



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
23.03.2022 Bulletin 2022/12

(51) International Patent Classification (IPC):
A41D 1/08 (2018.01) **A41D 31/18** (2019.01)

(21) Application number: **21188296.4**

(52) Cooperative Patent Classification (CPC):
A41D 1/08; A41D 31/185; A41D 2400/38;
A41D 2500/54

(22) Date of filing: **28.07.2021**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(72) Inventors:
• **AMORUSO, Joseph London**
16039 SESTRI LEVANTE (GE) (IT)
• **BELLINI, Luca**
16043 CHIAVARI (GE) (IT)

(74) Representative: **Kratter, Carlo et al**
Giambrocono & C. s.p.a.
Via Rosolino Pilo 19 b
20129 Milano (IT)

(30) Priority: **16.09.2020 IT 202000021865**

(71) Applicant: **LB9 Brand S.r.l.**
16043 Chiavari (GE) (IT)

(54) **COMPRESSION GARMENT, AND FABRIC FOR MAKING THE COMPRESSION PARTS OF A COMPRESSION GARMENT**

(57) A compression garment of the type comprising: a portion of base fabric (1A, 1B; 1A', 1B') that surrounds and encloses at least one first portion, having a substantially annular shape, of the anatomy of a person wearing the garment, in particular at least one portion of the arms or legs, wherein said portion of base fabric (1A, 1B; 1A', 1B') exerts a first compressive force on said first portion of the anatomy of the person wearing the garment, and an elastomer printed on at least said portion of base fabric (1A, 1B; 1A', 1B') so as to surround it too, at least partially, said first portion of the person's anatomy and adapted to exert a second compressive force on the first portion of the of the anatomy of the person wearing the garment; wherein the total compressive force applied by the compression garment at a given position of the first portion of the anatomy of the person wearing the garment is the sum of the first compressive force and the second compressive force at that garment position; and wherein: the elastomer is divided into a plurality of printed micro elements (2, 2'), whose maximum dimensions (T, T') are between 5 cm and 0.01 cm, more preferably between 2 cm and 0.1 cm, wherein the size and/or density of said micro elements decrease going from said lower end parts (3A, 3B; 3A', 3B') of the portions of base fabric (1A, 1B; 1A', 1B') of the garment, provided at the extremities of the person wearing the garment, to upper parts (4A 4B; 4A', 4B') of the portions of base fabric (1A, 1B; 1A', 1B') of the garment provided at the torso of the person wearing the garment, so as to reduce said second compressive force going from said lower end parts (3A, 3B; 3A', 3B') to said upper parts (4A 4B; 4A', 4B'), that is going from

the extremities of the person wearing the garment to the torso of the person wearing the garment.

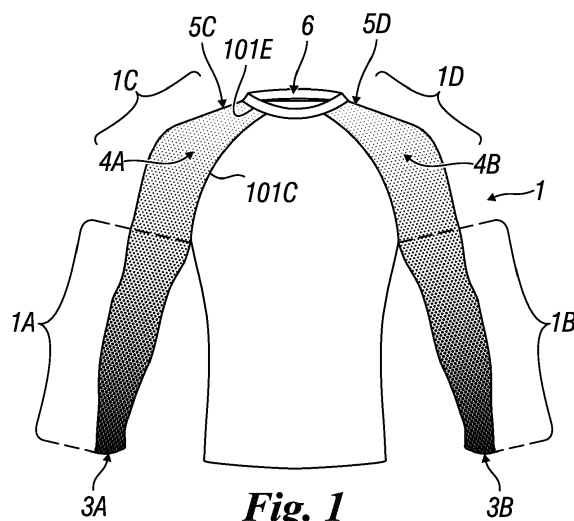


Fig. 1

Description

[0001] Object of the present invention is a compression garment, and a fabric for making the compression parts of a compression garment, according to the pre-characterizing part of the independent claims.

[0002] In the field of sportswear, the term "compression" identifies a category of garments comprising parts which are designed to compress certain muscles of the person wearing the garment, during a physical exercise, increasing their strength, reducing fatigue, reducing vibrations and muscle micro traumas, improving performance and facilitating recovery.

[0003] Compression garments are known in which compression is obtained using a highly elastic fabric comprising for this purpose a high percentage (for example greater than 15%) of a yarn of the "elastane" or "spandex" type, for example of the type marketed with brands: Lycra (Invista), Elasthan (Invista), Dorlastan (Asahi), Roica (Asahi), Linel (Fillattice), so the person wears the garment reduced by one or more sizes compared to that usual for him/her in order to create a compression on the muscle bands. This solution is not particularly effective because, due to the physical differences between one person and another, the garment fabric only partially adapts to the wearer's body, and in any case not adequately to achieve the desired effects; moreover it does not create any real areas of gradual compression.

[0004] Other garments are known in which the compression effect is obtained by associating the fabric of the garment in certain positions with silicone bands adapted to activate the neuromuscular system; the major drawback, in this solution, too, is related to the fact that the muscle bands of the various people are not always the same; consequently two people can wear a garment of the same size but be muscularly very different from each other and therefore not be able to benefit from these garments and have real gradual compression areas.

[0005] WO 2019/191498 describes an energizing garment that in particular is capable of acting on the lymphatic system of the wearer's body to stimulate circulation and smooth/reduce cellulite (in this regard, see for example paragraphs 3, 4, 29 and 30).

[0006] The invention described in this document relates to the making of a compression garment comprising a compression material formed by one or more layers and with one or more parts secured together, wherein the following elements are secured to said compression material:

- a plurality of watershed fingers positioned about at least one portion of a lymphatic watershed of the garment and configured to stimulate at least one portion of this lymphatic watershed of the user to encourage the fluid flow along at least said lymphatic watershed,
- and a plurality of massage fingers positioned about at least one non-watershed portion of the garment, arranged in such a way that they define a fluid path for passage of fluid from one non-watershed portion to a pathway for the passage of fluids from the at least one non-watershed portion to the at least one watershed.

[0007] WO 2019/191498 teaches to generate a compressive force by using the compression material the garment itself is made of; WO 2019/191498 also teaches to provide the watershed fingers and massage fingers on said compression material which do not have a compressive purpose but have the purpose of selectively activating the watershed regions and/or massaging the non-watershed region in order to reduce cellulite. To this purpose WO 2019/191498 teaches to position the watershed fingers and the massage fingers on said compression material only and exclusively in certain predefined patterns, which follow the lymphatic watersheds for the watershed fingers, and follow the non-watershed regions for the massage fingers.

[0008] US 2007/074328 relates to an article of apparel having a cylindrical portion, such as an arm region or a leg region for extending around a joint of the wearer of the article of apparel itself. The cylindrical portion includes a textile material and a pattern located on a surface of the textile material. The pattern has: a first density in at least one area of the cylindrical portion oriented substantially parallel to a plane of bending of the joint, and the pattern has a second density in at least one area of the cylindrical portion oriented substantially perpendicular to the plane of bending of the joint.

[0009] The teaching of US 2007/074328 is that the higher density due to the pattern printed on the textile material varies the stretch resistance of the article of apparel. The purpose of the pattern printed on the textile material is not to increase the compression exerted by the article of apparel for example on an arm, but to vary the stretch resistance of the article of apparel at the joints, for example at the elbow. To this purpose, the density of the pattern has a non-uniform development and has a plurality of vertical areas, in which each vertical area has its own development in the density of the elements forming the pattern, and in which in any case the density of the elements of the patterns of each of said vertical areas first decreases, then increases and then decreases again, or vice versa (as shown for example in Figure 6 of US 2007/074328).

[0010] US 2018/279696 relates to a garment to facilitate weight loss. US 2018/279696 explicitly states (see paragraph 42) that the invention is not intended to portray a supplement to physical activity; rather, it is a tool that can aide people who want temporary weight-loss and who seek to reduce their weight through some depletion of water weight by perspiration.

[0011] The concept is also reiterated in paragraph 5 where it is said that there is a need for a water weight-loss garment that is light, thin and fashionable, and that can be worn as a regular outfit. US 2018/279696 does not therefore describe a compression garment.

[0012] US 2018/279696 describes a compression garment for use in sport which allows to improve athletic performance, and teaches, to this purpose, to provide a first material on the inner face of the garment and a second material on the outer face, wherein these materials are adapted to vary the modulus of elasticity of the garment and ultimately the extent and position of the compression exerted by the garment itself. These first and second materials form a sort of "taping" on the garment. US 2018/279696 does not suggest making silicone microelements on the garment, but printing a silicone film or ink, i.e. a continuous silicone element.

[0013] The object of the present invention is to make a compression garment, a fabric for making said garment, and a method for making this garment, which overcome the drawbacks of known compression garments and wherein the compression parts of the garment adapt to the different physical/muscular characteristics of the wearer, in order to guarantee an effective compression effect, even if the garment is worn by people who do not have identical or similar physical/muscular characteristics.

[0014] A further object is to provide a fabric which is simple and easy to produce.

[0015] These and other objects which will be evident to one skilled in the art are achieved by a garment and a fabric according to the characterizing part of the attached claims.

[0016] For a better understanding of the present invention, there are attached, by way of non-limiting example, the following drawings, wherein:

Figure 1 shows a front schematic view of a first embodiment of a garment according to the invention,
 Figure 2 shows a rear schematic view thereof,
 Figures 3A and 3B show first enlargements of parts of Figures 1 and 2,
 Figures 4A-C show second further enlargements of the parts indicated by the arrows IVA-C of Figure 3A,
 Figure 5 shows a front schematic view of a second embodiment of a garment according to the invention,
 Figure 6 shows a rear schematic view thereof,
 Figures 7A and 7B show first enlargements of parts of Figures 5 and 6,
 Figures 8A-C show second further enlargements of the parts indicated by the arrows IVA'-C' of Figure 3A,
 Figure 9 shows a fabric for making a compression part of the garment referred to in Figure 1,
 Figures 10 A-E show enlargements of the parts indicated by the arrows XA-XE of Figure 9.

[0017] With reference to Figures 1-4, they show a first embodiment of a compression garment according to the invention, indicated as a whole with 1, wherein the garment is a long-sleeved shirt.

[0018] The compression garment 1 comprises:

- a portion of base fabric 1A, 1B that surrounds and encloses at least one portion, having a substantially annular shape, of the arms (fig. 1) (and/or of the legs as will be discussed below) of a person wearing the garment, wherein said portion of base fabric 1A, 1B exerts a first compressive force on said at least one portion of the arms, b) and an elastomer printed on at least said portion of base fabric 1A, 1B so as to surround it too, at least partially, said at least one portion of the arms and adapted to exert a second compressive force on the first portion of the anatomy of the person wearing the garment, wherein the total compressive force applied by the compression garment at a given position on said at least one portion of the arms is the sum of the first compressive force and the second compressive force at that position of the garment.

[0019] In this context, elastic base fabric not only refers to an elastic element which is actually made by weaving but it also refers to any substantially two-dimensional elastic body, of a conventional type for one skilled in the art, adapted to cover and fit the body of the person wearing the garment.

[0020] It should be noted that in figures 1-4 the elastomer has been graphically represented with a black colouring while the base fabric has been represented with a white colouring.

[0021] The total compressive force applied by the compression garment at a given position of the first portion of the anatomy of the person wearing the garment (in the example of Figs. 1-4 along the arms) is the sum of the first compressive force and the second compressive force at that position of the garment.

[0022] According to the invention:

- the elastomer printed on at least said portion of base fabric 1A, 1B is divided into a plurality of printed micro elements 2 whose maximum dimensions T, are between 5 cm and 0.01 cm, more preferably between 2 cm and 0.1 cm,
- wherein the portion of base fabric 1A, 1B comprises: lower parts 3A, 3B, provided closer to the end portions of the arms of the person wearing the garment, for example the wrists, and upper parts 4A 4B provided closer to the torso

of the person wearing the garment,

- wherein the size and/or density of said micro elements are maximum only at said lower parts 3A, 3B of said portion of base fabric 1A, 1B, and are minimum only at said upper parts 4A 4B of said portion of base fabric 1A, 1B, and that the size and/or density of said micro elements continuously decrease going from said lower parts 3A, 3B to said upper parts 4A, 4B of said portion of base fabric 1A, 1B, so that said second compressive force is maximum at said lower parts 3A, 3B and is minimum at said upper parts 4A 4B and continuously reduces going from said lower parts 3A, 3B to said upper parts 4A, 4B, that is going from the extremities of the person wearing the garment to the torso of the person wearing the garment.

[0023] Preferably, the elastomer printed on at least said portion of base fabric 1A, 1B of at least one portion of the arms and/or legs only provides said micro elements whose size and/or density decrease continuously.

[0024] Preferably, at least one plurality of the micro elements is positioned on the portion of base fabric 1A, 1B along a plurality of annular portions Z, which surround corresponding annular portions of the arms and/or legs, and all the micro elements of each of said annular portions Z have equal size and/or density, so that all said micro elements of each of said annular portions of micro elements exert a substantially equal compressive force on the corresponding portion of the arms and/or legs.

[0025] In this context, density of the elastomer micro elements refers to the ratio between the surface of base fabric of the garment covered by the elastomer micro elements and the surface of this base fabric free from these micro elements, namely:

$$\text{Fabric surface covered by micro elements (Stc)}$$

$$\text{Density} = \frac{\text{Fabric surface covered by micro elements (Stc)}}{\text{Free fabric surface (Stl)}}$$

$$\text{Free fabric surface (Stl)}$$

[0026] This is calculated, for example, by dividing the base fabric which includes the elastomer micro elements, into a plurality of annular bands F1-Fn (shown in Fig. 4 A) all having an equal height H, for example a height between 5 cm and 1 cm, and calculating for each annular band the values of the fabric surface covered by micro elements (Stc) and of the free fabric surface (Stl).

[0027] The term dimensions of the micro elements refers to the flat dimensions of the micro elements, that is their length and/or width or diameter.

[0028] In this context, torso refers to that part of the human body to which the upper limbs (that is the arms) and the lower limbs (that is the legs) are connected, that is that part of the body comprising, among other parts, the shoulders and the hip.

[0029] By continuously decreasing of the size and/or density of the micro elements going from the lower end parts 3A, 3B to the upper parts 4A 4B of the portion of base fabric 1A, 1B in this context it is meant that the size and/or density of said micro elements vary from an absolute maximum value to an absolute minimum value without further intermediate maximum and/or minimum values. Continuous variation does not necessarily means either a uniform, or linear, or regular variation; these types of variation are preferred, but not essential for the invention. According to the invention, in fact, the decrease in the size and/or density of the micro elements could be less marked in a first determined portion of the base fabric, for example the one going from the wrists to the elbow, and then be more marked in a second determined portion of the base fabric, for example the one going from the elbow to the shoulders; or vice versa.

[0030] According to a preferred embodiment of the invention all the micro elements or at least part of them (for example more than 50%, more preferably more than 80%) have an equal regular shape, for example a circular or regular polygonal shape, such as a square, rectangular, hexagonal, triangular shape.

[0031] This feature makes the micro element printing process quicker and easier.

[0032] Advantageously, the micro elements have decreasing dimensions (for example the diameter, or the diagonal) going from the lower end parts 3A, 3B of the portions of base fabric 1A, 1B of the garment to the upper parts 4A, 4B of the portions of base fabric 1A, 1B; this technical feature is even more advantageous if combined with the previous one relating to the fact that the microelements have all or at least part of them (for example more than 50%, more preferably more than 80%, even more preferably more than 100%) an equal regular shape.

[0033] This feature also makes the micro element printing process quicker and easier.

[0034] Advantageously, the micro elements have uniformly decreasing dimensions (for example the diameter, or the diagonal) going from the lower end parts 3A, 3B of the portions of base fabric 1A, 1B of the garment to the upper parts 4A, 4B of the portions of base fabric 1A, 1B, and for example the dimension of the micro elements (for example their diameter) decreases by a percentage which is almost equal (almost equal meaning a difference between +/- 5%) to the percentage of decrease in the surface of the fabric including the elastomer; so, if for example with 100% printed fabric

comprising the micro elements, these have a diameter of 0.57 cm, with 90% printed fabric comprising the micro elements, these have a diameter of 0.512 cm, with 80% of printed fabric the diameter drops to about 0.457 cm and with 70% of printed fabric the diameter drops to 0.399 cm, and so on, up to when with 10% of printed fabric the diameter is 0.057.

[0035] It should be noted that, as shown in Figures 1 and 2, the printed elastomer micro elements can also be provided in the garment areas that do not completely surround or enclose an anatomical part of the body of the person wearing the garment, for example in figures 1, 2 these micro elements are also arranged at the upper parts 1C, 1D of the arms and shoulders, in these parts the garment has a lower compressive force than the other parts 1A, 1B previously discussed because the garment does not tighten annularly, therefore completely, the arm. However, it has been experimentally verified that the addition of the micro elements also in these non-annular parts 1C, 1D of the garment contributes to stiffen and make the base fabric less elastic, which fabric in this area has therefore an increased support effect on the musculature, compared to other parts of the garment without elastomer micro elements and in any case also has a compressive, albeit reduced effect, compared to that of the areas 1A, B. Also in the areas 1C, 1D the conformation, sizing and distribution of the micro elements is the same as in the previously described areas 1A, 1B. Advantageously, therefore, in the areas 1C, 1D the size and/or the density of said micro elements decrease going towards the upper parts 5C, 5D of the garment provided at the upper part of the shoulders and/or the opening 6 for the neck, so as to reduce the compressive force exerted by said micro elements going towards said opening, that is going from the extremities of the person wearing the garment to the upper part of the shoulders and/or the neck of the person wearing the garment. Advantageously, the decrease in the size and/or density of the micro elements in the areas 1C, 1D follows the same decreasing development of the micro elements of the areas 1A, 1B, so that there is a continuous and preferably uniform decrease of the micro elements from the lower end parts 3A, 3B to the upper parts of the garment 5C, 5D provided at the shoulders and/or the opening for the neck 6.

[0036] Advantageously, the development of the size and/or density of the micro elements decreases, preferably uniformly, even more preferably substantially linearly (the term "substantially" is intended to indicate possible deviations equal to +/- 5%), going from the lower end parts 3 A, B, that is from the cuffs, in which it is maximum, to the upper parts 5C, D provided at the upper part of the shoulders and/or collar, where it is minimum.

[0037] Figures 5-8 show a second embodiment of a garment according to the invention wherein the garment is trousers that entirely cover the legs. The parts or components of this second garment shared with the previously described garment will be indicated with the same numbering used for the first garment with the addition, however, of a superscript. The compression garment 1' comprises:

- a portion of base fabric 1A', 1B' which surrounds and encloses at least one portion, having a substantially annular shape, of the legs of a person wearing the garment wherein said portion of base fabric 1A', 1B' exerts a first compressive force on said at least one portion of the legs b) and an elastomer printed on at least said portion of base fabric 1A', 1B' so as to surround it too, at least partially, said at least one portion of the legs and adapted to exert a second compressive force on the first portion of the anatomy of the person wearing the garment, wherein the total compressive force applied by the compression garment at a given position on said at least one portion of the legs is the sum of the first compressive force and the second compressive force at that garment position.

[0038] According to the invention:

- the elastomer printed on at least said portion of base fabric 1A', 1B' is divided into a plurality of printed micro elements 2', whose maximum dimensions T' are between 5 cm and 0.01 cm, more preferably between 2 cm and 0.1 cm,
- wherein the portion of base fabric 1A', 1B' comprises: lower parts 3A', 3B', provided closer to the leg end parts of the person wearing the garment, for example the ankles, and upper parts 4A', 4B', provided closer to the torso of the person wearing the garment,
- wherein the size and/or density of said micro elements are maximum only at said lower parts 3A', 3B' of said portion of base fabric 1A', 1B', and are minimum only at said upper parts 4A', 4B' of said portion of base fabric 1A', 1B', and the size and/or density of said micro elements continuously decrease going from said lower parts 3A', 3B' to said upper parts 4A', 4B' of said portion of base fabric 1A', 1B', so that said second compressive force is maximum at said lower parts 3A', 3B' and is minimum at said upper parts 4A', 4B' and continuously reduces going from said lower parts 3A', 3B' to said upper parts 4A', 4B', that is going from the extremities of the person wearing the garment to the torso of the person wearing the garment.

[0039] Preferably, the elastomer printed on at least said portion of base fabric 1A, 1B of at least one portion of the arms and/or legs only provides said micro elements whose size and/or density decrease continuously.

[0040] Preferably, at least one plurality of the micro elements is positioned on the portion of base fabric 1A', 1B' along a plurality of annular portions Z', which surround corresponding annular portions of the arms and/or legs, and all the micro elements of each of said annular portions Z' of micro elements have equal size and/or density, so that said micro

elements of each of said annular portions of micro elements all exert substantially equal compressive force on the corresponding portion of the arms and/or legs.

[0041] In this context, density of the elastomer micro elements refers to the ratio between the surface of the base fabric of the garment covered by the elastomer micro elements and the surface of this base fabric free from these micro elements, namely:

$$\text{Density} = \frac{\text{Fabric surface covered by micro elements (Stc)}}{\text{Free fabric surface (Stl)}}$$

[0042] This is calculated, for example, by dividing the base fabric which includes the elastomer micro elements, into a plurality of annular bands F1'-Fn' (shown in Fig. 8 A) all having an equal height H', for example a height between 5 cm and 1 cm, and calculating for each annular band the values of the fabric surface covered by micro elements (Stc) and of the free fabric surface (Stl).

[0043] As for the first embodiment, also for this second embodiment the micro elements have all or at least part of them (for example more than 50%, more preferably more than 80%, even more preferably more than 100%), an equal regular shape, for example a circular or regular polygonal shape, such as a square, rectangular, hexagonal shape.

[0044] Advantageously, the micro elements have decreasing dimensions (for example the diameter, or the diagonal) going from the lower end parts 3A', 3B' of the portions of base fabric 1A', 1B' of the garment to the upper parts 4A', 4B' of the portions of base fabric 1A', 1B'; this technical feature is even more advantageous if combined with the previous one relating to the fact that the microelements have all or at least part of them (for example more than 50%, more preferably more than 80%, even more preferably more than 100%) an equal regular shape.

[0045] Advantageously, the micro elements have uniformly decreasing dimensions (for example the diameter, or the diagonal) going from the lower end parts 3A', 3B' of the portions of base fabric 1A', 1B' of the garment to the upper parts 4A', 4B' of the portions of base fabric 1A', 1B', and for example the dimension of the micro elements (for example their diameter) decreases by a percentage which is almost equal (almost equal meaning a difference between +/- 5%) to the percentage of decrease in the surface of the fabric including the elastomer; so, if for example with 100% printed fabric comprising the micro elements, these have a diameter of 0.57 cm, with 90% printed fabric comprising the micro elements, these have a diameter of 0.512 cm, with 80% of printed fabric the diameter drops to about 0.457 cm and with 70% of printed fabric the diameter drops to 0.399 cm, and so on, up to when with 10% of printed fabric the diameter is 0.057.

[0046] It should be noted that, as shown in Figures 1 and 2, the printed elastomer micro elements can also be provided in the garment areas that do not completely surround or enclose an anatomical part of the body of the person wearing the garment, for example in Figures 5, 6 these micro elements are also arranged at the upper parts 1C', 1D' of the legs, in these parts the garment has a lower compressive force than the other parts 1A', 1B' previously discussed because the garment does not tighten annularly, therefore completely, the legs. However, it has been experimentally verified that the addition of the micro elements also in these non-annular parts 1C', 1D' of the garment contributes to stiffen and make the base fabric less elastic, which fabric in this area has therefore an increased support effect on the musculature compared to other parts of the garment without elastomer micro elements and in any case also has a compressive, albeit reduced effect, compared to that of the areas 1A', 1B'. Also in the areas 1C', 1D' the conformation, sizing and distribution of the micro elements is the same as in the previously described areas 1A', 1B'. Advantageously, therefore, in the areas 1C', 1D' the size and/or density of said micro elements decrease going towards the upper parts 5C', 5D' of the garment provided at the iliac crests of the hip of the person wearing the garment, so as to reduce the compressive force exerted by said micro elements going towards said parts 5C', 5D', that is going from the extremities of the person wearing the garment to the iliac crests of the person wearing the garment. Advantageously, the decrease in the size and/or density of the micro elements in the areas 1C', 1D' follows the same decreasing development of the micro elements of the areas 1A', 1B', so that there is a continuous and preferably uniform decrease of the micro elements from the lower end parts 3A', 3B' to the upper parts of the garment 5C', 5D' provided at the iliac crests 6.

[0047] Advantageously, the development of the size and/or density of the micro elements decreases, preferably uniformly, going from the lower end parts 3A', 3B', where it is maximum, to the upper parts 5C', 5D' provided at the iliac crests, where it is minimum.

[0048] The elastomer to print the micro elements on the base fabric can be of any conventional type to the one skilled in the art, for example it can be of the type comprising silicone. The silicone is advantageously printed on the base fabric.

[0049] The micro element printing process is also of a conventional type for the one skilled in the art, and includes, for example, a screen, silkscreen or high frequency transfer printing process.

[0050] In both garments described so far, advantageously:

- a) all the micro elements 2 have an equal, preferably circular or regular geometric shape,
- b) all the micro elements 2 are arranged along annular portions Z, Z' (some of these annular portions are highlighted in Figs. 4B, 4C, 8B, 8C) of micro elements,

- wherein, in each annular portion the micro elements are in a row,
- and wherein the micro elements of each annular portion have all a common axis K, K' passing through a centre of symmetry of said micro elements of each annular portion,
- and wherein said axes K, K' are all substantially parallel to each other when the portion of the base fabric is on a plane.

[0051] This arrangement of the micro elements makes the compression more uniform and allows to better fit the different physical and/or muscular characteristics of the wearer.

[0052] Advantageously, all the annular portions have the same number of micro elements.

[0053] Advantageously, the distance S between an axis K and the one immediately following is the same for all the annular portions of micro elements.

[0054] Also these technical features of the micro elements make the compression more uniform and allow to better fit the different physical and/or muscular characteristics of the wearer.

[0055] Finally, advantageously, some of the micro elements have maximum dimensions T greater than said constant distance S between the axes K, of the annular portions, so that the micro elements can also partially overlap each other, in the areas of the fabric that are required to have less elasticity (those which are closer to the ends 3A, 3B), that is those areas of the garment that are required to have a maximum percentage of the base fabric (for example between 100% and 90%) covered by the micro elements.

[0056] The invention also relates to an elastic fabric 100 (fig. 9) for manufacturing the compression parts of a compression garment, for example of the previously described type, which surround and enclose the circumference of at least one first part of the anatomy of a person wearing the garment, namely the upper limbs (that is the arms) in the example shown in figures 1-4 and the lower limbs, that is the legs of the wearer in the example shown in figures in figures 5-8, and/or for manufacturing the entire sleeve/leg of the garment, that is parts 1A, 1C and 1B, 1D of the garment.

[0057] Figure 9 shows the portion of fabric necessary for manufacturing a sleeve of the long-sleeved shirt of figures 1, 2; the profile of this sleeve has been represented with a double continuous line, as usual in the textile field, and the sleeve is indicated as a whole with the reference 1A. By cutting the sleeve 1A from the fabric and sewing it along the edges 101 A and B, the tubular part of the sleeve that encloses and surrounds the arm is obtained, the edges 101 C, D and E of the sleeve are sewn to the other parts of the shirt (not represented in Fig. 9) as shown in Figures 1 and 2.

[0058] The fabric 100 preferably has a rectangular shape, with edges 100A and 100B and 100C and D in pairs parallel to each other and perpendicular. The fabric 100 also has a length L1 and a width L2; these dimensions must be greater than or equal to the dimensions of the compression part of the garment (in the example of Fig. 9, of the sleeve 1A) to be manufactured. Furthermore, the longitudinal axis L of this compression part 1A of the garment should preferably be parallel to one of the edges 100A-D of the fabric 100, preferably to the greater edge 100B, C.

[0059] According to the invention, the fabric 100 includes:

- a) an elastic portion of base fabric;
- b) and an elastomer printed on at least said portion of base fabric.

[0060] As for the other figures, also for figures 9-10 the elastomer has been graphically represented with a black colouring, while the base fabric has been represented with a white colouring.

[0061] According to the invention, the elastomer is divided into a plurality of printed micro elements 102 (shown in particular in Figures 10A-E), whose dimensions are between 5 cm and 0.01 cm (0.1 mm), more preferably between 1 cm and 0.1 cm, wherein the size and/or density of said micro elements are maximum only at a first edge 100C and are minimum only at a second edge 100D opposite and parallel to the first of said portion of base fabric 1A', 1B', so that the elasticity of the fabric is minimum at said first edge and is maximum at said second edge, so as to continuously increase the elasticity of the elastic fabric going from said first edge 110C to the second edge 100D (with the exception of the perimeter parts of the fabric that are not used for making the garments which are to be considered the fabric waste parts, in which the microelements are either absent or have a density other than the one provided in the remaining area of the fabric).

[0062] Still according to the invention, the elastomer printed on the portion of base fabric only includes the micro elements whose dimensions and/or density decrease continuously.

[0063] In this context, the term "elasticity" refers to the ability of the fabric to stretch, if subjected to a force, and subsequently return to its original shape.

[0064] The base fabric can be any known type of elastic fabric, but it is preferably an elastic fabric with a high percentage

(for example greater than 15%, advantageously greater than or equal to 20%) of a yarn of the "elastane" or "spandex" type, for example of the type marketed with brands: Lycra, Elasthan, Dorlastan, Roica, Linel.

[0065] In this context, density of the elastomer micro elements refers to the ratio between the surface of base fabric of the garment covered by the elastomer micro elements and the surface of this base fabric free from these micro elements, namely:

$$\text{Density} = \frac{\text{Fabric surface covered by micro elements (Stc)}}{\text{Free fabric surface (Stl)}}$$

[0066] This is calculated, for example, by dividing the base fabric which includes the elastomer micro elements into a plurality of bands F (schematically represented in Figs. 10A-D) all having an equal length L3 and a width equal to the length L2 of the base fabric, for example a length between 5 cm and 1 cm, and calculating for each annular band the values of the fabric surface covered by the micro elements (Stc) and the free fabric surface (Stl).

[0067] According to a preferred embodiment of the invention the micro elements have all or at least part of them (for example more than 50%, more preferably more than 80%, even more preferably more than 100%) an equal regular shape, for example a circular or regular polygonal shape, such as a square, rectangular, hexagonal shape.

[0068] This feature makes the micro element printing process quicker and easier.

[0069] Advantageously, the micro elements have decreasing dimensions (for example the diameter, or the diagonal) going from the first edge 100C to the second edge 100D; this technical feature is even more advantageous if combined with the previous one relating to the fact that the micro elements have all or at least part of them (for example more than 50%, more preferably more than 80%, even more preferably more than 100%) an equal regular shape.

[0070] This feature also makes the micro element printing process quicker and easier.

[0071] Advantageously, the micro elements have uniformly decreasing dimensions (for example the diameter, or the diagonal) going from the first edge 100C to the second edge 100D, and for example the dimension of the micro elements (for example their diameter) decreases by a percentage which is almost equal (almost equal meaning a difference between +/- 5%) to the percentage of decrease in the surface of the fabric including the elastomer.

[0072] This technical feature improves the variation in the elasticity of the fabric and allows the manufacture of compression garments with improved compression features.

[0073] According to a preferred embodiment:

- a) all the micro elements have an equal regular, preferably circular shape,
- b) they are all arranged along lines (in the example referred to in the figures vertical lines R1...Rn), wherein the micro elements of each row are arranged in a row, and wherein the micro elements of each row all have a common axis M (some of these axes M have been represented in Figures 10A-E) passing through the centre of all the micro elements of each row,
- c) wherein these axes M are all parallel to each other and to the first and the second edge 100C, 100D of the fabric and perpendicular to the other two edges 100A, 100B of the fabric;
- d) wherein the number of micro elements of all rows is constant,
- e) and wherein the dimensions of the micro elements decrease going from the first edge 100C to the second edge 100D, preferably in a uniform way, and even more preferably in a way proportional to the surface variation of the base elastic fabric which is not covered by the micro elements;
- f) and wherein the distance E between an axis M and the one immediately following is constant along the entire fabric (some of these distances D have been shown in figures 10A-E).

[0074] Preferably, some of the micro elements have dimensions T greater than the distance D between the axes M, as shown in Figure 10A so that the micro elements can also partially overlap each other, in the areas of the fabric that are required to have less elasticity (those which are closer to the edge 100C), that is those areas of the garment that are required to have a maximum percentage of the base fabric (for example between 100% and 90%) covered by the micro elements.

[0075] Finally, it must be underlined that the embodiments of the garment and fabric shown so far have been provided purely by way of example and that numerous variants are possible, all falling within the same innovative concept.

[0076] Thus, for example, the garment could have a shape other than that shown in Figures 1-4 and 5-8 and be, for example, a garment adapted to only cover a part of the arms, for example only the forearms, or only a part of the legs, for example only the calves, or even a different anatomical part or a plurality of anatomical parts of the body of the person wearing the garment.

[0077] It is also underlined that the distribution of the micro elements on the base fabric can be such as to vary the elasticity of the fabric in a linear but also in a continuous but non-linear way, for example so as to have a high compression at the ankles or wrists and a similar compression substantially up to the knees or elbows, which then rapidly decreases above the knees or elbows.

[0078] According to another variant (not shown) the elastomer micro elements could cover about 100% of the base fabric at the extremity of the limb to be compressed, and be present only up to an intermediate part of the length of the limb to be compressed and not for the entire length of the limb, and with a distribution that substantially requires the absence of base fabric covered by micro elements above this intermediate part of the limb. Thus, for example, the micro elements could cover about 100% of the base fabric at the wrist or ankle, and not be present or cover only a limited percentage of the base fabric at the biceps or thigh.

[0079] According to another variant, it is also possible to envisage a distribution of the elastomer micro elements on the base fabric starting from less than 100%, for example between 99% and 60%, more preferably between 90% and 70%, and ending with a distribution of the elastomer micro elements which is greater than 0%, for example between 5% and 40%, more preferably between 10% and 25%.

Claims

1. A compression garment of the type comprising:

- a portion of base fabric (1A, 1B; 1A', 1B') that surrounds and encloses at least one portion, having a substantially annular shape, of the arms and/or legs of a person wearing the garment
- wherein said portion of base fabric (1A, 1B; 1A', 1B') exerts a first compressive force on said at least one portion of the arms or legs,

b) and an elastomer printed on at least said portion of base fabric (1A, 1B; 1A', 1B') so as to surround it too, at least partially, said first one portion of the arms and/or legs and adapted to exert a second compressive force on the first portion of the anatomy of the person wearing the garment,

wherein the total compressive force applied by the compression garment at a given position on said at least one portion of the arms and/or legs is the sum of the first compressive force and the second compressive force at that garment position;

characterized in that:

- the elastomer printed on at least said portion of base fabric (1A, 1B; 1A', 1B') is divided into a plurality of printed micro elements (2, 2'), whose maximum dimensions (T, T') are between 5 cm and 0.01 cm, more preferably between 2 cm and 0.1 cm,
- wherein said portion of base fabric (1A, 1B; 1A', 1B') comprises: lower parts (3A, 3B; 3A', 3B'), provided closer to the end portions of the arms and/or legs of the person wearing the garment, for example the wrists and/or ankles, and upper parts (4A 4B; 4A', 4B'), provided closer to the torso of the person wearing the garment,
- wherein the size and/or density of said micro elements are maximum only at said lower parts (3A, 3B; 3A', 3B') of said portion of base fabric (1A, 1B; 1A', 1B'), and are minimum only at said upper parts (4A 4B; 4A', 4B') of said portion of base fabric (1A, 1B; 1A', 1B'), and the size and/or density of said micro elements continuously decrease going from said lower parts (3A, 3B; 3A', 3B') to said upper parts (4A 4B; 4A', 4B') of said portion of base fabric (1A, 1B; 1A', 1B'), so that said second compressive force is maximum only at said lower parts (3A, 3B; 3A', 3B') and is minimum only at said upper parts (4A 4B; 4A', 4B') and continuously reduces going from said lower parts (3A, 3B; 3A', 3B') to said upper parts (4A 4B; 4A', 4B'), that is going from the extremities of the person wearing the garment to the torso of the person wearing the garment.

2. A compression garment according to claim 1, **characterized in that** said elastomer printed on at least said portion of base fabric (1A, 1B; 1A', 1B') of at least one portion of the arms and/or legs only provides said micro elements whose size and/or density decrease continuously.

3. A compression garment according to one or more of the preceding claims, **characterized in that** at least one plurality of said micro elements is positioned on the portion of base fabric (1A, 1B; 1A', 1B') along a plurality of annular portions (Z, Z') which surround corresponding annular portions of the arms and/or legs, and **in that** all the micro elements of each of said annular portions (Z, Z') of micro elements have equal size and/or density, so that all said micro elements of each of said annular portions of micro elements exert a substantially equal compressive force on the corresponding portion of the arms and/or legs.

4. A compression garment according to one or more of the preceding claims, **characterized in that** the micro elements (2; 2') have all or at least part of them, preferably more than 50%, more preferably more than 80%, an equal regular shape, preferably a circular, or regular polygonal shape.

5. A compression garment according to one or more of the preceding claims, **characterized in that** the micro elements (2; 2') have uniformly decreasing dimensions going from the lower end parts (3A, 3B; 3A', 3B') of the portions of base fabric (1A, 1B; 1A', 1B') of the garment to the upper parts (4A, 4B; 4A', 4B') of the portions of base fabric (1A, 1B; 1A', 1B'), wherein preferably the size of the micro elements decreases by a percentage which is almost equal to the percentage of decrease in the surface of the portion of base fabric on which the elastomer is printed.

6. A compression garment according to one or more of the preceding claims, **characterized in that** the elastomer of the micro elements (2; 2') comprises silicone.

7. A compression garment according to one or more of the preceding claims, **characterized in that** the compression garment is a long-sleeved shirt or trousers adapted to cover the legs entirely, and wherein the portion of base fabric is a right sleeve (1A) or a left sleeve (1B), or a right leg (1A') or left leg (1B'), wherein the micro elements (2, 2') are provided at least along the entire surface of said sleeves and legs which surrounds and encloses the arms and legs of the person wearing the garment, and **in that** the size and/or density of said micro elements are maximum only at said lower part (3A, 3B; 3A', 3B') of said portion of base fabric (1A, 1B; 1A', 1B') provided at the wrists and/or ankles of the person wearing the garment.

8. A compression garment according to one or more of the preceding claims, **characterized in that:**

a) all the micro elements (2) have an equal regular, preferably circular shape,

b) all the micro elements (2) are arranged along annular portions (Z, Z') of micro elements, wherein in each annular portion the micro elements are in a row, wherein the micro elements of each annular portion all have a common axis (K, K') passing through a centre of symmetry of said micro elements of each annular portion,

c) wherein said axes (K, K') are all substantially parallel to each other when the portion of the base fabric is laid out onto a plane.

9. A compression garment according to claim 8, **characterized in that** the number of micro elements of all the annular portions (Z, Z') is the same.

10. A compression garment according to one or more of claims 8-9, **characterized in that** the distance (S) between an axis (K, K') and the one immediately following it is the same for all the annular portions of the micro elements, and **in that** preferably the maximum dimensions (T, T') of some of the micro elements are greater than said constant distance (S) between the axes (K).

11. A fabric (100) for manufacturing the compression parts of a compression garment according to claims 1-10, comprising:

a) an elastic portion of base fabric;

b) and an elastomer printed on at least said portion of base fabric;

characterized in that:

- the elastomer is divided into a plurality of printed micro elements (102), whose maximum dimensions are between 5 cm and 0.01 cm, more preferably between 2 cm and 0.1 cm,

- the size and/or density of said micro elements continuously decrease going from a first edge (100C) of said portion of base fabric, to a second edge (100D), opposite and parallel to the first edge of said portion of base fabric, so as to continuously increase the elasticity of the elastic fabric going from said first edge (110C) to the second edge (100D),

- the size and/or density of said micro elements are maximum only at said first edge (100C) and are minimum only at said second edge (100D) of said portion of base fabric (1A, 1B; 1A', 1B'), so that the elasticity of the fabric is minimum at said first edge and is maximum at said second edge;

- and **in that** said elastomer printed on at least said portion of base fabric only provides said micro elements whose size and/or density continuously decrease.

12. A fabric according to claim 11, **characterized in that** the micro elements (102) have decreasing dimensions going from the first edge (100C) to the second edge (100D),

- preferably the micro elements have uniformly decreasing dimensions going from the first edge (100C) to the second edge (100D),
- and **in that** preferably the dimensions of the micro elements decrease by a percentage almost equal to the percentage of decrease in the surface of the fabric that has the elastomer.

13. A fabric according to one or more of claims 10-12, **characterized in that**

- a) all the micro elements (102) have an equal regular, preferably circular shape,
- b) all the micro elements (102) are arranged along rows of micro elements, in each row the micro elements being in a row, wherein the micro elements of each row all have a common axis (M) passing through a centre of symmetry of said micro elements of each row,
- c) said axes (M) are all parallel to each other and preferably also to said first and second edges (100C, 100D) of said portion of the base fabric,
- d) and **in that** the dimensions of the micro elements decrease going from the first edge (100C) to the second edge (100D), preferably in a uniform way, and even more preferably in a way proportional to the surface variation of the base elastic fabric which is not covered by the micro elements.

14. A fabric according to claim 13, **characterized in that** the number of micro elements of all rows is the same.

15. A fabric according to one or more of claims 13-14, **characterized in that** the distance (E) between an axis (M) and the one immediately following it is the same for all rows of micro elements, and **in that** preferably some of the micro elements have maximum dimensions (T) which are greater than said constant distance (E) between the axes (M) .

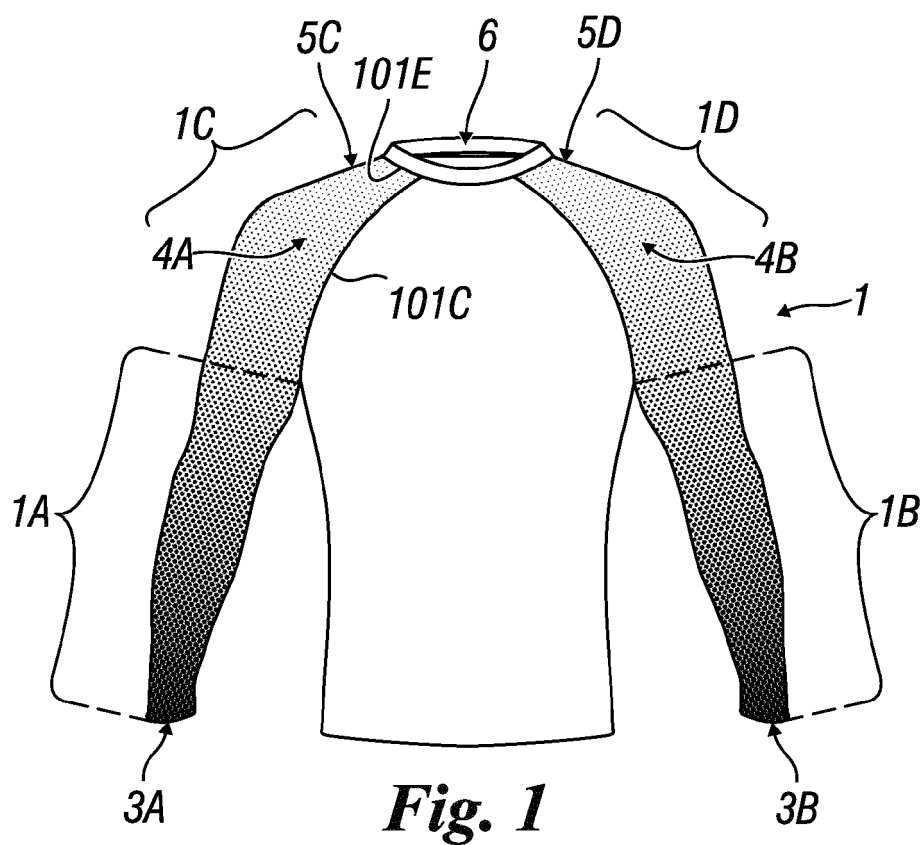


Fig. 1

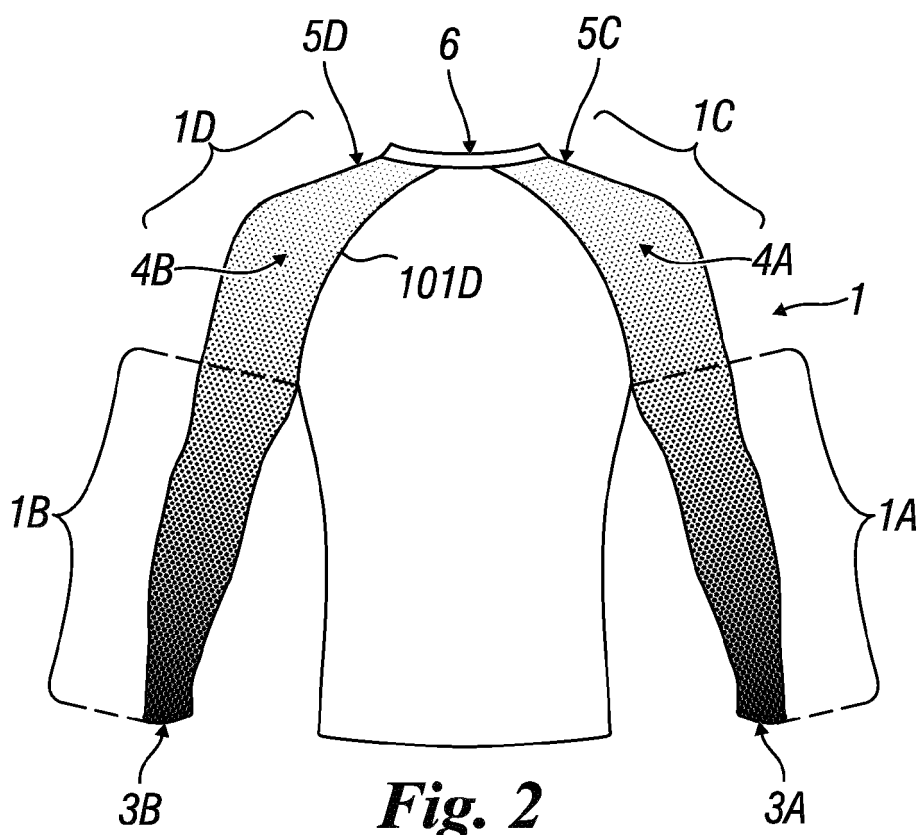


Fig. 2

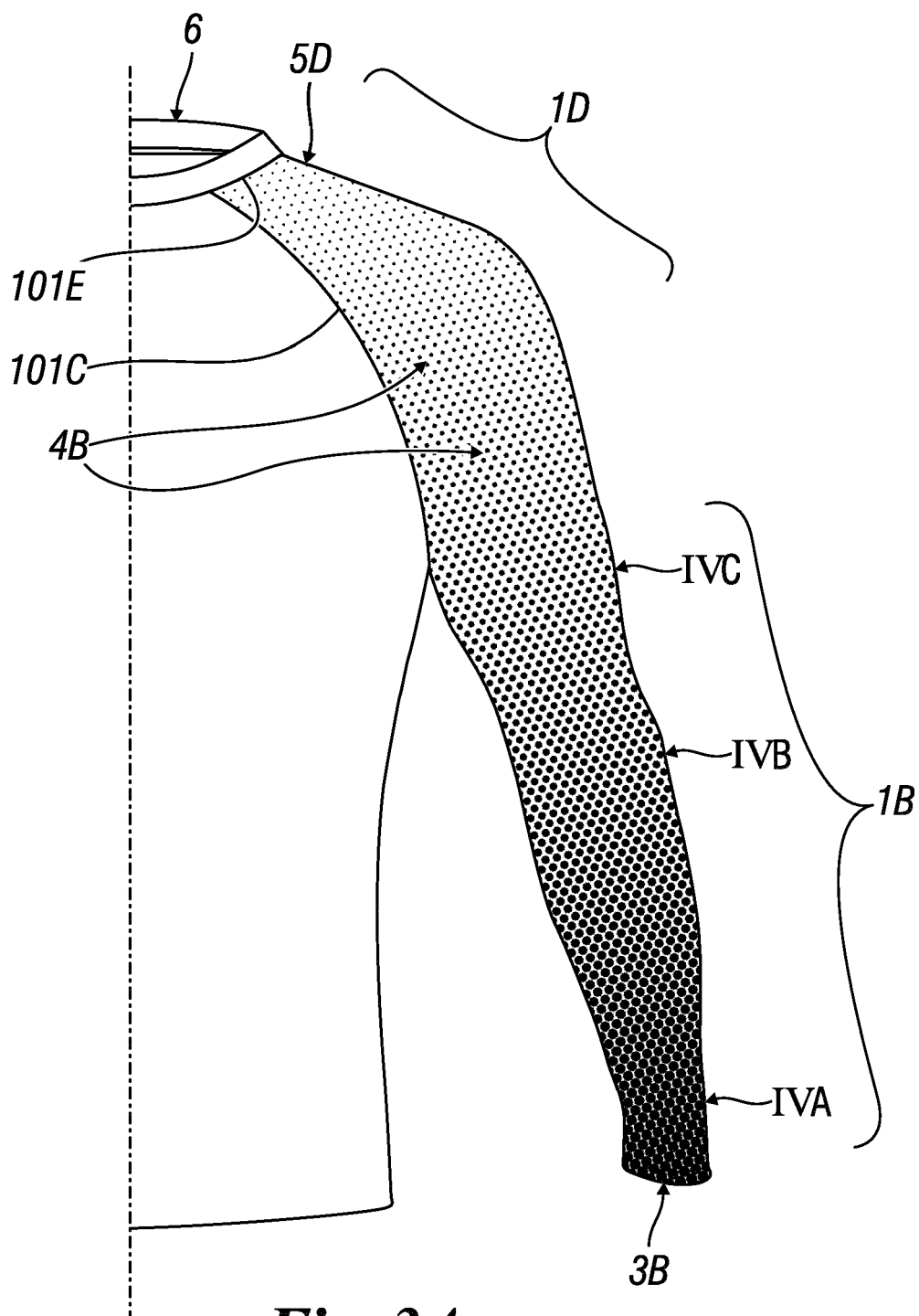


Fig. 3A

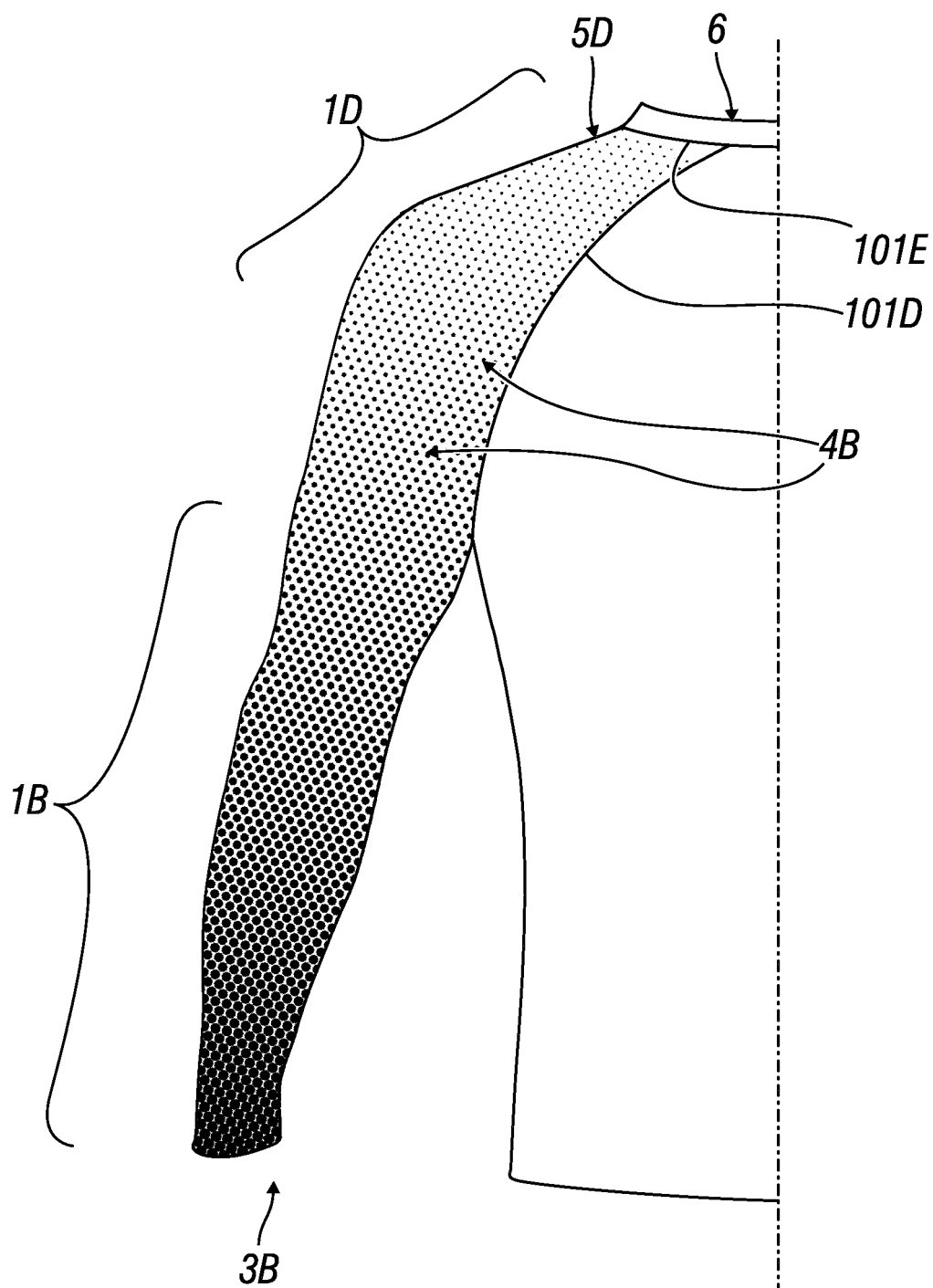


Fig. 3B

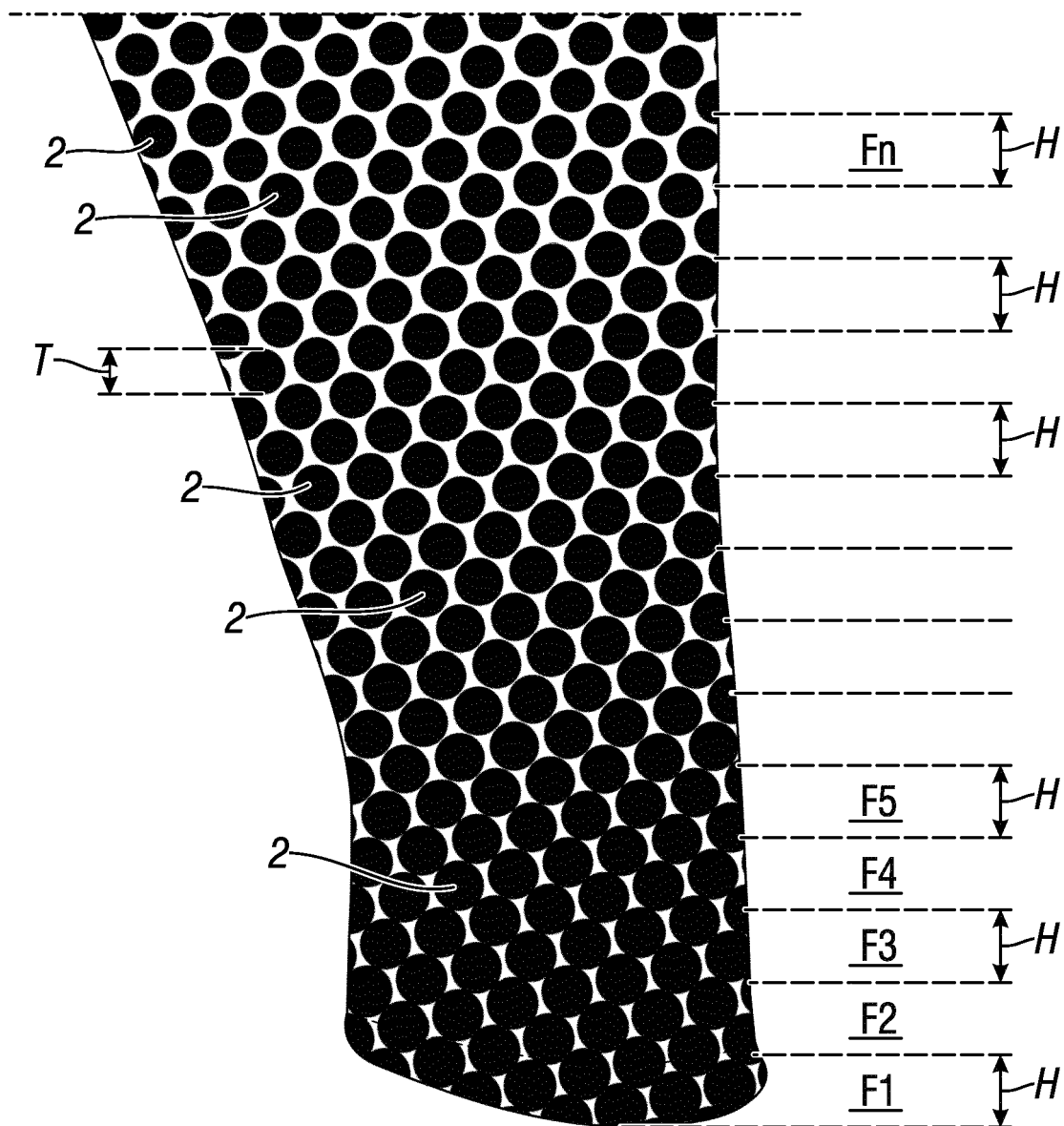


Fig. 4A

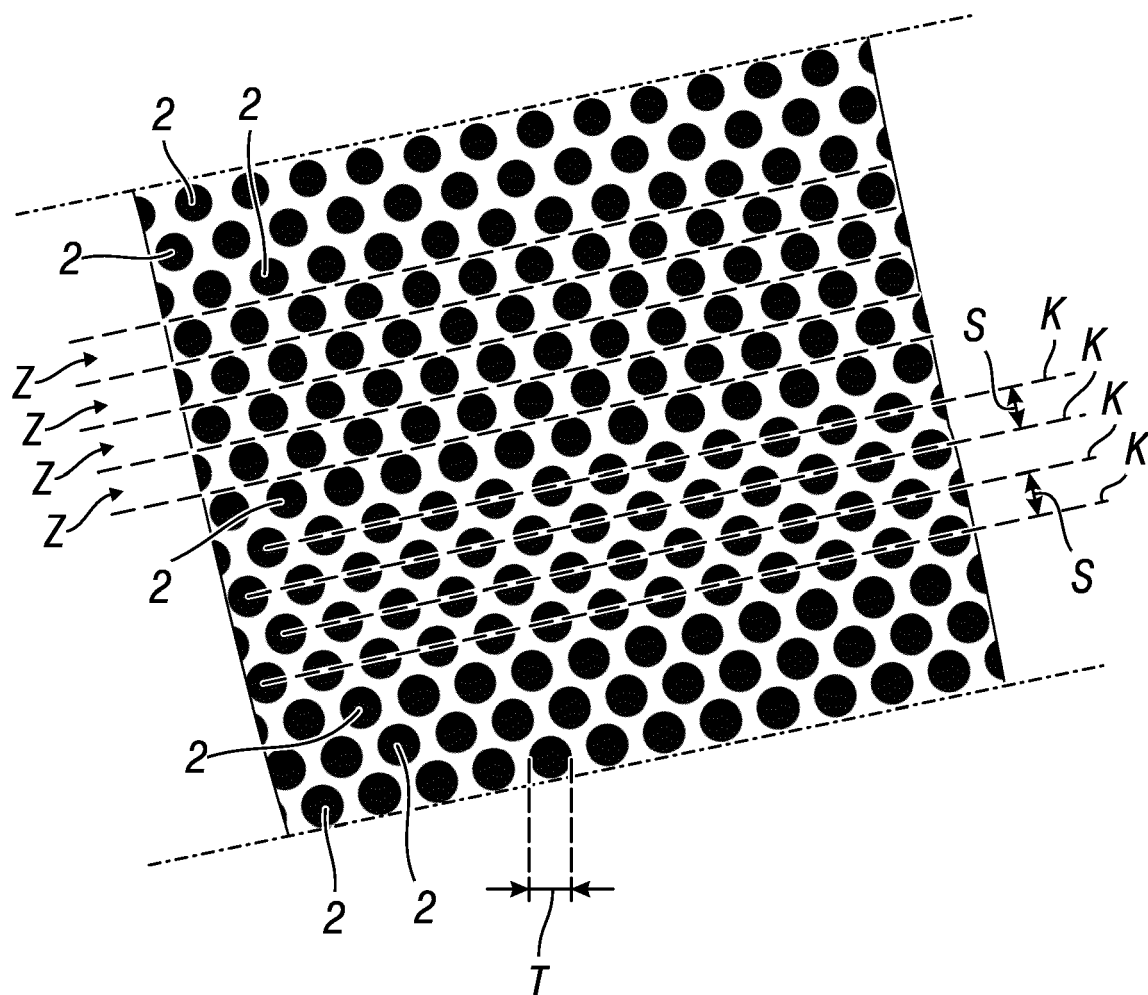


Fig. 4B

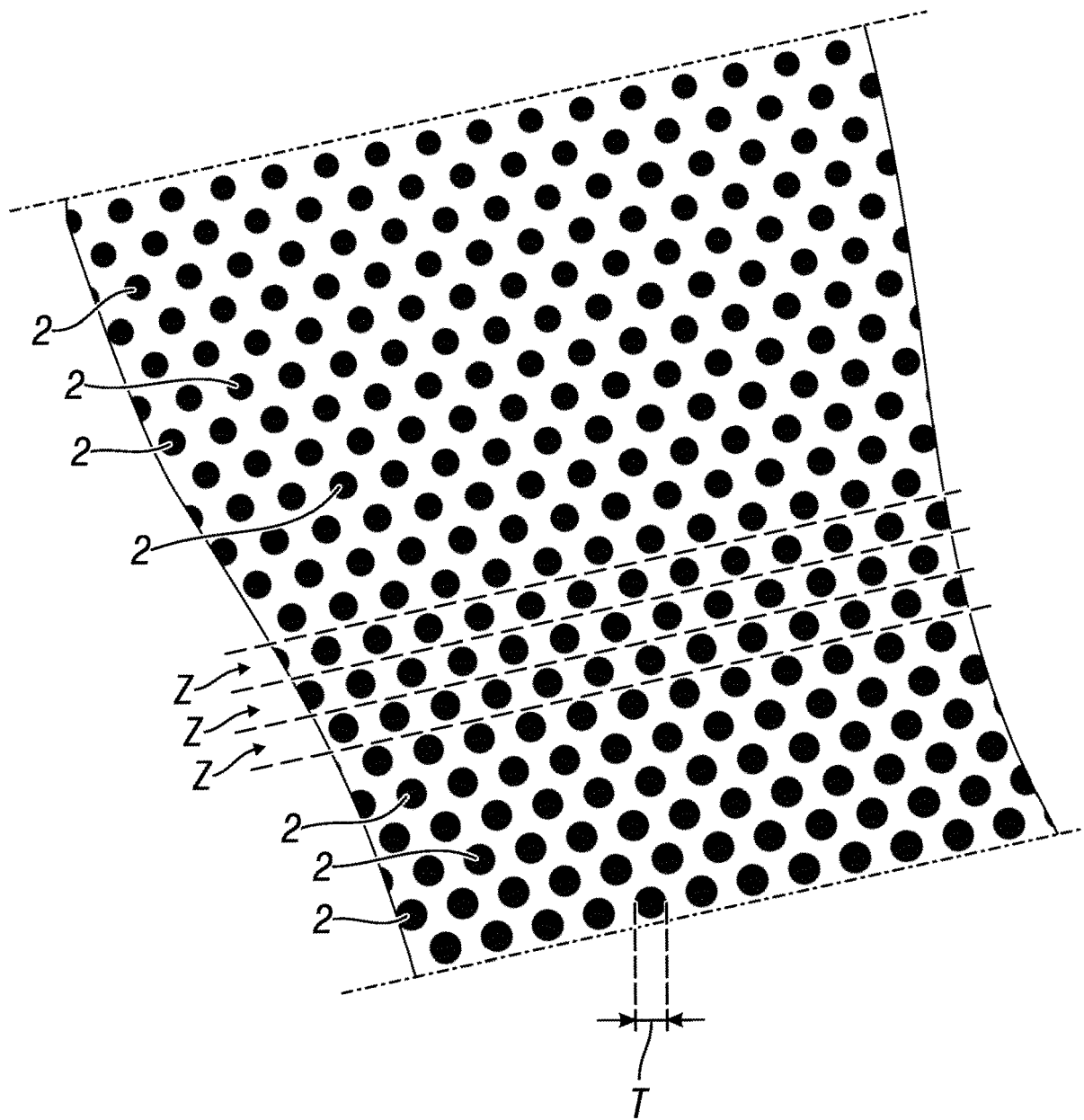


Fig. 4C

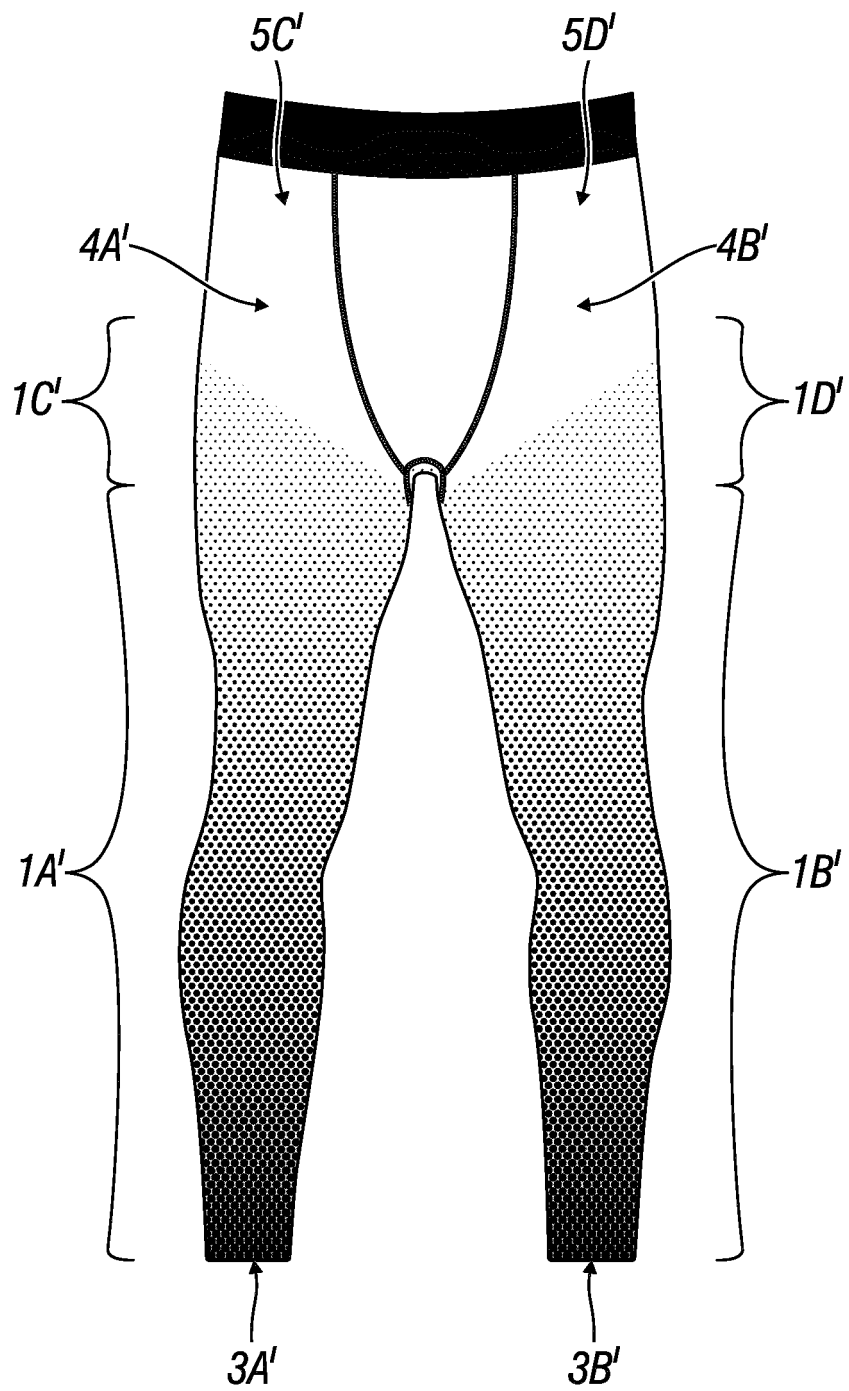


Fig. 5

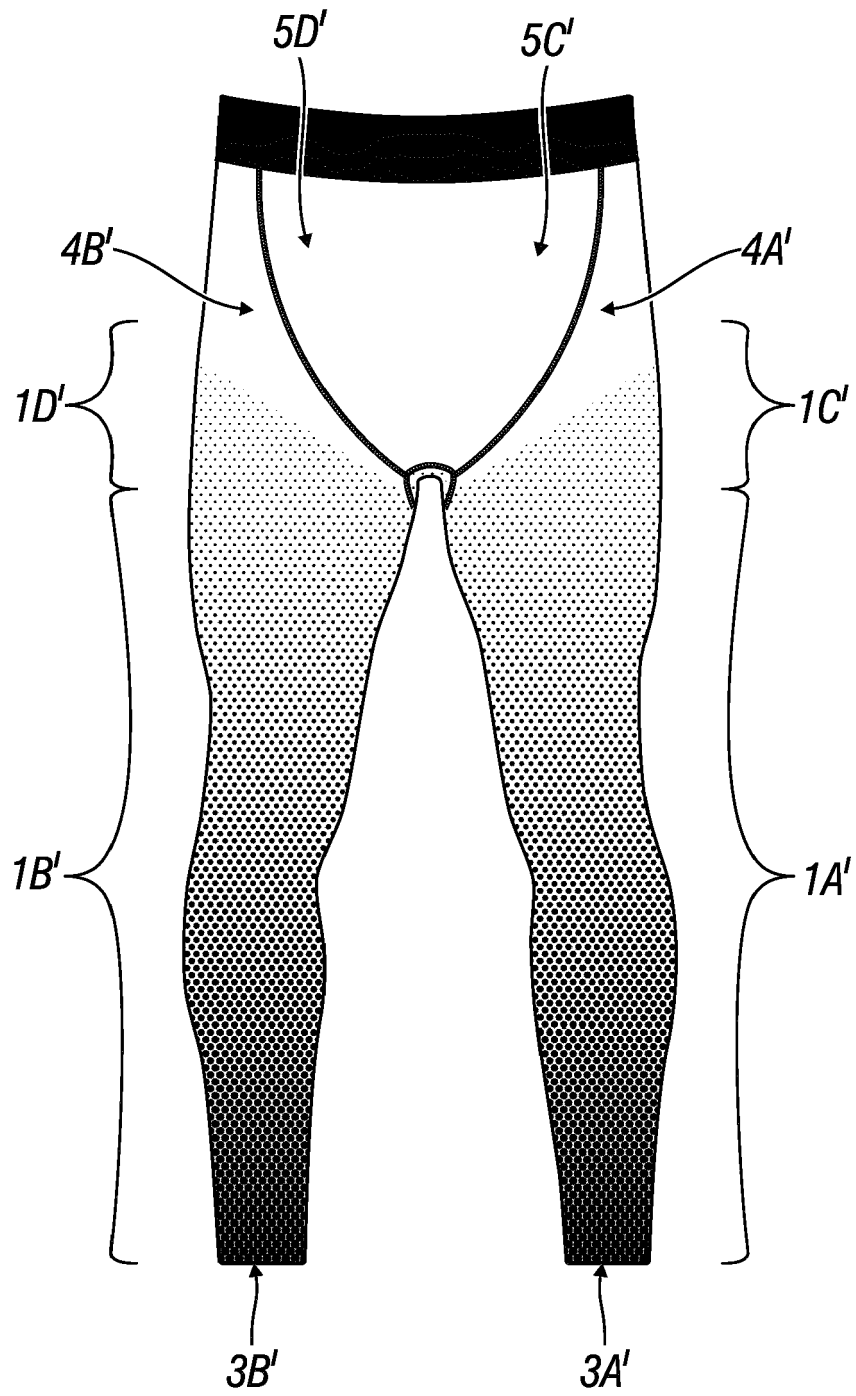


Fig. 6

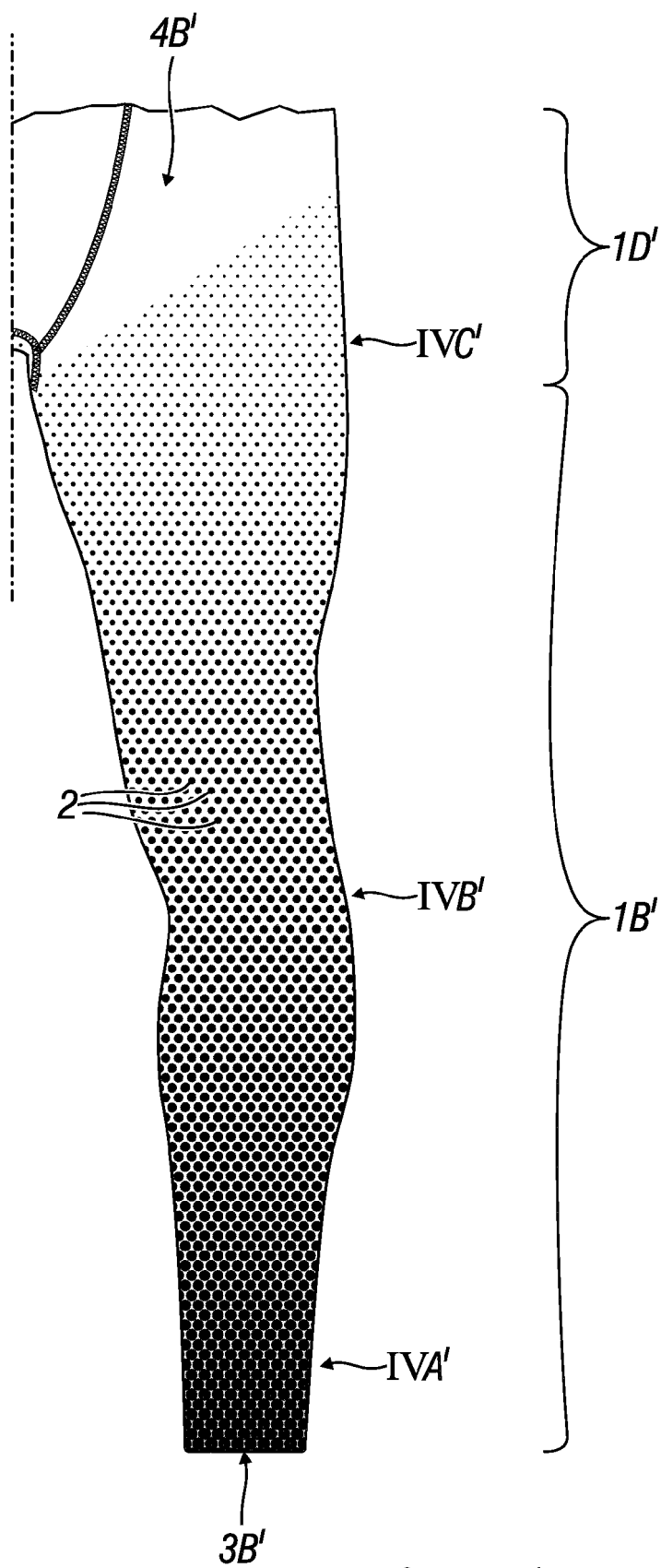


Fig. 7A

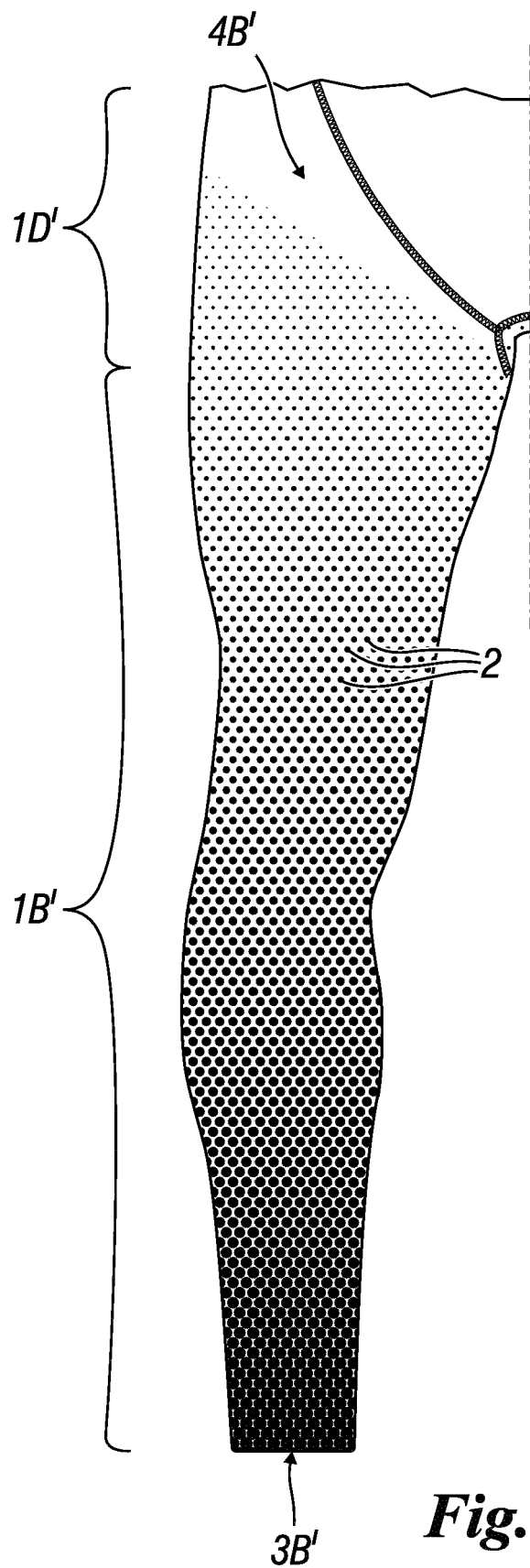


Fig. 7B

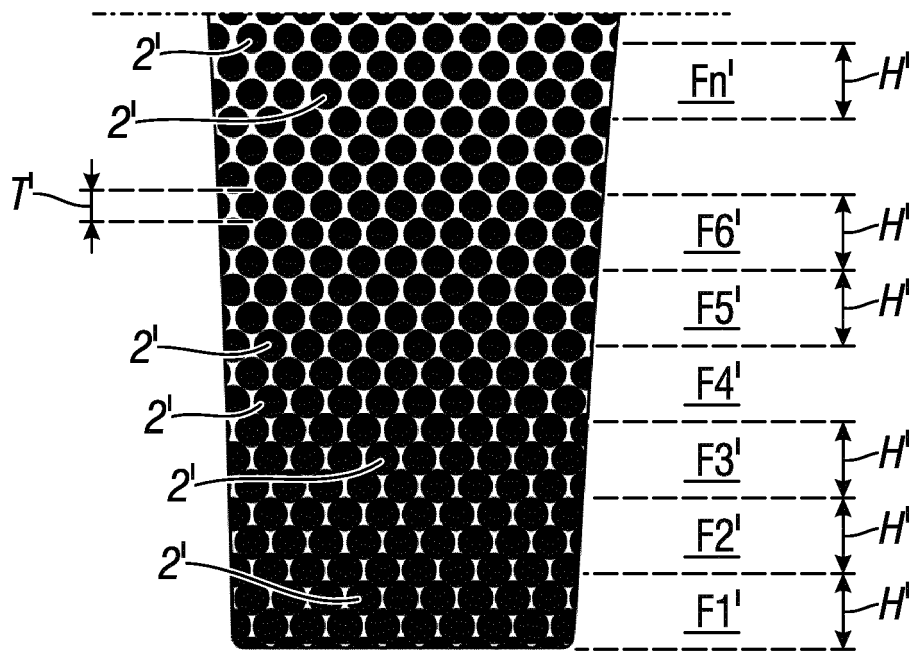


Fig. 8A

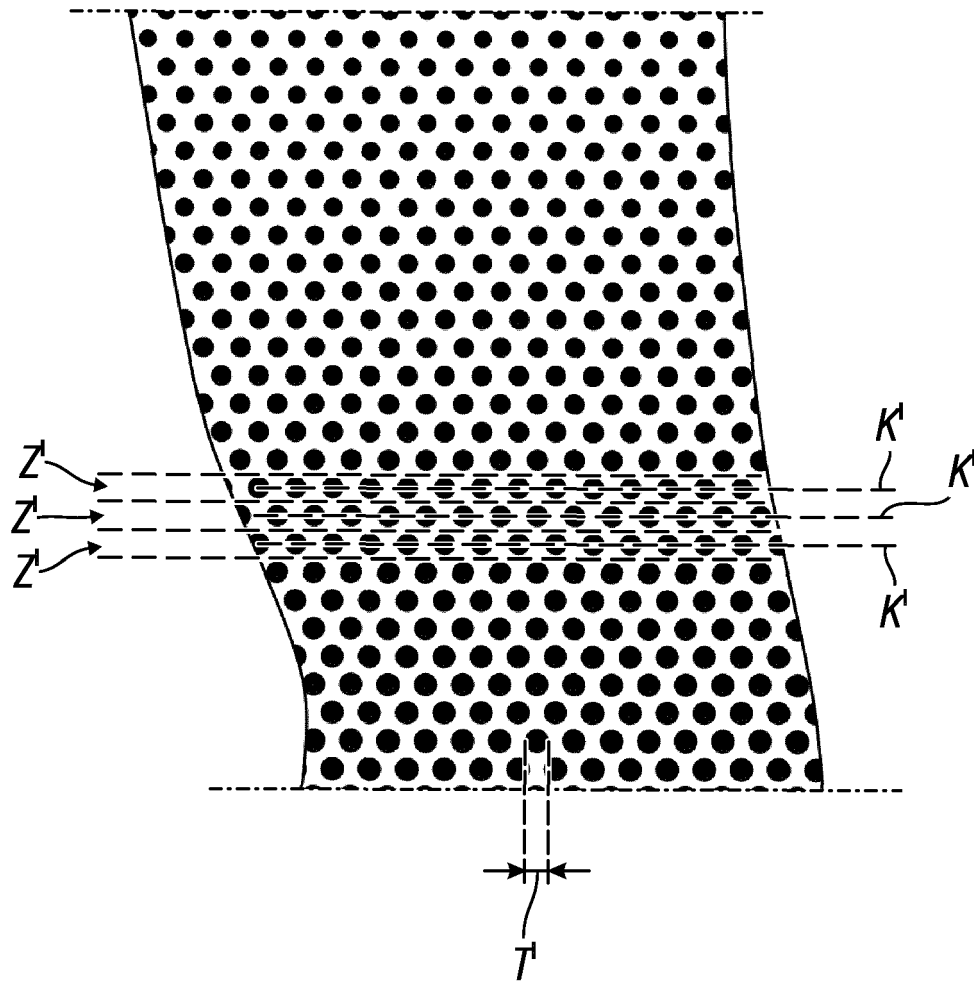


Fig. 8B

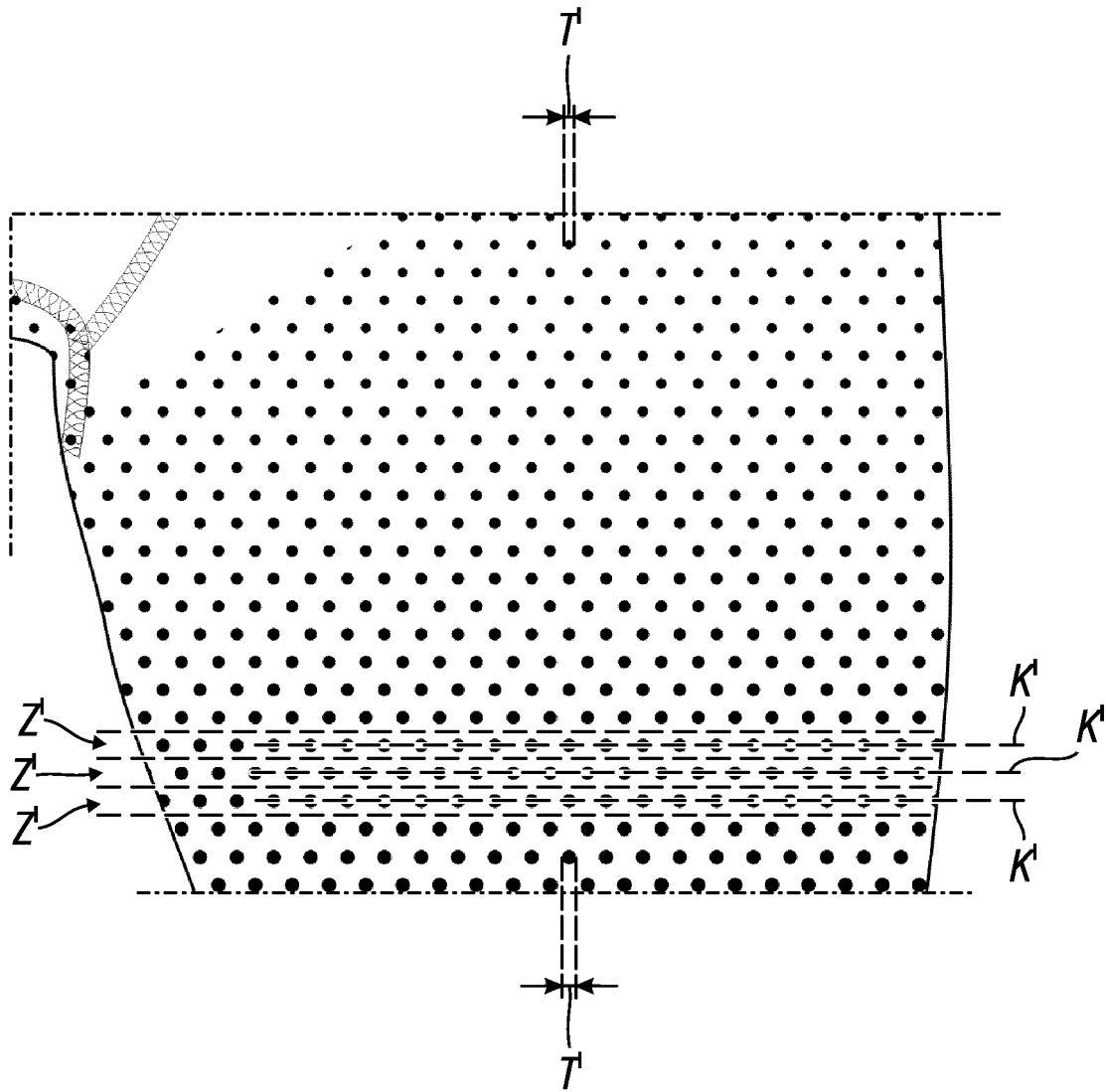


Fig. 8C

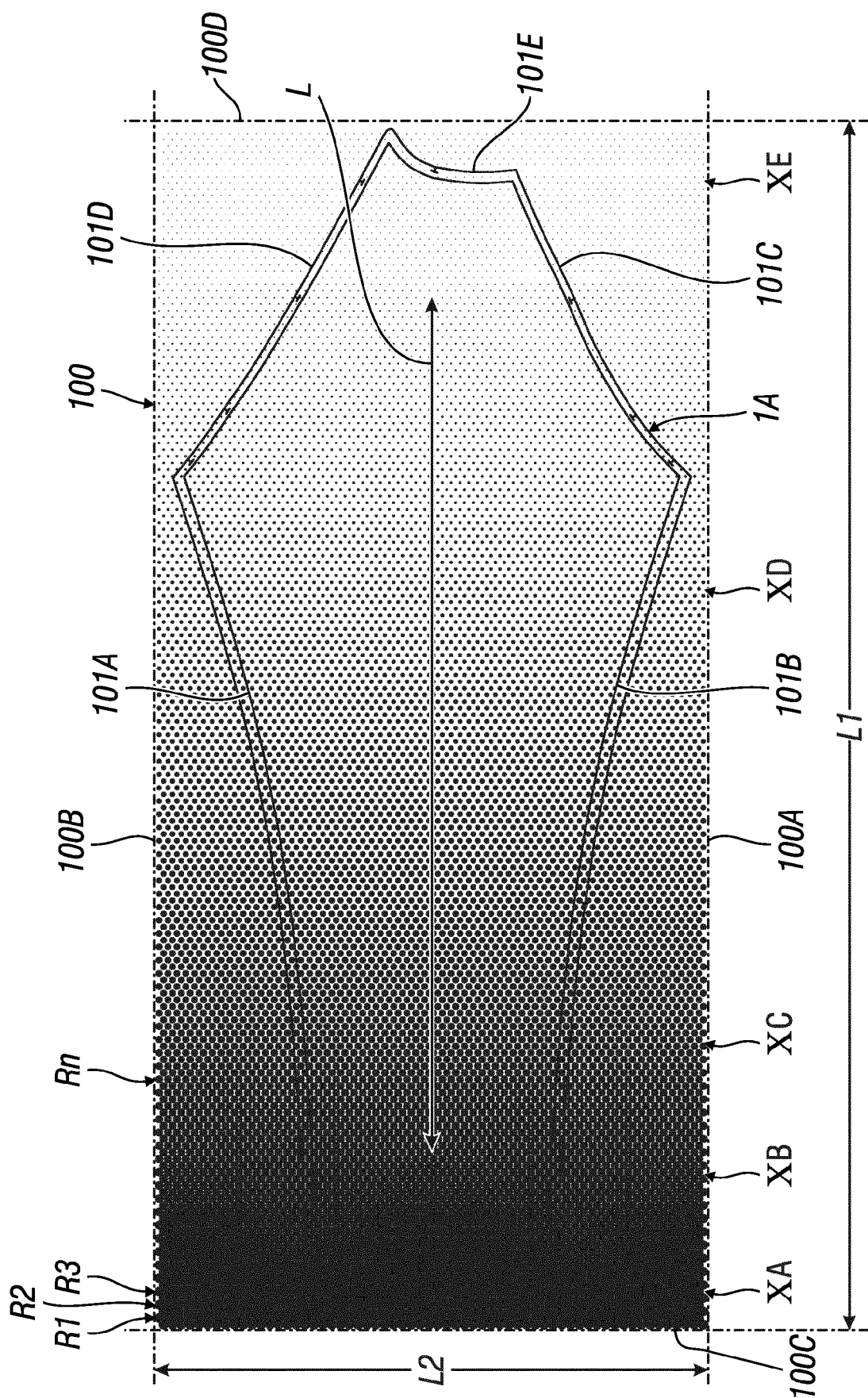


Fig. 9

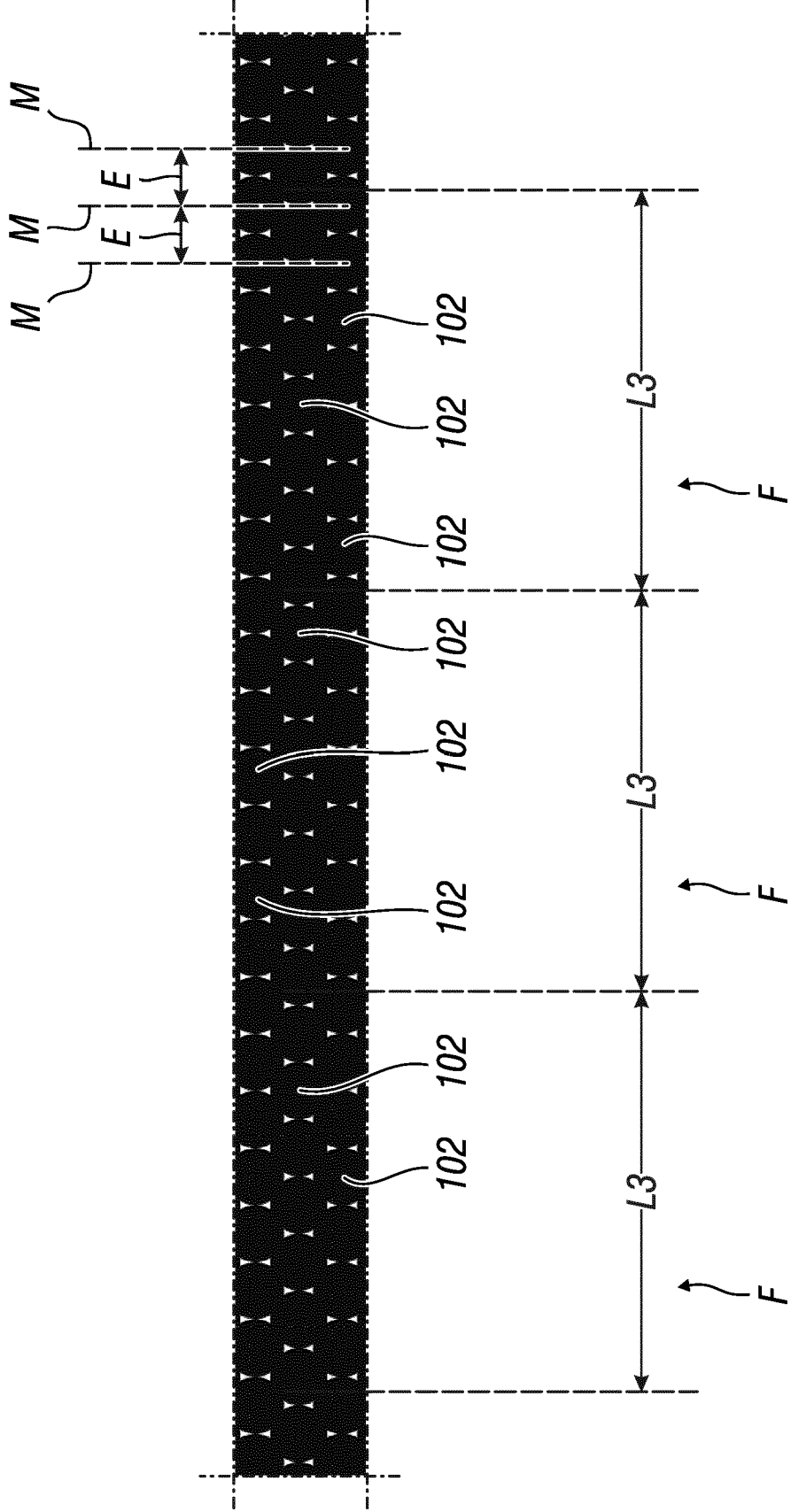


Fig. 10A

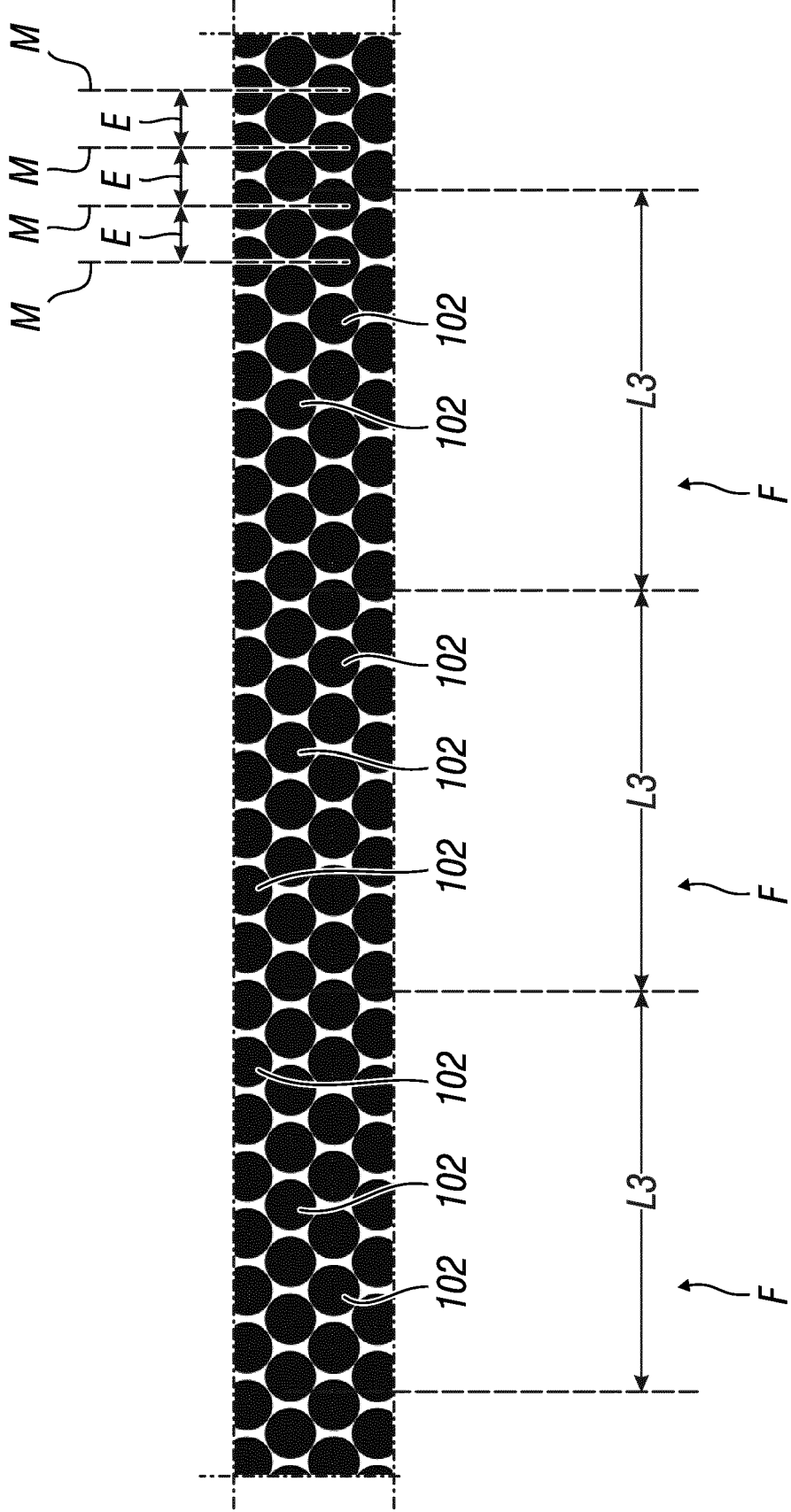


Fig. 10B

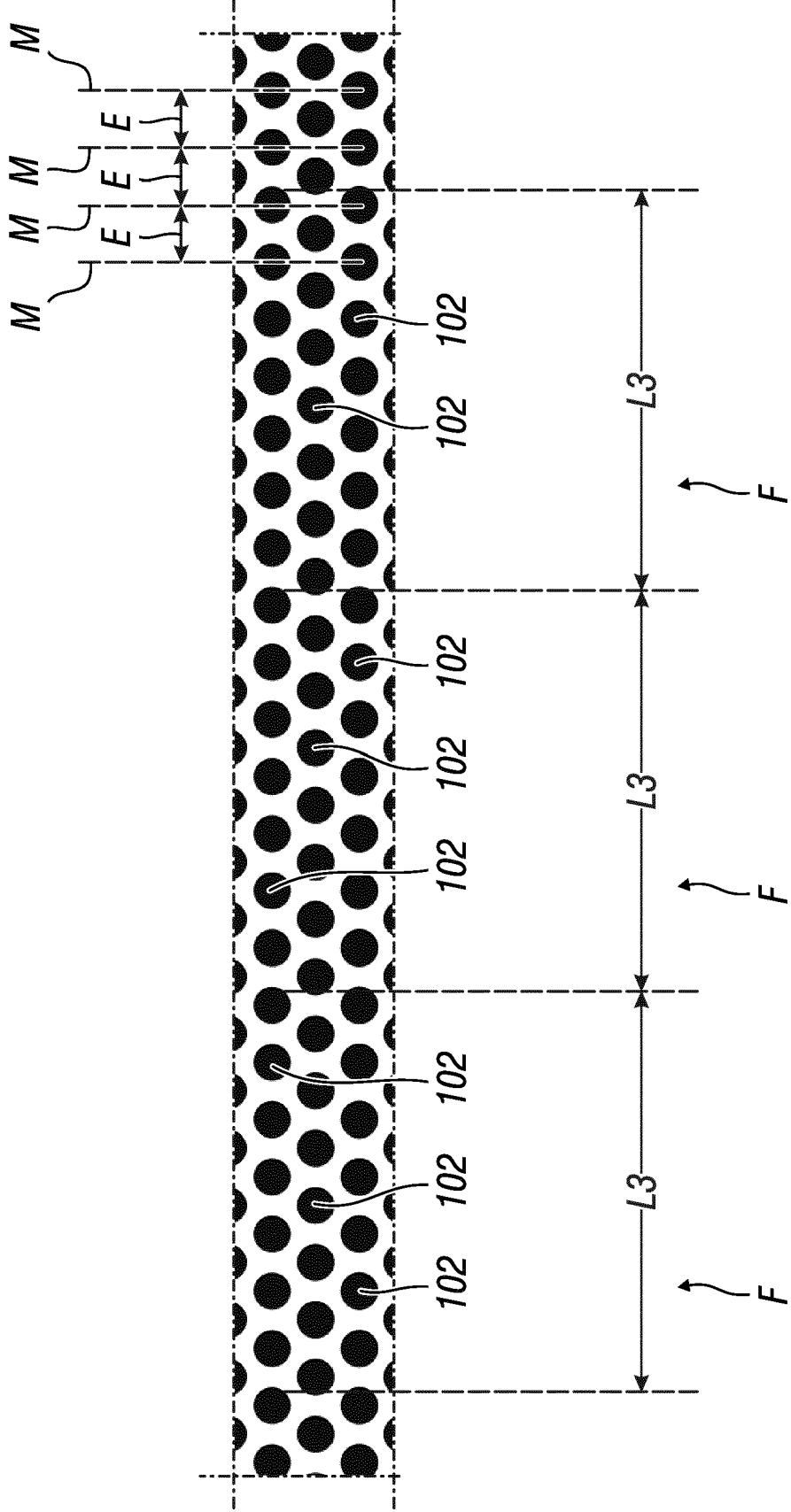


Fig. 10C

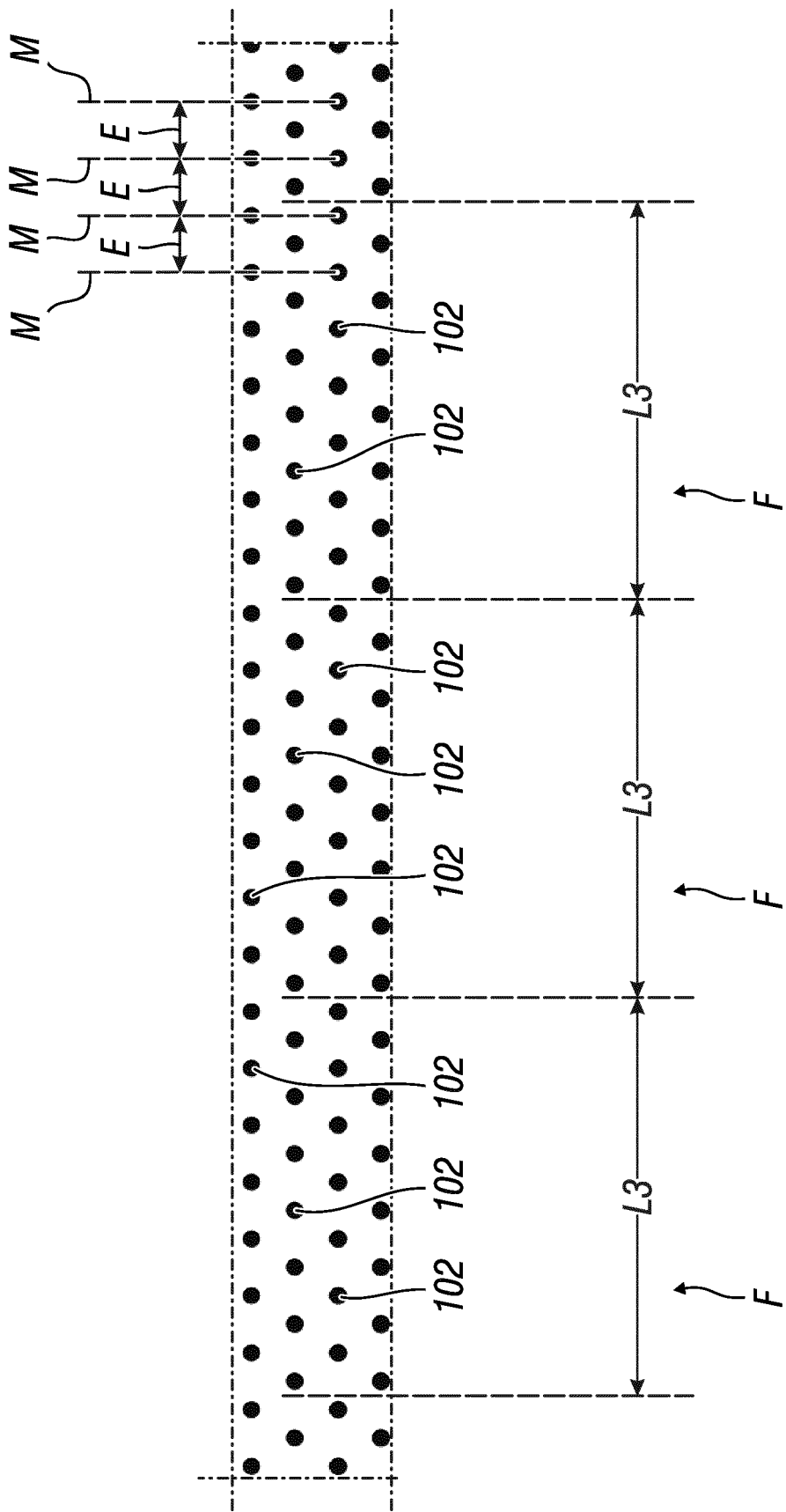


Fig. 10D

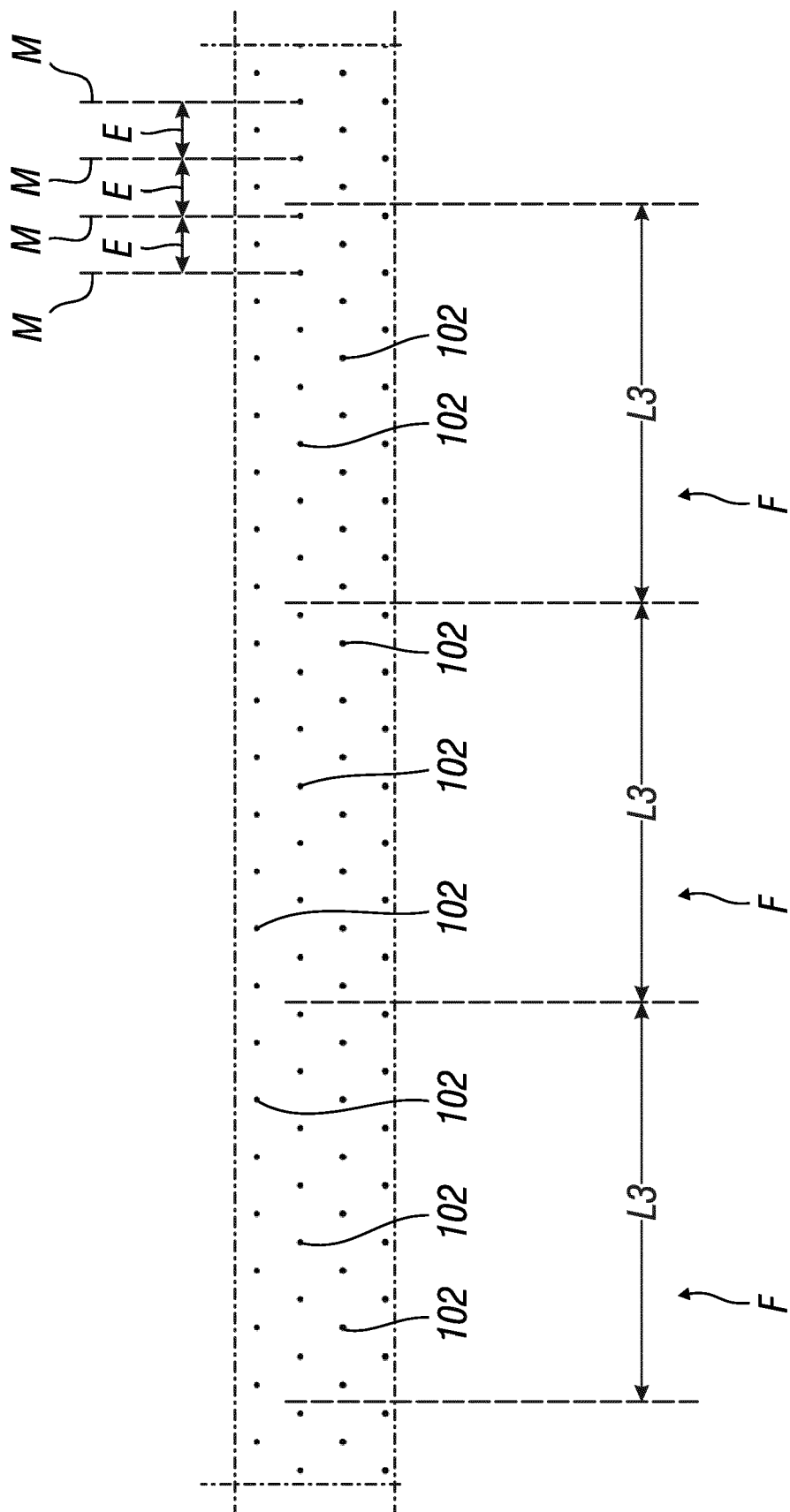


Fig. 10E



EUROPEAN SEARCH REPORT

Application Number

EP 21 18 8296

5

10

15

20

25

30

35

40

45

50

55

EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2019/191498 A1 (KUHNER STOUT EMELINE [US]; STOUT MYRON [US]) 3 October 2019 (2019-10-03)	2-4, 7-13, 15	INV. A41D1/08 A41D31/18
Y	* figures 5A, 5C, 6A * * paragraphs [0011], [0042], [0043], [0045], [0050] - [0053], [0058], [0087]; claim 10 *	5, 6, 14	
Y	US 2007/074328 A1 (MELHART JAMES H [US] ET AL) 5 April 2007 (2007-04-05) * paragraphs [0025], [0026], [0032], [0034], [0035], [0037], [0039], [0042], [0043]; claims 9, 13, 16, 17; figures 1, 2, 8, 10 *	1-15	
Y	US 2018/279696 A1 (NAVARRO SALVADOR [US] ET AL) 4 October 2018 (2018-10-04) * paragraphs [0017], [0034], [0039]; figures 1, 2, 5 *	5, 14	
Y	US 2018/325196 A1 (MILLER MERIDA [US] ET AL) 15 November 2018 (2018-11-15) * paragraphs [0057], [0058], [0110]; claims 8, 9 *	6	TECHNICAL FIELDS SEARCHED (IPC) A41D A61F
Y	US 2010/130903 A1 (ROCK MOSHE [US]) 27 May 2010 (2010-05-27) * paragraph [0003] *	1-15	
A	GB 1 445 233 A (FANKHANEL K) 4 August 1976 (1976-08-04) * page 1, lines 53-60; figure 1 *	1, 11	
3 The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 22 December 2021	Examiner da Silva, José
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 21 18 8296

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22-12-2021

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
WO 2019191498 A1		03-10-2019	AU	2019243318 A1		15-10-2020
			CA	3095055 A1		03-10-2019
			GB	2587129 A		17-03-2021
			US	2021093023 A1		01-04-2021
			WO	2019191498 A1		03-10-2019

US 2007074328 A1		05-04-2007	JP	5188394 B2		24-04-2013
			JP	5502127 B2		28-05-2014
			JP	2009510277 A		12-03-2009
			JP	2011140744 A		21-07-2011
			JP	2012149378 A		09-08-2012
			US	2007074328 A1		05-04-2007
			US	2010064415 A1		18-03-2010
			WO	2007040954 A1		12-04-2007

US 2018279696 A1		04-10-2018	US	2018279696 A1		04-10-2018
			US	2020297048 A1		24-09-2020

US 2018325196 A1		15-11-2018	NONE			

US 2010130903 A1		27-05-2010	AT	554666 T		15-05-2012
			CA	2742116 A1		10-06-2010
			EP	2348902 A1		03-08-2011
			US	2010130903 A1		27-05-2010
			WO	2010065324 A1		10-06-2010

GB 1445233 A		04-08-1976	AT	336776 B		25-05-1977
			CH	566777 A5		30-09-1975
			FR	2213762 A1		09-08-1974
			GB	1445233 A		04-08-1976
			IT	1006866 B		20-10-1976
			NL	7400218 A		16-07-1974

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2019191498 A [0005] [0007]
- US 2007074328 A [0008] [0009]
- US 2018279696 A [0010] [0011] [0012]