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(71) Applicant: **BIC Violex Single Member S.A.**  
**14569 Anoixi (GR)**

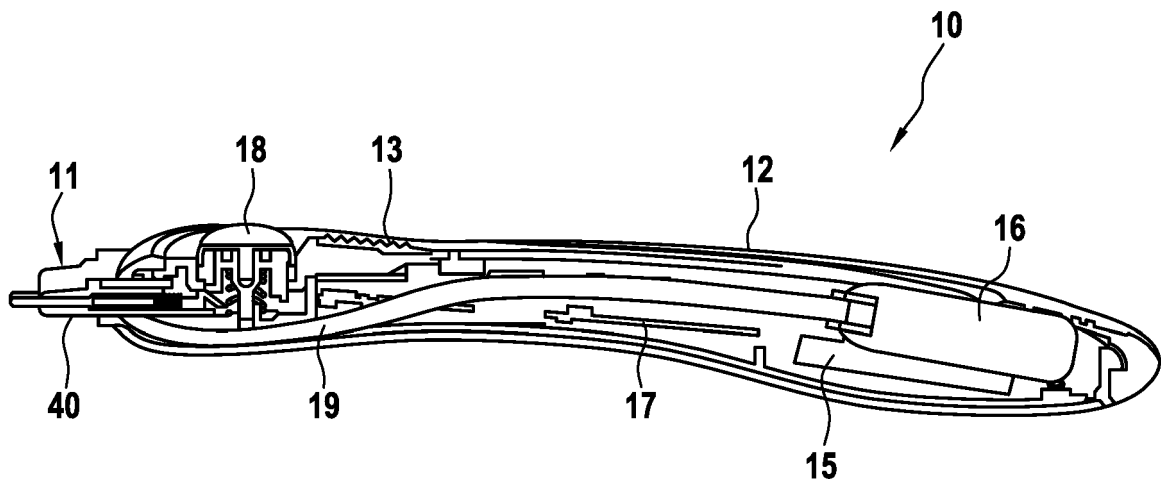
(72) Inventor: **Kokozidis, Michail**  
**14569 ANOIXI (GR)**

(74) Representative: **Cabinet Beau de Loménie**  
**158, rue de l'Université**  
**75340 Paris Cedex 07 (FR)**

(54) **SHAVER**

(57) A shaver, comprising a power supply unit (15), an electronic control unit (17), a plasma generating unit (16), a shaving head, including at least one blade, or a socket configured to connect a shaving head including

at least one blade, a rim, extending along at least an edge of the shaving head or of the socket, and at least one plasma outlet, provided on the rim and configured to supply plasma on the skin of a user.



**FIG.2**

## Description

### TECHNICAL FIELD

**[0001]** The present disclosure relates to a shaver and a shaving method improving the hygiene of the skin during the shaving operation. Particularly, such a shaver may contribute to reduce the occurrence of skin infection.

### TECHNOLOGICAL BACKGROUND

**[0002]** It is well known that shaving can create minor wounds on the skin that are possible centers of infection. Particularly, some people have very sensitive skins more easily prone to such skin infections. This issue is all the more problematic that the shaving process may transfer a local infection to adjacent regions of the skin, thus spreading the infection.

**[0003]** In order to reduce the occurrence of such skin infections, it is usually recommended to carefully clean the skin before starting the shaving. It is also possible to use an aftershave lotion in order to disinfect possible cuts caused by the shaving. A proper cleaning of the shaving head before and after the shaving is also recommended. However, a lot of people neglect such hygiene recommendations, most often because of a lack of time.

**[0004]** Improvements have also been devised in order to enhance the safety of the shaving heads and, thus, to reduce the occurrence of cuts: multiples blades, guard bars, lubricating strips etc. However, in spite of such improvements, minor cuts still occur from time to time, which may lead to an infection if the above hygiene recommendations are not followed.

**[0005]** As a result, there is a real need for a shaver and a shaving method which enable to reduce the occurrence of skin infection.

### SUMMARY

**[0006]** The present disclosure relates to a shaver handle, comprising

- a handle body,
- a frame, connected to the handle body and having a socket configured to receive a shaving head,
- a power supply unit,
- an electronic control unit,
- a plasma generating unit, and
- at least one plasma pipe extending from the plasma generating unit toward the frame.

**[0007]** A shaver equipped with such a shaver handle therefore includes a plasma generating unit able to produce plasma guided by the plasma tube to the frame and, from that point to the shaving head. It is therefore possible to apply plasma on the skin during the shaving process, which helps to disinfect the skin and thus to reduce the risk of infection.

**[0008]** Plasma is the fourth state of matter, being an electrically quasineutral medium of unbound positive and negative particles (i.e. the overall charge of a plasma is roughly zero). Particularly, plasma can efficiently inactivate microbial pathogens such as bacteria, fungi and viruses. Plasma is also able to degrade toxins produced by such pathogens. Such a plasma application can therefore disinfect the skin at the very moment of the shaving, thus reducing the risk of infection even in the case of minor cuts.

**[0009]** Also, plasma is able to inactivate and remove bacterial biofilms from former wounds already infected. Therefore, the use of such a shaver contributes to soothe former wounds and to quicken the natural healing of the skin.

**[0010]** Such a disinfection effect may also be used for disinfecting the shaving head itself before and/or after shaving. For instance, the shaver may be received in a base configured to diffuse the plasma supplied by the shaver all around the shaving head.

**[0011]** In addition, the application of plasma provides mild heating of the skin and thus an enjoyable feeling which improves the overall shaving experience.

**[0012]** In embodiments, the frame is non removably connected to the handle body.

**[0013]** In embodiments, the plasma generating unit is configured to generate cold atmospheric pressure plasma. The temperature and the pressure of such cold atmospheric pressure plasma (usually referred to as "CAP") are close to the ambient temperature and the atmospheric pressure, which prevents any harm for the user.

**[0014]** In embodiments, the plasma generating unit is configured to generate plasma from surrounding air. Such a configuration is particularly convenient since the fluid at the origin of the plasma may be directly collected from the surrounding air, without the need to provide the shaver with a fluid cartridge. Nevertheless, in other embodiments, the plasma generating unit could use other gas, for instance a noble gas, stored in a cartridge.

**[0015]** In embodiments, the plasma generation unit comprises a pumping device that is configured to pump the surrounding air.

**[0016]** In embodiments, the plasma generating unit includes a spark generating unit. The plasma is therefore effectively produced in the plasma generating unit then guided toward the shaving unit through the plasma pipe. However, in embodiments, the spark generating unit could be provided outside from the plasma generating unit, for instance at the plasma outlets; in such a case, the plasma generating unit processes the fluid at the origin of the plasma, then the processed fluid is guided toward the plasma outlets where it is ionized by the spark generating unit.

**[0017]** In embodiments, the plasma generation unit comprises a spark generation unit that is configured to ionize the air that is pumped from the pumping device

**[0018]** In embodiments, the diameter of the plasma

pipe is lower than 10 mm, more specifically lower than 5 mm, most specifically lower than 2 mm. In some embodiments, the diameter of the plasma pipe decreases between the plasma generating unit and the plasma outlets.

**[0019]** In embodiments, the power supply unit comprises a rechargeable or replaceable power source. The power source is for instance a battery.

**[0020]** In embodiments, the electronic control unit is configured to control the power supply unit and the plasma generating unit.

**[0021]** In embodiments, the shaver handle comprises a connecting interface provided at the upper end of the handle body and configured to connect a shaving unit. Thanks to such a connecting interface, it is possible to provide a removable and possibly replaceable shaving unit, including the frame and a possible shaving head.

**[0022]** In embodiments, the connecting interface comprises a fluid connector, in fluid communication with the plasma pipe, configured to engage and connect a fluid connector of the shaving unit. Thanks to such a fluid connector, it is possible to ensure a fluid connection from the handle to the shaving unit so as to guide the plasma, or its precursor fluid, toward plasma outlets of the shaving unit.

**[0023]** In embodiments, the connecting interface comprises a power connector, connected to the power supply unit, configured to engage and connect a power connector of the shaving unit. Thanks to such a power connector, it is possible to ensure a power connection from the handle to the shaving unit. Such a configuration is particularly useful when the shaving unit comprises a spark generating unit.

**[0024]** In embodiments, the handle body comprises a pivot configured to pivot the frame around an axis substantially orthogonal to the main direction of the handle body. Such a pivoting movement allows the shaving head to follow the contours of the face of the user during shaving thereby improving the overall shaving experience.

**[0025]** In embodiments, the frame comprises a rim, extending along at least an edge of the socket, and at least one plasma outlet, provided on the rim and configured to supply plasma on the skin of a user, said at least one plasma outlet being connected to said at least one plasma pipe.

**[0026]** In embodiments, the rim extends at least along the trailing edge and/or the leading edge of the socket, that is to say of the shaving head. The trailing edge of the shaving head is the edge parallel to the blades which comes after the blades in a normal shaving action. Conversely, the leading edge of the shaving head is the edge parallel to the blades which comes before the blades in a normal shaving action.

**[0027]** In embodiments, the rim extends at least along the lateral edges of the socket, that is to say of the shaving head.

**[0028]** In embodiments, the rim is configured to be flush with the shaving surface of the shaving head.

**[0029]** In embodiments, at least one plasma outlet is

provided downstream of the socket, that is to say of the shaving head, on the trailing part of the rim. In examples, several plasma outlets are provided in this area. Accordingly, the skin may be disinfected immediately after the passage of the blades and, thus, immediately after the possible appearance of cuts.

**[0030]** In embodiments, at least one plasma outlet is provided upstream of the socket, that is to say of the shaving head, on the leading part of the rim. In examples, several plasma outlets are provided in this area. Accordingly, each area of the skin crossed by the shaving head can be disinfected before the passage of the blades.

**[0031]** In embodiments, several plasma outlets are provided all around the socket, that is to say of the shaving head. This provides a large disinfected area around the shaving head.

**[0032]** In embodiments, the diameter of at least one plasma outlet, in examples of each plasma outlet, is lower than 10 mm, more specifically lower than 5 mm, most specifically lower than 2 mm.

**[0033]** In embodiments, at least one plasma outlet includes a spark generating unit. In such a case, the plasma is ionized just before reaching the skin of the user.

**[0034]** In embodiments, the supply pipe is branched from the fluid connector to each plasma outlet.

**[0035]** In embodiments, the shaving unit comprises a connecting interface providing at the connecting end and configured to connect the handle body. Thanks to such a connecting interface enables, it is possible to provide a removable and possibly replaceable shaving unit.

**[0036]** In embodiments, the connecting interface comprises a fluid connector, in fluid communication with the supply pipe, configured to engage and connect a fluid connector of the shaver handle. Thanks to such a fluid connector, it is possible to ensure a fluid connection from a plasma generation unit provided in the handle so as to guide the plasma, or its precursor fluid, toward the plasma outlets.

**[0037]** In embodiments, the connecting interface comprises a power connector configured to engage and connect a power connector of the handle body. Thanks to such a power connector, it is possible to ensure a power connection from a power supply unit of the handle to the shaving unit. Such a configuration is particularly useful when the shaving unit comprises a spark generating unit.

**[0038]** The present disclosure also relates to a shaver, comprising one shaver handle according to any one of the above embodiments and one shaving head including at least one blade and mounted in the socket.

**[0039]** Accordingly, the present disclosure relates to a shaver, comprising a power supply unit, an electronic control unit, a plasma generating unit, a shaving head, including at least one blade, or a socket configured to connect a shaving head including at least one blade, a rim, extending along at least an edge of the shaving head or of the socket, and at least one plasma outlet, provided on the rim and configured to supply plasma on the skin of a user.

**[0040]** In embodiments, the shaving head comprises at least three blades, a lubricating strip and/or a guard bar. The shaving head may be removable and replaceable; however, in other embodiment, the shaving head may be integral with the rim.

**[0041]** The present disclosure also relates to a shaving method, comprising providing a shaver equipped with a shaving head including at least one blade, a plasma generating unit and at least one plasma outlet provided on a rim extending along at least an edge of the shaving head, turning on the plasma generating unit, and applying the shaving head against a skin to be shaved and moving the shaving head along the skin in shaving movements while plasma is directed to the skin through the at least one plasma outlet.

**[0042]** The above mentioned features and advantages, and others, will become apparent when reading the following detailed description of exemplary embodiments of the presented shaver and shaving method. This detailed description refers to the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0043]** The accompanying drawings are diagrammatic and seek above all to illustrate the principles of the disclosure.

**[0044]** On these drawings, from one figure to another, elements (or element parts) which are identical are marked by the same reference signs. In addition, elements (or element parts) pertaining to different examples but having an analogous function are marked on the figures by reference signs incremented by 100, 200, etc.

FIG. 1 is a perspective view of a first exemplary shaver according to the disclosure.

FIG. 2 is a diagrammatic section view of the handle of the shaver of FIG. 1.

FIG. 3 is a diagrammatic section view of the shaving unit of the shaver of FIG. 1, without shaving head.

FIG. 4 is a diagrammatic section view of the shaving unit of the shaver of FIG. 1, with a shaving head.

FIG. 5 is a front view of the shaving unit of FIG. 4.

FIG. 6 is a front view of a second exemplary shaving unit.

FIG. 7 is a front view of a third exemplary shaving unit.

FIG. 8 is a flowchart of an exemplary shaving method.

#### DETAILED DESCRIPTION OF EMBODIMENTS

**[0045]** In order to make the disclosure more concrete, exemplary embodiments of shavers and of shaving methods are described in detail below with reference to the accompanying drawings. It should be recalled that the disclosure is not limited to these examples.

**[0046]** FIG. 1 depicts a first exemplary shaver 1. This shaver 1 comprises a shaver handle 10 and a shaving

unit 50 mounted at the upper end 11 of the shaver handle 10.

**[0047]** As better seen on FIG. 2, the shaver handle 10 comprises an elongated body 12 having an ergonomic shape and grip portions 13 enabling the shaver handle 10 to be firmly and comfortably gripped by a user. The upper end 11 of the shaver handle 10 comprises a connecting interface 40 configured to mechanically connect the shaving unit 50 in a removable fashion. However, in other examples, the shaving unit 50 could be connected in a non-removable manner to the handle body 12.

**[0048]** The shaver handle 10 also comprises a power supply unit 15, a plasma generation unit 16 and an electronic control unit 17, the three of them being accommodated inside the body 12. The body 12 also accommodates a push-button 18 whose pressing surface is flush with the front surface of the body 12.

**[0049]** In examples, the power supply unit 15 is a battery which can be recharged in a known way thanks to a charging cable or a charging base.

**[0050]** In examples, the plasma generation unit 16 is configured to produce cold atmospheric pressure plasma from the surrounding air. Therefore, the plasma generation unit 16 comprises a pumping device enabling to pump air from the surroundings of the shaver 1 thanks to an inlet provided on the handle body 12. The plasma generation unit 16 also comprises a spark generation unit configured to produce sparks so as to ionize the air pumped by the pumping device, thus producing cold plasma. Voltage can be created by piezoelectric transformers with voltage transformation ratio, which is high enough for ignition of atmospheric pressure discharges in the air even for small primary voltages in the range of 5-25 V.

**[0051]** The operations of the power supply unit 15 and of the plasma generating unit 16 are controlled by the electronic control unit 17. Particularly, the push-button 18 is connected to the electronic control unit 17 so as to switch on and off the plasma generation.

**[0052]** A plasma tube 19 is accommodated in the body 12 and extends from the plasma generating unit 16 to the connecting interface 40 so as to guide the plasma produced by the plasma generating unit 16 up to the shaving unit 50. In this respect, the connecting interface 40 is equipped with a fluid connector enabling to safely pass said plasma into the shaving unit 50.

**[0053]** As better seen on FIG. 3, the shaving unit 50 comprises a frame 51 surrounding a socket 52 having a rectangular shape. The top surface of the frame 51 forms a rectangular rim 53 substantially planar. The shaving unit 50 also comprises a connecting end having a connecting interface 60 configured to mechanically engage with the connecting interface 40 of the handle 10. In examples, the connecting interface 60 comprises a fluid connector configured to engage the fluid connector of the handle 10 to ensure a fluid connection from the plasma tube 19 of the handle 10 to a supply tube 54 of the shaving unit 50. However, in other examples, a direct

connection is possible from the plasma generating unit 16 to the shaving unit 50, the supply tube 54 then being the extension of the plasma tube 19.

**[0054]** As better seen on FIG. 4, the socket 52 is configured to receive a shaving head 70. In the present example, the shaving head 70 comprises three blades 71, a guard 72, on the leading side of the blades 71, that is to say upstream of the blades 71, and a lubricating strip 73, on the trailing side of the blades 71, that is to say downstream of the blades 71. Once a shaving head 70 is mounted in the socket 52, the shaving surface is substantially flush with the rim 53.

**[0055]** As better seen on FIG. 5, the trailing portion 53t of the rim 53 comprises plasma outlets 55 connected to the supply tube 54, which is branched, and therefore configured to emit plasma on the surface of the rim 53. In such a way, it is possible to apply plasma on the skin of the user downstream of the blade passage so as to disinfect possible cuts. In the present example, the shaving unit 50 comprises five plasma outlets 55.

**[0056]** FIG. 6 illustrates a second example wherein plasma outlets 155 are provided both on the trailing portion 153t and the leading portion 153l of the rim 153 of the shaving unit 150. In such a way, it is possible to apply plasma on the skin of the user both upstream and downstream of the blade passage so as to disinfect the skin before and after the passage of the blades. In the present example, the shaving unit 150 comprises five plasma outlets 155 on the trailing portion 153t of the rim 153 and five plasma outlets 155 on its leading portion 153l.

**[0057]** FIG. 7 illustrates a third example wherein plasma outlets 255 are provided on the trailing portion 253t of the rim 253, on its leading portion 253l and also on both lateral sides 253s thereof. In such a way, it is possible to apply plasma on a large area completely surrounding the blades. In the present example, the shaving unit 250 comprises five plasma outlets 255 on the trailing portion 253t of the rim 153, five plasma outlets 255 on its leading portion 253l and two plasma outlets 255 on both lateral sides 253s.

**[0058]** FIG. 8 now schematically illustrates an exemplary shaving method taking advantage of a shaver 1 according to present disclosure. In a first step S1, the user switches on the plasma generating unit 16 by pressing the push-button 18. In a second step S2, the plasma generating unit 16 produces cold atmospheric pressure plasma and said plasma is guided through the plasma tube 19 then the supply tube 54 up to the plasma outlets 55 where the plasma is emitted. In a third step S3, the user shaves normally. In a fourth step S4, the user switches off the plasma generating unit 16 by pressing again the push-button 18.

**[0059]** Even if the present disclosure has been described with regard to particular exemplary embodiments, it is clear that these examples may be modified without departing from the scope of the disclosure as defined by the claims. Particularly, individual features of different presented embodiments can be combined in ad-

ditional embodiments. As a result, the description and the drawings shall be considered in an illustrative way rather than a limitative way.

**[0060]** It is also clear that all the features described with reference to a method are transposable, individually or in combination, to a device, and vice versa.

## Claims

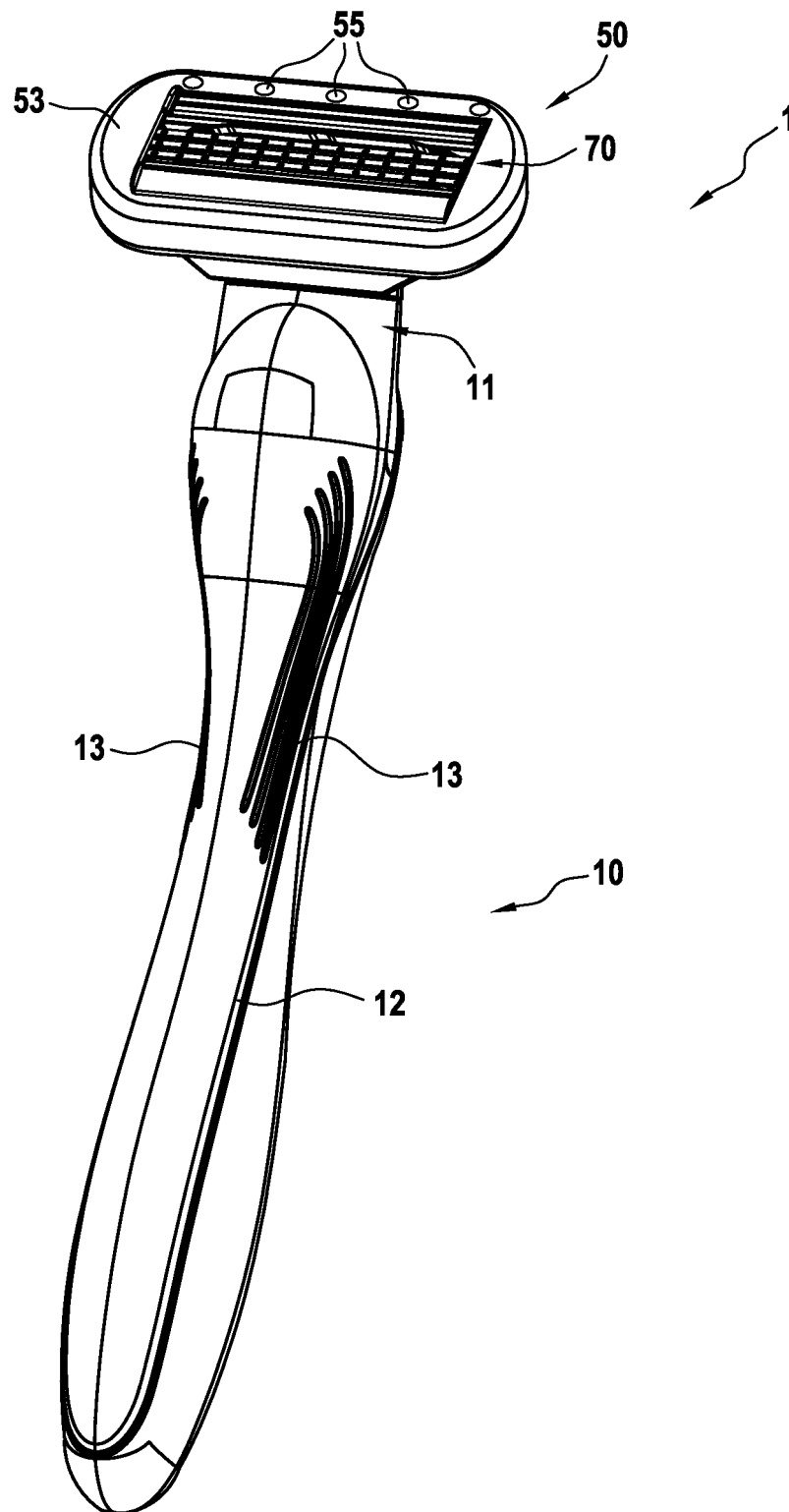
1. A shaver handle, comprising
  - a handle body (12),
  - a frame (51), connected to the handle body (12) and having a socket (52) configured to receive a shaving head (70),
  - a power supply unit (15),
  - an electronic control unit (17),
  - a plasma generating unit (16), and
  - at least one plasma pipe (19) extending from the plasma generating unit (16) toward the frame (51).
2. The shaver handle of claim 1, wherein the frame (51) is non removably connected to the handle body (12).
3. The shaver handle of claim 1 or 2, wherein the plasma generating unit (16) is configured to generate cold atmospheric pressure plasma.
4. The shaver handle of any one of claims 1 to 3, wherein the plasma generating unit (16) is configured to generate plasma from surrounding air.
5. The shaver handle of claim 4, wherein the plasma generation unit (16) comprises a pumping device that is configured to pump the surrounding air.
6. The shaver handle of claim 5 wherein the plasma generation unit comprises a spark generation unit that is configured to ionize the air that is pumped from the pumping device.
7. The shaver handle of any one of claims 1 to 6, wherein the frame (51) comprises
  - a rim (53), extending along at least an edge of the socket (52),
  - at least one plasma outlet (55), provided on the rim (53) and configured to supply plasma on the skin of a user, said at least one plasma outlet (55) being connected to said at least one plasma pipe (19).
8. The shaver handle of claim 7, wherein the rim (53) is configured to be flush with the shaving surface of the shaving head (70).

9. The shaver handle of claim 7 or 8, wherein at least one plasma outlet (55) is provided downstream of the socket (52).
10. The shaver handle of any one of claims 7 to 9, wherein at least one plasma outlet (155) is provided upstream of the socket (52). 5
11. The shaver handle of any one of claims 7 to 10, wherein several plasma outlets (255) are provided all around the socket. 10
12. The shaver handle of any one of claims 7 to 11, wherein the diameter of at least one plasma outlet (55) is lower than 10 mm, more specifically lower than 5 mm, most specifically lower than 2 mm. 15
13. The shaver handle of any one of claims 7 to 12, wherein at least one plasma outlet (55) includes a spark generating unit. 20
14. A shaver, comprising one shaver handle according to any one of claims 1 to 13 and one shaving head (70) including at least one blade (71) and mounted in the socket (52). 25
15. A shaving method, comprising
- providing a shaver (1) equipped with a shaving head (70) including at least one blade (71), a plasma generating unit (16) and at least one plasma outlet (55) provided on a rim (53) extending along at least an edge of the shaving head (70), 30
- turning on the plasma generating unit (16), and applying the shaving head (70) against a skin to be shaved and moving the shaving head (70) along the skin in shaving movements while plasma is directed to the skin through the at least one plasma outlet (55). 35 40

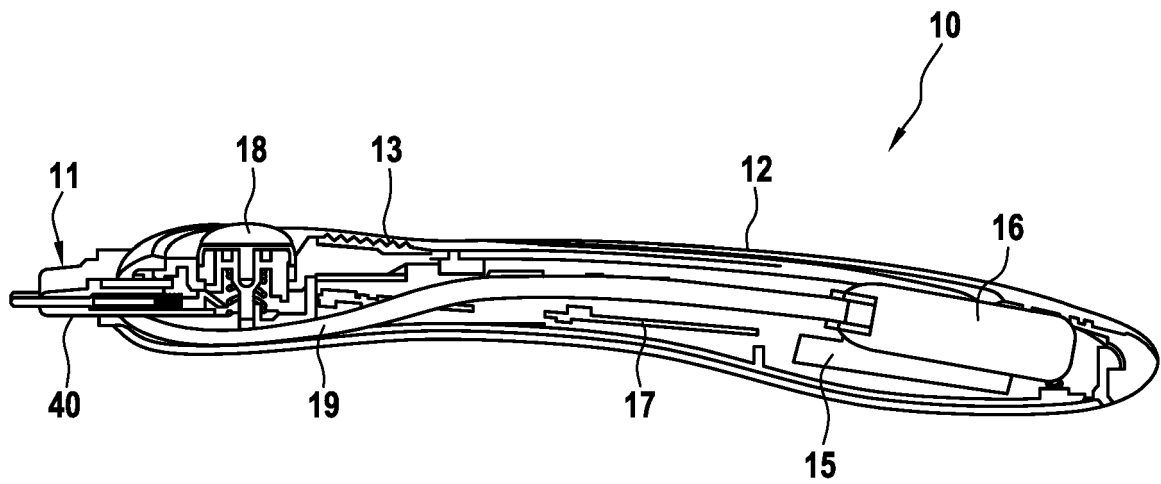
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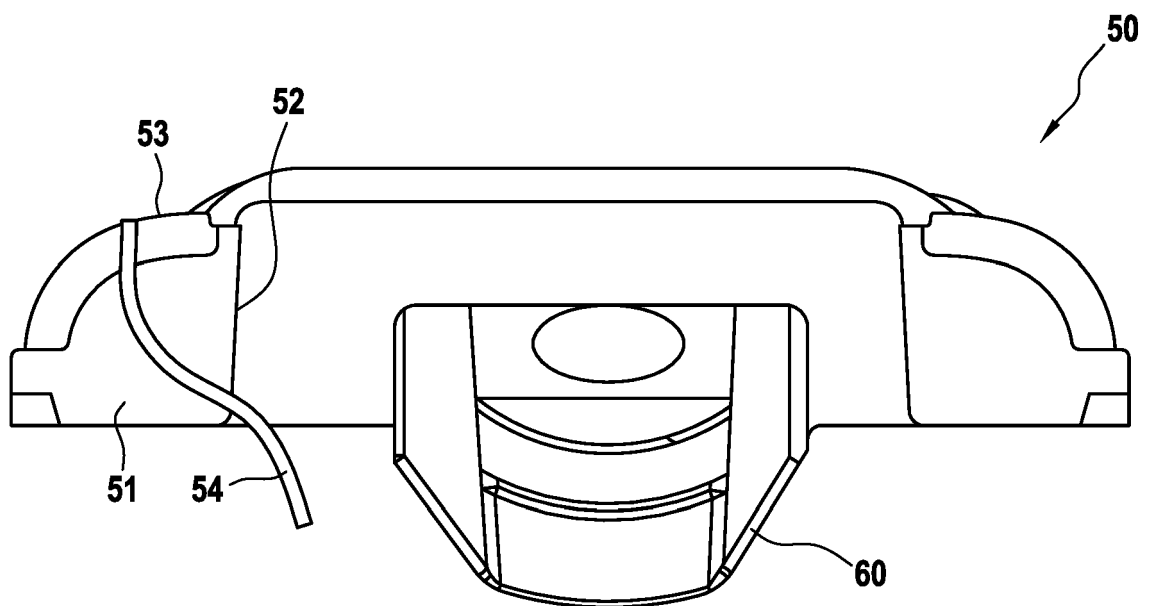
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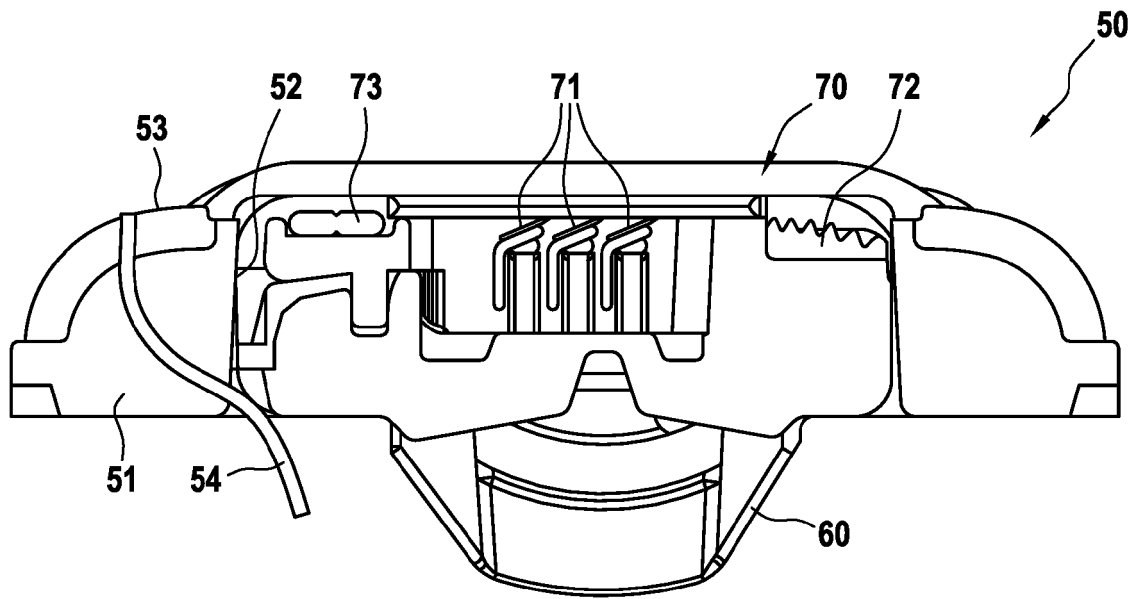
**FIG.1**



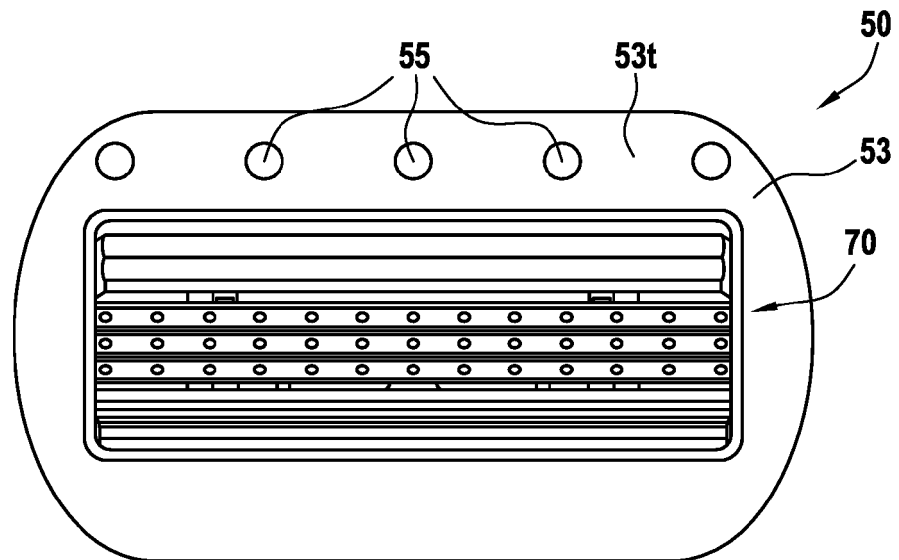
**FIG. 2**



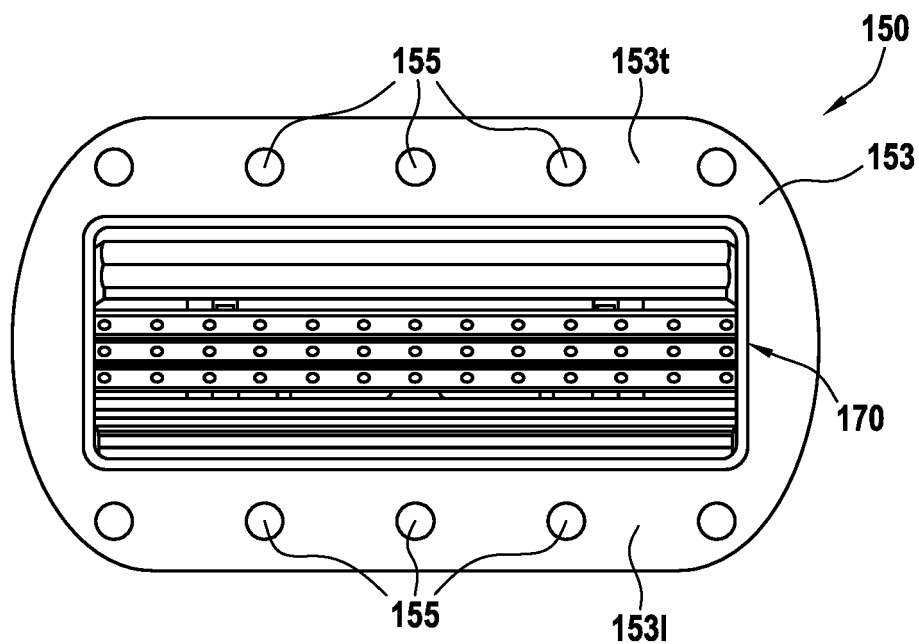
**FIG. 3**



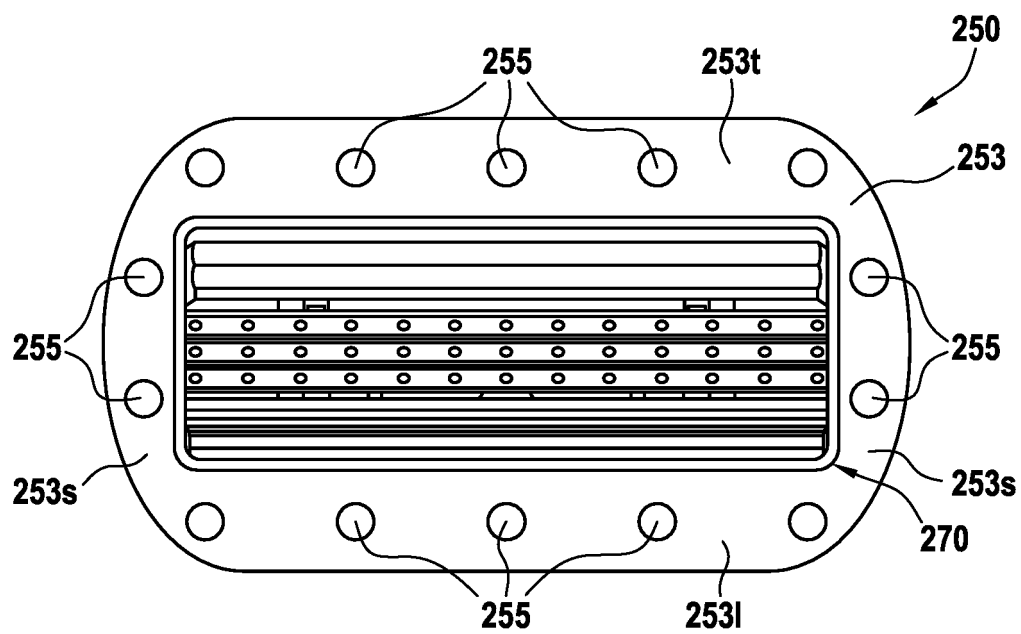
**FIG. 4**



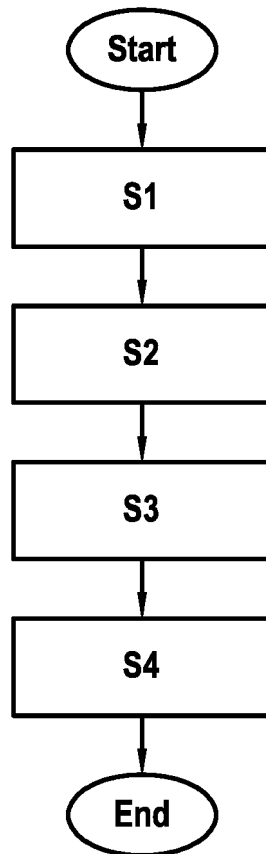
**FIG. 5**



**FIG. 6**



**FIG. 7**



**FIG.8**



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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                    |                                                                                                                                  |                                                                                                                                                                                                                                                                                       |                                         |
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| The present search report has been drawn up for all claims                                                                                                                                                                                             |                                                                                                                                  |                                                                                                                                                                                                                                                                                       |                                         |
| Place of search<br><b>Munich</b>                                                                                                                                                                                                                       |                                                                                                                                  | Date of completion of the search<br><b>10 May 2023</b>                                                                                                                                                                                                                                | Examiner<br><b>Calabrese, Nunziante</b> |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                                                  | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |                                         |

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