

(19)



(11)

**EP 3 579 724 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:  
**24.01.2024 Bulletin 2024/04**

(51) International Patent Classification (IPC):  
**A46D 1/05** (2006.01) **A46B 15/00** (2006.01)  
**A46D 1/00** (2006.01)

(21) Application number: **17908331.6**

(52) Cooperative Patent Classification (CPC):  
**A46D 1/0246**; A46B 2200/202; A46D 1/0207;  
A46D 1/0238; A46D 1/0292; A46D 1/04

(22) Date of filing: **30.11.2017**

(86) International application number:  
**PCT/SE2017/051195**

(87) International publication number:  
**WO 2018/203783 (08.11.2018 Gazette 2018/45)**

(54) **METHOD OF PRODUCING A HOLLOW SYNTHETIC BRISTLE, A HOLLOW SYNTHETIC BRISTLE  
AND A PAINT BRUSH COMPRISING SUCH HOLLOW SYNTHETIC BRISTLES**

VERFAHREN ZUR HERSTELLUNG EINER HOHLEN SYNTHETISCHEN BORSTE, HOHLE  
SYNTHETISCHE BORSTE UND PINSEL MIT SOLCHEN HOHLEN SYNTHETISCHEN BORSTEN

PROCÉDÉ DE FABRICATION D'UNE SOIE SYNTHÉTIQUE CREUSE, SOIE SYNTHÉTIQUE  
CREUSE ET PINCEAU COMPRENANT DE TELLES SOIES SYNTHÉTIQUES CREUSES

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB  
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO  
PL PT RO RS SE SI SK SM TR**

(30) Priority: **02.05.2017 SE 1750529**  
**29.09.2017 CN 201710912103**  
**29.09.2017 CN 201721275332 U**

(43) Date of publication of application:  
**18.12.2019 Bulletin 2019/51**

(73) Proprietor: **Orkla House Care AB**  
**564 23 Bankeryd (SE)**

(72) Inventors:  
• **RAGNARSSON, Maria**  
**556 25 Jönköping (SE)**  
• **HEINSJÖ, Fredrik**  
**302 40 Halmstad (SE)**

(74) Representative: **AWA Sweden AB**  
**Box 5117**  
**200 71 Malmö (SE)**

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## Description

### TECHNICAL FIELD

[0001] The present invention relates to a method of producing a hollow synthetic bristle, a hollow synthetic bristle and a paint brush comprising a plurality of such hollow synthetic bristles.

### BACKGROUND ART

[0002] Synthetic bristles, i.e. monofilaments, can be produced from a wide variety of thermoplastic polymers, in a wide variety of configurations including solid and hollow, and in a wide variety of cross-sections, including circular, oval, triangular, trilocular, tetralocular, lobate, or may contain multiple voids. Much work has been done in the trade to improve paint pickup and paint release of paint brushes by experimenting with blends of different polymers, configurations, and cross-sections.

[0003] Natural fibres having split ends are known to hold paint more effectively and the multitude of small hairs at the tip section of each bristle to create a finer, smoother surface finish.

[0004] Hollow paint brush synthetic bristles have become more and more popular since they have a good paint pick up. However, no hollow synthetic bristles providing a similar efficiency as the natural fibres regarding the combination of holding paint and creating a finer surface finish has yet been satisfactorily achieved.

[0005] US4,381,325 A describes a method for providing a brush with ocatafoliate cross-section bristles with improved paint pickup.

### SUMMARY OF THE INVENTION

[0006] Finish treatment or processing of the tip section of synthetic bristles, i.e. tapering, can be achieved mechanically or chemically. Mechanical tapering can be achieved by passing the bristle over a rotating grindstone. Chemical tapering can be achieved by dipping an end portion of a bristle or bundle of bristles into a chemical tipping fluid, such as a caustic base or acid, to a certain bristle and/or bundle depth.

[0007] It is commonly known within the technical field that hollow synthetic bristles cannot be satisfactorily tapered by means of chemical tipping according to present tapering methods, because of the capillary action drawing the chemical tipping fluid into a non-controllable inside depth of the hollow synthetic bristle. A disadvantage with mechanical tapering is that hollow synthetic bristles are readily damaged when subjected to known commercial tapering machines and methods.

[0008] Furthermore, it is commonly known that paint brushes having synthetic bristles are easier to clean and usually are less expensive than paint brushes having natural fibres.

[0009] It is, accordingly, an object of the present inven-

tion to overcome deficiencies of the prior art, such as indicated above.

[0010] It is another object to provide improved paint brush hollow synthetic bristles having satisfactorily tipped sections which to a greater extent simulate natural fibres with split ends.

[0011] It is yet another object of the invention to provide a process for making a satisfactorily tipped section of a hollow synthetic bristle.

[0012] It is still another object of the invention to provide superior paint brush synthetic bristles having an improved paint pickup and paint release as well as create a fine and smooth surface finish.

[0013] Another object of the invention is to provide paint brush synthetic bristles with optimised performance/characteristics, e.g. in regard of tailored stiffness, i.e. lower stiffness at their tips and higher stiffness closer to their roots.

[0014] It is a further object of the present invention to provide a tapered and/or flagged synthetic bristle useful in the manufacture of paint brushes and having an improved paint pickup, paint release and which create a fine and smooth surface finish.

[0015] A further object of the present invention is to provide a method of chemically flagging/fraying free ends of hollow synthetic bristles such that their free ends are flagged/fringed "enough", i.e. not too much or too little. Hence, after finishing the treatment/method their free ends comprise an optimised shape and/or number and/or size of useful split ends/frays being two, three or a plurality of smaller and/or fractional ends at the free end section of each hollow synthetic bristle and to provide such inventive hollow synthetic bristles for manufacture of paint brushes. In principle, the method according to the invention make the free ends of the hollow synthetic bristles tattered and torn by chemically dividing them/splitting them up/disunite them into more and smaller free ends out of one larger free end. These hollow synthetic bristles, each comprising a multi-tipped free end, i.e. a free end comprising at least two "micro" tips, instead of only one "macro" tip, accomplishing improved paint pickup, paint release and fine and smooth surface finish.

[0016] According to the invention a method of producing a hollow synthetic bristle for a paint brush is provided, wherein the method comprise; arranging a first end of the hollow synthetic bristle in a holder, immersing a part of a second end of the hollow synthetic bristle in a chemically tipping fluid, lifting up the hollow synthetic bristle from the chemically tipping fluid after a period of time, wherein the part of the hollow synthetic bristle that is immersed in the chemically tipping fluid is 1 - 30% of the length of the hollow synthetic bristle.

[0017] By "tipping" is throughout this document hereby meant any processing or finish treatment suitable to be applied to a tip section of a synthetic bristle, such as a modified method of tapering and flagging.

[0018] Hereby is provided a finish treatment or

processing of the free or second end of the hollow synthetic bristle, including chemical tipping of between 1 - 30% of the length of the hollow synthetic bristle.

**[0019]** Furthermore is provided a finish treatment or processing wherein the part of the second end of the hollow synthetic bristle is being processed on both its inside and outside.

**[0020]** In the context of the present invention under the term "bristle" there is understood an elongated flexible body having a first end and a second end. The first end is part of a root section where the bristle may be contained in and/or fastened in a bristle carrier. The second end of the bristle forms a free tip which usually contacts a surface to be coated with paint. The second end is part of a tip section of the bristle.

**[0021]** The hollow synthetic bristle may be produced from a wide variety of thermoplastic polymers, such as polyamides, polyesters and polyolefins.

**[0022]** The cross-sectional area of the hollow synthetic bristle may be cylindrical or oval shaped or S-shaped and the hollow synthetic bristle may have an approximate even wall thickness along the length of the synthetic bristle before being chemically tipped.

**[0023]** The hollow synthetic bristle may be between 40 - 100 mm long.

**[0024]** The hollow synthetic bristle may comprise one or more longitudinal cavities extending from an opening in the free or second end of the synthetic bristle toward the first end of the synthetic bristle. The one or more longitudinal cavities may extend along a part of the length of the synthetic bristle or along the whole length of the synthetic bristle making the synthetic bristle partly hollow along its length or hollow along its full length similar to a tube. Moreover, the one or more longitudinal cavities may, but do not have to, be in exact alignment with the central axis of the synthetic bristle. Such a cavity may also extend at an angle relative the longitudinal extension and the extension of the central axis of a synthetic bristle.

**[0025]** Hereby is provided a hollow synthetic bristle having a satisfactorily tipped section. The tip section corresponding to the part of the second end of the hollow synthetic bristle being immersed in the chemically tipping fluid.

**[0026]** Furthermore, the chemical tipping reduces the wall thickness of the hollow synthetic bristle on both its outside and inside surface. Hence, the reduced wall thickness obtained by tipping the outside surface of the hollow synthetic bristle provides a tapered synthetic bristle. Hence, also the reduced wall thickness obtained by tipping the inside surface of the hollow synthetic bristle provides a larger hollow cavity within the tipped part of the synthetic bristle which accommodates an increased capability of paint pickup.

**[0027]** Furthermore, the chemical tipping flag the tipped part of the hollow synthetic bristle into a plurality of split ends or tips, which accommodates a further increased capability of paint pickup, paint release and creation of a fine and smooth surface finish.

**[0028]** In principle, the method according to the invention make the free ends of the hollow synthetic bristles tattered and torn by chemically dividing them/splitting them up/disunite them into more and smaller free ends out of one larger free end. These hollow synthetic bristles, each comprising a multi-tipped free end, i.e. a free end comprising at least two "micro" tips, instead of only one "macro" tip.

**[0029]** According to an aspect the outer diameter of the hollow synthetic bristle is 0,3 - 1.0mm. By having an outer diameter of the hollow bristle that is larger than the normally used for paint brushes, the method produces a bristle that both improves the paint pick-up and the painting qualities of the bristle.

**[0030]** According to an aspect the inner diameter of the hollow synthetic bristle is equal to or larger than 0,15mm. By having an inner diameter that is equal to or larger than 0,15mm the hollow synthetic bristle achieves a capillary force that is strong enough to suck in the chemically tipping fluid and at the same time release the chemically tipping fluid to stop the reaction between the bristle and the chemically tipping fluid.

**[0031]** According to an aspect length of the part of the hollow synthetic bristle that is immersed in the chemically tipping fluid is equal to or smaller than 20mm.

**[0032]** According to an aspect the part of the hollow synthetic bristle that is immersed in the chemically tipping fluid is 10 - 30%, 10 - 25% or 10 - 20% of the length of the hollow synthetic bristle.

**[0033]** In one aspect of the invention the part of the hollow synthetic bristle that is immersed in the chemically tipping fluid is 10 - 30%, 10 - 25% or 10 - 20% of the length of hollow synthetic bristle.

**[0034]** In another aspect of the invention the length of the part of the hollow synthetic bristle that is immersed in the chemically tipping fluid is 1 - 20 mm, 5 - 15 mm or about 10 mm.

**[0035]** In yet another aspect of the invention the chemically tipping fluid comprises sodium hydroxide (NaOH). The method may thereby comprise applying a chemically tipping fluid, which may be a sodium hydroxide, to the part of the second end of the hollow synthetic bristle.

**[0036]** The chemically tipping fluid may be a sodium hydroxide solution or any other suitable lye being highly soluble in water producing a caustic basic solution. The sodium hydroxide solution may comprise 30 - 40% sodium hydroxide and 60 - 70% water and be heated to approximately 100 C°.

**[0037]** The chemical tipping may be provided by immersing the part of the second end of the hollow synthetic bristle one or more times into the chemically tipping fluid, such as the sodium hydroxide solution.

**[0038]** The chemical tipping may be provided by immersing the part of the second end of the hollow synthetic bristle with a varying depth/distance into the chemically tipping fluid during the time duration in the tipping fluid. The immersed part of the second end of the hollow synthetic bristle may be lifted up and down in tipping fluid at

different time rates and/or velocities and/or stepwise. It may be held immersed at different depths and with varying duration at each depth or immersed in steps and with varying depth and/or held immersed with the same or different duration at each step.

**[0039]** In another aspect of the invention a wall thickness of the hollow synthetic bristle is from about 0.05 - 0.1 mm and/or between 0.05 - 0.1 mm.

**[0040]** The chemically tipped part of the second end of the synthetic bristle may comprise a thinner wall thickness compared to the non-tipped remaining part of the synthetic bristle.

**[0041]** The hollow synthetic bristle(s) may be dipped into the chemically tipping solution, such as the sodium hydroxide solution, preferably in between 30 - 60 minutes and/or about 30 minutes and/or about 60 minutes or for a period of time being more or less.

**[0042]** In one aspect of the invention, lifting up the hollow synthetic bristle from the chemically tipping fluid is made after such a period of time that the part of the hollow synthetic bristle has been partly decomposed in the chemically tipping fluid.

**[0043]** In another aspect of the invention, lifting up the hollow synthetic bristle from the chemically tipping fluid is made after such a period of time that longitudinal parts of the hollow synthetic bristle has been decomposed in the chemically tipping fluid and the second end of the hollow synthetic bristle has two or more tips.

**[0044]** In yet another aspect of the invention, the period of time is such that 1 - 30% of the part of the hollow synthetic bristle that is immersed in the chemically tipping fluid is decomposed in the chemically tipping fluid.

**[0045]** In one aspect of the invention, the method further comprising immersing the second end of the hollow synthetic bristle in water after it has been lifted up from the chemically tipping fluid.

**[0046]** In another aspect of the invention, the hollow synthetic bristle is a hollow polyester bristle.

**[0047]** In yet another aspect of the invention, the method further comprises the step of drying the hollow synthetic bristle.

**[0048]** According to an aspect the wall thickness of the hollow synthetic bristle is 0.05 - 0.4 mm, 0,05 - 0,2mm or 0.05-0,1mm. The wall thickness effects how long the chemically tipping fluid needs to interact with the material of the bristle to achieve the desired split ends of the bristle.

**[0049]** According to an aspect the method further comprising washing the hollow synthetic bristle in water after it has been lifted up from the chemically tipping fluid. By washing the hollow synthetic bristle in water the reaction between the hollow synthetic bristle and the chemically tipping fluid could be stopped in a controlled way.

**[0050]** According to an aspect the method further comprising the step of enclosing the circumference of the hollow synthetic bristle with a sheet of synthetic material before the step of immersing. By enclosing the hollow synthetic bristle with a sheet of synthetic material the

reaction between the chemically tipping fluid and the bristle is controlled to start from the second end of the bristle to better control the effect of the method.

**[0051]** According to an aspect the method further comprising the step of arranging a bundle of hollow synthetic bristles in the holder.

**[0052]** According to an aspect the method further comprising the step of enclosing the circumference of the bundle of hollow synthetic bristles with a sheet of synthetic material before the step of immersing.

**[0053]** According to an aspect the hollow synthetic bristle have a annular cross section The invention also relates to a hollow synthetic bristle obtained by the above method.

**[0054]** The invention also relates to a paint brush comprising a plurality of hollow synthetic bristles as described above. Hereby is provided a paint brush having an improved paint pickup and paint release.

**[0055]** The paint brush may comprise a handle, a bristle carrier and a plurality of bristles attached to the handle by means of an adhesive and/or the bristle carrier and/or any other suitable fastening means.

**[0056]** The paint brush may comprise a blend of different types of natural and/or synthetic bristles, wherein a first type of synthetic bristles is the hollow synthetic bristles as described above. The different types of bristles may include solid and hollow bristles or partly solid/hollow bristles, in a wide variety of cross-sections, including circular, oval, triangular, trilocular, tetralocular, lobate, and/or may contain multiple voids, be corrugated and/or have other structured surfaces. Furthermore the different types of bristles may include bristles being mechanically and/or chemically tipped.

**[0057]** Generally, all terms used in the claims are to be interpreted according to their ordinary meaning in the technical field, unless explicitly defined otherwise herein. All references to "a/an/the [element, device, component, means, etc.]" are to be interpreted openly as referring to at least one instance of said element, device, component, means, etc., unless explicitly stated otherwise. Further, by the term "comprising" it is meant "comprising but not limited to" throughout the application.

**[0058]** The invention is as defined in the appended claims.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0059]** The foregoing will be apparent from the following more particular description of the example embodiments, as illustrated in the accompanying drawings in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the example embodiments and aspects.

Fig. 1a shows a chemically tipped hollow synthetic bristle according to the invention,

Fig. 1b shows a cross-sectional view (A-A) of the

synthetic bristle in Fig. 1a,

Fig. 2 shows a chemically tipped hollow synthetic bristle being flagged, and

Fig. 3 shows steps of a method of producing the hollow synthetic bristle(s) according to the invention.

## DETAILED DESCRIPTION

**[0060]** The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments and aspects of the invention are shown. The invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments and aspects set forth herein; rather, these embodiments and aspects are provided for thoroughness and completeness. Like reference characters refer to like elements throughout the description. The drawings are not necessarily to scale and certain features may be exaggerated in order to better illustrate and explain the exemplary embodiments of the present invention.

**[0061]** The terminology used herein is for the purpose of describing particular aspects of the disclosure only, and is not intended to limit the disclosure. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise.

**[0062]** In some implementations and according to some aspects of the disclosure, the functions or steps in the method can occur out of the order noted in the operational illustrations. For example, two steps shown in succession can in fact be executed substantially concurrently or the steps can sometimes be executed in the reverse order, depending upon the functionality/acts involved.

**[0063]** Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure belongs. It will be further understood that terms used herein should be interpreted as having a meaning that is consistent with their meaning in the context of this specification and the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

**[0064]** The present invention relates to a hollow synthetic bristle 1 to be used together with several other synthetic bristles being the same, similar or different as a plurality or a bundle or mixture of synthetic bristles with at least one such inventive hollow synthetic bristle, preferably more than one, in paint brushes (not shown) and a paint brush comprising a plurality of such synthetic bristles 1. The present invention also relates to a method of forming/shaping the synthetic bristle 1, i.e. at least a part of its free end, i.e. its second end.

**[0065]** Figs. 1a-1b show a synthetic bristle 1 according to the invention. Referring to Fig. 1a, a hollow synthetic bristle 1 that has been chemically tipped according to the invention is illustrated. The synthetic bristle 1 comprise a first end and a second end. The synthetic bristle 1 com-

prise a part 2 at the second end and a remaining part 4. The synthetic bristle 1 is divided into the part 2 of the second end, i.e. a tipped section, and the remaining part 4, i.e. a non-tipped section, extending from a first end (not shown) of the hollow synthetic bristle towards part 2 of the second end. The tipped part 2 extends from the non-tipped remaining part 4 towards an opening 5 at the second end. The tipped part 2 is part of the free end of the hollow synthetic bristle 1. The hollow synthetic bristle 1 may be a tubular synthetic bristle 1 comprising a longitudinal cavity 6 extending from the opening 5 along the length of the synthetic bristle. The longitudinal cavity 6 may as in the presently illustrated aspect be cylindrical, or have any other suitable shape. According to an aspect the opening 5 /longitudinal cavity 6 has an inner diameter, i.e. the hollow synthetic bristle 1 has an inner diameter. According to an aspect the opening 5 is circular. The longitudinal cavity 6 may as in the presently illustrated aspect be an inner cavity extending along the length of the synthetic bristle. If the hollow synthetic bristle 1 is oval-shaped in cross-section the longitudinal cavity 6 may have a corresponding oval shape. The hollow synthetic bristle 1 may be made from polyester and the non-tipped remaining part 4 may have an outer diameter between 0,2 - 1,0mm. According to an aspect the outer diameter is 0.2 - 0,4 mm. The tipped part 2 of the second end of the synthetic bristle comprises 1 - 30% or 10 - 30% or 10 - 25% of the total length of the synthetic bristle 1. Alternatively the tipped part 2 of the second end of the synthetic bristle 1 comprises 10 - 20% of the total length of the synthetic bristle. The wall thickness of the non-tipped remaining part 4 may be between 0.05 - 0.1 mm and the wall thickness of the tipped part 2 of the second end may be between 0.05 - 0.1 mm. In some aspects, the wall thickness of tipped part 2 of the second end is less than the wall thickness of non-tipped remaining part 4.

**[0066]** According to an aspect the outer diameter of the hollow synthetic bristle is 0,3 - 1.0mm before being processed according to the method.

**[0067]** According to an aspect the inner diameter of the hollow synthetic bristle is equal to or larger than 0,15mm before being processed according to the method. By having an inner diameter that is equal to or larger than 0,15mm the hollow synthetic bristle achieves a capillary force that is strong enough to suck in the chemically tipping fluid and at the same time release the chemically tipping fluid to stop the reaction between the bristle and the chemically tipping fluid. By the inner diameter is meant the diameter of the circular longitudinal cavity 6. If the cross section of the longitudinal cavity 6 has another shape than circular, the shape should according to an aspect comprise a length in the smallest direction that is equal to or larger than 0,15mm.

**[0068]** According to an aspect length of the part of the hollow synthetic bristle that is immersed in the chemically tipping fluid is equal to or smaller than 20mm.

**[0069]** According to an aspect the part of the hollow

synthetic bristle that is immersed in the chemically tipping fluid is 10 - 30%, 10 - 25% or 10 - 20% of the length of the hollow synthetic bristle.

**[0070]** According to an aspect the wall thickness of the hollow synthetic bristle is 0.05 - 0.4 mm, 0.05 - 0.2mm or 0.05-0.1mm.

**[0071]** Referring to Fig. 1b, a cross-section A-A of the chemically tipped hollow synthetic bristle 1 of Fig. 1a is shown, wherein the applied chemical tipping has reduced the wall thickness of both the inside and the outside surface of tipped part 2 of the second end of the hollow synthetic bristle 1. Hereby is provided a tapered synthetic bristle 1 having a longitudinal cavity 6 which cross-sectional area of the bristle wall is decreased in the tipped part 2 of the second end of the hollow synthetic bristle 1 being immersed into a chemically tipping fluid. The cross-sectional area of the cavity 6 is larger in the tipped part 2 of the second end of the hollow synthetic bristle 1 than in the non-tipped remaining part 4 of the hollow synthetic bristle 1, wherein the cross-sectional area of the cavity 6 may be largest at the opening 5. The tipped part 2 of the hollow synthetic bristle 1 may transition into the non-tipped remaining part 4, i.e. as seen in the direction from the second or free end and its opening 5 towards the non-tipped remaining part 4 of the hollow synthetic bristle 1.

**[0072]** Referring to Fig. 2, a chemically tipped hollow synthetic bristle 1 being flagged according to the invention is illustrated wherein the hollow synthetic bristle 1 has been provided with a plurality of split ends or tips 7. The tips 7 are provided by the chemically tipping fluid decomposing longitudinal parts along the length of the hollow synthetic bristle 1 in the second end of the hollow synthetic bristle 1.

**[0073]** The tipped part 2 of the second end of the hollow synthetic bristle 1 may be both tapered and flagged when being chemically tipped, i.e. when applying the method of producing the hollow synthetic bristle 1 according to the invention. In some aspects due to the fact that the chemical tipping corrodes through the wall of at least a part of the tipped part 2, i.e. the resulting "pit depth" of the corrosion exceeds its wall thickness, in principle a chemical flagging or cutting up or cutting "open" the tipped section 2 into more than one small end or tip 7 is accomplished. The number of tips 7 enhances the bristles 1 ability to release paint in an even and effective way when the bristle 1 is used in a paint brush.

**[0074]** Referring to Fig. 3, the steps A - D of a method of producing the hollow synthetic bristle 1 according to the invention is illustrated, wherein a first step A comprises arranging the first end (not shown) of the hollow synthetic bristle 1 in a holder (not shown). According to an aspect the hollow synthetic bristle 1 is arranged in a holder in the form of a cage, wherein the second ends are directed downwards.

**[0075]** The following step B comprises immersing the part 2 to be tipped of the second end of the hollow synthetic bristle 1 in a chemically tipping fluid, wherein the

part 2 to be tipped of the second end of the hollow synthetic bristle 1 may make up 1 - 30% of the length of hollow synthetic bristle 1. According to an aspect the part 2 to be tipped of the second end of the hollow synthetic bristle 1 may make up 10 - 30% or 10 - 25% or 10 - 20% of the length of hollow synthetic bristle 1. Alternatively, the part 2 to be tipped of the second end of the hollow synthetic bristle 1 may make up 1 - 20 mm, 5 - 15 mm or about 10 mm of the length of hollow synthetic bristle 1.

**[0076]** The following step C comprises lifting up the hollow synthetic bristle 1 from the chemically tipping fluid after a period of time. According to an aspect the period of time may be in between 30 - 60 minutes and/or about 30 minutes and/or about 60 minutes or for a period of time being more or less.

**[0077]** Step D and E are both optional steps wherein one of them or both may be performed after step C. Step D comprises immersing the second end of the hollow synthetic bristle 1 in water or any other suitable cleaning liquid after it has been lifted up from the chemically tipping fluid. According to an aspect the method further comprising washing the hollow synthetic bristle 1 in water after it has been lifted up from the chemically tipping fluid. By washing the hollow synthetic bristle 1 in water the reaction between the hollow synthetic bristle 1 and the chemically tipping fluid could be stopped in a controlled way. According to an aspect the washing fluid could be water, a water mixed with additives or any other suitable washing fluid. Step D is done to rinse or wash off the tipping fluid from the hollow synthetic bristle 1 before further use

**[0078]** Step E comprises drying the hollow synthetic bristle 1.. Purpose of step E is self-explanatory.

**[0079]** Experiments have shown that by applying the chemical tipping to a shorter end portion of the synthetic bristle than conventionally done when using chemically tipping on solid bristles, usually about 25 mm of the tip section or up to 50% of the length of prior art bristles, a method is provided which allows the use of chemical tipping on a hollow synthetic bristle, as the problem of capillary action drawing tipping fluid into a non-controllable inside depth of the synthetic bristle is avoided. Experiments also show that uncontrollable suction and/or capillary effect is reduced as the hollow synthetic bristle in some aspects "let's go" of the paint inside its cavity as the paint is not fully enclosed, at least not circumferentially. This is due to that the hollow synthetic bristle is at least in some aspects partly open along its envelope surface of its free end after treatment according to the invention such that the paint does not "cling" too firmly to the free end, i.e. the capillary action has less firm "grip"/capillary holding According to an aspect the part of the hollow synthetic bristle that is immersed in the chemically tipping fluid is 10 - 30%, 10 - 25% or 10 - 20% of the length of hollow synthetic bristle.

**[0080]** According to an aspect the length of the part of the hollow synthetic bristle that is immersed in the chemically tipping fluid is 1 - 20 mm, 5 - 15 mm or about 10 mm.

**[0081]** The chemically tipping fluid comprises accord-

ing to an aspect sodium hydroxide (NaOH). The method may thereby comprise applying a chemically tipping fluid, which may be a sodium hydroxide, to the part of the second end of the hollow synthetic bristle.

**[0082]** According to an aspect the chemically tipping fluid is a sodium hydroxide solution or any other suitable lye being highly soluble in water producing a caustic basic solution. The sodium hydroxide solution may comprise 30 - 40% sodium hydroxide and 60 - 70% water and be heated to approximately 100 C°.

**[0083]** According to an aspect the step of immersing the part of the second end of the hollow synthetic bristle is repeated one or more times into the chemically tipping fluid, such as the sodium hydroxide solution.

**[0084]** The chemical tipping is according to an aspect provided by immersing the part of the second end of the hollow synthetic bristle with a varying depth/distance into the chemically tipping fluid during the time duration in the tipping fluid. The immersed part of the second end of the hollow synthetic bristle is lifted up and down in tipping fluid at different time rates and/or velocities and/or step-wise. It may be held immersed at different depths and with varying duration at each depth or immersed in steps and with varying depth and/or held immersed with the same or different duration at each step.

**[0085]** The chemically tipped part of the second end of the synthetic bristle comprise a thinner wall thickness compared to the non-tipped remaining part of the synthetic bristle.

**[0086]** The hollow synthetic bristle(s) may be dipped into the chemically tipping solution, such as the sodium hydroxide solution, preferably in between 30 - 60 minutes and/or about 30 minutes and/or about 60 minutes or for a period of time being more or less.

**[0087]** According to an aspect the step of lifting up the hollow synthetic bristle 1 from the chemically tipping fluid is made after such a period of time that the part of the hollow synthetic bristle 1 has been partly decomposed, as disclosed in fig 2, in the chemically tipping fluid. As the hollow synthetic bristle 1 decomposes the wall thickness of the second end of the hollow synthetic bristle 1 is reduced. As the second end is immersed longer time in the chemically tipping fluid the wall thickness will be reduced to zero in some parts of the second end of the hollow synthetic bristle 1 and thereby dividing the second end into different tips 7.

**[0088]** According to an aspect the step of lifting up the hollow synthetic bristle from the chemically tipping fluid is made after such a period of time that longitudinal parts of the hollow synthetic bristle has been decomposed in the chemically tipping fluid and the second end of the hollow synthetic bristle has two or more tips.

**[0089]** According to an aspect the period of time is such that 1 - 30% of the part of the hollow synthetic bristle that is immersed in the chemically tipping fluid is decomposed in the chemically tipping fluid.

**[0090]** According to an aspect the method further comprising the step of enclosing the circumference of the

hollow synthetic bristle with a sheet of synthetic material before the step B of immersing. By enclosing the hollow synthetic bristle with a sheet of synthetic material the reaction between the chemically tipping fluid and the bristle is controlled to start from the second end of the bristle to better control the effect of the method.

**[0091]** According to an aspect the method further comprising the step of arranging a bundle of hollow synthetic bristles in the holder.

**[0092]** According to an aspect the method further comprising the step of enclosing the circumference of the bundle of hollow synthetic bristles with a sheet of synthetic material before the step of immersing.

**[0093]** According to an aspect the hollow synthetic bristle 1 has a annular cross section, i.e. a ring shaped cross sectional shape. The inner cavity of the hollow synthetic bristle has a circular cross section, i.e. the hollow part of the hollow synthetic bristle 1 is circular. The outer dimension of the hollow synthetic bristle 1 has a circular cross section, i.e. the outer shape of the hollow synthetic bristle 1 is circular. The difference in radius of the inner circular cavity and the radius of the outer circular shape corresponds to the wall thickness of the hollow synthetic bristle 1.

**[0094]** Although the invention has been described in relation to specific combinations of components, it should be readily appreciated that the components may be combined in other configurations as well which is clear for the skilled person when studying the present application. Thus, the above description of the example embodiments of the present invention and the accompanying drawings are to be regarded as a non-limiting example of the invention and the scope of protection is defined by the appended claims. Any reference sign in the claims should not be construed as limiting the scope.

**[0095]** The person skilled in the art realizes that the present invention by no means is limited to the preferred embodiments described above. On the contrary, many modifications and variations are possible within the scope of the appended claims.

**[0096]** The description of the aspects of the disclosure provided herein has been presented for purposes of illustration. The description is not intended to be exhaustive or to limit aspects of the disclosure to the precise form disclosed, and modifications and variations are possible in light of the above teachings or may be acquired from practice of various alternatives to the provided aspects of the disclosure. The examples discussed herein were chosen and described in order to explain the principles and the nature of various aspects of the disclosure and its practical application to enable one skilled in the art to utilize the aspects of the disclosure in various manners and with various modifications as are suited to the particular use contemplated. It should be appreciated that the aspects of the disclosure presented herein may be practiced in any combination with each other.

**[0097]** It should be noted that the word "comprising" does not necessarily exclude the presence of other ele-

ments or steps than those listed. It should further be noted that any reference signs do not limit the scope of the claims

## Claims

1. Method of producing a hollow synthetic bristle (1) for a paint brush, wherein the method comprises;

- arranging at least a first end of the hollow synthetic bristle (1) in a holder,
- immersing a part (2) of a second end of the hollow synthetic bristle (1) in a chemically tipping fluid,
- lifting up the hollow synthetic bristle (1) from the chemically tipping fluid after a period of time,

wherein the part (2) of the hollow synthetic bristle (1) that is immersed in the chemically tipping fluid is 1-30% of the length of the hollow synthetic bristle (1).

2. Method according to claim 1, wherein the outer diameter of the hollow synthetic bristle (1) is 0,3 - 1.0mm.

3. Method according to claim 1 or 2, wherein the inner diameter of the hollow synthetic bristle (1) is equal to or larger than 0,15mm.

4. Method according to any of the preceding claims, wherein length of the part (2) of the hollow synthetic bristle (1) that is immersed in the chemically tipping fluid is equal to or smaller than 20mm.

5. Method according to any of the preceding claims, wherein the part (2) of the hollow synthetic bristle (1) that is immersed in the chemically tipping fluid is 10 - 30%, 10 - 25% or 10 - 20% of the length of the hollow synthetic bristle (1).

6. Method according to any of the preceding claims,, wherein the length of the part (2) of the hollow synthetic bristle (1) that is immersed in the chemically tipping fluid is 1-20 mm, 5 -15 mm or about 10 mm.

7. Method according to any of the preceding claims, wherein the chemically tipping fluid comprises sodium hydroxide (NaOH).

8. Method according to any of the preceding claims, wherein a wall thickness of the hollow synthetic bristle (1) is 0.05 - 0.4 mm, 0,05 - 0,2mm or 0.05-0,1mm.

9. Method according to any of the preceding claims, wherein lifting up the hollow synthetic bristle (1) from the chemically tipping fluid is made after such a period of time that the part (2) of the hollow synthetic

bristle (1) has been partly decomposed in the chemically tipping fluid.

10. Method according to any of the preceding claims, wherein lifting up the hollow synthetic bristle (1) from the chemically tipping fluid is made after such a period of time that longitudinal parts of the hollow synthetic bristle (1) has been decomposed in the chemically tipping fluid and the second end of the hollow synthetic bristle (1) has two or more tips (7).

11. Method according to any of the preceding claims, wherein the period of time is such that 1 - 30% of the part (2) of the hollow synthetic bristle (1) that is immersed in the chemically tipping fluid is decomposed in the chemically tipping fluid.

12. Method according to any of the preceding claims, further comprising immersing the second end of the hollow synthetic bristle (1) in water after it has been lifted up from the chemically tipping fluid.

13. Method according to any of the preceding claims, further comprising washing the hollow synthetic bristle (1) in water after it has been lifted up from the chemically tipping fluid.

14. Method according to any of the preceding claims, wherein the hollow synthetic bristle (1) is a hollow polyester bristle (1).

15. Method according to any of the preceding claims, further comprising the step of drying the hollow synthetic bristle (1).

16. Method according to any of the preceding claims, further comprising the step of enclosing the circumference of the hollow synthetic bristle (1) with a sheet of synthetic material before the step of immersing.

17. Method according to any of the preceding claims, further comprising the step of arranging a bundle of hollow synthetic bristles (1) in the holder.

18. Method according to claim 17, further comprising the step of enclosing the circumference of the bundle of hollow synthetic bristles (1) with a sheet of synthetic material before the step of immersing.

19. Method according to any of the preceding claims, wherein the hollow synthetic bristle (1) has a annular cross section.

20. A hollow synthetic bristle (1) for a paint brush having a chemically tipped part which is 1-30% of the length of the hollow synthetic bristle (1), wherein the hollow synthetic bristle (1) is obtained by the method according to any of claims 1 to 19.

21. A paint brush comprising a plurality of hollow synthetic bristles (1) according to claim 20.

### Patentansprüche

1. Verfahren zur Herstellung einer hohlen synthetischen Borste (1) für einen Farbpinsel, wobei das Verfahren umfasst:

- Anordnen wenigstens eines ersten Endes der hohlen synthetischen Borste (1) in einer Halterung,
- Eintauchen eines Teils (2) eines zweiten Endes der hohlen synthetischen Borste (1) in ein chemisch ansitzendes Fluid,
- Herausheben der hohlen synthetischen Borste (1) aus dem chemisch ansitzenden Fluid nach einem Zeitraum,

wobei der Teil (2) der hohlen synthetischen Borste (1), der in das chemisch ansitzende Fluid eingetaucht wird, 1-30 % der Länge der hohlen synthetischen Borste (1) bildet.

2. Verfahren gemäß Anspruch 1, wobei der Außendurchmesser der hohlen synthetischen Borste (1) 0,3-1,0 mm beträgt.
3. Verfahren gemäß Anspruch 1 oder 2, wobei der Innendurchmesser der hohlen synthetischen Borste (1) gleich oder größer als 0,15 mm ist.
4. Verfahren gemäß einem der vorstehenden Ansprüche, wobei die Länge des Teils (2) der hohlen synthetischen Borste (1), der in das chemisch ansitzende Fluid eingetaucht wird, gleich oder kleiner als 20 mm ist.
5. Verfahren gemäß einem der vorstehenden Ansprüche, wobei der Teil (2) der hohlen synthetischen Borste (1), der in das chemisch ansitzende Fluid eingetaucht wird, 10-30 %, 10-25 % oder 10-20 % der Länge der hohlen synthetischen Borste (1) bildet.
6. Verfahren gemäß einem der vorstehenden Ansprüche, wobei die Länge des Teils (2) der hohlen synthetischen Borste (1), der in das chemisch ansitzende Fluid eingetaucht wird, 1-20 mm, 5-15 mm oder etwa 10 mm beträgt.
7. Verfahren gemäß einem der vorstehenden Ansprüche, wobei das chemisch ansitzende Fluid Natriumhydroxid (NaOH) umfasst.
8. Verfahren gemäß einem der vorstehenden Ansprüche, wobei eine Wanddicke der hohlen syntheti-

schen Borste (1) 0,05-0,4 mm, 0,05-0,2 mm oder 0,05-0,1 mm beträgt.

9. Verfahren gemäß einem der vorstehenden Ansprüche, wobei Herausheben der hohlen synthetischen Borste (1) aus dem chemisch ansitzenden Fluid nach einem derartigen Zeitraum durchgeführt wird, dass der Teil (2) der hohlen synthetischen Borste (1) in dem chemisch ansitzenden Fluid teilweise zersetzt worden ist.

10. Verfahren gemäß einem der vorstehenden Ansprüche, wobei Herausheben der hohlen synthetischen Borste (1) aus dem chemisch ansitzenden Fluid nach einem derartigen Zeitraum durchgeführt wird, dass längslaufende Teile der hohlen synthetischen Borste (1) in dem chemisch ansitzenden Fluid zersetzt worden sind und das zweite Ende der hohlen synthetischen Borste (1) zwei oder mehr Spitzen (7) aufweist.

11. Verfahren gemäß einem der vorstehenden Ansprüche, wobei der Zeitraum so ist, dass 1-30 % des Teils (2) der hohlen synthetischen Borste (1), der in dem chemisch ansitzenden Fluid eingetaucht ist, in dem chemisch ansitzenden Fluid zersetzt wird.

12. Verfahren gemäß einem der vorstehenden Ansprüche, ferner umfassend Eintauchen des zweiten Endes der hohlen synthetischen Borste (1) in Wasser, nachdem sie aus dem chemisch ansitzenden Fluid herausgehoben worden ist.

13. Verfahren gemäß einem der vorstehenden Ansprüche, ferner umfassend Waschen der hohlen synthetischen Borste (1) in Wasser, nachdem sie aus dem chemisch ansitzenden Fluid herausgehoben worden ist.

14. Verfahren gemäß einem der vorstehenden Ansprüche, wobei die hohle synthetische Borste (1) eine hohle Polyesterborste (1) ist.

15. Verfahren gemäß einem der vorstehenden Ansprüche, ferner umfassend den Schritt des Trocknens der hohlen synthetischen Borste (1).

16. Verfahren gemäß einem der vorstehenden Ansprüche, ferner umfassend den Schritt des Umhüllens des Umfangs der hohlen synthetischen Borste (1) mit einer Bahn von synthetischem Material vor dem Schritt des Eintauchens.

17. Verfahren gemäß einem der vorstehenden Ansprüche, ferner umfassend den Schritt des Anordnens eines Bündels von hohlen synthetischen Borsten (1) in der Halterung.

18. Verfahren gemäß Anspruch 17, ferner umfassend den Schritt des Umhüllens des Umfangs des Bündels von hohlen synthetischen Borsten (1) mit einer Bahn von synthetischem Material vor dem Schritt des Eintauchens.
19. Verfahren gemäß einem der vorstehenden Ansprüche, wobei die hohle synthetische Borste (1) einen ringförmigen Querschnitt aufweist.
20. Hohle synthetische Borste (1) für einen Farbpinsel mit einem chemisch angespitzten Teil, der 1-30 % der Länge der hohlen synthetischen Borste (1) bildet, wobei die hohle synthetische Borste (1) durch das Verfahren gemäß einem der Ansprüche 1 bis 19 erhalten ist.
21. Farbpinsel umfassend eine Vielzahl von hohlen synthetischen Borsten (1) gemäß Anspruch 20.

## Revendications

1. Procédé de fabrication d'une soie synthétique creuse (1) pour un pinceau, le procédé comprenant :
- l'agencement d'au moins une première extrémité de la soie synthétique creuse (1) dans un dispositif de support,
  - l'immersion d'une partie (2) d'une seconde extrémité de la soie synthétique creuse (1) dans un fluide d'amincissement chimique,
  - l'élévation de la soie synthétique creuse (1) par rapport au fluide d'amincissement chimique après une période de temps,
- la partie (2) de la soie synthétique creuse (1) qui est immergée dans le fluide d'amincissement chimique représentant 1 à 30 % de la longueur de la soie synthétique creuse (1).
2. Procédé selon la revendication 1, le diamètre extérieur de la soie synthétique creuse (1) étant compris entre 0,3 et 1,0 mm.
3. Procédé selon la revendication 1 ou 2, le diamètre intérieur de la soie synthétique creuse (1) étant égal ou supérieur à 0,15 mm.
4. Procédé selon l'une quelconque des revendications précédentes, la longueur de la partie (2) de la soie synthétique creuse (1) qui est immergée dans le fluide d'amincissement chimique étant égale ou inférieure à 20 mm.
5. Procédé selon l'une quelconque des revendications précédentes, la partie (2) de la soie synthétique creuse (1) qui est immergée dans le fluide d'amincisse-

ment chimique représentant 10 à 30 %, 10 à 25 % ou 10 à 20 % de la longueur de la soie synthétique creuse (1).

6. Procédé selon l'une quelconque des revendications précédentes, la longueur de la partie (2) de la soie synthétique creuse (1) qui est immergée dans le fluide d'amincissement chimique étant de 1 à 20 mm, de 5 à 15 mm ou d'environ 10 mm.
7. Procédé selon l'une quelconque des revendications précédentes, le fluide d'amincissement chimique comprenant de l'hydroxyde de sodium (NaOH).
8. Procédé selon l'une quelconque des revendications précédentes, une épaisseur de la paroi de la soie synthétique creuse (1) étant de 0,05 à 0,4 mm, de 0,05 à 0,2 mm ou de 0,05 à 0,1 mm.
9. Procédé selon l'une quelconque des revendications précédentes, l'élévation de la soie synthétique creuse (1) par rapport au fluide d'amincissement chimique étant réalisée après une période de temps telle que la partie (2) de la soie synthétique creuse (1) a été partiellement décomposée dans le fluide d'amincissement chimique.
10. Procédé selon l'une quelconque des revendications précédentes, l'élévation de la soie synthétique creuse (1) par rapport au fluide d'amincissement chimique étant réalisée après une période de temps telle que les parties longitudinales de la soie synthétique creuse (1) ont été décomposées dans le fluide d'amincissement chimique et que la seconde extrémité de la soie synthétique creuse (1) présente deux pointes (7) ou plus.
11. Procédé selon l'une quelconque des revendications précédentes, la période de temps étant telle que 1 à 30 % de la partie (2) de la soie synthétique creuse (1) qui est immergée dans le fluide d'amincissement chimique est décomposée dans le fluide d'amincissement chimique.
12. Procédé selon l'une quelconque des revendications précédentes, comprenant en outre l'immersion de la seconde extrémité de la soie synthétique creuse (1) dans de l'eau après qu'elle a été retirée du fluide d'amincissement chimique.
13. Procédé selon l'une quelconque des revendications précédentes, comprenant en outre le lavage à l'eau de la soie synthétique creuse (1) après qu'elle a été soulevée du fluide d'amincissement chimique.
14. Procédé selon l'une quelconque des revendications précédentes, la soie synthétique creuse (1) étant une soie creuse en polyester (1).

15. Procédé selon l'une quelconque des revendications précédentes, comprenant en outre l'étape de séchage de la soie synthétique creuse (1).
16. Procédé selon l'une quelconque des revendications précédentes, comprenant en outre l'étape consistant à entourer la circonférence de la soie synthétique creuse (1) d'une feuille de matériau synthétique avant l'étape d'immersion. 5
17. Procédé selon l'une quelconque des revendications précédentes, comprenant en outre l'étape consistant à disposer un faisceau de soies synthétiques creuses (1) dans le dispositif de support. 10
18. Procédé selon la revendication 17, comprenant en outre l'étape consistant à entourer la circonférence du faisceau de soies synthétiques creuses (1) d'une feuille de matériau synthétique avant l'étape d'immersion. 15
19. Procédé selon l'une quelconque des revendications précédentes, la soie synthétique creuse (1) présentant une section transversale annulaire. 20
20. Soie synthétique creuse (1) pour un pinceau ayant une partie à pointe chimique représentant 1 à 30 % de la longueur de la soie synthétique creuse (1), la soie synthétique creuse (1) étant obtenue par le procédé selon l'une quelconque des revendications 1 à 19. 25
21. Pinceau comprenant une pluralité de soies synthétiques creuses (1) selon la revendication 20. 30

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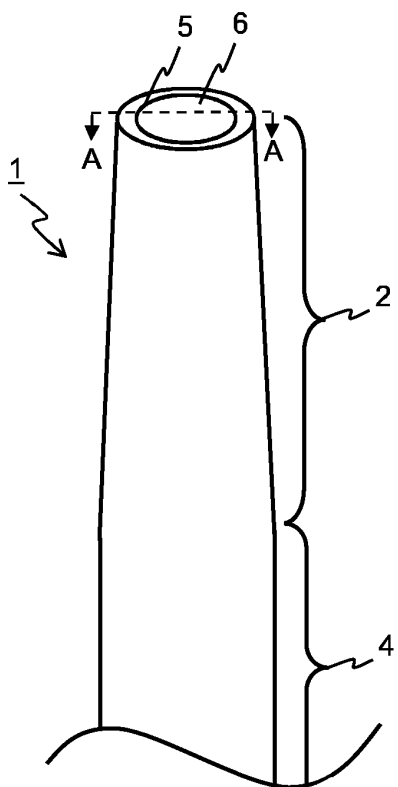


Fig. 1a

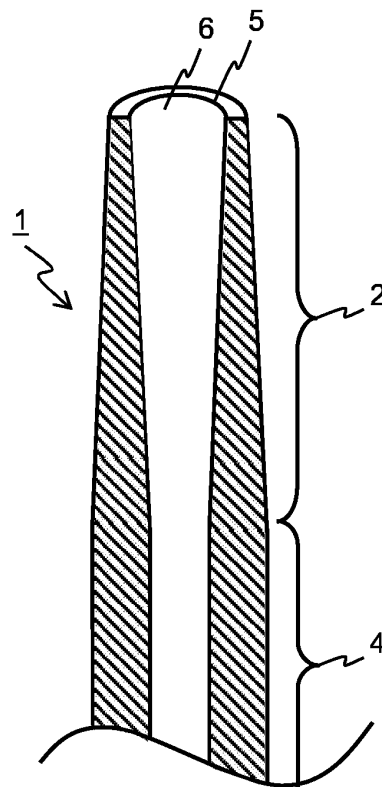


Fig. 1b (A-A)

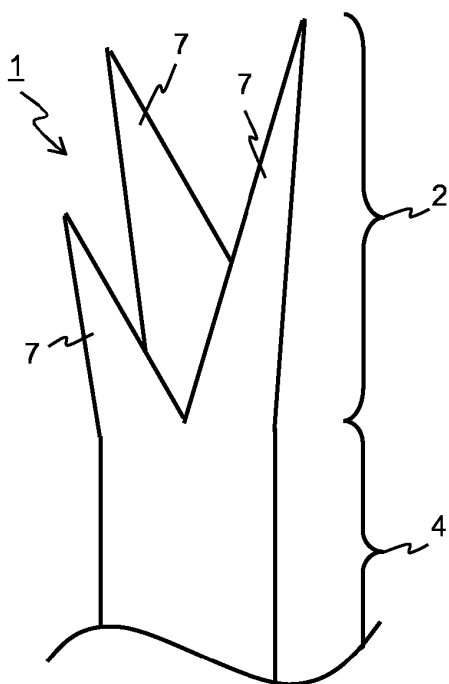


Fig. 2

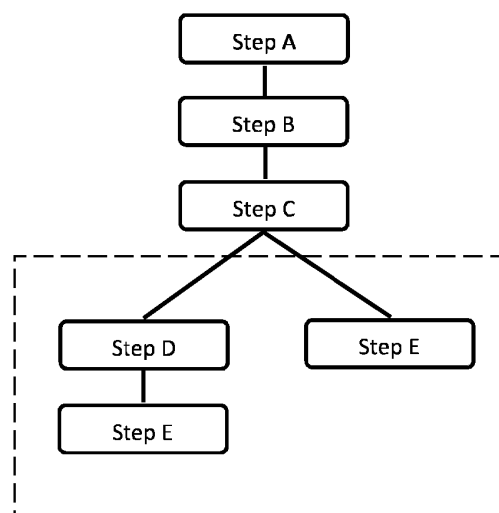


Fig. 3

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

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