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(54) **FIXATION CLIP AND RESPIRATOR MASK**

(57) The invention relates to a fixation clip (7) for a respirator mask (1), in particular a nose fixation clip, the fixation clip (7) comprising an elongated clip element (8) having an U- or V-shaped arrangement with at least one flexible portion (9) that allows an elastic deformation of the clip element (8) for providing a pretention on the respirator mask (1). It is provided that at least one flexible portion (9) of the clip element (8) is designed as bistable hinge connection (15) that provides an instable sticking point between two stable arrangements of the clip element (8), one stable arrangement being the U- or V-shaped arrangement and another stable arrangement being an at least essentially flat arrangement.

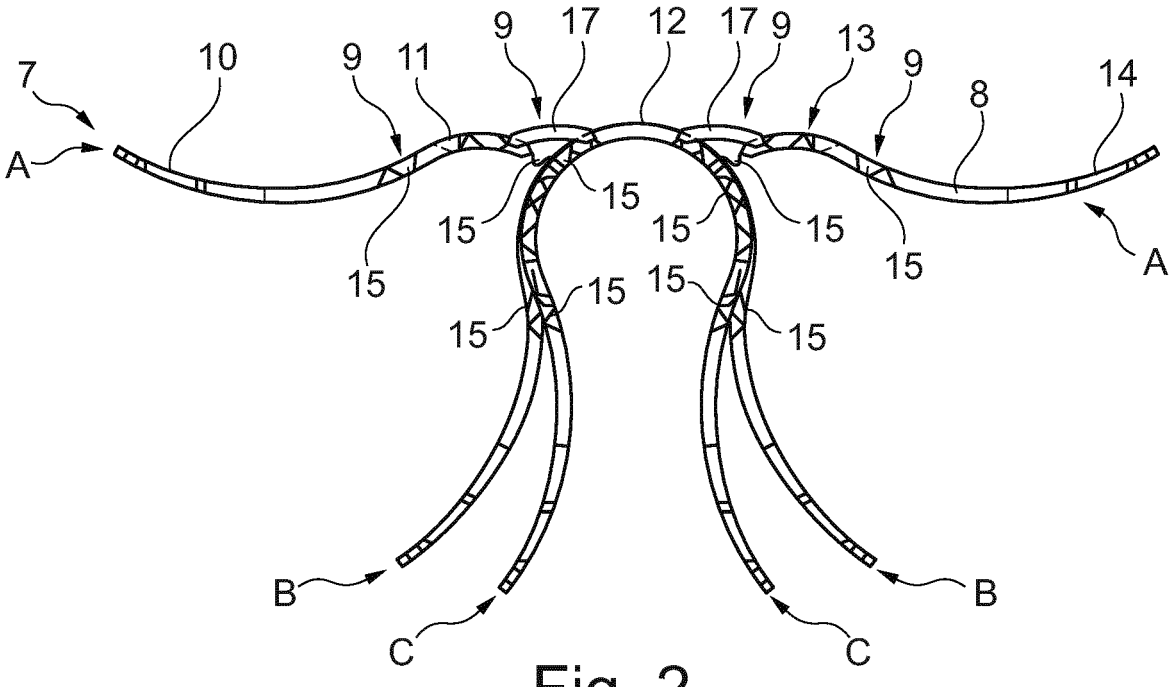

Fig. 2

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Description

[0001] The present invention relates to a fixation clip for a respirator mask, in particular a nose fixation clip, the fixation clip comprising an elongated clip element having an U- or V-shaped arrangement with at least one flexible portion that allows an elastic deformation of the clip element for providing a pretention on the respirator mask.

[0002] Moreover, the invention relates to a respirator mask for a human being, comprising a main body element that is designed to cover the mouth of the user with a mouth section and the nose of the user with a nose section, whereby a fixation clip is assigned to the nose section of the main body element.

[0003] Respirator masks are well-known in the prior art. In order to avoid inhaling dust particles or the like, respirator masks are used such that they cover the mouth and the nose of the user so that all air that the user inhales has to go through a filter element of the respirator mask. Although, respirator masks exist which make use of changeable filter elements, many respirator masks are used which are of the disposable kind, whereby a main body element of the mask is made up from a filtering material itself. In this way, a very light and easy to use respirator mask is provided. In order to guarantee that the respirator mask is attached to the face of the user in a sealing manner such that all intake air goes through the filter material, a tight seat on the face of the user is necessary, in particular in the area of the user's nose. It is known in the prior art to assign a fixation clip to the nose part of the respirator mask, the fixation clip being elastically deformable such that it provides a certain pretension that guarantees the sealing seat of the respirator mask on the user's face.

[0004] However, the fixation clip can render the respirator mask rather stiff when it comes to handling, transport and distribution, since the fixation clip is often already V- or U-shaped corresponding to the typical contour of a user's nose area. As such, transporting the fixation clip itself or the respirator mask with the fixation clip requires a certain amount of space and handling measurements. Furthermore, it is also known to flatten the respirator mask with the fixation clip for an easy transport and handling of the respirator mask. However, by flattening the respirator mask, the fixation clip is stressed before it is used. In order to guarantee the function of the fixation clip during use after the flattening, it must be carefully constructed in order to endure usage as well as transport and handling.

[0005] It is therefore an object of the present invention to provide a better fixation clip that allows for a safe usage of a respirator mask that comprises the fixation clip on the one hand as well as an easy handling and transportation of the fixation clip or the respirator mask on the other hand.

[0006] The object of the present invention is achieved by a fixation clip with the features of claim 1. The inventive fixation clip has the advantage that it can easily be deformed from an essentially flat arrangement to the arrangement needed for usage on the respirator mask, meaning the U- or V-shaped arrangement, without losing its ability for providing the above described pretension. In its flat arrangement the fixation clip is easily transported. Also the respirator mask comprising the fixation clip can be transported in a flat arrangement such that it is easy to stack a number of respirator masks above each other to form a tight package of respirator masks that is easy to handle. The inventive fixation clip is designed such that at least one, preferably each flexible portion of the clip element is designed as bistable hinge connection that provides an instable sticking point between two stable arrangements of the clip element, one stable arrangement being the before-mentioned U- or V-shaped arrangement and another arrangement being an at least essentially flat or straight arrangement. One of the stable arrangements is thus the at least essentially flat arrangement for stacking and the other stable arrangement is the U- or V-shaped usage arrangement of the fixation clip. By usage of a bistable hinge connection, the flat arrangement is reached without the need for a permanent stress due to an elastic deformation during transportation and handling. By moving the clip element from the one arrangement to the other arrangement by overcoming the resistance of the bistable hinge connection at the sticking point, the user may bring the fixation clip element into its form necessary for usage on the respirator mask whereby the sticking point of the bistable hinge connection guarantees that in the U- or V-shaped arrangement the elasticity of the fixation clip is available for the before-explained pretension that guarantees the sealed seat of the respirator mask on the user's face.

[0007] According to a preferred embodiment of the invention, the clip element comprises at least two, three or four flexible portions that are arranged spaced apart from one another along the length of the clip element. By using more than just one flexible portion of the described type a more flexible arrangements of the clip element and the fixation clip are possible, since it is not required that only one bistable hinge connection provides the overall movement range of the fixation clip. Instead, the overall movement range is divided by the number of flexible portions such that the movement range of each single bistable hinge connection is reduced to a minimum such that the realization of each bistable hinge connection becomes more convenient and affordable.

[0008] According to a further preferred embodiment of the invention, each bistable hinge connection connects two adjacent and in particularly at least essentially stiff clip sections of the clip element with one another. This means that between two rather stiff clip sections of the clip element a bistable hinge connection is arranged or constituted. The stiff or essentially stiff clip sections guarantee the overall elasticity and sufficient stiffness of the clip element for the pretension of the fixation clip during use. The rather stiff clip sections may be designed flat or with an in particular light curvature in its longitudinal direction to allow for a comfortable seat on the user's face on the one hand and a room-efficient

arrangement during transportation on the other hand.

[0009] It is preferred that each bistable hinge connection comprises at least one first protrusion on a first clip section of the two adjacent clip section protruding in the direction of the second clip section of the adjacent clip sections for establishing the sticking point. According to one embodiment of the invention the first protrusion is pressed against the second clip section only temporary when moving the clip sections from one stable arrangement to the other stable arrangement in order to establish an instable pressure resistance point of the bistable hinge connection between the stable arrangements. The first protrusion establishes the sticking point of the bistable hinge connection only temporarily such that the pressure resistance of the sticking point acts only within a predefined movement range of the two clip sections relative to one another, whereby the movement direction is defined by the hinge connection itself. This means that only in a certain movement range the so called sticking point the movement of the two clip sections is hindered, whereby the sticking point can be overcome by the user through usage of a sufficient force. The first protrusion is therefore preferably designed such that it only acts in the afore-mentioned movement range providing a preferred pressure resistance. The protrusion may be designed with a sharp or flat or rounded protrusion and that is pressed against the second clip section at the sticking point.

[0010] The second clip section preferably comprises at least one second protrusion that protrudes in the direction of the first protrusion of the first clip section, for example such that it is pressed against the at least one second protrusion of the second clip section to establish the initial pressure resistance point. Whereas the first protrusion may also contact the free end of the second clip section directly, it is preferred that the second clip section also comprises a second protrusion that acts together with the first protrusion. By doing so, the bistable hinge connection between the adjacent clip section is easily and cost-efficient realized. According to a further embodiment a second clip section comprises at least two second protrusions which are arranged in the direction of movement spaced apart from each other in order to establish two instable pressure resistant points between all three stable arrangements of the two adjacent clip sections. In this capacity, the bistable hinge connection acts as detent mechanism that provides at least two pressure resistant points or sticking points such that the adjacent clip sections can be arranged in three stable arrangements. This embodiment has the advantage that on top of the possibility to transport the fixation clip or the respirator mask in a at least essentially flat manner, the user may now adjust the tension and the arrangement of the fixation clip to its personal or individual needs. In case the user has a small nose, for example, he may tighten the fixation clip by moving the arrangement of at least one bistable hinge connection into the third stable arrangement instead of the second stable arrangement which would be suitable for a person with a lager nose. Furthermore, the film hinge is preferably elastically deformable such that the adjacent clip sections can be moved away from each other in order for the first protrusion to overcome the pressure resistance point without plastically deforming the bistable hinge connection. This ensures that only an elastic deformation takes place when the clip sections are moved from one arrangement to the other stable arrangement. As such, the arrangements can be switched more than just once by the user which allows for a robust and easy to use fixation clip. It is furthermore preferred that the first protrusion protrudes beyond a bending axis of the hinge between the adjacent clip sections. By protruding beyond the bending axis, the pressure resistance point is defined. In particular, depending on the length of the first protrusion, the acting pressure at the pressure resisting point of the bistable hinge connection is adaptable. For example, in order to gain a higher pressure, the first protrusion protrudes further beyond the bending axis and for a lower pressure the first protrusion protrudes less beyond the bending axis of the hinge between the clip sections. While it is preferred that the hinge between the adjacent clip sections is designed as film hinge, it is also possible to design the hinge as common multiple part hinge.

[0011] According to a further development of the present invention, a spring element is arranged between the first protrusion and the second protrusion in a preloaded manner and is preferably designed in one piece with the first and the second protrusion. Due to the preload or pretension of the spring element, it acts on the first and second clip section such that they are pushed into a stable arrangement. By overcoming the pretension or preload of the spring element by moving the adjacent or neighbouring clip sections from one arrangement to the other, the spring element is elastically deformed such that the clip element for example may be deformed from the essentially flat manner to the U-shaped arrangement. The spring element ensures that without external force the clip element remains in its present arrangement. Therefore, the spring element defines the force of the pressure resistant point or the sticking point which has to overcome by the user in order to change the arrangement of the fixation clip. In case the spring element is designed in one piece with the first and second protrusion, the bistable hinge connection is realized in a very cost-efficient and reliable way.

[0012] According to a further advantageous development of the fixation clip, the adjacent clip sections are connected to one another via a at least one film hinge. The film hinge provides the basic movable or flexible connection between the two adjacent clip sections of the clip element. The form hinge is small and cost-efficient and allows for reliable connection between the two clip sections. In particular, the film hinge is designed in one piece with the clip sections so that the clip element itself is also designed in one piece with the respective film hinges. The film hinge is also known as integral hinge or living hinge.

[0013] According to a preferred embodiment of the invention, the film hinge comprises two spaced apart film hinge sections. By arranging the first protrusion preferably between the two film hinge sections guarantees that the film hinge

sections are stressed equally by the pressure resistance. Consequently, if the first protrusion is arranged between the two film hinge sections, the second protrusion, if available, is also arranged between the two film hinge sections. According to a further preferred embodiment, the film hinge sections are arranged spaced apart from one another in the longitudinal extension of the clip element such that between the two film hinge sections a film hinge element is provided that is connected to the first clip section and the second clip section via its own film hinge. Preferably, two film hinge elements are provided on either side of the at least first protrusion. Providing the hinge element between the clip sections allows for two in particular parallel arranged bending axes of the bistable hinge connection and thus for a more flexible arrangement of the adjacent clip sections and a reliable bistable hinge connection in between the adjacent clip sections.

[0014] In particular, at least the first protrusion and/or the second protrusion are designed in one piece with the respective clip section. Hence, the protrusions are easily and cost-efficiently designed with the clip element. Accordingly, a misuse of the fixation clip is less likely and a long life of the fixation clip is ensured, due to the small number of single pieces. Furthermore, the bistable hinge connection is preferably designed in one piece with the clip element. According to this embodiment, the first protrusion and/or the second protrusion on the one hand as well as the film hinge on the other hand are designed in one piece with the clip element such that the flexible portion of the clip element is designed in one piece with the clip element and the fixation clip is in particular easy to handle and to manufacture.

[0015] The inventive respirator mask with the features of claim 13 is characterized by the inventive fixation clip as described above. The respirator mask has the advantages described before, in particular with respect to an easy handling and storing on the one hand and a reliable pretension during use on the other hand.

[0016] Preferably, the fixation clip is integrated into the main body portion of the respirator mask such that the main body portion is deformable from an essentially flat arrangement to an essentially U- or V-shaped arrangement at the nose section. Thus, the fixation clip is integrated into the main body and thus forms a part of the respirator mask. The fixation clip is preferably permanently fixed to the main body portion such that it cannot be removed by the user and exchanged for a new fixation clip element.

[0017] Alternatively, the fixation clip is removable integrated into the main body portion such that the user may exchange an old or broken fixation clip for a new one or such that the respirator mask and the fixation clip can be transported separately from another. It is particularly preferred that the fixation clip is arranged within a holding pocket of the main body portion. The main body portion thus comprises a holding pocket for incorporating the fixation clip. It is preferred that the contour of the holding pocket is essentially equal to that of the fixation clip such that the fixation clip is arranged within the holding pocket with only little or no play in order to secure the arrangement of the respirator mask on the user's face.

[0018] Further advantages and preferred embodiments result from features described above and combinations thereof as well as from the claims. In the following, the invention shall be further explained by use of the drawings. To that extent

Figure 1	shows a respirator mask with a fixation clip in a perspective presentation,
Figure 2	shows the fixation clip in three different arrangements in a side view and
Figures 3A and 3B	show a flexible portion of the fixation clip in two different arrangements in a perspective representation, respectively.

[0019] Figure 1 shows in a schematic perspective presentation a respirator mask 1 for a human being. The respirator mask 1 comprises a main body portion 2 that consists of a filter material and is designed to cover a mouth and a nose of a user. For that reason, the main body element 2 comprises a mouth portion 3 intended to cover the mouth and a nose portion 4 intended to cover the nose of the user, whereby the mouth portion 3 and the nose portion 4 merge into one another and are thus formed in one piece by the main body element 2.

[0020] The main body element comprises on its outer edge 5 an optional sealing lip 6 that extends all around the outer edge 5 and is intended to sit on the face of the user in a sealing manner such that all intake air that the user breathes, whether it is through the nose or the mouth, will have to go through the main body element 3 with the filter material, such that the user will only breath filtered air.

[0021] The nose portion 4 is designed with a V- or U-shaped curvature such that it is adapted to fit on the nose of a user. In order to guarantee a safe seat of the respirator mask 1 on the face of the user, in particular in the area of the nose, a fixation clip 7 is assigned to the nose portion 4. The fixation clip 7 is elastically bendable to provide a pretension that acts on the respirator mask 1, in particular the main body portion 2, to guarantee a safe seat on the user's face. The fixation clip comprises an elongated clip element 8 which is bent into a V- or U-shaped form in order to be adapted to the nose portion 4 of the main body portion 2. In order to adapt the pretension to a user individually and in order to allow an easy transportation of the respirator mask 1 and the fixation clip in particular, the clip element 8 is provided with presently four flexible portions 8. Three of which can be seen in figure 1. By use of the flexible portions, the clip element 8 can be moved or formed into different arrangements as shown in figure 2.

[0022] Figure 2 shows in a side view the fixation clip 7 in three different arrangements A, B and C. In the first arrangement A, the fixation clip 7 is arranged in an essentially flat arrangement or almost completely flat-manner. The clip element 8 comprises five at least essentially stiff clip sections 10, 11, 12, 13 and 14 in its longitudinal extension. Between each adjacent clip section 10 to 14 one of the flexible portions 9 is provided. That means that clip sections 10 and 11, clip sections 11 and 12, clip sections 12 and 13 and clip sections 13 and 14 are connected to each other by one of the flexible portions 9, respectively.

[0023] According to the present embodiment, the clip sections 10 to 14 are shaped with a curvature in their longitudinal extension in order to provide a comfortable fit of the fixation clip 7 on the respirator mask 1, in particular to ensure a comfortable pretension that acts on the user's face without being distant far from the main body element 2, so as to allow for a advantageously integrated design of the fixation clip into the respirator mask 1.

[0024] When the fixation clip 7 is in the first arrangement A, as shown in figure 2, the fixation clip is easily stackable such that a number of fixation clips of the same kind can be stacked on one another for easy transport and handling of the fixation clips. Also, in case the fixation clip 7 is already integrated into the main body portion 2 of the respirator mask 1, the respirator mask 1 can be transported in a rather flat or folded manner such that a number of respirator masks 1 of the same kind can be stacked on one another in a room-efficient capacity to allow for an easy transport and handling of a number of respirator masks 1 during transport.

[0025] By use of the flexible portions 9, the arrangement may be changed to one of the arrangements B or C as shown in figure 2. Each flexible portion 9 is designed as bistable hinge connection 15 that provides a sticking point between two stable arrangements of the clip element, in particular of the two clip sections that are connected by the respective flexible portion 9.

[0026] Due to the design as bistable hinge connection 15, the flexible portions 9 allow the fixation clip 7 to be shaped into different stable arrangements, wherein in each arrangement an elastic deformation of the clip element 8 may occur in order to establish the before-mentioned pretension. This is in particular of advantage in the arrangements B and C as shown in figure 2, which are the usage-arrangements on a user's face or at least on the pre-shaped respirator mask 1 of figure 1.

[0027] In the second or third arrangement B, C, the fixation clip 7 provides a pretension that acts on the nose portion 4 of the respirator mask when the clearance between the two free ends of the clip element 8 is smaller than the nose portion 4 such that the clip element 8 is elastically bent such that a pretension occurs. As long as the pretension does not overcome the sticking point or pressure resistance of the respective bistable hinge connection 15 the arrangement of the clip element 8 remains stable.

[0028] Figures 3A and 3B show a preferred embodiment of the bistable hinge connection 15 in two different arrangements for a better understanding. The bistable hinge connection 15 is designed in one piece with the clip element 8 and thus in one piece with neighbouring clip sections 11 and 12, for example.

[0029] The bistable hinge connection 15 comprises a film hinge 16 through which the adjacent clip sections 11 and 12 are swivelably connected to one another. According to the present embodiment, the hinge connection 15 comprises two hinge elements 17 that are spaced apart from one another and designed in one piece with the clip sections 11 and 12. Between the hinge elements 17 and the respective clip section element 11, 12 a film hinge section 18 is provided such that two bending axes 19 are formed which are parallel to one another and perpendicular to the longitudinal extension of the clip element 8.

[0030] Between the hinge elements 17, a first protrusion 20 of the clip section 11 and a second protrusion 21 of the second clip section 12 are arranged. The protrusion 20 extends into the direction of the second clip section 12 and the protrusion 21 into the direction of the first clip section 11. According to the present embodiment, the protrusions are connected to one another through a flexible spring element 22 which is designed integral or in one piece with the protrusions 20 and 21. The spring element 22 is designed as flat spring that comprises a wavy course from one protrusion 20 to the protrusion 21.

[0031] The spring element 22 is preloaded such that it pushes the adjacent clip sections 11 and 12 in one of two possible arrangements relative to one another.

[0032] For a better understanding, it is assumed that the hinge bending axis 18 form a virtual plane, whereby the spring element 22 can be arranged on either side of that virtual plane. If the spring element 22 is arranged on the lower side of the plane as shown in figure 3A, it pushes the clip sections 11, 12 into the direction of the first arrangement A such that they are arranged in a rather flat manner to one another. If the spring element 22 is arranged above the plane, as shown in figure 3B, it pushes the clip sections 11 and 12 into the V- or U-shaped arrangement as shown in figure 2 (B or C). In case the spring element 22 lies within the plane between the bending axes 19, the arrangement or the clip element 8 is instable. This position marks the sticking point or pressure resistance point of the bistable hinge connection 15.

[0033] Preferably, the clip sections 11 and 12 are designed such that they limit the bending extent of the film hinge 16 to a given extent such that the clip sections 11 and 12 cannot be bend beyond the given extent, in particular in both bending directions. According to the present embodiment, this limitation is provided by the design of the hinge elements 17 and the clip sections 11 and 12 at their opposing surface. As can be seen in figures 3A and 3B, close to the film hinge

sections 18, the hinge elements 17 as well as the clip section elements 11 and 12 comprise a tapered or wedge-shaped end pointing towards one another. The chosen degree of the surfaces 23 at the ends define the bending-limit. Once the opposing surfaces 23 of the clip section 11 and the hinge section 17 or the clip section 12 and the hinge section 17 come in contact with one another, a further bending of the film hinge 16 is prohibited because the clip sections 11, 12 prohibit the hinge sections 17 from bending any further. The surfaces 23 of the clip sections 11, 12 and the hinge sections 17 are thus designed as movement-limiting stop-surfaces 23.

[0034] It is required that the user uses a certain amount of force in order to bend the clip sections 11 and 12 from one arrangement to the other by elastically deforming the spring element 12 such that it can be moved through the sticking point through the virtual plane where the largest pretension force occurs. This means that when the spring element 22 is on either side of the virtual plane, the clip sections 11, 12 are in a stable arrangement to one another. Only by overcoming the spring tension of the spring element 22, the user is able to change the arrangement. Therefore, the clip element 8 can be moved into different arrangement as shown in figure 2, whereby in each of these arrangements an elastic pretension is available as long as the pretension force of the spring element 22 is not overcome.

[0035] According to an alternative embodiment of the present hinge connection 15, the protrusions 20 and 21 are connected on their free ends pointing to one another and may come into contact only within the disconnected plane, whereby an elasticity is provided by the hinge sections 18 allowing the protrusion to be moved through the plane by elastically stretching the film hinge sections 18 or preferably the hinge elements 17 themselves.

Claims

1. Fixation clip (7) for a respirator mask (1), in particular a nose fixation clip, the fixation clip (7) comprising an elongated clip element (8) having an U- or V-shaped arrangement with at least one flexible portion (9) that allows an elastic deformation of the clip element (8) for providing a pretention on the respirator mask (1), **characterized in that** at least one flexible portion (9) of the clip element (8) is designed as bistable hinge connection (15) that provides an instable sticking point between two stable arrangements of the clip element (8), one stable arrangement being the U- or V-shaped arrangement and another stable arrangement being an at least essentially flat arrangement.

2. Fixation clip according to claim 1, **characterized in that** the clip element comprises at least two, three or four flexible portions (9) that are arranged spaced apart from another along the length of the clip element (8).

3. Fixation clip according to one of the preceding claims, **characterized in that** each bistable hinge connection (15) connects two adjacent and in particularly at least essentially stiff clip sections (11,12) of the clip element (8) with one another.

4. Fixation clip according to one of the preceding claims, **characterized in that** each hinge connection comprises at least one film hinge (16) that connects the two adjacent clip sections (11,12) swiveable to one another.

5. Fixation clip according to one of the preceding claims, **characterized in that** each bistable hinge connection (15) comprises at least a first protrusion (20) on a first clip section (11) of the two adjacent clip sections (11,12) protruding in the direction of the second clip section (12) of the adjacent clip sections (11,12) for establishing the sticking point.

6. Fixation clip according to one of the preceding claims, **characterized in that** the second clip section (12) comprises at least one second protrusion (21) and that protrudes in the direction of the first protrusion (20) of the first clip section (11).

7. Fixation clip according to one of the preceding claims, **characterized in that** a spring element (22) is arranged between the first protrusion (20) and the second protrusion (21) in a preloaded manner

8. Fixation clip according to one of the preceding claims, **characterized in that** the spring element (22) is preferably designed in one piece with the first and the second protrusion (20,21).

9. Fixation clip according to one of the preceding claims, **characterized in that** the adjacent clip sections (11,12) are connected to one another via at least one film hinge (16).

10. Fixation clip according to one of the preceding claims, **characterized in that** each film hinge (16) comprises two spaced apart film hinge (18) sections between which the first protrusion (20) is arranged.

11. Fixation clip according to one of the preceding claims, **characterized in that** the film hinge comprises at least one hinge element (17) that is connected to the first clip section (11) and to the second clip section (12) via a film hinge (18) section respectively.

12. Fixation clip according to one of the preceding claims, **characterized in that** at least the first protrusion (20) and/or the second protrusion (21) are designed in one piece with the respective clip section (11,12).

13. Respirator mask (1) for a human being, comprising a main body element (2) that is designed to cover the mouth of the user with a mouth section (3) and the nose of the user with a nose section (4), whereby the nose section (4) is supported by use of a fixation clip (7) that extends across the nose section (4), **characterizes in that** the fixation clip (7) is designed according to one of claims 1 to 15.

14. Respirator mask according to claim 13, **characterized in that** the fixation clip is integrated into the main body portion (2) such that the main body portion (2) is deformable form an essentially flat arrangement to an essentially U- or V-shaped arrangement at least at the nose section (4).

15. Respirator mask according to one of the preceding claims, **characterized in that** the fixation clip (7) is arranged within a holding pocket of the main body portion (2).

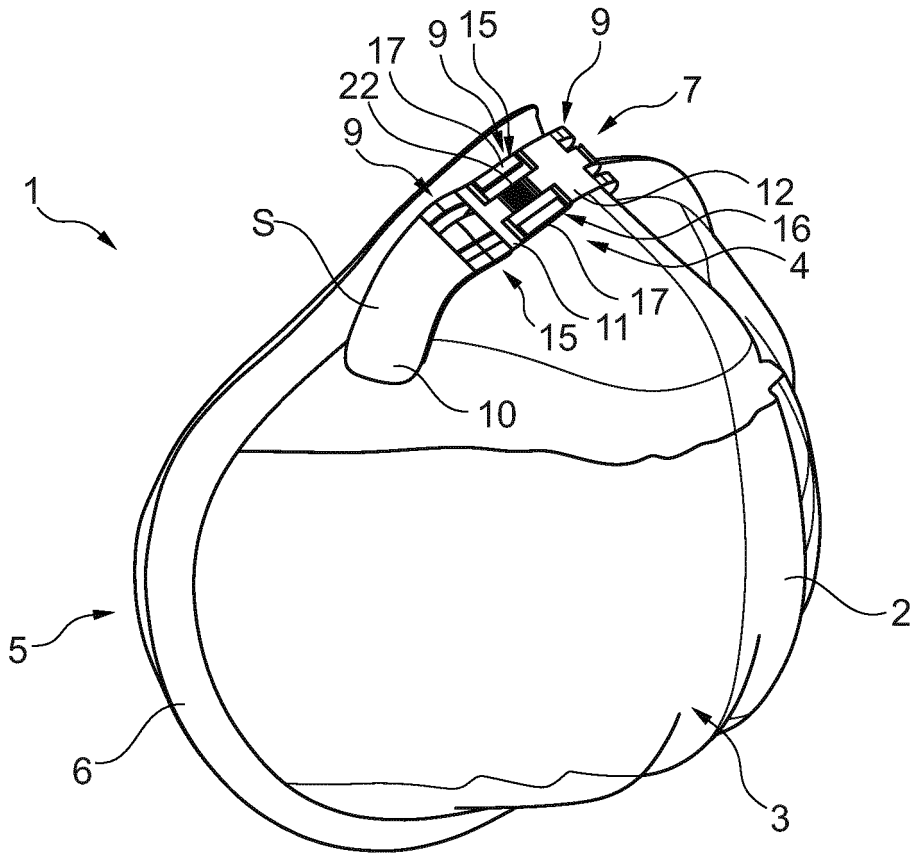
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Fig. 1

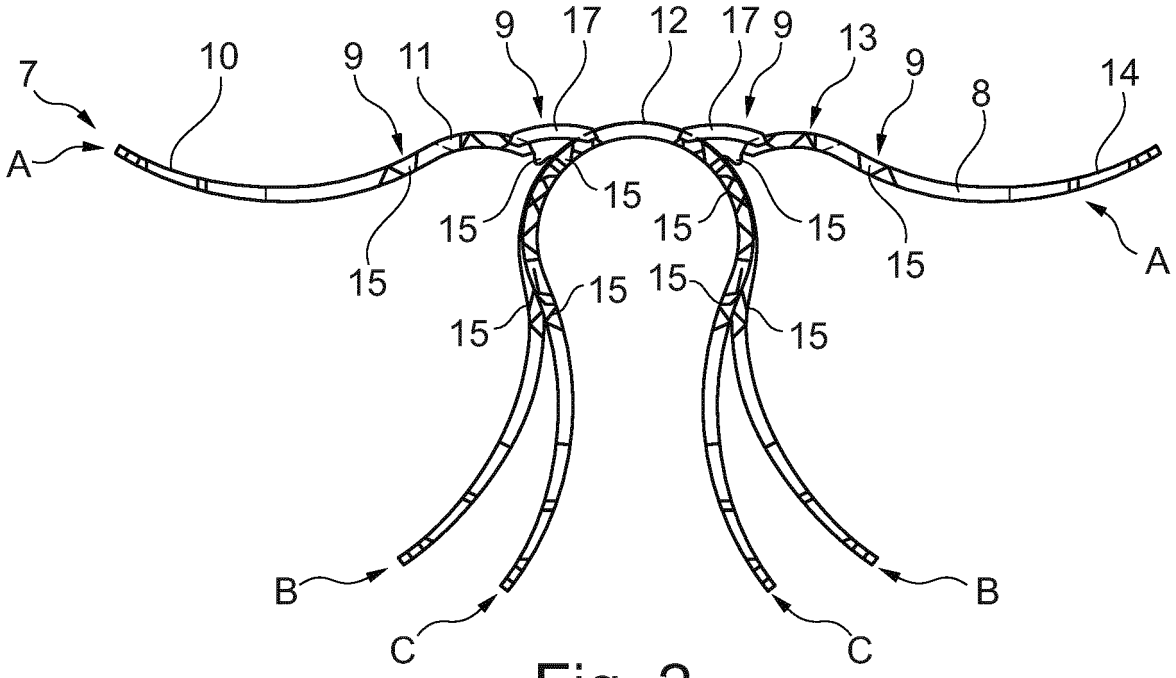
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Fig. 2

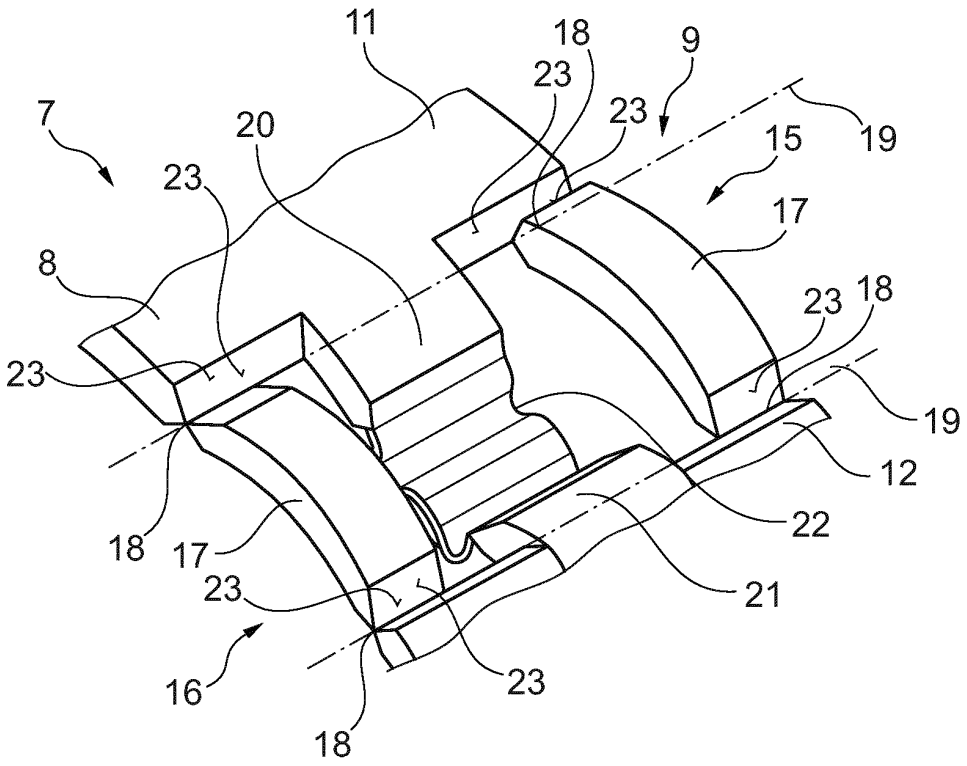
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Fig. 3A

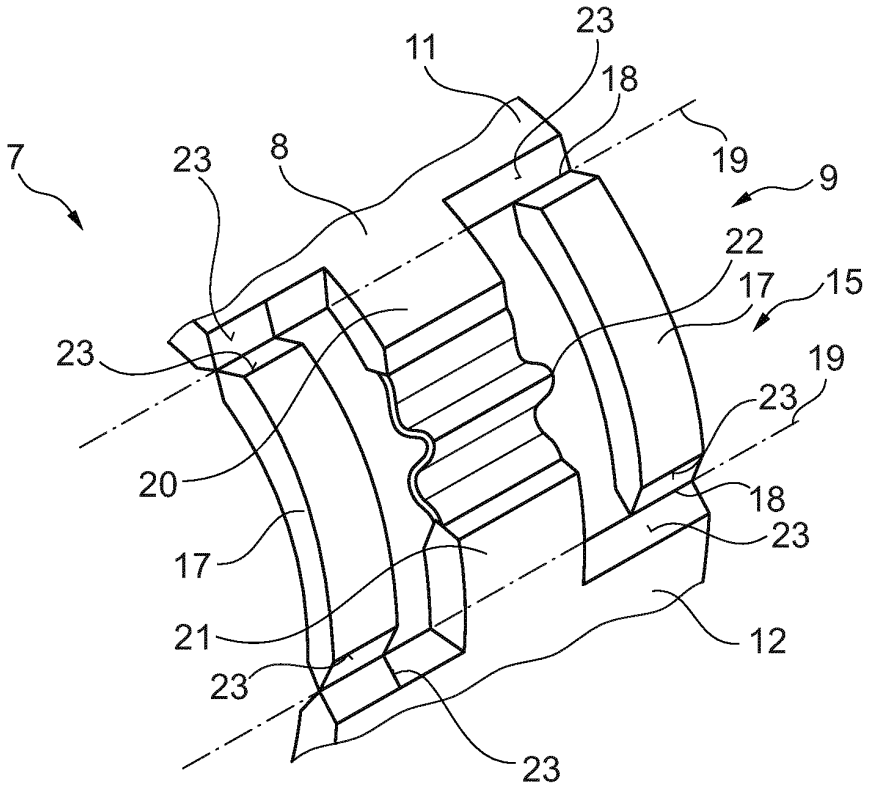
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Fig. 3B

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 18 21 5393

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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Place of search	Date of completion of the search	Examiner
The Hague	24 May 2019	Nehrdich, Martin

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