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(54) Medical device belt or strap

(57) A belt (12) or strap (20) for use with medical devices such as patient supports, hoists, harnesses, slings, transfer sheets and so on has a core (22) of fibrous material provided as a webbing and a coating of biocompatible sealant material, preferably thermoplastic polyurethane, covering the fibrous core. The ends of the strap (20) are sealed with a sealing strip (32) preferably of the same material as the coating (24), which is pressed onto the exposed ends and heat sealed to the coating layers (24). The end strips (32) ensure complete sealing of the strap (20) and yet retain the thickness and flexibility of the strap.

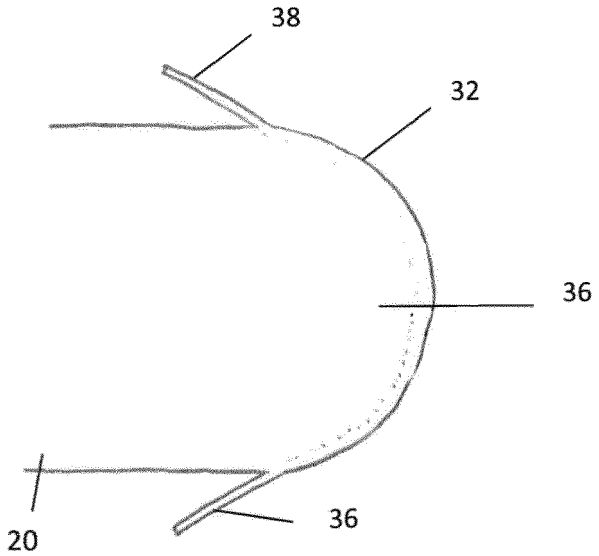

Fig. 11

EP 2 649 974 A1

Description

[0001] The present invention relates to a medical device belt or strap for use with medical devices such as patient supports, hoists, harnesses, slings, transfer sheets and so on.

[0002] As a result of risks of cross-contamination for staff and patients particularly in hospital and other clinical environments, it is important to be able to cleanse equipment which may be used from one patient to another. For this purpose, most equipment and materials which are to be reused are designed to be washable and/or able to be wiped clean with disinfectant. While this is effective for much equipment used in hospital environments, difficulties arise with belts and straps. For instance, with harnesses, patient supports and so on, the belts of these devices must be strong, flexible and pliable in order to be able to conform to shape, to be easily passed through and locked by a buckle or ladderlock, to be comfortable to the patient, It also important for such belts and straps to be strong enough to support a patient's weight. The preferred belts and straps for such devices are made from webbing, typically of a fibrous polymer material or in some instances a natural material, A webbing or textile belt can provide the required strength, flexibility and conformability. However, straps of this nature inevitably include an array of interstices able to hold bacteria, viruses and other particles which cannot easily be cleaned by wiping, for instance. Thus, in order for such belts and straps to be cleaned effectively, it is necessary to subject them to more laborious cleaning processes. These may not be appropriate when the device needs to be frequency reused. More particularly, such belts and straps should be biocompatible, able to resist normal chemicals used for disinfection, (such as chlorine, alcohol and disinfection products), as well as to satisfy environmental demands.

[0003] Coating a belt or strap with a sealing layer has not been considered to be effective and is not practiced in the industry for a variety of reasons, including for example desire not to lose flexibility and softness to the belt or strap, desire not to lose structural integrity of the belt or strap over time as a result of usage, and difficulties with being able properly to seal the webbing of the belt or strap. With respect to sealing, particular difficulties arise with the ends of the belt or strap, with buckle holes and other fixing points.

[0004] The present invention seeks to provide an improved strap for use with medical devices.

[0005] According to an aspect of the present invention, there is provided a method of making a strap including the steps of:

> providing an elongate structural element of webbing material and having first and second sides, at least first and second ends and being substantival flat; and forming over the first and second sides a coating of material so as to cover the elongate structural element, said coating being integral with the structural element and providing a substantially smooth surface to the strap.

[0006] Preferably, the coating is of biocompatible material and extends into interstices in the webbing of the structural element.

[0007] The combination of a coating and a structural element formed of webbing can provide a pliable strap which can be readily disinfected by wiping, not possible with existing straps. The integral nature of the coating ensures that the strap functions in unitary manner with minimal risk of detachment of the coating layers.

[0008] In the preferred embodiment, the coating is applied by extrusion onto the webbed structural support. It has been found that extrusion of a coating to the webbed structural element ensures that the coating becomes unitary with the structural element and is best able to withstand the stresses imposed on the strap during use. Extrusion will generally promote the passage of coating material into the interstices of the webbing and thus an improved bond. It is not excluded, however, that in some embodiments the coating could be applied by other methods, such as spraying or dip coating.

[0009] Advantageously, the method includes the step of bonding to said coating at at least one end of the structural element a strip of sealing material. The production method can lead to areas of the strap not being properly coated with the sealing material. This may occur, for instance, as a result of cutting of the structural element to the required length, shaping one or more ends of the strap, cutting of buckle pin holes and so on. Sealing these parts is not straightforward, for instance it has been found not effective to hot melt the coating to seek to cause this to flow over and thus seal any open section of the structural element. Similarly, spraying coating material onto these parts of the structural element has not been found effective, either in providing a reliable coating or in maintaining the performance characteristics of the structural element, such as thickness, flexibility and so on. By contrast, applying a strip of material over the exposed parts of the structural element and bonding this to the extruded coating has been found particularly effective.

[0010] The strip may be bonded by heat melting, adhesive bonding, pressure bonding or other method. It has been found that welding, particularly high frequency welding, is optimal.

[0011] Advantageously, the structural element is a webbing of fibrous material. It has been found that the combination of webbing and extruded coating maintains the flexibility, softness and strength of the strap, particularly compared to uncoated straps, yet has the advantage of being sealed and thus more hygienic.

[0012] The strap is preferably made of a woven webbing and in the preferred embodiment of a polymer material. However, given the quality of the sealing able to be achieved by the coating and strip taught herein, it is also possible to have a structural element formed of a

natural material such as cotton or linen. It is thus possible, where desired, to use a structural element with particular advantages in terms of flexibility, strength and dimensions irrespective of the ease of disinfection of the material of the structural element given the fact that it is properly sealed.

[0013] In the preferred embodiment, sealing strip is applied to all exposed areas of the structural element after extrusion of the coating, in particular all of the ends of the structural element. Sealing strip may also be applied around buckle holes formed subsequently to extrusion of the coating.

[0014] The method also allows long lengths of coated strap to be produced and then cut to size and number as required for the particular devices to which the strap is to be fitted.

[0015] Advantageously, the coating material is a thermoplastic polyurethane. The strip is preferably also of thermoplastic polyurethane. The strip may be a contiguous element or may be multi- stranded such as a thin strip.

[0016] According to another aspect of the present invention, there is provided a strap for a medical device, including an elongate structural element of webbing material having first and second sides, at least first and second ends and being substantially flat; and a coating of biocompatible material covering the elongate structural element; said coating being integral with the structural element and providing a substantially smooth surface to the strap.

[0017] Preferably, the coating is an extruded coating.

[0018] Advantageously, there is provided at least one strip of biocompatible sealing material over at least one end of the structural element and bonded to the coating.

[0019] The at least one strip is preferably bonded also to the structural element.

[0020] Advantageously, the structural element is a webbing of fibrous material.

[0021] The strap is preferably made of a woven webbing and in the preferred embodiment of a polymer material. In other embodiments, the structural element is formed of a natural material such as cotton or linen.

[0022] Sealing strip is advantageously applied to all areas of the structural element not covered by the coating. Sealing strip may also be applied around buckle holes. In another embodiment, a sealing ring of the same or a bondable material to the coating is applied around buckle pin holes.

[0023] The coating material is preferably a thermoplastic polyurethane, as is the strip. The strip may be a contiguous element or may be multi-stranded such as a thin strip.

[0024] According to another aspect of the present invention, there is provided a medical device including a strap as taught herein.

[0025] The medical device may be a harness, patient support, hoist, sling, transfer sheet, bodice and so on.

[0026] Embodiments of the present invention are described below, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic diagram of a part of a patient lift using a belt which may be of the type taught herein:

Figure 2 is the photograph of a support belt of the type taught herein:

Figures 3 to 8 show stents in the manufacture of a belt or strap as taught herein; and

Figures 9 to 12 show schematically various steps in the application of an end seal to an end of a strap.

[0027] Referring first to Figure 1, there is shown a photograph of a part of a patient support 10 used for moving the patient to and from medical facilities, in this case a patient bed. The patient lift 10 includes a belt or strap 12 which is used to hold a patient to the lifting mechanism so as to transport the patient. An example of belt 12 is shown in Figure 2, being formed of an elongate strap coupled to a buckle and having length adjustment features so as to adjust the length of the belt 12 around the patient.

[0028] Belts or straps of this nature are used in a variety of different hospital applications including, but not limited to patient supports, harnesses, slings, transfer sheets, bodices and so on. As explained above, these belts or straps 12 must be cleaned between uses in order to prevent cross-contamination from one patient to another and/or to hospital staff. As will apparent in particular from Figures 1 and 2, the belt or strap 12 must be flexible and soft in order to be able to conform to the shape of the patient, to the fixings of the medical device and also to be comfortable. In addition, as such belts or straps 12 often have to support heavy weights or other loads, they must be very strong, in particular to be able to support the weight of a heavy patient. It is considered that belts or straps made of a webbing of fibrous material are the most effective, particularly woven webbings. This enables the use of materials of very high tensile strength, which are also able to be curved and folded with ease. However, as also described above, belts or straps made of such webbing leave many interstrecs which can harbour bacteria, viruses and other germs. As taught herein, the structural element of the belt 12, which is preferably a webbing, is coated with a biocompatible sealant thereby to seal the webbing and enable the belt or strap to be disinfected simply by wiping with a disinfecting agent, which is not possible with uncoated straps of this type.

[0029] Referring now to Figures 3 to 5, there are shown different stages in the production of a coated belt or strap 20.

[0030] The strap 20 has a fibrous core 22 arranged as a webbing, particularly woven webbing and preferably of polymer material. This core 22 provides strength and flexibility to the strap 20. Extruded over the core or support element 22 is a coating 24 of a biocompatible sealing material. This coating 24 is extruded to both sides of the core 22, that is of the strap 20. Extrusion of the coating

24, it has been found, ensures a reliable and effective bond of the coating layer 24 to the core 22, in such a manner that the assembly of core 22 and coating layer 24 becomes unitary and does not separate during use. It will be appreciated that extrusion could be accompanied with pressurisation of the material forming the coating layer 24 into the core 22, such that coating material will pass into the interstices of the fibrous material of the webbing, thereby to enhance the bonding of the two components to one another and the integrity of the eventual structure.

[0031] The extrusion process preferably also applies a coating material to the side edges 26 along the length of the strengthening core 22.

[0032] In the preferred method, the extrusion process produces very long lengths of coated webbing 22 which are then cut to shorter lengths appropriate to make the belts 12 shown in Figures 1 and 2. Furthermore, after formation of the coated strap 20, there may be formed one or more apertures 28 for receiving a buckle pin of a buckle provided on the belt, in cases where this is the chosen latching mechanism.

[0033] As will be apparent in particular from Figures 3 and 4, the cutting and shaping of the ends 30 of the strap 20 and buckle pin holes 28 expose the fibrous core 22 of the strap 20, leaving unprotected areas of core 22. These exposed areas are in the preferred embodiment subsequently covered by strips 32 of sealing material, one of which is shown in Figure 5 covering the rounded end of the strap 20. The strips 32 of sealing material are preferably made of the same material as the coating layers 24.

[0034] It is preferred that the material of the coating layers 24 and the sealing strip 32 are made from a thermoplastic polymer material, most preferably thermoplastic polyurethane, which is biocompatible, provides good sealing characteristics, is able to resist chemicals typically used for disinfection and is relatively environmentally friendly. Polyurethane is able to resist alcohol, chlorine as well as the disinfection products supplied by the Applicant. Moreover, thermoplastic polyurethane is a very flexible material, particularly when applied as a coating as taught herein, which thus does not adversely affect the flexibility or other functional characteristics of the belt or strap 12,20.

[0035] The coating 24 and strip 32 provide a substantival smooth outer surface to the belt or strap 12, 20, thus enacting it to be cleaned simply by wiping with disinfectant agent, thereby facilitating the cleansing of medical devices for reuse.

[0036] Referring now to Figures 6 to 8, there are shown different features of various embodiments of belt or strap incorporating the teachings herein.

[0037] With reference to Figure 6, there is shown an end 40 of a strap 42, the end being folded over itself so as to seal the extremity of the strap and provide a solid grip, for instance for assisting in tightening a belt of the type in Figure 2. The use of a thermoplastic polymer as a coating to the strap 42 means that the end 40 can be formed and sealed by a heating process, for example by high frequency welding. It is not necessary to use bonding agents such as adhesives, staples, sutures or the like. Strong bonds created by extrusion of the coating over the core also ensures a solid and reliable structure.

[0038] With reference to Figure 7, there is shown an eyelet 50 within a strap 52. The eyelet 50 would cover a hole of the type shown at 28 in Figure 3. In this instance, the eyelet 50 is preferably made of a double-flanged ring which extends over both sides of the opening, and is preferably made of the same or a compatible material to the coating 24 in order for these two materials to be able to be welded together, advantageously by heat welding. In other embodiments, the exposed core on the inner surface of the hole 28 may be covered with a strip of sealing material similar to the strip 32 shown in Figure 5 and applied in a similar process, as described in further detail below.

[0039] With reference now to Figure 8, there is shown a portion of a belt 60, one end of which is looped through a buckle 62 and then secured in place. More particularly, the end 64 of the strap is sealed to the strap 67 as shown in Figure 8, again by a heat welding processes taking advantage of the thermoplastic characteristics of the coating material. As with Figure 6, it is not necessary to use any other tying mechanism such as adhesives, staples, sutures or the like.

[0040] Referring now to Figures 9 to 12, there is shown an embodiment of method of sealing the exposed zones of the end of a strap. With reference to Figure 9 first, there is shown in better detail one end of a strap 20 to which there has been extruded a coating 24 over the top and bottom sides of the core 22. The end of the strap 20 has been cut to a rounded shape, thereby leaving exposed the core as shown in Figure 9, in particular in the perspective and end views thereof.

[0041] With reference now to Figure 10, a strip 32 of thermoplastic polymer, preferably, is positioned over the end 36 of the strap 20. The strip 32 has a width which is preferably no greater than or only slightly greater than the thickness of the strap 20 with the coating layers 24 applied thereto, shown as thickness T in the end view of Figure 9. This ensures that there is no excess material which would add bulk and rigidity to the end 36 of the strap 20.

[0042] As can be seen in Figure 11, the strip 32 is pressed onto the end 36 (the latter preferably being supported within a suitable support structure to prevent bending or buckling) and then bonded to the end 36, preferably by a heat melt process such as high frequency melting. The strip 32, which in the preferred embodiment is made of the same material as the coating 24, but which in other embodiments can be made of any other compatible material, will melt under the applied heat so as to bond to the coating 24, particularly when pressure is applied to the junction between the strip 32 and coating layers 24. Further pressure may be applied directly by

pushing with a suitable tool onto the outside of the strip 32 towards the coating layers 24 and smoothing the interface between these two components. Thus, the strip 32 will bond to and become integral with the coating layers 24 and preferably also will bond to the core 22.

[0043] As will be apparent from Figure 11, it is preferred that the strip 32 is longer than the length of exposed region of core 22, which will ensure complete sealing of the exposed end of the core 22, in which case there will typically left lengths 38 of strip 36. These ends 38 can be cut and the remaining portions smoothed to leave a fully sealed and smooth surface end 36 to the strap 20, as shown in Figures 12 and 5.

[0044] The strip 32 thus ensures a full and reliable seal of the strap 20 whilst retaining a smooth and uniform outer surface as well as the flexibility of the strap. There is no excess material.

[0045] Thus, it is possible to produce a fully sealed strap which is able to be disinfected readily by wiping/spraying without the need to use separate disinfection equipment such as washing machines, flusher disinfectors and the like.

[0046] It will be apparent also that the coating 24 and strip 32 is of a material impervious to liquids, material, dirt, soil and the like. Furthermore, the strap remains soft, thin and with ends which are flexible. Moreover, it is possible to shape the end or ends of the strap as desired without requiring any significant changes to the manufacturing process or loss of hygiene.

[0047] It will be appreciated that Figures 3 to 5 and 9 to 12 show a single sealing strip at one end of the strap. Of course sealing strips could be provided at both ends the strap; while in the case of a strap with multiple strap elements sealing strips could be provided at all of the ends of the strap, as well as to seal any other cut-outs such as buckle pin hole holes and the like.

Claims

1. A method of making a strap including the steps of:

   providing an elongate structural element of webbing material, having first and second sides, at least first and second ends and being substantially flat; and
   forming over the first and second sides a coating of material so as to cover the elongate structural element, said coating being integral with the structural element and providing a substantially smooth surface to the strap.

2. A method according to claim 1, wherein the coating extends into interstices in the webbing material of the structural element.

3. A method according to any preceding claim, including the step of bonding to at least one end of the structural element a strip of biocompatible sealing material.

4. A method according to claim 3, wherein the sealing strip is bonded to the coating material and to the structural element.

5. A method according to any one of claims 3 to 4, wherein the sealing strip is applied to all exposed areas of the structural element after extrusion of the coating.

6. A method according to any one of claims 3 to 5, wherein the sealing strip is of thermoplastic polyurethane.

7. A method according to any preceding claim, wherein the structural element is made of a woven webbing.

8. A method according to any preceding claim, wherein the structural element is made from a polymer material.

9. A method according to any preceding claim, wherein the coating material is a biocompatible material.

10. A strap for a medical device, including an elongate structural element of webbing material and having first and second sides, at least first and second ends and being substantially flat; and a coating of material covering the elongate structural element; said coating being integral with the structural element and providing a substantially smooth surface to the strap.

11. A strap according to claim 10, wherein the coating is of a biocompatible material.

12. A strap according to claim 10 or 11, including at least one strip of biocompatible sealing material over at least one end of the structural element and bonded to the coating.

13. A strap according to claim 12, wherein the at least one strip is bonded also to the structural element.

14. A strap according to claim 12 or 13, wherein the sealing strip is applied to all areas of the structural element not covered by the coating.

15. A strap according to any one of claims 10 to 14, wherein the structural element is made of a woven webbing.

16. A strap according to any one of claims 10 to 15, wherein the structural element is made of a polymer material.

17. A strap according to any one of claims 10 to 16,

wherein the coating is of a biocompatible material.

Fig. 1

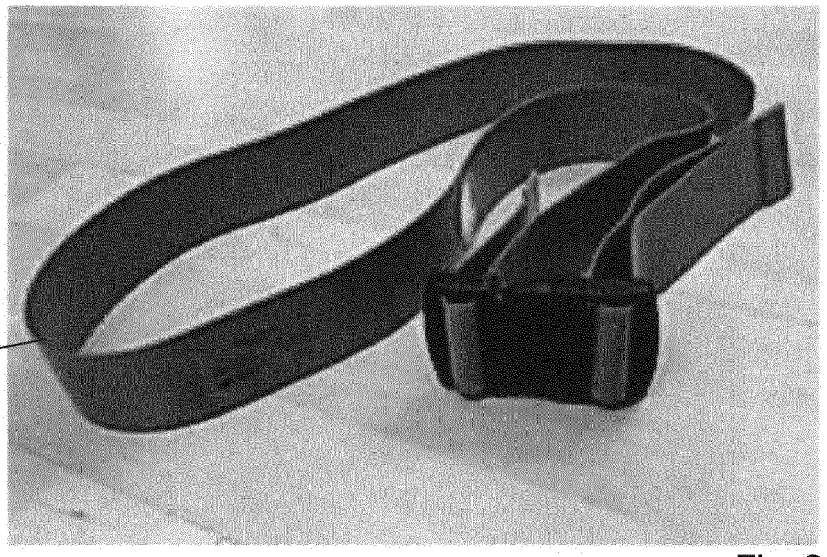

Fig. 2

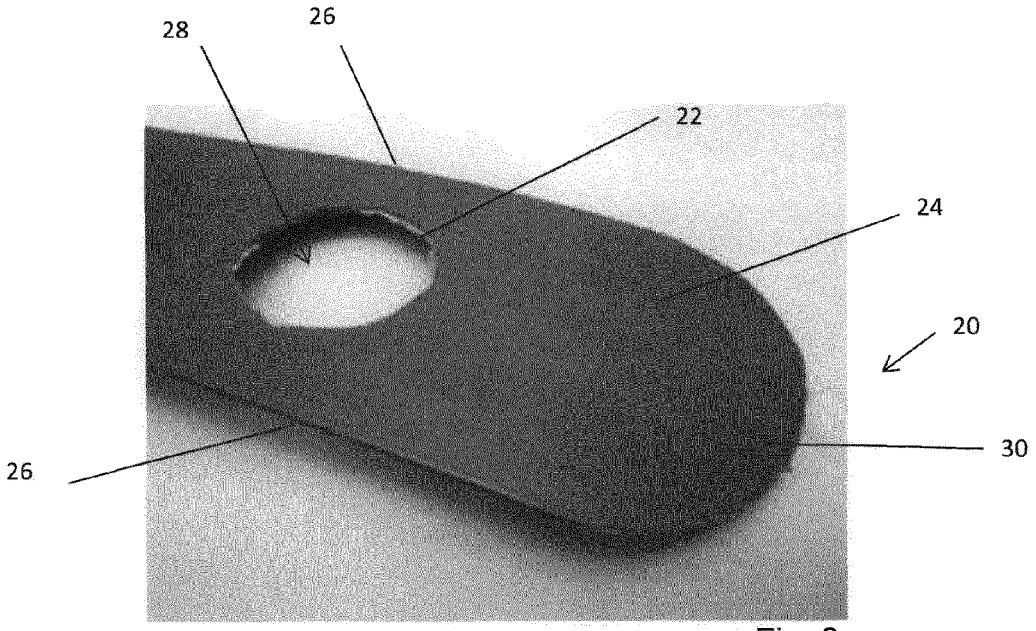

Fig. 3

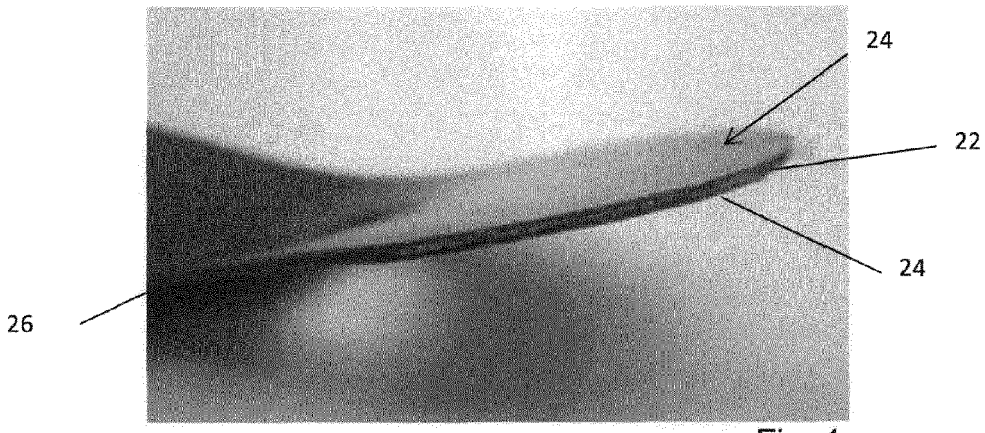

Fig. 4

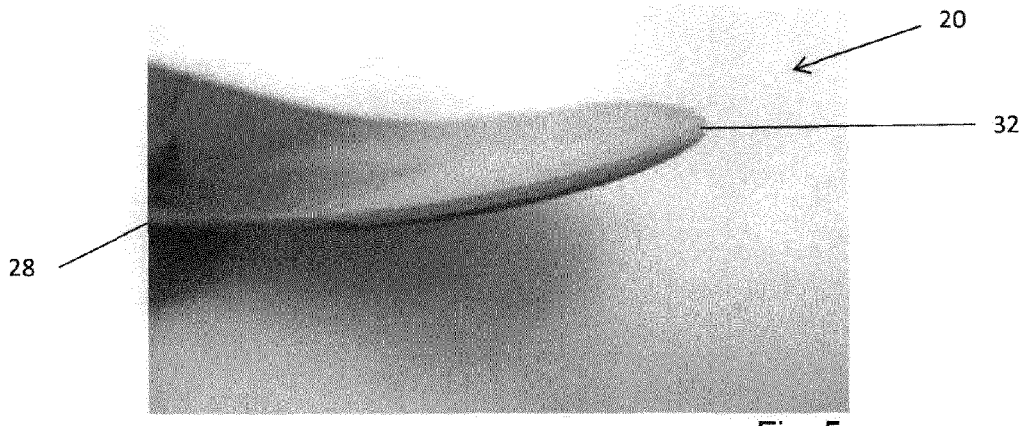

Fig. 5

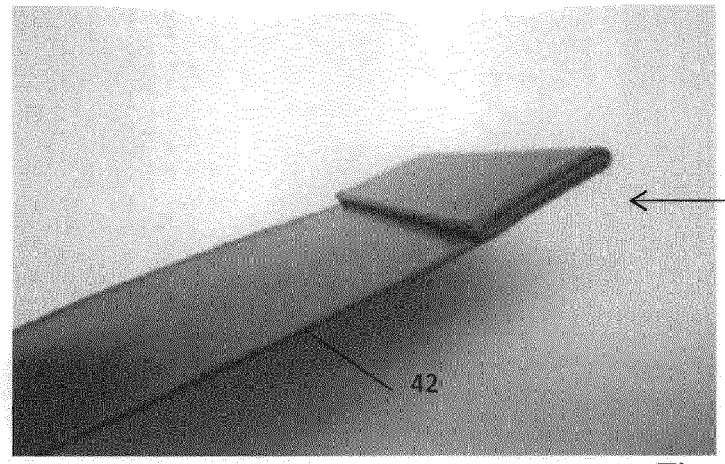

Fig. 6

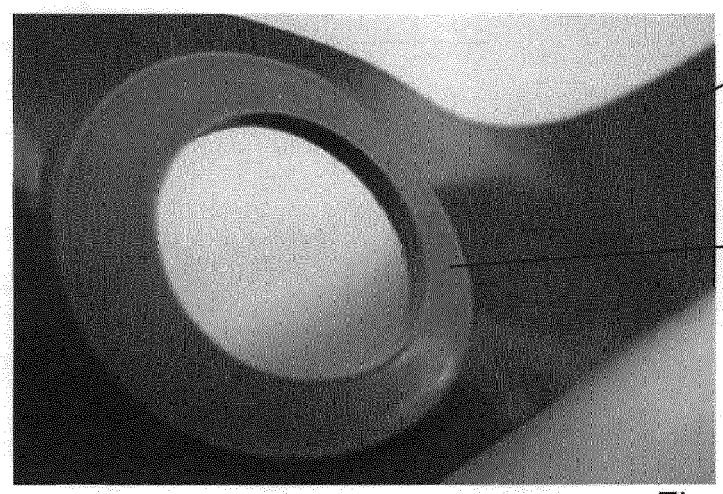

Fig. 7

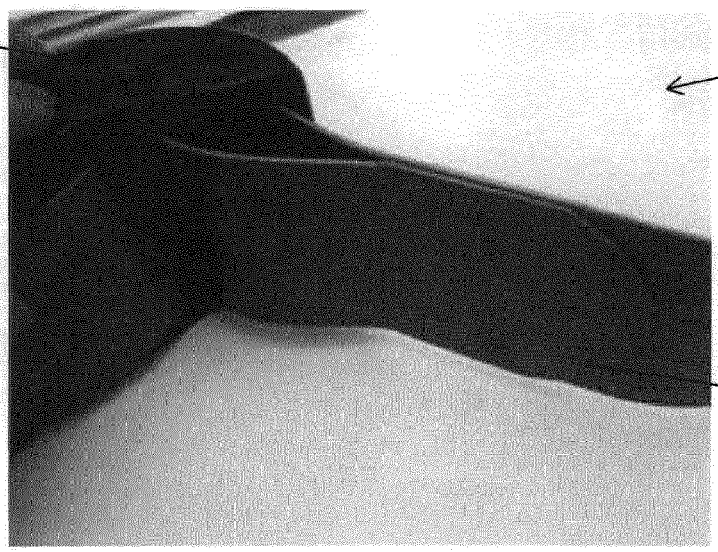

Fig. 8

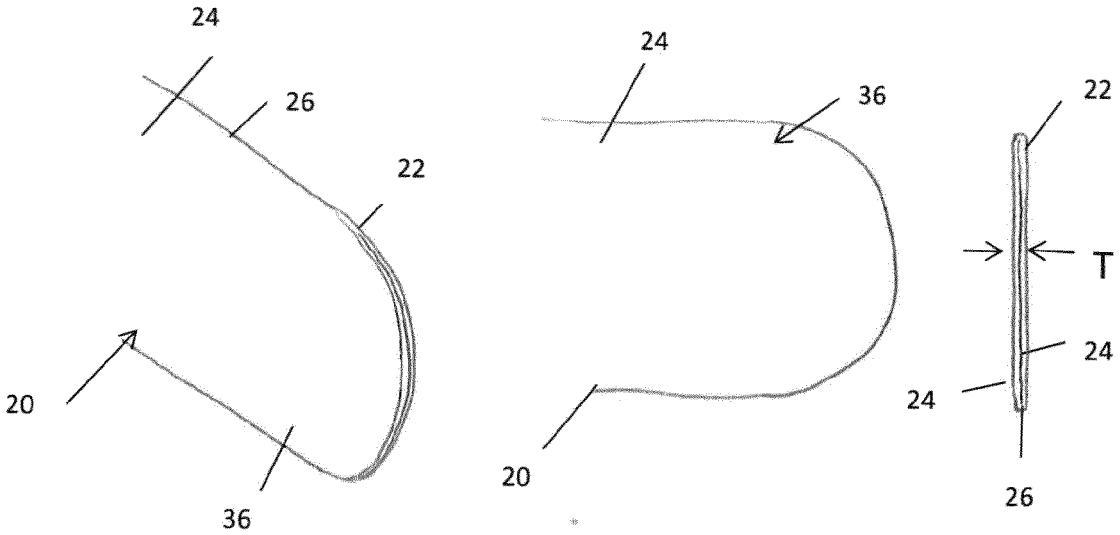

Fig. 9

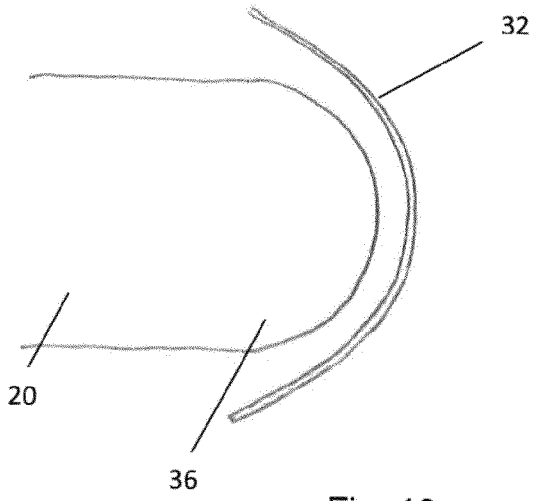

Fig. 10

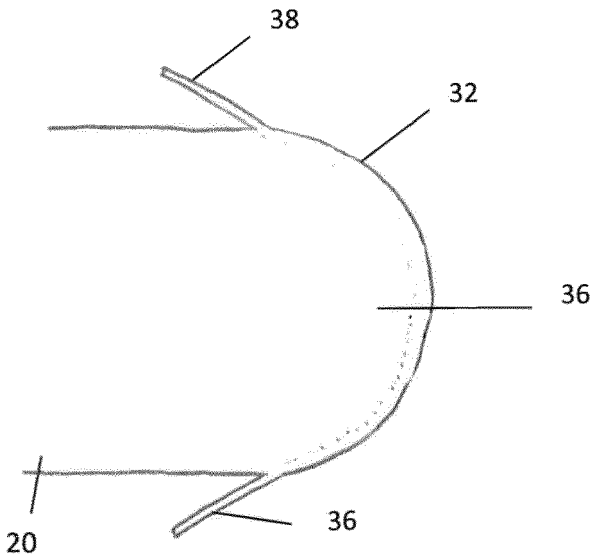

Fig. 11

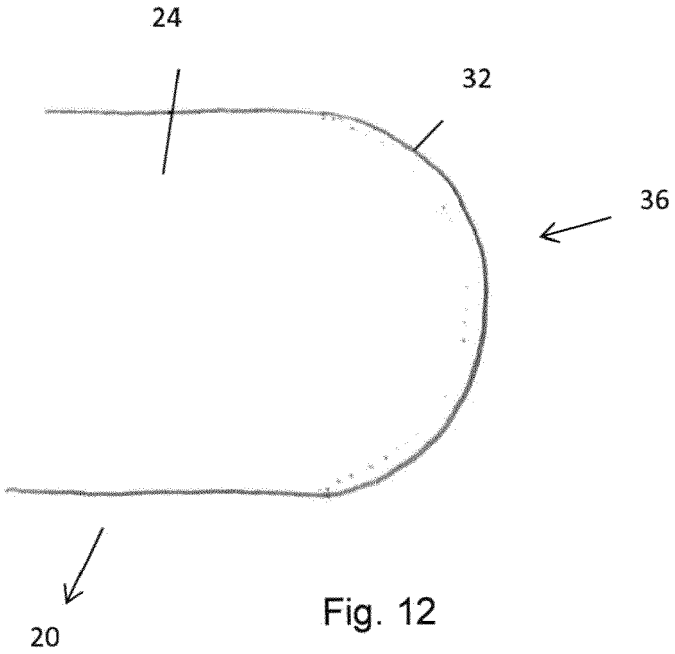

Fig. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 12 16 3939

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	EP 2 436 355 A1 (KRISTENSEN STEEN [DK]; JOERGENSEN GITTE JANEKE [DK]) 4 April 2012 (2012-04-04) * paragraph [0024]; figure 3 *	1,2, 9-11,16, 17	
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A	US 5 121 756 A (KOLEDIN MICHAEL J [US]) 16 June 1992 (1992-06-16) * column 5, lines 25-32; figures 1-4 *	1,2, 7-11, 15-17	TECHNICAL FIELDS SEARCHED (IPC) A61G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 September 2012	Gkama, Alexandra

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
L : document cited for other reasons

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2

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 16 3939

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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21-09-2012

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82