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(71) Demandeur/Applicant:
BASE360 INC., CA

(72) Inventeurs/Inventors:
LOYENS, ROLF, CA;
AHMED, IQBAL, PK

(74) Agent: BRION RAFFOUL

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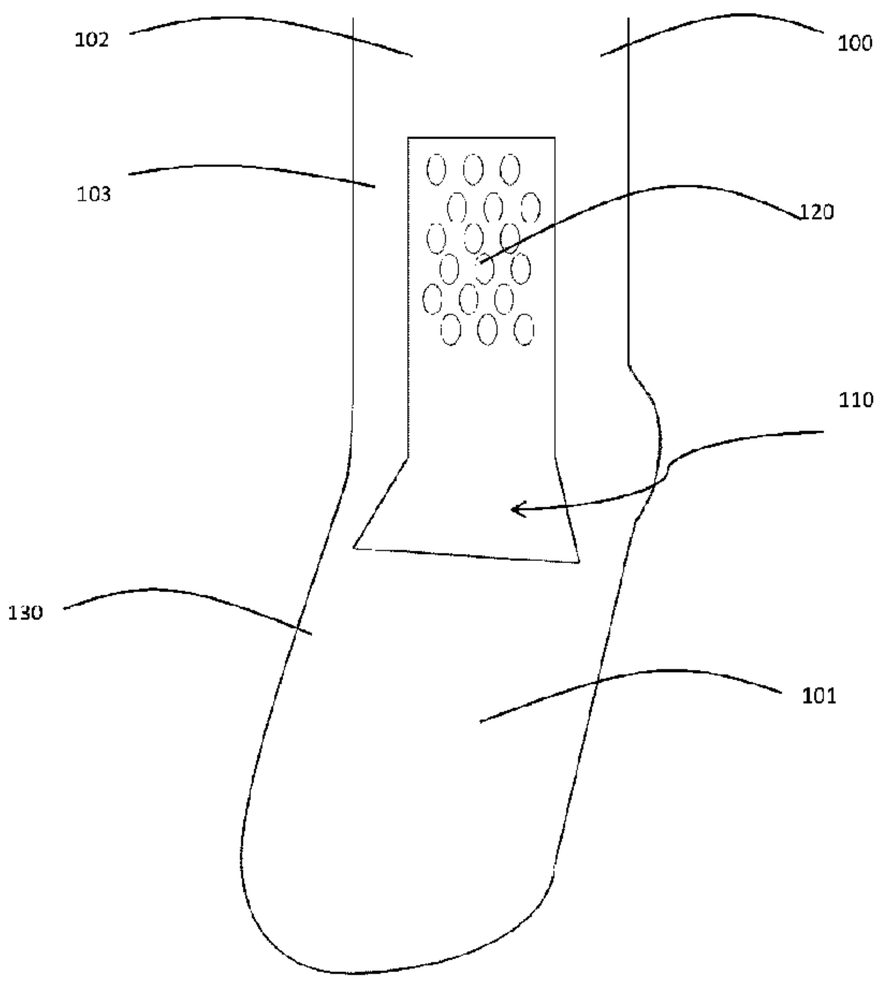

FIGURE 1

(57) Abrégé/Abstract:
A protective sock that integrates a protective padding to provide a unitary garment is disclosed. As such, a wearer's need to frequently adjust the position of the protective equipment is likely reduced. An integrated and flexible protective padding also limits the amount of equipment required by the wearer. The padding also conforms to the wearer's body, and thus likely increases the athlete's wearer's comfort. A protective sock that integrates a high friction surface to restrict the movement of any secondary equipment is also disclosed. Such a restriction prevents the exposure of a wearer's body to potential injury. Movement of the secondary equipment may also be distracting to the wearer. As such, the integrated high friction surface likely provides the athlete wearer with a performance advantage. The sock may integrate the protective padding and/or the high friction surface.

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(71) **Applicant**: **BASE360 INC.** [CA/CA]; 205-460 West Hunt Club Road, Ottawa, Ontario K2E 0B8 (CA).

(72) **Inventors**: **LOYENS, Rolf**; 205-460 West Hunt Club, Ottawa, Ontario K2E 0B8 (CA). **AHMED, Iqbal**; Super rd2, Phase 1 EPZ, Sri Lanka, Katunayaka (PK).

(74) **Agent**: **BRION RAFFOUL**; 289 Cyr Avenue, Ottawa, ontario K1L 7N6 (CA).

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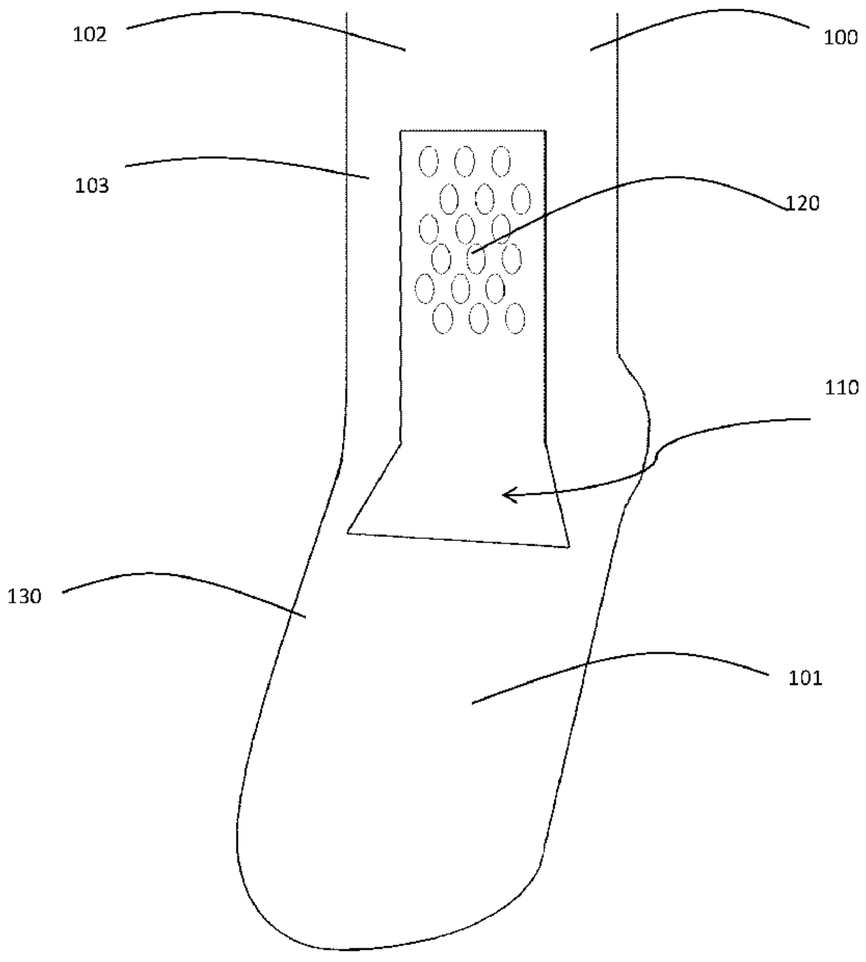

FIGURE 1

(57) Abstract: A protective sock that integrates a protective padding to provide a unitary garment is disclosed. As such, a wearer's need to frequently adjust the position of the protective equipment is likely reduced. An integrated and flexible protective padding also limits the amount of equipment required by the wearer. The padding also conforms to the wearer's body, and thus likely increases the athlete's wearer's comfort. A protective sock that integrates a high friction surface to restrict the movement of any secondary equipment is also disclosed. Such a restriction prevents the exposure of a wearer's body to potential injury. Movement of the secondary equipment may also be distracting to the wearer. As such, the integrated high friction surface likely provides the athlete wearer with a performance advantage. The sock may integrate the protective padding and/or the high friction surface.

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A PROTECTIVE SOCK

TECHNICAL FIELD

[0001] This invention relates to the field of protective equipment. More specifically, this invention relates to apparel that provides protection to a wearer's foot and ankle during a myriad of activities, including but not limited to, ice skating, running, hiking, dancing, law enforcement, industrial applications, or other physical activities requiring securely fitted footwear.

BACKGROUND

[0002] Many sports, such as hockey, figure skating, inline skating, and speed skating, involve the use of footwear that must be tied securely to a wearer's foot. Poorly or tightly fitting footwear may cause undue pressure to be placed on the extensor hallucis tendon leading to painful injury. Such injury may be avoided through the proper use of protective equipment.

[0003] For example, it is known that tightly tied skate-laces may aggravate the muscles joined by the extensor hallucis tendon that may in turn lead to acute inflammation of the tendon (extensor tendonitis) and acute inflammation of the fluid surrounding the tendon (extensor tenosynovitis). Extensor tendonitis and extensor tenosynovitis, commonly referred to as lace bite, may cause sharp pain and pressure felt along the front of the lower leg and top of the foot. The use of

protective padding in front of the affected areas can help to prevent such injuries from occurring.

[0004] Lace bite has been addressed in the art by the use of added foam or gel inserts between the front of the wearer's ankle and the tongue of the foot wear. Such a solution requires frequent adjustment of the added insert and is often deemed uncomfortable and distracting for the wearer. Such inserts may also be adhered to the tongue of the footwear. However, this solution potentially damages the footwear as it is a permanent adhesion, and thus cannot be repositioned if it causes further aggravation or if it does not address lace bite symptoms.

[0005] Ankle sleeves are another known solution. The sleeve incorporates a protective padding in the lace bite region. However this equipment must be worn over a sock and must be adjusted to ensure coverage of the affected area.

[0006] In another prior art reference, U.S. Patent No. 8,856,968, by Sherman, describes a sock with removable stabilizer pads adjacent to an ankle of a wearer. These stabilizer pads are however susceptible to movement and require assembly.

[0007] In addition to socks and protective padding, a wearer, including, but not limited to, law enforcement professionals and athletes such as hockey players, typically requires secondary protective equipment. Poorly positioned secondary equipment may leave the wearer susceptible to injury. To ensure protection and to prevent movement, this secondary equipment is often further secured to the circumference of the leg by means of adhesive tape, or a hook and loop fastening

band. However, the need to secure the secondary equipment with an additional product can be time consuming and cumbersome for the wearer. Furthermore, these securing means are often not entirely effective at preventing movement of the secondary equipment. Therefore, additional means of securement of the secondary protective equipment is desired.

[0008] There is therefore a need to mitigate, if not overcome, the shortcomings of the prior art and to, preferably, provide protection from injury while reducing movement of secondary equipment in a less cumbersome solution.

SUMMARY

[0009] The present invention provides a protective sock that prevents injury due to lace bite or movement of secondary protective equipment. Use of this protective sock is applicable to hockey and other ice skating-related activities, as well as running, hiking, dancing, law enforcement or other physical activities requiring securely fitted footwear.

[0010] More specifically, the present invention provides a protective sock that integrates a protective padding to provide a unitary garment. As such, a wearer's need to frequently adjust the position of the protective equipment is likely reduced. An integrated and flexible protective padding also limits the amount of equipment required by the wearer. The padding also conforms to the wearer's body, and thus likely increases the wearer's comfort.

[0011] The present invention also provides a protective sock that integrates a high friction surface to restrict the movement of any secondary equipment. Such a restriction prevents the exposure of a wearer's body to potential injury. Movement of the secondary equipment may also be distracting to the wearer. As such, the integrated high friction surface likely provides the wearer with a performance advantage.

[0012] Also in accordance with the present invention, the sock may integrate the protective padding and/or the high friction surface.

[0013] In a first aspect, this document discloses a protective sock for use on and for protecting a wearer's foot and ankle comprising: a foot portion enclosing the wearer's foot having a top side and an underside, a leg portion extending from the foot portion, having a front portion extending upwardly from the top side and a rear portion extending upwardly from the underside, and at least one protective padding, wherein the at least one protective padding is integrated into at least an area of the front portion of the leg portion.

[0014] In a second aspect, this document discloses a protective sock for use on and for protecting a wearer's foot and ankle comprising: a foot portion enclosing the wearer's foot having a top side and an underside, a leg portion extending from the foot portion, having a front portion extending upwardly from the top side and a rear portion extending upwardly from the underside, and at least one high friction surface, wherein the at least one high

friction surface is integrated into at least an area of the leg portion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The embodiments of the present invention will now be described by reference to the following figures, in which identical reference numerals in different figures indicate identical elements, and in which:

FIGURE 1 is a front view of the protective sock according to one embodiment of the present invention.

FIGURE 2 is a side view of the protective sock according to another embodiment of the present invention where two protective pads overlap one another.

FIGURE 3 is a side view of the protective sock according to a further embodiment of the present invention including a protective padding adjacent to a wearer's ankle.

FIGURE 4 is a front view of the protective sock according to a further embodiment of the present invention that includes a high surface area adjacent to the leg of the wearer.

FIGURE 5 is a perspective view of the protective sock according to one embodiment of the present invention that includes compression zones integrated in the sock.

FIGURE 6 is a side view of the protective sock according to a further embodiment of the present

invention that includes a high friction surface area adjacent to the leg of the wearer.

FIGURE 7 is an enlarged view of a protective padding on the protective sock according to another embodiment of the present invention.

FIGURE 8 is an enlarged view of a protective padding on the protective sock according to a further embodiment of the present invention.

[0016] The figures are not to scale and some features may be exaggerated or minimized to show details of particular elements while related elements may have been eliminated to prevent obscuring novel aspects. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention.

DETAILED DESCRIPTION

[0017] The present invention provides a protective sock conforming to the wearer's body including a protective padding and/or a high friction surface.

[0018] **FIGURE 1** shows a protective sock 100 having a foot portion 101 and a leg portion 102. In the embodiment shown in the Figure, the front portion 103 of the leg portion 102 includes a protective padding 110 with perforations 120.

[0019] In one embodiment, the protective padding 110 extends outwardly onto the top side 130 of the foot portion

101. The perforations 120 included in some embodiments assist in reducing trapped moisture on the wearer's foot thereby preventing blistering.

[0020] In another embodiment, the protective padding 110 is a high friction surface.

[0021] The protective sock 100 may be made of material including, but not limited to: natural fibers such as cotton, silk, and wool, and synthetic fibers such as, but not limited to: polyester, wrapped glass, steel fibers, nylon, acrylic, elastane, rayon, aramids, and high-performance polyethylene. For example, Dyneema™, or ultra-high-molecular-weight polyethylene, is a high-performance polyethylene that is desirable for use as a material for the protective sock as it has the highest impact strength of any thermoplastic material currently made due to its extremely long molecular chains. Wrapped glass and steel fibers and filaments may be incorporated into yarn for increased cut resistance, and as such are desirable for use in a protective garment. Similarly, nylon, a polyamide fiber, is desirable as it is highly durable in a wide temperature range. Polyester is also a desirable fiber for use as this polymer is very strong, and is hydrophobic, which helps to keep the material dry. It is readily contemplated that the material of the sock may be comprised of any combination of the above noted fibers. The protective sock may also include a material that is a sweat-wicking, anti-bacterial, anti-odor and/or cooling fiber. For example, fibers or materials that incorporate silver, other metals, or natural stone particles, such as jade, may provide specialized properties to the material.

[0022] The fibers are wound, wrapped, twisted, or plaited, in a specific manner to form yarn. The choice of yarn and yarn plaiting and wrapping, as well as the choice of knitting pattern, provides specialized properties for the material. As such, multiple yarns may be plaited or plied together to form threads that are knitted together to form fabric. Different fibers may be interwoven to produce the fabric. In a first example, a first yarn may be comprised of 150 D (denier) polyester fiber. A second yarn may be comprised of 70 D nylon fiber and 40 D elastane fiber. These two yarns may be knitted together to form a fabric for at least a portion of the sock. Table 1 shows the yarn combination of the first example:

Table 1

Yarn no.	**Yarn type**	**Count**	**Color**	**Filament**
Yarn 1	Polyester X 3	150 D	Black	96F
Yarn 2	Nylon X 1	70 D	Black	24F
	Elastane X 1	40 D	White	_

[0023] A second example includes fabric formed by knitting together a yarn including 400 D Dyneema™, with a yarn including 70 D nylon and 40 D elastane. Table 2 shows the yarn combination of the second example:

Table 2

Yarn no.	Yarn type	Count	Color	Filament
Yarn 3 (intermingle)	Dyneema™ X 2	400 D	White	195F
Yarn 2	Nylon X 1	70 D	Black	24F
	Elastane X 1	40 D	White	_

[0024] Table 3 outlines a further example, showing different Nylon yarns with different deniers that are interwoven to produce the fabric.

Table 3

Yarn no.	Yarn type	Count	Color	Filament
Yarn 5	Nylon x 2	140 D	Black	24F
Yarn 6	Nylon x 1	140 D	Black	24F
Yarn 7	Nylon x 1	70 D	Black	24F
	Elastane x 1	40 D	White	_

The properties provided by a fabric may be improved beyond simply combining different fibers to create different yarn compositions, and knitting various yarns together to form specialized fabrics. The yarn may also be plaited either inward or outward, to produce a different texture, to increase performance, such as cut-resistance, as well as comfort for the

wearer. For example, in the first example above, the first yarn may be plaited outward, while the second yarn may be plaited inward. Tables 4, 5, and 6 show exemplary plaiting details for the first, second, and third yarn combination examples, respectively.

Table 4

Yarn	**Plaiting**
Yarn 1	OUT
Yarn 2	IN

Table 5

Yarn	**Plaiting**
Yarn 3	OUT
Yarn 4	IN

Table 6

Yarn	**Plaiting**
Yarn 5	OUT
Yarn 6	OUT
Yarn 7	IN

[0025] The yarn may be knit to form a fabric using a specific needle gauge. The yarn may also be knit using a specific pattern and at a specific speed. For example, a No. 132 gauge needle may knit at 250 RPM to produce the sock. The use of a particular fibers, yarn, and knitting parameters allow for creating a desirable fabric texture. For example, the combination of thread wrapping and knitting pattern of the material may optimize the material for heat dissipation, cooling, or a particular texture such as softness or coarseness to touch. In one embodiment, the choice of thread wrapping and/or knitting pattern may create a soft and smooth inner surface with a coarse external surface that provides a high friction surface. Threads of more than one material may also be interwoven for use in the protective sock. The different fabrics may be applied to different areas of the sock. For example, one fabric may be utilized for the foot portion, while another fabric is utilized for the leg portion.

[0026] In a further embodiment of the present invention, the protective padding 110 may cover a relatively smaller or larger area of the sock 100. The padding size may depend on the size of the sock or the intended use, such as the sport type.

[0027] Referring to **FIGURE 2**, the front portion 103 of the leg portion 102 includes a protective padding 110 that is comprised of a plurality of protective pads 140 and 150. In this embodiment, the two protective pads 140 and 150 overlap one another. This arrangement provides for increased protection of the wearer's ankle, filling the gap between the leg portion 102 of the

protective sock 100 and any footwear or secondary equipment.

[0028] **FIGURE 3** shows the front portion 103 of the leg portion 102 having a plurality of protective pads 160. The plurality of protective pads 160 may define a design. For example, a pattern of criss-crossing protective pads or any other shape of protective pad is contemplated. The use of a plurality of protective pads may reduce trapped moisture on the wearer's foot or leg, thereby reducing the risk of blistering. In this embodiment, the protective sock 100 further comprises a protective padding 170 adjacent to a wearer's ankle.

[0029] The protective padding 170 may be designed, and in particular, shaped, to offer enhanced protection of the ankle. The design feature of the plurality of protective pads 160 and of the protective padding 170 is not limited to what is shown in the Figures.

[0030] **FIGURE 3** further shows a protective padding 180 on the underside of the foot portion 101.

[0031] Referring to **FIGURE 4**, in another embodiment, the front portion 103 of the leg portion 102 includes a high friction surface 210 that is integrated exteriorly. The high friction surface 210 may also form a design, such as a pattern or a word mark, or a particular shape as shown in **FIGURE 4**.

[0032] **FIGURE 4** also shows compression zones 205 integrated in the sock to better conform the sock to the leg and to the foot of the wearer. The compression zones reduce movement of the sock on the foot and leg of the wearer to help keep the high friction surface 210 in

place. This increases comfort for the wearer. The sock may also include ribbing 206 at the top to help prevent the sock from sliding down.

[0033] **FIGURE 5** shows the compression zones 205 more clearly. As shown in **FIGURES 4, 5, and 6**, in one embodiment, the protective sock may include at least one compression zone 205 integrated circumferentially into the sock 100 to better conform the sock to the foot and leg of the wearer. The inclusion of a compression zone 205 is to minimize any movement of the sock on the leg of the wearer during activity and to help maintain the positioning of the high friction surface 210. In the embodiment shown in the Figures, three compression zones are integrated for securing the sock: a first zone near the top of the leg portion 102 and under the ribbing 206 at the top of the sock, a second zone above the ankle portion of the protective sock, and a third zone near the arch of the foot of the wearer. These three zones provide for a sock that conforms to the natural curves of feet and legs. The sock conforms to the natural curves by compressing at the arch of the foot, above the ankle, and above the calf muscle. Providing compression zones in these narrower areas of the leg reduces the amount of loose material, thereby minimizing potential chafing and discomfort for the wearer.

[0034] As may be readily contemplated by the skilled artisan, the location of the compression zone on the sock is not limited to the areas depicted in the Figures. It should also be noticed that the surface area covered by the compression zones is not limited to the surface area that is shown in the Figures. For example, in one embodiment, a compression zone may cover a smaller or

larger surface area of the sock, and may encompass the entire shin/calf region of the leg portion. In another embodiment, the protective sock may be comprised of a compression material in its entirety. It is also readily contemplated that a compression zone may be integrated circumferentially horizontally, as shown, along a diagonal (not shown), or with any pattern or design, such as a criss-cross pattern (not shown).

[0035] **FIGURE 5** also shows an outline of knitting pattern regions A through G.

[0036] **FIGURE 6** further shows a side view of a high friction surface 210 that is integrated exteriorly on the protective sock.

[0037] **FIGURE 7** shows the protective padding 110 with a high friction surface 210 that is made of a silicone material. Alternatively, the protective padding 110 may be made of material that is heat resistant, cut-resistant and/or machine washable. The protective padding 110 may adhere to the fibres of the protective sock material 230 without bleeding through the fibres to an interior surface of a sock, thereby increasing comfort for the wearer. The protective padding may also be flexible with the expansion and contraction of the protective sock material 230. The protective padding 110 is also contemplated as being durable to withstand rigorous athletic activity and frequent laundering, and may be of light-weight material to reduce discomfort.

[0038] **FIGURE 8** includes a protective padding 110 that is a plurality of protective pads 140 and 150. In this embodiment, two of the plurality of protective pads 140 and 150 overlap one another. This arrangement

seeks to provide increased protection for the leg or foot of the wearer.

[0039] It is further contemplated that the protective pad and/or high friction surface may extend circumferentially around the leg portion to a rear portion of the leg portion, such as a band or similar configuration (not shown).

[0040] In addition, it should be readily understood that the protective pads and/or high friction surface may be constructed and arranged on the rear portion of the leg portion (also not shown), in addition to its front portion.

[0041] It is also contemplated that the top side and the underside of the foot portion may also include any combination of protective pad and high friction surface. For example, some athlete training may require high friction surfaces on the underside of the foot portion.

[0042] Residual fabric due to a poor fit of the foot portion may create unwanted movement and friction on the wearer, causing discomfort or injuries such as blisters. Therefore, the foot portion is preferably constructed of a material with elastic properties, or an elastic material composition, to tightly conform to the wearer's foot. Additionally, the material of the foot portion is preferably thin for comfort of the wearer and to keep the wearer's foot cool. As such, it may be readily understood that a given portion of the sock may have a different thickness of material from another portion of the sock.

[0043] It is further contemplated that the foot portion may enclose individual toes (not shown).

[0044] The present invention also contemplates that the sock may extend beyond the knee portion of the leg portion to the thigh area (not clearly shown).

[0045] A person understanding this invention may now conceive of alternative structures and embodiments or variations of the above all of which are intended to fall within the scope of the invention as defined in the claims that follow.

What is claimed is:

1. A protective sock for use on and for protecting a wearer's foot and ankle comprising:

at least one material for forming the protective sock,

a foot portion enclosing the wearer's foot having a top side and an underside,

a leg portion extending from the foot portion,

having a front portion extending upwardly from the top side and a rear portion extending upwardly from the underside, and

at least one protective padding,

wherein the at least one protective padding is integrated into at least an area of the front portion of the leg portion.

2. The protective sock according to claim 1, wherein the at least one protective padding is a plurality of protective pads, wherein at least two of the plurality of protective pads overlap one another.

3. The protective sock according to claim 1, wherein the at least one protective padding is integrated exteriorly at the front portion.

4. The protective sock according to claim 1, wherein the protective padding comprises a silicone material.

5. The protective sock according to claim 1, wherein the at least one material is a machine-washable material.

6. The protective sock according to claim 1, wherein the at least one material is a cut-resistant material, wherein at least a portion of the protective sock is made of the cut-resistant material.

7. The protective sock according to claim 1, further including at least one auxiliary protective padding adjacent to a wearer's ankle.

8. The protective sock according to claim 1, wherein the at least one protective padding is integrated on the top side of the foot portion.

9. The protective sock according to claim 1, wherein the at least one protective padding is integrated on the underside of the foot portion.

10. The protective sock according to claim 1, wherein the at least one protective padding includes at least one perforation.

11. The protective sock according to claim 1, wherein the at least one material comprises at least one of: polyester, cotton, wool, silk, rayon, nylon, acrylic, glass, steel, elastane, aramids, and high-performance polyethylene.

12. The protective sock according to claim 1, wherein the at least one material in the foot portion is a first material, and the at least one material in the leg portion is a second material being different from the first material.

13. The protective sock according to claim 12, further comprising a ribbing at a top of the leg portion, wherein the at least one material in the ribbing is a third fabric.

14. The protective sock according to claim 1, wherein the at least one material comprises at least one yarn, wherein the at least one yarn is plaited.

15. The protective sock according to claim 1, further including at least one high friction surface on at least the front portion of the leg portion.

16. The protective sock according to claim 15, wherein the at least one protective padding includes at least one high friction surface.

17. The protective sock according to claim 1, wherein the protective padding has a design feature.

18. The protective sock according to claim 1, further comprising at least one auxiliary protective padding adjacent to a wearer's heel.

19. The protective sock according to claim 1, further comprising at least one compression zone for minimizing movement of the sock during activity.

20. The protective sock according to claim 19, wherein a location of the at least one compression zone is at least one of: the leg portion, an arch of the foot, above the ankle, near a top of the leg portion.

21. A protective sock for use on and for protecting a wearer's foot and ankle comprising:

at least one material for forming the protective sock,

a foot portion enclosing the wearer's foot having a top side and an underside,
a leg portion extending from the foot portion, having a front portion extending upwardly from the top side and a rear portion extending upwardly from the underside, and
at least one high friction surface,
wherein the at least one high friction surface is integrated into at least an area of the leg portion.

22. The protective sock according to claim 21, wherein the at least one material comprises at least one of of: polyester, cotton, wool, silk, rayon, nylon, acrylic, glass, steel, elastane, aramids, and high-performance polyethylene.

23. The protective sock according to claim 21, wherein at least one high friction surface has a design feature.

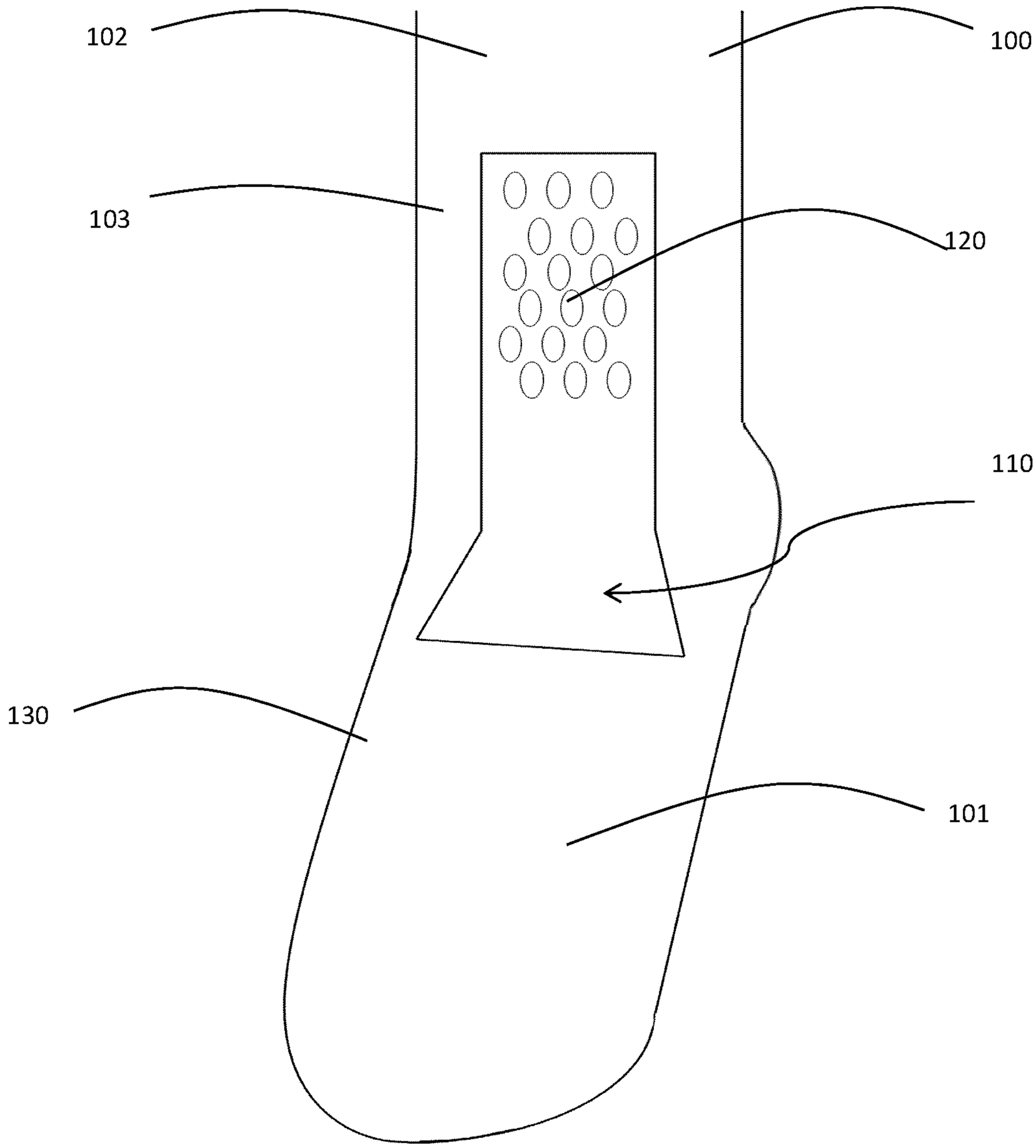

FIGURE 1

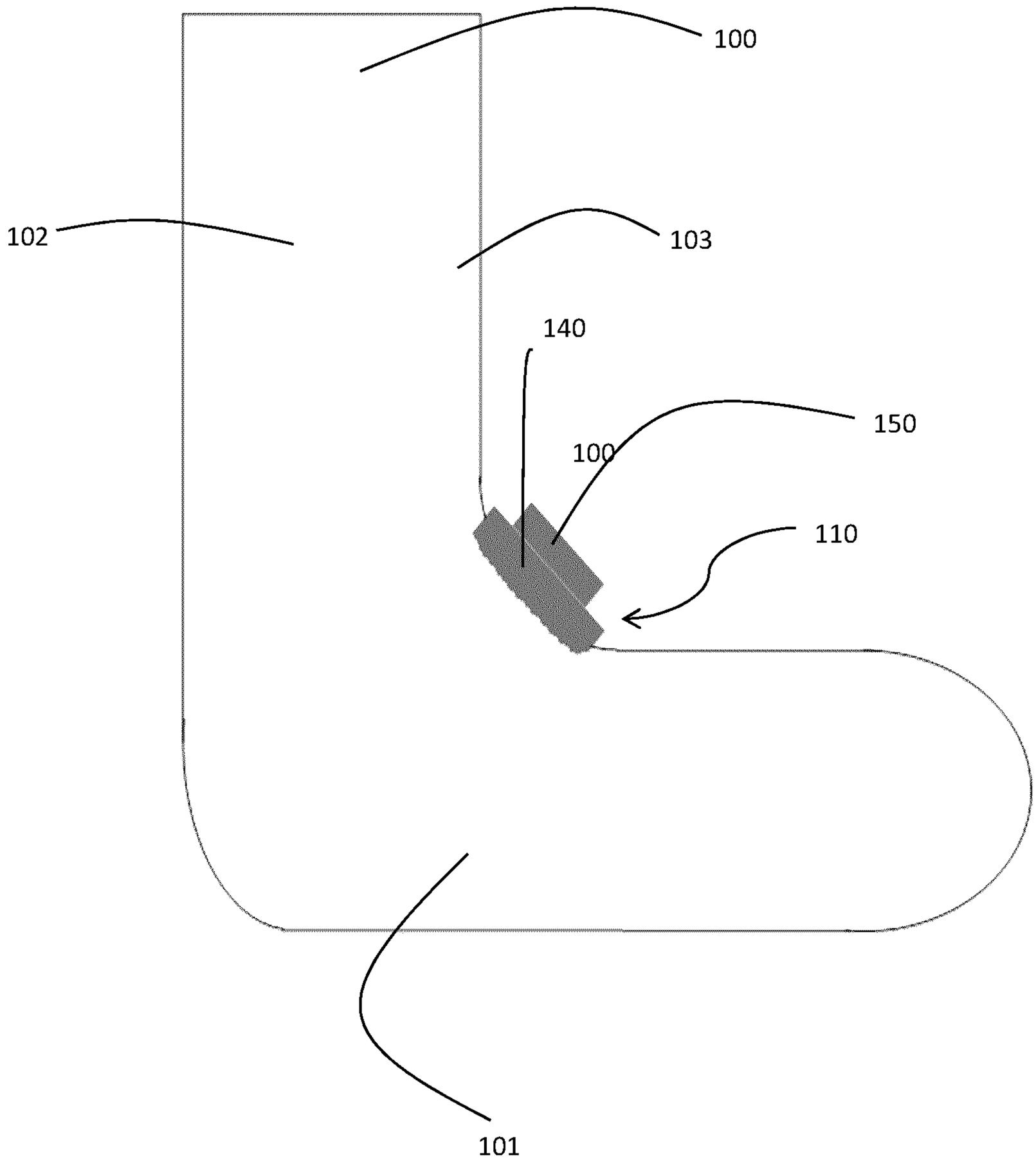

FIGURE 2

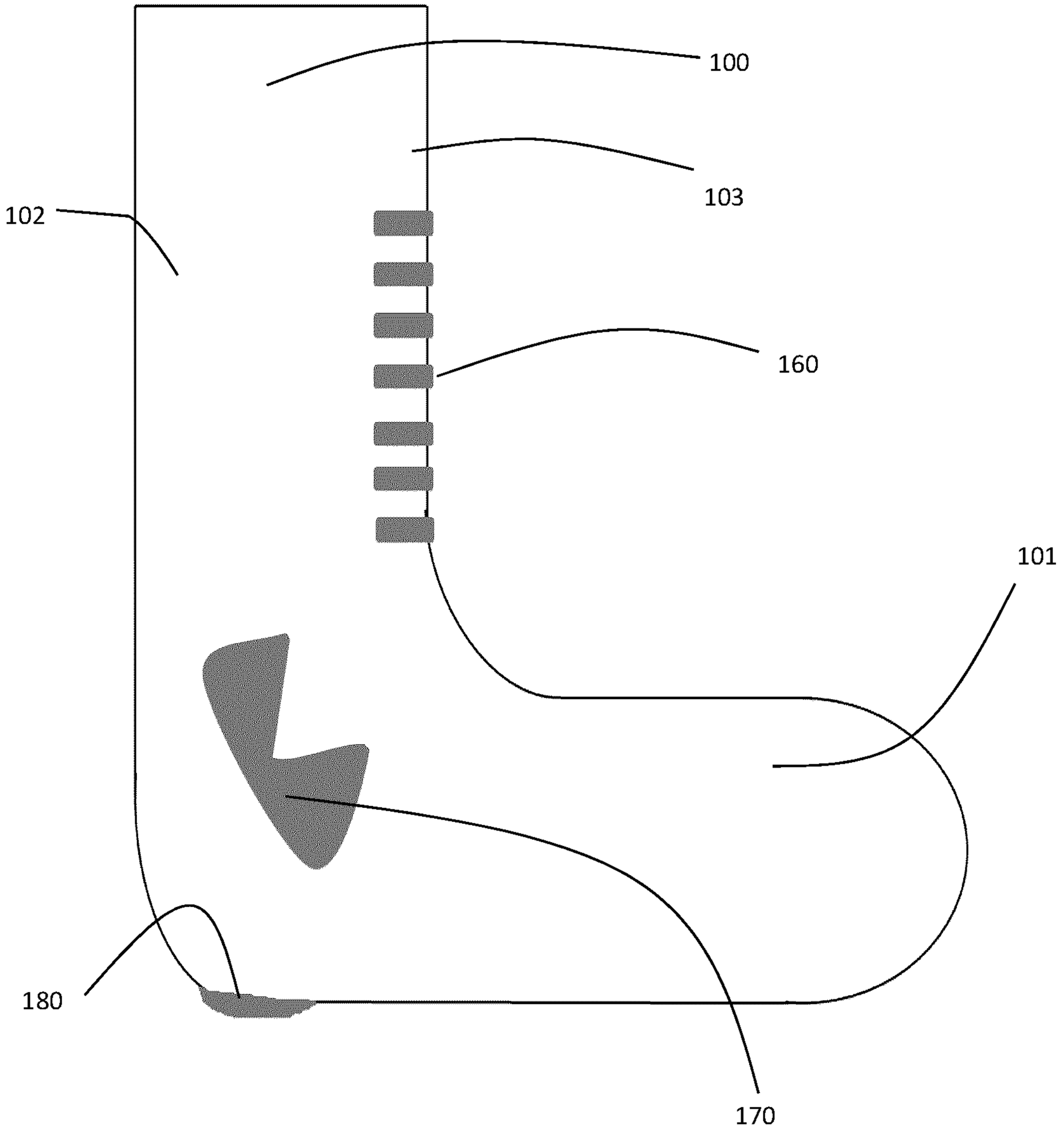

FIGURE 3

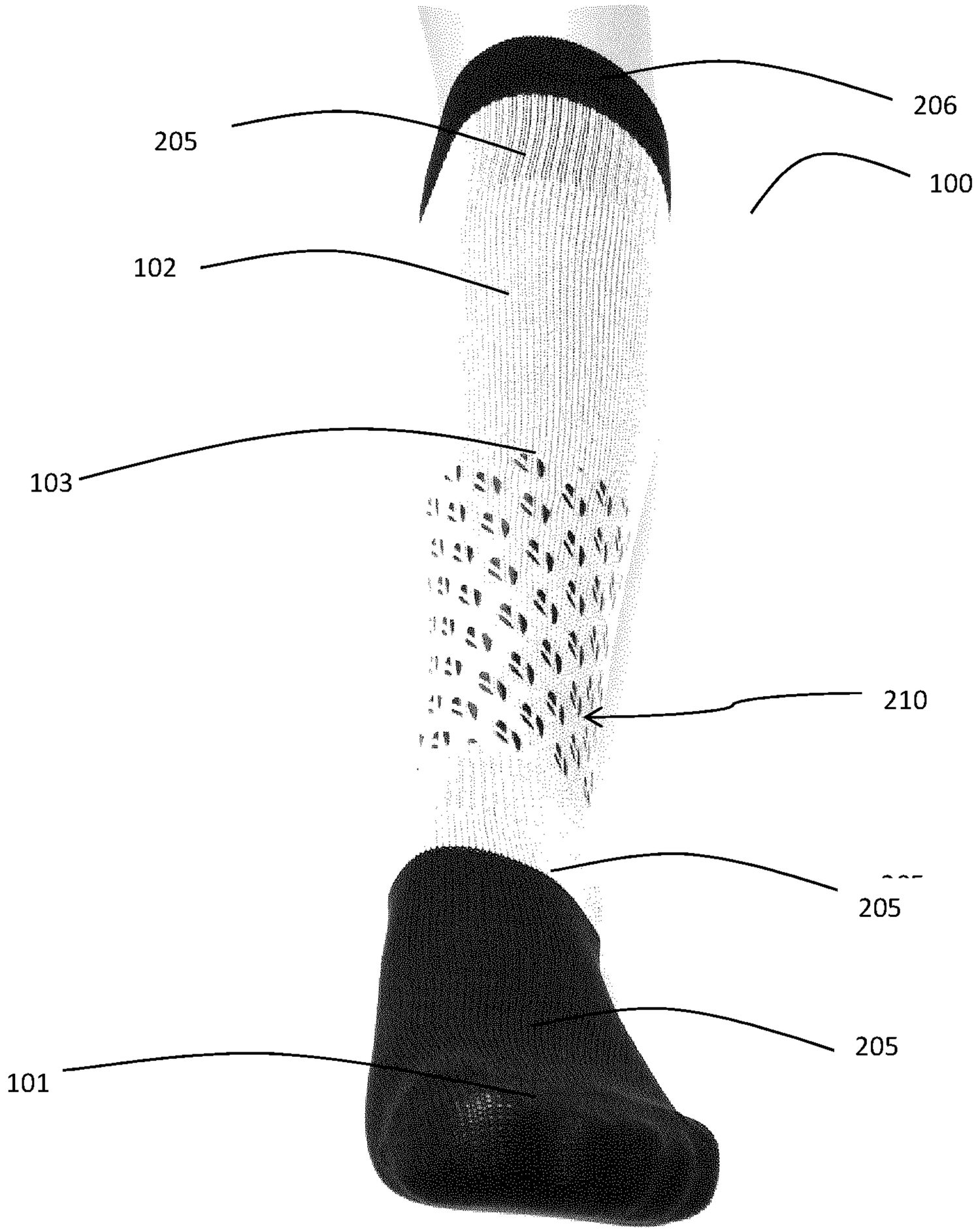

FIGURE 4

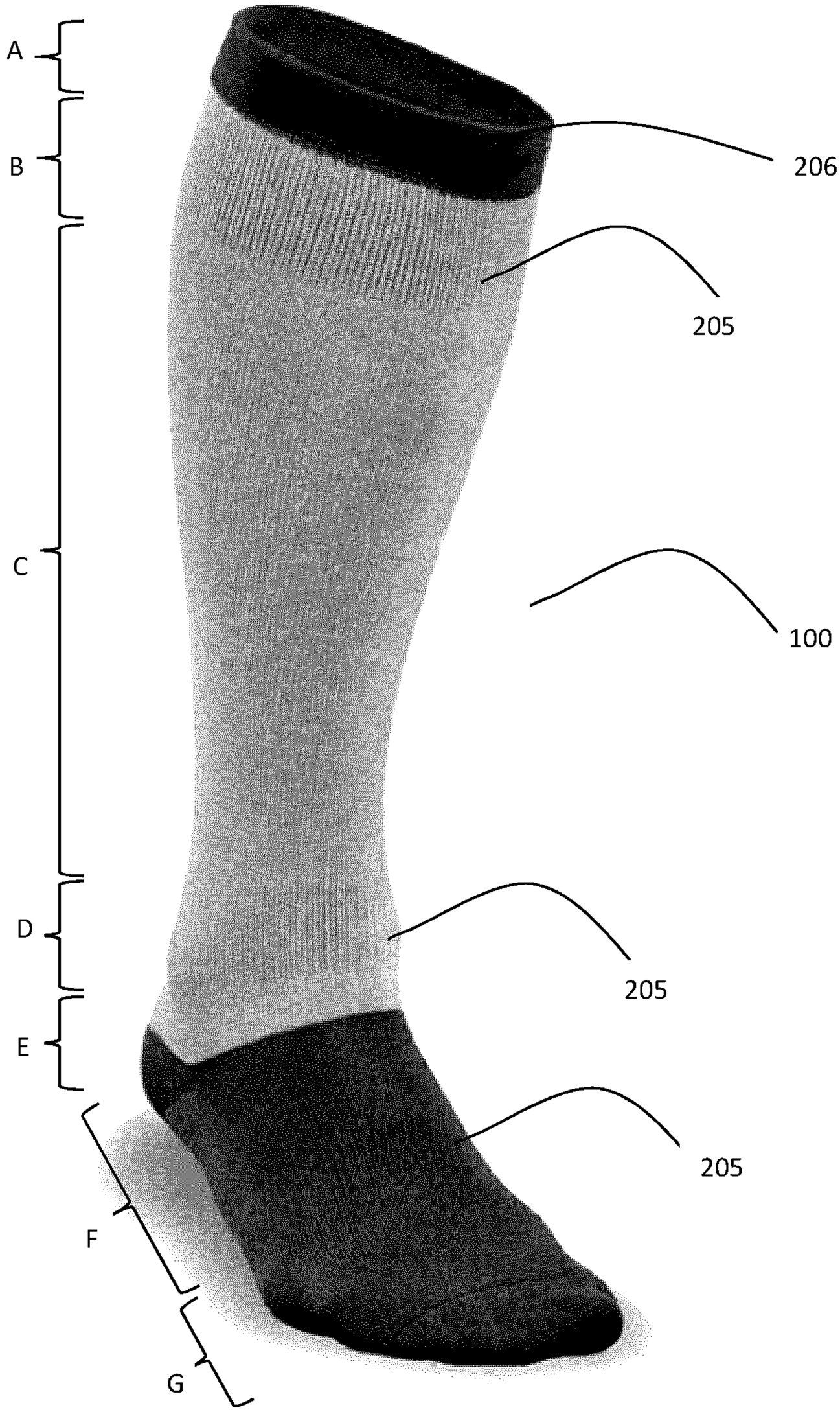

FIGURE 5

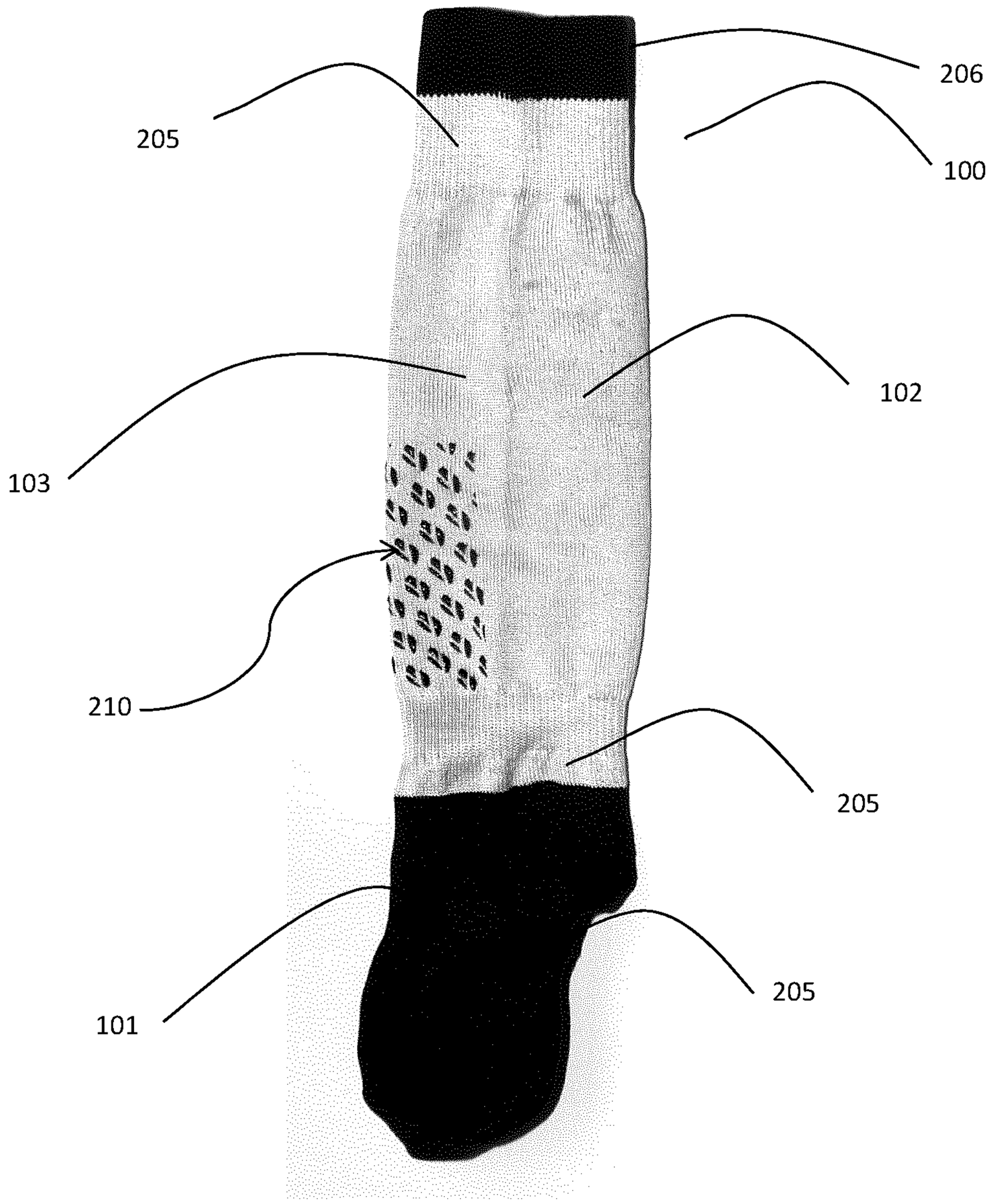

FIGURE 6

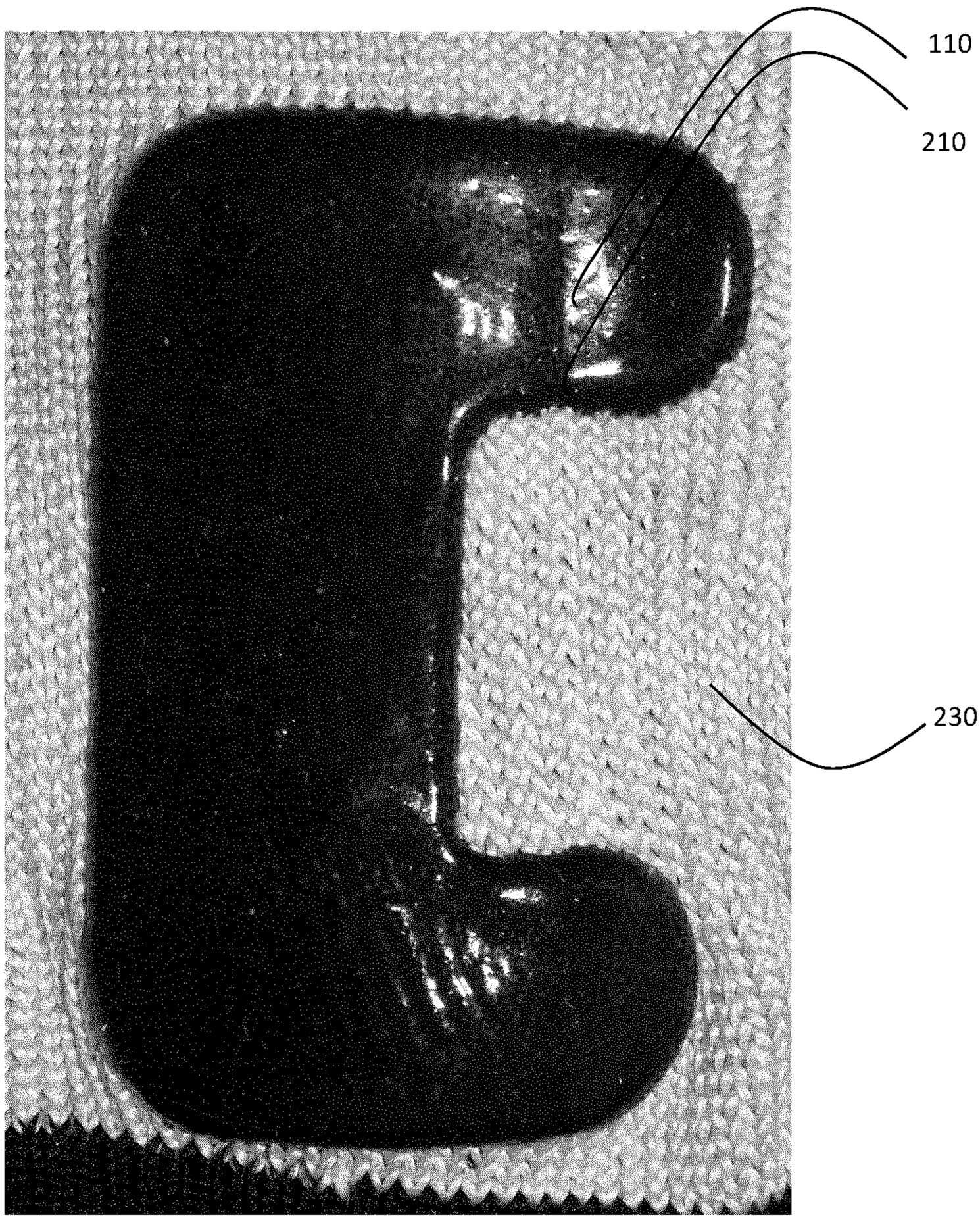

FIGURE 7

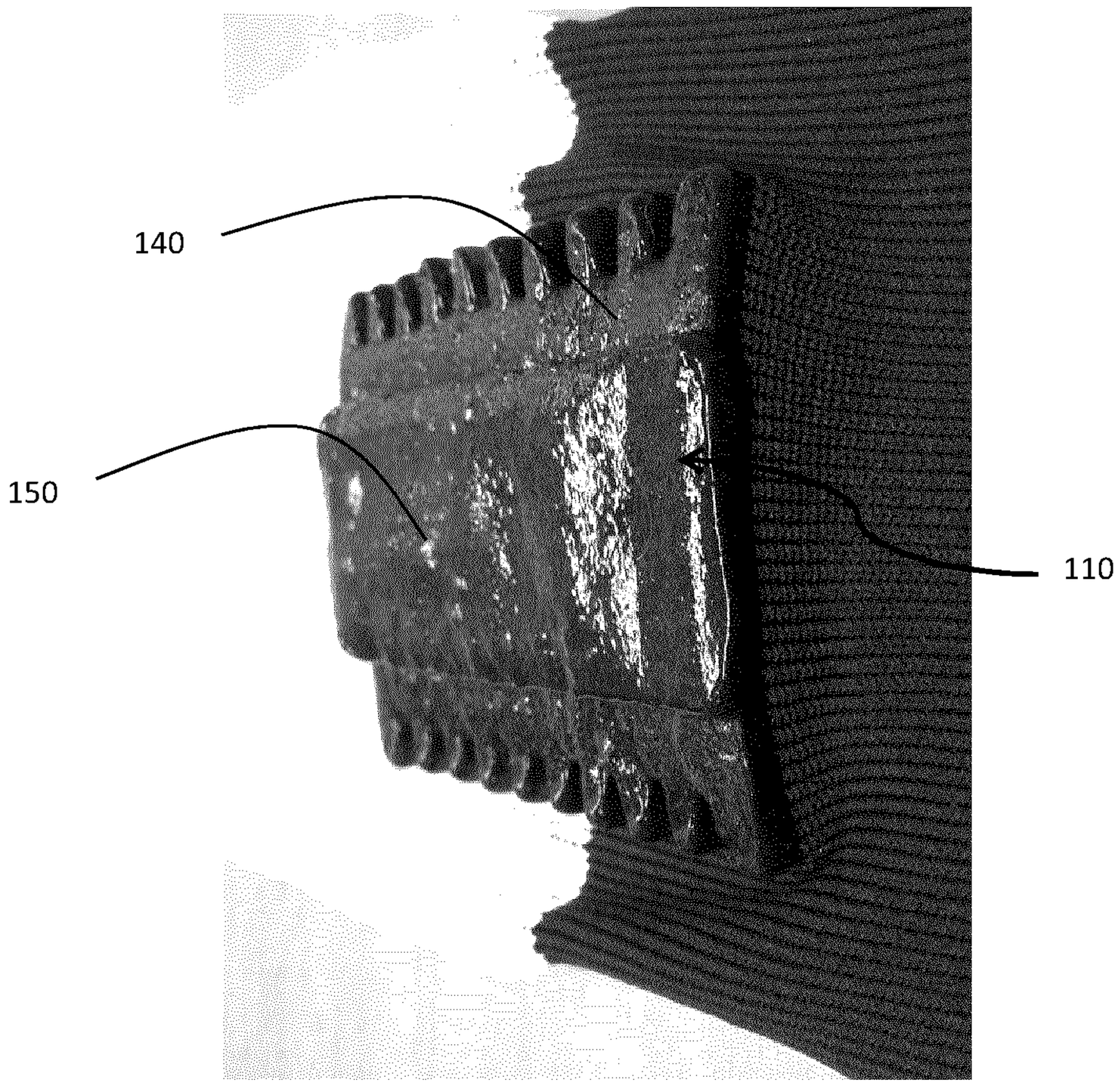

FIGURE 8

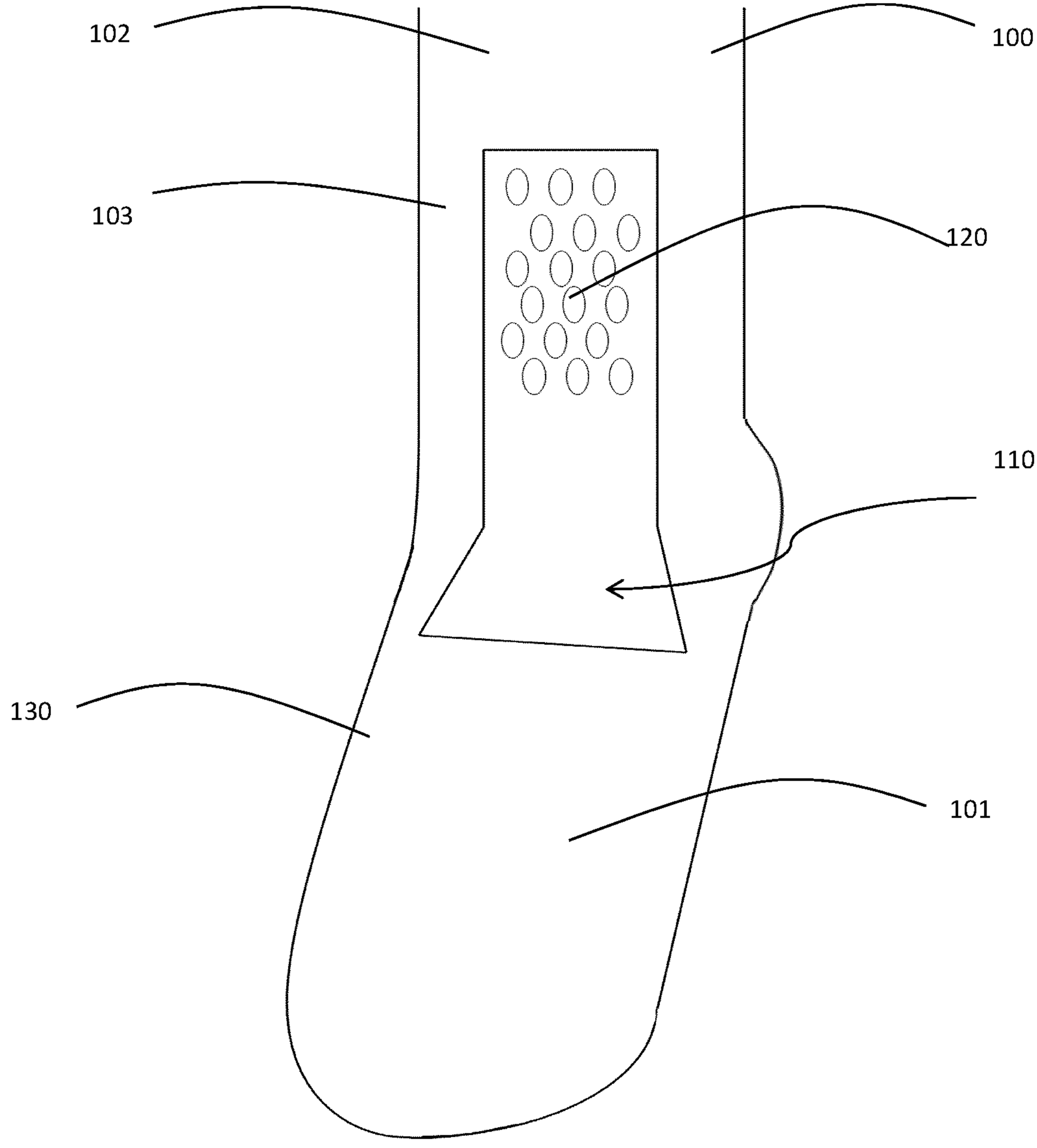

FIGURE 1