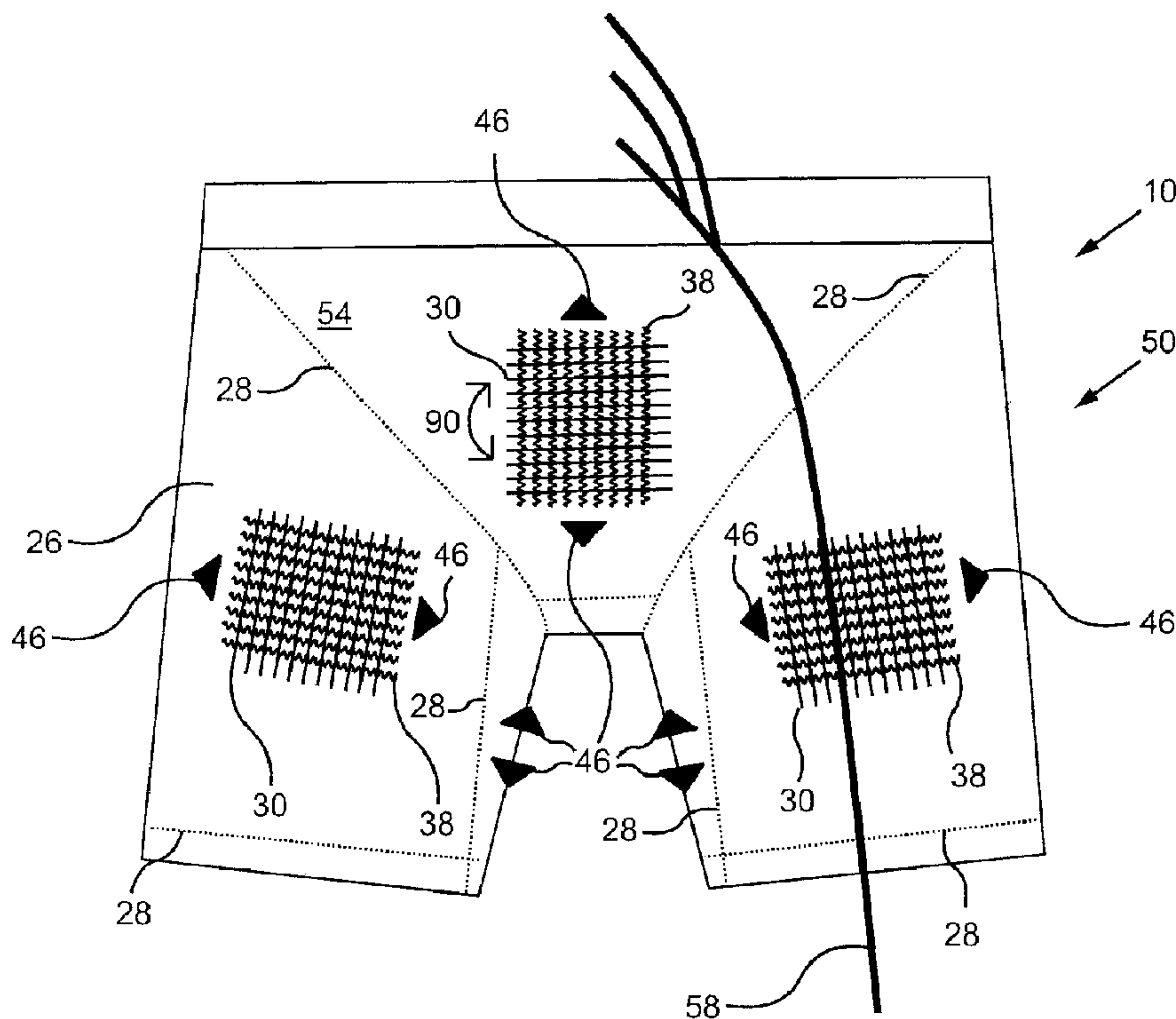




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(54) Titre : SOUS-VETEMENT EN TRICOT RESISTANT A LA CHALEUR  
 (54) Title: HEAT-RESISTANT KNITTED UNDERWEAR



(57) Abrégé/Abstract:

An underwear including a pair of side portions disposed on a front portion of the underwear, the pair of side fabric portions including fabric comprising warps aligned in a longitudinal direction of the underwear and welfs generally disposed at an angle from

(57) **Abrégé(suite)/Abstract(continued):**

the warps allowing the fabric to stretch in a transversal direction, and a center fabric portion disposed on a rear portion of the underwear, the center fabric portion including warps aligned in the transversal direction of the underwear and welfs generally disposed at an angle from the warps allowing the center fabric portion to stretch in the longitudinal direction, the fabric includes no-melt no-drip heat-resistant material and wherein the stretching property of the fabric is mechanically provided by the weaving thereof, whereby the center fabric portion is adapted to longitudinally stretch when a wearer is bending forward to cover a wearer's lower back.

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**ABSTRACT**

An underwear including a pair of side portions disposed on a front portion of the underwear, the pair of side fabric portions including fabric comprising warps aligned in a longitudinal direction of the underwear and welfs generally disposed at an angle from the warps allowing the fabric to stretch in a transversal direction, and a center fabric portion disposed on a rear portion of the underwear, the center fabric portion including warps aligned in the transversal direction of the underwear and welfs generally disposed at an angle from the warps allowing the center fabric portion to stretch in the longitudinal direction, the fabric includes no-melt no-drip heat-resistant material and wherein the stretching property of the fabric is mechanically provided by the weaving thereof, whereby the center fabric portion is adapted to longitudinally stretch when a wearer is bending forward to cover a wearer's lower back.

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**HEAT-RESISTANT KNITTED UNDERWEAR**

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**BACKGROUND OF THE INVENTION**

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**1. Field of the Invention**

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**[01]** This invention generally relates to a heat-resistant knitted underwear. The present invention more specifically relates to an underwear having portions thereof with different fabric stretching properties.

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**2. Description of the Related Art**

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**[02]** Underwear are commonly made of fabrics that contain materials that are not resistant to heat or flames and that melt and drip when heated. These underwears are not designed for specific activities that can be subjected to high temperature and, even, contact with flames. They generally contain elastic polymeric materials in their composition that allow some stretching in two orthogonal directions, which is desirable when the underwear is worn close to the body to allow free movements of the wearer and body humidity evacuation.

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**[03]** Fabrics that are sustaining high heat and/or flames, commonly called no-melt no-drip, cannot contain polymeric materials components and are not designed to stretch. Unfortunately, underwears including materials that are resistant to the above conditions make the underwear stiff and uncomfortable.

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**[04]** It is therefore desirable to provide a comfortable underwear that is made of fabric sustaining heat and/or flames over the existing art.

22

23

**[05]** It is desirable to provide an underwear that has stretching properties and is comfortable.

24

25

**[06]** It is desirable to provide an underwear that can be worn next to the body of a wearer and has stretching properties thereof.

26

27

**[07]** It is desirable to provide an underwear that is inexpensive to assemble and manufacture.

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29

**[08]** It is desirable to provide a no-melt no-drip underwear that includes a fabric that has no elastic added material and that can stretch.

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1 [09] Other deficiencies will become apparent to one skilled in the art to which the  
2 invention pertains in view of the following summary and detailed description with its  
3 appended figures.

4

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#### SUMMARY OF THE INVENTION

6 [10] One aspect of the present invention is to alleviate one or more of the  
7 shortcomings of the background art by addressing one or more of the existing needs in  
8 the art.

9 [11] The following presents a simplified summary of the invention in order to  
10 provide a basic understanding of some aspects of the invention. This summary is not an  
11 extensive overview of the invention. It is not intended to identify key/critical elements of  
12 the invention or to delineate the scope of the invention. Its sole purpose is to present  
13 some concepts of the invention in a simplified form as a prelude to the more detailed  
14 description that is presented later.

15 [12] The invention is generally described as an ergonomic stretchable heat-  
16 resistant underwear.

17 [13] An object of our work provides, in accordance with at least one embodiment,  
18 a heat-resistant knitted underwear that includes no polymeric material and provides  
19 stretching properties in at least one direction.

20 [14] An object of our work provides, in accordance with at least one embodiment,  
21 a heat-resistant knitted underwear that includes non-isometric stretching properties.

22 [15] An object of our work provides, in accordance with at least one embodiment,  
23 a heat-resistant knitted underwear that includes a back center portion that is made  
24 without polymeric material and provides stretching properties to prevent exposing a  
25 lower back skin of a wearer when the wearer of the underwear is bending forward.

26 [16] At least one aspect of the invention, in accordance with at least one  
27 embodiment thereof, provides an underwear that is made of a heat-resistant and  
28 stretchable fabric.

29 [17] At least one aspect of the invention, in accordance with at least one  
30 embodiment thereof, provides an underwear that is made of a mechanically stretchable  
31 fabric.

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1 **[18]** At least one aspect of the invention, in accordance with at least one  
2 embodiment thereof, provides an underwear that is made of a melt and/or drip-resistant  
3 fabric.

4 **[19]** At least one aspect of the invention, in accordance with at least one  
5 embodiment thereof, provides an underwear that is made of a flame-resistant fabric.

6 **[20]** At least one aspect of the invention, in accordance with at least one  
7 embodiment thereof, provides an underwear that is made of a natural fabric.

8 **[21]** At least one object of the invention, in accordance with at least one  
9 embodiment thereof, provides an underwear that is made of a plurality of alternate  
10 portions of fabric.

11 **[22]** At least one object of the invention, in accordance with at least one  
12 embodiment thereof, provides an underwear that is made of a plurality of portions of  
13 fabric knitted in non-parallel directions.

14 **[23]** At least one object of the invention, in accordance with at least one  
15 embodiment thereof, provides an underwear that is made of a plurality of fabric portions  
16 including stretching properties that are changing in function of the stretching directions  
17 requirement.

18 **[24]** At least one object of the invention, in accordance with at least one  
19 embodiment thereof, provides an underwear including front lap portions stretching  
20 laterally and a rear portion stretching longitudinally.

21 **[25]** At least one object of the invention, in accordance with at least one  
22 embodiment thereof, provides an underwear including a rear portion stretching  
23 longitudinally for preventing a lack of extension when a wearer bends forward.

24 **[26]** At least one object of the invention, in accordance with at least one  
25 embodiment thereof, provides an underwear including a plurality of portions assembled  
26 in a fashion where stitches are not aligned with a sciatic nerve of a wearer when worn by  
27 a wearer.

28 **[27]** At least one object of the invention, in accordance with at least one  
29 embodiment thereof, provides a no-melt no-drip underwear comprising a front portion,  
30 the front portion including a pair of side fabric portions secured on lateral sides of a  
31 middle fabric portion, the pair of side fabric portions including warps generally aligned in

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1 a longitudinal direction of the underwear and welfs generally disposed at an angle from  
2 the warps allowing the fabric to stretch in a transversal direction, and a rear portion,  
3 opposed to the front portion, the rear portion including a pair of side fabric portions  
4 secured on lateral sides of a center fabric portion, the pair of side fabric portions  
5 including warps generally aligned in a longitudinal direction of the underwear and welfs  
6 generally disposed at an angle from the warps allowing the fabric to stretch in a  
7 transversal direction, the center fabric portion including fabric comprising warps  
8 generally aligned in the transversal direction of the underwear and welfs generally  
9 disposed at an angle from the warps allowing the center fabric portion to stretch in the  
10 longitudinal direction, wherein the fabric portions include no-melt no-drip heat-resistant  
11 material and wherein the stretching property of the fabric is mechanically provided by the  
12 knitting thereof, whereby the center fabric portion is adapted to longitudinally stretch  
13 when a wearer is bending forward to cover a wearer's lower back.

14 **[28]** At least one object of the invention, in accordance with at least one  
15 embodiment thereof, provides a fire-resistant underwear comprising fabric devoid of  
16 polymer, the fabric being woven with a weaving including at least two distinct sets of  
17 interlaced yarns capable of temporarily stretching in one direction when tension is  
18 applied to the fabric in the at least one direction, the fabric recovering its original size  
19 when tension thereon is released, the underwear further comprising a rear portion  
20 including a pair of side fabric portions disposed on lateral sides of a center fabric portion,  
21 the center fabric portion including longitudinal stretching capability, wherein the fabric  
22 includes no-melt no-drip heat-resistant material and wherein the stretching property of  
23 the fabric is mechanically provided by the weaving thereof, whereby the center fabric  
24 portion is adapted to longitudinally stretch when a wearer is bending forward to cover a  
25 wearer's lower back.

26 **[29]** Each of the embodiments of the present invention has at least one of the  
27 above-mentioned objects and/or aspects, but does not necessarily have all of them. It  
28 should be understood that some aspects of the present invention that have resulted from  
29 attempting to attain the above-mentioned objects may not satisfy these objects and/or  
30 may satisfy other objects not specifically recited herein.

31 **[30]** Additional and/or alternative features, aspects, and advantages of  
32 embodiments of the present invention will become apparent from the following  
33 description, the accompanying drawings, and the appended claims.

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**BRIEF DESCRIPTION OF THE DRAWINGS**

3 [31] Figure 1 is a schematic illustration of a front portion of an underwear in  
4 accordance with an embodiment of the invention;

5 [32] Figure 2 is a schematic illustration of a rear portion of an underwear in  
6 accordance with an embodiment of the invention;

7 [33] Figure 3 is a schematic illustration of a front portion of an underwear in  
8 accordance with an embodiment of the invention;

9 [34] Figure 4 is a schematic illustration of a rear portion of an underwear in  
10 accordance with an embodiment of the invention; and

11 [35] Figure 5 is a schematic illustration of a fabric knitting in accordance with an  
12 embodiment of the invention.

13

14

**DESCRIPTION OF EMBODIMENT(S) OF THE INVENTION**

15 [36] Our work is now described with reference to the figures. In the following  
16 description, for purposes of explanation, numerous specific details are set forth in order  
17 to provide a thorough understanding of the present invention by way of embodiment(s).  
18 It may be evident, however, that the present invention may be practiced without these  
19 specific details.

20 [37] The underwear exemplified in Figure 1 throughout Figure 4 is made of fabric  
21 that has at least one of following properties: heat resistance, flame resistance, drip  
22 resistance and melt resistance, combined with mechanical stretching capabilities. For  
23 example, the fabric is free of synthetic material that cannot sustain heat, or flames, that  
24 melts and/or drips. However, synthetic materials are providing stretching capabilities to  
25 heat, flames, melt and drip resistant fabrics. Heat, flames, melt and drip resistant fabrics  
26 are therefore not elastic by nature and the lack of stretching results in a stiffer material.  
27 Heat resistance is going to be used below to ease readability of the text and is not  
28 disclaiming flame resistance, drip resistance and melt resistance by any means.

29 [38] Underwears need to be comfortable, are preferably worn next to the skin and  
30 stretching is a significant attribute. Indeed, it is desirable to wear an underwear close to  
31 the skin to efficiently evacuate humidity of the body. Such a garment worn next to the

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1 body is uncomfortable if it cannot adjust to the movements of the wearer by stretching  
2 where and when required.

3 **[39]** Fabrics are generally woven or knitted with interlaced sets of yarns. At least  
4 two sets of yarns are interlaced at right angle thereof. A first set of parallel yarns is called  
5 warp. The warps are not significantly stretching in their longitudinal direction.  
6 Conversely, a second set of yarns is called welf and is generally interlaced at right angle  
7 from the first set of yarns, the warp. The welf allows stretching in its knitting direction if it  
8 uses a knitting pattern that allows stretching thereof. The resulting material is thus  
9 stretchable in the longitudinal welf direction. Other types of weaving like felting, braiding  
10 and plaiting are encompassed by the present application despite the text of the  
11 specification is directed to weaving without disclaimer to ease its readability.

12 **[40]** Referring to Figure 1, a front portion 8 of an underwear 10 is illustrated. The  
13 underwear 10 is made of fabric 14 material and includes a hips portion 18, a middle  
14 portion 22 and two side portions 26. The side portions 26 includes fabric having the warp  
15 yarns 30 in the longitudinal direction 34 of the underwear 10. The welf yarns 38 are  
16 generally disposed at an angle from the warp yarn 30, generally orthogonal to the warp  
17 yarn 30, and allows the fabric 14 to stretch in the transversal direction 42. Stretch  
18 direction is illustrated with arrows 46. The two side portions 26 are interconnected with  
19 the middle portion 22 with a joint 28 that could be embodied as a seam.

20 **[41]** Figure 2 illustrates a rear portion 50 of the underwear 10 of Figure 1. The  
21 underwear 10 includes a center portion 54 generally extending over most of the rear  
22 portion of the underwear. The center portion 54 including fabric having the warp yarns  
23 30 in the transversal direction 42 of the underwear 10. The welf yarns 38 are generally  
24 disposed at an angle from the warp yarn 30 and allows the fabric 14 to stretch in the  
25 longitudinal direction 34. The center portion 54 of the rear portion 50 of the underwear  
26 10 is hence allowing the underwear 10 to stretch when a wearer of the underwear 10 is  
27 bending over in a forward direction and prevent exposing a portion of skin. Stretch  
28 direction is illustrated with triangular arrows 46.

29 **[42]** Still referring to Figure 2, the warp 30 and the welf 38 of the two side portions  
30 26 are disposed in opposite arrangement with the center portion 54 to allow material  
31 stretching in opposite directions and improve the comfort provided by the underwear 10  
32 by adjusting to movements of a wearer, even if the underwear 10 is worn close to the  
33 skin hence reacting to all movements of the body of a wearer. The two side portions 26

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1 are interconnected with the middle portion 54 with a joint 28 that could be embodied,  
2 here again, as a seam. It can be appreciated that the middle portion 54 includes sort of a  
3 "V" shape distally beginning in the region of the hips of a wearer at its upper portion  
4 thereof and proximally ending between the legs of a wearer at its lower portion thereof.  
5 The joint 28 between the middle portion 54 and the side portions 26 is located in such a  
6 way to intersect a sciatic nerve 58 of a wearer when worn by the wearer to prevent  
7 uncomfortable, and even painful, interaction thereof. In other words, there is only a  
8 limited overlapping, and no lengthy overlapping, of the the joint 28 with the sciatic nerve  
9 58 that is generally aligned with a leg axis 62, when worn by a wearer.

10 **[43]** The underwear 10 assembled in such a manner allows front transversal 42  
11 stretching over the legs and back longitudinal 34 stretching using different yarn  
12 orientations for different portions of the underwear 10 to cooperate with the underwear  
13 stretching when adapting to movements of a wearer. This underwear 10 construction  
14 allows rear longitudinal stretching over the upper butt and lower back when a wearer  
15 bends forward to prevent uncovering lower back skin.

16 **[44]** Referring now to Figure 3 and Figure 4 illustrating a different embodiment of  
17 the underwear 10. It can be appreciated the warp 30 and the welf 38 of the two side  
18 portions 26 are disposed in a similar arrangement than the underwear 10 embodied in  
19 Figure 1 and Figure 2. However, it can be appreciated the middle portion 54 includes  
20 sort of a "U" shape distally beginning in the region of the hips at its upper portion thereof  
21 and proximally ending between the legs at its lower portion thereof. The joint 28 between  
22 the middle portion 54 and the side portions 26 is located in such a way to intersect the  
23 sciatic nerve 58, at about 90 degrees, when worn by a wearer to prevent uncomfortable  
24 and even painful interaction thereof. Similarly, with the previous embodiment, there is  
25 only a punctual overlapping and no lengthy or parallel overlapping of the the joint 28 with  
26 the sciatic nerve 58, when worn by a wearer.

27 **[45]** Figure 5 illustrates an exemplary knitting 66 with knitting 66 exemplified,  
28 without being limited to, with a series of warps 30 and a series of welf 38. Note that  
29 knitting 66 can be made without the warps 30 in an alternate embodiment without  
30 departing from the scope of the present invention. In the illustrated embodiment, the  
31 knitted piece of fabric has a stretching direction 70 and a non-stretching direction 74 to  
32 manufacture a non-isotropic fabric. If knitting does not include warps 30, some stretching

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1 can be obtained in the orthogonal direction 78 to manufacture an isotropic fabric without  
2 departing from the scope of the invention.

3 **[46]** The description and the drawings that are presented above are meant to be  
4 illustrative of the present invention. They are not meant to be limiting of the scope of the  
5 present invention. Modifications to the embodiments described may be made without  
6 departing from the present invention, the scope of which is defined by the following  
7 claims:

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1 What is claimed is:

2

3 1. A no-melt no-drip underwear comprising:

4 a front portion, the front portion including a pair of side fabric portions secured  
5 on lateral sides of a middle fabric portion, the pair of side fabric portions including warps  
6 generally aligned in a longitudinal direction of the underwear and welfs generally  
7 disposed at an angle from the warps allowing the fabric to stretch in a transversal  
8 direction; and

9 a rear portion, opposed to the front portion, the rear portion including a pair of  
10 side fabric portions secured on lateral sides of a center fabric portion, the pair of side  
11 fabric portions including warps generally aligned in a longitudinal direction of the  
12 underwear and welfs generally disposed at an angle from the warps allowing the fabric  
13 to stretch in a transversal direction, the center fabric portion including fabric comprising  
14 warps generally aligned in the transversal direction of the underwear and welfs generally  
15 disposed at an angle from the warps allowing the center fabric portion to stretch in the  
16 longitudinal direction,

17 wherein the fabric portions include no-melt no-drip heat-resistant material and  
18 wherein the stretching property of the fabric is mechanically provided by the knitting  
19 thereof,

20 whereby the center fabric portion is adapted to longitudinally stretch when a  
21 wearer is bending forward to cover a wearer's lower back.

22

23 2. The no-melt no-drip underwear of claim 1, wherein the fabric portions include  
24 natural fibers therein.

25

26 3. The no-melt no-drip underwear of any one of claims 1 or 2, wherein the fabric  
27 portions include yarns that has minimal stretching capability.

28

29 4. The no-melt no-drip underwear of any one of claims 1 to 3, wherein the  
30 center fabric portion includes a "V" shape.

31

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- 1 5. The no-melt no-drip underwear of any one of claims 1 to 4, wherein the  
2 center fabric portion includes a "U" shape.  
3
- 4 6. The no-melt no-drip underwear of any one of claims 1 to 5, wherein the  
5 center fabric portion is secured to the side fabric portions with joint disposed at an angle  
6 in respect with a leg axis.  
7
- 8 7. A fire-resistant underwear comprising fabric devoid of polymer, the fabric  
9 being woven with a weaving including at least two distinct sets of interlaced yarns  
10 capable of temporarily stretching in one direction when tension is applied to the fabric in  
11 the at least one direction, the fabric recovering its original size when tension thereon is  
12 released, the underwear further comprising a rear portion including a pair of side fabric  
13 portions disposed on lateral sides of a center fabric portion, the center fabric portion  
14 including longitudinal stretching capability,  
15 wherein the fabric includes no-melt no-drip heat-resistant material and  
16 wherein the stretching property of the fabric is mechanically provided by the weaving  
17 thereof,  
18 whereby the center fabric portion is adapted to longitudinally stretch when a  
19 wearer is bending forward to cover a wearer's lower back.  
20
- 21 8. The fire-resistant underwear of claim 7, wherein the fabric portions include  
22 natural fibers therein.  
23
- 24 9. The fire-resistant underwear of any one of claims 7 or 8, wherein the fabric  
25 portions include yarns that has minimal stretching capability.  
26
- 27 10. The fire-resistant underwear of any one of claims 7 to 9, wherein the center  
28 fabric portion includes a "V" shape.  
29

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1 11. The fire-resistant underwear of any one of claims 7 to 10, wherein the center  
2 fabric portion includes a "U" shape.

3

4 12. The fire-resistant underwear of any one of claims 7 to 11, wherein the center  
5 fabric portion is secured to the side fabric portions with joint disposed at an angle in  
6 respect with a leg axis.

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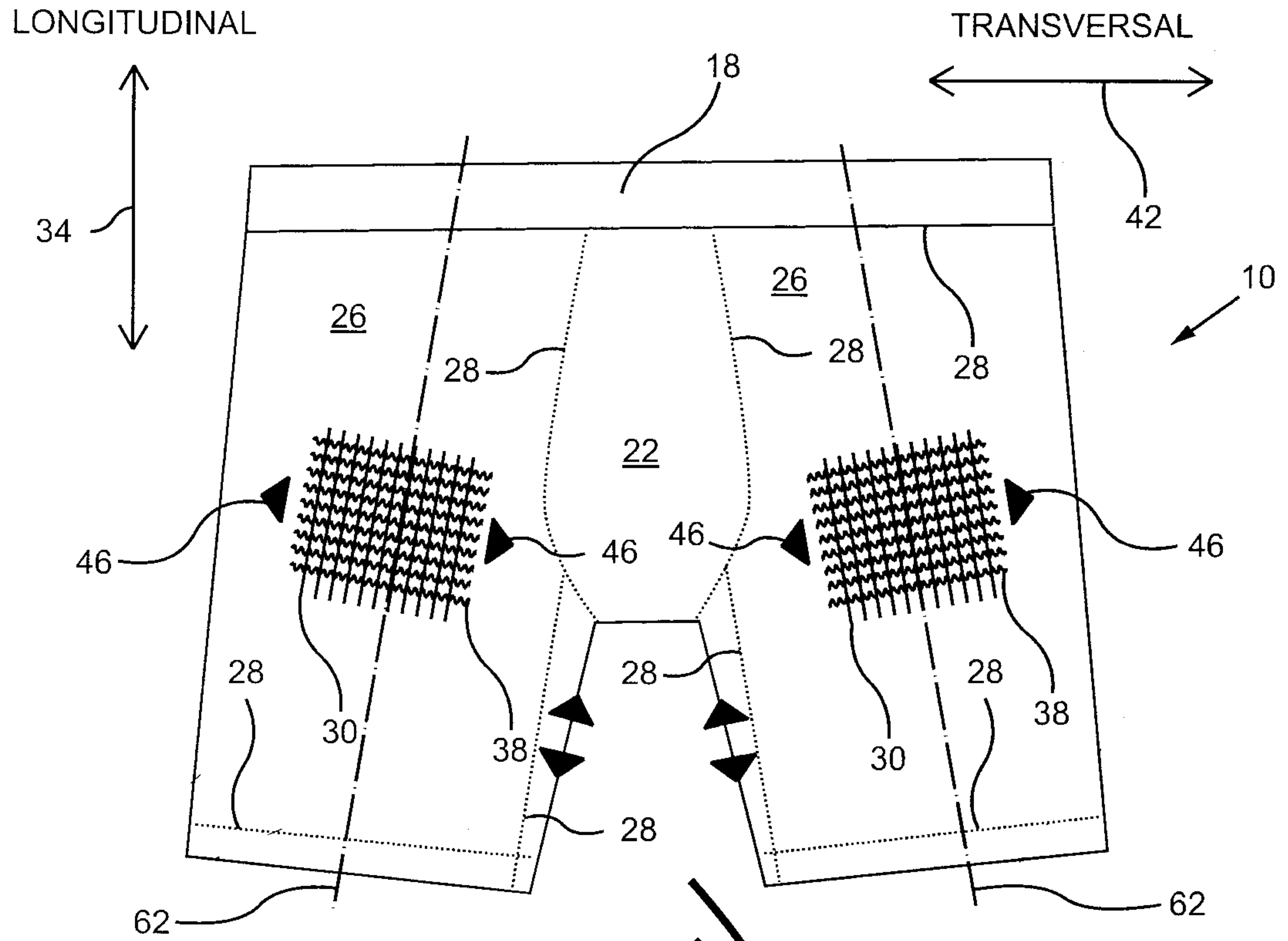


FIG. 1

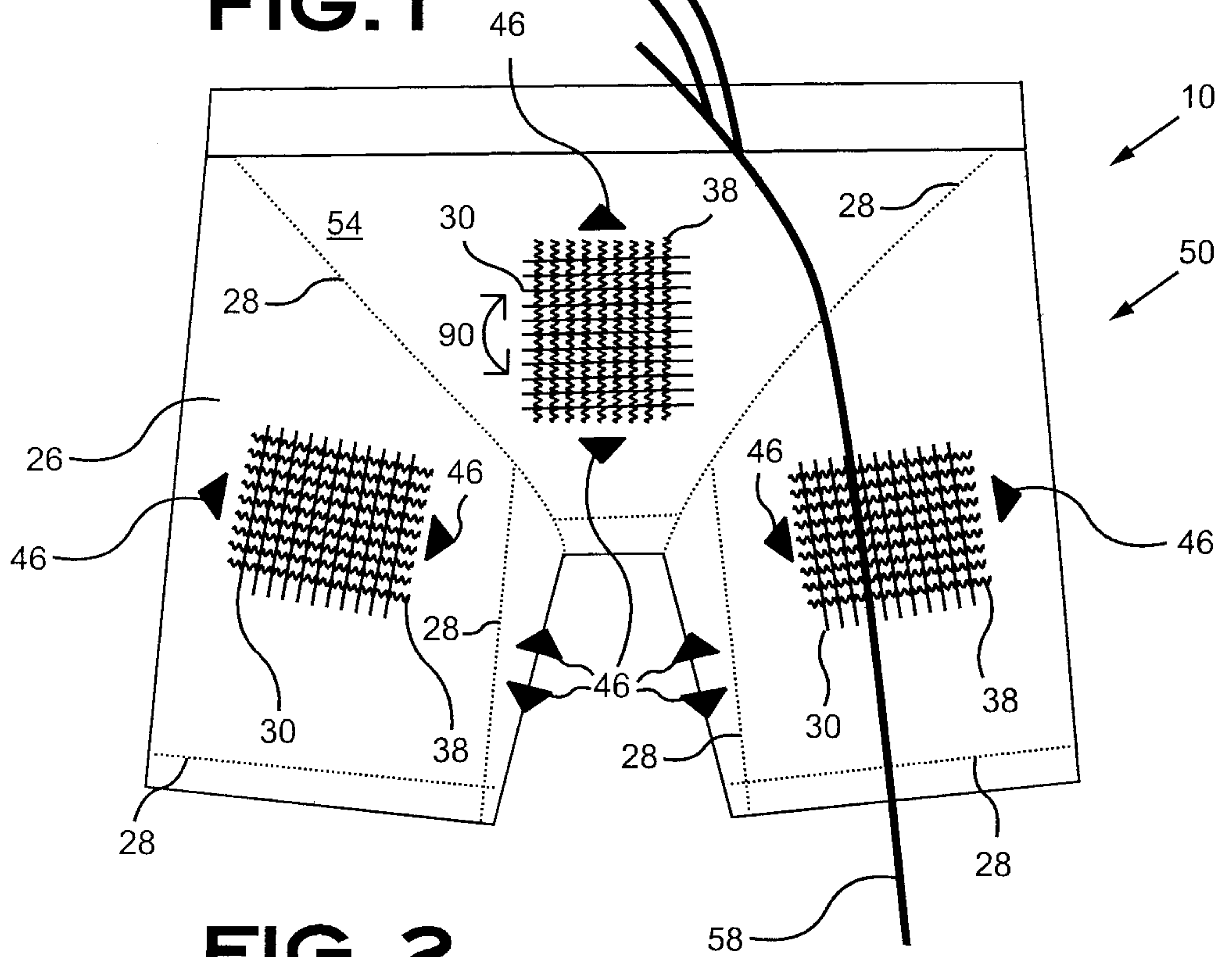
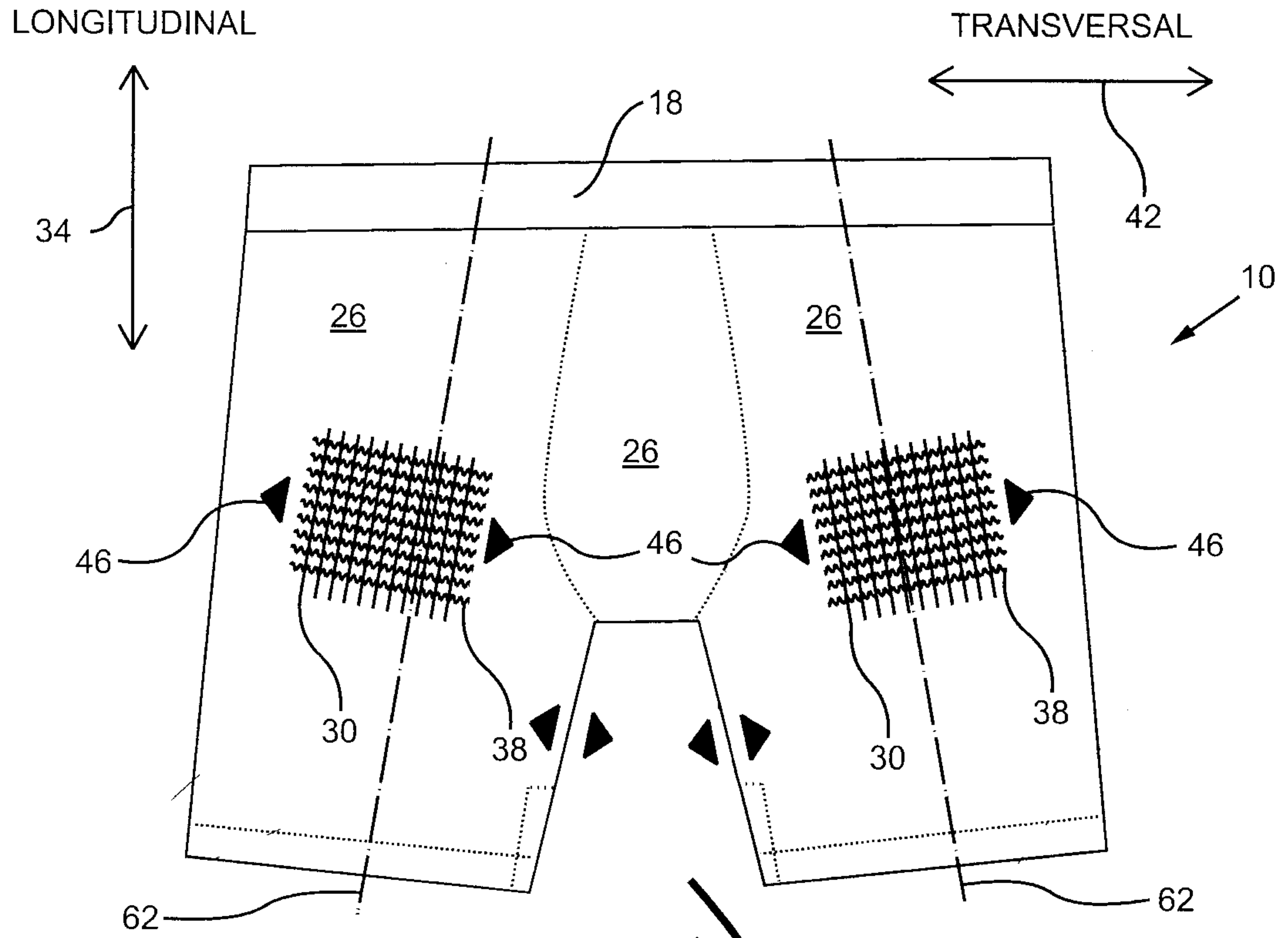
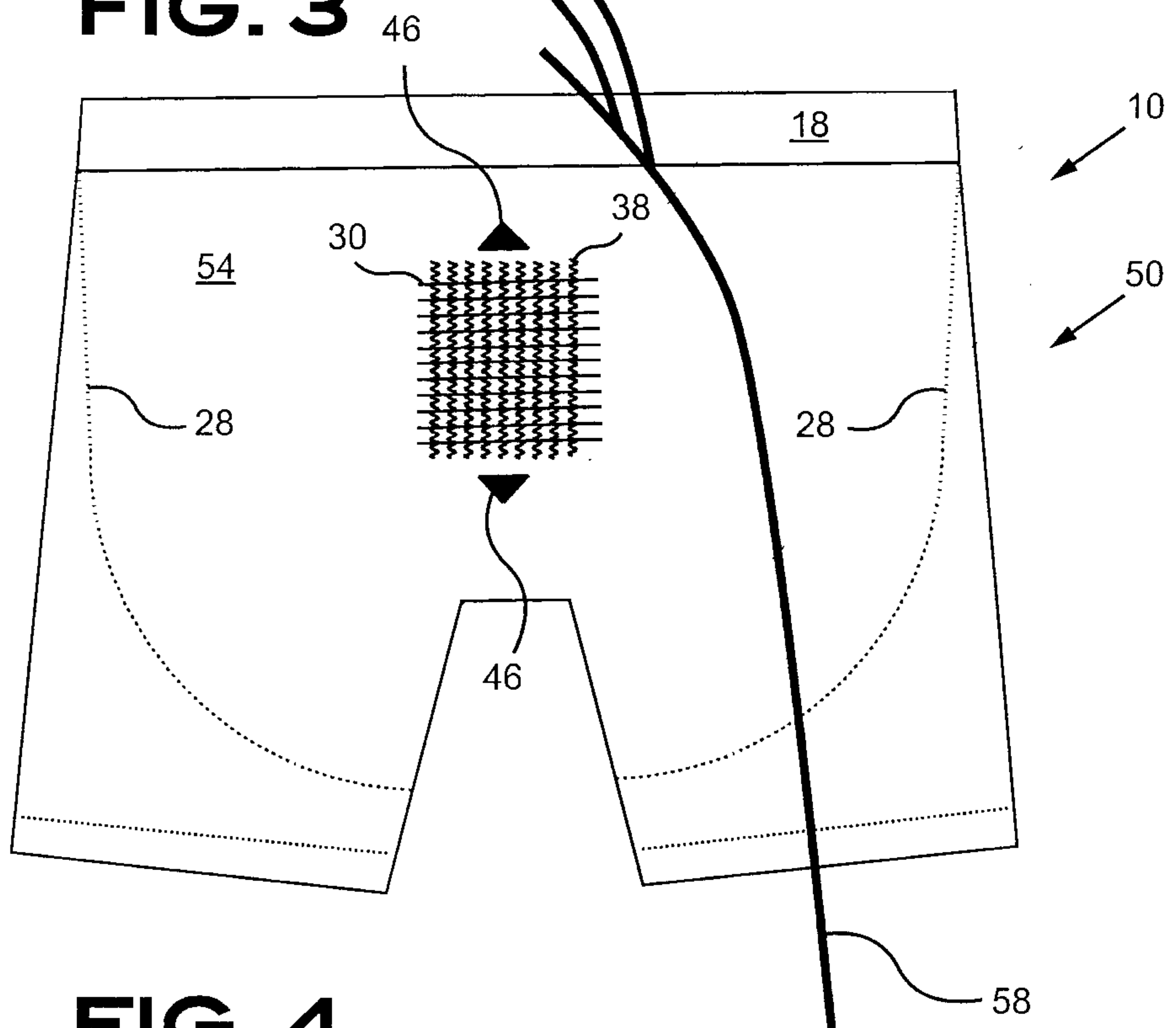


FIG. 2

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**FIG. 3**



**FIG. 4**

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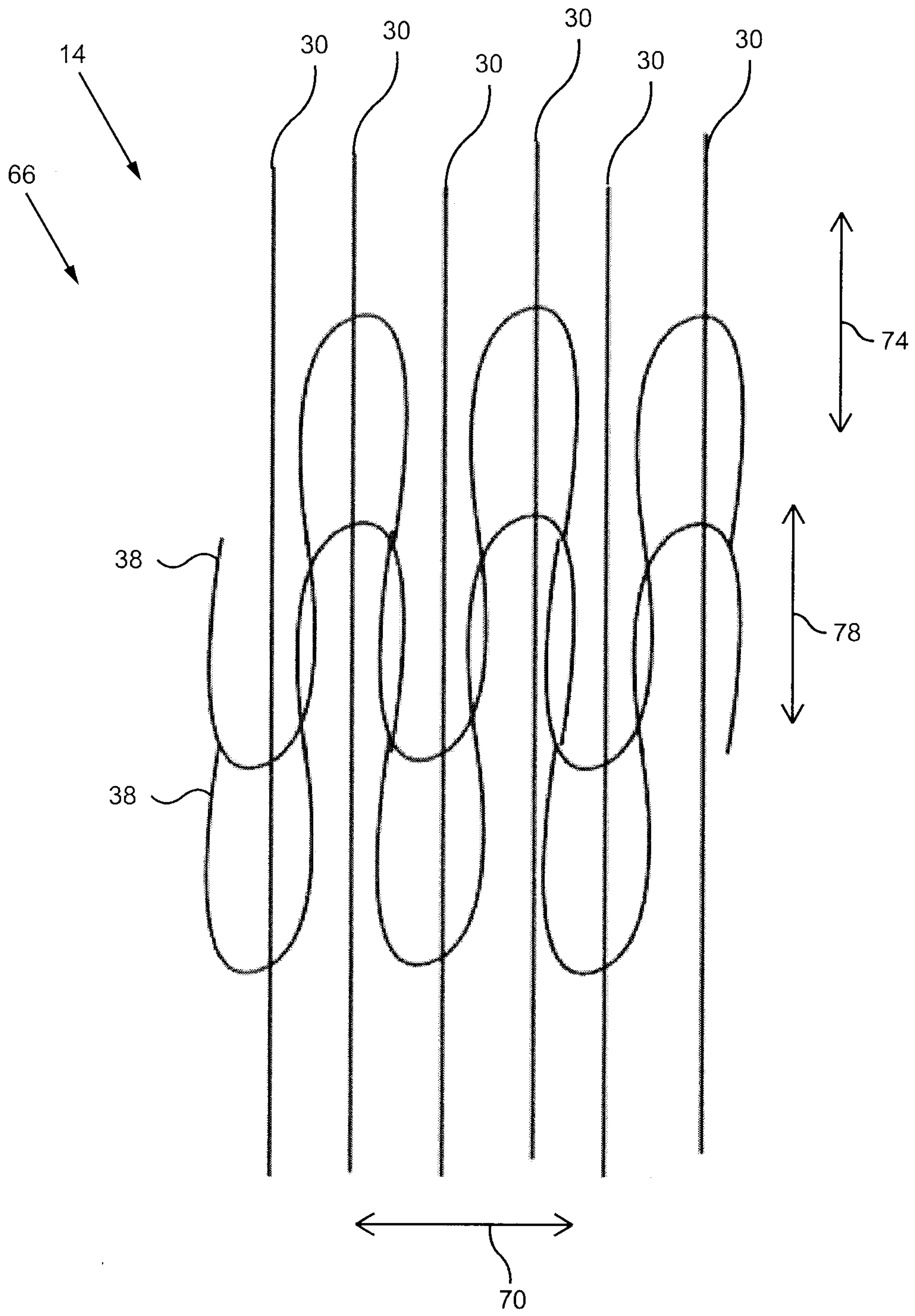


FIG. 5

