least some of the plurality of spacers on top of corresponding ones of the plurality of heating elements.

20. The hairbrush of claim **1**, wherein the plurality of heat insulating elongate peripheral spacers are disposed around substantially an entirety of the hair treating area of the hairbrush including the plurality of heating elements and the plurality of heating insulating spacers.

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