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# (54) METHOD FOR HAIR STRAIGHTENING AND RELATIVE DEVICE FOR HAIR STRAIGHTENING

VERFAHREN UND VORRICHTUNG ZUM GLÄTTEN VON HAAREN

PROCEDE ET DISPOSITIF POUR LE DEFRISAGE DES CHEVEUX

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## Description

**[0001]** The object of the present invention is a method for hair straightening through exposure to a modified atmosphere and to a variation in temperature, as well as a relative straightening device.

**[0002]** As is known in the field of hair treatments, and in particular the straightening of curly or frizzy hair, the changes on the hair are made through mechanical, thermal and chemical actions.

**[0003]** At present, the most common straightening method by thermal/mechanical action involves heating the hair during combing, in order to make it smooth, usually with a hair dryer and a brush or with a hair plate. As is known, this method has only a temporary effect, lasting from a few hours to a few days, and with a significant deterioration of the hold if the hair is exposed to moisture or other external factors.

**[0004]** In order to counteract these negative effects, therefore, chemical products are often used which allow an extension of the duration and the hold of the straightening. This known method, however, exposes the subject treated to unpleasant vapors, long treatments, and not always positive results, as well as a weakening of the hair due to the aggressiveness of the chemical reagents used.

**[0005]** The known methods (see for example US2015320171) for hair straightening therefore involve stress on the hair which weakens the structure and generally worsens the state of health thereof. The consequences of this stress range from the impossibility of repeating the treatment with a high frequency, and in some cases they cause permanent damage to the hair.

**[0006]** The object of the present invention is to solve the problems of the prior art taking into account the needs of the field.

**[0007]** In particular, the object of the present invention is to provide hair straightening by means of a method which does not involve the use of aggressive or damaging chemical compounds for the hair, and ensures a lasting straightening without causing excessive stress on the hair.

**[0008]** This object is achieved by a straightening method according to claim 1, as well as by a straightening device according to claim 10. The dependent claims describe preferred embodiments of the invention.

**[0009]** Further features and advantages of the straightening method and of the respective device will be apparent from the detailed description that follows, illustrated by way of non-limiting example in the accompanying figures in which:

figure 1 shows a summary table of the results of the straightening tests carried out according to the straightening method according to the present invention;

figures 2 and 3 show an embodiment example of a device for straightening the hair according to the present invention.

**[0010]** The method according to the present invention provides for subjecting the hair to a thermal and mechanical action, by means of a straightening plate, simultaneously with exposure to an atmosphere enriched with hydrogen gas.

**[0011]** The straightening method provides for:

- heating the plate to a working temperature T;
- applying a gas flow on the hair that changes the gas environment around the hair and at the same time passing the plate (straightening) slowly on a lock at a time, carrying out a plurality of passages.

**[0012]** In particular, the plate is heated to a working temperature T of between 200 °C and 250 °C, preferably to 230 °C.

**[0013]** The gas environment around the hair during the passage of the plate is composed of air in which:

- the chemical components have been changed through the addition of gaseous hydrogen, in percentages below the level of Combustion (LEL) by at least 50%.

**[0014]** In an embodiment example, the method involves applying a pure hydrogen gas flow to the hair through nozzles distributed along the plate or in its vicinity, allowing at its dispersion the proper dilution, and at the same time passing the plate slowly over one lock at a time. The hydrogen flow is supplied with a flow rate between 150 ml/min and 250 ml/min, preferably 200 ml/min.

**[0015]** Preferably, the method involves passing the plate slowly over a lock at a time carrying out at least a total of ten passages on the same lock. The passages can be consecutive, or interspersed with an intermediate treatment step.

**[0016]** The method may also include a pre-treatment step in which the hair is moistened with an aqueous solution. For example, the pre-treatment step involves moistening the hair with water, spraying a total of 1.2 ml.

**[0017]** In a further example, the hair is moistened with demineralized water.

**[0018]** In a further example, the hair is moistened with saline water containing 3% sodium chloride.

**[0019]** In a further example, particularly suitable in the case of bleached hair, the aqueous solution comprises 0.1% polyglutamic acid. This solution allows improving the structure and the shine of the hair.

**[0020]** In a further embodiment, the method can also provide a pre-treatment step in which the hair is combed with a brush (set treatment).

**[0021]** In a further embodiment, the method can also provide a pre-treatment step in which the hair is washed with shampoo and dried with a hair dryer.

**[0022]** The method can also provide an intermediate

treatment step, provided between the straightening passages, in which the hair is moistened with an aqueous solution. It is important that this step does not leave residues of runny water.

**[0023]** The method also includes a post-treatment step, in which the hair is washed with shampoo, even more than once.

**[0024]** Figure 1 shows a summary table of the results of the tests carried out on the hair straightening method according to the present invention, in the various application variants thereof, to evaluate the effectiveness and duration thereof also according to the different type of hair subjected to the treatment.

**[0025]** The locks are classified according to the type: African; Very frizzy; Soft curly; Frizzy curly; Frizzy and wavy.

**[0026]** Both natural locks and bleached locks are selected.

**[0027]** A standard treatment protocol is defined in which the hair is moistened (sprayed with water for a total of 1.2 ml), the plate is heated to a temperature of 230 °C, and the hydrogen flow is made to escape from the center of the plate (flow rate of 200 ml/min).

**[0028]** The steps of the method followed in the various tests are defined below:

1P - Wet hair treatment with 10 plate passages;
2P - Wet hair treatment with 20 plate passages;
3P - Chemical straightening treatment with glyoxyl acid as a reference sample;
4P - Treatment with 20 plate passages on bleached hair;
5P - Initial hair treatment moistened with 5 plate passages; intermediate stage in which the hair is moistened again and treated with another 5 plate passages;
6P - Pre-treatment with brush (set) and then treatment with 10 plate passages;
7P - Damp hair treatment with 10 heated plate passages at a temperature of 160 °C as a reference sample to verify the optimal temperature of the plate;
10P - Damp hair treatment with 10 plate passages; intermediate treatment in which the hair is washed with cold water, dried with a hair dryer and treated with another 10 plate passages; post-treatment in which the hair is washed with 2 shampoos;
1T - pre-treatment in which the hair is washed with a shampoo and dried with a hair dryer; treatment with 5 plate passages; intermediate treatment in which the hair is moistened (without running water) and treated with another 7 plate passages;
1TBIS - pre-treatment in which the hair is washed with a shampoo and dried with a hair dryer; treatment with 5 plate passages; intermediate treatment in which the hair is moistened (without running water) and treated with another 7 plate passages; post-treatment in which the hair is washed with 2 shampoos.

**[0029]** The results of the tests carried out were evaluated considering the straightening degree obtained, gloss and tactile consistency. The evaluation was then summarized in: negative result; sufficient result; good result. This evaluation (summarized in figure 1) allowed identifying the most effective procedures of the method according to the present invention.

**[0030]** As can be seen from the result of test 7P, a plate temperature of 160° is considered insufficient to obtain a sufficient result; the plate must therefore have a temperature of at least 200 °C, preferably of 230 °C.

**[0031]** Furthermore, as can be seen in the result of test 3P (performed as a reference sample for sufficiency, by a known chemical straightening treatment), the tests relating to the method according to the present invention all lead to a better straightening result, with the sole exception of test 4P performed on bleached hair.

**[0032]** With reference to figures 2 and 3, an embodiment example of a straightening device for applying the hair-straightening method according to the present invention, i.e. through exposure to a gas flow and to temperature variations, is generally indicated.

**[0033]** The device 1 comprises a gas flow generator 10 connected, through a conduit 14, to a dispensing plate 20 heated to a working temperature T.

**[0034]** The gas flow generator 10 comprises a hydrogen generator 11.

**[0035]** In an embodiment example, the hydrogen generator 11 is a hydrolyser. The electrochemical method for hydrogen production uses electrolysis which separates hydrogen and oxygen from water. The electricity applied in the system breaks the chemical bonds between the two atoms that make up a water molecule; the two gases that form hydrogen and oxygen migrate, the first one towards a cathode and the second one towards an anode.

**[0036]** In a further embodiment example, the hydrogen generator 11 is a proton exchange membrane (PEM). It is a hydrolysis cell with a polymer membrane, in which the production of hydrogen takes place simply using only distilled water without using corrosive solution.

**[0037]** In a further embodiment example, the hydrogen generator 11 is at least one hydride cylinder. In particular, in the medium-low pressure anhydrous hydrogen cylinder, the gas is present in a compound based on metal hydrides (canister) previously loaded by a suitable device. These cylinders have the advantage of storing hydrogen at low pressure and can be refilled. The advantage of this implementation is the total safety and independence from corrosive liquids and compounds in free gaseous form.

**[0038]** The gas flow generator 10 further comprises, connected to the hydrogen generator 11, an enrichment device 12 for enriching the gas flow with vapor from liquid, e.g. steam.

**[0039]** In an embodiment example, the enricher 12 is a bubbler.

**[0040]** In a further embodiment, the enricher 12 is an

ultrasonic wet mist generator in the presence or absence of heating of the mixture.

**[0041]** The gas flow generator 10 further comprises pumping means 13 adapted to push the gas flow, through the conduit 14, towards the dispensing plate 20.

**[0042]** The gas flow generator 10 further comprises means for regulating the gas flow (not shown).

**[0043]** The dispensing plate 20 (shown in detail in figure 3) is heated to a working temperature T by means of heating means 21.

**[0044]** The dispensing plate 20 comprises a front straightening portion 22, which houses a pair of heating elements 21, and a rear handle portion 23 which allows an easy manual use of the dispensing plate 20.

**[0045]** In particular, the front straightening portion 22 further comprises dispensing means 24 for the gas flow, connected to the conduit 14. The dispensing means 24 are adapted to dispense the gas flow precisely at the heating elements, to allow the correct execution of the method according to the present invention, which provides for applying a gas flow to the hair while simultaneously passing the plate (straightening) on the locks.

**[0046]** Innovatively, the straightening method according to the present invention allows obtaining excellent levels of hair straightening without the use of aggressive chemical compounds or harmful for the hair.

**[0047]** Advantageously, the straightening method according to the present invention ensures a lasting straightening without causing excessive stress on the hair.

**[0048]** It is clear that a man skilled in the art can make changes and variations to the straightening method and to the relative device described above, all falling within the scope of protection as defined in the following claims.

## Claims

1. Method for straightening hair, comprising the steps of:

   - heating a plate for hair (20) to a working temperature (T) ;
   - applying to the hair a gas flow that changes the gas environment around the hair;
   - simultaneously passing the plate (20) slowly over one lock at a time carrying out a plurality of passages; **characterized in that** the gas environment around the hair during the passage of the plate (20) is enriched with hydrogen by a gas flow generator (10) comprising a hydrogen generator (11).

2. Method for straightening hair according to claim 1, wherein the step of applying a gas flow to the hair provides for applying a pure hydrogen gas flow through nozzles distributed along the plate (20) or in its vicinity, allowing at its dispersion the proper dilution.

3. Method for straightening hair according to claim 1 or 2, wherein the hydrogen is supplied with a flow rate of between 150 ml/min and 250 ml/min and preferably 200 ml/min.

4. Method for straightening hair according to any one of the preceding claims, wherein the plate (20) is heated to a working temperature (T) between 200°C and 250°C and preferably 230°C.

5. Method for straightening hair according to any one of the preceding claims, wherein the step of passing the plate over one lock at a time involves carrying out at least a total of ten passages, consecutive or interspersed with an intermediate treatment step.

6. Method for straightening hair according to any one of the preceding claims, wherein a pre-treatment step is provided wherein the hair is dampened with an aqueous solution.

7. Method for straightening hair according to claim 6, wherein the aqueous solution is water or demineralized water or saline containing at least 3% sodium chloride, or water comprising at least 0.1% polyglutamic acid.

8. Method for straightening hair according to any one of the preceding claims, wherein a pre-treatment step is provided wherein the hair is combed and dried with a hair dryer (curling treatment), or washed with shampoo and dried with a hairdryer.

9. Method for straightening hair according to any one of the preceding claims, wherein an intermediate treatment step is provided after a certain number of passages of the plate (20), wherein the hair is dampened with an aqueous solution.

10. Device for straightening hair, for applying the method for straightening hair according to any one of the preceding claims, comprising a gas flow generator (10) connected through a conduit (14) to a dispensing plate (20) heated to a working temperature (T) via heating means (21);
    wherein said gas flow generator (10) comprises a hydrogen generator (11) connected through the duct (14) to dispensing means (24) provided on the dispensing plate (20) near the heating means (41).

11. Device for straightening hair according to claim 10, wherein the hydrogen generator (11) is an electrolyzer, or a proton exchange membrane PEM, or at least a hydrogen cylinder.

12. Device for straightening hair according to claim 10

or 11, further comprising, connected to the hydrogen generator (11), an enrichment device (12) for enriching the gas flow with vapor from liquid, e.g. steam.

**13.** Device for straightening hair according to claim 12, wherein the enrichment device (12) is a bubbler or an ultrasonic wet mist generator.

**14.** Device for straightening hair according to any one of claims 10 to 13, comprising pumping means (13) adapted to push the gas flow through the conduit (14) towards the dispensing plate (20), and/or means for regulating the gas flow.

**Patentansprüche**

**1.** Verfahren zum Glätten von Haaren, umfassend die folgenden Schritte:

- Erhitzen einer Platte (20) für Haare auf eine Arbeitstemperatur (T);
- Anwenden einer Gasströmung auf die Haare, die die Gasumgebung um die Haare ändert;
- gleichzeitiges langsames Führen der Platte (20) über jeweils eine Locke, wobei eine Vielzahl von Führungen durchgeführt werden;

**dadurch gekennzeichnet, dass** die Gasumgebung um die Haare während des Führens der Platte (20) von einem Gasströmungsgenerator (10), der einen Wasserstoffgenerator (11) umfasst, mit Wasserstoff angereichert wird.

**2.** Verfahren zum Glätten von Haaren nach Anspruch 1, wobei der Schritt des Anwendens einer Gasströmung auf die Haare für das Anwenden einer Gasströmung aus reinem Wasserstoff durch um die Platte (20) verteilt Düsen oder in ihrer Nähe sorgt, wodurch bei ihrer Ausbreitung die richtige Verdünnung ermöglicht wird.

**3.** Verfahren zum Glätten von Haaren nach Anspruch 1 oder 2, wobei der Wasserstoff mit einer Durchflussmenge von zwischen 150 ml/min und 250 ml/min und vorzugsweise 200 ml/min zugeführt wird.

**4.** Verfahren zum Glätten von Haaren nach einem der vorhergehenden Ansprüche, wobei die Platte (20) auf eine Arbeitstemperatur (T) von zwischen 200 °C und 250 °C und vorzugsweise 230 °C erhitzt wird.

**5.** Verfahren zum Glätten von Haaren nach einem der vorhergehenden Ansprüche, wobei der Schritt des Führens der Platte über jeweils eine Locke das Durchführen von mindestens insgesamt zehn Führungen umfasst, die aufeinander folgen oder in die ein Zwischenbehandlungsschritt eingestreut wird.

**6.** Verfahren zum Glätten von Haaren nach einem der vorhergehenden Ansprüche, wobei ein Vorbehandlungsschritt bereitgestellt wird, in dem die Haare mit einer wässrigen Lösung befeuchtet werden.

**7.** Verfahren zum Glätten von Haaren nach Anspruch 6, wobei die wässrige Lösung Wasser oder demineralisiertes Wasser oder Kochsalzlösung, die mindestens 3 % Natriumchlorid enthält, oder Wasser ist, das mindestens 0,1 % Polyglutaminsäure umfasst.

**8.** Verfahren zum Glätten von Haaren nach einem der vorhergehenden Ansprüche, wobei ein Vorbehandlungsschritt bereitgestellt wird, wobei die Haare gekämmt und mit einem Haartrockner getrocknet (Lockenbehandlung) oder mit Shampoo gewaschen und mit einem Haartrockner getrocknet werden.

**9.** Verfahren zum Glätten von Haaren nach einem der vorhergehenden Ansprüche, wobei ein Zwischenbehandlungsschritt nach einer bestimmten Anzahl von Führungen der Platte (20) bereitgestellt wird, wobei die Haare mit einer wässrigen Lösung befeuchtet werden.

**10.** Vorrichtung zum Glätten von Haaren, zum Anwenden des Verfahrens zum Glätten von Haaren nach einem der vorhergehenden Ansprüche, umfassend einen Gasströmungsgenerator (10), der durch einen Kanal (14) mit einer Abgabeplatte (20) verbunden ist, die über Heizmittel (21) auf eine Arbeitstemperatur (T) erhitzt wird;
wobei der Gasströmungsgenerator (10) einen Wasserstoffgenerator (11) umfasst, der durch die Leitung (14) mit Abgabemitteln (24) verbunden ist, die an der Abgabeplatte (20) in der Nähe der Heizmittel (41) bereitgestellt sind.

**11.** Vorrichtung zum Glätten von Haaren nach Anspruch 10, wobei der Wasserstoffgenerator (11) ein Elektrolyseur oder eine Protonenaustauschmembran (PEM) oder mindestens eine Wasserstoffflasche ist.

**12.** Vorrichtung zum Glätten von Haaren nach Anspruch 10 oder 11, die ferner, verbunden mit dem Wasserstoffgenerator (11), eine Anreicherungsvorrichtung (12) zum Anreichern der Gasströmung mit Dampf von Flüssigkeit, z. B. Wasserdampf, umfasst.

**13.** Vorrichtung zum Glätten von Haaren nach Anspruch 12, wobei die Anreicherungsvorrichtung (12) ein Bubbler (Blasdüsen) oder ein Ultraschall-Feuchtnebelgenerator ist.

**14.** Vorrichtung zum Glätten von Haaren nach einem der Ansprüche 10 bis 13, die Pumpmittel (13), die geeignet sind, die Gasströmung durch den Kanal (14) hin zu der Abgabeplatte (20) zu drücken, und/oder

Mittel zur Regulierung der Gasströmung umfasst.

**Revendications**

1. Procédé pour le défrisage des cheveux, comprenant les étapes de :

   - chauffer une plaque pour cheveux (20) à une température de travail (T),
   - appliquer aux cheveux un flux de gaz qui change l'environnement de gaz autours des cheveux,
   - passer la plaque (20) en même temps lentement sur une mèche à la fois, effectuant une pluralité de passages,

   **caractérisé en ce que**, pendant le passage de la plaque (20), l'environnement de gaz autour des cheveux est enrichi avec de l'hydrogène par un générateur de flux de gaz (10) comprenant un générateur d'hydrogène (11).

2. Procédé pour le défrisage des cheveux selon la revendication 1, **caractérisé en ce que** l'étape d'appliquer un flux de gaz aux cheveux comprend appliquer un flux de gaz d'hydrogène pur à travers de buses réparties le long de la plaque (20) ou dans ses alentours, permettant lors de sa dispersion sa propre dilution.

3. Procédé pour le défrisage des cheveux selon la revendication 1 ou 2, **caractérisé en ce que** l'hydrogène est fourni avec un débit entre 150 ml/min et 250 ml/min et de préférence de 200 ml/min.

4. Procédé pour le défrisage des cheveux selon l'une des revendications précédentes, **caractérisé en ce que** la plaque (20) est chauffée à une température de travail (T) entre 200 °C et 250 °C et de préférence de 230 °C.

5. Procédé pour le défrisage des cheveux selon l'une des revendications précédentes, **caractérisé en ce que** l'étape de passer la plaque sur une mèche à la fois implique d'effectuer un total d'au moins dix passages consécutifs ou entrecoupés d'une étape de traitement intermédiaire.

6. Procédé pour le défrisage des cheveux selon l'une des revendications précédentes, **caractérisé en ce qu'**une étape de prétraitement est prévue pendant laquelle les cheveux sont humidifiés avec une solution aqueuse.

7. Procédé pour le défrisage des cheveux selon la revendication 6, **caractérisé en ce que** la solution aqueuse est de l'eau ou de l'eau déminéralisée ou de l'eau saline contenant au moins 3% de chlorure de sodium, ou de l'eau contenant au moins 0,1 % d'acide polyglutamique.

8. Procédé pour le défrisage des cheveux selon l'une des revendications précédentes, **caractérisé en ce qu'**une étape de prétraitement est prévue pendant laquelle les cheveux sont peignés et séchés avec un sèche-cheveux (traitement de mise en boucles) ou lavés au shampoing et séchés avec un sèche-cheveux.

9. Procédé pour le défrisage des cheveux selon l'une des revendications précédentes, **caractérisé en ce qu'**une étape de traitement intermédiaire est prévue après un certain nombre de passages de la plaque (20), pendant laquelle les cheveux sont humidifiés avec une solution aqueuse.

10. Dispositif pour le défrisage des cheveux pour appliquer le procédé pour le défrisage des cheveux selon l'une des revendications précédentes, comprenant un générateur de flux de gaz (10) relié par un conduit (14) à une plaque de distribution (20) chauffée à une température de travail (T) à l'aide de moyens de chauffage (21),
    **caractérisé en ce que** le générateur de flux de gaz (10) comprend un générateur d'hydrogène (11) relié par le conduit (14) à des moyens de distribution (24) prévus sur la plaque de distribution (20) proches des moyens de chauffage (41).

11. Dispositif pour le défrisage des cheveux selon la revendication 10, **caractérisé en ce que** le générateur d'hydrogène (11) est un électrolyseur ou une membrane d'échange de protons PEM ou au moins un cylindre d'hydrogène.

12. Dispositif pour le défrisage des cheveux selon la revendication 10 ou 11, comprenant en outre, relié au générateur d'hydrogène (11), un dispositif d'enrichissement (12) pour enrichir le flux de gaz avec de la vapeur provenant d'un liquide, par exemple vapeur d'eau.

13. Dispositif pour le défrisage des cheveux selon la revendication 12, **caractérisé en ce que** le dispositif d'enrichissement (12) est un barboteur ou un générateur de brouillard humide à ultrasons.

14. Dispositif pour le défrisage des cheveux selon l'une des revendications 10 à 13, comprenant des moyens de pompage (13) adaptés pour pousser le flux de gaz par le conduit (14) vers la plaque de distribution (20) et/ou des moyens pour régler le flux de gaz.

TREATMENTS

| TYPE OF LOCKS | 1P | 2P | 3P | 4P | 5P | 6P | 7P | 11P | 1T | 1Tbis |
|---|---|---|---|---|---|---|---|---|---|---|
| **AFRO** | B | B | S | S | B | B | N | B | B | B |
| **VERY FRIZZY** | B | B | S | S | B | B | N | B | B | B |
| **SOFT CURLY** | B | B | S | S | B | B | N | B | B | B |
| **FRIZZY CURLY** | B | B | S | S | B | B | N | B | B | B |
| **FRIZZY WAVY** | B | B | S | S | B | B | N | B | B | B |

TREATMENT RESULTS

| | |
|---|---|
| NEGATIVE | N |
| SUFFICIENT | S |
| GOOD | B |

FIG.1



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# (FIG.1 - continued)

| | TYPE OF STRAIGHTENING | T°C | HAIR CONDITION | NO. PASSAGES | NO. REPETITIONS OF THE TREATMENT | NOTES |
|---|---|---|---|---|---|---|
| **1P** | CENTRAL HYDROGEN PLATE | 230 | DAMP | **10** | 2 (after 2 days) | |
| **2P** | CENTRAL HYDROGEN PLATE | 230 | DAMP | 20 | 2 (after 2 days) | |
| **3P** | CHEMICAL | | | | | |
| **4P** | CENTRAL HYDROGEN PLATE | 230 | BLEACHED | **20** | 2 (after 2 days) | |
| **5P** | CENTRAL HYDROGEN PLATE | 230 | DAMP | 5+5 | | intermediate treatment (after 5 passages): the hair is dampened |
| **6P** | CENTRAL HYDROGEN PLATE | 230 | DRY | **10** | | Set pre-treatment |
| **7P** | CENTRAL HYDROGEN PLATE | 160 | DAMP | **10** | | |
| **11P** | CENTRAL HYDROGEN PLATE | 230 | DAMP | 10+10 | | intermediate treatment (after 10 passages): the hair is washed with cold water and dried with a hair dryer<br>Post-treatment: the hair is washed with 2 shampoos |
| **1T** | CENTRAL HYDROGEN PLATE | 230 | DRY | 5+7 | | Pre-treatment: the hair is washed with shampoo and dried with a hair dryer.<br>Intermediate treatment (after 5 passages): the hair is dampened. |
| **1TBIS** | CENTRAL HYDROGEN PLATE | 230 | DRY | 5+7 | | Pre-treatment: the hair is washed with shampoo and dried with a hair dryer.<br>Intermediate treatment (after 5 passages): the hair is dampened.<br>Post-treatment: the hair is washed with 2 shampoos |

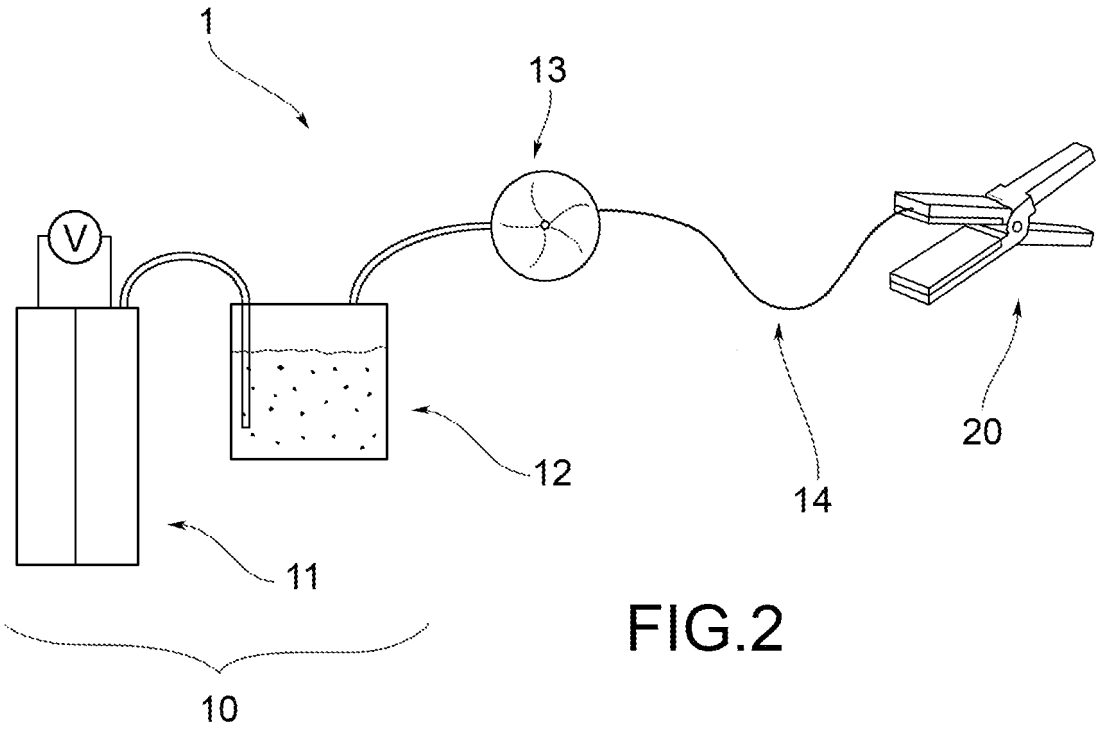


FIG.2

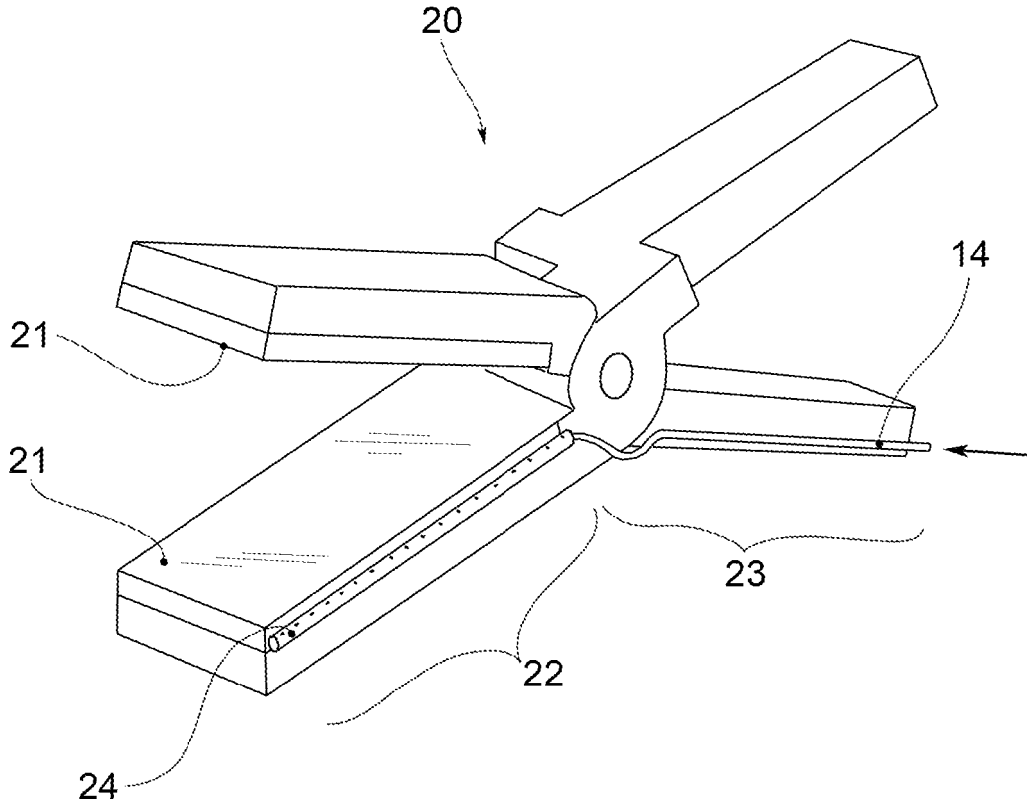


FIG.3

## REFERENCES CITED IN THE DESCRIPTION

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