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(54) **A fluid-tight slide fastener**

(57) A fluid-tight slide fastener (1) comprising coated tapes (2) carrying respective rows of teeth (3), top and bottom stops (4, 5) and a slider (6), wherein the tapes (2) comprises a knurled region (10) in correspondence of the portion of tapes (2) where said teeth (3) are fixed to the same tapes (2).

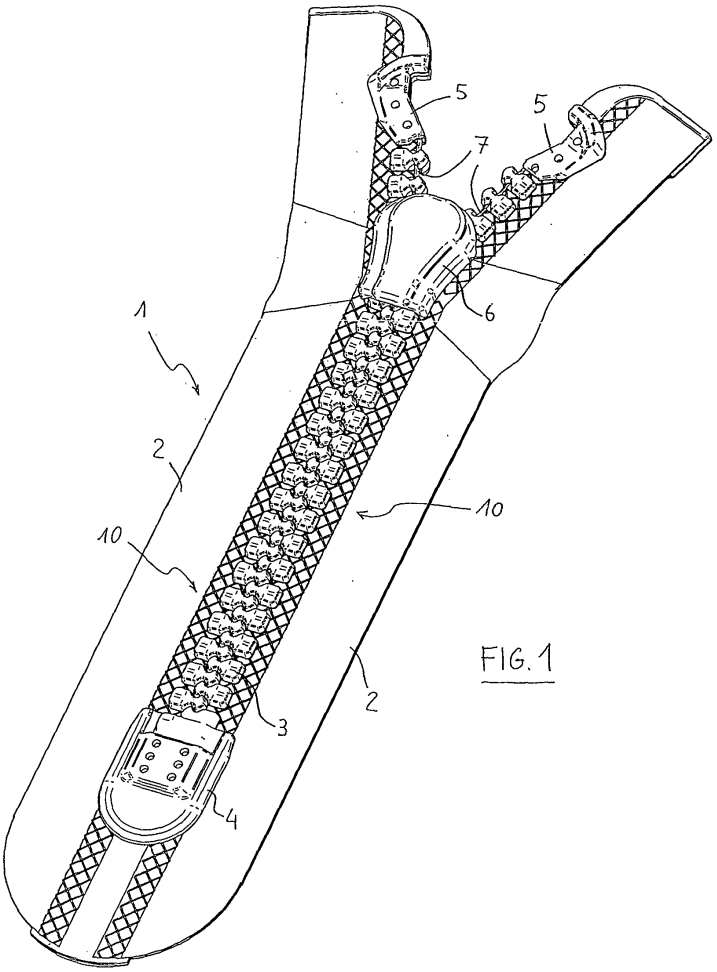

FIG. 1

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Description

Field of application

[0001] The present invention refers to a fluid-tight slide fastener and to a process for manufacturing a fluid-tight slide fastener.

Prior Art

[0002] A slide fastener, in essential terms, comprises a pair of tapes bearing respective rows of teeth, top and bottom stops, and a slider for opening and closing the fastener by engaging and disengaging the teeth.

[0003] Fluid-tight slide fasteners are needed for a number of applications, such as provision of sports and outdoor activity items, diving or sailing suits, camping tents and the like. Said fasteners are required to be resistant to passage of a liquid and/or gas, e.g. water and/or air even under a significant pressure difference between the interior and the exterior, for example up to about 2 bars; at the same time, they must be tenacious and pliable.

[0004] According to known art, fluid-tight slide fasteners are realized with layered tapes made of a textile core layer coated with a suitable fluid-barrier layer, and teeth which are applied to the layered tapes or injection-molded. With regard to materials, it is known to realize fluid-tight slide fasteners with textile tapes coated with a thermoplastic elastomer material (TPE) and teeth made of a thermoplastic material.

[0005] The region of the slide fastener wherein teeth are fixed to the coated tapes is known to be a critical point of a fluid-tight slide fastener. The coupling between each tooth and the tapes, in fact, must be fluid-tight and must also withstand the mechanical stress due to opening and closing action of the slider, bending of the tapes, handling and direct exposure to environment.

[0006] Furthermore, the layered tapes may suffer a separation of the layers due to intensive use and/or lack of adhesion between the layers. Due to said separation, also known as delamination, the textile core may be exposed and in such a case the fluid-tight performance is generally compromised.

Summary of the invention

[0007] The technical problem underlying the invention is to improve the fluid-tight performance and reliability of a fluid-tight slide fastener as defined above, with particular regard to the coupling between the teeth and the coated tapes.

[0008] This problem is solved by providing a knurled or embossed region on at least one side of the tapes of the slide fastener. More in detail, the problem is solved by a fluid-tight slide fastener comprising a pair of tapes, each of said tape comprising a textile core layer and a fluid barrier layer coating said textile layer, and having at least a portion carrying a row of teeth along an inner edge, **characterized in that** each of said tapes comprises a knurled region on at least one side, said knurled region being extended along said inner edge of tape and at least on said portion of the tape carrying said row of teeth.

[0009] According to one aspect of the invention, said knurled (or embossed) region is formed as a continuous longitudinal stripe parallel to said inner edge.

[0010] According to another aspect of the invention, said knurled region has a width which is greater than width of root portions of said teeth. As the root portions of the teeth are portions which are fixed with to the tape, the coupling region between the teeth and the tape is fully comprised in said knurled region of tape. In a preferred embodiment, the width of the knurled region of tape is about 1.5 - 2 times the width of root portions of teeth.

[0011] According to embodiments of invention, said knurled region is provided on one side of the tapes, preferably the front side facing the exterior, or the same knurled region is provided on both front and rear sides of tapes.

[0012] The knurled region can be obtained directly during the manufacturing of the coated tapes, for example directly after the coating of the textile core layer with the fluid-barrier layer. In an equivalent manner, the knurled region may be obtained with a subsequent process step operated on a semi-finished product such as a strip of textile material coated with said fluid-barrier layer.

[0013] According to a preferred embodiment, tapes of the slide fastener are manufactured by extrusion or lamination of a selected fluid-barrier material, preferably in a melted state, onto strips of textile material. A knurling process step is performed on the coated strips, obtaining said knurled region on one or both sides of the tapes. Teeth are then fixed and made integral to said knurled region of the tapes, for example by injection molding.

[0014] A process according to the invention for making a tape for a slide fastener comprises at least the steps of:

- coating a textile strip with a fluid-barrier material;
- subjecting the coated strip to a knurling process, obtained a knurled region on at least one side of said strip and near an edge thereof;
- fixing a row of teeth to said knurled region of the strip;
- cutting the strip to obtain a tape of a given length.

[0015] The textile material of the core layer of tapes is chosen preferably among polyester (PE), preferably polyethylene terephtalate (PET), polyamide (PA) and their blends or copolymers.

[0016] According to another aspect of the invention, the textile material is a spun yarn of cut fibers, having an irregular surface similar to a natural fiber which tends to

remain embedded in the fluid-barrier layer, enhancing the resistance to delamination. The fluid-barrier material is preferably provided on the textile core layer in a melted state, for example extruded or laminated.

[0017] Hence, the process as disclosed above preferably provides use of a textile strip of a spun yarn of cut fibers, said fibers being obtained with a cutting process of continuous fibers. More preferably, the strip of textile material is coated by extrusion or lamination of melted fluid-barrier material so that surface irregularities of the spun yarn remain embedded in the fluid-barrier layer.

[0018] The fluid-barrier layer is preferably made of a thermoplastic elastomer polyurethane (TPE-U) or a thermoplastic elastomer polyester (TPE-E). For example, said TPE-E is a polyether-ester block copolymer and said TPE-U is a block copolymer obtained from an ether and/or an ester and a isocyanate.

[0019] Teeth of the slide fastener are made, according to some embodiments, of a thermoplastic material consisting of a blend including PBT and polycarbonate (PC). Preferably, the PBT/PC weight ratio in said blend ranges between 70/30 and 30/70. According to other embodiments, the teeth are made of a blend including ABS and a polyamide (PA). More preferably, the ABS/PA weight ratio in said blend ranges between 70/30 and 30/70.

[0020] According to a more preferred embodiment, a fluid barrier layer of TPE-E is chosen in combination with teeth made of PBT. According to another embodiment, a fluid barrier layer of TPE-U is chosen in combination with teeth made of either a blend of ABS and PA or a blend of PBT and PC.

[0021] The fluid barrier layer and the teeth may include suitable additives such as, for instance fillers, pigments, binders and/or compatibilizers, the latter being incorporated to improve the physical and chemical affinity between said materials and/or between the materials used for the layered structure of the tape.

[0022] The tapes of the slide fastener may also comprise a further, optional adhesive layer between the textile core and layer and the fluid-barrier coating. Advantageously, the adhesive is selected to have a strong chemical affinity for both the materials to be joined. Preferably, the adhesive comprises a polyurethane resin.

[0023] According to the invention, sports and outdoor activity items, such as a diving suit, a sailing suit, a camping tent and the like, are made comprising a fluid-tight slide fastener as described above.

[0024] Advantages of the invention are the following. The knurled region has a non-smooth surface, with crests alternated to embossed regions according to a direction perpendicular to the surface of the tapes, thus increasing the whole contact surface available to the coupling between the tapes and the teeth. Hence, a stronger bond between each tooth and the tape is obtained.

[0025] Moreover, is has been found that the knurled region has a retaining effect on the teeth, opposing to their movement and/or rotation respective to the tape, and thus increasing the mechanical resistance to bending.

[0026] The fluid-tight performance is also improved by the fact that the knurled region is a further obstacle to the passage of fluids like air and water at the tooth-tape interface. It may be stated that said crests and embossed areas on the surface of the tape act like a labyrinth against the passage of fluids, especially water.

[0027] In practical terms, it has been found that a fluid-tight fastener with knurled tapes as above defined has better fluid-tight performance and resistance to mechanical wear compared to known fasteners. It has also been found that the invention reduces the percentage of defective pieces, compensating for some imperfect adhesion between tapes and certain teeth, which otherwise would have lead to a loss of fluid-tightness.

[0028] The preferred materials, as listed above, give a further advantage in terms of mechanical properties at both interfaces between the layers of the tapes and between the fluid barrier layer and teeth, due to a chemical bonding effect.

[0029] The use of a spun yarn for the textile core layer of the tapes has a further advantage. The spun yars has fibers protruding from the ideal diameter of the yarn itself, which remain embedded in the material of the fluid-barrier layer, giving a further mechanical bond between the layers and enhancing the resistance to delamination.

[0030] Another advantage is that the knurled or embossed region defines a useful reference line for assembling the tapes of the slide fastener on a garment on suit. In fact, the external borderline of the knurled region indicates a limit not to overcome when assembling (e.g. sewing) the slide fastener on the garment.

[0031] Further advantages and characteristics of the slide fasteners according to the inventions will be more evident from the detailed description and examples provided here below, given as indicative and not limiting purpose.

Brief description of the drawings

[0032]

Fig. 1 is a perspective view of a fluid-tight slide fastener according to an embodiment of the present invention.

Fig. 2 is a top view of a portion of a tape of the slide fastener of Fig. 1.

Fig. 3 is a section according to line III-III of Fig. 2.

Fig. 4 is a top view of a portion of a tape of the slide fastener of Fig. 1.

Fig. 5 is a section according to line V-V of Fig. 4.

Fig. 6 is a perspective, enlarged view of a portion of tapes of Fig. 1, in the region where a tooth is coupled

to the tape.

Fig. 7 and 8 are a view of a portion of the tapes of the fastener in Fig. 1, during their manufacturing process.

Fig. 9 is a simplified scheme of a process for realizing tapes for a slide fastener according to the invention.

Detailed description of preferred embodiments

[0033] With reference to figures 1, a fluid-tight slide fastener 1, in accordance with an embodiment of the present invention, comprises a pair of tapes 2, equipped with teeth 3, a bottom stop 4, top stops 5, and a slider 6.

[0034] Tapes 2 have a layered structure made of a textile core layer fully coated on both sides by a suitable fluid-barrier layer.

[0035] Each of tapes 2 is carrying a row of teeth 3. Teeth 3 are associated with a portion of the tapes 2, between bottom stop 4 and top stops 5, along inner edges 7 of said tapes 2. Teeth 3 are associated to tapes 2 in a fluid-tight manner, for example through injection molding.

[0036] Top and bottom stops 4, 5 are also fixed to the tapes 2 in a fluid-tight manner, for example through injection molding. The figures relates, in a non-limiting way, to an embodiment wherein the bottom stop 4 is made in a single piece applied on both tapes at one end of the teeth rows, whereas two top stops 5 are applied the respective tapes 2 at the opposite end of the teeth rows. In other embodiments of the invention, the top stop can be made in a single piece, or the bottom stop can be made in two half-pieces.

[0037] Each tape 2 comprises a knurled surface region 10, formed as a longitudinal stripe extending from said inner edge 7 and having a predetermined width, so that teeth 3 are associated with said knurled region 10 of the tape 2. Knurled region 10 is provided along the entire tape 2 or, at least, on the portion of tape 2 carrying the row of teeth 3.

[0038] Figs. 2 and 3 show more detail of the embodiment herein discussed. Tapes 2 comprise a textile core 20 fully enveloped by a fluid-barrier coating 21. Teeth 3 have a root portion 30, coupled to the respective tape 2, and a head portions 31 projecting from inner edge 7 for reciprocal engagement under the action of slider 6. It may be noted that edges 7 are formed by the coating 21 envelopping the textile core 20.

[0039] The knurled region 10 has a non-smooth surface with a pattern of crests 11 projecting away from embossed surface areas 12, obtained as a permanent deformation of the fluid-barrier coating 21 of tapes 2. Preferably, the crests 11 are arranged according to the pattern of Fig. 2, i.e. straight lines crossing at 90° and inclined by 45° with respect to the rows of teeth 3.

[0040] The width W of knurled region 10 is preferably about 1.5 - 2 times the width of root portions 30 of teeth 3 (Fig. 2).

[0041] As seen in Fig. 3, a knurled region 10 is provided on both sides of tapes 2, namely on front surface 22, intended to face the exterior, and on the opposite rear surface 23. In a garment including the slide fastener 1, for example, front surface 22 is the outer surface exposed to environmental agents, while rear surface 23 is the inner surface. The provision of knurled regions 10 with crests 11 and embossed areas 12 on both surfaces 22 and 23 of the tapes 2, can be further seen in Figs. 4 and 5.

[0042] In other (not shown) embodiments, a knurled region 10 can be provided only on one side of the tapes 2, namely on one of said surfaces 22, 23, preferably on the front surface 22.

[0043] Fig. 6 allows a better appreciation of crests 11 projecting away from areas 12 engraved on the fluid-barrier coating 21 of tapes 2. Fig. 6 also shows a passing hole 13 which is used for molding the teeth 3. Fig. 6 also provides better appreciation of the fact that crests 11 increase the available surface for coupling with the teeth 3, compared to a perfectly smooth tape. In fact, the surface on the plane perpendicular to axis of the hole 13, which would be the only available surface on a smooth tape, is increased by the side surfaces of said crests projecting away from areas 12. A gain in available surface of 10% or more can be achieved.

[0044] Figs. 7 and 8 show a portion of a tape 2 during the manufacturing process. Referring to Fig. 7, a strip 40 is formed by coating a textile, inner core layer with a fluid-barrier layer, enveloping said inner core layer on both sides. Said strip 40 has an edge 7, also covered by said fluid-barrier layer, where teeth are associated to the strip. A knurled, longitudinal region 10, in the form of a stripe having a width W, is formed from said edge 7, by a knurling or embossing process of the strip 40. Said process defines on surface of the region 10 a pattern of crests 11 projecting away from embossed areas 12, wherein the fluid-barrier layer is made thinner.

[0045] Teeth 3 are then associated to the strip 40, for example by injection molding, along said edge 7 (Fig. 8). Teeth 3 are made integral with the knurled, longitudinal region 10 of the strip 40. Strip 40 is then cut transversally to obtain tapes 2 of a desired length, and said tapes 2 are equipped with stops and a slider, such as stops 4, 5 and slider 6, to obtain a fastener zip as seen, for example, in Fig. 1.

[0046] Referring to Fig. 9, a process for obtaining the strip 40 is schematized. A textile, continuous strip 50 is passed through a suitable extruder 51, fed with a fluid-barrier material M in a melted state, obtaining as intermediate product a coated strip 52, wherein the textile strip is enveloped by the fluid-barrier material.

[0047] Then, the coated strip is passed through a couple of rolls 53 and 54, deforming both front and rear surfaces of the coated strip near an edge thereof, obtaining the strip 40 with knurled region 10. Preferably, the rolls 53, 54 are immediately downstream the extruder 51, so that the coating is still hot and easily deformed. It should be noted that the coated tapes 2 can also be made by

lamination.

[0048] The strip 50 can be made of a spun yarn and coated by extrusion or lamination of melted fluid-barrier material, so that the surface irregularities of the spun yarn remain embedded in the solidified fluid-barrier layer and provides a "grasping" effect of the textile layer on the fluid-barrier layer, i.e. a stronger coupling between the layers.

[0049] As stated above, there are a number of preferred materials for the layers 20, 21 of tapes 2 and for the teeth 3 in order to obtain a chemical bonding effect which further improves the resistance to delamination.

[0050] From the previous description it can clearly be seen that the fluid-tight slide fastener according to the present invention solves the technical problem, mostly by the fact that it exhibits good long-term fluid-tight characteristics and resistance to delamination, bending and other mechanical stress especially at tooth-tape interface.

[0051] Of course, a person skilled in the art can bring numerous modifications and variants to the slide fastener described above in order to satisfy specific and contingent requirements, all of which are in any case covered by the scope of protection of the present invention, as defined by the following claims.

Claims

1. A fluid-tight slide fastener (1) comprising a pair of tapes (2), each of said tapes (2) comprising a textile core layer (20) and a fluid barrier layer (21) coating said textile layer, and having at least a portion carrying a row of teeth (3) along an inner edge (7), **characterized in that** each of said tapes (2) comprises a knurled region (10) on at least one side, said knurled region being extended along said inner edge (7) of tape (2) and at least on said portion of the tape (2) carrying said row of teeth (3).

2. A slide fastener according to claim 1, wherein said knurled region (10) is formed as a continuous longitudinal stripe parallel to said inner edge (7) of tape (2).

3. A slide fastener according to claim 1 or 2, wherein said knurled region (10) has a width (W) which is greater than width of root portions (30) of said teeth (3) fixed to the tape (2).

4. A slide fastener according to claim 3, wherein said knurled region has a width (W), in a direction perpendicular to said inner edge (7), which is about 1.5-2 times the width of said root portions (30) of teeth (3).

5. A slide fastener according to any one of preceding claims, wherein said knurled region (10) has a pattern of crests (11) projecting from embossed areas (12) of the tape (2).

6. A slide fastener according to claim 5, wherein said crests (11) are crossing at 90° each other and inclined by 45° with respect to the longitudinal direction of the tape (2).

7. A slide fastener according to any one of preceding claims, wherein said knurled region (10) is provided on both front and rear surfaces (22, 23) of tapes (2).

8. A slide fastener according to any one of preceding claims, wherein said textile core (20) of the tapes (2) is made with a spun yarn.

9. A slide fastener according to any one of preceding claims,, wherein said fluid barrier layer is made of TPE-E and teeth are made of PBT.

10. A slide fastener according to claim 9, wherein said fluid barrier layer is made of TPE-U and teeth are made of either a blend of ABS and PA or a blend of PBT and PC.

11. A process for making a tape (2) for a slide fastener (1) according to claim 1, comprising at least the steps of:

    - coating a textile strip with a fluid-barrier material;
    - subjecting the coated strip to a knurling process, obtained a knurled region on at least one side of said strip and near an edge thereof;
    - fixing a row of teeth to said knurled region of the strip;
    - cutting the strip to obtain a tape of a given length.

12. A process according to clam 11, wherein said textile strip is made of a spun yarn of cut fibers, said fibers being obtained with a cutting process of continuous fibers.

13. A process according to claim 12, wherein said strip of textile material is coated by extrusion or lamination of said fluid-barrier material, said fluid-barrier material being in a melted state, so that surface irregularities of said spun yarn remain embedded in the fluid-barrier layer.

14. A sports and outdoor activity item, such as diving suit, sailing suit, camping tent and the like, comprising a fluid-tight slide fastener according to any one of claims 1 to 10.

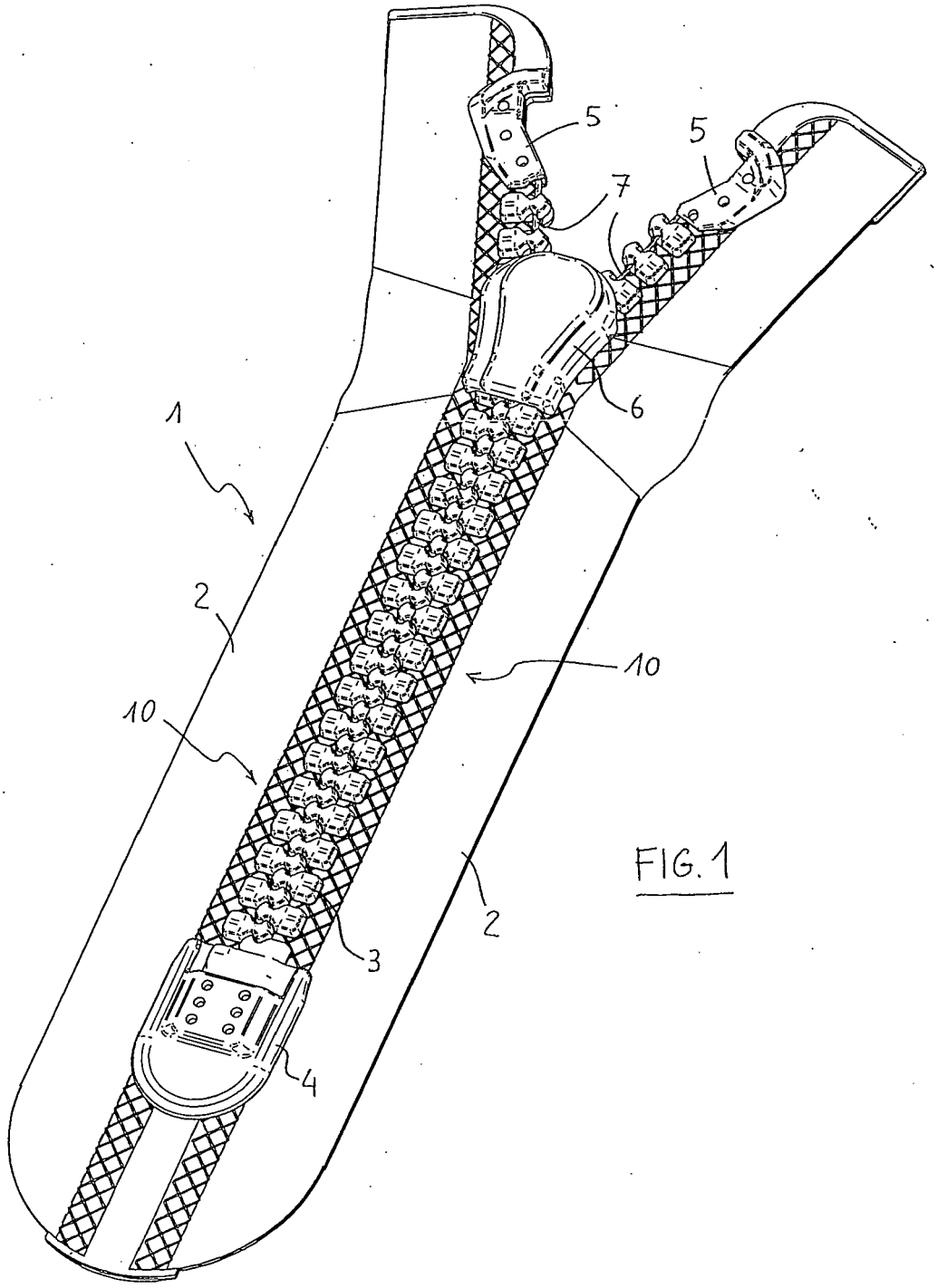

FIG. 1

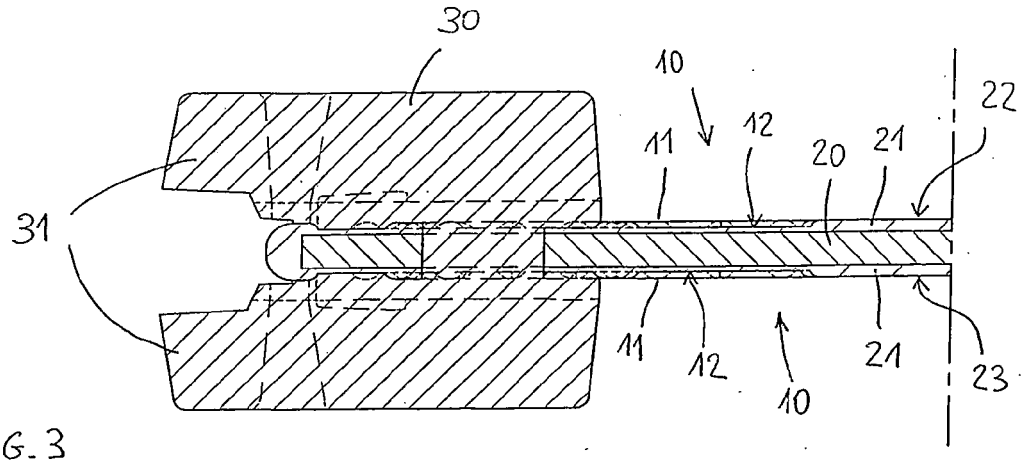

FIG. 3

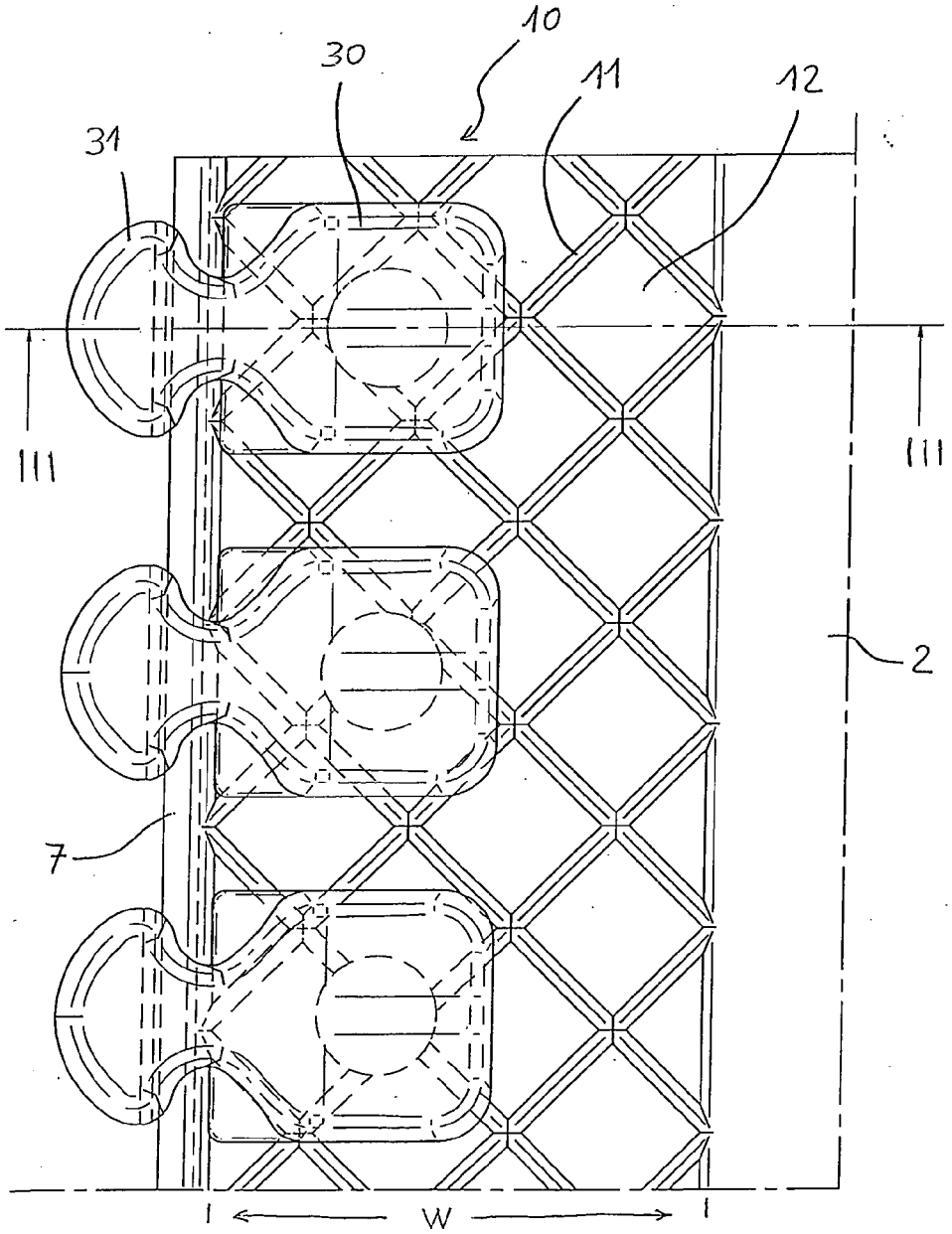

FIG. 2

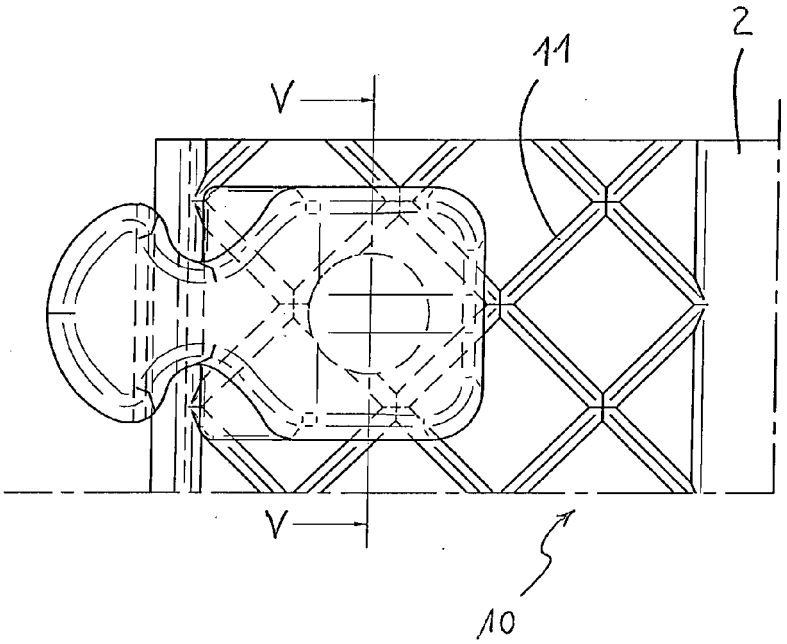

FIG. 4

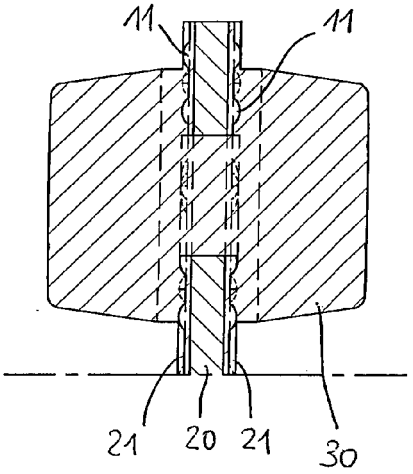

FIG. 5

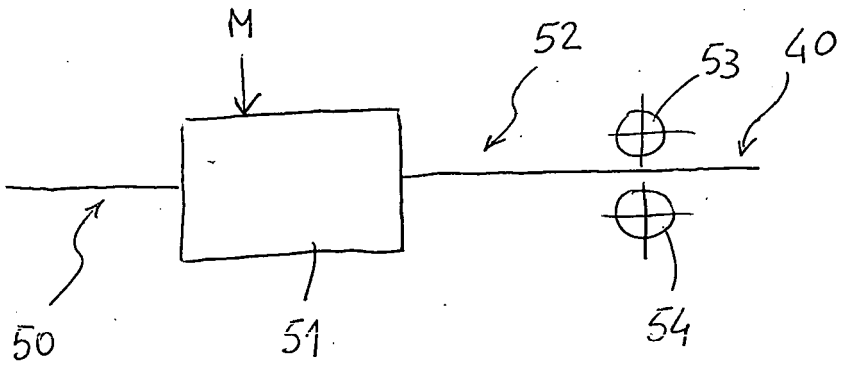

FIG. 9

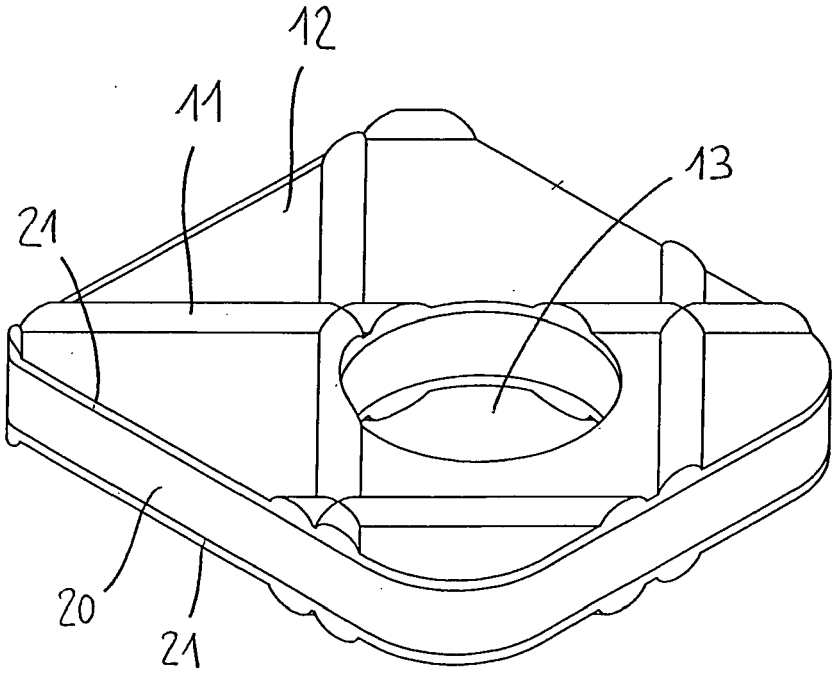

FIG. 6

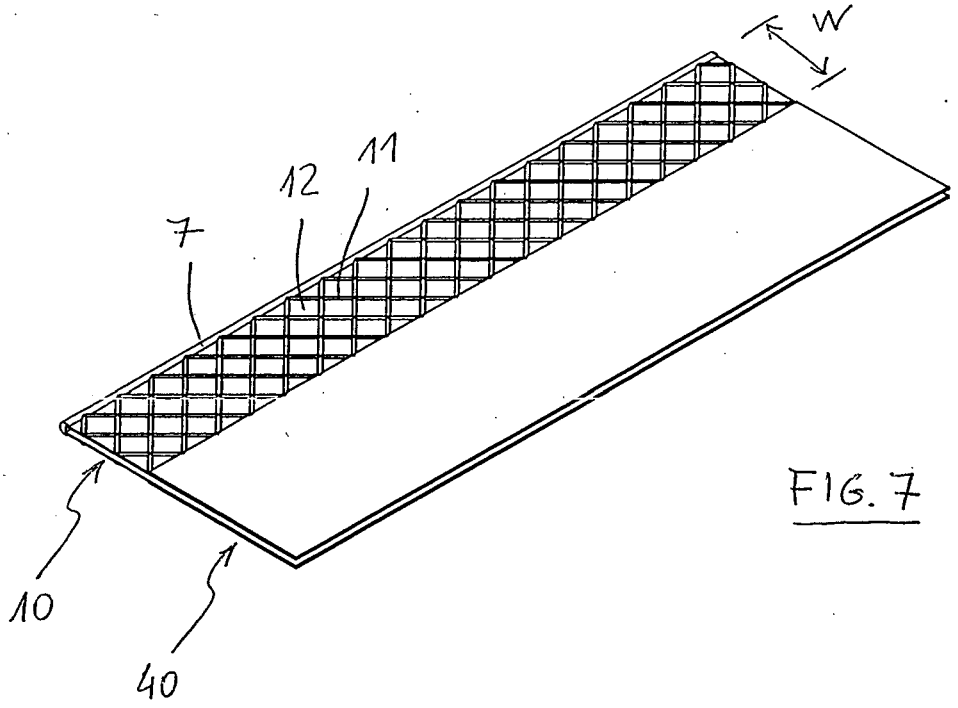

FIG. 7

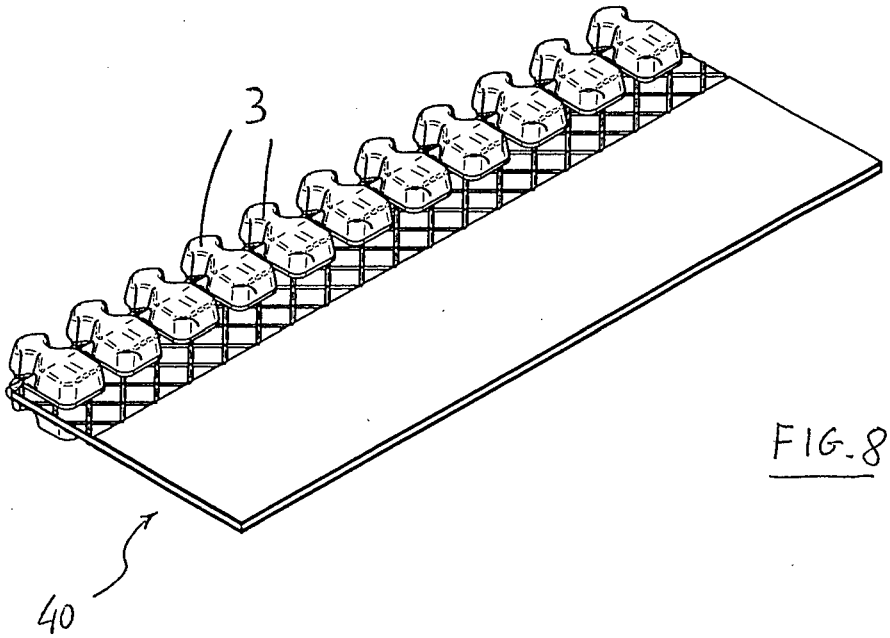

FIG. 8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 02 4770

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 May 2008	Richmond, Sarah

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 02 4770

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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