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(54) **HAIR STYLING DEVICE**  
HAARSTYLINGVORRICHTUNG  
DISPOSITIF DE COIFFURE

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## Description

### FIELD OF THE INVENTION

**[0001]** The present invention relates to a hair styling device, and more particularly to a hair styling device made of a flexible workpiece, and switching between a working state and a preparatory state with the state change of the flexible workpiece.

### BACKGROUND OF THE INVENTION

**[0002]** A conventional hair clip, which is so-called as a snap clip, includes an upper metal piece 11 and a lower metal piece 12. The upper metal piece 11 consists of two metal pins connected together at one end, thereby forming a bistable mechanism that is capable of switching between concave-convex positions so as to render an open (preparatory) state and a closed (working or standby) state relative to the lower metal piece 12. When the upper metal piece 11 is switched to be the open position by forcing the upper metal piece 11 to become concave, as shown in FIG. 1A, a hair portion may enter the space between the upper metal piece 11 and lower metal piece 12. Then the metal piece 11 is forced to become convex, as shown in FIG. 1B, and close the space together with the lower metal piece 12 so as to clamp the hair portion inside. Afterwards, the upper metal piece 11 can be forced to open again for releasing the hair portion.

**[0003]** Since the lower metal piece 12 of such a snap clip is implemented with a single metal strip, it is likely to slide off hair. Another conventional snap clip as shown in FIG. 1C is thus developed to ameliorate the unstable clamping problem. The snap clip includes an upper metal piece 11 similar to that shown in FIG. 1A, and a widened lower metal piece 13. The widened lower metal piece 13 is made hollow for reducing weight to minimize the gravity effect on sliding off hair. Even so, the clamping force of such a snap clip is still insufficient for stabilizing the clip on hair.

**[0004]** US Patent No. 7,373,940 discloses a snap clip as shown in FIG. 2A and FIG. 2B, which includes an upper metal piece 21, a lower metal piece 22, and a living hinge 23 between the upper metal piece 21 and the lower metal piece 22. Likewise, the upper metal piece 21 consists of two metal pins connected together at one end, thereby forming a bistable mechanism that is capable of switching between concave-convex positions so as to render an open (preparatory) state and a closed (working or standby) state relative to the lower metal piece 22. The lower metal piece 22 is formed under the upper metal piece 21 and has enhanced clamping force as more metal strips are involved for clamping hair. In addition, as the three metal strips are separate at the open end and have gaps in between, hair may enter the gaps and be hindered from relative movement to the metal strips due to interaction with the metal strips. Such a snap clip, however, suffers from the gravity effect since the snap clip is

formed with a larger workpiece to be folded at a position of the living hinge 23 to define the upper metal piece 21 and the lower metal piece 22. The larger workpiece means a higher cost, and the folding operation means an additional procedure requiring aligning precision. Such a snap clip further suffers from an inherent gap between the upper metal piece 21 and the lower metal piece 22 as a result of folding the workpiece. The gap would adversely affect the clamping tightness. Moreover, the flexibility of the living hinge might adversely affect the bistable switching performance.

### SUMMARY OF THE INVENTION

**[0005]** Therefore, there is a need to design a hair styling device, which has an improved clamping performance.

**[0006]** According to the present invention, a hair styling device includes a base; and a plurality of pins having respective first ends connected to a first side of the base, and spaced from each other. The base and the plurality of pins are produced from a single-layer flexible workpiece, in which the base is located at one end of the workpiece. At least two of the plurality of pins are connected to each other at respective second ends opposite to the first ends, thereby forming a first branch of pins exhibiting a bistable mechanism that is capable of switching between concave-convex positions in response to an external force, and at least another two of the plurality of pins are remained to have free second ends opposite to the first ends, thereby forming a second branch layered from the first branch. The first branch is switched to a concave position relative to the second branch to create a space for receiving or releasing hair, and switched to a convex position relative to the second branch to close the space for securing hair.

**[0007]** The pins forming the second branch may be all disposed between the pins forming the first branch. Alternatively, some of the pins forming the second branch are disposed between the pins forming the first branch, and the others are disposed outside the pins forming the first branch.

**[0008]** Shapes of the pins forming the second branch may be selected from lines, curves, waves, or a combination thereof, or any other suitable shape.

**[0009]** In an embodiment, adjacent two of the pins forming the second branch have respective lateral extensive structures protruding toward each other, and the lateral extensive structures are deformable to retain a resilient force when compressed by hair entering the space between the first branch and the second branch, thereby further securing hair in the hair styling device. Preferably, the lateral extensive structures are thinner than the pins where they are connected, and have conformable shapes to each other.

**[0010]** In an embodiment, the hair styling device further comprises mini-posts protruding from a specified surface of the pins forming the second branch and/or mini-posts

protruding from a specified surface of the pins forming the first branch. Preferably, the specified surface of the pins forming the second branch is the surface facing the first branch, and the specified surface of the pins forming the first branch is the surface facing the second branch.

**[0011]** The single-layer flexible workpiece for producing a hair styling device according to the present invention is made of metal, plastic or paper.

**[0012]** The present invention also provides a method for producing a hair styling device as described above. The method comprises providing a metal sheet; stamping the metal sheet to obtain the single-layer flexible workpiece defining with the base and the plurality of pins; and connecting the at least two pins for forming the first branch.

**[0013]** The present invention further provides a method for producing a hair styling device as described above. The method comprises: providing an injection-molded plastic sheet as the single-layer flexible workpiece defining with the base and the plurality of pins; and connecting the at least two pins for forming the first branch.

**[0014]** The present invention further provides a method for producing a hair styling device as described above. The method comprises: providing a 3D printed material sheet as the single-layer flexible workpiece defining with the base and the plurality of pin; and connecting the at least two pins for forming the first branch.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0015]** The above contents of the present invention will become more readily apparent to those ordinarily skilled in the art after reviewing the following detailed description and accompanying drawings, in which:

FIGS. 1A and 1B are schematic diagrams illustrating two operational states of a conventional hair styling device;

FIG. 1C is a schematic diagram illustrating another conventional hair styling device;

FIGS. 2A and 2B are schematic diagrams illustrating two operational states of still another hair styling device;

FIG. 3A is a schematic top view of a workpiece for forming a hair styling device according to an embodiment of the present invention;

FIG. 3B is a schematic top view of the hair styling device produced from the workpiece of FIG. 3A;

FIGS. 3C and 3D are schematic side views illustrating two operational states of the hair styling device of FIG. 3B;

FIGS. 4A-4D are schematic top views illustrating variations of pins of hair styling devices according to the present invention;

FIG. 5A is a schematic top view of a workpiece for forming a hair styling device according to another embodiment of the present invention;

FIG. 5B is a schematic top view of the hair styling

device produced from the workpiece of FIG. 5A;

FIG. 6A is a schematic top view of a workpiece for forming a hair styling device according to an embodiment of the present invention;

FIG. 6B is a schematic top view of the hair styling device produced from the workpiece of FIG. 6A;

FIG. 7A is a schematic top view of a workpiece for forming a hair styling device according to an embodiment of the present invention;

FIG. 7B is a schematic top view of the hair styling device produced from the workpiece of FIG. 7A;

FIGS. 7C and 7D are schematic side views illustrating two operational states of an example modified from the hair styling device of FIG. 7B;

FIGS. 7E and 7F are schematic side views illustrating two operational states of another example modified from the hair styling device of FIG. 7B;

FIG. 8A is a schematic top view of a workpiece for forming a hair styling device according to an embodiment of the present invention;

FIG. 8B is a schematic top view of the hair styling device produced from the workpiece of FIG. 8A;

FIGS. 8C and 8D are schematic side views illustrating two operational states of the hair styling device of FIG. 8B;

FIG. 9 is a schematic diagram illustrating a hair styling device according to an embodiment of the present invention, which is produced from an injection-molded workpiece;

FIG. 10 is a schematic top view of a hair styling device according to an embodiment of the present invention, which is produced from an injection-molded workpiece; and

FIG. 11 is a schematic diagram illustrating a hair styling device according to an embodiment of the present invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

**[0016]** The present invention will now be described more specifically with reference to the following embodiments. It is to be noted that the following descriptions of preferred embodiments of this invention are presented herein for purpose of illustration and description only; it is not intended to be exhaustive or to be limited to the precise form disclosed.

**[0017]** FIGS. 3A and 3B schematically illustrate an embodiment of a hair styling device according to the present invention, wherein FIG. 3A schematically illustrates a workpiece and FIG. 3B schematically illustrates a hair styling device produced from the workpiece of FIG. 3A. The workpiece is a flexible material sheet, which is integrally formed and configured as a single layer. The term "flexible," material sheet used herein and hereinafter means the material sheet is deformable when being applied with a proper intensity of external force, and restorable to its original state when the external force is re-

moved. The flexible material sheet also includes a sheet of relative rigid material, which is thin enough to be elastically deformable. The workpiece is defined with a base 31 and four pins 301, 302, 303 and 304 commonly coupled to the base 31. Respective ends 3010 and 3040 of the pins 301 and 304 are connected to define a first branch 310. The structure of the first branch 310 renders a bistable mechanism that is capable of switching between concave-convex positions in response to an external force. The pins 302 and 303 have free ends 3020 and 3030, extending in a direction substantially the same as the pins 301 and 304, and defining a second branch 320 layered from the first branch 310. The second branch 320, as a whole, is substantially flat, and does not involve any state change when the hair styling device is operated in different states. Accordingly, a hair styling device as shown in FIG. 3B can be produced. For example, the hair styling device may be used as a snap clip. In this embodiment, the pins 301-304 of the workpiece are spaced from each other, and the pins 302 and 303 forming the second branch 320 are disposed between the pines 301 and 304 forming the first branch 310. Furthermore, the length of the pins 302 and 303 are shorter than that of the pines 301 and 304. Therefore, when the hair styling device is produced as shown in FIG. 3B, the second branch 320 is completely surrounded by the first branch 310 in a top view, while the second branch 320 is in a different layer from the first branch 310 in a side elevational view.

**[0018]** The use of the hair styling device is briefly exemplified herein. First, force the first branch 310 to switch to a concave position, as illustrated in FIG. 3C, thereby creating an open space 312 together with the second branch 320. Insert the pins 302 and 303 into hair to have hair enter the hair styling device from the open space 312. Then force the first branch 310 to switch to a convex position, as illustrated in FIG. 3D, thereby closing the opening space 312 together with the second branch 320 for securing hair therein. For releasing hair, force the first branch 310 to switch to the concave position again.

**[0019]** In the embodiment illustrated in FIG. 3, the pins 301-304 are linear and flat. In other embodiments, one or more of the pins may be independently modified to have alternative configurations according to practical requirements. FIGS. 4A-4D schematically illustrate examples of variations of pins according to the present invention. For example, as shown in FIG. 4A, the pins 302 and 303 are curved. In the example shown in FIG. 4B, the pins 302 and 303 are made wavy in a direction normal to the plane of the second branch 320 and/or in a directional conformal to the plane of the second branch 320. This embodiment is advantageous in enhancing the frictional force with hair clamped therein and thus improving clamping performance. Referring to FIG. 4C and FIG. 4D, for further stabilizing the hair styling device in hair, a lateral extensive structure 321 may be provided at one or both sides of the pin. The lateral extensive structure 321 is advantageous in enlarging the interaction area

with hair. It is to be noted that the term "lateral,, extensive structure means the structure 321 extends from the pin 302 or 303 in a direction substantially conformal to the plane of the second branch 320. The lateral extensive structure 321 may extend a little upper or lower relative to the plane of the second branch 320 as long as the function of the lateral extensive structure 321 can be conducted. Preferably, the lateral extensive structure 321 is thinner than the pin that it is connected to. The thin and flexible feature of the lateral extensive structure provides an elastically deformable feature to the hair styling device so as to further secure the clamped hair.

**[0020]** FIGS. 5A and 5B schematically illustrate an embodiment of a hair styling device according to the present invention, wherein FIG. 5A schematically illustrates a workpiece and FIG. 5B schematically illustrates a hair styling device produced from the workpiece of FIG. 5A. The workpiece is a flexible material sheet, which is integrally formed and configured as a single layer. The workpiece is defined with a base 51 and six pins 501, 502, 503, 504, 505 and 506 commonly coupled to the base 51. Respective ends 5020 and 5050 of the pins 502 and 505 are connected to define a first branch 510. The structure of the first branch 510 renders a bistable mechanism that is capable of switching between concave-convex positions in response to an external force. The pins 501, 503, 504 and 506 have free ends 5010, 5030, 5040 and 5060, extending in a direction substantially the same as the pins 502 and 505, and defining a second branch 520 layered from the first branch 510. The second branch 520, as a whole, is substantially flat, and does not involve any state change when the hair styling device is operated in different states. Accordingly, a hair styling device as shown in FIG. 5B can be produced. For example, the hair styling device may be used as a snap clip. In this embodiment, the pins 501-506 of the workpiece are spaced from each other, the pins 503 and 504 forming the second branch 520 are disposed between the pines 501 and 505 forming the first branch 510, and the pins 501 and 506 forming the second branch 520 are disposed outside the pines 501 and 505 forming the first branch 510. Furthermore, the length of the pins 503 and 504 are shorter than that of the pines 502 and 505, while the length of the pins 501 and 506 are longer than that of the pines 502 and 505. Therefore, when the hair styling device is produced as shown in FIG. 5B, the second branch 520 is partially distributed inside and partially distributed outside the first branch 510 in a top view, while the second branch 520 is in a different layer from the first branch 510 in a side elevational view. It is to be noted that the number and length of the pins forming the second branch 520 in each of the embodiments described herein, hereinbefore and hereinafter may properly change depending on practical requirements. By simultaneously inserting the four pins 501, 503, 504 and 506 into hair, the hair styling device can be used in more stable way. Furthermore, a variety of modifications to the pins, e.g. those shown in FIG. 4, can be made for improved functions and/or decoration

purposes.

**[0021]** FIGS. 6A and 6B schematically illustrate an embodiment of a hair styling device according to the present invention, wherein FIG. 6A schematically illustrates a workpiece and FIG. 6B schematically illustrates a hair styling device produced from the workpiece of FIG. 6A. The workpiece is a flexible material sheet, which is integrally formed and configured as a single layer. The workpiece is defined with a base 61 and nine pins 601, 602, 603, 604, 605, 606, 607, 608 and 609 commonly coupled to the base 61. Respective ends 6030 and 6070 of the pins 603 and 607 are connected to define a first branch 610. The structure of the first branch 610 renders a bistable mechanism that is capable of switching between concave-convex positions in response to an external force. The pins 601, 602, 604, 605, 606, 608 and 609 have free ends 6010, 6020, 6040, 6050, 6060, 6080 and 6090, extending in a direction substantially the same as the pins 603 and 607, and defining a second branch 620 layered from the first branch 610. The second branch 620, as a whole, is substantially flat, and does not involve any state change when the hair styling device is operated in different states. Accordingly, a hair styling device as shown in FIG. 6B can be produced. For example, the hair styling device may be used as a snap clip. In this embodiment, the pins 601-609 of the workpiece are spaced from each other, the pins 604, 605 and 606 forming the second branch 620 are disposed between the pines 603 and 607 forming the first branch 610, and the pins 601, 602, 608 and 609 forming the second branch 620 are disposed outside the pines 603 and 607 forming the first branch 610. Therefore, when the hair styling device is produced as shown in FIG. 6B, the second branch 620 is partially distributed inside and partially distributed outside the first branch 610 in a top view, while the second branch 620 is in a different layer from the first branch 610 in a side elevational view. By simultaneously inserting the seven pins 601, 602, 604, 605, 606, 608 and 609 into hair, the hair styling device can be used in more stable way, and function like a comb clip. Furthermore, a variety of modifications to the pins, e.g. those shown in FIG. 4, can be made for improved functions and/or decoration purposes. The hair styling device in this embodiment further includes lateral extensive structures 621. The lateral extensive structures 621 extending from a pair of adjacent pins extend into a gap between the adjacent pins. The lateral extensive structures are thinner than the pins where they are connected, and have conformable shapes to each other. The lateral extensive structures 621 are deformable to retain a resilient force when compressed by hair entering the space between the first branch 610 and the second branch 620, thereby further securing hair in the hair styling device.

**[0022]** FIGS. 7A and 7B schematically illustrate an embodiment of a hair styling device according to the present invention, wherein FIG. 7A schematically illustrates a workpiece and FIG. 7B schematically illustrates a hair styling device produced from the workpiece of FIG. 7A.

The workpiece is a flexible material sheet, which is integrally formed and configured as a single layer. The workpiece is defined with a base 71 and seven pins 701, 702, 703, 704, 705, 706, 707, 708 and 709 commonly coupled to the base 71. Respective ends 7020 and 7060 of the pins 702 and 706 are connected to define a first branch 710. The structure of the first branch 710 renders a bistable mechanism that is capable of switching between concave-convex positions in response to an external force. The pins 701, 703, 704, 705 and 707 have free ends 7010, 7030, 7040, 7050 and 7070, extending in a direction substantially the same as the pins 702 and 706, and defining a second branch 720 layered from the first branch 710. In this embodiment, Respective ends 7030 and 7050 of the pins 703 and 705 are connected as a composite pin of the second branch 710, which may be considered to have a free end as a whole. The structure of the composite pin renders a bistable mechanism that is capable of switching between concave-convex positions in response to an external force. Accordingly, a hair styling device as shown in FIG. 7B can be produced. For example, the hair styling device may be used as a snap clip. In this embodiment, the pins 701-707 of the workpiece are spaced from each other, the pins 703, 704 and 705 forming the second branch 720 are disposed between the pines 702 and 706 forming the first branch 710, and the pins 701 and 707 forming the second branch 720 are disposed outside the pines 702 and 706 forming the first branch 710. Therefore, when the hair styling device is produced as shown in FIG. 7B, the second branch 720 is partially distributed inside and partially distributed outside the first branch 710 in a top view, while the second branch 720 is in a different layer from the first branch 710 in a side elevational view. Furthermore, the composite pin is further layered from the other part of the second branch 720. When in use, the pins 710, 704 and 707 of the second branch is first inserted into hair. Then the pins 703 and 705 are forced to switch to a convex position to close and clamp hair together with the pins 710, 704 and 707. Afterwards, more hair may be put inside the open space between the pins 702 and 706 forming the first branch 710 and the pins 701, 703, 704, 705 and 707 forming the second branch 720, and the first branch 710 is forced to switch to a convex position to close the open space, thereby securing more hair thereinside.

**[0023]** The configurations of the entire hair styling device may vary with the distribution of lengths of the pins 703, 704 and 705. As shown in FIG. 7C and 7D, which schematically illustrate an open state, e.g. a preparatory state, and a closed state, e.g. a working state, the pins 702 and 706 forming the first branch 710 are longer than the pins 703 and 705 forming the composite pin of the second branch 720, which are further longer than the pins 701, 704 and 707 forming the other part of the second branch 720. Alternatively, as shown in FIG. 7E and 7F, which schematically illustrate an open state, e.g. a preparatory state, and a closed state, e.g. a working state, the pins 702 and 706 forming the first branch 710 are

shorter than the pins 703 and 705 forming the composite pin of the second branch 720, which are longer than the pins 701, 704 and 707 forming the other part of the second branch 720. It is to be noted that the number and positions of pins in the second branch to be configured as a composite pin may vary with practical requirements, and the number and positions of composite pins may also vary with practical requirements.

**[0024]** FIGS. 8A and 8B schematically illustrate an embodiment of a hair styling device according to the present invention, wherein FIG. 8A schematically illustrates a workpiece and FIG. 8B schematically illustrates a hair styling device produced from the workpiece of FIG. 8A. The workpiece and the resulting hair styling device are similar to those shown in FIG. 3A and 3B, except that there are mini-posts, e.g. teeth or bumps, disposed on surfaces of selected pins, forming an auxiliary structure 370. In this embodiment, the mini-posts extend from lateral surfaces of the pins as the auxiliary structure 370 is integrally formed with the workpiece. Of course, the mini-posts may be provided in alternative ways such as adhesion. By folding the mini-posts of the workpiece toward the space wherein hair is accommodated, a hair styling device having a structure as shown in FIG. 8B, and switchable between two states as shown in FIGS. 8C and 8D can be produced. The auxiliary structure 370 is advantageous in grasping hair. It is understood that any of the previously described embodiments of hair styling device may be provided with the auxiliary structure 370, and it is not intended to redundantly describe the details.

**[0025]** The workpiece used in the above-described embodiments and other embodiments modified from those embodiments according to the present invention may be formed of any proper flexible material and produced in a variety of ways. The materials, for example, include metal, plastic, paper, bamboo or any other relative rigid material with small thickness. When metal is used, a metal sheet is processed into a single-layer workpiece defined with a base and a plurality of pins and optional lateral extensive structure and/or auxiliary structure by way of stamping, and then associated pins are connected to form a hair styling device. Alternatively, the single-layer workpiece defined with a base and a plurality of pins and optional lateral extensive structure and/or auxiliary structure may also be produced by way of other techniques such as injection molding of plastic or three-dimensional (3D) printing of proper material. Particularly when the size of pins, gap between pins, extensive structure from pins, and/or auxiliary structures are small, injection molding or three-dimensional (3D) printing might be a better solution than stamping. For example, when producing a hair styling device as illustrated in FIG. 9, it is preferred to use injection molding to form a workpiece defined with a base 91, a first branch 910, a second branch 920 and an auxiliary structure 970 since the mini-posts 970 can be integrally formed, i.e. directly produced, with the other parts of the workpiece.

**[0026]** As long as the principles and purposes of the

present invention can be achieved, the shapes, sizes and positions exemplified in different embodiments may be modified and combined according to practical requirements. For example, a hair styling device as illustrated in FIG. 10 includes various features of the above-described embodiments.

**[0027]** Please further refer to FIG. 11. The embodiment illustrated in FIG. 11 is similar to that shown in FIG. 3B except that an auxiliary structure 350 is provided. The auxiliary structure 350 includes three pins 311, 312 and 313 extending from another side of the base 31, opposite to the other pins 310-304. The pins 311, 312 and 313 may be integrally formed with the single-layer workpiece defined with the base 31 and the pins 301-304, and disposed under the second branch 320 by folding the workpiece from the base 31. When in use, the auxiliary structure 350 and the second branch 320 disposed in different layers are both inserted into hair, and then the first branch 310 is forced to switch to the convex position to clamp hair together with the second branch 320 and auxiliary structure 350. Since there are two layers of hair clamped inside the hair styling device, better clamping performance can be achieved, particularly for thick hair. The pins of the auxiliary structure 350 may overlap or stagger from the pins of the second branch 320. An overlapping configuration facilitates physical clamping between pins, while a staggering configuration exhibits slide-hindering capability.

**[0028]** In view of the foregoing, a hair styling device according to the present invention is cost-effective, laboring-effective, light and stable for use.

## Claims

1. A hair styling device, comprising:

a base (31, 51, 61, 71, 91); and  
a plurality of pins (301-304, 501-506, 601-609, 701-707) having respective first ends connected to a first side of the base (31, 51, 61, 71, 91), and spaced from each other,

**characterized in that:**

the base (31, 51, 61, 71, 91) and the plurality of pins (301-304, 501-506, 601-609, 701-707) are produced from a single-layer flexible workpiece, in which the base (31, 51, 61, 71, 91) is located at one end of the workpiece,

at least two of the plurality of pins (301 and 304, 502 and 505, 603 and 607, 702 and 706) are connected to each other at respective second ends (3010 and 3040, 5020 and 5050, 6030 and 6070, 7020 and 7060) opposite to the first ends, thereby forming a first branch of pins (310, 510, 610, 710, 910) exhibiting a bistable mechanism that is ca-

- pable of switching between concave-convex positions in response to an external force,
- at least another two of the plurality of pins (302, 303, 501, 503, 504, 506, 601, 602, 604, 605, 606, 608, 609, 701, 702, 703, 704, 705, 707) are remained to have free second ends (3020, 3030, 5010, 5030, 5040, 5060, 6010, 6020, 6040, 6050, 6060, 6080, 6090, 7010, 7020, 7030, 7040, 7050, 7070) opposite to the first ends, thereby forming a second branch (320, 520, 620, 720, 920) layered from the first branch (310, 510, 610, 710, 910), and
- the first branch (310, 510, 610, 710, 910) is switched to a concave position relative to the second branch (320, 520, 620, 720, 920) to create a space (312) for receiving or releasing hair, and switched to a convex position relative to the second branch (320, 520, 620, 720, 920) to close the space (312) for securing hair.
2. The hair styling device according to claim 1, **characterized in that** all the pins (302, 303) forming the second branch (320) are disposed between the pins (301 and 304) forming the first branch (310) or the pins (501, 503, 504, 506, 601, 602, 604, 605, 606, 608, 609, 701, 702, 703, 704, 705, 707) forming the second branch (520, 620, 720, 920) are partially disposed between the pins (502 and 505, 603 and 607, 702 and 706) forming the first branch (510, 610, 710, 910) and partially outside the first branch (510, 610, 710, 910).
  3. The hair styling device according to claim 1 or 2, **characterized in that** at least one of the pins (703, 705) forming the second branch (720) is a composite pin formed by connecting two of the plurality of pins (703, 705) at respective second ends (7030, 7050) opposite to the first ends, thereby forming a bistable mechanism that is capable of switching between concave-convex positions in response to an external force.
  4. The hair styling device according to any of claims 1 to 3, **characterized in that** shapes of the pins (302, 303, 501, 503, 504, 506, 601, 602, 604, 605, 606, 608, 609, 701, 702, 703, 704, 705, 707) forming the second branch (320, 520, 620, 720, 920) are selected from a group consisting of lines, curves, waves and a combination thereof.
  5. The hair styling device according to claims 1 to 4, **characterized in that** adjacent two of the pins (302 and 303, 601 and 602, 604 and 605, 605 and 606, 608 and 609) forming the second branch (320, 620) have respective lateral extensive structures (321, 621) protruding toward each other, and the lateral extensive structures (321, 621) are deformable to retain a resilient force when compressed by hair entering the space between the first branch (310, 610) and the second branch (320, 620), thereby further securing hair in the hair styling device.
  6. The hair styling device according to any of claims 5, **characterized in that** the lateral extensive structures (321, 621) are thinner than the pins (302 and 303, 601 and 602, 604 and 605, 605 and 606, 608 and 609) connected thereto, and have conformable shapes to each other.
  7. The hair styling device according to claim 5 or 6, **characterized in that** lateral extensive structures (321, 621) are produced from the single-layer flexible workpiece together with the base (31, 61) and the plurality of pins (301-304, 601-609).
  8. The hair styling device according to any of claims 1 to 7, further comprising mini-posts (370) protruding from a specified surface of the pins forming the second branch (320).
  9. The hair styling device according to any of claims 1 to 8, **characterized in** further comprising mini-posts (970) protruding from a specified surface of the pins forming the first branch (910).
  10. The hair styling device according to claim 9, **characterized in that** the specified surface of the pins forming the second branch is the surface facing the first branch, and the specified surface of the pins forming the first branch is the surface facing the second branch.
  11. The hair styling device according to any of claims 1 to 10, **characterized in** further comprising an auxiliary structure (350) connected to a second side of the base (31) opposite to the first side, and disposed at a side of the second branch (320) opposite to the first branch (310).
  12. The hair styling device according to any of claims 1 to 11, **characterized in that** the single-layer flexible workpiece is made of metal, plastic or paper.
  13. A method for producing a hair styling device as recited in any of claims 1 to 12, **characterized in** comprising:
    - providing a metal sheet;
    - stamping the metal sheet to obtain the single-layer flexible workpiece defining with the base (31, 51, 61, 71, 91) and the plurality of pins; and
    - connecting the at least two pins (301 and 304, 502 and 505, 603 and 607, 702 and 706) for

forming the first branch (310).

14. A method for producing a hair styling device as recited in any of claims 1 to 12, **characterized in** comprising:

providing an injection-molded plastic sheet as the single-layer flexible workpiece defining with the base (31, 51, 61, 71, 91) and the plurality of pins (301-304, 501-506, 601-609, 701-707); and connecting the at least two pins (301 and 304, 502 and 505, 603 and 607, 702 and 706) for forming the first branch (310).

15. A method for producing a hair styling device as recited in any of claims 1 to 12, **characterized in** comprising:

providing a 3D printed material sheet as the single-layer flexible workpiece defining with the base (31, 51, 61, 71, 91) and the plurality of pins; and connecting the at least two pins (301 and 304, 502 and 505, 603 and 607, 702 and 706) for forming the first branch (310).

#### Patentansprüche

1. Haarstylingvorrichtung, umfassend:

eine Basis (31, 51, 61, 71, 91); und eine Vielzahl von Nadeln (301-304, 501-506, 601-609, 701-707), die jeweilige erste Enden aufweisen, die mit einer ersten Seite der Basis (31, 51, 61, 71, 91) verbunden sind und voneinander beabstandet sind,

**dadurch gekennzeichnet, dass:**

die Basis (31, 51, 61, 71, 91) und die Vielzahl von Nadeln (301-304, 501 - 506, 601-609, 701-707) aus einem einlagigen biegsamen Werkstück hergestellt sind, wobei sich die Basis (31, 51, 61, 71, 91) an einem Ende des Werkstücks befindet, wenigstens zwei der Vielzahl von Nadeln (301 und 304, 502 und 505, 603 und 607, 702 und 706) an jeweiligen zweiten Enden (3010 und 3040, 5020 und 5050, 6030 und 6070, 7020 und 7060), die den ersten Enden gegenüberliegen, miteinander verbunden sind, wodurch sie einen ersten Arm von Nadeln (310, 510, 610, 710, 910) bilden, der einen bistabilen Mechanismus darstellt, der imstande ist, als Reaktion auf eine externe Kraft zwischen konkav-konvexen Positionen zu wechseln, wenigstens zwei weitere der Vielzahl von

Nadeln (302, 303, 501, 503, 504, 506, 601, 602, 604, 605, 606, 608, 609, 701, 702, 703, 704, 705, 707) übriggelassen werden, um freie zweite Enden (3020, 3030, 5010, 5030, 5040, 5060, 6010, 6020, 6040, 6050, 6060, 6080, 6090, 7010, 7020, 7030, 7040, 7050, 7070) aufzuweisen, die den ersten Enden gegenüberliegen, wodurch sie einen zweiten Arm (320, 520, 620, 720, 920) bilden, der von dem ersten Arm (310, 510, 610, 710, 910) überlagert ist, und der erste Arm (310, 510, 610, 710, 910) in eine konkave Position relativ zu dem zweiten Arm (320, 520, 620, 720, 920) umgestellt wird, um einen Raum (312) zum Aufnehmen oder Freigeben von Haar zu bilden, und in eine konvexe Position relativ zu dem zweiten Arm (320, 520, 620, 720, 920) umgestellt wird, um den Raum (312) zum Festhalten von Haar zu schließen.

2. Haarstylingvorrichtung nach Anspruch 1, wobei alle Nadeln (302, 303), die den zweiten Arm (320) bilden, zwischen den Nadeln (301 und 304) angeordnet sind, die den ersten Arm (310) bilden, oder die Nadeln (501, 503, 504, 506, 601, 602, 604, 605, 606, 608, 609, 701, 702, 703, 704, 705, 707), die den zweiten Arm (520, 620, 720, 920) bilden, teilweise zwischen den Nadeln (502 und 505, 603 und 607, 702 und 706), die den ersten Arm (510, 610, 710, 910) bilden, und teilweise außerhalb des ersten Arms (510, 610, 710, 910) angeordnet sind.
3. Haarstylingvorrichtung nach Anspruch 1 oder 2, wobei wenigstens eine der Nadeln (703, 705), die den zweiten Arm (720) bilden, eine zusammengesetzte Nadel ist, die gebildet wird, indem zwei der Vielzahl von Nadeln (703, 705) an jeweiligen zweiten Enden (7030, 7050) gegenüber den ersten Enden miteinander verbunden werden, wodurch ein bistabiler Mechanismus gebildet wird, der imstande ist, als Reaktion auf eine externe Kraft zwischen konkav-konvexen Positionen zu wechseln.
4. Haarstylingvorrichtung nach einem der Ansprüche 1 bis 3, wobei Formen der Nadeln (302, 303, 501, 503, 504, 506, 601, 602, 604, 605, 606, 608, 609, 701, 702, 703, 704, 705, 707), die den zweiten Arm (320, 520, 620, 720, 920) bilden, aus einer Gruppe ausgewählt sind, die aus Linien, Kurven, Wellen und einer Kombination davon besteht.
5. Haarstylingvorrichtung nach einem der Ansprüche 1 bis 4, wobei zwei benachbarte der Nadeln (302 und 303, 601 und 602, 604 und 605, 605 und 606, 608 und 609), die den zweiten Arm (320, 620) bilden, jeweilige seitliche ausgedehnte Strukturen (321, 621) aufweisen, die zueinander hin vorragen, und



- die seitlichen ausgedehnten Strukturen (321, 621) verformbar sind, um eine Federkraft zu speichern, wenn sie durch Haar zusammengedrückt werden, das in den Raum zwischen dem ersten Arm (310, 610) und dem zweiten Arm (320, 620) eintritt, wodurch das Haar in der Haarstylingvorrichtung weiter festgehalten wird.
- 5
6. Haarstylingvorrichtung nach Anspruch 5, wobei die seitlichen ausgedehnten Strukturen (321, 621) dünner als die damit verbundenen Nadeln (302 und 303, 601 und 602, 604 und 605, 605 und 606, 608 und 609) sind und aneinander anpassbare Formen aufweisen.
- 10
7. Haarstylingvorrichtung nach Anspruch 5 oder 6, wobei die seitlichen ausgedehnten Strukturen (321, 621) zusammen mit der Basis (31, 61) und der Vielzahl von Nadeln (301-304, 601-609) aus dem einlagigen biegsamen Werkstück hergestellt sind.
- 15
8. Haarstylingvorrichtung nach einem der Ansprüche 1 bis 7, ferner umfassend Mini-Vorsprünge (370), die von einer bestimmten Oberfläche der Nadeln vorragen, die den zweiten Arm (320) bilden.
- 20
9. Haarstylingvorrichtung nach einem der Ansprüche 1 bis 8, wobei sie ferner Mini-Vorsprünge (970) umfasst, die von einer bestimmten Oberfläche der Nadeln vorragen, die den ersten Arm (910) bilden.
- 25
10. Haarstylingvorrichtung nach Anspruch 9, wobei die bestimmte Oberfläche der Nadeln, die den zweiten Arm bilden, die Oberfläche ist, die dem ersten Arm zugewandt ist, und die bestimmte Oberfläche der Nadeln, die den ersten Arm bilden, die Oberfläche ist, die dem zweiten Arm zugewandt ist.
- 30
11. Haarstylingvorrichtung nach einem der Ansprüche 1 bis 10, wobei sie ferner eine Hilfsstruktur (350) umfasst, die mit einer zweiten Seite der Basis (31) verbunden ist, die der ersten Seite gegenüberliegt, und die auf einer Seite des zweiten Arms (320) angeordnet ist, die dem ersten Arm (310) gegenüberliegt.
- 35
12. Haarstylingvorrichtung nach einem der Ansprüche 1 bis 11, wobei das einlagige biegsame Werkstück aus Metall, Kunststoff oder Papier hergestellt ist.
- 40
13. Verfahren zur Herstellung einer Haarstylingvorrichtung nach einem der Ansprüche 1 bis 12, **gekennzeichnet durch:**
- 45
- Bereitstellen einer Metallplatte;  
Stanzen der Metallplatte, um das einlagige biegsame Werkstück zu erhalten, das durch die Basis (31, 51, 61, 71, 91) und die Vielzahl von Na-
- 50
- 55
- deln definiert wird; und  
Verbinden der wenigstens zwei Nadeln (301 und 304, 502 und 505, 603 und 607, 702 und 706), um den ersten Arm (310) zu bilden.
14. Verfahren zur Herstellung einer Haarstylingvorrichtung nach einem der Ansprüche 1 bis 12, **gekennzeichnet durch:**
- Bereitstellen einer spritzgegossenen Kunststoffplatte als einlagiges biegsames Werkstück, das durch die Basis (31, 51, 61, 71, 91) und die Vielzahl von Nadeln (301-304, 501-506, 601-609, 701-707) definiert wird; und  
Verbinden der wenigstens zwei Nadeln (301 und 304, 502 und 505, 603 und 607, 702 und 706), um den ersten Arm (310) zu bilden.
15. Verfahren zur Herstellung einer Haarstylingvorrichtung nach einem der Ansprüche 1 bis 12, **gekennzeichnet durch:**
- Bereitstellen einer 3D-gedruckten Materialplatte als einlagiges biegsames Werkstück, das durch die Basis (31, 51, 61, 71, 91) und die Vielzahl von Nadeln definiert wird; und  
Verbinden der wenigstens zwei Nadeln (301 und 304, 502 und 505, 603 und 607, 702 und 706), um den ersten Arm (310) zu bilden.
- Revendications**
1. Dispositif de coiffure, comprenant :
- une base (31, 51, 61, 71, 91) ; et  
une pluralité de tiges (301 à 304, 501 à 506, 601 à 609, 701 à 707) ayant des premières extrémités respectives reliées à un premier côté de la base (31, 51, 61, 71, 91), et espacées les unes des autres,  
**caractérisé en ce que :**
- la base (31, 51, 61, 71, 91) et la pluralité de tiges (301 à 304, 501 à 506, 601 à 609, 701 à 707) sont produites à partir d'une pièce de fabrication flexible monocouche, dans laquelle la base (31, 51, 61, 71, 91) est située au niveau d'une extrémité de la pièce de fabrication,  
au moins deux de la pluralité de tiges (301 et 304, 502 et 505, 603 et 607, 702 et 706) sont reliées l'une à l'autre au niveau de secondes extrémités (3010 et 3040, 5020 et 5050, 6030 et 6070, 7020 et 7060) respectives opposées aux premières extrémités, formant ainsi une première branche de tiges (310, 510, 610, 710, 910) présentant un mé-

- canisme bistable qui est capable de permuter entre des positions concave et convexe en réponse à une force externe, au moins deux autres de la pluralité de tiges (302, 303, 501, 503, 504, 506, 601, 602, 604, 605, 606, 608, 609, 701, 702, 703, 704, 705, 707) sont restées pour avoir des secondes extrémités libres (3020, 3030, 5010, 5030, 5040, 5060, 6010, 6020, 6040, 6050, 6060, 6080, 6090, 7010, 7020, 7030, 7040, 7050, 7070) opposées aux premières extrémités, formant ainsi une seconde branche (320, 520, 620, 720, 920) en couche par rapport à la première branche (310, 510, 610, 710, 910), et la première branche (310, 510, 610, 710, 910) est permutée à une position concave par rapport à la seconde branche (320, 520, 620, 720, 920) pour créer un espace (312) permettant de recevoir ou de libérer des cheveux, et permutée à une position convexe par rapport à la seconde branche (320, 520, 620, 720, 920) pour fermer l'espace (312) afin d'attacher les cheveux.
2. Dispositif de coiffure selon la revendication 1, **caractérisé en ce que** toutes les tiges (302, 303) formant la seconde branche (320) sont disposées entre les tiges (301 et 304) formant la première branche (310) ou les tiges (501, 503, 504, 506, 601, 602, 604, 605, 606, 608, 609, 701, 702, 703, 704, 705, 707) formant la seconde branche (520, 620, 720, 920) sont disposées partiellement entre les tiges (502 et 505, 603 et 607, 702 et 706) formant la première branche (510, 610, 710, 910) et partiellement à l'extérieur de la première branche (510, 610, 710, 910).
  3. Dispositif de coiffure selon la revendication 1 ou 2, **caractérisé en ce qu'**au moins l'une des tiges (703, 705) formant la seconde branche (720) est une tige composite formée en reliant deux de la pluralité de tiges (703, 705) au niveau de secondes extrémités (7030, 7050) respectives opposées aux premières extrémités, formant ainsi un mécanisme bistable qui est capable de permuter entre des positions concave et convexe en réponse à une force externe.
  4. Dispositif de coiffure selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** des formes des tiges (302, 303, 501, 503, 504, 506, 601, 602, 604, 605, 606, 608, 609, 701, 702, 703, 704, 705, 707) formant la seconde branche (320, 520, 620, 720, 920) sont sélectionnées dans un groupe constitué de lignes, de courbes, d'ondulations et d'une combinaison de celles-ci.
  5. Dispositif de coiffure selon les revendications 1 à 4, **caractérisé en ce que** deux tiges adjacentes des tiges (302 et 303, 601 et 602, 604 et 605, 605 et 606, 608 et 609) formant la seconde branche (320, 620) ont des structures extensives latérales (321, 621) respectives en saillie l'une vers l'autre, et les structures extensives latérales (321, 621) sont déformables pour garder une force résiliente lorsqu'elles sont comprimées par des cheveux entrant dans l'espace entre la première branche (310, 610) et la seconde branche (320, 620), attachant ainsi davantage des cheveux dans le dispositif de coiffure.
  6. Dispositif de coiffure selon la revendication 5, **caractérisé en ce que** les structures extensives latérales (321, 621) sont plus minces que les tiges (302 et 303, 601 et 602, 604 et 605, 605 et 606, 608 et 609) reliées à celles-ci, et ont des formes conformables l'une à l'autre.
  7. Dispositif de coiffure selon la revendication 5 ou 6, **caractérisé en ce que** des structures extensives latérales (321, 621) sont produites à partir de la pièce de fabrication flexible monocouche conjointement avec la base (31, 61) et la pluralité de tiges (301 à 304, 601 à 609).
  8. Dispositif de coiffure selon l'une quelconque des revendications 1 à 7, comprenant en outre des mini-montants (370) en saillie depuis une surface spécifiée des tiges formant la seconde branche (320).
  9. Dispositif de coiffure selon l'une quelconque des revendications 1 à 8, **caractérisé en ce qu'il** comprend en outre des mini-montants (970) en saillie depuis une surface spécifiée des tiges formant la première branche (910).
  10. Dispositif de coiffure selon la revendication 9, **caractérisé en ce que** la surface spécifiée des tiges formant la seconde branche est la surface en face de la première branche, et la surface spécifiée des tiges formant la première branche est la surface en face de la seconde branche.
  11. Dispositif de coiffure selon l'une quelconque des revendications 1 à 10, **caractérisé en ce qu'il** comprend en outre une structure auxiliaire (350) reliée à un second côté de la base (31) opposé au premier côté, et disposée d'un côté de la seconde branche (320) opposé à la première branche (310).
  12. Dispositif de coiffure selon l'une quelconque des revendications 1 à 11, **caractérisé en ce que** la pièce de fabrication flexible monocouche est en métal, en plastique, ou en papier.
  13. Procédé de production d'un dispositif de coiffure selon l'une quelconque des revendications 1 à 12, **caractérisé en ce qu'il** comprend :

la fourniture d'une feuille de métal ;  
 l'estampage de la feuille de métal pour obtenir  
 la pièce de fabrication flexible monocouche définissant la base (31, 51, 61, 71, 91) et la pluralité  
 de tiges ; et 5  
 la liaison des au moins deux tiges (301 et 304,  
 502 et 505, 603 et 607, 702 et 706) afin de former  
 la première branche (310).

14. Procédé de production d'un dispositif de coiffure selon l'une quelconque des revendications 1 à 12, **caractérisé en ce qu'il** comprend : 10

la fourniture d'une feuille de plastique moulée  
 par injection en tant que la pièce de fabrication flexible monocouche définissant la base (31, 51,  
 61, 71, 91) et la pluralité de tiges (301 à 304, 501 à 506, 601 à 609, 701 à 707) ; et 15  
 la liaison des au moins deux tiges (301 et 304,  
 502 et 505, 603 et 607, 702 et 706) afin de former 20  
 la première branche (310).

15. Procédé de production d'un dispositif de coiffure selon l'une quelconque des revendications 1 à 12, **caractérisé en ce qu'il** comprend : 25

la fourniture d'une feuille de matériau imprimée  
 en 3D en tant que la pièce de fabrication flexible monocouche définissant la base (31, 51, 61, 71,  
 91) et la pluralité de tiges ; et 30  
 la liaison des au moins deux tiges (301 et 304,  
 502 et 505, 603 et 607, 702 et 706) afin de former  
 la première branche (310).

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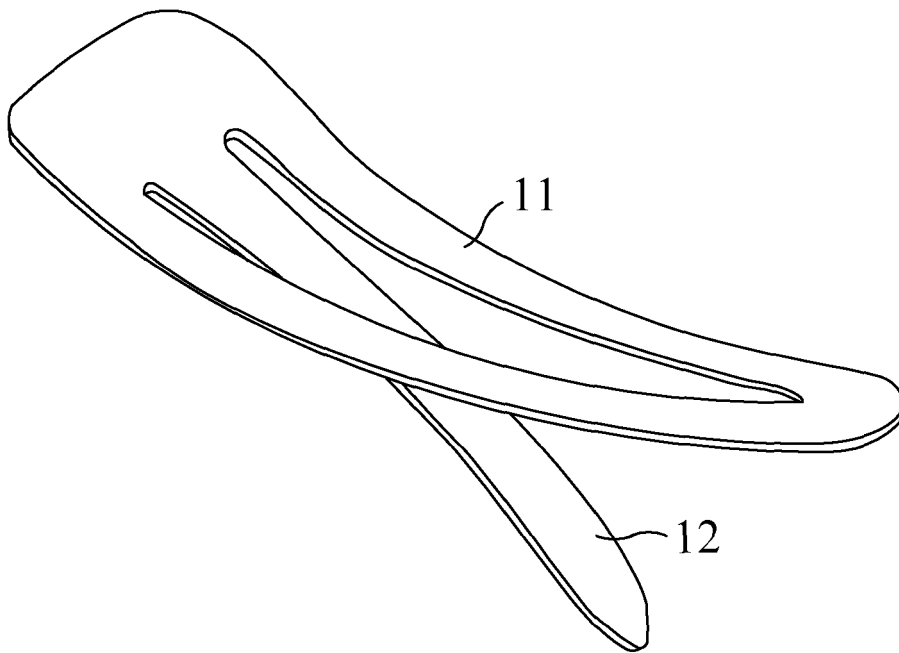


FIG. 1A (Prior Art)

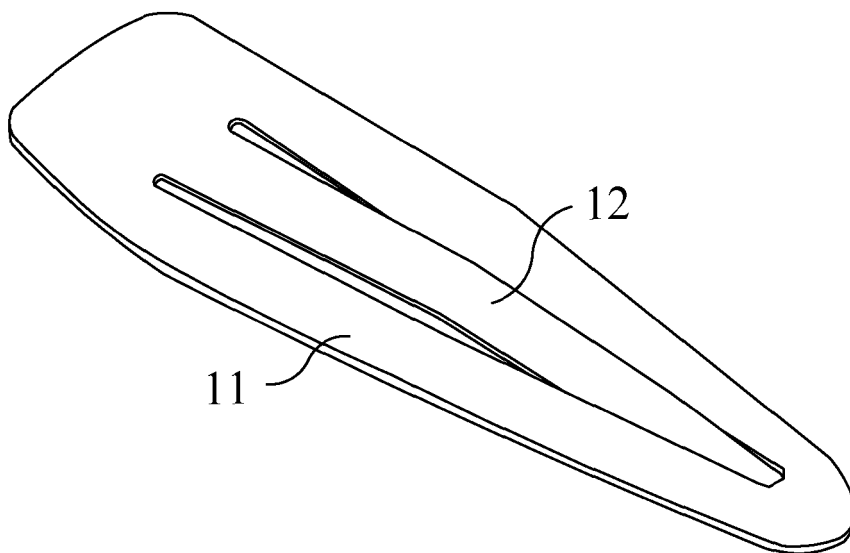


FIG. 1B (Prior Art)

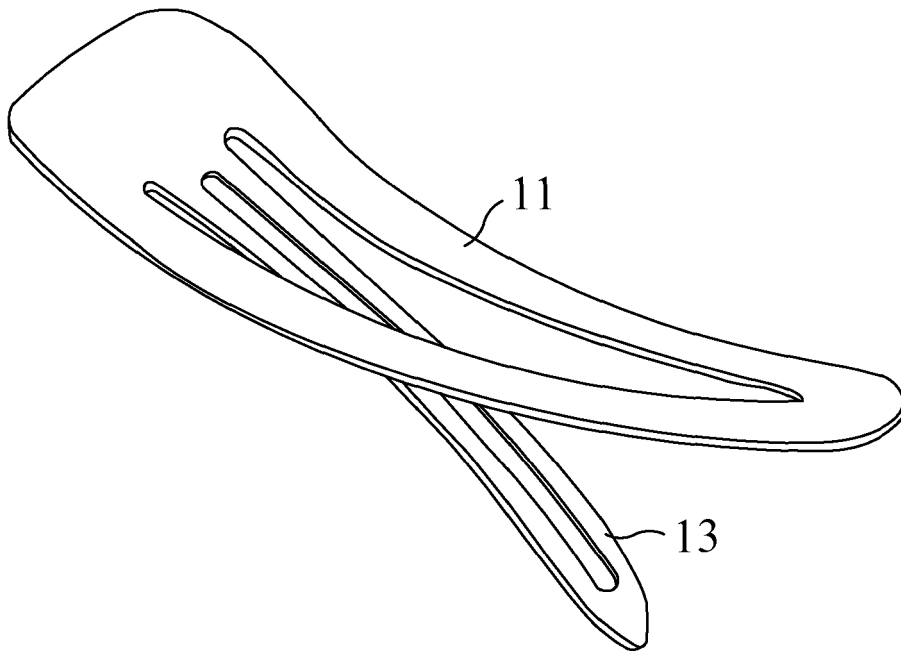


FIG. 1C (Prior Art)

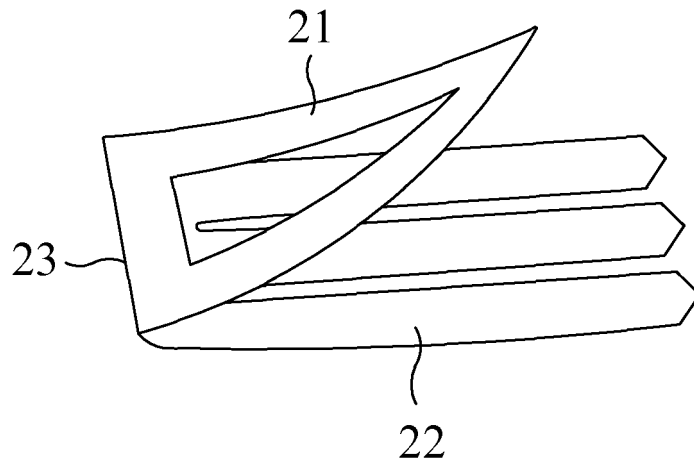


FIG. 2A (Prior Art)

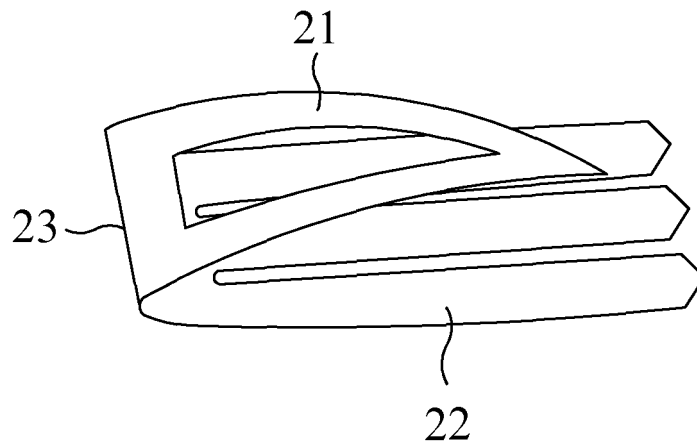


FIG. 2B (Prior Art)

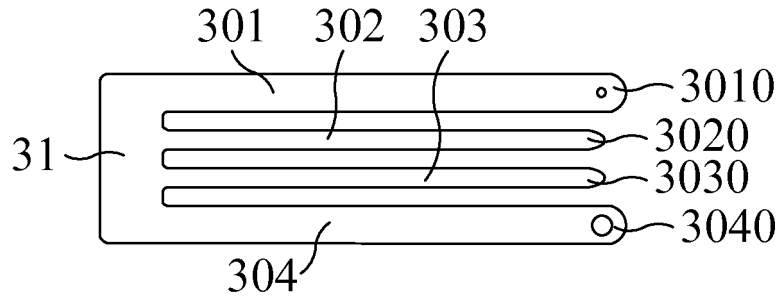


FIG. 3A

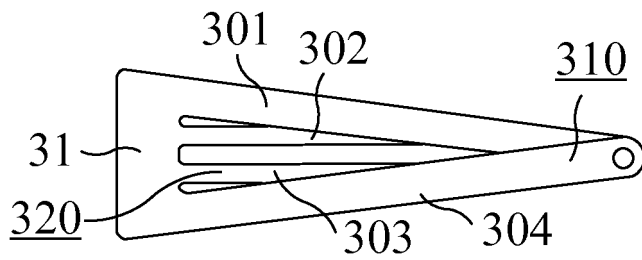


FIG. 3B

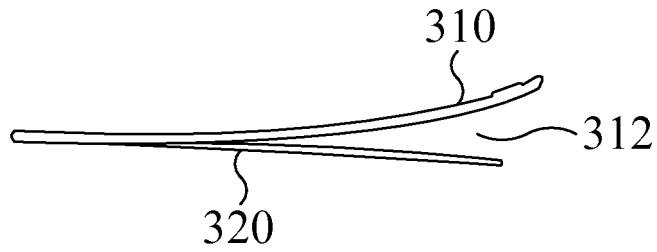


FIG. 3C

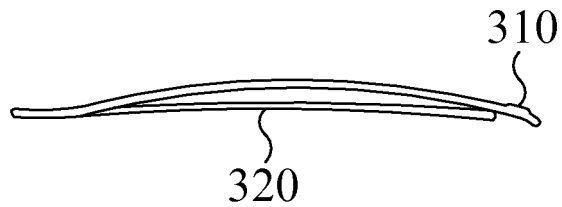


FIG. 3D

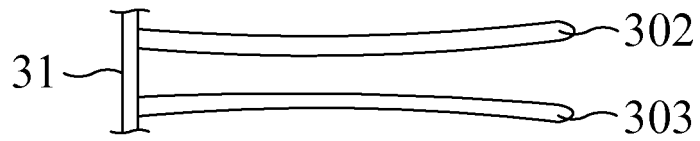


FIG. 4A

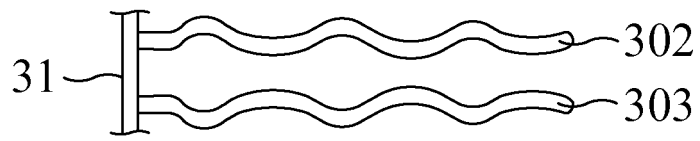


FIG. 4B

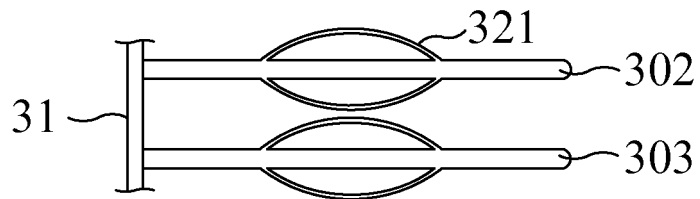


FIG. 4C

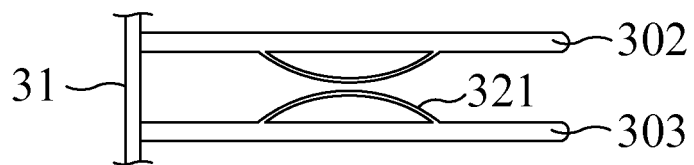


FIG. 4D



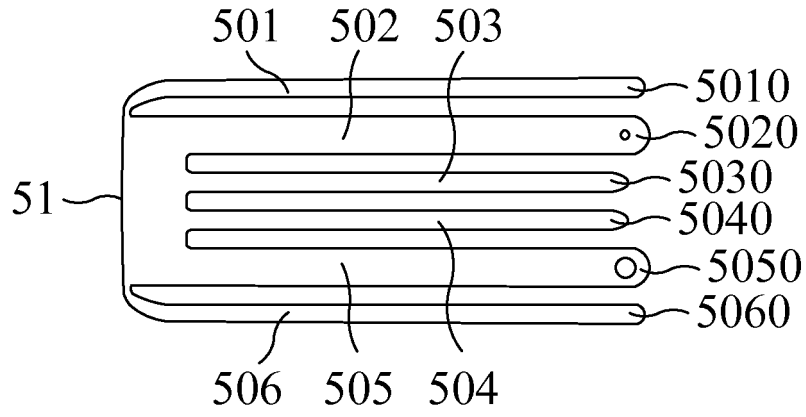


FIG. 5A

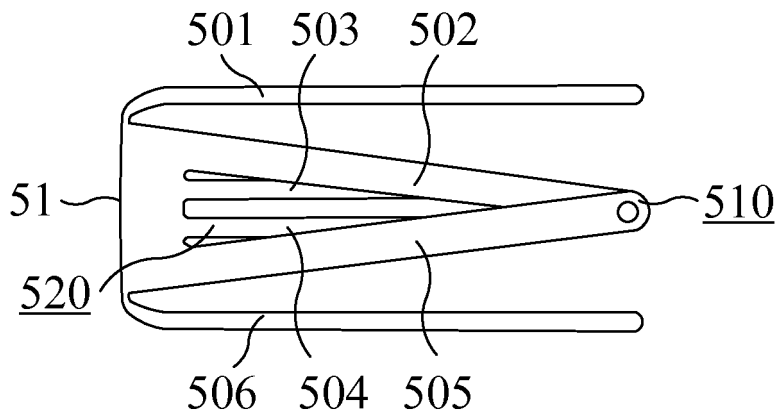


FIG. 5B

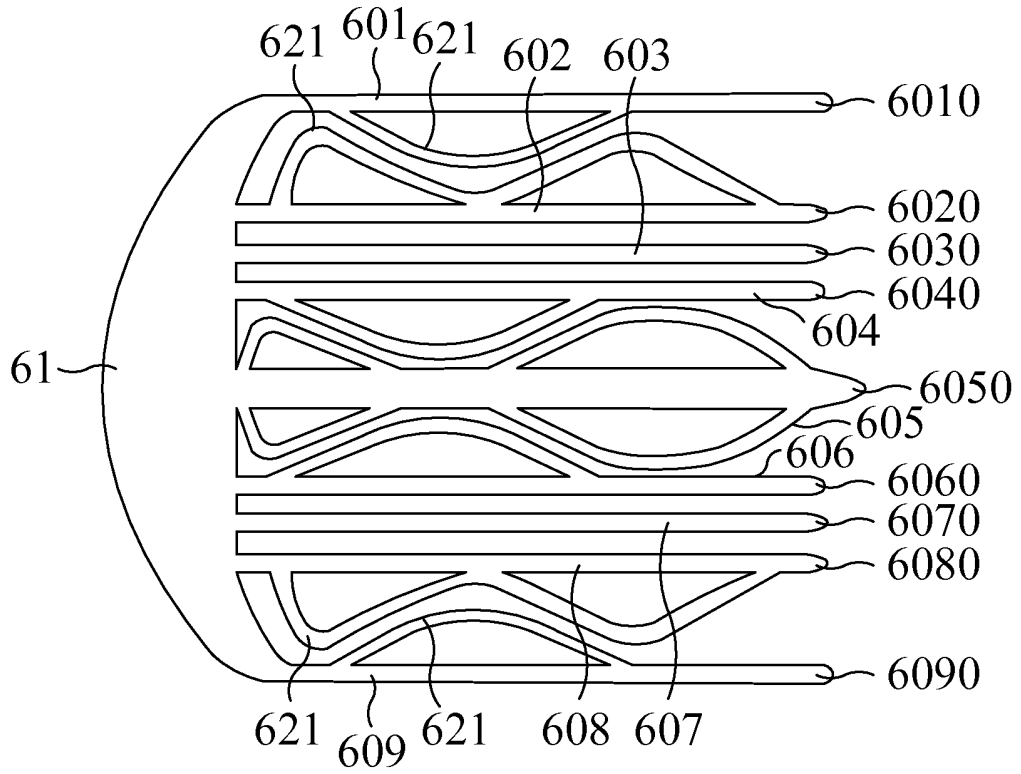


FIG. 6A

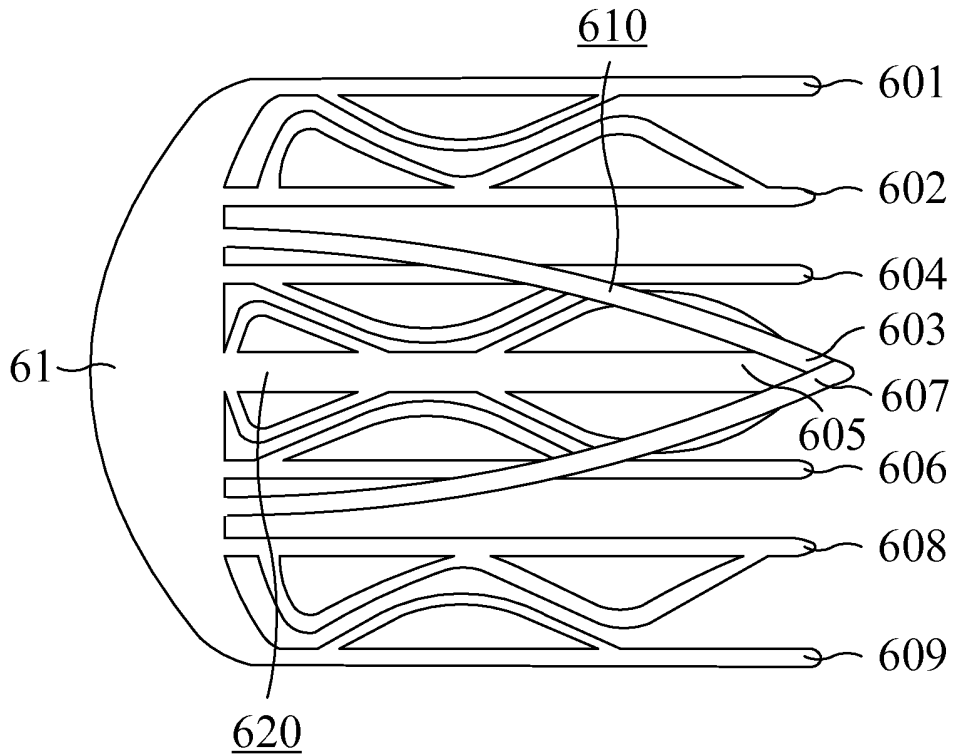


FIG. 6B

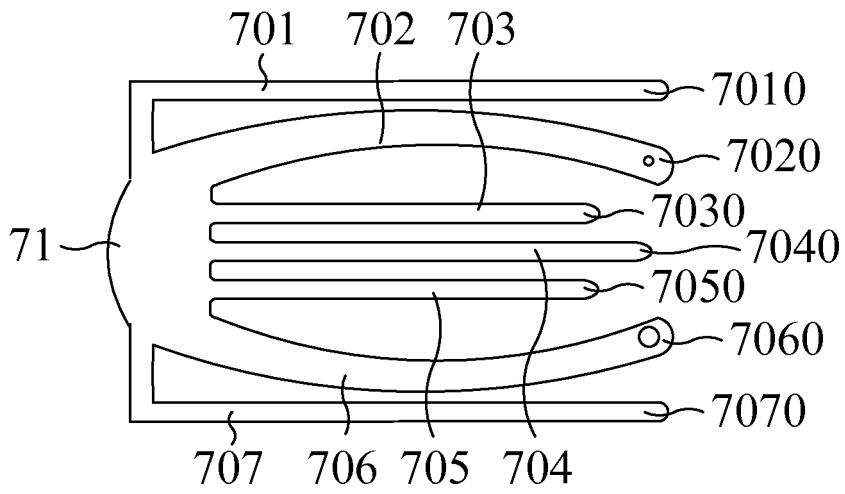


FIG. 7A

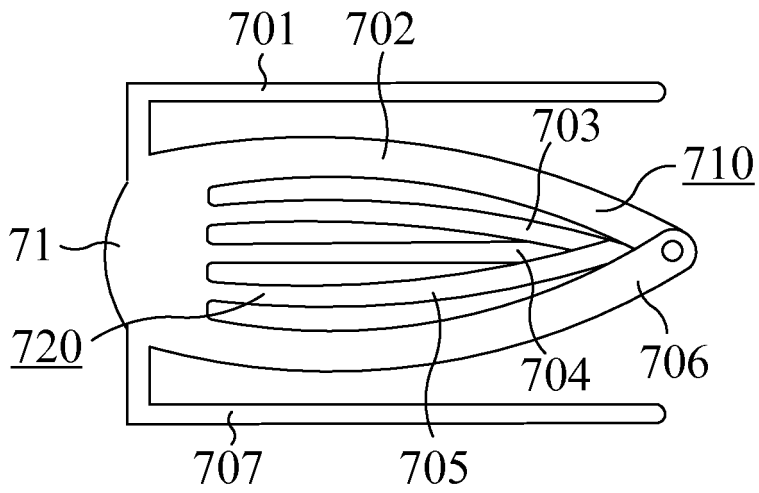


FIG. 7B

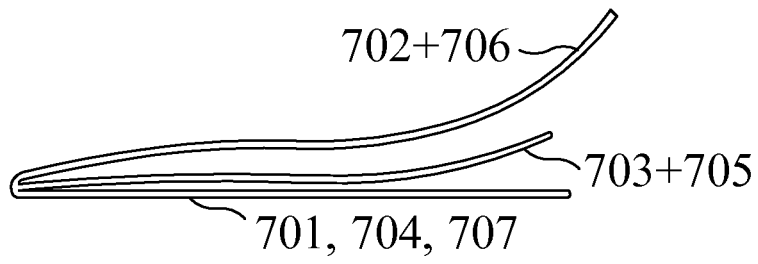


FIG. 7C

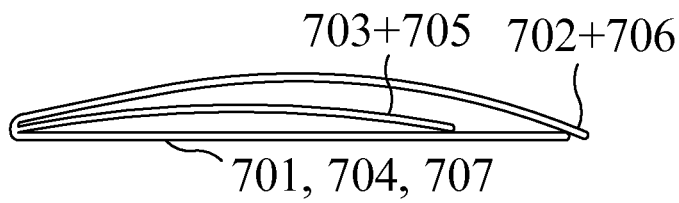


FIG. 7D

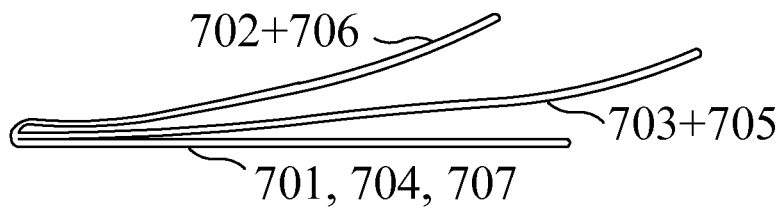


FIG. 7E

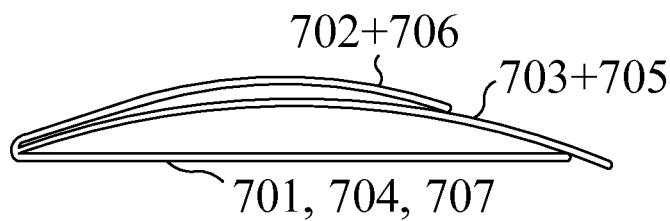


FIG. 7F

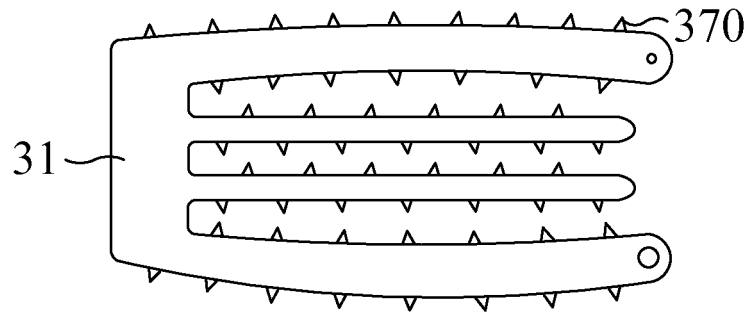


FIG. 8A

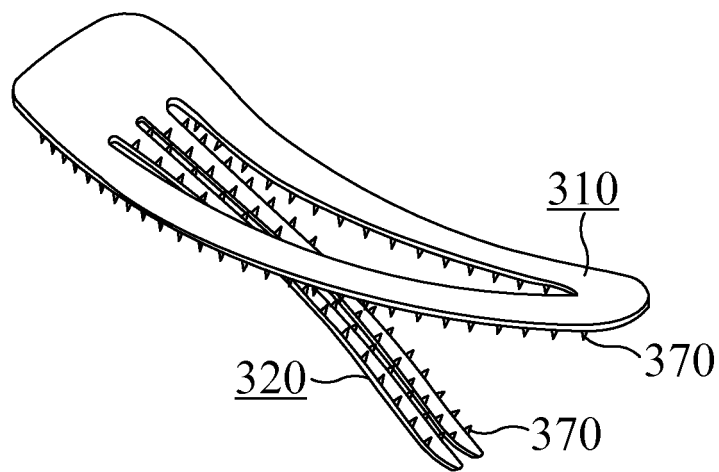


FIG. 8B

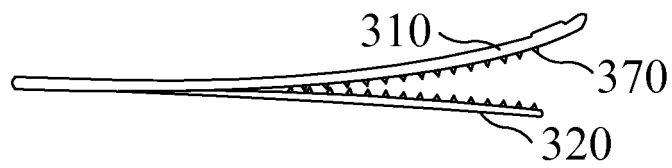


FIG. 8C

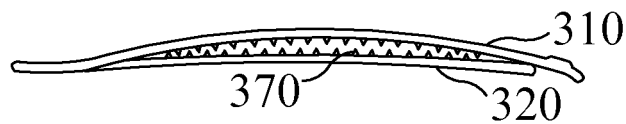


FIG. 8D

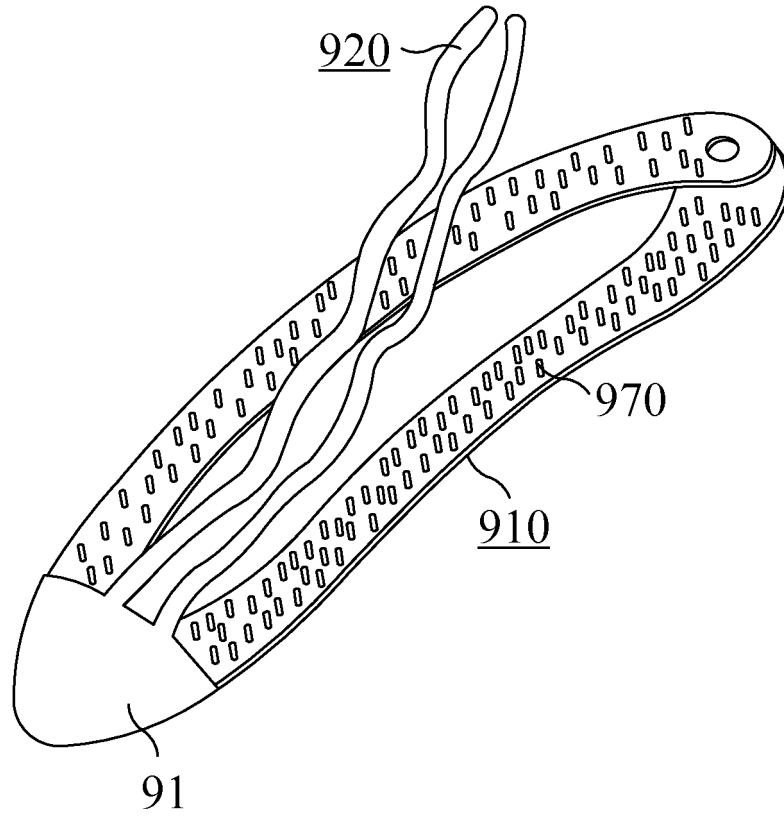


FIG. 9

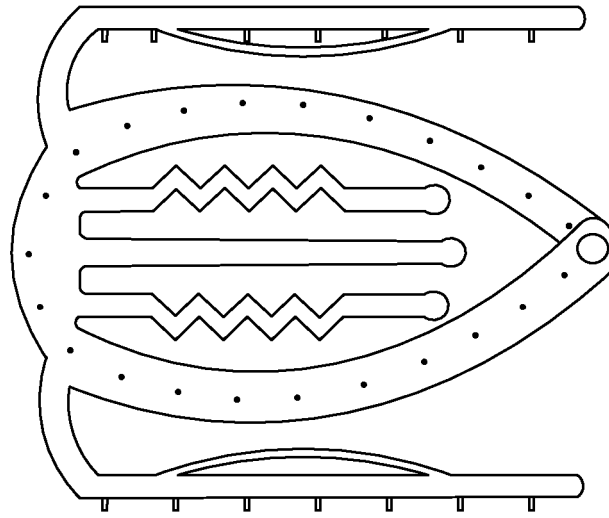


FIG. 10

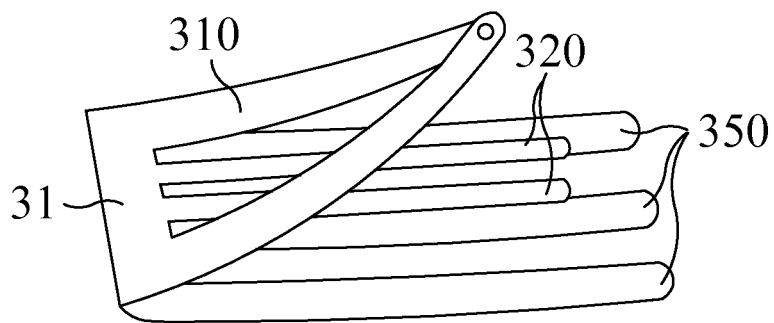


FIG. 11

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- US 7373940 B [0004]