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**(19) AUSTRALIAN PATENT OFFICE**

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(54) Title  
**Bristle, method for producing said bristle and a device with a bristle of this type**

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(56) Related Art  
**US 5137039**  
**DE 19533815**  
**US 3689118**



**PCT**  
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<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top; padding: 5px;"> <b>(21) Internationales Aktenzeichen:</b> PCT/EP99/02403   <b>(22) Internationales Anmeldedatum:</b> 9. April 1999 (09.04.99)   <b>(30) Prioritätsdaten:</b>            198 18 345.3      24. April 1998 (24.04.98)      DE   <b>(71) Anmelder (für alle Bestimmungsstaaten ausser US):</b> PEDEX &amp; CO. GMBH [DE/DE]; Hauptstrasse 67, D-69483 Wald-Michelbach (DE).   <b>(72) Erfinder; und</b>  <b>(75) Erfinder/Anmelder (nur für US):</b> WEIHRAUCH, Georg [DE/DE]; Am Rossert 1, D-69483 Wald-Michelbach (DE).   <b>(74) Anwälte:</b> LICHTI, Heiner usw.; Postfach 41 07 60, D-76207 Karlsruhe (DE).         </td> <td style="width: 50%; vertical-align: top; padding: 5px;"> <b>(81) Bestimmungsstaaten:</b> AU, BR, CA, CN, CZ, ID, IN, JP, KP, KR, MX, PL, RU, TR, UA, US, ZA, europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).   <b>Veröffentlicht</b>  <i>Mit internationalem Recherchenbericht.            Vor Ablauf der für Änderungen der Ansprüche zugelassenen Frist; Veröffentlichung wird wiederholt falls Änderungen eintreffen.</i> </td> </tr> </table>			<b>(21) Internationales Aktenzeichen:</b> PCT/EP99/02403  <b>(22) Internationales Anmeldedatum:</b> 9. April 1999 (09.04.99)  <b>(30) Prioritätsdaten:</b> 198 18 345.3      24. April 1998 (24.04.98)      DE  <b>(71) Anmelder (für alle Bestimmungsstaaten ausser US):</b> PEDEX & CO. GMBH [DE/DE]; Hauptstrasse 67, D-69483 Wald-Michelbach (DE).  <b>(72) Erfinder; und</b> <b>(75) Erfinder/Anmelder (nur für US):</b> WEIHRAUCH, Georg [DE/DE]; Am Rossert 1, D-69483 Wald-Michelbach (DE).  <b>(74) Anwälte:</b> LICHTI, Heiner usw.; Postfach 41 07 60, D-76207 Karlsruhe (DE).	<b>(81) Bestimmungsstaaten:</b> AU, BR, CA, CN, CZ, ID, IN, JP, KP, KR, MX, PL, RU, TR, UA, US, ZA, europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Veröffentlicht</b> <i>Mit internationalem Recherchenbericht.            Vor Ablauf der für Änderungen der Ansprüche zugelassenen Frist; Veröffentlichung wird wiederholt falls Änderungen eintreffen.</i>
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**(54) Title:** BRISTLE, METHOD FOR PRODUCING SAID BRISTLE AND A DEVICE WITH A BRISTLE OF THIS TYPE

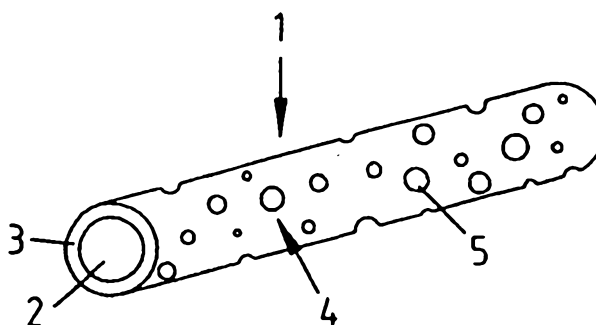
**(54) Bezeichnung:** BORSTE, VERFAHREN ZU IHRER HERSTELLUNG UND GERÄT MIT EINER SOLCHEN BORSTE

**(57) Abstract**

The invention relates to a bristle (1) comprising a core (2) consisting of a relatively hard, flexurally elastic plastic and at least one layer consisting of a rubber elastic plastic. Said layer is shaped by embossment against the core. A film-like layer can also be applied to said layer to even out the profile. A bristle of this type is produced by coextruding the core and the rubber elastic layer and then embossing the latter against the core. The film-like layer is applied after the embossment.

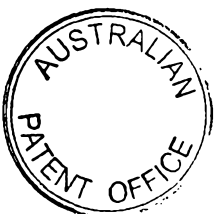
**(57) Zusammenfassung**

Eine Borste (1) besteht aus einem Kern (2) aus einem vergleichsweise harten, biegeelastischen Kunststoff und wenigstens einer Schicht aus einem gummielastischen Kunststoff, die durch Prägen gegen den Kern profiliert ist. Auf dieser Schicht kann eine weitere die Profilierung glättende filmartige Schicht aufgebracht sein. Eine solche Borste wird durch Koextrudieren des Kerns und der gummielastischen Schicht und durch anschließendes Prägen derselben gegen den Kern hergestellt. Die filmartige Schicht wird nach dem Prägen aufgebracht.



ABSTRACT OF THE DISCLOSURE

A bristle comprises a core of a comparatively rigid, bending-elastic plastics material and at least one layer of a rubberlike plastics material, which is profiled by stamping or embossing against the core. To said layer can be applied a further film-like coating smoothing the profiling. Such a bristle is produced by the coextrusion of the core and the rubberlike layer and the subsequent stamping thereof against the core. The film-like coating is applied following stamping.



BRISTLE, PROCESS FOR ITS PRODUCTION AND IMPLEMENT HAVING SUCH A BRISTLE

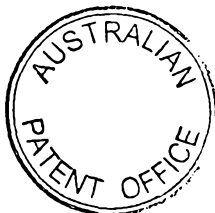
5 The invention relates to a bristle comprising a core of a comparatively rigid, bending-elastic plastic and at least one layer of a rubberlike plastic. The invention also relates to a process for the production of such bristles and to implements equipped with such bristles.

10 Independently of the intended use of a brush, certain fundamental demands are made on the bristles. These more particularly include the bending elasticity, flexural strength and resistance to wear. Further and often very differing requirements result from the intended use of the brush. Thus, e.g. brushes for oral and body hygiene must be sufficiently soft to avoid injury, whereas abrasively acting, industrial brushes must have hard and rough bristles. Other technical brushes, such as car wash brushes, must  
15 once again be smooth and pliable. This also applies in the case of polishing brushes. Brushes or paintbrushes used for the application of media, must have relatively closely juxtaposed, standing bristles for storing the medium, whereas in other applications individual standing bristles or bristle bundles are desired.

20 The action of a bristle on the surface of the object to be treated or worked is decisively dependent on the surface characteristics thereof and the bristle material. Generally bristles are produced from extruded plastic monofilaments. As a result of the choice of the plastic it is essentially  
25 only possible to influence the bending and wear resistance, but only to a very limited extent the surface characteristics and the effectiveness of the surface, apart from simple longitudinal profiles. Thus, numerous attempts have been made in the prior art to modify the surface characteristics or the effectiveness of the surface of bristles by additional measures in order to  
30 better meet the requirements of each intended use.

In the literature reference list following the description, documents (1) to (8) describe bristles with incorporated, abrasively acting particles for different uses. It is in each case a question of giving the bristle a hard,  
35 abrading action.

Another development referred to in documents (9) to (15) is to profile in different ways the jacket of a bristle formed from a plastic monofilament.



It is in each case a question of forming more or less sharp edges and this extends to frayed structures.

5 All the aforementioned solutions with particle-filled or profiled, mono-filament bristles suffer from the decisive disadvantage that the strength characteristics, particularly the bending elasticity, flexural strength and also the resistance to wear are significantly reduced, so that use must once again be made of larger bristle diameters and/or higher quality plastics. However, this is often impossible for use reasons and also leads to  
10 undesired higher costs.

Other known proposals according to documents (16) to (21) aim at producing the bristle from two plastic components, namely a plastic core and a coating applied thereto either in the form of a jacket enveloping the core or in the  
15 form of fibres applied to the core. In these known solutions the strength characteristics of the bristle remain substantially controlled. To the extent that the core has a smooth-walled jacket (16), (17), the bristle action can only be insignificantly modified. If only the hard core is profiled and a profile-following, rubber-elastic coating is applied (18),  
20 the latter is rapidly worn away at the profile humps and the hard core is exposed. To the extent that the core is flocked with fibres (20), the bristle can only be used for specific purposes and is also complicated and expensive to manufacture.

25 Among the last-mentioned proposals, document (21) proposes a bristle comprising an extruded, relatively stiff core of PA (polyamide) or high density PE (polyethylene) and a soft, thermoplastic coating of natural or artificial rubber. This known bristle is designed for toothbrushes, where the soft, rubber-elastic coating is mainly intended to ensure a careful treatment of  
30 the teeth and gums, whilst the stiff core ensures the necessary strength characteristics for the bristle. However, such a bristle does not satisfy the demands made during cleaning, because its surface is too smooth. It is also unsuitable for applying media to an object.

35 On the basis of this prior art, the problem of the invention is to provide a bristle which, whilst maintaining the necessary strength characteristics in



the case of a soft surface also provides a good cleaning action and absorptivity for media.

On the basis of a bristle comprising a core of a comparatively rigid,  
5 bending-elastic plastic and at least one layer of a rubberlike plastic, the invention solves this problem in that the rubberlike layer is profiled by stamping against the core, preferably by hot stamping.

The invention is based on the surprising finding that a rubber-like plastic,  
10 e.g. a thermoplastic elastomer, even with a very limited thickness, which necessarily arises in the case of bristles and with toothbrushes is only a few tenths of a millimetre, can be profiled by stamping or embossing, without there being any shape recovery of the rubberlike plastic. A decisive  
15 part is played by the relatively rigid core against which the stamping or embossing forces can be applied. It is possible to implement fine to coarse structures with any random shaping. Small profile depths are in particular chosen in the case of bristles for oral and body hygiene, whereas greater profile depths are used for cleaning or coating brushes for in the first case receiving dirt and in the second application media.

20

The rubberlike layer can surround the core in jacket-like manner or also only zonally and the profiling resulting from stamping can be provided over the entire length of the bristle or only over partial lengths thereof.

25 In the case of the bristle constructed according to the invention the core is made from a plastics material defining the bending and flexural strength of the bristle and the rubberlike layer with its profiling from a plastics material defining the surface action of the bristle on the object and the resistance to wear. Through the choice of the two plastics and the nature  
30 of the profiling, the bristle can be readily adapted to random requirements.

In a preferred embodiment the core is made from a plastics material having a Shore hardness  $D > 45$  and the rubberlike layer from a plastics material with a Shore hardness  $D < 35$ . In a particularly preferred embodiment the Shore hardness  
35 of the core plastic is  $D > 65$  and that of the rubberlike layer  $20 < D < 35$ . Materials fulfilling the aforementioned requirements are e.g. in the case



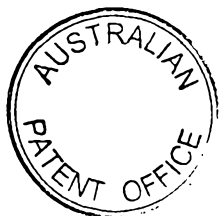
of the core PE (polyethylene), PP (polypropylene) or PA (polyamide) and for the rubberlike layer thermoplastic elastomers.

- 5 The profiling of the rubberlike layer can be formed by locally defined depressions distributed over the circumference. Instead of this the profiling can also run in the bristle extension direction, e.g. along generatrices or in helical manner. Finally, the profiling can also be preponderantly oriented transversely to the bristle extension direction.
- 10 According to a further feature of the invention, to the profiled, rubberlike layer is applied a film-like coating of a soft plastic clinging to its profile. As a result a certain smoothing effect can be obtained on the profiling without removing the surface action therefrom.
- 15 The core can be formed from one or more monofilaments. The first-mentioned form is recommended for toothbrushes and body brushes, whereas the second is better for industrial brushes and in particular car wash brushes. In this particular application the bristles must be bending-soft, so as to be applied in optimum manner to the contour of the surface to be cleaned and
- 20 also so as to carefully clean the surface. These bristles are subject to very rapid wear from the free end. This means in the case of the bristle according to the invention, that the rubberlike layer is firstly worn away at the bristle ends. In the variant according to the invention with several core monofilaments they are exposed in the form of fibres, which then still
- 25 ensure a careful action compared with a single, larger diameter core monofilament.

Normally bristles have a circular cross-section. However, in the case of the construction according to the invention it is possible to implement any

30 other bristle cross-section, in that the core has a cross-section diverging from the circular shape, e.g. a narrow, rectangular or cruciform or stellate cross-section. The rubberlike layer can then have a circular cross-section, so that it has a different thickness and can e.g. be more deeply stamped in the thicker areas. Instead of this it can also have a cross-section

35 following the core cross-section, so that independently of the location of the stamping equal-depth profiles can be produced and here again the core



serves as an abutment.

Finally, the entire bristle constituted by the core and rubberlike layer can be corrugated transversely to the bristle extension direction.

5

A good adhesion of the rubberlike layer to the core is obtained through a surface structure on the core acting as a primer.

10

For the manufacture of the above-described bristle, the invention proposes a process in which the core and the rubberlike layer are coextruded as a strand and the rubberlike layer, with the strand moving, is profiled by stamping against the core.

15

This process leads to a continuous bristle material, from which the bristles can be cut, as desired, to length immediately after stamping. Instead of this the bristle material can be wound and then the bristle is cut to length, as desired, from the unwound strand at the time of brush manufacture.

20

In another variant of the process, the core and the rubberlike layer are coextruded as a continuous strand, the strand is wound and the rubberlike layer is profiled by stamping against the core on unwinding the strand. In this process stamping can take place at the bristle material manufacturer or only at the brush manufacturer. This process can also be advantageous if the rubberlike layer is constituted by a slowly crosslinking elastomer and the stamping process is only to take place at the end of the crosslinking reaction.

25

30

In this process the rubberlike layer is preferably profiled by stamping tools acting against one another and against the core and said tools can produce different profiles. In the case of an only one-sided profiling the stamping tool cooperates with an unprofiled counter-tool.

35

In a further variant of the process according to the invention, to the profiled strand at the time of bristle material manufacture or prior to the cutting to length of the bristles, a soft plastic can be applied in film-like manner by extrusion, dipping, spraying or the shrinking on of a film,





e.g. in order to smooth the profile.

In another variant of the process, the core and the rubberlike layer are coextruded as a strand, the bristle is then cut to length from the strand  
5 and then the rubberlike layer is profiled by stamping against the core. In this process the film-like coating can be applied before or after cutting to length by dipping, spraying, or shrinking on a film.

The inventively constructed bristle is usable for implements of the most  
10 varied types. In the simplest case such a bristle can be directly used as an interdental cleaner, either in the form of a stick or in a similar manner to dental floss.

As opposed to this, a brush is provided with a plurality of bristles con-  
15 structed according to the invention and said bristles can be provided in separate arrangements. In particular, such a brush can have bristles with differently profiled, rubberlike layers.

The invention is described in greater detail hereinafter relative to embodi-  
20 ments diagrammatically represented in the attached drawings and which in each case perspectively show in cross-section a bristle.

The bristle 1 according to fig. 1 has a core 2 of a bending-elastic, flex-resistant plastic, e.g. PA, PP or PE and a rubberlike layer 3 surrounding in  
25 jacket-like manner the core 2, e.g. of a thermoplastic elastomer. In the rubberlike layer 3 is stamped a profile 4 in the form of locally defined, circumferentially distributed depressions 5. Stamping takes place against the rigid core 2.

30 In the embodiment according to fig. 2 the bristle 1 is only stamped with the profile shown in fig. 1 over part of its length, whereas it is unprofiled over the remaining length 6, which e.g. includes the fastening-side end of the bristle. It otherwise once again comprises a core 2 of a rigid plastic, the rubberlike layer 3 with the stamped in depressions and a film-like  
35 coating 7, which covers the profiling and clings to the latter, but leads to a certain smoothing effect. In the embodiment of fig. 3 the bristle once



again comprises a core 2 and a rubberlike layer 3, which is only zonally applied and runs on the core 2 in the form of longitudinal ribs, which are profiled by transverse stamping, so as to obtain depressions 8 and boss-like humps 9. In the embodiment according to fig. 4 the rubberlike layer 3 is

5 longitudinally profiled on the core 2 and the profile can be produced during a coextrusion operation or by stamping. In addition, the rubberlike layer 3 can have depressions produced by stamping as in figs. 1 and 2 or transverse stampings as in fig. 3.

10 Whereas in the embodiments according to figs. 1 to 4 at least the core has a circular cross-section, fig. 5 shows a bristle with a core 2 having a cruciform cross-section 10, whilst the rubberlike layer 3 has a circular cross-section. Thus, it is thinnest in the region of the ends of the beam of the cruciform cross-section 10. This leads to sharply defined abutments

15 against which the profile can be particularly well stamped, as indicated by the arrows 11.

In the embodiment according to fig. 6 the bristle 1 once again has a core 2 with a circular cross-section. The rubberlike layer 3 enveloping it is

20 stamped with a wavy profile 12.

Fig. 7 shows an embodiment modified compared with fig. 1, in that the core 2 comprises four monofilaments 13, which can be positioned parallel or twisted. The rubberlike layer 3 once again surrounds the core with a circular cross-

25 section and has on its jacket the stamped in profiling.

In the embodiment according to fig. 8 the core 2 has an elongated cross-section. The rubberlike layer 3 has a constant thickness, so that it follows the cross-section of the core 2 and a strip-like bristle is obtained,

30 which is e.g. only provided on its narrow sides with a stamped profile 4, much as in fig. 3.

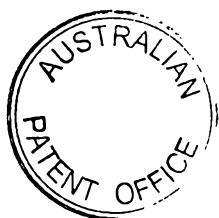
The bristle according to fig. 9 once again has a core 2 and a rubberlike layer 3 with a profiling 4 resulting from stamping. As a variant compared

35 with the previously described bristles, the bristle 14 according to fig. 9 is corrugated transversely to the longitudinal extension.



PRIOR ART DOCUMENTS

- 1) DE 322 089 A
- 2) US 2,642,705
- 3) DE 1 014 964 B
- 4) DD 32 963 A
- 5) GB 1 327 329 A
- 6) FR 2 546 097 A
- 7) EP 0 354 352 A
- 8) WO 93/18891 A
  
- 9) US 2,110,371 A
- 10) US 2,317,485 A
- 11) US 3,325,845 A
- 12) US 4,373,541 A
- 13) DE 3 116 189 A
- 14) US 5,678,275 A
- 15) DE 1 140 901 B
- 16) DE 1 037 434 B
  
- 17) DE 83 00 846 U
- 18) US 3,090,061 A
- 19) US 4,627,950 A
- 20) DE 3 717 475 C
- 21) US 4,263,691 A



THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Bristle, comprising a core of a bending-elastic plastic and at least one layer of a rubber-like plastic, wherein the bending-elastic plastic is relatively rigid when compared to the rubber-like plastic, the bristle  
5 characterized in that the rubber-like layer (3) has a pre-determined profile formed by stamping against the core (2).
2. Bristle according to claim 1, characterized in that the rubber-like layer (3) is profiled by hot stamping against the core (2).
3. Bristle according to claim 1 or 2, characterized in that the rubber-like  
10 layer (3) surrounds the core (2) in jacket-like manner.
4. Bristle according to claim 1 or 2, characterized in that the rubber-like layer (3) zonally surrounds the core (2).
5. Bristle according to any one of the claims 1 to 4, characterized in that the core (2) comprises a plastics material defining the bending and flexural  
15 strength of the bristle (1) and the rubber-like layer (3) with its profiling (4) a plastics material defining the surface action of the bristle (1) on the object and the resistance to wear.
6. Bristle according to any one of the claims 1 to 5, characterized in that the core (2) comprises a plastics material with a Shore hardness  $D > 45$  and  
20 the rubber-like layer (3) a plastics material with a Shore hardness  $D < 35$ .
7. Bristle according to any one of the claims 1 to 6, characterized in that the core (2) comprises a plastics material with a Shore hardness  $D > 65$  and the rubber-like layer (3) a plastics material with a Shore hardness  
20  $20 < D < 35$ .
8. Bristle according to any one of the claims 1 to 7, characterized in that  
25 the core (2) is of PE (polyethylene), PP (polypropylene) or PA (polyamide) and the rubber-like layer (3) of a thermoplastic elastomer.
9. Bristle according to any one of the claims 1 to 8, characterized in that the rubber-like layer (3) has circumferentially distributed, locally defined  
30 depressions (5).
10. Bristle according to any one of the claims 1 to 8, characterized in that the rubber-like layer (3) has a profile (8, 9) in the extension direction of the bristle (1).
11. Bristle according to any one of the claims 1 to 8, characterized in that  
35 the rubber-like layer has a profile extending transversely to the extension direction (8, 9).



12. Bristle according to any one of the claims 1 to 11, characterized in that to the profiled, rubber-like layer (3) is applied a film-like coating (7) of a soft plastics material which clings to the profiled, rubber-like layer (4).

13. Bristle according to any one of the claims 1 to 12, characterized in  
5 that the core (2) is formed from a monofilament.

14. Bristle according to any one of the claims 1 to 12, characterized in that the core (2) is formed from several monofilaments (13).

15. Bristle according to any one of the claims 1 to 13, characterized in that the core (2) has a non-circular cross-section (10).

10 16. Bristle according to any one of the claims 1 to 15, characterised in that the rubber-like layer (3) has a cross-section that differs from the cross-section of the core (2), including said rubber-like layer having a circular cross-section.

17. Bristle according to claim 15, characterized in that the rubber-like  
15 layer (3) has a cross-section following that of the core (2).

18. Bristle according to any one of the claims 1 to 17, characterized in that the core (2) with the rubber like layer (3) is corrugated transversely to the extension direction of the bristle (1).

19. Bristle according to any one of the claims 1 to 18, characterized in  
20 that the core (2) has a surface structure or a corresponding coating acting as a primer for the rubber-like layer (3).

20. Process for the production of bristle material for bristles according to any one of the claims 1 to 19, characterized in that the core and the rubber-like layer are coextruded as a continuous strand and, with the strand  
25 moving, the rubber-like layer is profiled against the core by stamping.

21. Process for the production of bristle material for bristles according to any one of the claims 1 to 19, characterized in that the core and the rubber-like layer are coextruded as a continuous strand, the strand is wound and the rubber-like layer is profiled on unwinding the strand by stamping  
30 against the core.

22. Process for the production of bristles according to any one of the claims 1 to 19, characterized in that the core and the rubber-like layer are coextruded as a strand, the bristle is cut to length from the strand and subsequently the rubber-like layer of the bristle is profiled by stamping  
35 against the core.



23. Process according to one of the claims 20 or 22, characterized in that the rubber-like layer is profiled by means of stamping tools acting against one another.

24. Process for the production of a bristle according to claim 12 and 20 or 21, characterized in that to the profiled strand is applied in film-like manner a soft plastics material by extrusion, dipping, spraying or the shrinking on of a film.

25. Process for the production of a bristle according to claim 12 and 22, characterized in that to the profiled bristle is applied in film-like manner a soft plastics material by dipping, spraying or shrinking on a film.

26. Bristle material, produced by the process according to any one of the claims 20 to 25.

27. Interdental cleaner having at least one bristle according to any one of the claims 1 to 19.

28. Brush having a plurality of bristles according to any one of claims 1 to 19.

29. Brush according to claim 28, characterized in that the plurality of bristles have differently profiled, rubber-like layers.

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Dated this 29th day of February 2002.

Pedex & Co. GmbH

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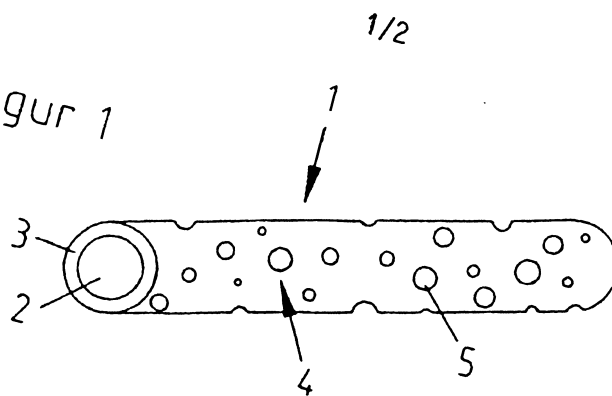
Patent Attorneys for the Applicant:

F B RICE & CO

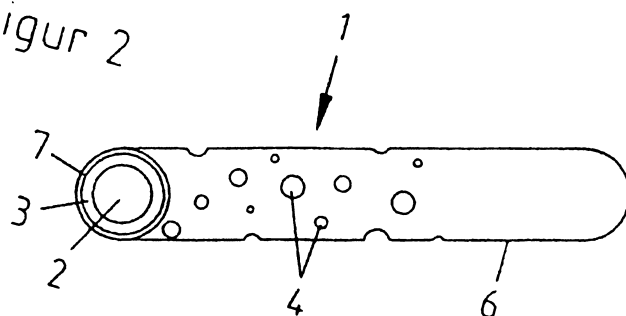
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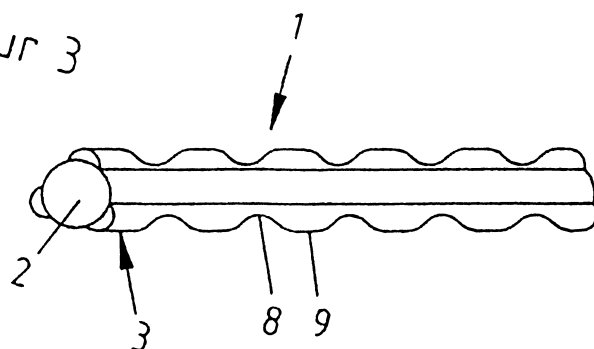
Figur 1



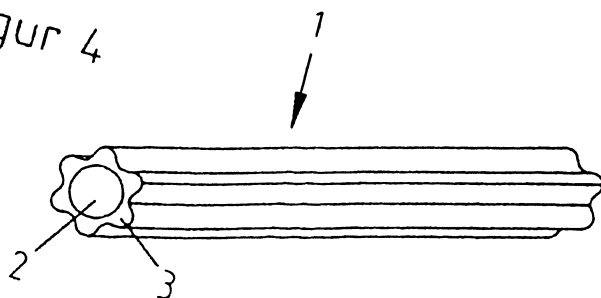
Figur 2



Figur 3



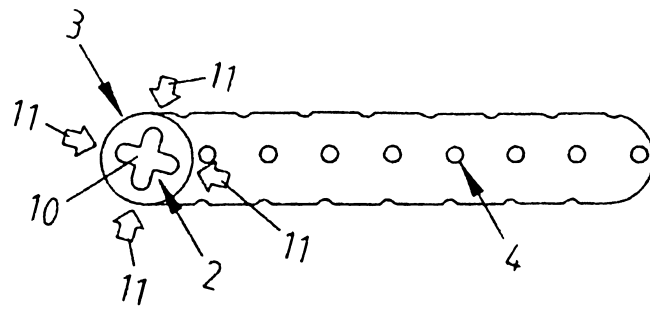
Figur 4



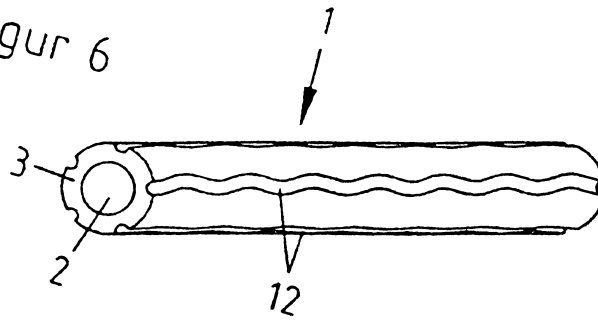
Figur 5

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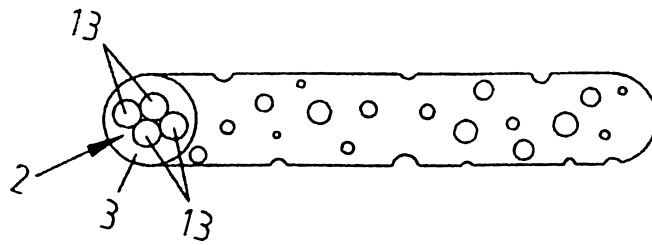
PCT/EP99/02



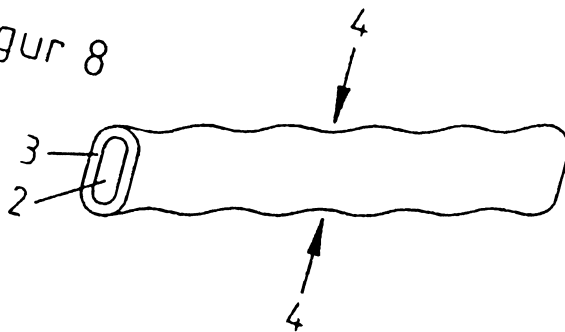
Figur 6



Figur 7



Figur 8



Figur 9

