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(54) **Method for manufacturing hair prostheses**

Verfahren zur Herstellung von Haarprothesen

Méthode pour la fabrication de prothèses capillaires

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(73) Proprietor: **Cesare Ragazzi Company S.P.A.**
40069 Zola Predosa (BO) (IT)

(72) Inventor: **Ragazzi, Cesare**
40069 Zola Predosa BO (IT)

(74) Representative: **Modiano, Micaela Nadia**
Dr. Modiano & Associati SpA
Via Meravigli 16
20123 Milano (IT)

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Description

[0001] The present invention relates to a method for manufacturing hair prostheses constituted by real or synthetic hair implanted on a base which replicates human skin and is placed in contact with the scalp of the user.

[0002] IT1233919 discloses a method for manufacturing hair prostheses, comprising the steps of:

generating a replica of the skull of the user with the references of the hairless area; placing on the replica of the skull, along the entire demarcation line, a fringe of hair and spreading onto said replica a thin layer of polyurethane resin in order to form a polyurethane cap, the extent of which corresponds to the part of the head to be covered with said prosthesis, said area being delimited by said demarcation line; distributing on said polyurethane cap a thin layer of silicone material, which forms a silicone cap; separating the pair of caps from said replica of the skull; applying to said replica of the skull a layer of sponge-like material;

fixing the pair of caps onto said layer of sponge-like material; implanting a plurality of hairs in the pair of caps by means of a microneedle in an oblique direction which corresponds to the direction of the hairline in the various regions of the scalp; separating the pair of caps, with the implanted hair, from said sponge-like layer and overturning said pair so as to direct outward the roots of said hair, oriented in said oblique direction, in order to spread on said oriented roots a layer of fixing resin; lifting from the replica of the skull the pair of caps and removing the silicone cap; applying a suitable lining inside the polyurethane cap; polymerizing in an oven the resulting prosthesis.

[0003] Hair prostheses are currently made of highly sophisticated material and increasingly use only real hair.

[0004] The need to work on these sophisticated materials and on hair with extreme skill entails a generally rather long time between the order from the user and the delivery of the prosthesis.

[0005] The various operations must in fact be performed by different individuals, who often do not even work within a same facility.

[0006] Substantially, in order to produce a high-quality hair prosthesis, each step of production must be followed by a specialized technician, because the processes are complicated.

[0007] The aim of the present invention is to obviate the cited drawbacks and meet the mentioned requirements, by providing a method for manufacturing hair prostheses which is easy to provide in practice and can be performed completely in a relatively short time even by personnel which is not highly specialized.

[0008] Within this aim, an object of the present invention is to minimize the number of operations requiring the

presence of the user, which is a great advantage both for the user and for the manufacturer.

[0009] Another object of the present invention is to minimize the number of times that the user has to be subjected to the taking of a cast of his or her skull.

[0010] Another object of the present invention is to provide a method with a sequence of operations which is simple, safe in use, effective in operation, and has a relatively low cost.

[0011] This aim and these and other objects which will become better apparent hereinafter are achieved by the present method for manufacturing hair prostheses, which consists in taking a cast of the skull of the user with the references of the hairless area; acquiring, with a sensor, the coordinates of all the points of the surface of the cast, including the demarcation line between the hairless area and the remaining area, and storing said set of coordinates in a storage unit; generating a replica of the skull of the user, by machining a solid body, according to the respective set of coordinates previously stored in said unit; placing on the replica of the skull, along the entire demarcation line, a fringe of hair and spreading onto said replica a thin layer of polyurethane resin in order to form a polyurethane cap, the extent of which corresponds to the part of the head to be covered with said prosthesis, said area being delimited by said demarcation line; distributing on said polyurethane cap a thin layer of silicone material, which forms a silicone cap; separating the pair of caps from said replica of the skull; applying to said replica of the skull a layer of sponge-like material; fixing the pair of caps onto said layer of sponge-like material; implanting a plurality of hairs in the pair of caps by means of an appropriate microneedle in an oblique direction which corresponds to the direction of the hairline in the various regions of the scalp; separating the pair of caps, with the implanted hair, from said sponge-like layer and overturning said pair so as to direct outward the roots of said hair, oriented in said oblique direction, in order to spread on said oriented roots a layer of fixing resin; lifting from the replica of the skull the pair of caps and removing the silicone cap; applying a suitable lining inside the polyurethane cap; polymerizing in an oven the resulting prosthesis.

[0012] Further characteristics and advantages of the invention will become better apparent from the following detailed description of a preferred but not exclusive embodiment of a method for manufacturing hair prostheses, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a block diagram which is representative of the method according to the invention;

Figure 2 is a block diagram of the use of the prostheses obtained with the method according to the invention;

Figure 3 is a sectional side view, taken along a vertical plane, of a prosthesis obtained with the method according to the invention.

[0013] With reference to the figures, the reference numeral 1 generally designates a method for manufacturing hair prostheses.

[0014] The method 1 for manufacturing hair prostheses 2 is constituted by a sequence of operations, some of which must be performed in the presence of a user 3: the method 1 inherently entails the advantage of minimizing the number of operations requiring the presence of the user 3, which is a great advantage both for the user 3 and for the manufacturer.

[0015] First of all, it is necessary to provide 4 a cast of the skull of the user 3 with the references of the hairless area: the easiest cast to take is made with plaster (although it is conceivable to replace the plaster with rapidly crosslinking polymers which are not toxic upon skin contact). In this case, the user 3 must undergo a series of procedures, during which he will get dirty and will have to remain motionless for a rather long time: the need to minimize the number of times that the user 3 has to undergo this procedure is one of the goals of the method 1, since as will become apparent hereafter, the possibility to store the coordinates of the skull of the user 3 and retrieve them when necessary is employed.

[0016] Once the cast has been taken, step 4, it is necessary to acquire, step 5, the coordinates of all the points of the surface of said cast (by means of an appropriate sensor), including the demarcation line between the area that corresponds to the hairless area on the head of the user 3 and the remaining area. In a preferred embodiment, the coordinates are acquired by using a probe, the acquisition end of which can move on the surface of the cast by being guided so as to trace all the points of the surface of said cast. These coordinates must be stored, step 6, within a single file in an appropriate storage unit: this file which contains the set of coordinates will also comprise a code suitable to associate it uniquely with the user 3 to which it corresponds. Generally, the storage unit is a computer (a personal computer, in a preferred solution) which is connected (with the interposition of at least one suitable interface) to the probe and manages its operation.

[0017] The stored sets of coordinates can be retrieved at any time to send them to a numeric-control milling machine which is functionally associated with the personal computer: by means of this milling machine, it is possible to generate, step 7, a replica of the skull of the user 3 by milling a solid body constituted by a material which is substantially of the polymeric type.

[0018] On the replica of the skull, along the entire demarcation line between the portion that corresponds to the area covered with hair and the hairless area, it is necessary to distribute, step 8, a fringe of hair, which is designed to make less conspicuous the discontinuity between the hair of the user 3 and the hair of the prosthesis being manufactured. On the replica of the skull, taking care to cover the previously distributed fringe, it is necessary to spread, step 9, a thin layer of polyurethane resin in order to form a polyurethane cap 10, the extent

of which corresponds to the part of the head to be covered with the prosthesis 2, said area being indeed delimited by said demarcation line. The polyurethane cap 10 must have a maximum thickness at its central region and a minimum thickness along the outside perimeter (as shown in Figure 3) in order to make the presence of the cap 10 undetectable when the user 3 wears the prosthesis 2.

[0019] One proceeds by distributing, step 11, on the polyurethane cap 10a thin layer of silicone material, which forms a silicone cap.

[0020] Once the pair of caps has been separated, step 12, from the replica of the skull, it is necessary to apply, step 13, on the replica of the skull a layer of sponge-like material: this is substantially a thin layer of a material such as sponge rubber which is distributed uniformly.

[0021] The pair of caps must then be fixed, step 14, again onto the layer of sponge-like material, and a plurality of hairs is implanted, step 15, therein by means of an appropriate microneedle: the implantation must be performed in an oblique direction with respect to the surface of the pair of caps, a direction which corresponds to the hairline direction in the various regions of the scalp on the head of the user 3.

[0022] After all the hairs have been implanted, the pair of caps with the implanted hairs must be separated, step 16, from the sponge-like layer and overturned, step 17, so as to direct outward the roots of the hairs (fitting the overturned pair again onto the replica of the skull), in order to spread onto it a layer of fixing resin.

[0023] At this point, the inverted pair of caps is lifted, step 18, from the replica of the skull and the silicone cap is removed, step 19.

[0024] One proceeds by applying, step 20, inside the polyurethane cap 10 a suitable lining and by polymerizing, step 21, in an oven the prosthesis 2 thus formed.

[0025] The method 1 is of particular interest in relation to the fact that it can be repeated easily in order to provide a plurality of prostheses designed to cover areas of the skull of the user having different sizes. When the method is complete, it is in fact sufficient to check, step 22, whether other prostheses 2 are needed and, if they are, arrange again the fringes of hair (as in step 8) on the replica of the skull and repeat the method 1. The purpose of providing a plurality of prostheses 2 is linked to the possibility to have a first prosthesis 23 which comprises a hair-covered area which is smaller than in a second prosthesis 24, and so forth, including a last prosthesis 25 which has the largest hair-covered area.

[0026] In this way, it is possible to provide (A) the user 3 with the first prosthesis 23 for a first period, during which he can become accustomed to seeing his own image altered by the prosthesis 23. Once this first period has ended, it is necessary to replace (B) the first prosthesis 23 with the second prosthesis 24 and leave the second prosthesis to the user 3 for a second period. This process entails several cycles of replacement of the prosthesis in use with the next one among the ones that have been

manufactured, once the corresponding period has ended, leaving the next prosthesis to the user 3 for a suitable period.

[0027] Only the last prosthesis 25 (the one with the maximum covering area) is provided (N) indefinitely, so that the user 3 does not see his image change overnight, struggling to accept the change.

[0028] Before arranging the hair on the replica of the skull and on the pair of caps, it is convenient to wash the hair with shampoo and water at a temperature between 25°C and 45°C, eliminating the hair that are defective and dividing them by groups having uniform characteristics: accordingly, locks of hair which are uniform in terms of color and type (straight, curly) are provided, allowing easier use.

[0029] Once the final polymerization has been performed, it is convenient to provide a distributed microporosity on the prosthesis 2, in which the holes 26 are mutually offset: in this way, breathability is allowed and the comfort of the user 3 is improved.

[0030] The polyurethane resin with which the caps 10 are manufactured comprises, within the base mix, suitable colors in order to give the polyurethane cap 10 the same color as the skin of the user 3.

[0031] Of course, the hair on the prosthesis 2 is distributed in accordance to the color distribution and orientation of the hair of the user 3.

[0032] It has thus been shown that the invention achieves the proposed aim and objects.

[0033] The invention thus conceived is susceptible of numerous modifications and variations which are within the scope of the appended claims.

[0034] In the exemplary embodiments shown, individual characteristics, given in relation to specific examples, may actually be interchanged with other different characteristics that exist in other exemplary embodiments.

[0035] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A method for manufacturing hair prostheses (2), comprising the steps of:

taking (4) a cast of the skull of the user (3) with the references of the hairless area;
acquiring (5), with a sensor, the coordinates of all the points of the surface of the cast, including the demarcation line between the hairless area and the remaining area, and storing (6) said set of coordinates in a storage unit;
generating (7) a replica of the skull of the user

(3), by machining a solid body, according to the respective set of coordinates previously stored (6) in said unit;

placing (8) on the replica of the skull, along the entire demarcation line, a fringe of hair and spreading (9) onto said replica a thin layer of polyurethane resin in order to form a polyurethane cap (10), the extent of which corresponds to the part of the head to be covered with said prosthesis (2), said area being delimited by said demarcation line;

distributing (11) on said polyurethane cap (10) a thin layer of silicone material, which forms a silicone cap;

separating (12) the pair of caps from said replica of the skull;

applying (13) to said replica of the skull a layer of sponge-like material;

fixing (14) the pair of caps onto said layer of sponge-like material;

implanting (15) a plurality of hairs in the pair of caps by means of a microneedle in an oblique direction which corresponds to the direction of the hairline in the various regions of the scalp; separating (16) the pair of caps, with the implanted hair, from said sponge-like layer and overturning (17) said pair so as to direct outward the roots of said hair, oriented in said oblique direction, in order to spread on said oriented roots a layer of fixing resin;

lifting (18) from the replica of the skull the pair of caps and removing (19) the silicone cap;

applying (20) a suitable lining inside the polyurethane cap;

polymerizing (21) in an oven the resulting prosthesis (2).

2. The method according to claim 1, comprising the step of providing a plurality of prostheses (2), a first prosthesis (23) comprising a smaller hair-covered area than the second prosthesis (24) and so forth, the last prosthesis (25) comprising a hair-covered area having the maximum dimensions.

3. The method according to claim 2, which comprises the steps of:

providing (A) to the user (3) the first prosthesis (23) for a first period,

replacing (B) the first prosthesis (23) with the second prosthesis (24), once said first period has ended, and leaving the second prosthesis (24) to the user (3) for a second period, replacing the prosthesis being used with the next one among the ones that have been manufactured, once the corresponding period has ended, and leaving the next prosthesis to the user (3) for a respective period,

supplying (N) the last prosthesis (25) to the user (3) indefinitely.

4. The method according to claim 1, which comprises the steps of:

before arranging (8) the hair on the replica of the skull and on the pair of caps, washing the hair with shampoo and water at a temperature between 25°C and 45°C, eliminating the hairs found to be defective, dividing the hairs by groups having uniform characteristics.

5. The method according to claim 1, which comprises the step of:

providing said layer of polyurethane resin, arranged on said replica of the skull, with a maximum thickness at its central region and a minimum thickness along the outside perimeter.

6. The method according to claim 1, which comprises, once the final polymerization has been performed, the step of:

performing on said prosthesis (2) a distributed microperforation in which the holes (26) are mutually offset.

7. The method according to claim 1, which comprises the step of:

mixing, within the polyurethane resin with which said caps (10) are produced, suitable colors in order to give the polyurethane cap (10) the same color as the skin of the user (3).

8. The method according to claim 1, which comprises the step of:

distributing the hair on the prosthesis (2) in accordance with the color distribution and orientation of the hair of the user (3).

9. The method according to claim 1, **characterized in that** the sensor (5) for acquiring the coordinates of all the points of the surface of the cast is a probe and **in that** said storage unit is a computer.

10. The method according to claims 1 and 9, **characterized in that** said machining (7) is performed by a numeric-control machine controlled by said computer, said machine being generally a milling machine.

Patentansprüche

1. Ein Verfahren zur Herstellung von Haarprothesen (2), das folgende Schritte umfasst:

Fertigung (4) eines Abgusses des Schädels des Benutzers (3) mit Bezug auf den haarlosen Bereich, Erfassung (5), mit einem Sensor, der Koordinaten aller Punkte der Oberfläche des Abgusses, einschließlich der Demarkationslinie zwischen dem haarlosen Bereich und dem restlichen Bereich, und Speicherung (6) des Satzes von Koordinaten in einer Speichereinheit, Herstellung (7) einer Kopie des Schädels des Benutzers (3) durch Bearbeitung eines festen Körpers gemäß dem entsprechenden Satz von Koordinaten, die zuvor in der Einheit gespeichert wurden (6), Platzierung (8) auf die Kopie des Schädels, entlang der gesamten Demarkationslinie, eines Saumes von Haar, und Verteilung (9) einer dünnen Schicht von Polyurethanharz auf die Kopie, um eine Polyurethan-Kappe (10) zu bilden, deren Ausdehnung dem Teil des Kopfes entspricht, der von der Prothese (2) bedeckt werden soll, wobei der Bereich durch die Demarkationslinie begrenzt wird, Verteilung (11), auf der Polyurethan-Kappe (10), einer dünnen Schicht von Silikon-Material, die eine Silikon-Kappe bildet, Trennung (12) des Paares von Kappen von der Kopie des Schädels, Auftragen (13) einer Schicht schwammähnlichen Materials auf die Kopie des Schädels, Befestigung (14) des Paares von Kappen auf der Schicht schwammähnlichen Materials, Implantation (15) einer Vielzahl von Haaren in das Paar von Kappen mit Hilfe einer Mikronadel in eine schräge Richtung, die der Richtung des Haaransatzes in den verschiedenen Bereichen der Kopfhaut entspricht, Trennung (16) des Paares von Kappen, mit dem implantierten Haar, von der schwammähnlichen Schicht und Umdrehen (17) des Paares, um die Wurzeln des Haars nach außen zu richten, ausgerichtet in die schräge Richtung, um auf den ausgerichteten Wurzeln eine Schicht Fixierharz zu verteilen, Abheben (18) des Paares von Kappen von der Kopie des Schädels und Entfernen (19) der Silikon-Kappe, Anbringung (20) einer geeigneten Auskleidung in der Polyurethan-Kappe, Polymerisation (21) der resultierenden Prothese (2) in einem Ofen.

2. Das Verfahren gemäß Anspruch 1, das den Schritt

- der Bereitstellung einer Vielzahl von Prothesen (2) umfasst, wobei eine erste Prothese (23) einen kleineren von Haar bedeckten Bereich umfasst als die zweite Prothese (24) und so weiter, wobei die letzte Prothese (25) einen von Haar bedeckten Bereich mit den größten Maßen umfasst. 5
3. Das Verfahren gemäß Anspruch 2, das folgende Schritte umfasst:
- Bereitstellung (A) der ersten Prothese (23) an den Benutzer (3) über einen ersten Zeitraum, Ersetzen (B) der ersten Prothese (23) durch die zweite Prothese (24), sobald der erste Zeitraum vorüber ist, und Überlassen der zweiten Prothese (24) an den Benutzer (3) über einen zweiten Zeitraum, Ersetzen der verwendeten Prothese durch die nächste unter denjenigen, die hergestellt wurden, sobald der entsprechende Zeitraum vorüber ist, und Überlassen der nächsten Prothese an den Benutzer (3) über einen entsprechenden Zeitraum, unbegrenzte Bereitstellung (N) der letzten Prothese (25) an den Benutzer (3). 10 15 20 25
4. Das Verfahren gemäß Anspruch 1, das folgende Schritte umfasst:
- vor Anordnung (8) des Haares auf der Kopie des Schädels und dem Paar von Kappen, Waschen des Haares mit Shampoo und Wasser bei einer Temperatur zwischen 25°C und 45°C, wobei die Haare, die sich als schadhaft herausstellen, beseitigt werden, Unterteilen der Haare in Gruppen, die einheitliche Eigenschaften haben. 30 35
5. Das Verfahren gemäß Anspruch 1, das folgenden Schritt umfasst:
- Versehen der Schicht von Polyurethanharz, die auf die Kopie des Schädels aufgetragen wird, mit einer maximalen Dicke an ihrem zentralen Bereich und einer minimalen Dicke entlang dem äußeren Umfang. 40 45
6. Das Verfahren gemäß Anspruch 1, das, sobald die abschließende Polymerisation durchgeführt wurde, folgenden Schritt umfasst:
- Durchführung einer verteilten Mikroperforation, in der die Löcher (26) voneinander versetzt sind, an der Prothese (2). 50 55
7. Das Verfahren gemäß Anspruch 1, das folgenden Schritt umfasst:
- Mischen innerhalb des Polyurethanharzes, mit dem die Kappen (10) hergestellt werden, geeigneter Farben, um der Polyurethan-Kappe (10) dieselbe Farbe zu verleihen, wie sie die Haut des Benutzers (3) hat.
8. Das Verfahren gemäß Anspruch 1, das folgenden Schritt umfasst:
- Verteilung des Haares auf der Prothese (2) gemäß der Farbverteilung und Ausrichtung des Haares des Benutzers (3).
9. Das Verfahren gemäß Anspruch 1, **dadurch gekennzeichnet, dass** der Sensor (5) zur Erfassung der Koordinaten aller Punkte der Oberfläche des Abgusses eine Sonde ist, und **dadurch**, dass die Speichereinheit ein Computer ist.
10. Das Verfahren gemäß Anspruch 1 und 9, **dadurch gekennzeichnet, dass** die Bearbeitung (7) von einer numerisch gesteuerten Maschine durchgeführt wird, die vom Computer gesteuert wird, wobei die Maschine im Allgemeinen eine Fräsmaschine ist.

Revendications

1. Procédé de fabrication de prothèses capillaires (2), comprenant les étapes consistant à:
- prendre (4) une empreinte du crâne de l'utilisateur (3) avec les références de la zone sans cheveux ;
- collecter (5) au moyen d'un capteur les coordonnées de tous les points de la surface de l'empreinte, y compris la ligne de démarcation entre la zone sans cheveux et le reste de la zone, et stocker (6) ledit ensemble de coordonnées dans une unité de stockage ;
- produire (7) une réplique du crâne de l'utilisateur (3), en usinant un corps solide, selon l'ensemble de coordonnées respectif précédemment stocké (6) dans ladite unité ;
- placer (8) sur la réplique du crâne, le long de toute la ligne de démarcation, une frange de cheveux, et appliquer (9) sur ladite réplique une fine couche de résine de polyuréthane afin de former une coiffe de polyuréthane (10), dont l'étendue correspond à la partie de la tête devant être recouverte par ladite prothèse (2), ladite zone étant délimitée par ladite ligne de démarcation ;
- distribuer (11) sur ladite coiffe de polyuréthane (10) une fine couche de matériau en silicone qui forme une coiffe en silicone ;
- séparer (12) la paire de coiffes de ladite réplique du crâne ;

- appliquer (13) sur ladite réplique du crâne une couche de matériau semblable à une éponge ;
fixer (14) la paire de coiffes sur ladite couche de matériau semblable à une éponge ;
implanter (15) une pluralité de cheveux dans la paire de coiffes au moyen d'une micro-aiguille dans une direction oblique qui correspond à la direction de la naissance des cheveux dans les diverses régions du cuir chevelu ;
séparer (16) la paire de coiffes, avec les cheveux implantés, de ladite couche semblable à une éponge et retourner (17) ladite paire de manière à diriger les racines desdits cheveux vers l'extérieur, orientées dans ladite direction oblique, afin d'appliquer sur lesdites racines orientées une couche de résine de fixation ;
soulever (18) les paires de coiffes de la réplique du crâne et retirer (19) la coiffe en silicone ;
appliquer (20) un revêtement approprié à l'intérieur de la coiffe en polyuréthane ;
polymériser (21) dans un four la prothèse obtenue (2).
2. Procédé selon la revendication 1, comprenant l'étape consistant à fournir une pluralité de prothèses (2), une première prothèse (23) comprenant une zone recouverte de cheveux plus petite que la seconde prothèse (24) et ainsi de suite, la dernière prothèse (25) comprenant une zone recouverte de cheveux présentant les dimensions maximales.
3. Procédé selon la revendication 2, comprenant les étapes consistant à :
- fournir (A) à l'utilisateur (3) la première prothèse (23) pendant une première période,
remplacer (B) la première prothèse (23) par la seconde prothèse (24), une fois que ladite première période s'est terminée, et laisser la seconde prothèse (24) à l'utilisateur (3) pendant une seconde période,
remplacer la prothèse utilisée par la suivante parmi celles qui ont été fabriquées, une fois que la période correspondante s'est écoulée, et laisser la prothèse à l'utilisateur (3) pendant une période respective,
fournir (N) la dernière prothèse (25) à l'utilisateur (3) de manière indéfinie.
4. Procédé selon la revendication 1, comprenant les étapes consistant à :
- avant de disposer (8) les cheveux sur la réplique du crâne et sur la paire de coiffes,
laver les cheveux avec du shampoing et de l'eau à une température comprise entre 25 °C et 45 °C, de manière à éliminer les cheveux qui s'avèreraient défectueux,
- séparer les cheveux en groupes présentant des caractéristiques uniformes.
5. Procédé selon la revendication 1, comprenant l'étape consistant à :
- agencer ladite couche de résine de polyuréthane, disposée sur ladite réplique du crâne, avec une épaisseur maximale au niveau de sa région centrale et une épaisseur minimale le long du périmètre extérieur.
6. Procédé selon la revendication 1, comprenant, une fois que la polymérisation finale a été effectuée, l'étape consistant à :
- réaliser sur ladite prothèse (2) une microperforation répartie dans laquelle les trous (26) sont mutuellement décalés.
7. Procédé selon la revendication 1, comprenant l'étape consistant à :
- mélanger dans la résine de polyuréthane avec laquelle lesdites coiffes (10) sont produites, des couleurs appropriées afin de donner à la coiffe de polyuréthane (10) la même couleur que la peau de l'utilisateur (3).
8. Procédé selon la revendication 1, comprenant l'étape consistant à :
- répartir les cheveux sur la prothèse (2) selon la répartition de couleur et l'orientation des cheveux de l'utilisateur (3).
9. Procédé selon la revendication 1, **caractérisé en ce que** le capteur (5) destiné à collecter les coordonnées de tous les points de la surface de l'empreinte est une sonde et **en ce que** ladite unité de stockage est un ordinateur.
10. Procédé selon l'une quelconque des revendications 1 à 9, **caractérisé en ce que** ledit usinage (7) est réalisé par une machine à commande numérique commandé par ledit ordinateur, ladite machine étant généralement une machine à fraiser.

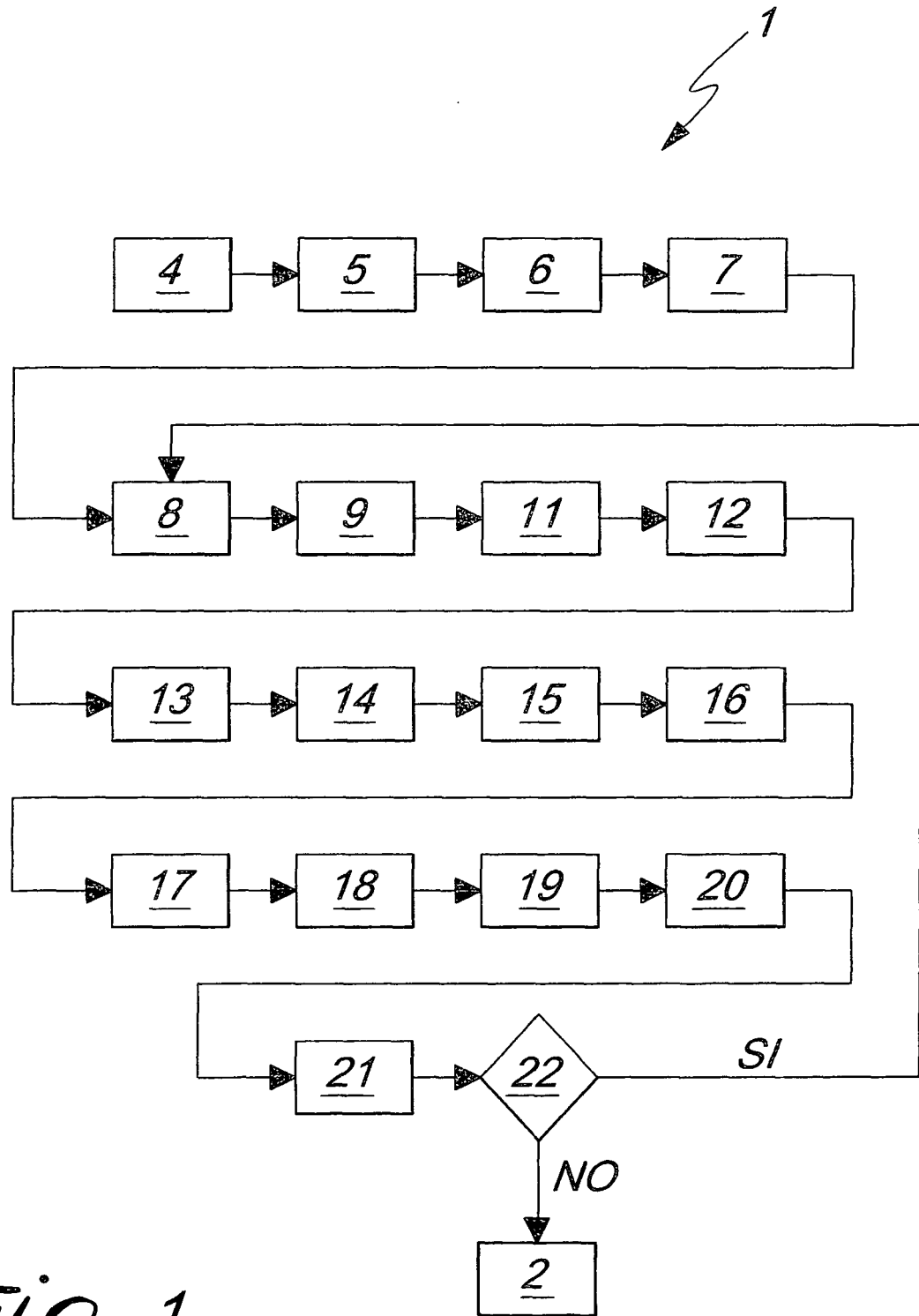


Fig. 1

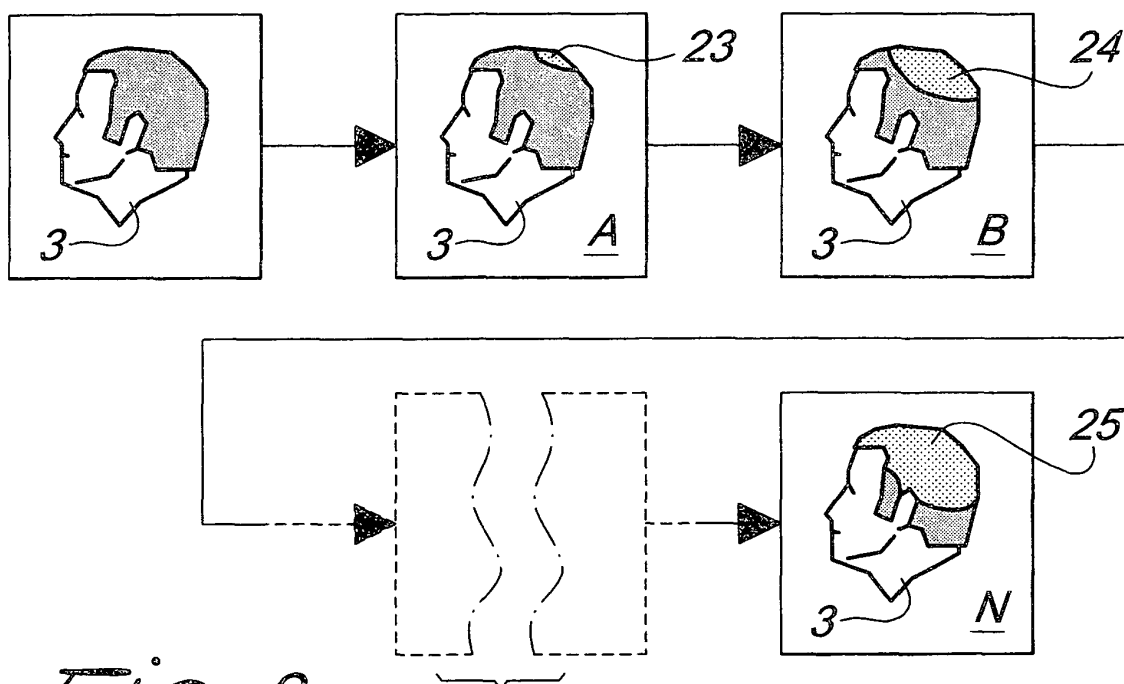


Fig. 2

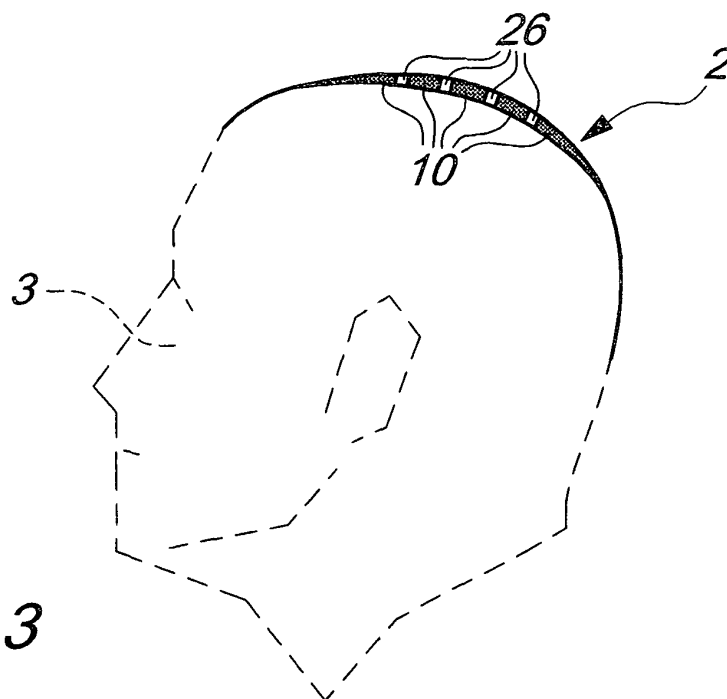


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- IT 1233919 [0002]