(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 900 532 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
10.03.1999 Bulletin 1999/10

(51) Int. Cl.[6]: **A44B 19/32**

(21) Application number: **98810534.2**

(22) Date of filing: **11.06.1998**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **12.06.1997 CH 1434/97**

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(54) Fluid-tight fasteners

(57) In a fastener (1) for joining together in a fluid-tight manner two hems (3, 4) of fabric or other impermeable material, comprising two rows of teeth (2) engaging with each other as a result of the action of a slide and applied respectively onto each of the said two hems, the said fluid-tight seal being obtained by compressing two elastic members each integral with one of the aforementioned hems, each of the said teeth (2) consists of several parts (2a, 2b) which are connected together and arranged on opposite sides of the said fabric or impermeable material, and the said elastic members consist of cords (5) of elastic material which are arranged in an intermediate position between the said two parts (2a, 2b) of the said teeth (2) of each row, the abovementioned cords (5) being dimensioned and arranged so as to be coplanar and so as to be compressed and rest frontally against one another with a predetermined force when the abovementioned teeth (2) are connected together by the said slide.

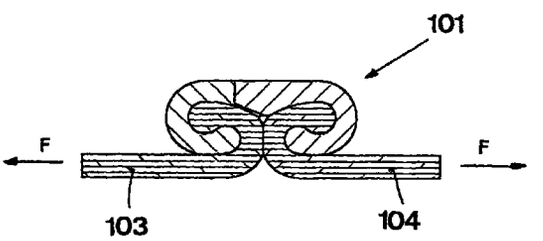

FIG. 1

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Description

[0001] The present invention relates to the sector of fasteners, also called "zip fasteners", and more particularly to those which must provide a fluid-tight closure, namely form a barrier which prevents the passage of fluids (liquids or gases) exerting a given pressure.

[0002] As is known, these fasteners join together two hems of fabric or other impermeable material by connecting two facing rows of teeth arranged in between one another and mechanically connected by means of the action of a slide, and the fluid-tight seal is obtained by arranging the said two hems next to one another by means of closing of the fastener and by exerting a predetermined compressive force on them; since the hems are made of elastic material, they thus create a linear fluid-tight seal along the entire length of the fastener.

[0003] According to the present state of the art, in fact, the said two hems which possess a certain degree of elasticity are arranged on top of one another and a pressure is exerted on them perpendicular thereto owing to closing of the fastener.

[0004] This system has some significant limitations and major functional drawbacks, including the fact that closing of the fastener must exert a considerable compressive preloading force on the said hems, with accentuated elastic yielding thereof capable of ensuring the fluid-tight seal even when a predetermined pulling force, tending to separate them from one another, is exerted on the two hems; in view of the geometrical configuration of the fastener and the necessary - albeit small - amount of play between the various teeth, a pulling force in the direction described always causes a given relative rotation of them which tends to separate the compressed hems, reducing the compressive (and hence sealing) force acting on them.

[0005] This is why it necessary that the said elastic yielding effect should be of a magnitude such as to ensure the desired fluid-tight seal even in the presence of the said relative rotation of the teeth and a certain elastic return movement of the two superimposed hems.

[0006] This fact has the consequence that the slide must exert a considerable force on the teeth in order to connect them together and this results in a great deal of effort needed to operate the fastener, so much so that it is difficult for a person wearing, for example, a wet suit which is closed by means of such fasteners, to perform alone the operations of opening or closing the said fastener.

[0007] Another drawback consists in the fact that the fasteners in question, because of their configuration, when closed create an aesthetically unattractive bulge in the form of a bead.

[0008] In order to avoid the drawbacks described hitherto, the inventor of the present invention has devised a fastener with specially shaped teeth divided into two parts which rest on opposite sides of the hem onto which they are applied and which contain inside them an elastic cord which extends at least over the whole length of the fastener.

[0009] The two cords of the two rows of opposite teeth are arranged next to one another frontally and compressed to a given degree as a result of closing of the fastener performed by the slide.

[0010] The force required for operation of the fastener is very light, and the fastener itself, when closed, has the dimensions and the aesthetic appearance of a normal fastener.

[0011] More particularly, the subject of the present invention consists of a fastener according to the preamble of the accompanying Claim 1 characterized by the technical characteristics described in the characterizing part of the same claim.

[0012] A more detailed description of a preferred exemplary embodiment of the fastener according to the invention will now be given, during which reference will also be made to the accompanying drawings, in which:

Figure 1 shows schematically a cross-sectional view of a fluid-tight fastener according to the state of the art;

Figure 2 shows a cross-sectional view of a preferred embodiment of the fluid-tight fastener according to the invention;

Figure 3 shows a side view of a tooth of the fastener according to Figure 2;

Figure 4 shows the plan view of a portion of the fastener according to Figures 2 and 3.

[0013] As can be seen in Figure 1, the fasteners according to the state of the art, as already explained, superimpose the two hems 103, 104 of impermeable fabric to be joined together by arranging them against one another and exerting a compressive force on the superimposed portion as a result of the closing action performed by the slide (not shown).

[0014] The fastener 101 is sensitive to the action of forces F which tend to move the two hems apart since the teeth 102 engaged together tend to rotate with respect to one another, diminishing the magnitude of the elastic compressive force acting on the hems to be joined together.

[0015] The fastener, moreover, when it is closed, forms an aesthetically unattractive bead which is raised with respect to the flat walls of the hems of impermeable fabric.

[0016] The fastener 1 according to the invention, on the other hand, is composed of two facing rows of teeth 2 which are formed as can be seen in Figure 2; each of them consists of two parts 2a, 2b which are connected together and arranged on opposite sides of one of the two hems 3, 4 made of fabric or other impermeable

material and accommodates internally a cord 5 (see Figure 3) of elastic material (for example neoprene) arranged in an intermediate position between the said two parts 2a, 2b.

[0017] The cords 5 located between the teeth 2 of the two facing rows which are connected in a known manner by a slide of the conventional type (not shown) are coplanar and are dimensioned and arranged so as to be compressed and rest frontally against one another when the abovementioned teeth 2 are connected together by the said slide, as shown in Figure 3.

[0018] As already mentioned, the force required to compress the two cords 5 arranged opposite one another frontally is very low and consequently the force to be exerted on the slide in order to perform closing (and opening) of a fastener 1 according to the invention is also very small.

[0019] In order to reduce this force to a minimum, the inventor of the present invention has envisaged shaping the cords 5 with a section which is tapered with a predetermined convergence closed by a rounded portion in the zones where they frontally come into contact when the fastener 1 is closed.

[0020] The said rounded section has the effect of increasing the pressure which is exchanged between the cords for the same compressive force acting on them, therefore reducing the latter and ensuring elastic deformation of the contact zones sufficient to create a reliable fluid-tight seal capable of preventing the infiltration of fluids exerting a pressure even greater than 2 bar.

[0021] As can be seen in Figure 3, the said two parts 2a, 2b forming a tooth 2 are connected together by a connecting element 6 which is fixed integrally to them and which passes through the elastic cord 5 and the hem of fabric or other impermeable material 3 arranged on top of one another (it obviously being necessary to form suitable holes in them for this purpose).

[0022] Each tooth 2 exerts its action on a shoulder 5s of the cord 5 by means of an abutting element 2t.

[0023] The inventor, in order to distribute radially in a uniform manner over the whole length of the cord 5 itself the pressure exerted by the said abutting elements 2t, has envisaged shaping, in a substantially cylindrical manner with a suitable curvature, the portion of each of the abutting elements 2t which is in contact with the cord 5.

[0024] The teeth 2, according to a preferred embodiment, are made of synthetic resin and may be formed as one piece, already connected to the cord 5 and to the hem 3, 4 of fabric, by means of injection moulding.

[0025] The construction of the fluid-tight fastener using synthetic resin offers, moreover, the advantages of a reduced weight and a high resistance to the corrosive action of aggressive physical or chemical elements.

[0026] A plan view of a portion of the fastener according to the invention is shown in Figure 4.

[0027] The two elastic cords 5 contained in a fastener 1 according to the invention advantageously extend beyond the end of the two rows of teeth 2 over a predetermined length so as to form a fluid-tight closing stop which can be realized by the compression exerted on them by the said slide when it brings them together, travelling an additional distance with respect to that which it must cover in order to perform closing of the fastener.

[0028] It is preferable, moreover, for the fastener to be provided with means which are connected to it, or to the hems of impermeable fabric, and which are designed to be reversibly inserted so as to keep the slide fixed in the position in which it is located when it has realized the closing stop in question.

[0029] Normally these means, which are already essentially known, may consist of fixed parts which can be connected to the pull-piece of the slide. The said closing stop and the means for fixing the slide are not shown in the drawings.

[0030] A further advantage provided by the fluid-tight fastener according to the invention consists in the fact that, for its operation, the hems of impermeable fabric which are to be joined together need not consist of a material which is elastic upon compression, since the seal is not produced by compressing the hems themselves, but the said elastic cords which are connected to the said hems. The preferred exemplary embodiment described hitherto and shown in the drawings is neither binding nor limiting in respect of other embodiments which may be obtained by referring to that which is stated in the accompanying claims: these embodiments also fall within the scope of protection defined by the present patent application.

Claims

1. Fastener (1) for joining together in a fluid-tight manner two hems (3, 4) of fabric or other impermeable material, comprising two rows of teeth (2) engaging with one another as a result of the action of a slide and applied respectively onto each of the said two hems, the said fluid-tight seal being obtained by compressing two elastic members each integral with one of the aforementioned hems, characterized in that each of the said teeth (2) consists of several parts (2a, 2b) which are connected together and arranged on opposite sides of the said fabric or impermeable material, and the said elastic members consist of cords (5) of elastic material which are arranged in an intermediate position between the said two parts (2a, 2b) of the said teeth (2) of each row, the abovementioned cords (5) being dimensioned and arranged so as to be coplanar and so as to be compressed and rest frontally against one another with a predetermined force when the abovementioned teeth (2) are connected together by the said slide.

2. Fastener according to one of the preceding claims, in which the said two elastic cords (5) have a tapered section closed by a rounded portion (e) in the zone where they come frontally into contact when the respective rows of teeth (2) are connected together by the said slide.

3. Fastener according to Claim 2, in which the said tapered part of the elastic cord has, in the direction of the associated tooth, a shoulder (5s) against which an abutting element (2t) present on one of the said two parts of each tooth (2) engages.

4. Fastener according to Claim 6, in which the said abutting element (2t) rests against the said shoulder (5s) of the elastic cord (5) with a substantially cylindrical portion rounded with a predetermined profile so as to distribute radially in a uniform manner the compressive forces acting on the cord (5) itself when the two rows of teeth are connected together.

5. Fastener according to one of the preceding claims, in which the said two parts (2a, 2b) of each tooth (2) are connected by a connecting element (6) which is integral with them and passes through one of the said elastic cords (5) and one of hems (3, 4) of fabric or impermeable material which are arranged on top of one another.

6. Fastener according to one of the preceding claims, in which each tooth (2) formed by two parts (2a, 2b) connected together is a single piece obtained by means of injection moulding.

7. Fastener according to Claim 6, in which the said teeth (21 are made of synthetic resin.

8. Fastener according to one of the preceding claims, in which the said two cords (5) of elastic material extend beyond the end of the said rows of teeth (2) over a predetermined length so as to form a fluid-tight closing stop which can be realized by the compression exerted on them by the said slide when it brings them together, travelling an additional distance with respect to that which it must cover in order to perform the said connection between the two rows of teeth (2) themselves.

9. Fastener according to Claim 8, characterized in that it is provided with means which can be inserted reversibly and which are designed to keep the said slide fixed in the position in which it realizes the said closing stop.

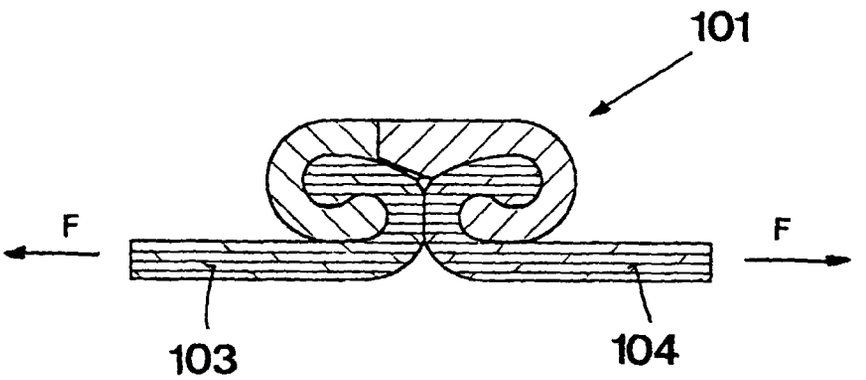

FIG. 1

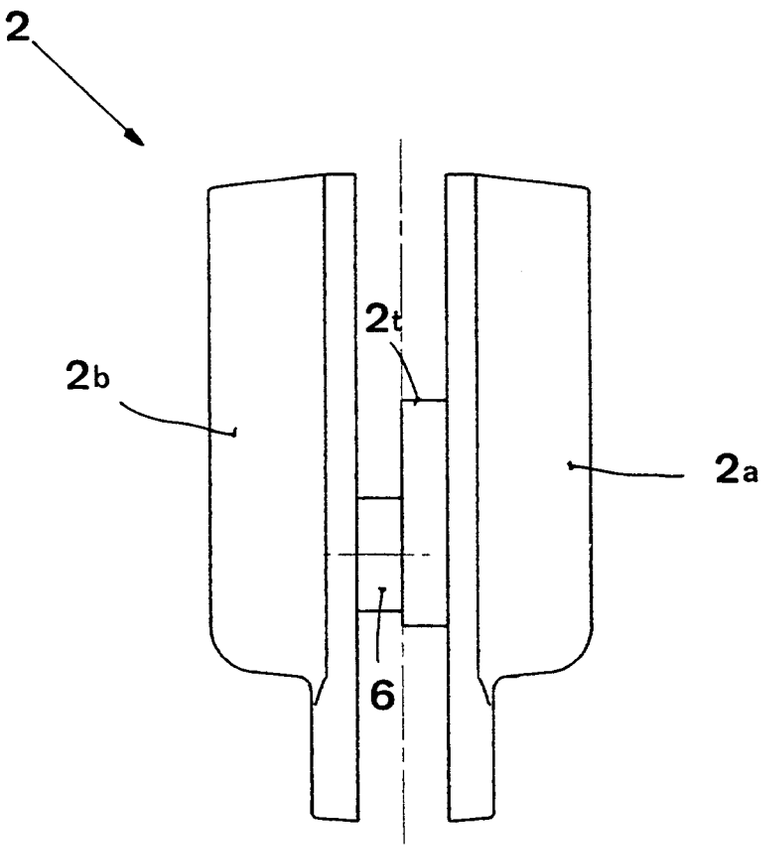

FIG. 2

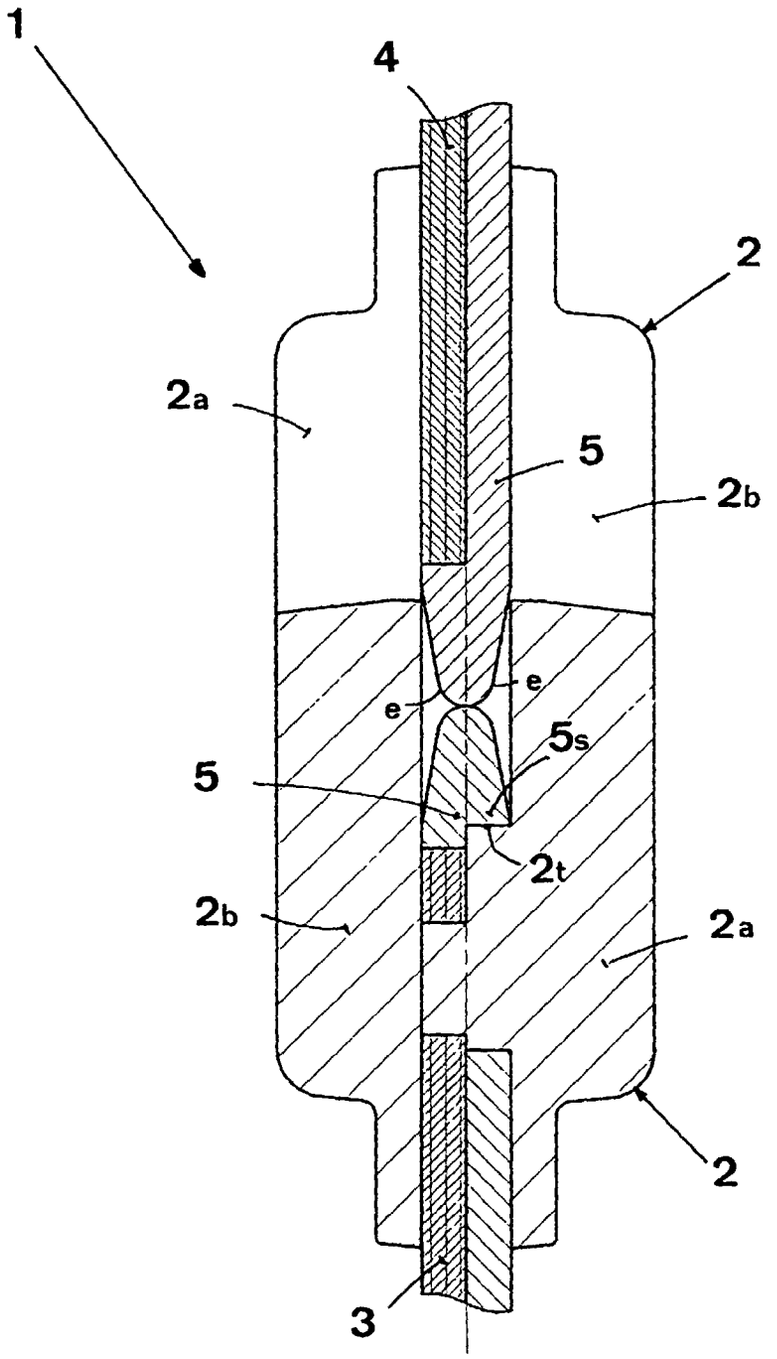

FIG. 3

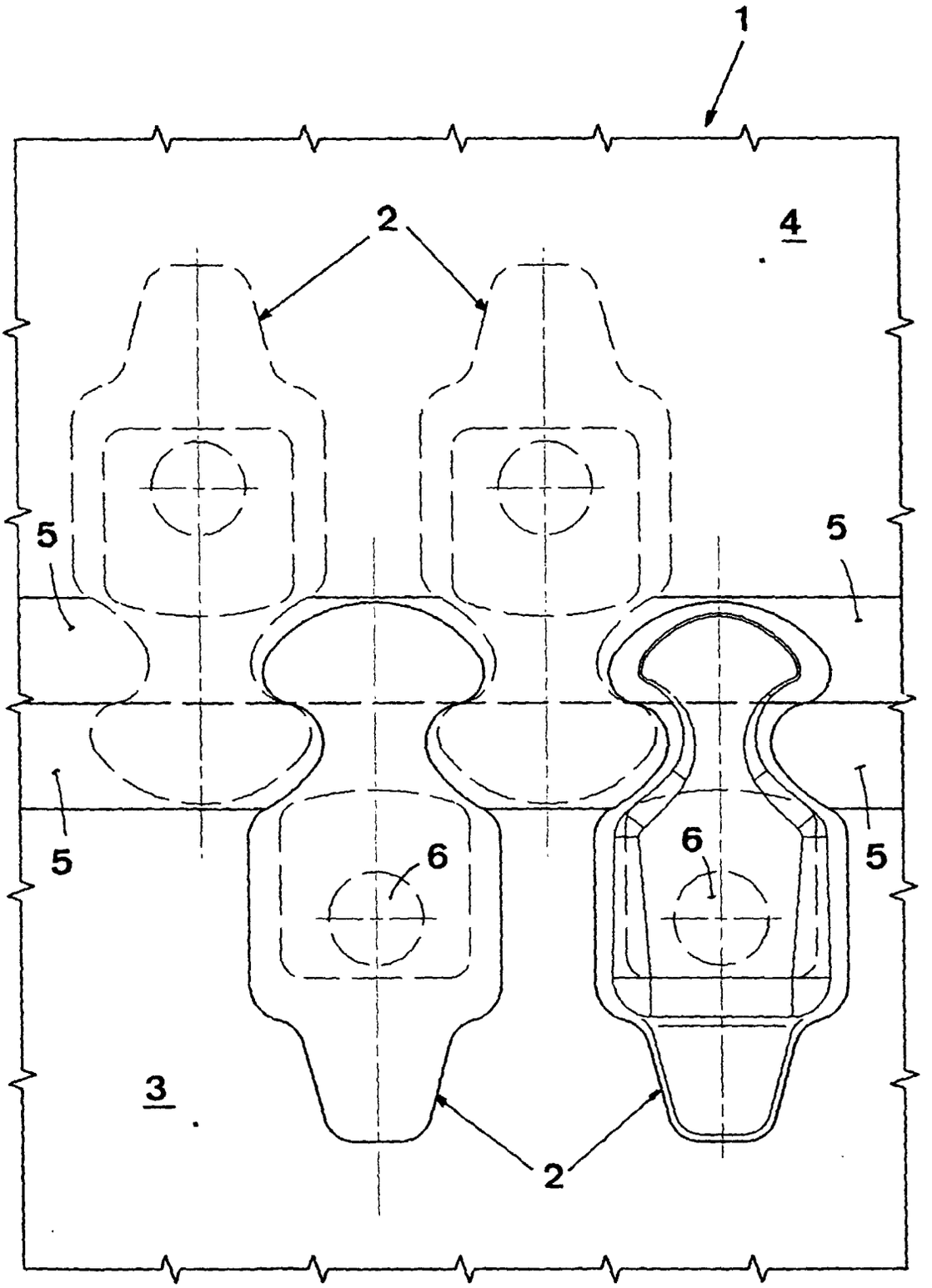

FIG.4