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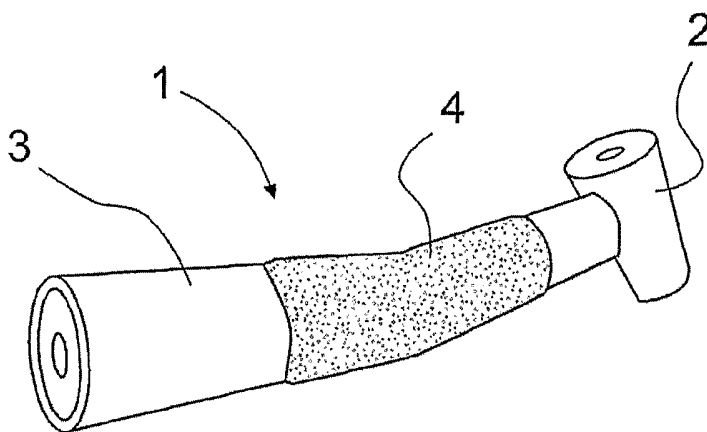
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(54) Title: DENTAL HAND INSTRUMENT TO BE USED IN DENTAL UNIT



(57) Abstract: The invention concerns a hand instrument for use in a dental unit, consisting of a hand piece (1), which has at least a working end (2) and a frame (3) made of metal or a corresponding material. One or more actuating elements transmitting operating power to the working end (2) are arranged inside the frame (3). The essential feature of the invention is that the hand piece is provided with a gripping surface softer than the material of the frame (3) and covering at least part of the outer surface of the frame, which gripping surface substantially consists of an elastomer and has, e.g., a ring-like or conical shape (4).

DENTAL HAND INSTRUMENT TO BE USED IN DENTAL UNIT

The present invention relates to a hand instrument for use in a dental unit as defined in the preamble of claim 1.

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The present invention concerns a hand instrument designed for use in a dental unit and comprising a handpiece made of metal or some other hard and rigid material which forms its frame or a part of it, said instrument being supplied via
10 its back end with quantities needed for utilization of the instrument. In particular, the invention concerns hand instruments in which the working element connected to the working end of the handpiece has been arranged to be movable by a rotating motion arranged in the instrument to implement
15 a working movement pertaining to dental care.

Prior-art rotatable hand instruments used in dental care typically receive their operating power, such as electricity or compressed air, as well as their control signals from the
20 dental unit, and the instruments or the handpieces comprised in them are metallic objects of straight or angular shape and contain actuators transmitting the aforesaid control signals and/or operating power. A strong and hard shell protects the internal structures of the instrument. In this
25 context, 'handpiece' thus refers to those parts of hand instruments used in a dental unit, which comprise that surface or area of the instrument whereby the instrument is grasped when being used for a dental operation. The instruments according to the invention are used especially for dental
30 drilling, treatment of the surfaces of teeth or tooth fillings and in conjunction with filling drilled cavities with filling material, the instruments' working end receiving its operating power e.g. via a turbine or micromotor.

35 A problem with prior-art instruments for dental units is their operating ergonomics especially in situations where a person has to work with the instrument for lengthy periods

at a time. In such a situation, the hardness of metal together with the vibration caused by the actuating and/or working element of the instrument causes a strain on the muscles and tissues of the user's hand and fingers. When the instrument is operated user's fingers grow numb and extended use may even result in permanent damage. The metal surface may also get unpleasantly warmed up, especially if hand instruments will be increasingly frequently provided with an integrated light source in the future to facilitate the work.

On the other hand, a patient may find the metallic instrument unpleasant, e.g. as metallic cool, when the instrument touches patient's lip or other tissue of the oral area in connection with a treatment operation.

The object of the present invention is to overcome the above-mentioned drawbacks and to create in a relatively inexpensive way a solution for a handpiece of a hand instrument used in a dental unit, which is ergonomically better than the prior-art solutions. The aim of the invention is to create a hand instrument for use in a dental unit which comprises a gripping point, surface or area that has a vibration damping property and a low heat transfer coefficient as compared to metal, is more elastic and softer than a metallic surface and thus allows a good and non-sliding working grip to be taken even when the gripping surface gets wet, without the necessity to exert too much compression on the instrument.

The instrument of the invention is characterized by what is disclosed in the characterization part of claim 1. Correspondingly, other embodiments of the invention are characterized by what is disclosed in the other claims.

The instrument of the invention has the advantage of an ergonomic gripping surface, which is elastic and conveniently

soft, thus enabling a good grip and which, on the other hand, dampens the vibrations transmitted to the hand by the handpiece. A suitable degree of softness is achieved using e.g. elastomers having a hardness above 20 Shore A but below 5 90 Shore A. Therefore, the instrument needs not be gripped with as much pressure as when a metallic handpiece is used to bring and keep the instrument in a correct working position. The strain on hand muscles and tissues caused by the slight pressure applied to the soft and elastic gripping 10 area of the handpiece is far less than in case of the prior-art metallic handpieces, and vibration of the instrument transmitted to a hand is dampened. As elastomers are also good thermal insulators, the heat that may be generated inside the handpiece or the coldness of the handpiece surface 15 is not transmitted to the user in the same way as from a metallic surface. Also, the light grip becoming possible, thanks to the elastomer coating, further reduces transmittal of heat or cold to the hand. By arranging the elastomer on the handpiece in an appropriate manner, it is also possible 20 to avoid contacts between the metallic instrument surface and patient's tissues.

Certain preferred embodiments of the invention have the advantage that the gripping part of the instrument is held 25 firmly in place by shape-locking achieved by means of suitable receiving elements arranged in the handpiece and corresponding locking elements arranged in the gripping part.

Certain preferred embodiments of the invention have the advantage that the gripping part placed over the handpiece by 30 stretching can be easily removed and e.g. sterilized and placed again over the handpiece. Such a gripping part is also easy to replace when necessary.

35 On the other hand, a gripping surface cast or injected onto the handpiece during manufacture has the advantage that the gripping part can be arranged to be so tight in its edge ar-

easy that no impurities can readily get between the handpiece and the edges of the gripping part and maintaining the handpiece in a hygienic state is as easy as in the case of prior art handpieces.

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Certain preferred embodiments of the invention also have the advantage that the handpieces can be easily provided with differently colored elastomer inserts forming the gripping surface, so that handpieces of different colors can be readily distinguished from each other and, among a plurality of users, each user or each reception room may have differently colored handpieces. Color codes can also be used to indicate e.g. that the handpiece has certain technical properties, such as e.g. a handpiece having a given transmission ratio.

15 Especially silicone is a material that ingeniously allows combining the various advantages of the invention as, besides being both soft and elastic, it can also be both steam-sterilized at a high temperature and easily dyed, unlike many other elastomers.

20

In the following, the invention will be described in more detail with the help of exemplary embodiments and reference to the attached drawings, wherein

25 Fig. 1 presents an oblique side view of a hand instrument/handpiece according to the invention provided with an elastomeric gripping part,

Fig. 2 presents a side view of the hand instrument/handpiece of Fig. 1 with the gripping part longitudinally sectioned,

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Fig. 3 presents an oblique side view of a hand instrument/handpiece provided with a lightened gripping part,

Fig. 4 presents a side view of a second hand instrument/handpiece according to the invention provided with a gripping part,

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- Fig. 5 presents a side view of a third hand instrument/handpiece according to the invention provided with a gripping part,
- Fig. 6 presents a side view of yet another hand instrument/handpiece according to the invention provided with a gripping part partially longitudinally sectioned,
- Fig. 7 presents the hand instrument/handpiece of Fig. 6, cross-sectioned along line VII-VII of Fig. 6,
- 10 Fig. 8 presents a side view of yet another hand instrument/handpiece according to the invention provided with a gripping part.

Figs. 1 and 2 present a handpiece 1 implementing the idea of the invention, designed for use in dental care, comprising at least a working end 2 for the attachment and rotation of a working element, such as a dental drill bit, and a frame 3 made of metal or corresponding material, which is fastened to the working end 2 and forms a substantially strong and hard shell. The frame 3 may have a bent shape, as shown in Figs. 1-6, or a substantially straight shape, as shown in Fig. 8. The frame 3 may also have a uniformly curved shape. In addition, the frame 3 is generally conical, such that the diameter of the frame 3 diminishes towards the working end 2. Placed inside the frame 3 and working end 2 are actuating elements and actuating means, which are operated by means of a dental unit or equivalent so that mechanical motion and electric signals are transmitted from the dental unit through the frame 3 to the working end 2 and further to the working element used during a dental operation.

Over the frame 3 of the handpiece, a substantially soft gripping part 4 is placed which gives a secure grip, is made e.g. of an elastomer, such as silicone, having suitable

softness and gripping properties. The gripping part preferably has a hardness substantially greater than 20 Shore A, suitably e.g. between 30-90 Shore A, preferably between 50-80 Shore A. In the solution illustrated in Fig. 1, the gripping part 4 has a length substantially shorter than the length of the frame 3 and it is placed at a position that is as well suited as possible for the position of the grip of the user of the handpiece 1 when the handpiece is used to perform a dental operation. In this case, the gripping part 4 consists of a hollow, conical and elongated silicone sleeve. This gripping part, such as a silicone sleeve, which has been designed to be threaded afterwards onto the frame 3, has a wall thickness e.g. below 1.5 mm, preferably below 1 mm, because a thin-walled sleeve is easier to thread onto the frame 3 than a sleeve with a thick wall. Correspondingly, gripping parts made by casting may have a significantly larger wall thickness, such as e.g. as large as 5 mm. On the other hand, the gripping part may also extend beyond the actual handgrip area of the handpiece, e.g. substantially or exactly to the working end 2 of the gripping part or even over it.

The silicone sleeve 4 serving as a gripping part 4 may have a cylindrical or conical form, so that it will fit well on straight handpieces but can also be stretched onto a bent handpiece. However, the gripping part 4 is preferably arranged to have a shape and dimensions such that it corresponds to that area of the handpiece over which it is intended to be placed. Thus, for example, the silicone sleeve forming the gripping part 4 has a diameter which is appropriately smaller than the diameter of the corresponding part of the frame 3, in other words, the diameter of the gripping part 4 has been arranged to change according to the diameter of the frame 3. In addition, for bent handpieces, the grip-

ping part 4 may be bent to substantially the same angle as the frame 3 of the handpiece.

Fig. 2 presents the handpiece 1 of Fig. 1 in a way that the gripping part 4 is shown on top of frame 3 as longitudinally sectioned. The outer surface of the frame 3 is substantially smooth and the gripping part 4 stays at its place with the help of friction.

Fig. 3 presents a lightened gripping part 4, which is designed to be threaded onto the frame 3. The lightenings 12, which are through holes or thinned areas in the wall of the gripping part 4, are located at suitable places, e.g. in the area of the bend of frame 3 on the upper and lower sides of the gripping part 4. In such an embodiment, the thickness of the wall of the gripping part 4 in the actual gripping area on the sides of frame 3 of the handpiece can be arranged to correspond to the wall thickness of a continuous sleeve. The lightenings 12 make it easier to thread the gripping part onto the frame 3 and to remove it from its position on the frame. Even more lightenings 12 than presented above may be provided and the whole gripping part 4 may have a net-like structure.

Fig. 4 presents a handpiece 1 according to the invention which is provided with grooves 5 extending transversely to the frame 3 and serving as receiving elements for receiving the gripping part 4 forming the gripping surface. This embodiment example comprises one groove 5 for the leading end of the gripping part 4, extending around the frame in the front part of the frame 3, and a second groove 5 for the trailing end of the gripping part 4, extending around the frame in the rear part of the frame 3. The distance between the grooves 5 substantially corresponds to the length of the

gripping part 4. The gripping part 4 may also extend past the grooves. Correspondingly, the leading and trailing edges of the gripping part 4 are provided with a collar 6 acting as a locking element and substantially corresponding to the dimensions and shapes of the groove 5 in frame 3, which collar can be fitted into the groove 5 and extends transversely and inwards relative to the gripping part 4. When a gripping part 4 thus shaped is threaded onto a frame 3 thus shaped, the collars 6 acting as locking element are pushed into the grooves serving as receiving elements and the gripping part 4 sets firmly in its place.

Fig. 5 presents one preferred handpiece 1 according to the invention, which is provided with an elevation 7 serving as a receiving element for the gripping part 4, with bevels 8 at the ends of the elevation. The elevation 7 substantially follows the shape of the frame 3, but its diameter is larger than the diameter of the frame 3. The gripping part 4 is placed over the elevation 7 so that the ends of the gripping part 4 are shape-locked on the bevels 8, thus keeping the gripping part 4 firmly in place. The ends of the gripping part 4 may be provided with collars 6a corresponding to the collars 6 presented in Fig. 4, but a gripping part having appropriately thin walls and a diameter smaller than that of frame 3 will bend onto the bevels 8 even without the collars.

Figs. 6 and 7 present yet another preferred handpiece 1 according to the invention, which is provided with a groove 9 serving as a receiving element for the gripping part 4 and extending in longitudinal direction of the frame 3, at the centre of the lower surface of the frame. The groove 9 is located substantially in the gripping area, and in bent

handpieces the groove 9 extends forward and backward from the bend.

Fig. 7 presents a cross-section of the frame 3 of the hand-
5 piece 1 along the section line VII-VII in Fig. 6. Correspondingly, the gripping part 4 has a longitudinal slit at its underside and both of the longitudinal edges have a fold 10 serving as a locking element and substantially corresponding to the dimensions and shapes of groove 9 of the
10 frame 3, which fold can be fitted into the groove 9 and extends longitudinally and inwards relative to the gripping part 4. When a gripping part 4 thus shaped is threaded onto a frame 3 thus shaped, the folds 10 serving as locking elements are pushed side by side into the groove 9 functioning
15 as a receiving element and the gripping part 4 sets firmly in its place. Instead of one common groove 9, a separate groove may be provided for both of the folds 10. The above-described structure allows the gripping part 4 to be easily threaded onto the frame and also to be easily removed from
20 the frame 3.

Fig. 8 presents yet another preferred handpiece 1 according to the invention, which is provided with an incision 11 serving as a receiving element for the gripping part 4. The
25 incision 11 substantially follows the shape of the frame 3 but its diameter is smaller than the diameter of the frame 3. The gripping part 4 is so placed over the incision 11 that the gripping part 4 can be shape-locked between the front and back ends of the incision 11, the gripping part 4
30 thus remaining firmly in its place. The wall thickness of the gripping part 4 and the depth of the incision 11 are designed e.g. in such manner that the wall thickness corresponds to the depth of the incision 11 substantially throughout the length of the gripping part 4, the outer sur-

face of the gripping part 4 being thus smoothly integrated with the form of the outer surface of the frame 3. However, the wall thickness of the gripping part 4 may also be, throughout or in some parts of its length, appropriately
5 larger than the depth of the incision 11, in which case at least some portions of the gripping part 4 raise above the rest of the surface of frame 3. The handpiece 1 presented in Fig. 8 is substantially straight, but it may have a bent or curved shape as well.

10

In the structures presented in Figs. 1-8, the gripping part 4 has been threaded onto the frame 3 of the handpiece 1 after the actual manufacturing process of the instrument. Such a gripping part can be easily removed from the instrument,
15 e.g. to be sterilized or replaced with a new one. According to an embodiment of the invention, however, the gripping part 4 may be e.g. casted or injected on the frame 3 already in conjunction with the manufacture of the instrument/handpiece. Such a gripping part 4 can not be manually
20 replaced by a new one at a dental clinic but, on the other hand, in this case the structure can be more easily implemented in a manner that allows the instrument to be maintained in a hygienic state in the same way as conventional dental unit instruments.

25

It is obvious to the person skilled in the art that different embodiments of the invention are not exclusively limited to the examples described above. The inventive content of the application may also consist of several separate inven-
30 tions, and the inventive content disclosed in the application can be defined in other ways than is done in the claims below. In such a case, some of the definitions contained in the claims below may be superfluous from the point of view of separate inventive concepts. Within the framework of the ba-

5 sic concept of the invention, features of different embodiments of the invention can also be applied in conjunction with other embodiments. Thus, for example, an invention may also consist of combinations of different alternatives presented in the claims.

10 It is thus obvious to the person skilled in the art that e.g. the shape and size of the receiving elements in the frame of the instrument and of the locking elements in the gripping part as well as their number may vary from the above description.

15 It is additionally obvious to the skilled person that the wall thickness of the gripping part may vary at different points of the gripping part. Thus, the outer surface of the gripping part as seen in cross-section is not necessarily circular but elliptical or otherwise suitably shaped so that the user of the handpiece can easily detect with his/her fingers in what position the handpiece is in relation to its
20 longitudinal axis.

It is further obvious to the skilled person that the gripping parts may be differently colored, so that handpieces provided with differently colored gripping parts are readily
25 distinguished from each other and among a plurality of users, each user or each reception room can have differently colored gripping parts of the handpieces. Color codes can also be used to indicate e.g. that the handpiece has certain technical properties, such as e.g. a handpiece having a
30 given transmission ratio.

CLAIMS

1. A hand instrument for use in a dental unit, consisting of a handpiece (1) or comprising a handpiece (1), a frame (3) of which comprises a shell of substantially hard and rigid material, inside which shell is arranged, at least, one or more actuators transmitting operating power to the working end (2) of the handpiece (1), **characterized** in that the handpiece is provided with a vibration-damping and preferably also thermally insulating gripping surface which covers at least part of the outer surface of the frame (3), said gripping surface being substantially softer than said shell of the frame (3) and substantially consisting of an elastomer.

15

2. The hand instrument according to claim 1, **characterized** in that said gripping surface has a hardness substantially in the range of 20 Shore A ... 90 Shore A.

20 3. The handpiece (1) according to claim 1 or 2, **characterized** in that said gripping surface consists of a ring-like or sleeve-like gripping part (4) arranged on the outer surface of the frame (3) by stretching and threading the gripping part (4) onto the frame (3).

25

4. The handpiece (1) according to claim 1 or 2, **characterized** in that said gripping surface has been arranged as a gripping part (4) on the outer surface of the frame (3) by casting or injecting it onto the frame (3).

30

5. The handpiece (1) according to any one of the preceding claims, **characterized** in that the frame (3) is provided with receiving elements (5, 7, 9, 11) for receiving the gripping part (4) and keeping it in place.

6. The handpiece (1) according to claim 5, **characterized** in that the gripping part (4) is provided with locking elements (6, 10) fittable with the receiving elements (5, 7, 9, 11) in the frame (3).

5

7. The handpiece 1 according to claim 5 or 6, **characterized** in that the receiving element in the frame (3) consists of at least one groove (5) transverse to the frame (3), and that the locking element of the gripping part (4) is a col-
10 lar (6) substantially corresponding to the dimensions of the groove (5) and fittable into the groove (5), said collar (6) extending transversely and inwards relative to the gripping part (4).

15 8. The handpiece (1) according to claim 5 or 6, **character-ized** in that the receiving element in the frame (3) is an elevation (7) having a diameter larger than that of the frame (3), and that the locking element at the ends of the gripping part (4) is a collar (6a) substantially correspond-
20 ing to the dimensions of the ends of the elevation (7) and fittable onto the elevation (7), said collar (6a) extending transversely and inwards relative to the gripping part (4).

9. The handpiece (1) according to claim 5 or 6, **character-
25 ized** in that the frame (3) is provided with at least one groove (9) forming a receiving element and extending longitudinally relative to the frame (3), and that the gripping part (4) has been slit longitudinally and the locking elements at the edges of the slit of the gripping part (4) con-
30 sist of elongated folds (10) substantially corresponding to the dimensions of the groove (9) and fittable into the groove (9), said folds (10) extending longitudinally and inwards relative to the gripping part (4).

10. The handpiece (1) according to claim 5, **characterized** in that the receiving element in the frame (3) is an incision (11) having a diameter smaller than that of the frame (3) and having dimensions substantially corresponding to those of the gripping part (4), the gripping part (4) being fit-
table into said incision (11).

11. The handpiece (1) according to any one of the preceding claims, **characterized** in that the gripping part (4) is made
of silicone, and that the wall thickness of the gripping part (4) is substantially less than 1.5 mm, preferably less than 1 mm.

12. The handpiece (1) according to any one of the preceding claims, **characterized** in that the wall thickness of the gripping part (4) has been fitted to vary so that the wall has thicker portions in a given area.

13. The handpiece (1) according to any one of the preceding claims, **characterized** in that the wall thickness of the gripping part (4) has been fitted to vary so that a given area of the wall has lightenings (12), such as pits or through holes.

14. The handpiece (1) according to any one of the preceding claims, **characterized** in that the wall of the gripping part (4) has an at least partly a net-like structure.

15. The handpiece (1) according to any one of the preceding claims, **characterized** in that the dimensions and shape of the gripping part (4) have been fitted to correspond to the dimensions and shape of the frame (3) of the handpiece in the area of the frame (3) at which the gripping part (4) has been arranged to be fitted.

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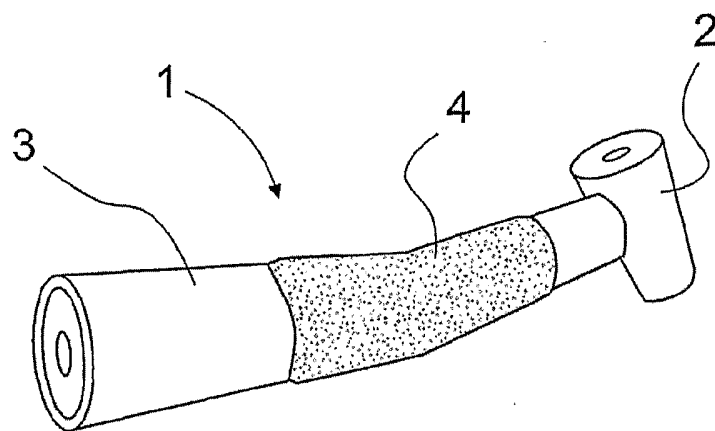


Fig. 1

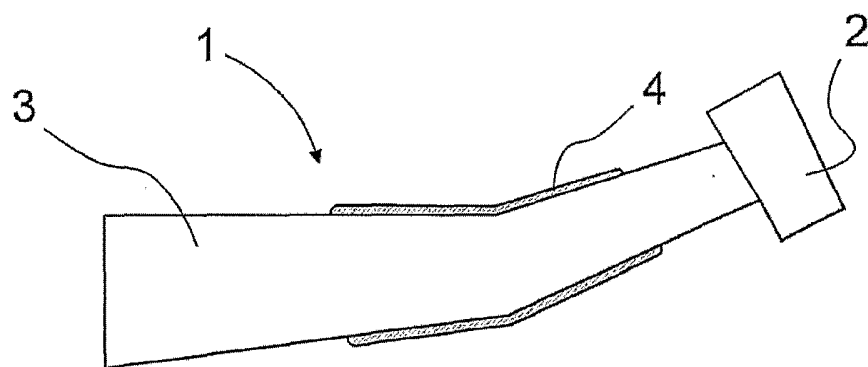


Fig. 2

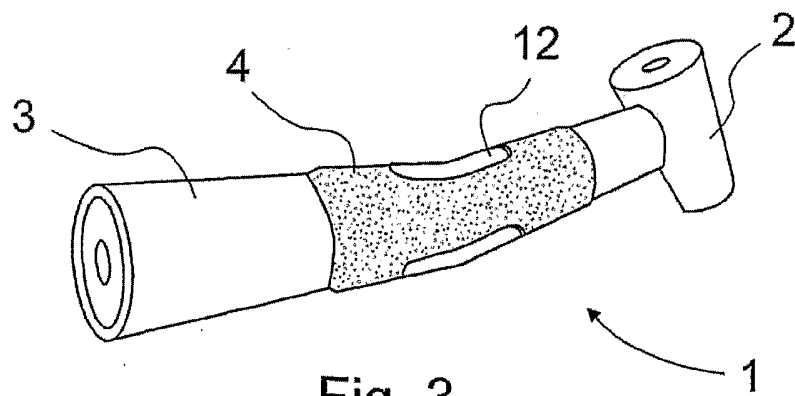


Fig. 3

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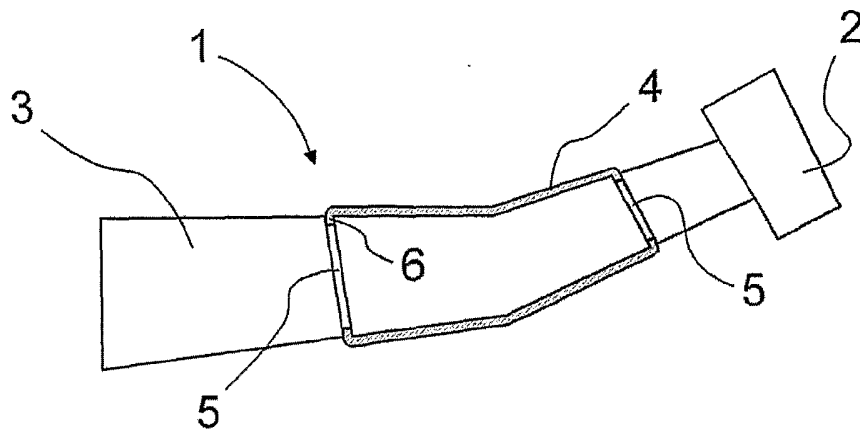


Fig. 4

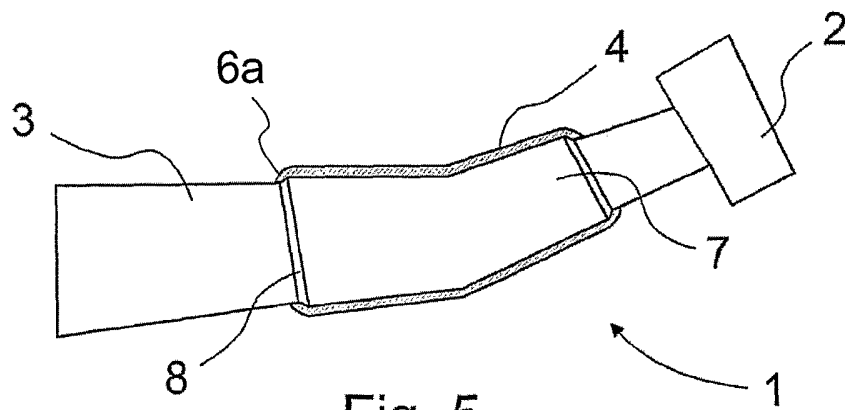


Fig. 5

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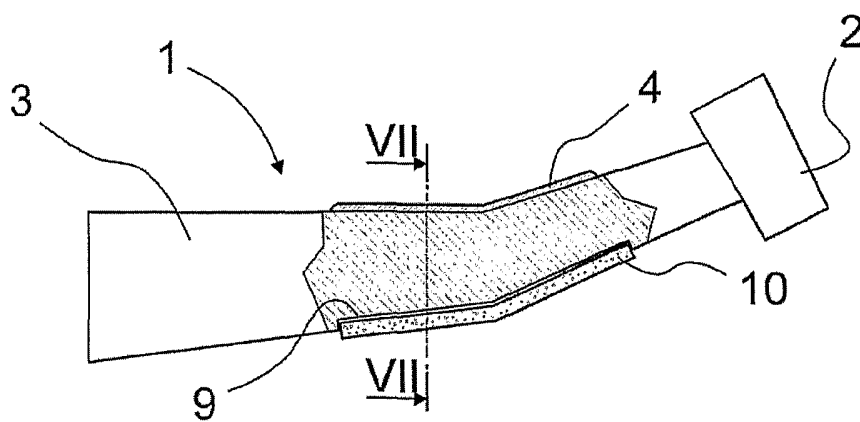


Fig. 6

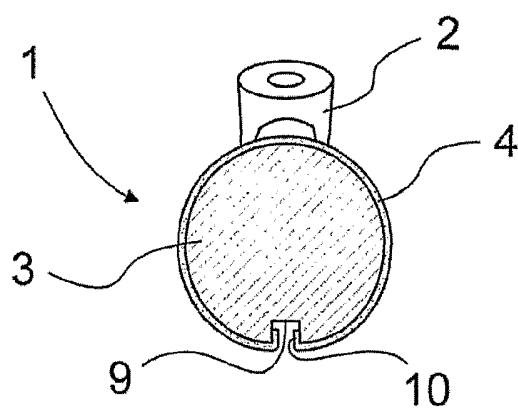


Fig. 7

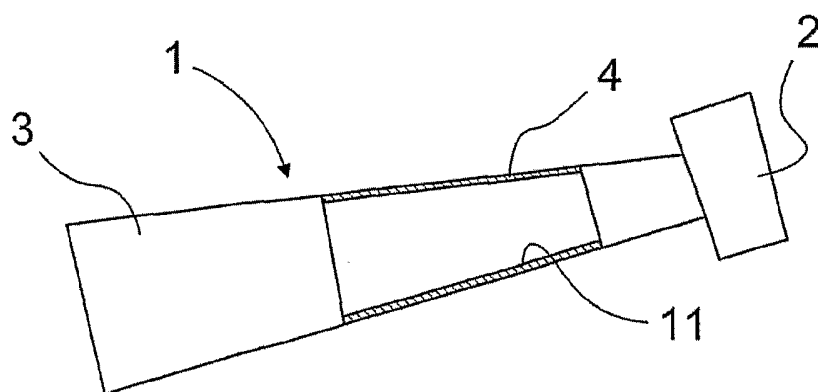


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2006/050132

A. CLASSIFICATION OF SUBJECT MATTER		
See extra sheet		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC8: A61C		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
FI, SE, NO, DK		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EPO-INTERNAL, WPI		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002119422 A1 (BECK MELANIE L et al.) 29 August 2002 (29.08.2002), page 1, paragraphs [0008] to [0011]; pages 2-3, paragraphs [0034] to [0040]; claims	1-15
X	EP 1180350 A1 (HU FRIEDY MFG CO INC) 20 February 2002 (20.02.2002), page 3, paragraphs [0017] to [0019]; page 6, paragraphs [0056] to [0057], claims 7 and 8, Fig. 8 and 9	1-15
X	WO 03011163 A2 (COLTENE WHALEDENT INC et al.) 13 February 2003 (13.02.2003), page 5, lines 9-16; claims 1-14	1-15
X	WO 2005002458 A2 (DISCUS DENTAL IMPRESSIONS INC) 13 January 2005 (13.01.2005), page 5, lines 22-27; page 6, lines 3-9; page 8, lines 33-37; Fig. 6A	1-15
X	US 6305937 B1 (WILLIAMS SHARON L) 23 October 2001 (23.10.2001), column 1, lines 59-67; column 2, lines 48-52; column 3, lines 54-64; claim 1	3, 5-15
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
22 June 2006 (22.06.2006)		26 July 2006 (26.07.2006)
Name and mailing address of the ISA/FI National Board of Patents and Registration of Finland P.O. Box 1160, FI-00101 HELSINKI, Finland Facsimile No. +358 9 6939 5328		Authorized officer Arja Leikas Telephone No. +358 9 6939 500

INTERNATIONAL SEARCH REPORT

International application No.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2001031443 A1 (FERRANTI MARANN) 18 October 2001 (18.10.2001), page 1, paragraphs [0012] to [0013]; page 2, [0025] to [0026]; claims	2, 3, 5-15
X, P	WO 2006034042 A2 (ORMCO CORP et al.) 30 March 2006 (30.03.2006), page 6, lines 11-26; page 9, lines 23-25; Fig. 2	1, 3, 10, 12, 15

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2006/050132

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
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CLASSIFICATION OF SUBJECT MATTER

Int.Cl.

A61C 1/00 (2006.01)**A61C 3/00** (2006.01)**A61C 17/00** (2006.01)