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(54) **PROTECTIVE KNEE WEAR**

(57) A protective clothing equipment is provided that is comfortable, stabilizing, and compatible with varying types of surfaces. One embodiment of the protective clothing equipment includes a shell, padding disposed in front of the knee of the wearer, the padding including a non-uniform stiffness.

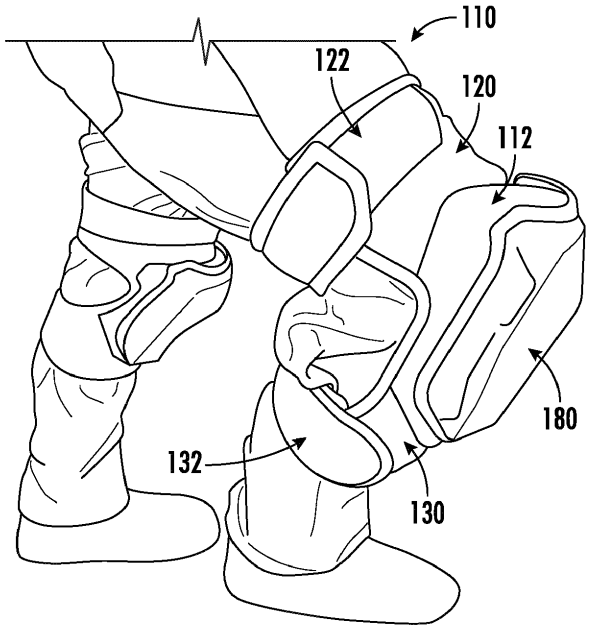

FIG. 1

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Description

CROSS-REFERENCE TO RELATED PATENT APPLICATION

[0001] The present application claims the benefit of and priority to U.S. Provisional Application No. 63/410,811 filed on September 28, 2022, which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] The present disclosure is directed generally to protective clothing equipment for workers. The present disclosure relates specifically to clothing equipment that protect the knees of the wearer.

[0003] Clothing accessories that attach to the knee of the wearer can be worn to improve comfort for the wearer and absorb trauma to the knees. Provided herewith is a knee pad that is comfortable, stabilizing, and designed to reduce stress and damage to the knee of the user.

SUMMARY OF THE INVENTION

[0004] One embodiment of the invention relates to a knee pad including an upper support configured to couple to a leg of a user above a knee, a lower support configured to couple to the leg of the user below the knee, and a shell. The shell is coupled to the upper support and the lower support and positioned between the upper support and the lower support. The shell is formed from a first material. The knee pad further includes a single integral padding sheet coupled to an interior surface of the shell such that the single integral padding sheet is positioned between the shell and the knee of the user when worn. The single integral padding sheet includes a central portion and an outer portion. The central portion is sized to interface with the knee of the user and includes a center and a periphery. The periphery extends around the central portion and defines a perimeter length. The periphery includes a concave portion and a convex portion. The concave portion is concave with respect to the center of the central portion and includes at least 80% of the perimeter length of the periphery of the central portion. The convex portion is convex with respect to the center of the central portion and includes at least 10% of the perimeter length of the periphery. The outer portion circumferentially surrounds the central portion. The outer portion and the central portion collectively include the entire single integral padding sheet. The central portion has a first durometer and the outer portion has a second durometer. The first durometer is different than the second durometer.

[0005] In various embodiments, the convex portion is located in a lower half or distal portion of the periphery and/or on an interior side or medial of the periphery facing toward the other knee of the user.

[0006] Another embodiment of the invention relates to a knee pad including an upper support configured to couple to a leg of a user above a knee, a lower support configured to couple to the leg of a user below the knee, and a shell. The shell is coupled to the upper support and the lower support and positioned between the upper support and the lower support. The knee pad further includes a padding sheet formed from a padding material and coupled to an interior surface of the shell. The padding sheet includes a central portion and an outer portion. The central portion is sized to interface with the knee of the user. The central portion includes a periphery that extends around the central portion and defines a perimeter of the central portion, a longitudinal axis that defines the longest vertical arc extending across the central portion and a lateral axis perpendicular to the longitudinal axis and bisecting the longitudinal axis. The lateral axis, the longitudinal axis, and the perimeter of the periphery together define four quadrants of the central portion. The four quadrants of the central portion include a lower-medial quadrant positioned in a lower half of the central portion and on a medial side, an upper-medial quadrant, a lower-lateral quadrant, and an upper-lateral quadrant. The outer portion circumferentially surrounds the central portion. An area of the lower-medial quadrant is less than areas of the upper-medial quadrant, the lower-lateral quadrant, and the upper-lateral quadrant.

[0007] Another embodiment of the invention relates to a knee pad including a shell and a padding sheet coupled to an interior surface of the shell. The padding sheet includes a central portion and an outer portion circumferentially surrounding the central portion. The central portion is sized to interface with a knee of a user. The central portion includes a periphery that extends around the central portion and defines a perimeter of the central portion, a longitudinal axis that defines the longest vertical arc extending between the periphery across the central portion, and a lateral axis perpendicular to the longitudinal axis and bisecting the longitudinal axis at an intersection. The longitudinal axis, the lateral axis, and the periphery define four quadrants of the central portion. The four quadrants include a lower-medial quadrant, an upper-medial quadrant, a lower-lateral quadrant, and an upper-lateral quadrant. The central portion has a first durometer and the outer portion has a second durometer. The first durometer is less the second durometer. Each of the four quadrants defines a central radius extending from the intersection of the lateral axis and the longitudinal axis to the periphery. A central radius of the lower-medial quadrant is smaller than a central radius of the upper-medial quadrant, the lower-lateral quadrant and the upper-lateral quadrant.

[0008] Additional features and advantages will be set forth in the detailed description which follows, and, in part, will be readily apparent to those skilled in the art from the description or recognized by practicing the embodiments as described in the written description included, as well as the appended drawings. It is to be understood that both the foregoing general description and the

following detailed description are exemplary.

[0009] The accompanying drawings are included to provide further understanding and are incorporated in and constitute a part of this specification. The drawings illustrate one or more embodiments and, together with the description, serve to explain principles and operation of the various embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] This application will become more fully understood from the following detailed description, taken in conjunction with the accompanying figures, wherein like reference numerals refer to like elements in which:

FIG. 1 is a perspective view of a knee pad, according to an exemplary embodiment.

FIG. 2 is a perspective view of a portion of the knee pad of FIG. 1, according to an exemplary embodiment.

FIG. 3 is a rear view of the shell of the knee pad of FIG. 1, according to an exemplary embodiment.

FIG. 4 is a front view of the padding of the knee pad of FIG. 1, according to an exemplary embodiment.

FIG. 5 is a detailed front view of the padding of the knee pad of FIG. 1, according to an exemplary embodiment.

FIG. 6 is a front view of a heat map measuring pressure, according to an exemplary embodiment.

FIG. 7 is a bottom view of the knee pad of FIG. 1 with a ghost view of a knee of a user, according to an exemplary embodiment.

FIG. 8 is a cross-section side view of the knee pad of FIG. 1, according to an exemplary embodiment.

FIG. 9 is a cross-section side view of the knee pad of FIG. 1, according to an exemplary embodiment.

FIG. 10 is a schematic side view of the knee pad of FIG. 1 being worn, according to an exemplary embodiment.

FIG. 11 is a schematic top view of the knee pad of FIG. 1 being worn, according to an exemplary embodiment.

FIG. 12 is a schematic top view of the knee pad of FIG. 1 being worn, according to an exemplary embodiment.

FIG. 13 is a front view of a kneeling user in a first position.

FIG. 14 is a front view of a kneeling user in a second position.

FIG. 15 is a front view of a knee pad, according to another exemplary embodiment.

DETAILED DESCRIPTION

[0011] Referring generally to the figures, one or more embodiments of knee supports are shown. Knee supports can be worn to improve comfort for the wearer and protect the knees from trauma.

[0012] One or more embodiments described herein include a knee pad including a padding with a non-uniform stiffness. For example, the padding includes a central portion softer than the outer portion that peripherally surrounds the inner portion, and the central portion includes an asymmetrical shape, such as one quadrant (e.g., the lower-inner quadrant) including a concave portion. By providing a knee pad with variable soft and firm zones, the knee pad can reduce pressure on certain portions of the knee (e.g., the patella bone) and surrounding cartilage, ligaments, and tendons, thereby providing a more comfortable experience for the user.

[0013] Referring to FIGS. 1-3, various aspects of a device a protective clothing equipment for protecting and/or supporting knees of users, shown as knee pad 110, are shown. Knee pad 110 includes shell 180 coupled to upper support 120 and lower support 130 via gasket 112. Upper support 120 is configured to couple to a leg of a user above a knee, such as via strap 122 that wraps around the leg of the user. Lower support 130 is configured to couple to the leg of the user below the knee, such as via strap 132. The shell 180 is coupled to the upper support 120 and the lower support 130 and extends between the upper support 120 and the lower support 130.

[0014] Shell 180 is formed from a first material, such as a flexible and durable polymer material. Shell 180 is formed from a material that has a higher durometer than padding sheet 140.

[0015] Knee pad 110 includes padding sheet 140 coupled to an interior surface 181 of shell 180, such as via padding sheet 140 coupling to protrusions 186. Protrusions 186 extend inward (i.e., toward the knee) from interior surface 181 of shell 180 toward the knee of the user. Padding sheet 140 is coupled to shell 180 between the interior surface 181 of shell 180 and the knee. In various embodiments, padding sheet 140 extends from one lateral wall 184 to the opposing lateral wall 184 such that padding sheet 140 is adjacent to and/or coupled to front wall 182 between the lateral walls 184. Lateral walls 184 extend from opposing sides of front wall 182 of shell 180. In other words, a first lateral wall 184 extends rearward, away from a first side of the front wall 182 and a second lateral wall 182 extends rearward from a second side of the front wall 182 opposing the first side of the front wall 182. In various specific embodiments, the lateral walls 184 extend past or beyond an anterior or rear edge of the padding sheet 140 such that each one of the lateral walls 184 provides a supporting force against a side (medial and lateral sides) of the knee when a user is kneeling. In various embodiments, the supporting force is applied inward, against a side of the knee when the user is kneeling.

[0016] In various embodiments, padding sheet 140 is made of a material and structure designed to absorb pressure and relieve stress from the knees of the user. For example, padding sheet 140 is made of a material that allows padding sheet 140 to be a reduced thickness compared to other padding structures for knee pads (e.g.,

foam padding). In various embodiments, the padding sheet 140 has a thickness less than a maximum thickness. As another example, padding sheet 140 absorbs impacts without detrimental effect to the padding sheet 140, and as a result the user continues to feel the same or similar support and comfort from knee pad 110 even after many uses.

[0017] Referring to FIGS. 4-5, padding sheet 140 includes a central portion 150 and an outer portion 170 that circumferentially surrounds the central portion 150. In a various embodiments, padding sheet 140 is formed from a single, integral sheet of padding material. In various embodiments, central portion 150 and outer portion 170 collectively include the entire padding sheet 140. In other embodiments, outer portion 170 includes the portion of padding sheet 140 adjacent to (e.g., within 1 inch) of central portion 150. In various embodiments, the central portion 150 is sized, shaped and located to interface with the knee of the user (e.g., sized to interface with the patella area of the user).

[0018] In various embodiments, padding sheet 140 is a single sheet with varying compressive characteristics. In multi-part padding structures for knee pads, users can feel the transitions between the different components. Thus, by providing padding that includes a single sheet, the transitions between different levels of ability to be compressed can be smooth and provide a comfortable fit for the user.

[0019] Even though formed from a single, integral piece of material, central portion 150 has a lower durometer than the outer portion 170. In other words, outer portion 170 of padding sheet 140 has a durometer greater than a durometer of the central portion 150 of padding sheet 140. In particular, central portion 150 has a first durometer and outer portion 170 has a second durometer. In various specific embodiments, the first durometer is less than the second durometer. In another example, central portion 150 has an average first durometer less than the average second durometer of the outer portion 170. As another example, central portion 150 has a first durometer less than the second durometer of outer portion 170 including each part of the central portion 150 having a first durometer less than the second durometer of each part of outer portion 170. In another specific embodiment, central portion 150 having a first durometer less than the second durometer of outer portion 170 includes each part of central portion 150 having a first durometer below a predetermined number/measurement and each part of outer portion 170 having a second durometer above the predetermined number/measurement.

[0020] In various embodiments, shell 180 is formed from a material different than padding sheet 140. In various embodiment, shell 180 is formed from a material having a third durometer. In such an embodiment, the third durometer is greater than the first durometer and the second durometer.

[0021] The padding sheet 140 geometry varies in thickness and density as well as physical shape. This variation in geometry allows the material of padding sheet 140 to have different compression and absorption properties all within the same individual part. For example, in various embodiments central portion 150 includes holes (e.g., hexagons) that are larger than the holes (e.g., hexagons) in outer portion 170, and the increased size of holes in central portion 150 makes central portion 150 correspondingly more compressive than outer portion 170. The central portion 150 has a first thickness and the outer portion 170 has a second thickness. In various embodiments, the first thickness is different than the second thickness.

[0022] Central portion 150 includes a periphery 152 that extends around the central portion 150 and defines a perimeter length. In various embodiments, periphery 152 includes a concave portion 168 that is concave with respect to a center 151 of the central portion 150, and the concave portion 168 includes at least 60% of the perimeter length of the periphery 152, or more specifically at least 70% of the perimeter length of the periphery 152, or even more specifically at least 80% of perimeter length of the periphery 152. In various embodiments, periphery 152 includes a convex portion 169 that is convex with respect to the center 151 and that includes at least 5% of the perimeter length of the periphery 152, or more specifically at least 10% of the perimeter length of the periphery 152, or even more specifically at least 20% of the perimeter length of the periphery 152. In various embodiments, convex portion 169 is located on a medial side of the periphery 152 facing toward the other or opposing knee of the user. In various embodiments, convex portion 169 is located in a lower half of periphery 152.

[0023] In various embodiments, central portion 150 includes a longitudinal axis 154 that defines the longest vertical arc extending across the central portion 150 (e.g., the longest vertical straight line extending from one point on the periphery 152 to a different point on the periphery 152). The central portion 150 further includes lateral axis 156 perpendicular to the longitudinal axis 154 that bisects the longitudinal axis 154. The longitudinal axis 154, the lateral axis 156 and the perimeter of the periphery 152 together define four quadrants of the central portion 150, such as upper-lateral quadrant 160, upper-medial quadrant 162, lower-medial quadrant 164, and lower-lateral quadrant 166. In various embodiments, the area of the lower-medial quadrant defines the smallest area of all four quadrants. In other words, an area of the lower-medial quadrant 164 is less than the areas of the upper-lateral quadrant 160, the upper-medial quadrant 162, and the lower-lateral quadrant 166.

[0024] Each of the terms "upper" and/or "superior" is in the reference to the quadrants that are in the upper half of the central portion 150. Each of the terms "lower" and/or "inferior" is in the reference to the quadrants that are in the lower half of the central portion 150. Each of the terms "outer" and/or "lateral" is in reference to the quadrants that are on the side furthest from the opposing

knee of the user. Each of the terms "inner" and/or "medial" is in reference to the quadrants that are on the side closest to the opposing knee of the user. For example, lower-medial quadrant 164 is in the lower side of central portion 150 and is on the side of central portion nearest to the opposing knee of the user wearing knee pad 110.

[0025] In various embodiments, each of the quadrants defines a central radius that is halfway between the longitudinal axis 154 and lateral axis 156 in each of the quadrants. For example, upper-lateral quadrant 160 defines a central radius 161 that is 45 degrees between each of longitudinal axis 154 and lateral axis 156, upper-medial quadrant 162 defines a central radius 163 that is 45 degrees between each of longitudinal axis 154 and lateral axis 156, lower-medial quadrant 164 defines a central radius 165 that is 45 degrees between each of longitudinal axis 154 and lateral axis 156, and lower-lateral quadrant 166 defines a central radius 167 that is 45 degrees between each of longitudinal axis 154 and lateral axis 156. Each of central radiuses 161, 163, 165, and 167 extend from intersection 158 of longitudinal axis 154 and lateral axis 156 to the periphery 152 or the perimeter of the central portion 150.

[0026] In various embodiments, central radius 165 of the lower-medial quadrant 164 is smaller than the central radius 161, 163, 167 for each of the other three quadrants 160, 162, 166.

[0027] Referring to FIG. 6, depicted is a pressure map that measures pressure when a user was kneeling on a standard cushion.

[0028] Referring to FIGS. 7-8, lateral walls 184 of shell 180 of knee pad 110 exert lateral force 185 against the sides of the knees (e.g., right knee 198, as shown in FIG. 7) when the user is kneeling. Lateral force 185 helps stabilize the knee of the user and acts as a supporting force.

[0029] Referring to FIG. 9, a cross-section schematic is depicted of a user using knee pad 110. In particular, firmer outer portion 170 extends on opposing sides of softer central portion 150, with central portion 150 interfacing with the front of the knee of the user (e.g., a patella 172).

[0030] Referring to FIG. 10, knee pad is depicted in various stages of the user moving. In various embodiments, knee pad 110 (e.g., shell 180) is sufficiently vertically flexible to permit knee pad 110 to actuate between a curved configuration (e.g., the left-most image, where the leg is bent approximately 90 degrees or more) and a straight or nearly straight configuration (e.g., the right-most image, where the leg is in the extended, or straight, position).

[0031] Referring to FIGS. 11-12, knee pad 200 is shown according to an exemplary embodiment. Knee pad 200 is substantially the same as knee pad 110 except for the differences discussed herein. In particular, knee pad 200 is designed to be worn on a left knee of a user, whereas knee pad 110 is designed to be worn on a right knee of user. In particular, knee pad 200 is a mirror image of knee pad 110 and as a result knee pad 200 provides the same support to a left knee as knee pad 110 provides to a right knee.

[0032] Further, knee pad 110 (e.g., shell 180) and knee pad 200 are also sufficiently flexible to laterally flex. For example, in FIG. 11 the knee pad 110 and knee pad 200 are shown when the user is in the seated position. Knee pad 110 and knee pad 200 are more tightly curved around the knee (e.g., radius 188 is smaller than radius 190 shown in FIG. 12). In FIG. 12, knee pad 110 and knee pad 200 are shown when the user is in the kneeling position. Knee pad 110 and knee pad 200 are more flattened (e.g., radius 190 is larger than radius 188).

[0033] Referring to FIGS. 13-14, two depictions of users kneeling are provided. As can be seen, users can position their knees close together (FIG. 13) thereby directing the force into the front of their knees, or users can position their knees further apart (FIG. 14) thereby directing the force into the interior-front of their knees. Knee pad 110 is designed to relieve pressure and stress on the users' knees in either position.

[0034] Referring to FIG. 15, knee pad 210 is shown according to an exemplary embodiment. Knee pad 210 is substantially the same as knee pad 110 except for the differences discussed herein. In particular, shell of knee pad 210 includes one or more ridges (e.g., recesses) extending laterally across the front and/or sides of the shell.

[0035] In various embodiments, shell 212 of knee pad 210 is smaller than shell 180 of knee pad 110, and as a result padding sheet 140 is always in contact with the leg of the user and shell 212 is not in contact with the leg of the user. In various embodiments, this configuration for shell 212 reduces and/or minimizes the chances that shell 212 contacts the leg of the user when the leg is straightened. In various embodiments, shell 212 being flexible and having a soft padding sheet 140 reduces and/or prevents discomfort from the knee pad digging into the thigh of the user above the knee.

[0036] It should be understood that the figures illustrate the exemplary embodiments in detail, and it should be understood that the present application is not limited to the details or methodology set forth in the description or illustrated in the figures. It should also be understood that the terminology is for description purposes only and should not be regarded as limiting.

[0037] Further modifications and alternative embodiments of various aspects of the disclosure will be apparent to those skilled in the art in view of this description. Accordingly, this description is to be construed as illustrative only. The construction and arrangements, shown in the various exemplary embodiments, are illustrative only. Although only a few embodiments have been described in detail in this disclosure, many modifications are possible (e.g., variations in sizes, dimensions, structures, shapes and proportions of the various elements, values of parameters, mounting arrangements, use of materials, colors, orientations, etc.) without materially departing from the novel teachings and advantages of the

subject matter described herein. Some elements shown as integrally formed may be constructed of multiple parts or elements, the position of elements may be reversed or otherwise varied, and the nature or number of discrete elements or positions may be altered or varied. The order or sequence of any process, logical algorithm, or method steps may be varied or re-sequenced according to alternative embodiments. Other substitutions, modifications, changes and omissions may also be made in the design, operating conditions and arrangement of the various exemplary embodiments without departing from the scope of the present disclosure.

[0038] Unless otherwise expressly stated, it is in no way intended that any method set forth herein be construed as requiring that its steps be performed in a specific order. Accordingly, where a method claim does not actually recite an order to be followed by its steps or it is not otherwise specifically stated in the claims or descriptions that the steps are to be limited to a specific order, it is in no way intended that any particular order be inferred. In addition, as used herein, the article "a" is intended to include one or more component or element, and is not intended to be construed as meaning only one. As used herein, "rigidly coupled" refers to two components being coupled in a manner such that the components move together in a fixed positional relationship when acted upon by a force.

[0039] Various embodiments of the disclosure relate to any combination of any of the features, and any such combination of features may be claimed in this or future applications. Any of the features, elements or components of any of the exemplary embodiments discussed above may be utilized alone or in combination with any of the features, elements or components of any of the other embodiments discussed above.

[0040] For purposes of this disclosure, the term "coupled" means the joining of two components directly or indirectly to one another. Such joining may be stationary in nature or movable in nature. Such joining may be achieved with the two members and any additional intermediate members being integrally formed as a single unitary body with one another or with the two members or the two members and any additional member being attached to one another. Such joining may be permanent in nature or alternatively may be removable or releasable in nature.

[0041] While the current application recites particular combinations of features in the claims appended hereto, various embodiments of the invention relate to any combination of any of the features described herein whether or not such combination is currently claimed, and any such combination of features may be claimed in this or future applications. Any of the features, elements, or components of any of the exemplary embodiments discussed above may be used alone or in combination with any of the features, elements, or components of any of the other embodiments discussed above.

[0042] In various exemplary embodiments, the relative dimensions, including angles, lengths and radii, as shown in the Figures are to scale. Actual measurements of the Figures will disclose relative dimensions, angles and proportions of the various exemplary embodiments. Various exemplary embodiments extend to various ranges around the absolute and relative dimensions, angles and proportions that may be determined from the Figures. Various exemplary embodiments include any combination of one or more relative dimensions or angles that may be determined from the Figures. Further, actual dimensions not expressly set out in this description can be determined by using the ratios of dimensions measured in the Figures in combination with the express dimensions set out in this description.

Claims

1. A knee pad comprising:

an upper support configured to couple to a leg of a user above a knee;
a lower support configured to couple to the leg of the user below the knee;
a shell coupled to the upper support and the lower support and positioned between the upper support and the lower support, the shell formed from a first material; and
a single integral padding sheet coupled an interior surface of the shell such that the single integral padding sheet is positioned between the shell and the knee of the user when worn, the single integral padding sheet comprising:

a central portion sized to interface with the knee of the user, the central portion comprising:

a center; and
a periphery that extends around the central portion and defines a perimeter length, the periphery comprising:

a concave portion that is concave with respect to the center of the central portion, the concave portion comprising at least 80% of the perimeter length of the periphery of the central portion; and
a convex portion that is convex with respect to the center of the central portion, the convex portion comprising at least 10% of the perimeter length of the periphery;

an outer portion circumferentially surrounding the central portion, the outer portion and central portion collectively comprising the

entire single integral padding sheet;
wherein the central portion has a first durometer and the outer portion has a second durometer and wherein the first durometer is different than the second durometer.

2. The knee pad of claim 1, wherein the first durometer is less than the second durometer.

3. The knee pad of claim 1, wherein the convex portion is located in a lower half of the periphery.

4. The knee pad of claim 1, wherein the convex portion is located on a medial side of the periphery facing toward the other knee of the user.

5. The knee pad of claim 1, wherein the first material has a third durometer and wherein the third durometer is greater than the first durometer and the second durometer.

6. The knee pad of claim 1, the shell further comprising:

a front wall; and
a pair of lateral walls, each lateral wall extending from an opposing side of the front wall.

7. The knee pad of claim 6, the pair of lateral walls extending rearward, away from the interior surface of the shell, past an anterior edge of the single integral padding sheet such that each one of the pair of lateral walls provides a supporting force against a side of the knee when the user is kneeling.

8. The knee pad of claim 1, the shell further comprising:

a plurality of protrusions extending inward from the interior surface of the shell toward the knee of the user;
wherein the plurality of protrusions couple to the single integral padding sheet.

9. A knee pad comprising:

an upper support configured to couple to a leg of a user above a knee;
a lower support configured to couple to the leg of the user below the knee;
a shell coupled to the upper support and the lower support and positioned between the upper support and the lower support; and
a padding sheet formed from a padding material and coupled to an interior surface of the shell, the padding sheet comprising:

a central portion sized to interface with the knee of the user, the central portion comprising:

a periphery that extends around the central portion and defines a perimeter of the central portion;
a longitudinal axis that defines the longest vertical arc extending across the central portion; and
a lateral axis perpendicular to the longitudinal axis and bisecting the longitudinal axis, the lateral axis, the longitudinal axis, and the perimeter of the periphery together defining four quadrants of the central portion, the four quadrants of the central portion comprising:

a lower-medial quadrant positioned in a lower half of the central portion and on a medial side;
an upper-medial quadrant;
a lower-lateral quadrant; and
an upper-lateral quadrant;

an outer portion circumferentially surrounding the central portion;

wherein an area of the lower-medial quadrant is less than areas of the upper-medial quadrant, the lower-lateral quadrant, and the upper-lateral quadrant.

10. The knee pad of claim 9, wherein a durometer of the outer portion of the padding sheet is greater than a durometer of the central portion of the padding sheet.

11. The knee pad of claim 9, wherein the padding sheet is formed from a single integral piece of padding material.

12. The knee pad of claim 9, wherein the outer portion and the central portion collectively comprise the entire padding sheet.

13. The knee pad of claim 9, the shell further comprising:

a front wall;
a first lateral wall extending rearward from a first side of the front wall; and
a second lateral wall extending rearward from a second side of the front wall opposing the first side of the front wall.

14. The knee pad of claim 13, the first lateral wall extending past an anterior edge of the padding sheet, such that the first lateral wall applies a force inward, against a side of the knee when the user is kneeling.

15. A knee pad comprising:

a shell; and
a padding sheet coupled to an interior surface of the shell, the padding sheet comprising:

a central portion sized to interface with a knee of a user, the central portion comprising:

a periphery that extends around the central portion and defines a perimeter of the central portion;
a longitudinal axis that defines the longest vertical arc extending between the periphery across the central portion; and
a lateral axis perpendicular to the longitudinal axis and bisecting the longitudinal axis at an intersection, wherein the longitudinal axis, the lateral axis, and the periphery define four quadrants of the central portion, the four quadrants comprising:

a lower-medial quadrant;
an upper-medial quadrant;
a lower-lateral quadrant; and
an upper-lateral quadrant;

an outer portion circumferentially surrounding the central portion;

wherein the central portion has a first durometer and the outer portion has a second durometer, and wherein the first durometer is less than the second durometer;
wherein each of the four quadrants defines a central radius extending from the intersection of the lateral axis and the longitudinal axis to the periphery, and wherein a central radius of the lower-medial quadrant is smaller than a central radius of the upper-medial quadrant, the lower-lateral quadrant, and the upper-lateral quadrant.

16. The knee pad of claim 15, wherein each central radius is positioned halfway between the longitudinal axis and the lateral axis in each of the four quadrants.

17. The knee pad of claim 15, wherein the padding sheet is formed from a single integral sheet of a padding material, and wherein the central portion and the outer portion collectively comprising the entire padding sheet.

18. The knee pad of claim 17, wherein the shell is formed from a second material that is different from the padding material, and wherein the second material has a third durometer that is greater than the first durometer and the second durometer.

19. The knee pad of claim 15, further comprising:

an upper support configured to couple to a leg of the user above the knee; and
a lower support configured to couple to the leg of the user below the knee;
wherein the shell is coupled to the upper support and the lower support and extends between the upper support and the lower support.

20. The knee pad of claim 15, the shell further comprising:

a front wall;
a first lateral wall extending rearward from a first side of the front wall; and
a second lateral wall extending rearward from a second side of the front wall opposing the first side of the front wall.

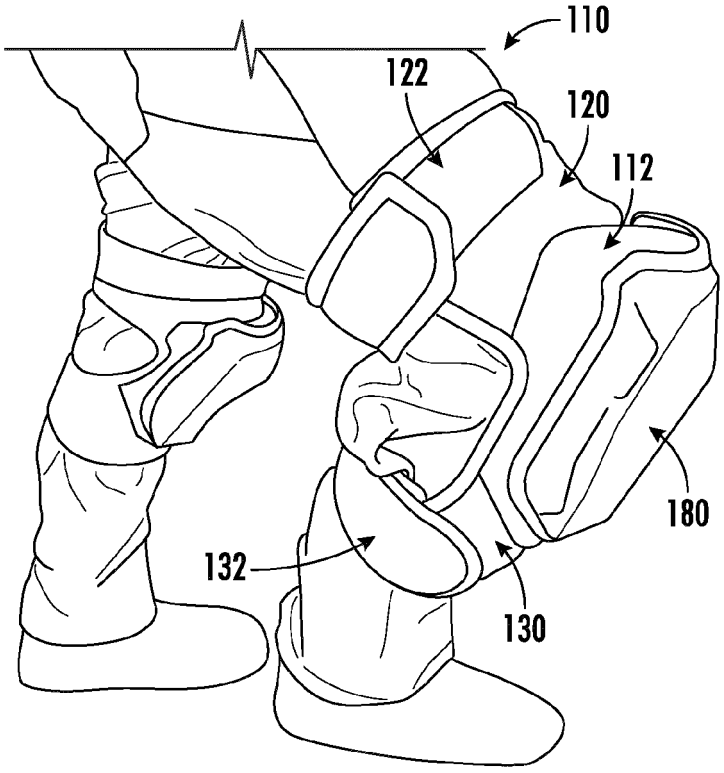

FIG. 1

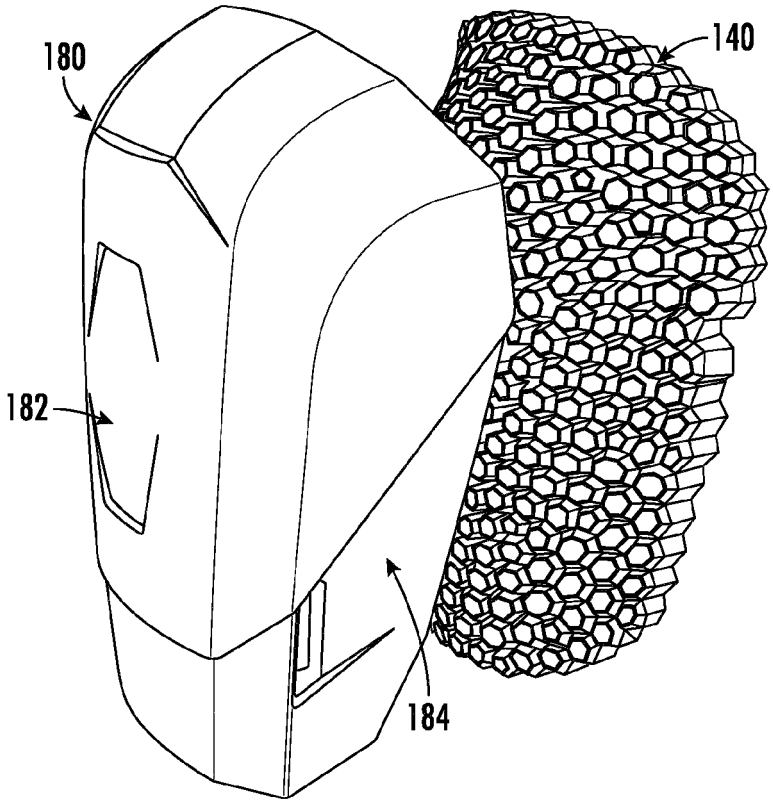

FIG. 2

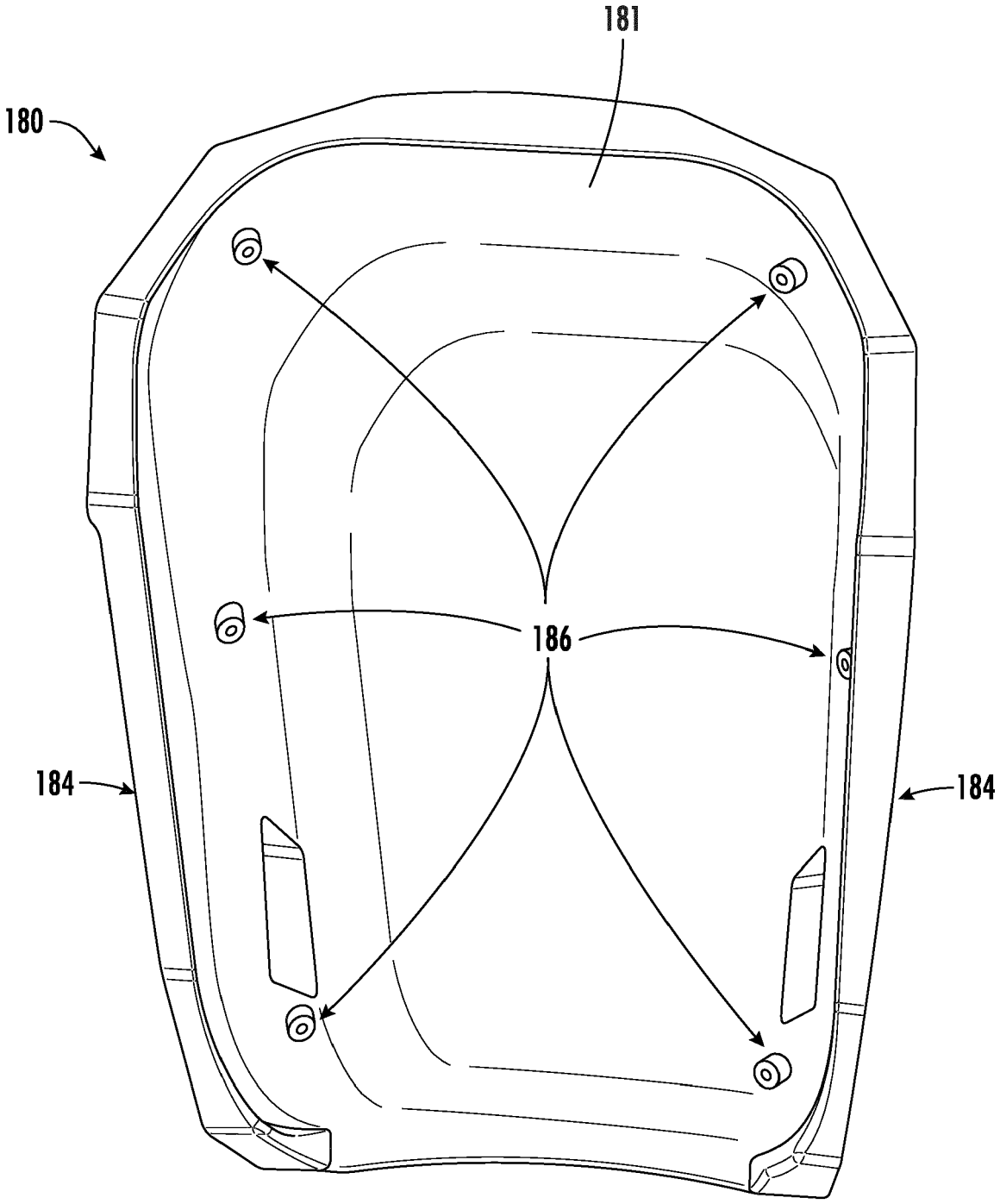

FIG. 3

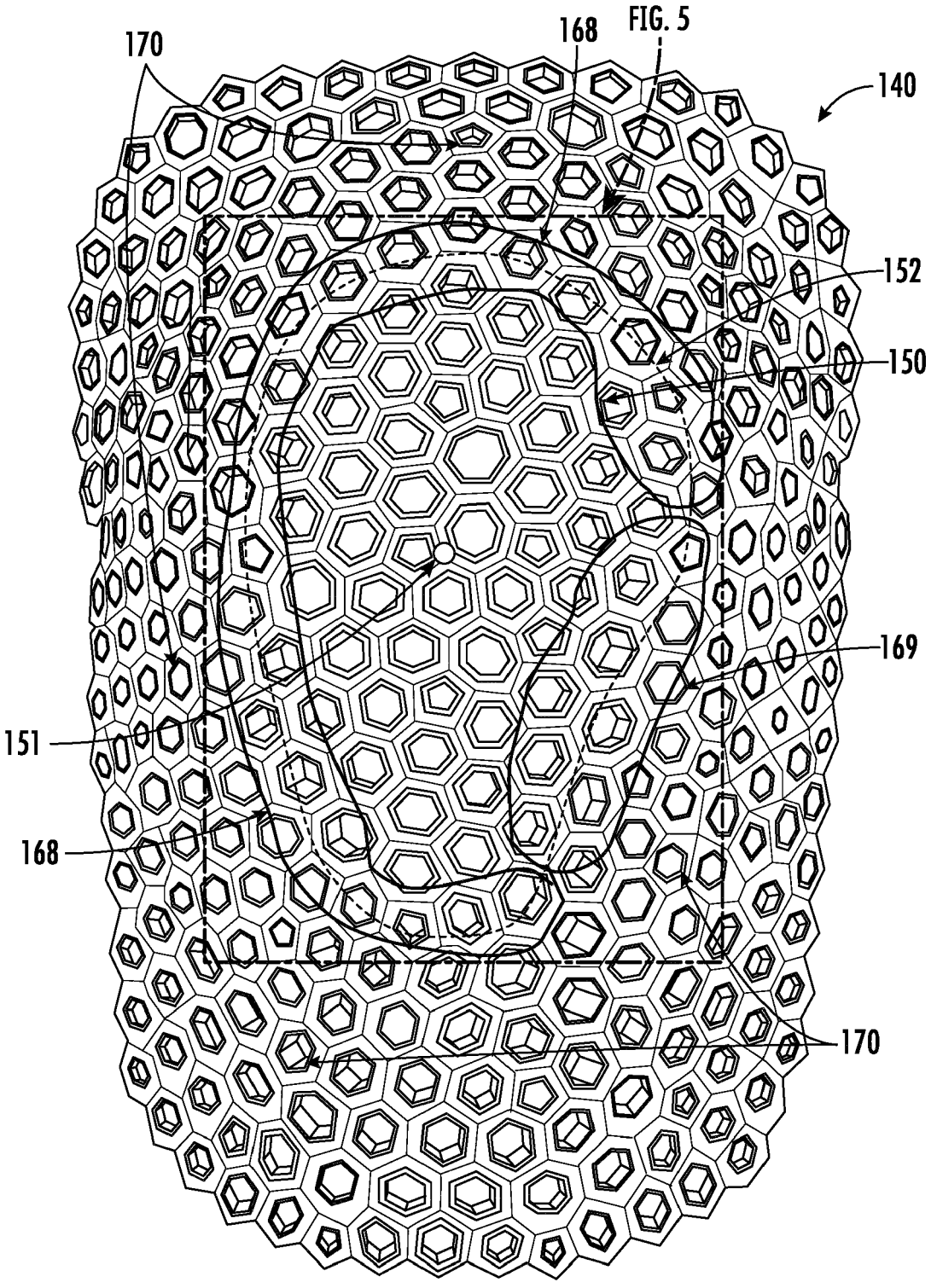

FIG. 4

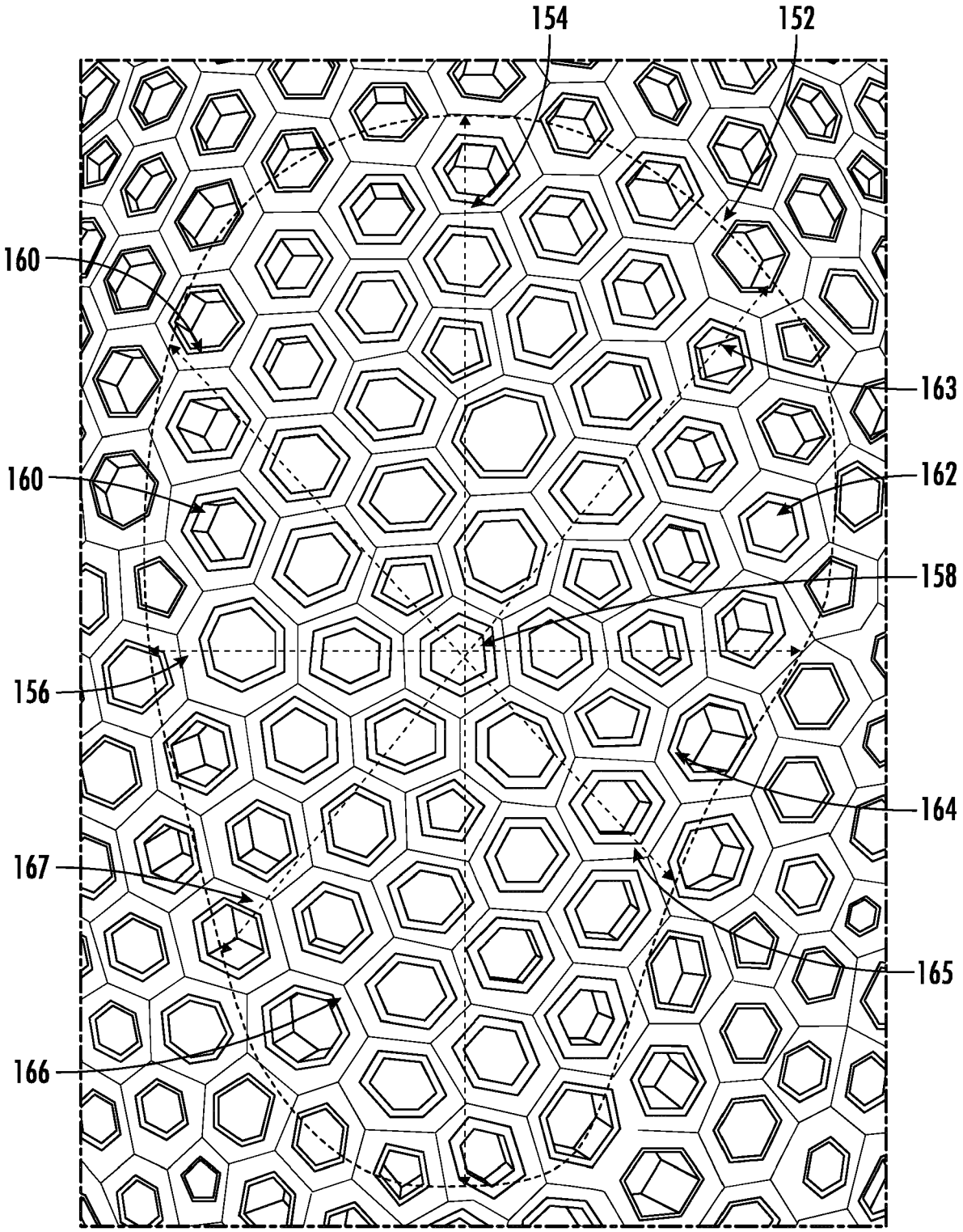

FIG. 5

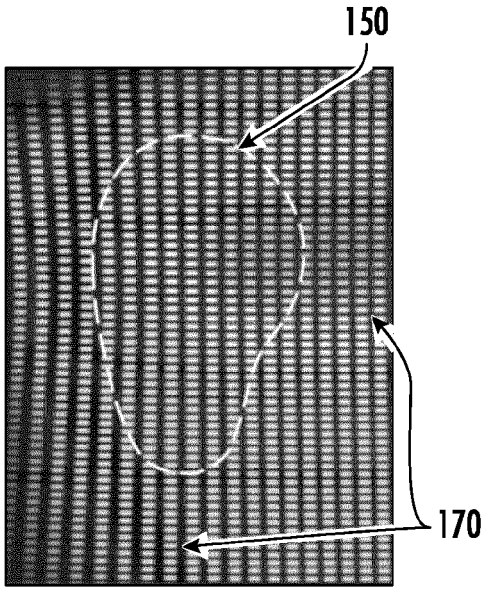

FIG. 6

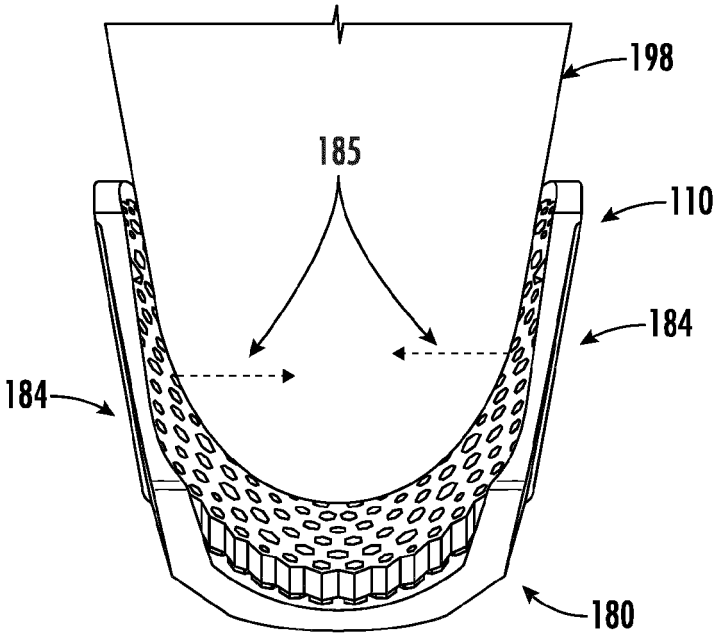

FIG. 7

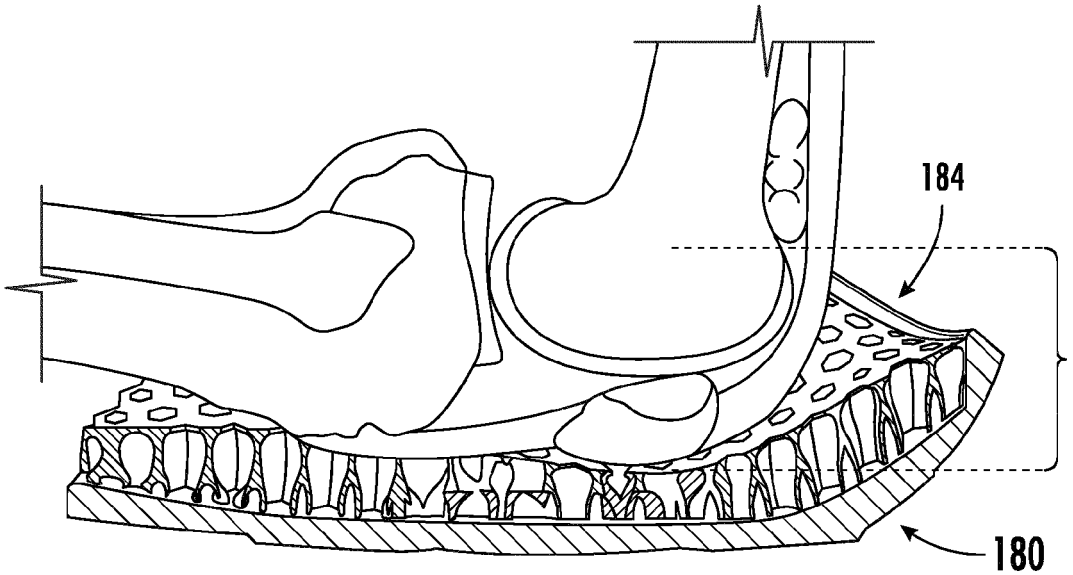

FIG. 8

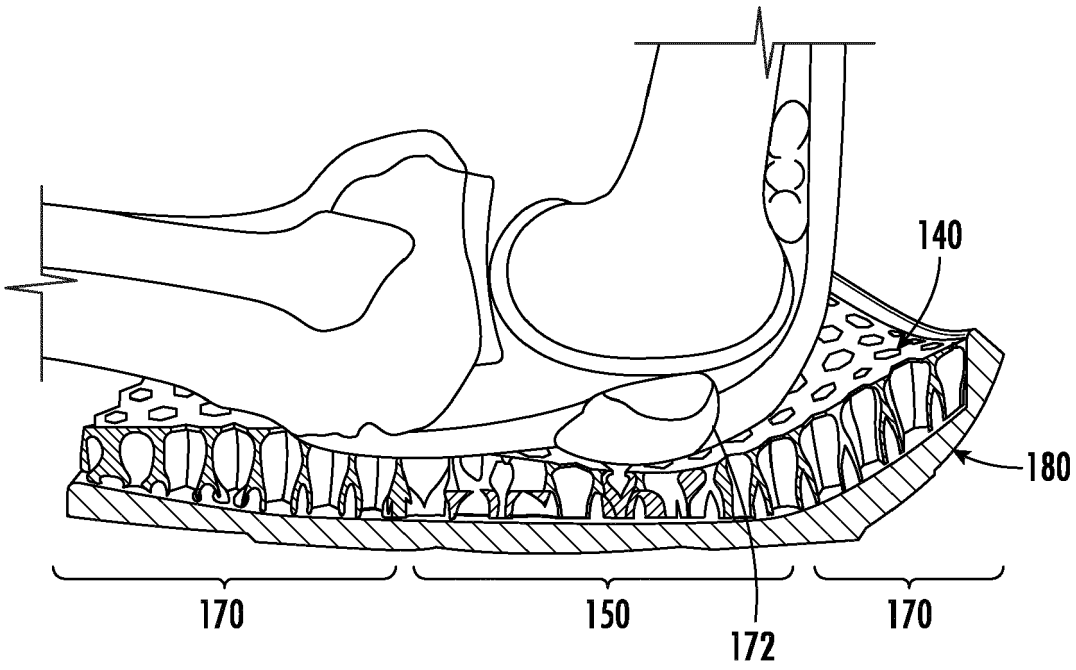

FIG. 9

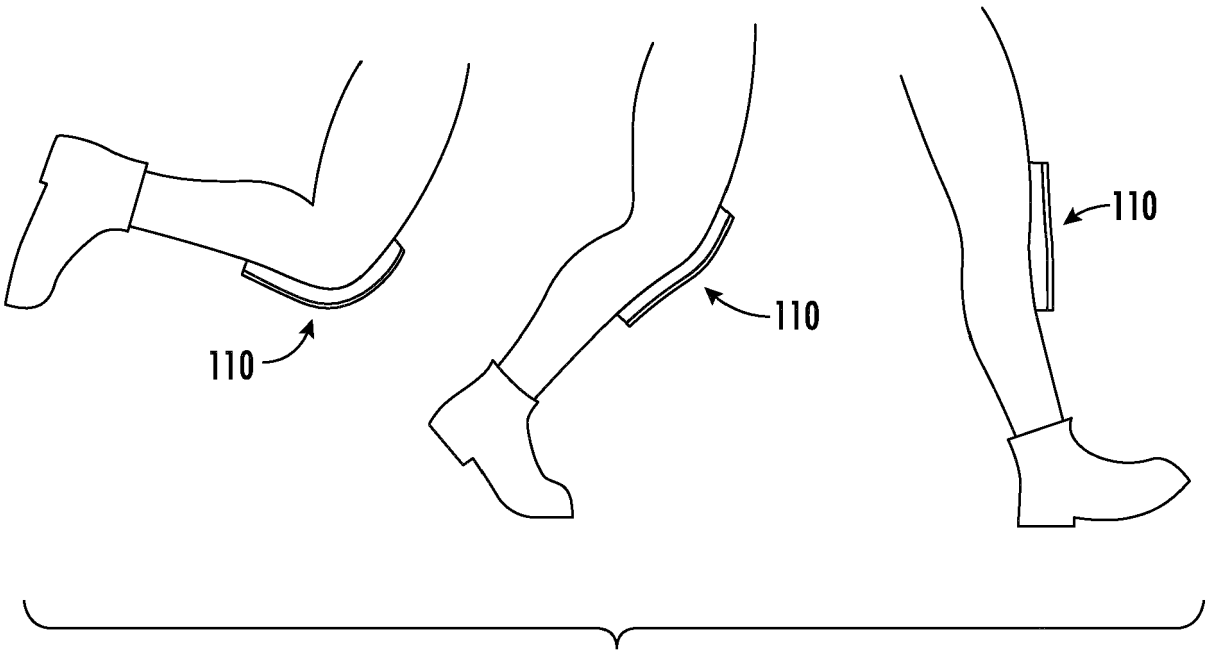

FIG. 10

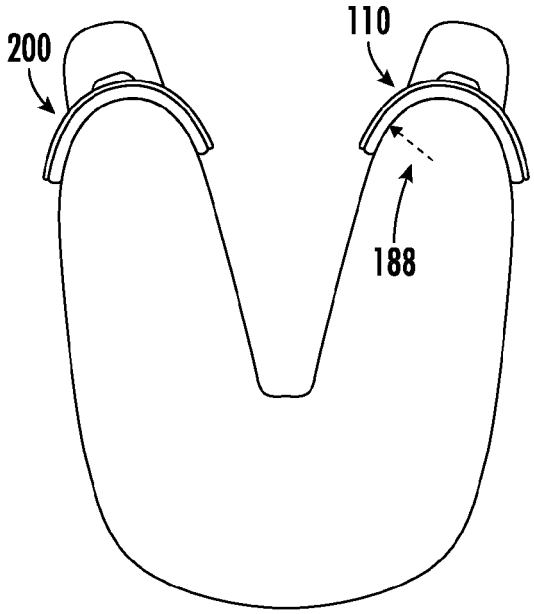

FIG. 11

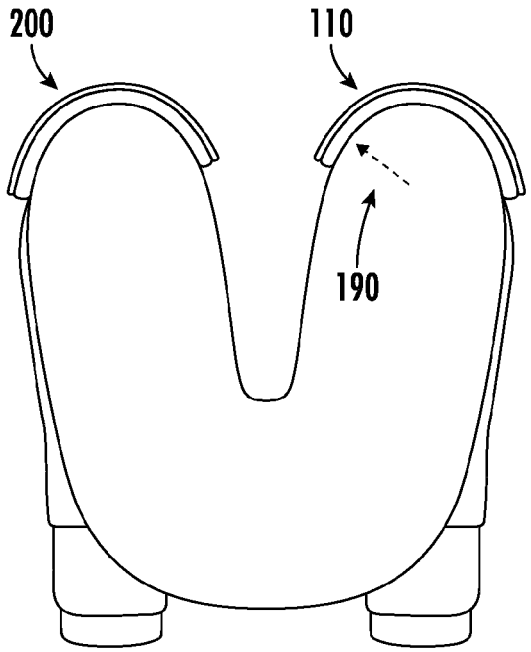

FIG. 12

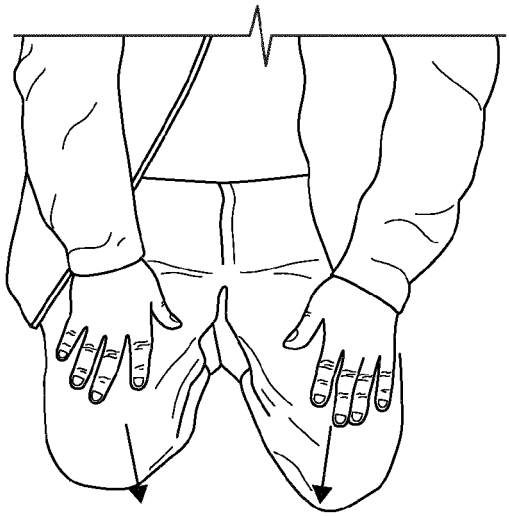

FIG. 13

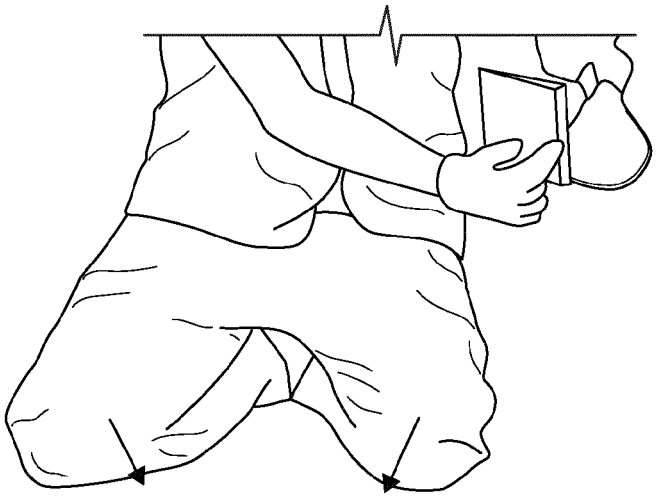

FIG. 14

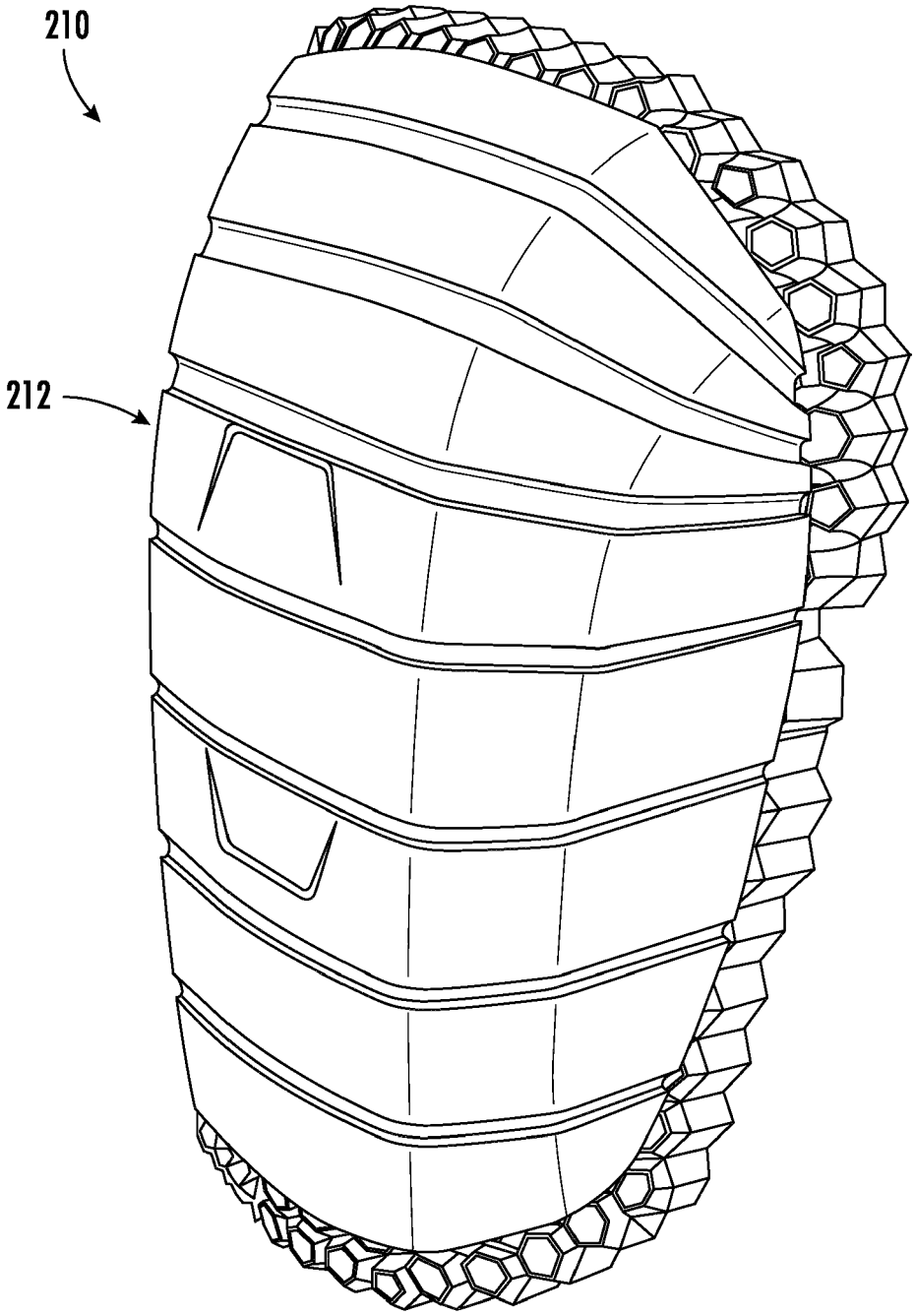

FIG. 15

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PARTIAL EUROPEAN SEARCH REPORT

under Rule 62a and/or 63 of the European Patent Convention. This report shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number
EP 23 19 6496

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	EP 1 450 635 B1 (KWM ENTWICKLUNGS VERTRIEBS UND [DE]) 16 January 2008 (2008-01-16) * paragraphs [0013] - [0019], [0026] - [0031]; figures *	1-8	INV. A41D13/015 A41D13/06 A41D31/28
X	US 7 181 770 B2 (TRAVEL CADDY INC [US]) 27 February 2007 (2007-02-27) * column 3, line 25 - column 4, line 32; figures 1-9 *	1,3-8	
A	CN 111 657 582 A (HANGZHOU DAFANG TOOLS CO LTD) 15 September 2020 (2020-09-15) * figure 1 *	1	

TECHNICAL FIELDS SEARCHED (IPC)

A41D

INCOMPLETE SEARCH

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

Place of search	Date of completion of the search	Examiner
The Hague	26 March 2024	Gallego, Adoración

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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INCOMPLETE SEARCH
SHEET C

Application Number
EP 23 19 6496

Claim(s) completely searchable:
1-8

Claim(s) not searched:
9-20

Reason for the limitation of the search:

The search has been restricted to the subject-matter indicated by the applicant in his letter of 28.02.2024 filed in reply to the invitation pursuant to Rule 62a(1) EPC.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 19 6496

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26-03-2024

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US 7181770 B2	27-02-2007	NONE	
CN 111657582 A	15-09-2020	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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