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(54) **WEARABLE ARTICLE**

(57) A protective wearable article (1) is described, said article including a first material or first layer of material suitable, for example, for protection against abrasion (8) and an insert (2, 3, 4, 5) made of a material different from said first material (8). The insert is a single non-uniform knitted body.

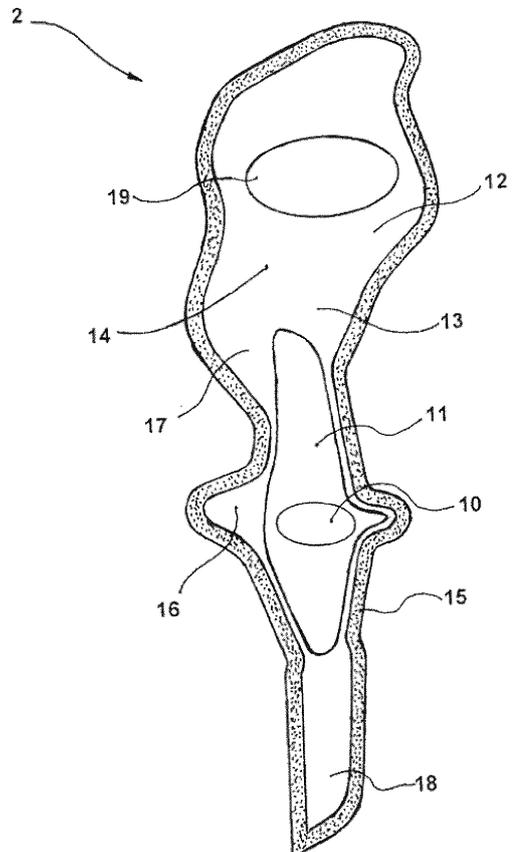


FIG. 3

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Description

[0001] The present disclosure relates to a protective wearable article, such as a protective garment, namely a motorcycle jacket or suit, an accessory, such as a glove, or another wearable article. Such a protective wearable article is made mainly and preferably of a material suitable for ensuring protection against abrasion, such as real leather, artificial leather, kevlar or some other suitable technical fabric. The wearable article is designed to protect a user, for example against abrasions, in the event of impacts and/or falls, during a sporting and/or working activity and/or any other activity. The user is for example a motorcyclist and/or motorcycle passenger, a skier, a horse rider or a similar user.

[0002] A wearable article such as a motorcycle suit, which is made mainly of leather or some other material suitable for ensuring protection against abrasion, is known. The suit is also provided with inserts of elastic material or elasticized structures which allow the garment to be adapted to the anatomy of the human body and ensure maximum adherence thereof. In order to obtain maximum adherence, the inserts of elastic material include a plurality of pieces which are joined together by means of stitches. The use of a plurality of pieces allows the insert to be made with a suitable three-dimensional shape which may follow, as far as possible, the curvature and anatomy of the human body.

[0003] The present disclosure is based on the recognition that an insert thus formed affects the aerodynamic performance and the comfort of the motorcyclist. In fact, the presence of stitches is a cause of discomfort for a user, in particular in the articulation zones of the body, for example behind the knees or in the inner elbow zone where, for example, in the motorcycle riding position, the suit is folded and would tend to form folds.

[0004] The folds and the stitches may create undesirable localized thicknesses which, in addition to creating discomfort for a rider, in particular at high speed are disadvantageous in terms of aerodynamic performance. Moreover, the stitches constitute a weak point. In the event of a fall, the stitch risks breaking.

[0005] As a result a known drawback of the wearable article is that the insert may create discomfort for a user wearing the article owing to the perception of the presence of greater thicknesses in the folding zones. Moreover, these stitches may negatively affect the aerodynamic behaviour of the wearable article since they create superficial discontinuities or irregularities which affect the air flows passing over the user's body, in particular at high speeds.

[0006] A technical problem forming the basis of the present disclosure consists in providing a protective wearable article for protection of a user able to overcome said drawback and/or able to reduce at least partially the folds and/or achieve further advantages.

[0007] This problem is solved by a protective wearable article for protection of a user and a respective method

as defined in the respective independent claims. Secondary characteristics forming the subject of the present disclosure are defined in the respective dependent claims.

5 **[0008]** The protective wearable article according to the present disclosure is characterized in that it includes a first material or first layer of material suitable for protection, for example against abrasion, and an insert made of a second material different from said first material, wherein said insert is a single knitted body. In other words, the protective wearable article according to the present disclosure includes an insert which is made as a single body by means of a knitting process.

10 **[0009]** The term "insert" refers to a body which is originally independent of the remaining first material or first layer and is joined, at the moment of manufacture of the article of clothing or the wearable accessory, to the first material or first layer in a conventional manner, for example by means of stitching.

20 **[0010]** The insert is such as to create a superficial discontinuity with respect to the remaining portion of the wearable article so that the wearable article is mainly made of a material suitable for protection, for example against abrasion, such as leather, or a synthetic material. The wearable article includes therefore locally one or more inserts, having a different function from the first material or first layer. The insert is preferably devoid of internal stitches, namely it preferably does not consist of pieces which are stitched together.

25 **[0011]** The insert is preferably arranged in a zone of the wearable article intended for a fold. Usually the zones which are subject to the greatest amount of folding are situated in the region of an articulation, even more particularly within an articulation zone, in the concave area, where, following bending of the human body, the two parts which form the articulation moves towards or away from each other respectively, so as to modify an angle formed between them. For example, the articulation zone defines a curve and said protective wearable article has an intrados side and an extrados side in the region of said articulation zone. The insert may be situated on an intrados side of said articulation zone or may also be situated on an extrados side. Alternatively, or in combination with these arrangements, the insert may be situated on one side of the articulation zone so as to follow the curvature of the articulation.

30 **[0012]** The single-body knitting technique is able to overcome the drawback of a large number of stitches, since the entire insert is made by means of knitting and therefore forms a single knitted body.

35 **[0013]** According to another aspect of the present disclosure, the knitted body is a non-uniform body, i.e. is not entirely the same or does not have the same structure over the whole of its surface area. The knitted body has at least a first zone or region having characteristics different from those of a second zone or region. Even more preferably, the knitted body has a plurality of regions or zones which, while being associated with each other in

a single body, have different structural characteristics, properties or behaviours. This means that the knit is not the same over the whole surface area of the knitted body. For example, the zones or regions may differ from each other in terms of material, elasticity, thickness, colour, or other characteristics, such as, for example, the mesh size.

[0014] As a result, one zone of the knitted body may be made of a material different from and less resistant and less rigid than the material of another zone, or may be made of a material having a smaller abrasion resistance. The zones are understood as being confined areas of the insert.

[0015] This differentiation between the zones allows the characteristics of the insert to be adapted to the part of the body with which each zone is associated or the part of the body covered by the associated insert. The insert may be adapted as precisely as possible to the human body. Some zones of the knitted body may be made of a softer yarn such as cotton or wool with a given yarn count, namely having yarns with a very soft consistency and suitable for insertion in an article of clothing with a minimum impact on the comfort. Other zones of the insert may be made using a thread having a high tensile strength or high abrasion resistance. Alternatively, or in combination with said example of embodiment, a zone of the insert may have an overall thickness greater than another zone, for example greater than a zone closer to the fold. This zone closer to the fold should in fact be made with a thickness which is as small as possible so as to reduce as far as possible any discomfort for the user.

[0016] The knitted body is preferably made using a knitting machine; it is also possible to envisage the possibility of weaving or knitting electric cables or wires of varying nature for internal sensors, for example pressure sensors, or for connection to any electronics which are present in the wearable article.

[0017] A person skilled in the knitting sector is able to provide a knitted insert, varying the zones of the insert depending on the mesh size or thickness or other characteristics, for example using threads of a varying nature or threads composed of a varying number of filaments.

[0018] In one embodiment, the knitted body has at least one region or zone, such as the aforementioned first zone or first region, which is made of an elastic material having a greater elastic force than the second zone, which may be made using an elastic thread or elastic fabric, and is designed to assume an elastically undeformed condition, namely a rest condition, and an elastically deformed condition. In said elastically undeformed condition, said region or zone is preferably in an at least partially curved arrangement and may exert a tensile action on a surrounding area. It is to be understood that, preferably, it consists if a zone which is curved at least in a rest or non elastic deformation condition.

[0019] An advantage of this latter embodiment consists in the fact that, owing to the use of the curved zone

made of elastic material and the elastic return action of this curved zone, it is possible to obtain a wearable article in which part of the insert, in the curved condition, does not form substantially folds or forms a small or barely noticeable number of folds. This curved zone is preferably intended to be arranged on one side of the wearable article intended to be directed towards the user, as for example in the case of an article of clothing or footwear, so as to be shaped anatomically to a corresponding curved region of a user's body, such as an articulation zone. A further advantage consists in the fact that the part of the insert assumes a curved arrangement or configuration, in a substantially automatic manner, owing to the fact that the curvature is determined beforehand, when the insert is knitted. In this way, by taking advantage, as mentioned, of the elastic return action, it is possible to obtain in a simple and rapid manner the curved configuration.

[0020] Obviously, the degree of curvature depends on the dimensions of the curved zone, on the material of the insert and the first layer and on the elastic force which forms the curvature. In one embodiment, the zone surrounding the curved zone is elastic, but has an elasticity less than that of the curved zone, so as to ensure the tensile action of the curved zone. The surrounding zone forms part of the elastic insert. Even more preferably, the entire elastic insert, even though non-uniform, is made of elastic material.

[0021] The elasticity may be a monoaxial elasticity or a biaxial elasticity so that the elastic return action occurs along at least two directions and a cap-like or dome-like curvature of the curved zone is obtained. This cap-like or dome-like form is suitable, for example, in the case of application to an article of clothing for protection of the articulations, so that the article may follow as far as possible the anatomical curvature of an articulation. In one embodiment, the curved zone has an elastic knitted thread in the knitted body wherein an extension of said thread increases when the insert is subjected to deformation. For example, the elastic thread is a weft thread or a thread which is inserted in the mesh, for example in a given direction.

[0022] Preferably, as mentioned, the curved region or zone is a region which occupies a part of said insert and said surrounding zone is a region of the insert. For example, it occupies a central zone of said insert, so as to obtain localized adaptation to the anatomy of the human body.

[0023] Even more preferably, in order to reduce the folds, the curved zone has a smaller thickness than the remainder of the insert.

[0024] A method for manufacturing a knitted body such as that described above envisages, for example, using a so-called three-dimensional knitting machine known to the person skilled in the art. Preferably, it consists if a double needle-bed knitting machine, or a knitting machine including a first needle-bed and a second needle-bed. As a result, in accordance with this embodiment, a

first side, or first knitted portion or wall, is one side of the knitted body (knitted on a first needle-bed of a double needle-bed knitting machine) and a second side, or second knitted portion or wall is an opposite side of the knitted body (knitted on a second needle-bed of said knitting machine).

[0025] Preferably, it consists of a flat knitting machine which is able to knit three-dimensionally and preferably also join the mesh by means of a joining thread, for example an elastic thread, which passes transversely within the dimensional structure and connects walls or zones of the knitted body. The knitted insert may therefore be a so-called "tubular spacer" where the tubular body is collapsed onto itself and two opposite portions of the tubular element are joined together by means of a joining thread. In order to form different zones, some zones may be of the single-mesh type, i.e. knitted on a single needle-bed, for example of the plain knit type.

[0026] As a result, according to an embodiment of the present disclosure, the knitted body may be manufactured automatically and in a much shorter production time by means of flat knitting machines known in the sector of machines intended to produce articles of clothing of the three-dimensional type, for example those flat knitting machines intended to produce single body knitted articles, such as gloves or stockings, and which allow variation of the thickness or the type of threads used to perform knitting.

[0027] For example a flat knitting machine includes at least one pair of needle-beds and is able to transfer the meshes of a knitted fabric between the needle-beds. This machine may be configured to perform knitting of the mesh on a first needle-bed, knitting of the mesh on a second needle-bed, and carry out knitting on one needle-bed and on the other needle-bed in such a way that the fabric knitted on the first needle-bed and the fabric knitted on the second needle-bed are joined together by means of a joining thread.

[0028] Basically, the knitted body is made by alternately working by means of a first thread-guide a first thread or first group of threads on the needles or some needles of the first needle-bed (so as to form a mesh row) and a second thread-guide which carries a second needle or second group of threads on the needles or some needles of the second needle-bed (so as to form the remaining mesh row), such as to obtain a complete mesh revolution, and therefore, after a number of complete mesh revolutions, a substantially tubular or tubular sleeve form of the knitted body.

[0029] The flat knitting machine may include a third thread-guide which carries a third thread alternately between the first needle-bed and the second needle-bed so as to connect a joining thread between the two opposite portions of the knitted body and obtain a single layer. Basically two opposite portions of the tubular article are joined together by means of the third thread. The third thread may be elastic.

[0030] The fact of using a knitting machine in order to

manufacture a knitted body allows the threads used for manufacture of the knitted body to be calibrated according to needs and the threads or the thickness of the knitted body to be varied according to the insert zone, but without an irregular surface.

[0031] In other words, these varieties and differentiation of material and/or thickness may be controlled by means of suitable configuration of the flat knitting machine.

[0032] For example, in zones where the knitted body is folded, the insert may have a smaller thickness or a different elasticity or, in zones which are more exposed to impact, the insert may have a greater abrasion resistance. The smaller thickness may be obtained by means of a knit formed on a single needle-bed, such as a plain knit.

[0033] The aforementioned curved zone of the insert may be formed by means of an elastic thread which is knitted, in a tensioned state, from right to left, and released when it is woven into the mesh.

[0034] It is also possible to envisage the possibility of weaving or knitting electric cables or wires of varying nature for internal sensors, for example pressure sensors, or for connection to any electronics which are present in the wearable article.

[0035] A person skilled in the art is able to provide a knitted insert by means of a knitting machine, varying the zones of the insert depending on the mesh size or thickness or other characteristics, for example using threads of a varying nature or threads composed of a varying number of filaments.

[0036] In order to form different zones, some zones may be of the single-mesh type, for example plain knit type. For example, the aforementioned curved zone may be, differently from the surrounding zone, a plain knit of smaller thickness. The curved zone may include an elastic thread which is inserted in the plain knit and which is inserted in a tensioned state from right to left and vice versa and allows the curvature to be imparted. In other words, the curved zone according to the present disclosure is a zone formed with a plain knit, and the zone surrounding the curved zone is a zone formed by means of a tubular spacer.

[0037] The fact of using a knitting machine in order to manufacture a knitted body allows the threads used for manufacture of the knitted body to be calibrated as required and the threads or the thickness of the knitted body to be varied according to the insert zone, but without an irregular surface.

[0038] In other words, these varieties and differentiation of material and/or thickness may be controlled by means of suitable configuration of the flat knitting machine.

[0039] Further advantages, characteristic features and modes of use of the subject of the present disclosure will become clear from the following detailed description of a number of preferred examples of embodiment thereof, provided by way of a non-limiting example. It is never-

theless evident that each embodiment may have one or more of the advantages listed above; in any case it is nevertheless not necessary that each embodiment should have simultaneously all the advantages listed.

[0040] Reference will now be made to the figures in the attached drawings in which:

- Figure 1 shows a front view of a protective wearable article according to an embodiment of the present disclosure;
- Figure 2 shows a view, from the rear, of a protective wearable article according to the embodiment shown in Figure 1;
- Figure 3 shows a first insert of the wearable article according to the present invention;
- Figure 4 is a detail of the insert shown in Figure 3 of the wearable article shown in Figure 1;
- Figure 4A is a cross-sectional view along the line IV-IV of Figure 4;
- Figure 5 shows a further insert of the wearable article shown in Figure 1;
- Figure 5A is a cross-sectional view along the line V-V of Figure 5;
- Figures 6-8 show a view of possible zones of a human body which are subjected to different situations, for example an elongation;
- Figure 9 shows a user wearing a protective wearable article according to the present disclosure;
- Figure 10 shows a front view of a protective wearable article according to an embodiment of the present disclosure;
- Figure 11 shows a view, from the rear, of a protective wearable article according to the embodiment shown in Figure 1;
- Figure 12 shows a first insert of the wearable article according to the present disclosure;
- Figure 13 is a detail of the insert shown in Figure 12 of the wearable article shown in Figure 10;
- Figure 13A shows a cross-sectional view along the line XIII-XIII of Figure 13;
- Figure 14 shows a further insert of the wearable article shown in Figure 10;
- Figure 14A shows a cross-sectional view along the line XIV-XIV of Figure 14;
- Figures 15-17 show a view of possible zones of a human body which are subjected to different situations, for example elongation;
- Figure 18 shows a user wearing a protective wearable article according to the present disclosure.

[0041] With reference to the accompanying Figures 1-9, the reference number 1 indicates a protective wearable article according to the present disclosure in accordance with a specific example of embodiment. In particular, the protective wearable article 1 is a motorcycle suit, which is made mainly of, or includes, a first material, for example a first anti-abrasion material 8, for example leather. The protective wearable article 1 further com-

prises a plurality of inserts 2, 3, 4, 5 situated in articulation zones of the legs and the arms. In particular, the inserts are inserted on an unexposed side, or inner side, of articulation zones, for example an inner side of an elbow or on an inner side of a leg. This side is a side which is subject to a plurality of working conditions, such as extension, bending, compression and other conditions, depending on the position assumed by the user; or the zones are zones which require a greater breathability or supporting. The zones with folds are visible in schematic form in Figure 9.

[0042] For example, the inserts indicated by the reference number 2, 3 are inserted so as to be situated on an inner side of the arm of the protective wearable article, while the inserts indicated by the reference number 4, 5 are inserted so as to be positioned behind the knees.

[0043] It is to be understood that the inserts shown in the figures are inserted by way of example and the protective wearable article may include other inserts having different characteristics.

[0044] It is to be understood also that the protective wearable article may also be another type of article, such as a jacket, a pair of trousers or a glove, which are made mainly, for example, of an anti-abrasion material.

[0045] With reference to Figures 6-8 it can be seen that the zones and muscles of the human body, mainly the zones of the limbs, are subject to extension, bending, twisting or other specific movements and that these movements are due mainly to the position which the body assumes and the intended use of the protective wearable article.

[0046] As a result an insert 2, 3, 4 and 5 associated with the protective wearable article 1 may be divided, or may comprise, various zones each intended for a different function. For example, with reference to Figure 3, a first zone 10 may be provided for maximum comfort, and a second zone 11 which surrounds the first zone 10 may be provided, again as a comfort zone, but less so than the zone 10. These comfort zones are located in the maximum folding zone of the insert. A third zone, 12, fourth zone 13 and fifth zone 14 are also provided, these requiring respective breathability of the insert since they are located closer to the armpit zones. A perimetral zone 15 is also provided for performing fixing, for example by means of stitching to the remaining first material 8. There are also stronger zones, such as zones providing greater protection against abrasion since they consist of more exposed zones, such as the zones indicated by the reference number 16 and 17, and a support zone 18, having therefore a greater rigidity. An additional maximum comfort zone 19 is provided in the vicinity of the armpits.

[0047] The insert 4, 5 has instead two different zones. A first, central, maximum comfort zone and a surrounding zone 21 which surrounds the central zone 20. The first zone 20 has a greater elasticity, namely an elastic force greater than the surrounding zone 21. In other words, the first zone 20, when subjected to extension or deformation, opposes deformation more than the surrounding

zone 21 or is characterized by an elastic force greater than that of the surrounding zone 21 for returning into the original position. According to one aspect of the present disclosure, in order to form these zones in a single body, the insert 2, 3, 4 and 5 is made by means of knitting and therefore forms a knitted body. In order to obtain zones with different characteristics, each insert may be made using a different thread, having different thicknesses, or using additional threads which impart particular structural and functional properties to the insert, for example they may be elastic threads which are added during knitting.

[0048] The knitted body may be made using a knitting machine, or a flat knitting machine of the known type which includes two needle-beds, namely two rows of needles intended for working of the knitted body. A knitting machine of the known type is a glove-making machine such as that identified by the code SWG0991 N of Shima Seiki.

[0049] The two needle-beds have a needle range with an extension or length which corresponds to a shape dimension, for example shape width or length, of the insert to be obtained. The machine is provided with a first thread-guide supporting a first thread intended to form a part of the knitted body, a second thread-guide which carries a second thread intended to form part of the knitted body, and a third thread-guide which carries a third thread intended to join together the two needle-beds obtained by means of the first thread-guide and the second thread-guide. The machine may include further thread-guides for inserting further threads.

[0050] The machine may be programmed so as to produce the knitted body by means of the first thread-guide which works alternately the thread on the first needle-bed and, alternately, the second thread-guide which works the second thread on the second needle-bed.

[0051] The machine may be programmed so as to join together two opposite zones of the knitted article by means of the third thread carried by the third thread-guide. For example, the machine may be programmed to work certain mesh rows so as to form a number of complete mesh revolutions, and then join together by means of the third thread-guide, and therefore the third thread, given needles of the first needle-bed with given needles of the second needle-bed. Then, a few mesh revolutions may again be worked and knitting then repeated with the third thread. It is understood that a person skilled in the art of using flat knitting machines may be able to program the machine in an optimum manner for obtaining the desired result.

[0052] It is pointed out moreover that the flat knitting machine may also be programmed so as to vary the thread of the first thread-guide depending on the zone of the insert to be formed, for example so as to obtain a zone of greater thickness or with a greater resistance. The machine may also be programmed to insert a further thread of the insert, for example an elastic thread. Moreover, the flat knitting machine may also be programmed

to vary the mesh size, for example modifying the programming by providing a so-called drop stitch, or when a more dense mesh is required, by using a double thread to form the mesh.

[0053] An important aspect associated with the fact that the knitted body is obtained in a single working step is that it is not required to provide stitches in the meshes and therefore the insert does not have an irregular surface.

[0054] With reference to the accompanying Figures 10-19, the reference number 101 indicates a protective wearable article according to the present disclosure in accordance with a specific example of embodiment.

[0055] In particular, the protective wearable article 101 is a motorcycle suit, which is made mainly of, or includes, a first material, for example a first anti-abrasion material 108, for example leather.

[0056] The protective wearable article 101 further comprises a plurality of inserts 102, 103, 104, 105 situated in articulation zones of the legs and the arms. In particular, the inserts are inserted on an unexposed side, or inner side, of articulation zones, for example an inner side of an elbow or on an inner side of a leg. This side is a side which is subject to a plurality of working conditions, such as extension, bending, compression and other conditions, depending on the position assumed by the user; or the zones are zones which require a greater breathability or supporting. The zones with folds are visible in schematic form in Figure 18.

[0057] For example, the inserts indicated by the reference number 102, 103 are inserted so as to be situated on an inner side of the arm of the protective wearable article, while the inserts indicated by the reference number 104, 105 are inserted so as to be positioned behind the knees.

[0058] It is to be understood that the inserts shown in Figures 10-19 are inserts shown by way of example and the protective wearable article may include other inserts having different characteristics.

[0059] It is also to be understood that the protective wearable article may be another type of article, such as a jacket, a pair of trousers or a glove, made mainly, for example, of an anti-abrasion material.

[0060] With reference to Figures 15-17 it can be seen that the zones and muscles of the human body, mainly the zones of the limbs, are subject to extension, bending, twisting or other specific movements and that these movements are due mainly to the position which the body assumes and the intended use of the protective wearable article.

[0061] In accordance with the present disclosure, the insert 102, 103, 104 and 105 has one or more curved zones or regions 110, 119, 120. Each curved region or zone 10, 19, 20 is made of elastic material and is designed to assume an elastically undeformed condition where, in said elastically undeformed condition, said region or zone is in an at least partially curved arrangement and is able to exert a pulling action on a surrounding

zone. The curvature may be obtained by means of an elastic thread knitted together with the knitted body and/or inserted in the knitted body. The arrangement of the thread is such that the extension of said thread increases when the insert is subject to deformation. For example, it may consist of a weft thread.

[0062] Preferably, as mentioned, the curved region or zone 110, 119, 120 is a region which occupies a part of said insert 102, 103, 104 and 105 and said surrounding zone is a region of the insert. For example, the curved region or zone 110, 119, 120 is situated in a central zone of said insert, so as to follow in a localized and precise manner the curvature or anatomy of the human body. The zone occupied by the curved region 110, 119, 120 may be an inner side or intrados side of the protective wearable article 1.

[0063] The localized curvature therefore allows the form of the insert to be adapted precisely to the anatomy of the human body.

[0064] The reasons for this are explained below.

[0065] With reference to Figures 15-17 it can be seen that the zones and muscles of the human body, mainly the zones of the limbs, are subject to extension, bending, twisting or other specific movements and that these movements are due mainly to the position which the body assumes and the intended use of the protective wearable article.

[0066] As a result an insert 102, 103, 104 and 105 associated with the protective wearable article 101 may be divided up, or may comprise, various zones each intended for a different function.

[0067] For example, with reference to Figure 12, a first zone 110 may be provided for maximum comfort (coinciding with the aforementioned curved zone 110) and a second zone 111 which surrounds the first zone 110 may be provided, again as a comfort zone, but requiring less comfort than the zone 110. These comfort zones are located in the maximum folding zone of the insert. A third zone, 112, fourth zone 113 and fifth zone 114 are also provided, these requiring respective breathability of the insert since they are located closer to the armpit zones. A perimetral zone 115 is also provided for performing fixing, for example by means of stitching, to the remaining first material 108 of the protective wearable article. There are also stronger zones, such as zones providing greater protection against abrasion since they consist of more exposed zones, such as the zones indicated by the reference number 116 and 117, and a support zone 118, therefore having a greater rigidity. A further curved zone 119 is provided in the region of the armpits.

[0068] The insert 104, 105 has instead two different zones. A first, central, maximum comfort zone (corresponding to the aforementioned curved zone) and a surrounding zone 121 which surrounds the central zone 120. The first zone 120 has a greater elasticity, namely has an elastic force greater than the surrounding zone 121. In other words, the first zone 120, when subjected to extension or deformation, opposes deformation more than

the surrounding zone 121 or is characterized by an elastic force greater than that of the surrounding zone 121 for returning into the original position.

[0069] According to one aspect of the present disclosure, in order to form these zones in a single body, the insert 102, 103, 104 and 105 is made by means of knitting and therefore forms a knitted body.

[0070] In order to obtain zones with different characteristics, each insert may be made using a different thread, having different thicknesses, or using additional threads which impart particular structural and functional properties to the insert, for example they may be elastic threads which are added during knitting.

[0071] The zones 110, 119 and 120 may be formed as a plain knit using an elastic thread inserted in a tensioned state and moved to the right and left in order to obtain curvature. The knitted body may be made using a knitting machine, or a flat knitting machine of the known type which includes two needle-beds, namely two rows of needles intended for working of the knitted body. A knitting machine of the known type is a glove-making machine such as that identified by the code SWG0991 N of Shima Seiki.

[0072] The two needle-beds have a needle range with an extension or length which corresponds to a shape dimension, for example shape width or length, of the insert to be obtained. The machine is provided with a first thread-guide supporting a first thread intended to form a part of the knitted body, a second thread-guide which carries a second thread intended to form part of the knitted body, and a third thread-guide which carries a third thread intended to join together the two needle-beds obtained by means of the first thread-guide and the second thread-guide. The machine may include further thread-guides for inserting further threads.

[0073] The machine may be programmed so as to produce the knitted body by means of the first thread-guide which works alternately the thread on the first needle-bed and, alternately, the second thread-guide which works the second thread on the second needle-bed.

[0074] The machine may be programmed so as to join together two opposite zones of the knitted article by means of the third thread carried by the third thread-guide. For example, the machine may be programmed to work certain mesh rows so as to form a number of complete mesh revolutions, and then join together by means of the third thread-guide, and therefore the third thread, given needles of the first needle-bed with given needles of the second needle-bed. Then, a few mesh revolutions may again be worked and knitting then repeated with the third thread.

[0075] It is to be understood that a person skilled in the art of using flat knitting machines may be able to program the machine in an optimum manner for obtaining the desired result.

[0076] It is pointed out moreover that the flat knitting machine may also be programmed so as to vary the thread of the first thread guide depending on the zone of

the insert to be formed, for example so as to obtain a zone of greater thickness or with a greater resistance. The machine may also be programmed so as to insert an elastic thread in the insert in the region of the curved zones.

[0077] It is also possible to use a single needle-bed in the curved zones in order to obtain a smaller thickness. In particular, the curved zone may be a simple single-thread mesh. Alternatively, the curved zone may be inside a tubular spacer with a greater elasticity than the surrounding zone.

[0078] Moreover, the flat knitting machine may be programmed to vary the mesh size, for example modifying the programming by providing a so-called drop stitch, or when a more dense mesh is required, by using a double thread to form the mesh.

[0079] An important aspect associated with the fact that the knitted body is obtained in a single working step is that it is not required to provide stitches in the meshes and therefore the insert does not have an irregular surface.

[0080] It should be pointed out that a combination of the embodiment shown in Figures 1-9 and the embodiment shown in Figures 10-19 may be provided.

[0081] The subject-matter of the present disclosure has been described hitherto with reference to preferred embodiments thereof. It is to be understood that other embodiments relating to the same inventive idea may exist, all of these falling within the scope of protection of the claims which are attached below.

Claims

1. Protective wearable article (1) including a first material or first layer (8) and an insert (2, 102, 3, 103, 4, 104, 5, 105) fixed to the first material or first layer (8) and made of a material different from said first material (8), wherein said insert is a single knitted body and wherein the knitted body includes at least a first zone or region (11, 111, 12, 112, 13, 113, 14, 114, 15, 116, 16, 116, 17, 117, 18, 118, 19, 119, 20, 120, 21, 121) and at least a second zone or region (11, 111, 12, 112, 13, 113, 14, 114, 15, 115, 16, 116, 17, 117, 18, 118, 19, 119, 20, 120, 21, 121), or a plurality of zones or regions (11, 111, 12, 112, 13, 113, 14, 114, 15, 115, 16, 116, 17, 117, 18, 118, 19, 119, 20, 120, 21, 121), wherein the first zone or first region (11, 111, 12, 112, 13, 113, 14, 114, 15, 115, 16, 116, 17, 117, 18, 118, 19, 119, 20, 120, 21, 121), or at least a first zone or region of the plurality of regions

has a different thickness compared to the second region or second zone (11, 111, 12, 112, 13, 113, 14, 114, 15, 115, 16, 116, 17, 117, 18, 118, 19, 119, 20, 120, 21, 121) or compared to a second zone or region of the plurality of re-

gions; and/or

is made of a material with a different rigidity and/or tensile strength compared to the material of the second region or second zone (11, 111, 12, 112, 13, 113, 14, 114, 15, 115, 16, 116, 17, 117, 18, 118, 19, 119, 20, 120, 21, 121) or compared to a second zone or region of the plurality of regions; and/or

is made of a material with a different breathability compared to the material of the second region or second zone (11, 111, 12, 112, 13, 113, 14, 114, 15, 115, 16, 116, 17, 117, 18, 118, 19, 119, 20, 120, 21, 121) or compared to a second zone or region of the plurality of regions; and/or

is made of a material with a different elasticity or elastic force compared to the material of the second region or second zone (10, 110, 19, 119, 20, 120) or compared to a second zone or region of the plurality of regions.

2. Protective wearable article (1, 101) according to claim 1, wherein the first zone or first region (10, 110, 19, 119, 20, 120) is made of a material with an elasticity or elastic force greater than the elasticity or elastic force of the second zone and is able to assume an undeformed or non-deformed condition, wherein, in said undeformed or non-deformed condition, said first region or first zone is able to assume a curved form or curved profile.

3. Protective wearable article (1, 101) according to claim 2, wherein the first zone or first region (10, 110, 19, 119, 20, 120) has a thickness smaller than the second zone or region.

4. Protective wearable article (1, 101) according to claim 2 or 3, wherein the first zone or first region (10, 110, 19, 119, 20, 120) is designed to follow an anatomical curve of a part of the user's body.

5. Protective wearable article (1, 101) according to any one of claims 2 to 4, wherein said second zone or second region is a zone surrounding the first region or first zone.

6. Protective wearable article (1, 101) according to any one of claims 2 to 5, wherein said first region or zone (10, 110, 19, 119, 20, 120) is situated in a central zone of said insert.

7. Protective wearable article (1, 101) according to any one of the preceding claims 2 to 6, wherein the first zone or region (10, 110, 19, 119, 20, 120) has an elastic thread inserted in the knitted body, wherein an extension of said thread increases when the insert is subjected to a deformation or tensile force.

8. Protective wearable article (1, 101) according to any

one of the preceding claims, wherein the entire insert is made of elastic material.

9. Protective wearable article (1, 101) according to any one of the preceding claims, wherein the wearable protective article (1) is designed to occupy an articulation zone of a user's body, and said insert (2, 102, 3, 103, 4, 104, 5, 105) is designed to be situated so as to cover an articulation zone.
10. Protective wearable article (1, 101) according to claim 9, wherein said articulation zone defines a curve and said protective wearable article (1, 101) has an intrados side and an extrados side in the region of said articulation zone, and wherein said insert (2, 102, 3, 103, 4, 104, 5, 105) is situated on an intrados side of said articulation zone or on an extrados side of said articulation zone.
11. Protective wearable article (1, 101) according to any one of the preceding claims, wherein said insert (2, 102, 3, 103, 4, 104, 5, 105) is situated on an inner side of an arm of the protective wearable article (1, 101) and more preferably at least on an inner side of an elbow.
12. Protective wearable article (1, 101) according to any one of the preceding claims, wherein said insert (2, 102, 3, 103, 4, 104, 5, 105) is situated on a rear side of a knee of the protective wearable article (1, 101).
13. Protective wearable article (1, 101) according to any one of the preceding claims, wherein said first layer or first material (8, 108) is an abrasion-resistant material.
14. Protective wearable article (1, 101) according to any one of the preceding claims, wherein said article is a motorcycle garment or a motorcycle suit or a garment for dynamic activities.
15. Protective wearable article (1, 101) according to any one of the preceding claims, wherein said insert is devoid of sewn parts.
16. Protective wearable article (1, 101) according to any one of the preceding claims, including a plurality of said first zones and a plurality of said second zones.
17. Method for manufacturing a protective wearable article (1, 101), the method comprising the steps of:

preparing a first material or first layer (8) and an insert (2, 102, 3, 103, 4, 104, 5, 105) made of a material different from said first material (8),
fixing the insert to the first material or first layer (8) and wherein said insert is a single knitted body,

wherein the knitted body includes at least a first zone or region (11, 111, 12, 112, 13, 113, 14, 114, 15, 115, 16, 116, 17, 117, 18, 118, 19, 119, 20, 120, 21, 121) and at least a second zone or region (11, 111, 12, 112, 13, 113, 14, 114, 15, 115, 16, 116, 17, 117, 18, 118, 19, 119, 20, 120, 21, 121) or a plurality of zones or regions (11, 111, 12, 112, 13, 113, 14, 114, 15, 115, 16, 116, 17, 117, 18, 118, 19, 119, 20, 120, 21, 121), wherein the first zone or first region (11, 111, 12, 112, 13, 113, 14, 114, 15, 115, 16, 116, 17, 117, 18, 118, 19, 119, 20, 120, 21, 121), or at least a first zone or region of the plurality of regions

has a different thickness compared to the second region or second zone (11, 111, 12, 112, 13, 113, 14, 114, 15, 115, 16, 116, 17, 117, 18, 118, 19, 119, 20, 120, 21, 121) or compared to a second zone or region of the plurality of regions; and/or

is made of a material with a rigidity and/or tensile strength different compared to the material of the second region or second zone (11, 111, 12, 112, 13, 113, 14, 114, 15, 115, 16, 116, 17, 117, 18, 118, 19, 119, 20, 120, 21, 121) or compared to a second zone or region of the plurality of regions; and/or

is made of a material with a different breathability compared to the material of the second region or second zone (11, 111, 12, 112, 13, 113, 14, 114, 15, 115, 16, 116, 17, 117, 18, 118, 19, 119, 20, 120, 21, 121) or compared to a second zone or region of the plurality of regions; and/or

is made of a material with a different elasticity or elastic force compared to the material of the second region or second zone (10, 110, 19, 119, 20, 120) or compared to a second zone or region of the plurality of regions.

18. Method according to claim 17, wherein the insert (2, 102, 3, 103, 4, 104, 5, 105) is manufactured in a single working step by means of a knitting machine.

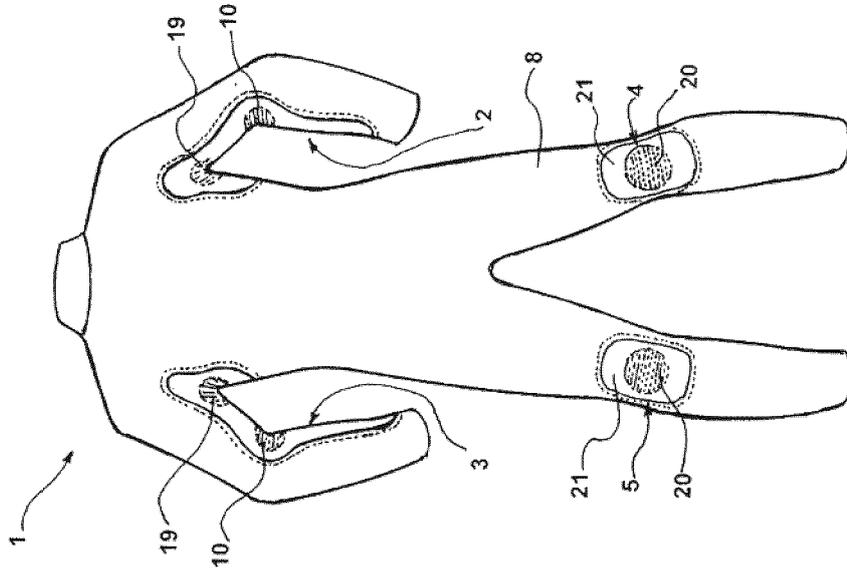


FIG. 2

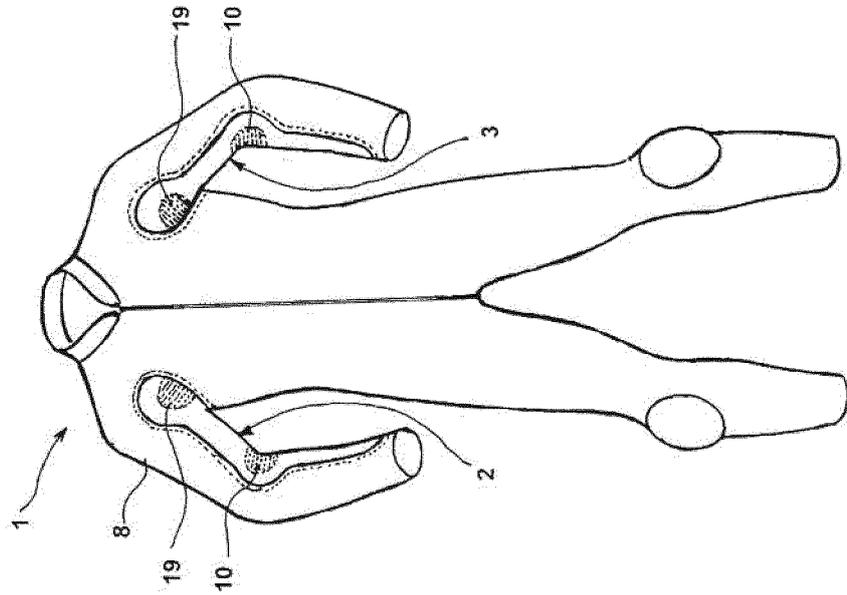


FIG. 1

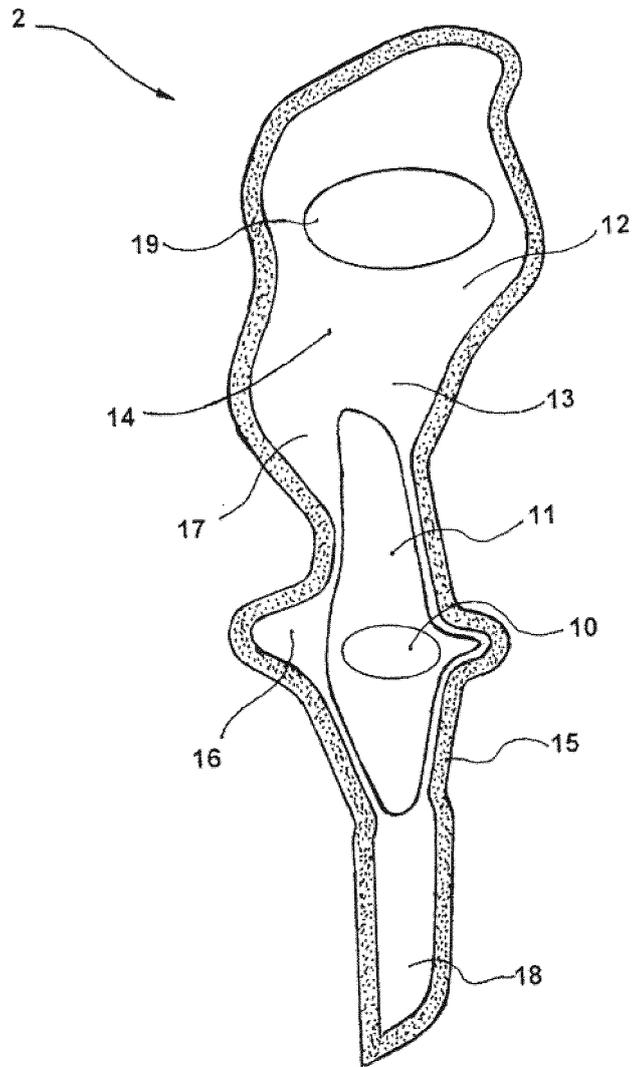


FIG. 3

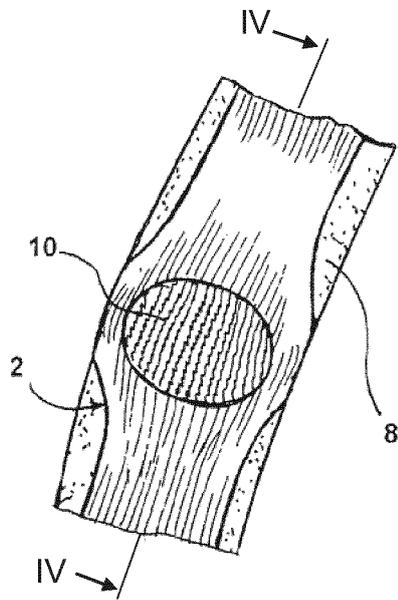


FIG. 4

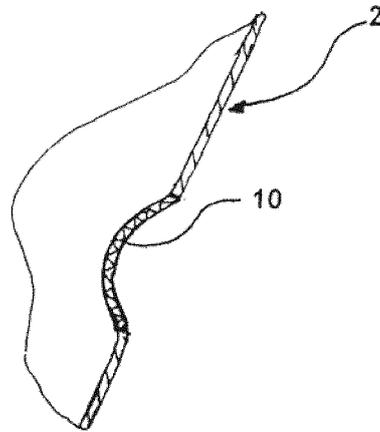


FIG. 4A

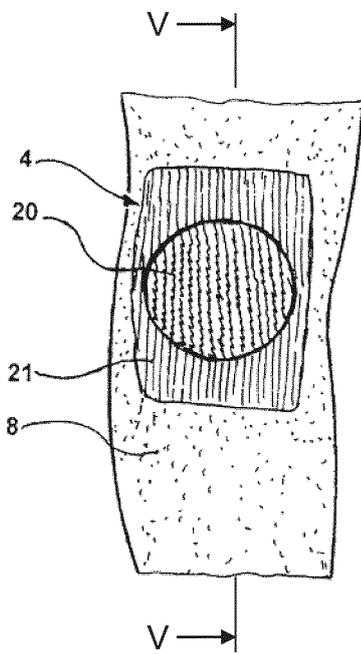


FIG. 5

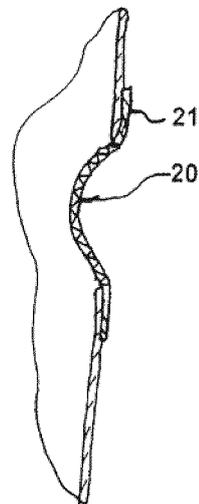


FIG. 5A

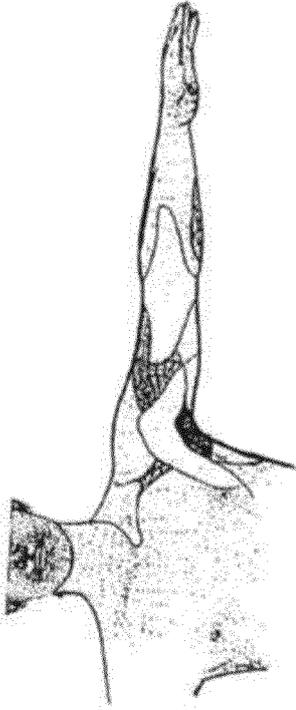


FIG. 7

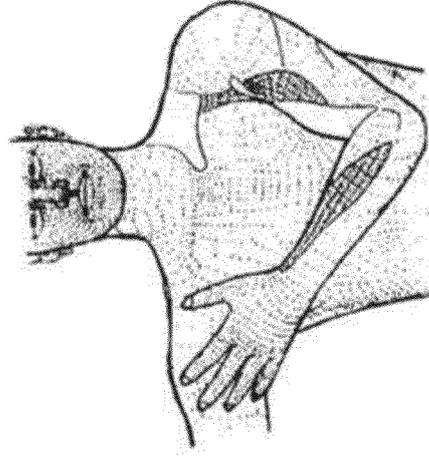


FIG. 8

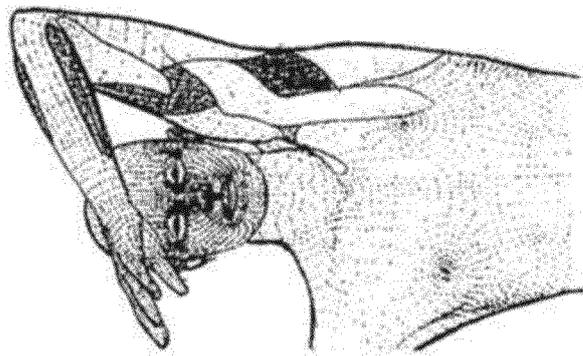


FIG. 6

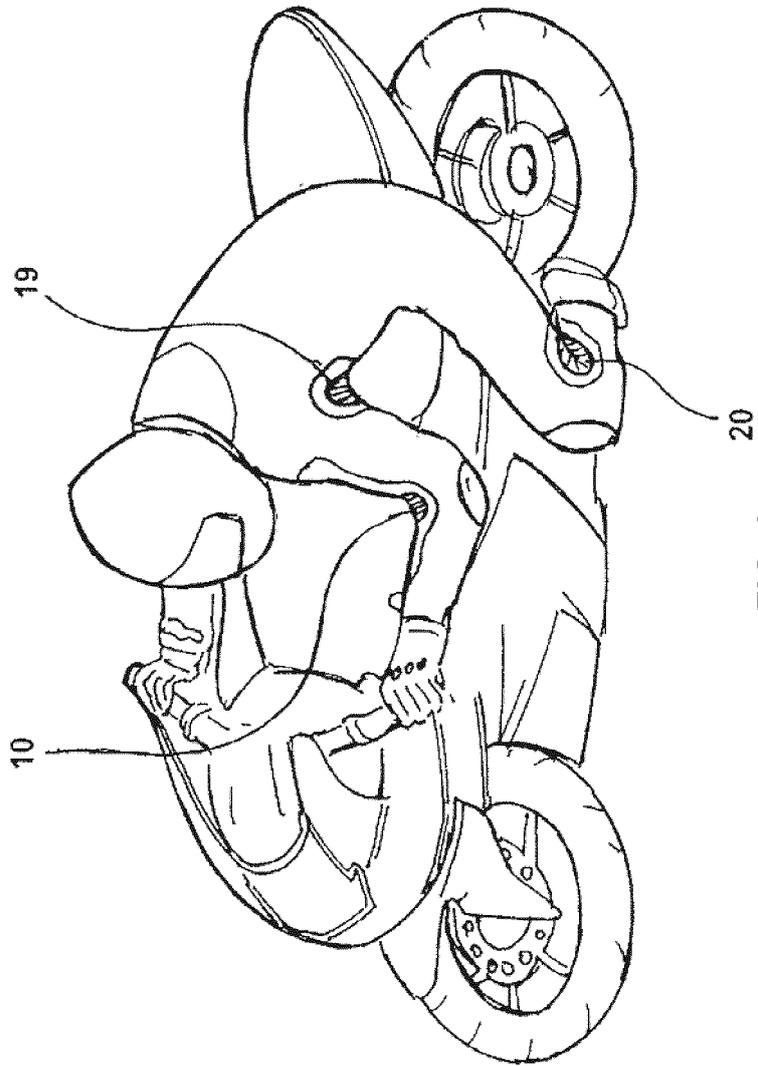


FIG. 9

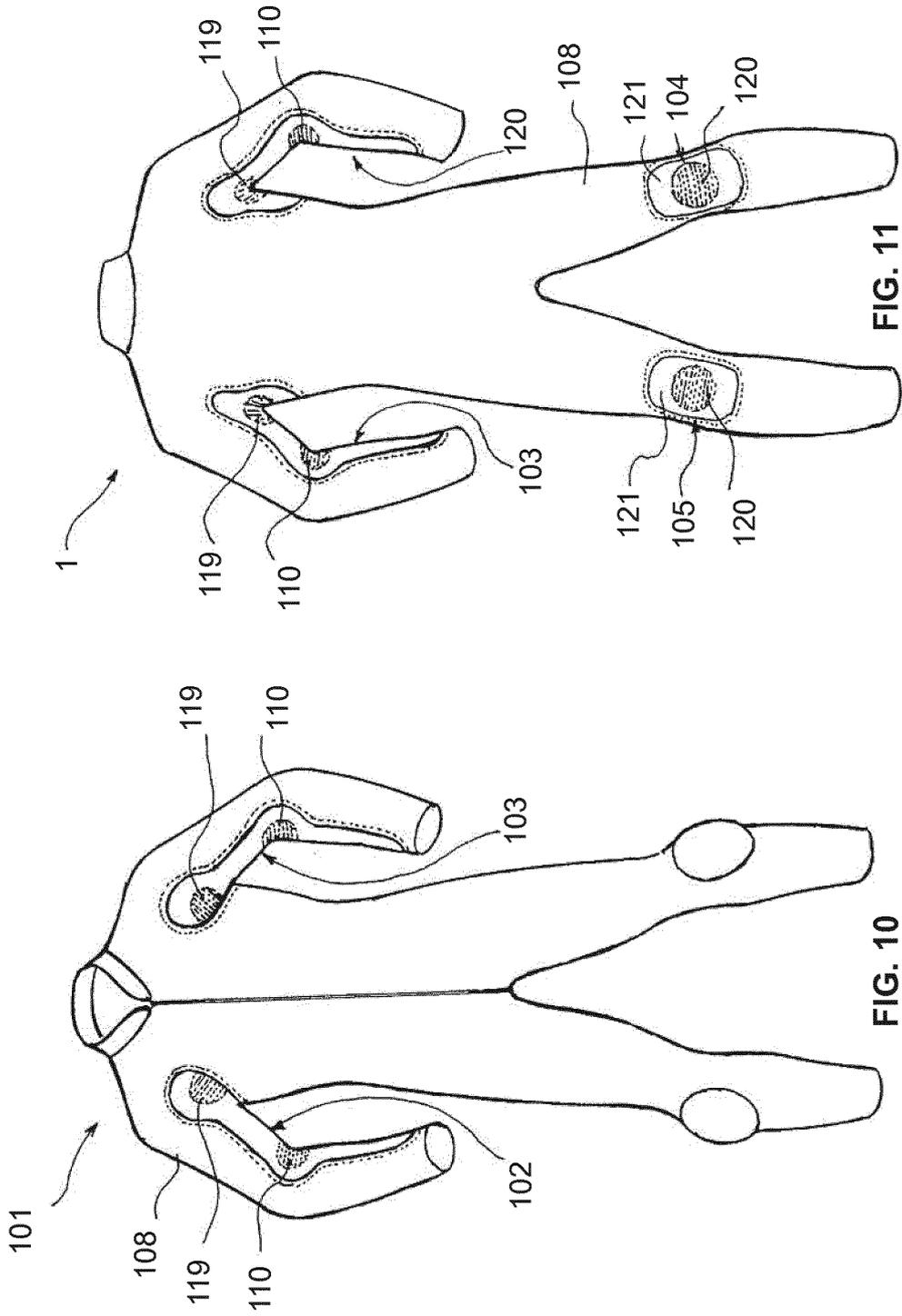


FIG. 11

FIG. 10

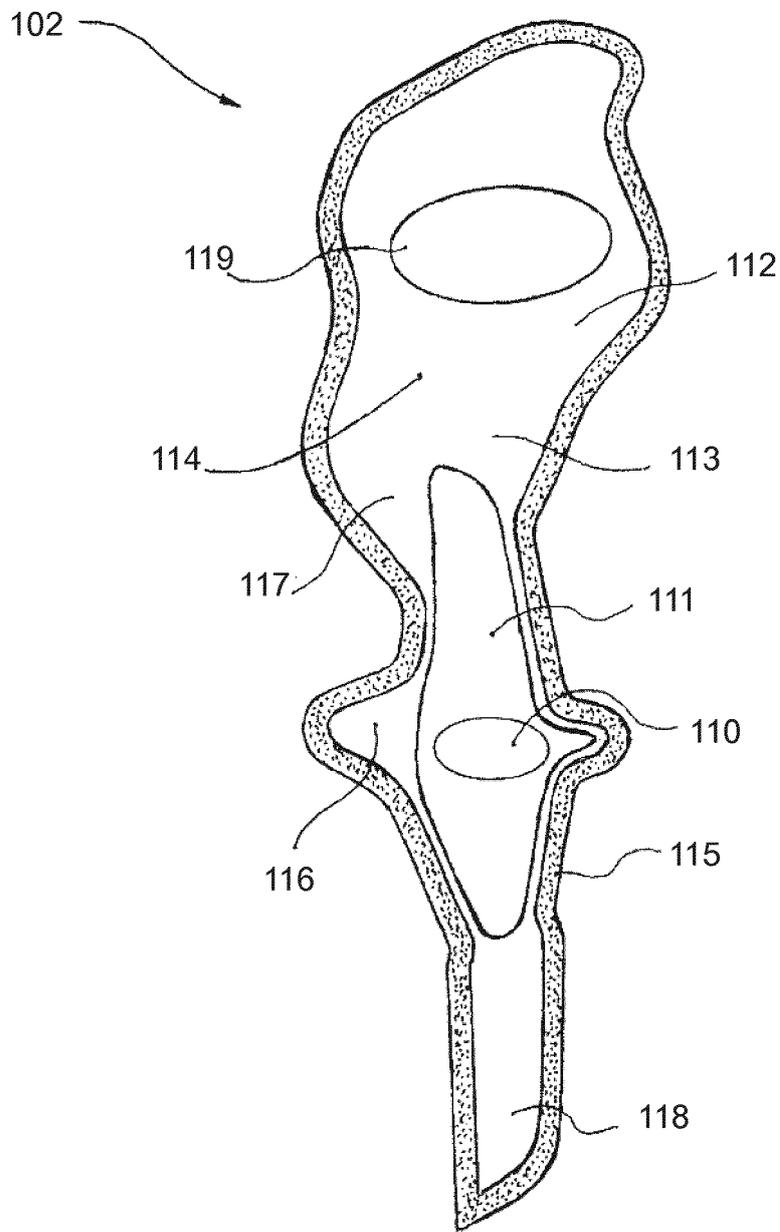


FIG. 12

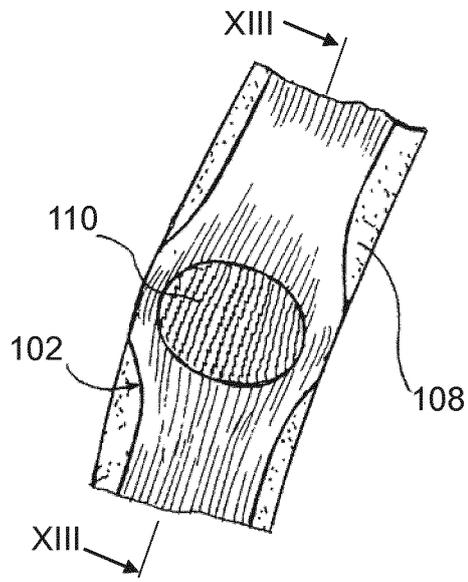


FIG. 13

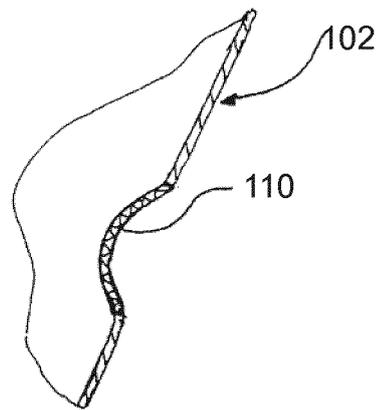


FIG. 13 A

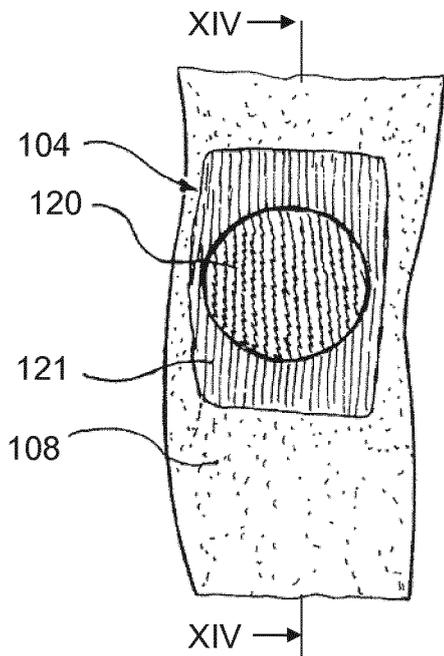


FIG. 14

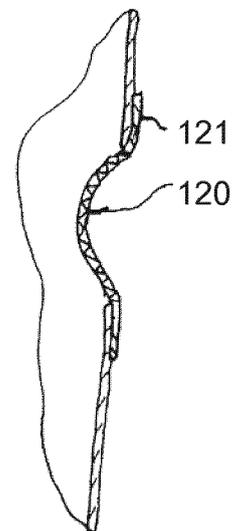


FIG. 14 A

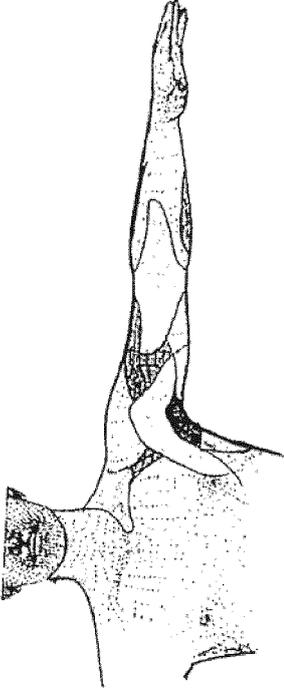


FIG. 16

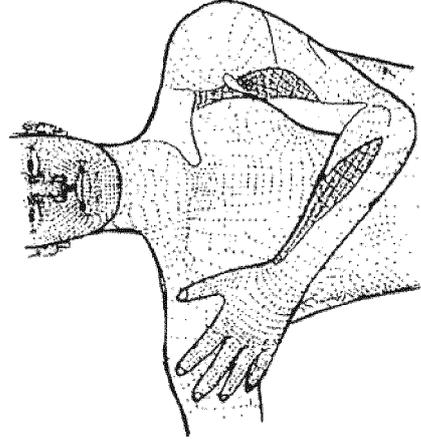


FIG. 17

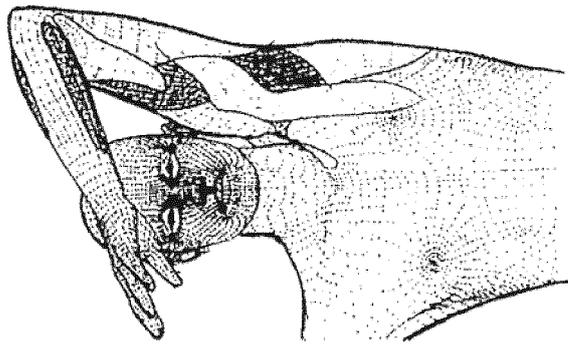


FIG. 15

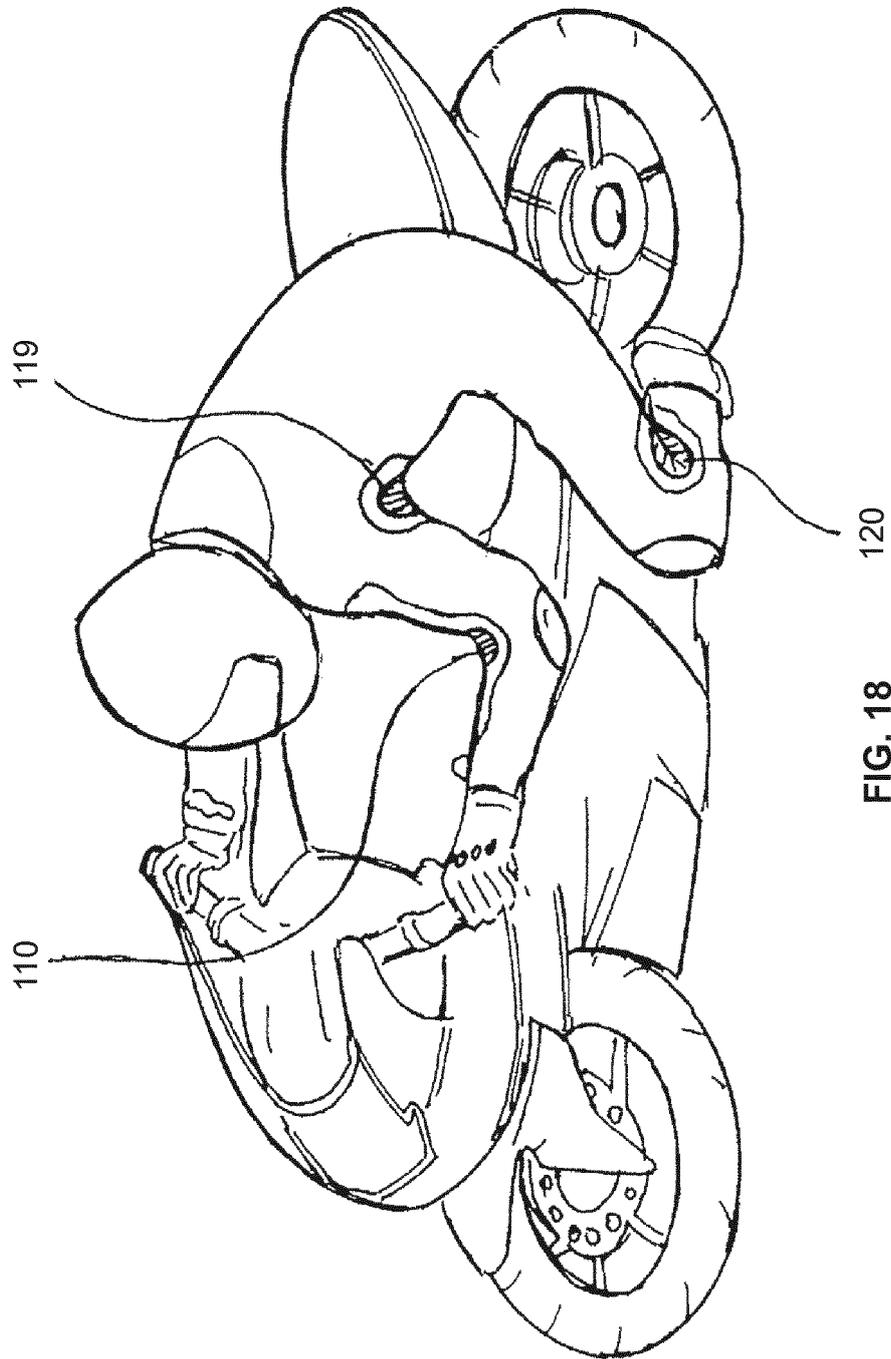


FIG. 18



EUROPEAN SEARCH REPORT

Application Number
EP 17 18 4356

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Place of search The Hague		Date of completion of the search 31 October 2017	Examiner Thielgen, Robert
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ON EUROPEAN PATENT APPLICATION NO.

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5 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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