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(54) **ADJUSTABLE AND MODULAR KNEE PROTECTOR AND KNEE SUPPORT DEVICE**

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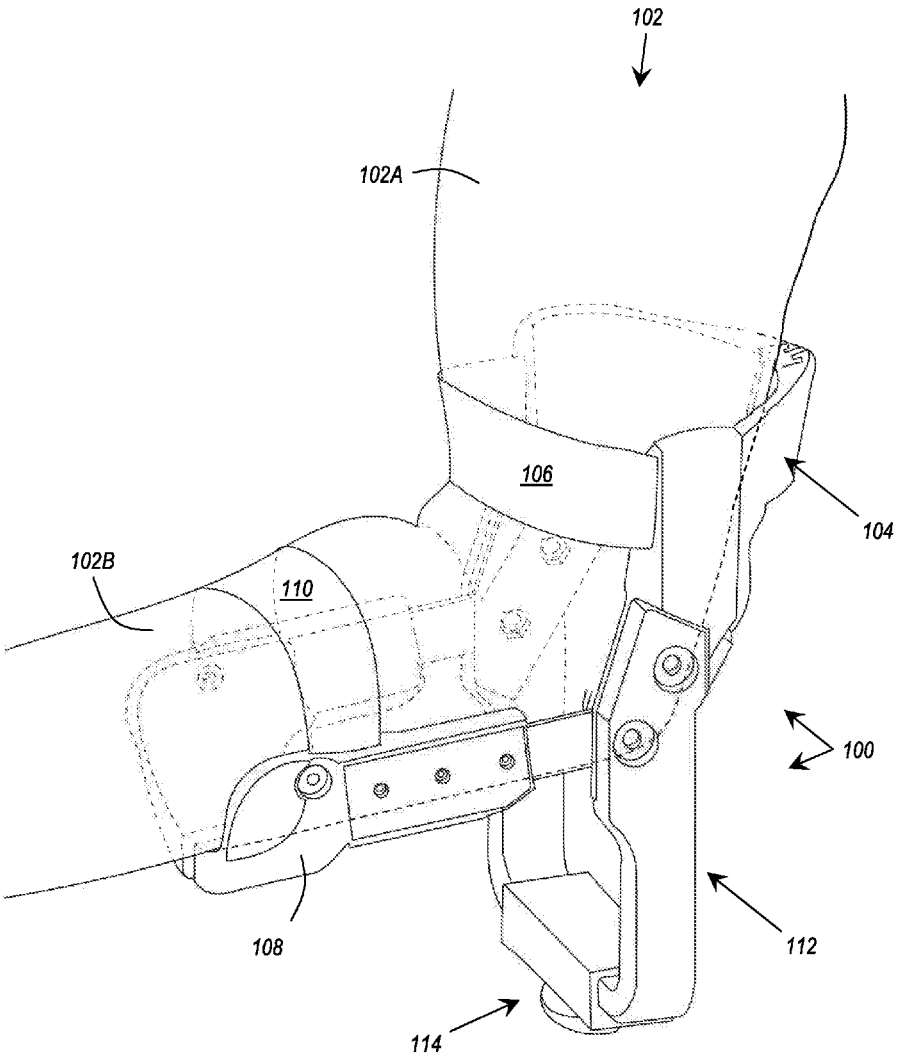
(57) **ABSTRACT**

The disclosed kneeling support apparatuses can be used to transfer a kneeling force away from a user's knee and to the user's upper and/or lower leg. Such apparatuses can include a first arcuate securing member configured to conform to the contour of an anterior portion of a user's upper leg and to attach thereto via an adjustable strap; a second arcuate securing member connected to the first arcuate securing member and configured to conform to the contour of an anterior portion of a user's lower leg and to attach thereto via a second adjustable strap; a bracing member coupled to the first and/or second arcuate securing member(s) that includes a pair of arms and a stabilizer attached to the pair of arms. The stabilizer is configured to contact a kneeling surface instead of a user's knee when the kneeling support apparatus is configured in a kneeling position.



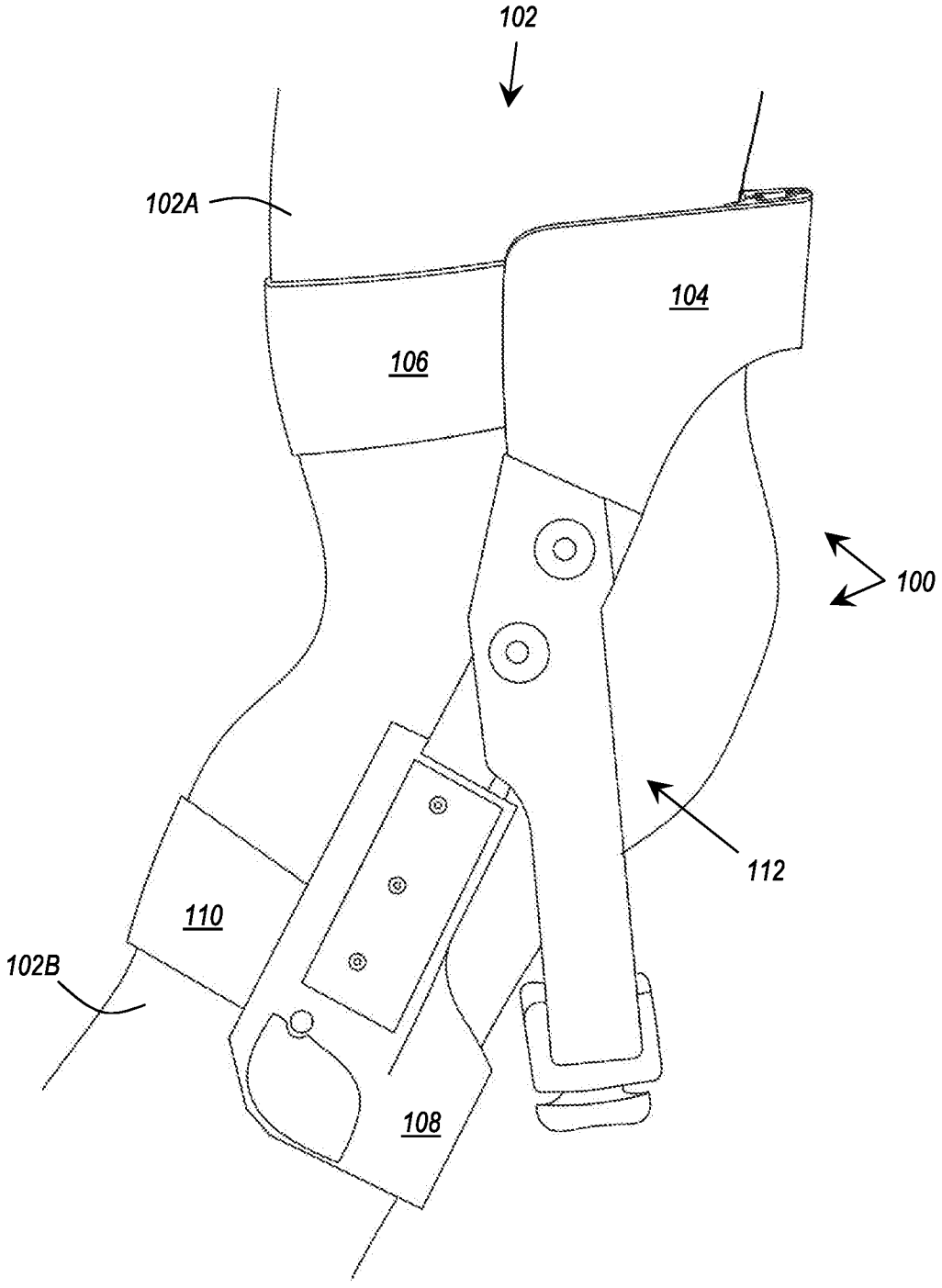


FIG. 1

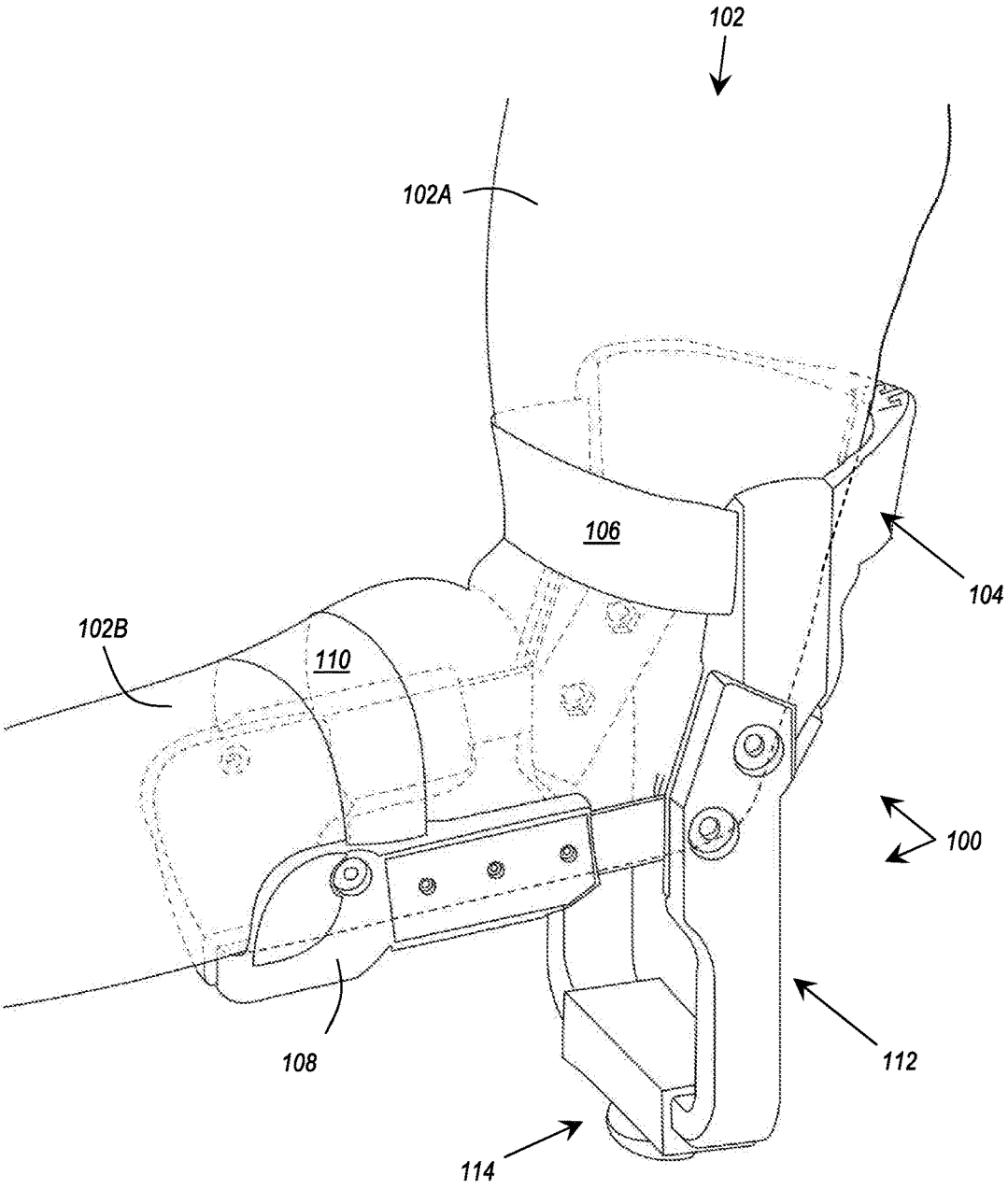


FIG. 2

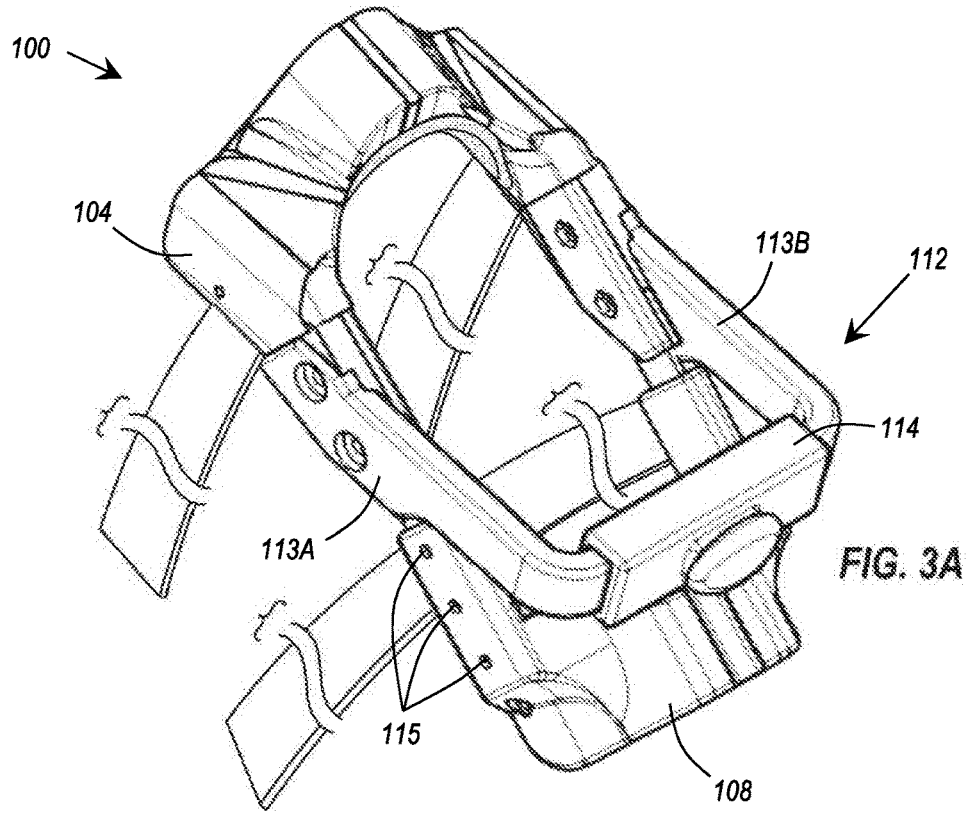


FIG. 3A

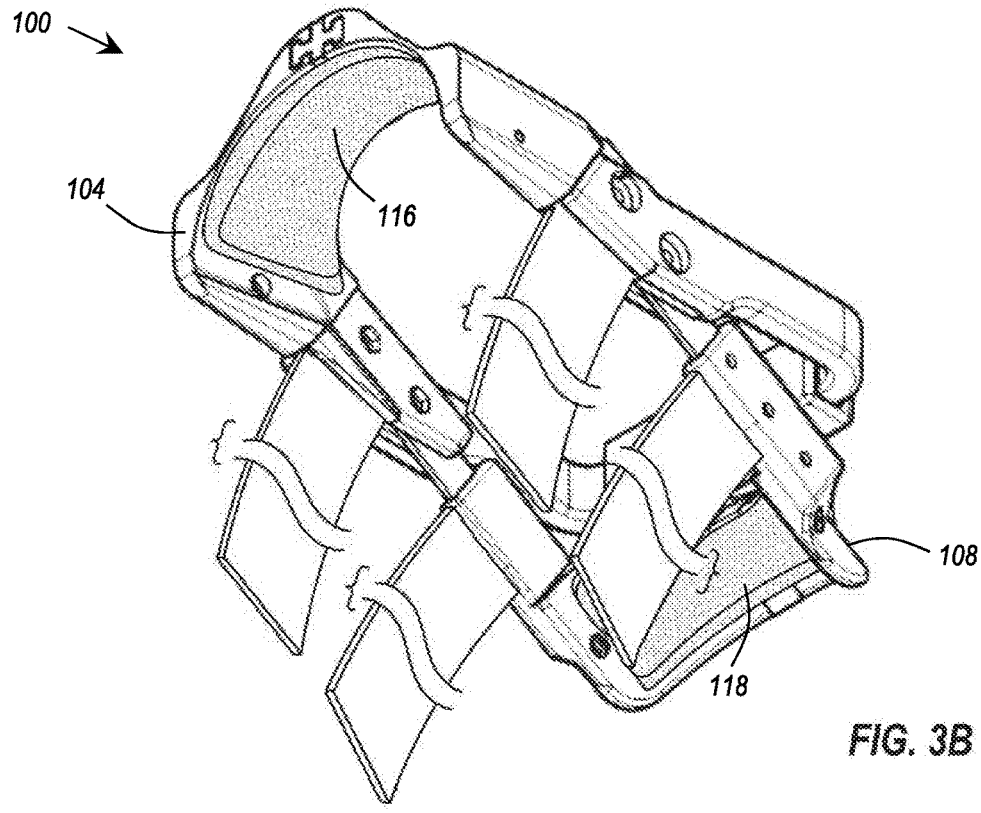


FIG. 3B

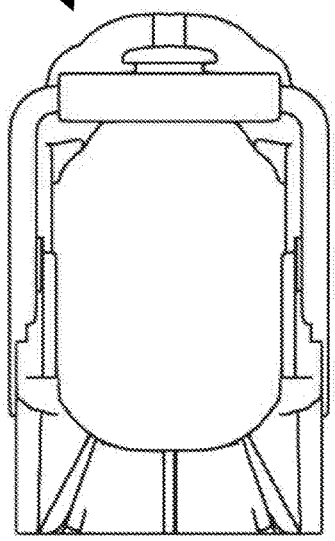


FIG. 3D

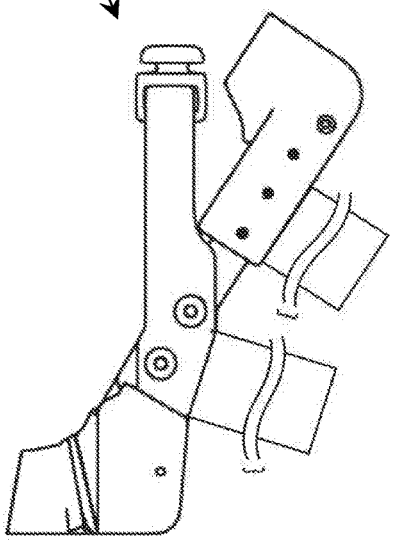


FIG. 3E

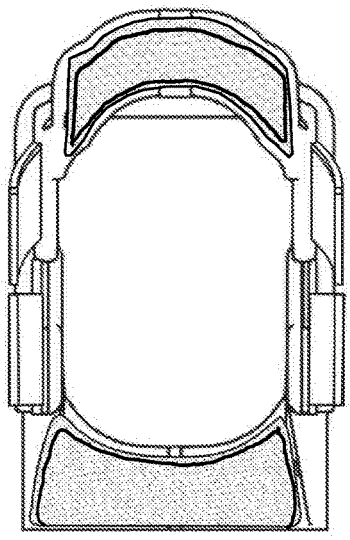


FIG. 3F

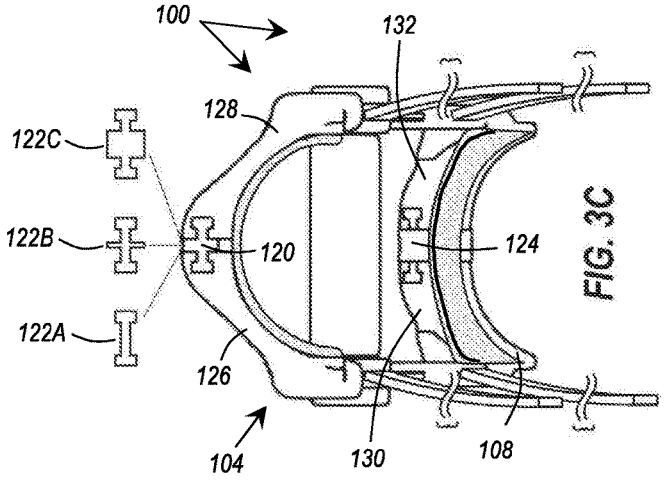


FIG. 3C

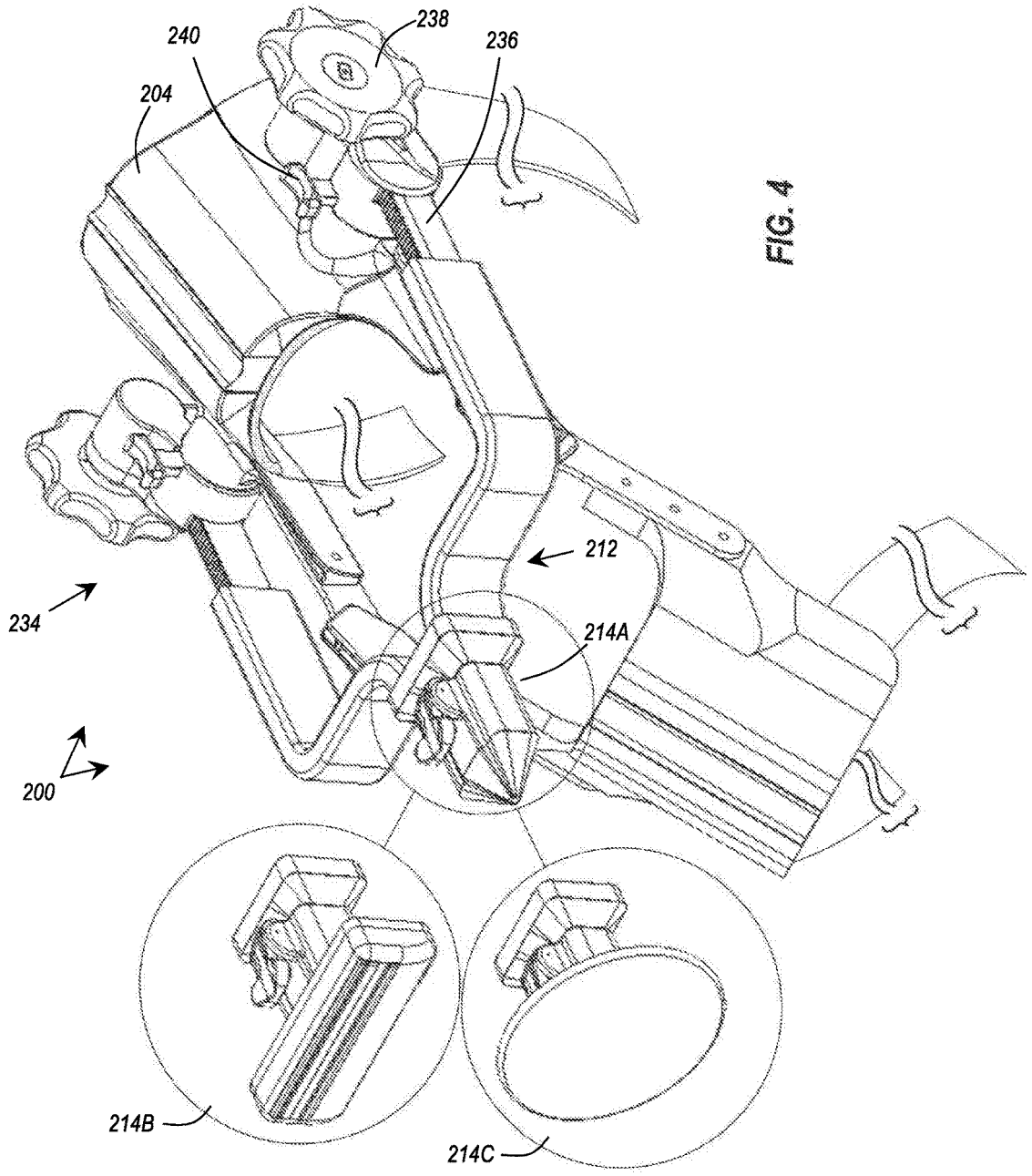


FIG. 4

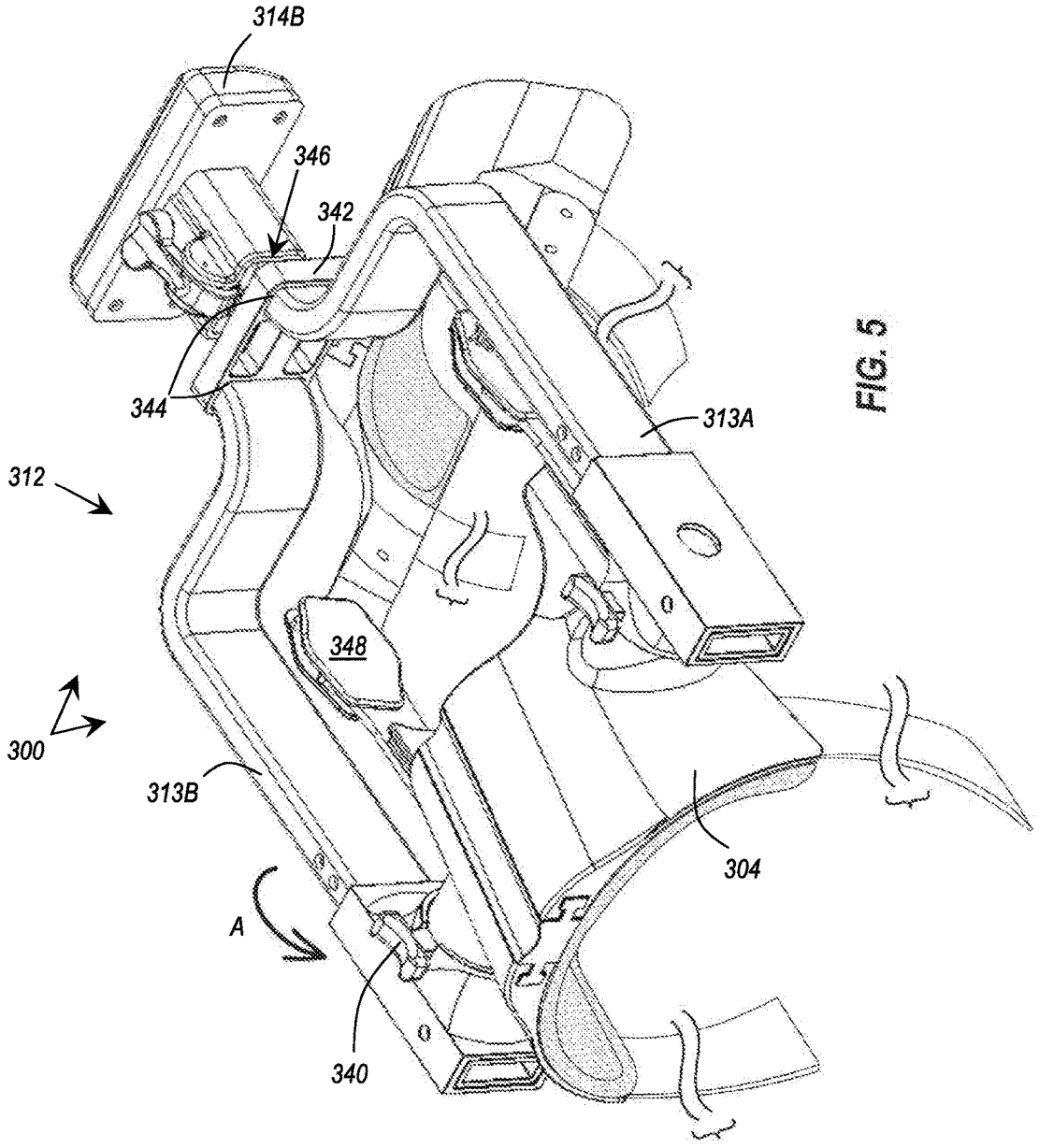


FIG. 5

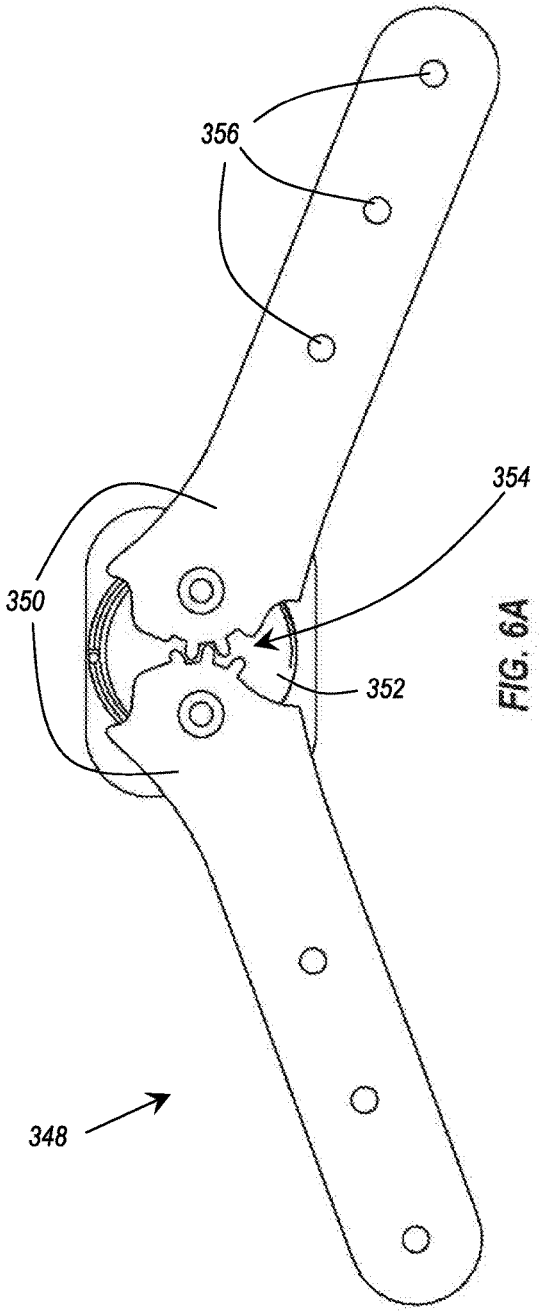


FIG. 6A

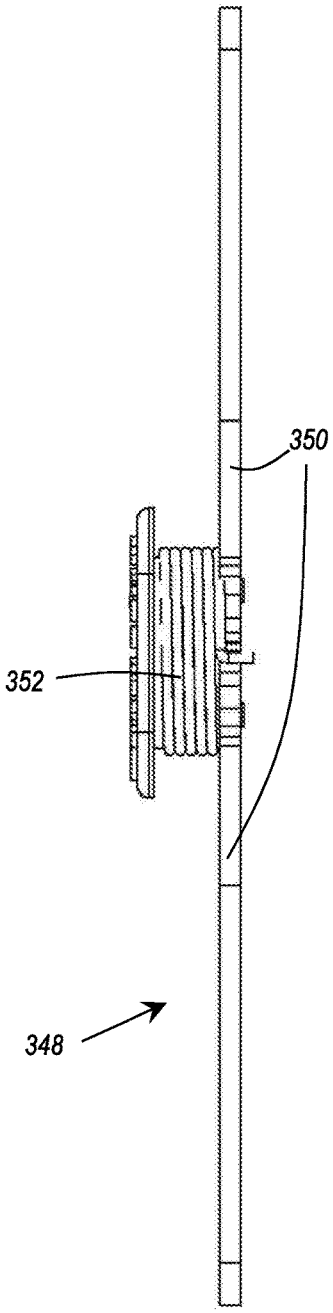


FIG. 6B

ADJUSTABLE AND MODULAR KNEE PROTECTOR AND KNEE SUPPORT DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to and the benefit of U.S. Provisional Patent Application Ser. No. 62/554,685, filed Sep. 6, 2017 and titled "ADJUSTABLE MODULAR KNEE PROTECTOR AND KNEELING SUPPORT DEVICE," which is incorporated herein by this reference in its entirety.

BACKGROUND

Technical Field

[0002] This disclosure generally relates to mechanical supports and braces. More specifically, the present disclosure relates to devices for protecting the knee and assisting a user in kneeling.

Related Technology

[0003] Joints are critically important parts of the body. They allow for mobility and agility, enabling animals to accomplish many necessary feats such as walking, running, gripping objects, feeding, and interacting with one's environment. The knee, in particular, is a critical part of the body. In addition to its articulation that enables variable positioning of one's body from a sitting to a standing position, the knee allows for kneeling. In some instances, mechanical or structural problems can make the knee too sore to be knelt upon, or the action of kneeling may harm the joint, itself. Some occupations or tasks require repeated kneeling, which can cause sensitivity or damage to the knee over time. The damage or sensitivity caused from overuse or as the result of other physical impairments may make kneeling a medically prohibited activity due to the stress placed upon the knee joint.

[0004] Extremely damaged knees can in some instances be repaired. Often, however, the knee is damaged too badly and is replaced with a prosthetic joint. In either case, damaged or artificial knees are often unsuited for kneeling. There is a dearth of devices that can both prevent damage to the knee caused by kneeling and protect a repaired or replacement knee while still enabling the user to kneel.

[0005] Accordingly, there are a number of disadvantages with devices for protecting and supporting the knee that can be addressed.

BRIEF SUMMARY

[0006] Embodiments of the present disclosure solve one or more of the foregoing or other problems in the art with devices for protecting and supporting the knee. In particular, one or more embodiments can include an apparatus for protecting a knee during kneeling and/or for acting as a kneeling support apparatus.

[0007] For example, a kneeling support apparatus can include (i) a first arcuate securing member configured in size and shape to conform to a contour defined by an anterior portion of an upper leg of a user, the first arcuate securing member including an adjustable strap for selectively connecting opposing sides of the first arcuate securing member; (ii) a second arcuate securing member pivotally connected to the first arcuate securing member, the second arcuate securing member configured in size and shape to conform to a contour defined by an anterior portion of a lower leg of a user and including a second adjustable strap for selectively connecting opposing sides of the second arcuate securing member; and (iii) a bracing member coupled to at least one of the first arcuate securing member and the second arcuate securing member, the bracing member including a pair of arms, each first end of the pair of arms being disposed on and coupled to one of the opposing sides of the first arcuate securing member, and a stabilizer connected to the pair of arms and configured to contact a kneeling surface when the kneeling support apparatus is configured in a kneeling position.

[0008] The stabilizer can be additionally operable to transfer a force applied to the stabilizer by the kneeling surface to the one or both of the first arcuate securing member and the second arcuate securing member. The stabilizer can be in the form of a roller ball, an elongate pad, a cup-shaped pad, and/or a spike and can include a gripping surface that is made of or includes a rubber pad, sandpaper, an abrasive material, an elastomer, an etched thermoplastic, or a silicone pad. The gripping surface can be selectively detachable and/or interchangeable.

[0009] Apparatuses of the present disclosure can also include a spacer disposed between and joining first and second assembly pieces of the first arcuate securing member. The spacer can be selected from any of a plurality of sizes such that each size of the plurality of sizes results in a different distance between the first and second assembly pieces and a different arc length formed between the first and second assembly pieces when coupled thereto.

[0010] As an additional example, a kneeling support apparatus can include (i) a first arcuate securing member, (ii) a second arcuate securing member pivotally connected to the first arcuate securing member, (iii) and a bracing member coupled to the first and/or second arcuate securing members. The first arcuate securing member can include a first assembly piece, a second assembly piece, a spacer disposed between and joining the first and second assembly pieces, and an adjustable strap for selectively connecting the first assembly piece to the second assembly piece. The second arcuate securing member can include a third assembly piece, a fourth assembly piece, and a second adjustable strap for selectively connecting the third assembly piece to the fourth assembly piece. The bracing member can include a pair of arms such that each first end of the pair of arms is disposed on and coupled to an opposing side of the first arcuate securing member. The bracing member can additionally include an adaptor coupled to the pair of arms and a stabilizer coupled to the adaptor.

[0011] The spacer associated with the first arcuate securing member can be sized such that the joined (first and second) assembly pieces form an arcuate surface configured in size and shape to conform to a contour defined by an anterior portion of an upper leg of a user. The second arcuate securing member can additionally include a second spacer that is sized such that the joined (third and fourth) assembly pieces form a (second) arcuate surface configured in size and shape to conform to a contour defined by an anterior portion of a lower leg of a user.

[0012] The stabilizer can further include a selectively detachable gripping surface selected from a rubber pad, sandpaper, an abrasive material, an elastomer, an etched thermoplastic, or a silicone pad.

[0013] Additionally, or alternatively, the bracing member can include a lateral adjustment member connected to the pair of arms. The lateral adjustment member is operable to selectively increase or decrease a length of the pair of arms and can be, for example, a rack and pinion. In such an exemplary embodiment, the pinion is connected to an arm of the pair of arms and to an adjustment knob that is operable to advance the pinion along the rack and thereby selectively increase or decrease the length of the pair of arms.

[0014] In yet another example, a kneeling support apparatus can include (i) a first arcuate securing member, (ii) a second arcuate securing member pivotally connected to the first arcuate securing member, and (iii) a bracing member coupled to the first and/or second arcuate securing member (s).

[0015] The first arcuate securing member can include a first assembly piece, a second assembly piece, a spacer disposed between and joining the first and second assembly pieces, and an adjustable strap for selectively connecting the first assembly piece to the second assembly piece. The joined first and second assembly pieces form an arcuate surface configured in size and shape to conform to a contour defined by an anterior portion of an upper leg of a user. The first arcuate securing member can additionally include a cushion coupled at least partially to the arcuate surface defined by the first and second assembly pieces.

[0016] The second arcuate securing member can include a third assembly piece, a fourth assembly piece, a second spacer disposed between and joining the third and fourth assembly pieces, and a second adjustable strap for selectively connecting the third assembly piece to the fourth assembly piece. The joined third and fourth assembly pieces form a second arcuate surface configured in size and shape to conform to a contour defined by an anterior portion of a lower leg of a user. The second arcuate securing member can additionally include a second cushion coupled at least partially to the second arcuate surface defined by the third and fourth assembly pieces.

[0017] The bracing member can include a pair of arms where each first end of the pair of arms is disposed on and coupled to an opposing side of the first arcuate securing member, an adaptor having first and second coupling regions, the first coupling region having one or more receptacles for receiving and coupling second ends of the pair of arms, and a stabilizer connected to the second coupling region of the adaptor.

[0018] In some instances, the bracing member further includes an adjustable gear operable to pivot the pair of arms from a first position to a second position relative to the first arcuate securing member. The bracing member can further include a switch for engaging the adjustable gear. Additionally, or alternatively, the bracing member can include a lateral adjustment member associated with the pair of arms, the lateral adjustment member operable to selectively increase or decrease a length of the pair of arms. The lateral adjustment member can be, for example, a rack and pinion where the pinion is connected to an arm of the pair of arms and to an adjustment knob for advancing the pinion along the rack.

[0019] A system for protecting a user's knee during kneeling can include (i) a kneeling support apparatus as described herein, (ii) a plurality of spacers for customizing a size of the kneeling support apparatus to the user, and (iii) a plurality of interchangeable gripping surfaces and/or stabilizers.

[0020] Accordingly, apparatuses and systems for protecting the knee and for providing kneeling support are disclosed.

[0021] This summary is provided to introduce a selection of concepts in a simplified form that are further described below in the detailed description. This summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an indication of the scope of the claimed subject matter.

[0022] Additional features and advantages of the disclosure will be set forth in the description which follows, and in part will be obvious from the description, or may be learned by the practice of the disclosure. The features and advantages of the disclosure may be realized and obtained by means of the instruments and combinations particularly pointed out in the appended claims. These and other features of the present disclosure will become more fully apparent from the following description and appended claims or may be learned by the practice of the disclosure as set forth hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] In order to describe the manner in which the above recited and other advantages and features of the disclosure can be obtained, a more particular description of the disclosure briefly described above will be rendered by reference to specific embodiments thereof, which are illustrated in the appended drawings. It is appreciated that these drawings depict only typical embodiments of the disclosure and are not therefore to be considered to be limiting of its scope. The disclosure will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

[0024] FIG. **1** illustrates an exemplary kneeling support apparatus attached to a user in a standing position, according to one or more implementations of the present disclosure.

[0025] FIG. **2** illustrates the exemplary kneeling support apparatus of claim **1** attached to the user in a kneeling position, according to one or more implementations of the present disclosure.

[0026] FIG. **3**A illustrates a front, upper right perspective view of an exemplary kneeling support device, according to one or more embodiments of the present disclosure.

[0027] FIG. **3**B illustrates a rear, lower right perspective view of the exemplary kneeling support device of FIG. **3**A in accordance with one or more embodiments of the present disclosure.

[0028] FIG. **3**C illustrates a rear elevation view of the exemplary kneeling support device of FIG. **3**A and exemplary differently-sized spacers in accordance with one or more embodiments of the present disclosure.

[0029] FIG. **3**D illustrates a top plan view of the exemplary kneeling support device of FIG. **3**A in accordance with one or more embodiments of the present disclosure.

[0030] FIG. **3**E illustrates a right elevation view of the exemplary kneeling support device of FIG. **3**A in accordance with one or more embodiments of the present disclosure.

[0031] FIG. **3**F illustrates a bottom plan view of the exemplary kneeling support device of FIG. **3**A in accordance with one or more embodiments of the present disclosure.

[0032] FIG. **4** illustrates a front, upper left perspective view of another exemplary kneeling support device and

exemplary alternative/interchangeable stabilizers, according to one or more embodiments of the present disclosure.

[0033] FIG. **5** illustrates a rear, upper right perspective view of yet another exemplary kneeling support device, according to one or more embodiments of the present disclosure.

[0034] FIG. **6**A illustrates a rear elevation view of a joint between the first and second arcuate securing members in an exemplary kneeling support device, according to one or more embodiments of the present disclosure.

[0035] FIG. **6**B illustrates a bottom plan view of the joint depicted in FIG. **6**A in accordance with one or more embodiments of the present disclosure.

DETAILED DESCRIPTION

[0036] Before describing various embodiments of the present disclosure in detail, it is to be understood that this disclosure is not limited to the parameters of the particularly exemplified systems, methods, apparatus, products, processes, and/or kits, which may, of course, vary. Thus, while certain embodiments of the present disclosure will be described in detail, with reference to specific configurations, parameters, components, elements, etc., the descriptions are illustrative and are not to be construed as limiting the scope of the claimed invention. In addition, the terminology used herein is for the purpose of describing the embodiments and is not necessarily intended to limit the scope of the claimed invention.

[0037] Embodiments of the present disclosure enable apparatuses and systems for protecting a user's knee when the user is in a kneeling position. Kneeling can be uncomfortable, particularly on hard surfaces, and prolonged kneeling can be painful: while kneeling and even after the individual leaves the kneeling position, the pain can persist. In situations where an individual is reiteratively in a kneeling position, damage to the knee joint and/or surrounding tissue can result. This can be mitigated in some situations by the introduction of a padded object between the user's knee and the kneeling surface. For example, a user may carry a foam pad and before kneeling place the foam pad on the kneeling surface to cushion the impact and prolonged force applied to the knee when kneeling. This solution is impractical in many situations, as the individual may need to carry other equipment or require the use of their hands when maneuvering in the kneeling position (e.g., to work).

[0038] Alternatively, an individual may remove the need to separately carry a cushion or padded object by wearing knee pads. The typical knee pad is secured around the user's knee and includes a durable outer surface and padded interior adjacent to the user's knee. Similar to the separate cushion, this solution is also fraught with inefficiencies and problems. For example, knee pads will often wear or thin at points of contact and where the pressure is greatest. This quickly deteriorates the beneficial effects of the knee pad, merely blunting the impact or prolonged pressure instead of deferring it away from the knee.

[0039] Even some attempted inventions, such as the support device disclosed in U.S. Patent Publication No. 2003/0127900, fail to provide a solution that protects an individual's knees when entering or sustaining a kneeling position. The support device disclosed in the '900 publication includes a device that attaches to a user's lower leg and includes a pad positioned at the top of the device that will fold down and cushion the user's knee when in a kneeling position. The device additionally includes a seat attached to the bottom of the device that is configured to receive the user's buttocks while in the kneeling position. The seat is intended to defer some of the kneeling force away from the knee. However, this seat will only serve its purpose in limited situations. That is, the user must not only be kneeling but leaning backwards in order to receive any benefit from the seat portion of the device. This body positioning is difficult—if not improbable—for many users who work in a kneeling position, making it functionally similar to a knee pad.

[0040] All of the foregoing are incomplete solutions because they fail to adequately remove the strain and impact from a user's knee when kneeling and fail to adequately protect a user's knee. This is particularly the case when the user has a replacement knee or other issue where the impact and/or pressure of kneeling is discouraged or prohibited. In U.S. Pat. No. 6,769,134, a support assembly is provided that transfers the impact and force of kneeling to a user's groin and hips. The device includes a girdle for attachment to the groin and hips—like a diaper—and includes two straight-armed supports attached at the hip of the girdle. Each straight-armed support is secured to the user's leg, so that it remains in line with the user's femur, and extends a distance beyond the user's knee. Accordingly, when the user enters a kneeling position, the support extends beyond the user's knee and impacts the kneeling surface, transferring the impact and force along the support and into the groin. This invention is impractical for working situations, as it limits the user's access to the floor and reduces mobility. The configuration of the device also increases a likelihood that the kneeling force will cause a commensurate torsional force to be transferred to the user's groin, causing discomfort and dissuading continual use.

[0041] In contrast to the foregoing, the kneeling support apparatuses disclosed herein are secured to the user's upper and lower legs and protect the user's knee by preventing it from touching the kneeling surface while deferring the kneeling force along the user's entire leg. Because the disclosed kneeling support apparatuses are secured to the user's upper and lower legs, the apparatuses are beneficially more stable and secure, resisting any torsional force and spreading the kneeling force along the user's entire leg. For example, if a user enters a kneeling position directly over the knee, the kneeling force will predominantly be transferred to the upper leg, but because the kneeling support apparatus is additionally secured to the user's lower leg, the apparatus is anchored in position, thereby reducing discomfort on the upper leg and preventing the apparatus from sliding up the user's leg, which could unintentionally cause the user's knee to contact the kneeling surface or the bracing member of the apparatus. In other kneeling positions and angles, the disclosed kneeling support apparatuses can defer the kneeling force through the user's leg while reducing discomfort in the kneeling position. Additionally, the disclosed kneeling support apparatuses benefit from a hands-free operation and allow the user the flexibility to get as close or as far away from a kneeling surface as desired.

[0042] The disclosed kneeling support apparatuses also include a durable frame that weathers hard use better than prior art devices while maintaining the ability to be securely and easily attached to the user. As another benefit of the disclosed kneeling support apparatuses, the durable frame can be customized to different user leg sizes. In some

embodiments, the kneeling support devices also benefit from interchangeability of parts, such as interchangeable types or shapes of stabilizers and/or gripping surfaces. Thus, the same kneeling support device can have myriad uses and can be adapted to many, varied situations. For example, implementations of the kneeling support apparatuses disclosed herein enable uses in the military, where gunners are often dropping to a knee for stability and added precision while engaging targets or taking cover; in construction, where workers are often alternating between standing and kneeling positions—or even working predominately in a kneeling position (e.g., when laying tile or installing other flooring material, installing baseboards, drywalling, roofing, etc.); for personal use in the garden, where planting and/or weeding the garden may encourage users to be on their knees; or for myriad other uses where a user may benefit from a device that protects the user's knee or otherwise supports the user in a kneeling position.

[0043] Taken together, the disclosed kneeling support apparatuses and systems provide ample benefits and improvements over known devices.

Abbreviated List of Defined Terms

[0044] To assist in understanding the scope and content of the foregoing and forthcoming written description and appended claims, a select few terms are defined directly below. It should be noted that any headings used herein are for organizational purposes only and are not meant to be used to limit the scope of the description or the claims.

[0045] The term "attachment mechanism" as used herein includes any device in one or more pieces that may be used to "attach" two or more components or to "attach" one component to another component. The term "attach" and/or "attachment" may refer to its common dictionary definition where appropriate, but it may contextually refer to particular acts of connecting, associating, affixing, fastening, sticking, joining, or any combination of the foregoing that cause an object to be fixedly or selectively proximate another object. In some embodiments, the attachment mechanism may be an integral part of a component, whereas in other embodiments, the attachment mechanism may be separate.

[0046] An attachment mechanism is to be understood to have any number of movable and/or fixed parts, any of which may be singularly or in combination with one or more components interact to facilitate attachment. As non-limiting examples, an attachment mechanism may include a mechanism for attaching components using one or more—or a combination of—chemical adhesives (e.g., an epoxy and/or other thermosetting adhesives, glue, cement, paste, tape and/or other pressure-sensitive adhesives, etc.), mechanical fasteners (e.g., threaded fasteners such as a combination of a threaded rod together with a complementary threaded nut, rivets, screws, clamps, buckles, tenon and mortise pairs, hook and loop fasteners, dual lock reclosable fasteners, cable ties, rubber bands, etc.), magnets, vacuums (e.g., suction cups, etc.), and/or interference fittings (e.g., press fittings, friction fittings, etc.). Additionally, or alternatively, an attachment mechanism may include any material or element resulting from physically attaching two or more components by crimping, welding, and/or soldering. The differing uses and implementations of attachment mechanisms can be selected based on the desired permanence of attachment and/or as known or expected by one having skill in the art.

[0047] The term "adjustable strap," as used herein, is intended to be a type of attachment mechanism that is selectively engaged. For example, an adjustable strap can include a pair of hook and loop fasteners that can be variably attached at differing positions or lengths. An adjustable strap can also include ladder straps, straps with quick release buckles, belt and buckle fasteners, lace and eyelet combination or similar. Additionally, an adjustable strap can be configured to remain fixed at a desired tension in opposition to an opposing force. For example, an adjustable strap, as disclosed herein, can include a hook and loop fastening system that can remain fixed at a desired adjustment while under a separating force of greater than 100 lbs., preferably greater than 200 lbs., more preferably greater than 400 lbs. It should be appreciated that the dimensions of the adjustable strap can be augmented to resist a greater or lesser separating force. For example, a hook and loop fastening system can include a greater area of interacting hooks and loops to resist a greater separating force.

[0048] Various aspects of the present disclosure can be illustrated by describing components that are bound, coupled, attached, connected, and/or joined together. As used herein, the terms "bound," "coupled", "attached", "connected," and/or "joined" are used to indicate either a direct association between two components or, where appropriate, an indirect association with one another through intervening or intermediate components. In contrast, when a component is referred to as being "directly bound," "directly coupled", "directly attached", "directly connected," and/or "directly joined" to another component, no intervening elements are present or contemplated. Furthermore, binding, coupling, attaching, connecting, and/or joining can comprise mechanical and/or chemical association.

[0049] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the present disclosure pertains.

Exemplary Kneeling Support Apparatuses

[0050] As provided above, the present disclosure relates to kneeling support systems and apparatuses that enable a user to comfortably kneel without contacting their knee on a kneeling surface, instead forcing an interaction between a stabilizer component that defers the force of impact and/or the kneeling force through the kneeling support system/apparatus and into the upper and lower portions of the user's leg. As an exemplary implementation of the foregoing, FIG. **1** illustrates one example of a kneeling support apparatus **100** attached to a user's leg **102**. As shown, the kneeling support apparatus **100** includes (i) a first arcuate securing member **104** secured to an upper portion **102**A of the user's leg **102** via a first adjustable strap **106**, (ii) a second arcuate securing member **108** pivotally connected to the first arcuate securing member **104** and secured to a lower portion **102**B of the user's leg **102** via a second adjustable strap **110**, and (iii) a bracing member **112** coupled to least one of the first arcuate securing member **104** and the second arcuate securing member **108**.

[0051] As shown in FIG. **1**, the user is in a standing position, causing the kneeling support apparatus **100** to be slightly bent (i.e., the first and second arcuate securing members are not coplanar, having an angle formed there between of less than 180°). The bracing member **112** is directed downward toward the second arcuate securing

member **108**, and in some embodiments (such as that shown in FIG. **1**) the bracing member **112** abuts against a portion of the second arcuate securing member **108**, thereby preventing the bracing member **112** from impacting and/or rubbing against the user's lower leg **102**B.

[0052] Upon entering a kneeling position, as shown in FIG. **2**, the first arcuate securing member **104** remains secured to the upper portion **102**A of the user's leg **102**, and the second arcuate securing member **108** remains secured to a lower portion **102**B of the user's leg **102**, rotating therewith. The bracing member **112** remains aligned with the first arcuate securing member **104**, which causes a stabilizer **114** associated with the bracing member **112** to intercept and contact the kneeling surface instead of the user's knee. The subsequent kneeling force (i.e., the force exerted against the stabilizer **114**, which in some embodiments is the force equivalent of the user's weight supported by the stabilizer **114**) is directed from the stabilizer **114** along the pair of opposing arms of the bracing member **112** and into the first and second arcuate securing members **104**, **108**.

[0053] As alluded to above, the kneeling force exerted on the first arcuate securing member **104** is at least partially absorbed and/or displaced within the upper portion **102**A of the user's leg **102**. This, in turn, can attempt to bias the first arcuate securing member **104** up the user's leg **102**, but because the second arcuate securing member **108** is coupled to the first arcuate securing member **104** and also secured to a lower portion **102**B of the user's leg **102**, such biasing force is counteracted by the anchoring force of the lower arcuate securing member **108**, which is mechanically coupled to the first arcuate securing member **104**, and the lower portion **102**B of the user's leg **102**. Accordingly, the kneeling support apparatus **100** absorbs and/or deflects the kneeling force through the kneeling support apparatus **100** and the user's leg **102**, generally, instead of the kneeling force being focused almost exclusively on the user's knee.

[0054] As particularly illustrated in FIGS. **1** and **2**, kneeling support devices of the present disclosure (e.g., kneeling support apparatus **100**) can be secured to anterior portions of the user's upper and lower leg using adjustable straps the draft circumferentially around the user's leg. While these and other figures provided herewith illustrates the adjustable straps as being a two-piece complementary strap system (i.e., a hook and loop fastening system), it should be appreciated that multiple adjustable straps can be included on one or both of the first and second arcuate securing members **104**, **108** for comfort or additional stability.

[0055] Referring now to FIGS. **3**A-**3**F, illustrated is the kneeling support apparatus **100** of FIGS. **1** and **2** detached from the user and shown in various views. For example, FIG. **3**A illustrates a front, upper right perspective view of exemplary kneeling support apparatus **100**. Reiterated for the purposes of illustration and for comparison with FIGS. **1** and **2**, the kneeling support apparatus **100** includes a first arcuate securing member **104** and a second arcuate securing member **108** pivotally connected to the first arcuate securing member **104**. The apparatus **100** additionally includes a bracing member **112** coupled to the first arcuate securing member. The bracing member **112** includes a pair of arms **113**A, **113**B where each arm **113**A, **113**B is disposed on and coupled to an opposing side of the first arcuate securing member **104**. A stabilizer **114**, which can include an adapter portion, is coupled to the pair of arms **113**A, **113**B. For example, each arm **113**A, **113**B of the bracing member **112** can be connected to the stabilizer (e.g., through the adapter portion) via an interference or friction fit.

[0056] In some embodiments, the arms **113**A, **113**B of the bracing member **112** can be detached from the first arcuate securing member **104** and replaced with a pair of arms having a different length and/or to switch the stabilizer **114** (e.g., due to wear, breakage, or to replace with a different shape or texture). In some embodiments, the pair of arms can be adjusted in length for variable positioning of the stabilizer and/or to account for a desired depth of lunge that a user engages in before the stabilizer **114** contacts the kneeling surface. Additionally, or alternatively, the second arcuate securing member **108** can be secured to the first arcuate securing member **104** at any of a plurality of securing points **115**, which can vary the positioning of the first and/or second arcuate securing member **104**, **108** relative to the another and thereby affect the positioning of the user's knee relative to the kneeling support apparatus **100**. These features, among others, can beneficially enable the kneeling support apparatus **100** to be configured according to a user's user preference and comfort.

[0057] The kneeling support apparatus **100** can be manufactured using any suitable material. For example, the material used to manufacture the apparatus **100** or components thereof can include high-strength materials such as high-strength plastics (e.g., made via plastic extrusion, using glass reinforcement, Kevlar reinforced, etc.) and hardened metals and metal alloys (e.g., stainless steel, hardened aluminum, etc.). In a preferred embodiment, the materials used to manufacture the apparatus **100** or components thereof are lightweight yet balanced to withstand rigorous use. Components of the apparatus **100** can be manufactured via injection molding or other suitable manufacturing methods, including the use of **3**D printing technologies. In embodiments where **3**D printing technologies are used to print one or more of the components comprising the apparatus **100**, the direction of layer orientation during the manufacturing process can be controlled to prevent or reduce a likelihood of delamination. For example, the pair of arms **113**A, **113**B can be manufactured such that the bulk of the kneeling force is normal to the printed layers making up the pair of arms **113**, **113**B. Further, the stabilizer **114** can be printed in a direction transverse to the printing direction of the pair of arms **113**A, **113**B such that when combined with the pair of arms **113**A, **113**B, the directionality of the printed layers adds to the mechanical strength of the apparatus instead of reducing it or increasing a likelihood of catastrophic failure due to delamination.

[0058] As shown in the rear, lower right perspective view of FIG. **3**B, the kneeling support apparatus **100** can additionally include a cushion **116** coupled to at least a portion of the arcuate interior surface defined by the first arcuate securing member **104**. Similarly, a second cushion **118** can be coupled to at least a portion of the arcuate interior surface defined by the second arcuate securing member **108**. In some embodiments, cushions and/or padding is placed on pressure points (e.g., the anterior portion of the upper and lower legs of the user—as shown and/or the posterior portion of the upper and/or lower legs of the user—not shown). In some embodiments, additional padding can be placed on at least a portion of the adjustable straps to reduce discomfort or prolonged use of the kneeling support apparatuses disclosed herein.

[0059] It should be understood and appreciated that the size of a user's leg can vary between users. More particularly, even some users with similarly sized upper leg portions can have differently sized lower leg portions, and vice versa. Accordingly, in some embodiments—noted with particularity in FIG. **3**C—the kneeling support apparatus **100** can include spacers **120**, **124** within the first and second arcuate securing members **104**, **108**, respectively. Such spacers **120**, **124** enable selective sizing of the first and second securing members **104**, **108** so that they can better conform to the particular contour/girth of a user's leg.

[0060] To enable ease of manufacturing and to increase customizability, the first arcuate securing member **104** can comprise a first assembly piece **126** and a second assembly piece **128** bridged together by the spacer **120**. Similarly, the second arcuate securing member **108** can comprise a third assembly piece **130** and a fourth assembly piece **132** bridged by spacer **124**. The spacer **120**, **124** can be made of any shape or size. For example, as shown in FIG. **3**C, the spacers **120**, **124** are shaped like a dog bone, which beneficially provides a strong mechanical interlock between the assembly pieces **126**, **128**, **130**, **132** of the first and second arcuate securing members **104**, **108**. The dog bone shape can make it easy to assemble the arcuate securing members and reduce slippage and/or separation of the assembly pieces following assembly.

[0061] In some embodiments, the spacer has additional material between—and spacing apart—the component assembly pieces, which can effectively increase the girth and/or size of the corresponding securing member. As non-limiting examples, spacers providing varying widths are shown in FIG. **3**C (i.e., spacers **122**A, **122**B, **122**C). An exemplary spacer can join the assembly pieces without any intervening material (e.g., spacer **122**A), with a small amount of intervening material (e.g., spacer **122**B), or large amount of intervening material (e.g., spacer **122**C). It should be appreciated that intervening material within a spacer can be customized based on individuals particular leg contour and/or shape. For example, intervening material can measure half a millimeter in width or any of 1 mm, 2 mm, 3 mm, 4 mm, 5 mm, 6 mm, 7 mm, 8 mm, 9 mm, 10 mm, 11 mm, 12 mm, 13 mm, 14 mm, 15 mm, 17.5 mm, 20 mm, 22.5 mm, 25 mm, 27.5 mm, 30 mm, or more in width or in any increment between any of the foregoing subject to manufacturing thresholds. The spacer can additionally include an arc or bend to increase or decrease curvature of the securing member, as desired. Embodiments having spacers as part of the kneeling support apparatus can advantageously provide customization of the apparatus for an individual user and thereby increase the comfort and utility of the apparatus. This can allow for prolonged use, increase the likelihood a user will continue to safely use the device, and/or increases user/patient compliance for using the device in a treatment regimen or daily life practice aimed at protecting the user's knee.

[0062] FIGS. **3**D-**3**F illustrate a top plan view, a right elevation view, and a bottom plan view of the kneeling support apparatus **100**, further illustrating and clarifying the components and configuration of the kneeling support apparatus **100** described above.

[0063] Alternative kneeling support apparatuses and components associated therewith are envisioned by this disclosure. For example, FIG. **4** illustrates a kneeling support apparatus **200** having substantially similar components as described above with respect to kneeling support apparatus **100**. However, kneeling support apparatus **200** includes a lateral adjustment member **234** associated with the bracing member **212** to selectively increase or decrease a length of the bracing member **212**. As shown, the lateral adjustment member **234** can include a rack **236** and pinion **238** for advancing the pinion along the rack to thereby selectively adjust the length of the bracing member **212**. In some embodiments, the pinion **238** is connected to an adjustment knob to increase the ease-of-use and fine-tune adjustment of the length. In some embodiments, the lateral adjustment member **234** can adjusts the length of the bracing member in ⅛-inch increments, up to a total of 2½ inches of adjustment length. It should be appreciated that the length of each adjustment can be smaller or larger (e.g., 1/32", 1/16", ¼", ½", 1", etc.) and may have a larger or smaller span of adjustment length (e.g., ½", 1", 1½", 2", 3", 4", 5", 6", 7", 8", 9", or more). In some embodiments, one or more of the lengths of each adjustment and/or the span of the adjustment can be dependent upon the rack and pinion that is used for making the adjustment. Such a variable adjustment can be advantageous because it allows the user to adjust the height at which the user engages surface, which may change from site to site.

[0064] In some embodiments, the lateral adjustment member includes a rod that is slidingly received into an aperture formed within the arms of the bracing member. The length can be adjusted by, for example, rotating a lever to a loosening position (e.g., loosens or expand the aperture), which allows the rod to more freely slide within aperture, and sliding the bracing member to a desired length. The lever can finally be rotated to a tightening position to maintain the desired length. The lateral adjustment member can additionally include any other mechanisms for laterally adjusting a length of components as known in the art.

[0065] The kneeling support apparatus **200** of FIG. **4** additionally includes a switch **240** for rotating the bracing member **212** into various user-defined positions. For example, the switch **240** can be depressed, allowing the bracing member **212** to be rotated away from the second arcuate securing member **208** and/or towards the first arcuate securing member **204**. In this way, the bracing member **212** can be positioned according to a user-defined angular position and may act to, for example, move the bracing member **212** into a position that does not interfere with the user walking or into a position that better accommodates the angle at which the user wishes to kneel.

[0066] Although FIG. **4** illustrates a pair of adjustment knobs (associated with pinion **238**) in a pair of switches **240**, in some embodiments, the kneeling support apparatus includes a single adjustment knob and/or switch **240** on a single exterior facing side of the apparatus. Engagement of the single adjustment knob and/or switch causes a coincident engagement of both sides of the bracing member to adjust a length of the bracing member and/or an angle of the bracing member relative to the arcuate securing members. For example, a user may depress a single switch and cause the entire bracing member to rotate. As an additional example, a user may engage a single adjustment knob to extend or retract a length of the entire bracing member (i.e., adjust a length of both arms of the bracing member at once).

[0067] As further illustrated by FIG. **4**, the kneeling support apparatus **200** can include an interchangeable stabilizer **214**A, **214**B, **214**C. As shown, the apparatus **200** includes a stabilizer in the form of a spike **214**A. Spikes can be

beneficial for anchoring a user to a defined spot, particularly when the defined spot is soft and/or earthen (e.g., gardening or aiming a firearm in the field). In some embodiments, a user can interchange the stabilizer to accommodate desired task or functionality. For example, an elongate pad **214**B can be used to stabilize a user against a rocking movement in the lateral directions and may additionally provide user with the flexibility to approach and/or rest against an edge (e.g., a wall-floor junction or similar). As an additional example, a cup-shaped pad **214**C can be used to allow the user a range of motion similar to that of an anatomic knee. It should be appreciated that although not illustrated, other stabilizers can be used with the kneeling support apparatus is disclosed herein (e.g., a rollerball for allowing a user to roll between various points).

[0068] In some embodiments, the stabilizer can include a gripping region that contacts and grips or interfaces with the kneeling surface. The stabilizer and the gripping region can be made of or include the same or different materials. For example, the gripping region and/or stabilizer can be made of or include rubber, sandpaper, an abrasive material, an elastomer, an etched thermoplastic, or silicone. The gripping region can, in some embodiments, be a removable pad that can be replaced due to wear and tear of the material or switched to accommodate different material types for better traction on different types of work surfaces and/or to protect a work surface (e.g., a gripping region made of silicone for use on hardwood surfaces and a gripping region made of an abrasive material for use on subfloors). The gripping region can form an integral part of the stabilizer or can be attached to the stabilizer via an attachment mechanism, as that term is defined herein.

[0069] Referring now to FIG. **5**, illustrated is another kneeling support apparatus **300**. The kneeling support apparatus **300** includes many of the same components as the kneeling support apparatus is **100** and **200** described above. Of note, the kneeling support apparatus **300** of FIG. **5** has a slimmer profile than the kneeling support apparatus **200** of FIG. **4** owing to the reduction of direct **236** and pinion **238**, yet similar to the apparatus **200** of FIG. **4**, the kneeling apparatus **300** can rotate (e.g., in the direction shown by arrow A) by pressing a switch **340**. Also of note, the kneeling apparatus includes an adaptor **342** into which the pair of opposing arms **313**A, **313**B of the bracing member **312** are coupled. Particularly, the pair of opposing arms **313**A, **313**B are received into a first coupling region **344** of the adapter **342**. The adapter **342** is additionally connected to the stabilizer (illustrated as the elongate stabilizer **314**B, though it can be any stabilizer disclosed herein) via a second coupling region **346**. The configuration and existence of a separate adapter **342** can allow for additional flexibility in configuring and customizing the kneeling support apparatus **300**.

[0070] The apparatus **300** of FIG. **5** additionally includes a hinge **348** having a torsional spring to assist the user in returning to a standing position. The action of the user kneeling causes the hinge to bend and consequently load the torsional spring such that when the user begins her return to the standing position, the torsional spring will unload its stored potential energy to assist the user in standing up. For example, as shown in better detail within the various views of FIGS. **6**A and **6**B, the hinge **348** can include two arms **350** that are connected to a torsional spring **352** and that are interlocking with each other via a plurality of interlocking digits **354**. As shown in FIGS. **6**A and **6**B, each arm can have plurality of apertures **356** that can be used to attach the arm to a corresponding first or second securing member. In some embodiments, the plurality of apertures **356** additionally enable the user to adjust the positioning of the securing members to be closer or further away from the user's knee.

[0071] Even though some of the disclosed components were illustrated within some—but not all—of the foregoing exemplary embodiments, it should be appreciated that any of the foregoing components can be combined with any of the other disclosed components to achieve a kneeling support apparatus having at least some of the disclosed advantages of the exemplary embodiments. Such kneeling support apparatuses are within the spirit and scope of—and therefore form part of—the present disclosure.

CONCLUSION

[0072] Various aspects of the present disclosure, including devices, systems, and methods may be illustrated with reference to one or more embodiments or implementations, which are exemplary in nature. As used herein, the term "exemplary" means "serving as an example, instance, or illustration," and should not necessarily be construed as preferred or advantageous over other embodiments disclosed herein. In addition, reference to an "implementation" of the present disclosure or invention includes a specific reference to one or more embodiments thereof, and vice versa, and is intended to provide illustrative examples without limiting the scope of the invention, which is indicated by the appended claims rather than by the following description.

[0073] As used throughout this application the words "can" and "may" are used in a permissive sense (i.e., meaning having the potential to), rather than the mandatory sense (i.e., meaning must). Additionally, the terms "including," "having," "involving," "containing," "characterized by," as well as variants thereof (e.g., "includes," "has," "involves," "contains," etc.), and similar terms as used herein, including within the claims, shall be inclusive and/or open-ended, shall have the same meaning as the word "comprising" and variants thereof (e.g., "comprise" and "comprises"), and do not exclude additional un-recited elements or method steps, illustratively.

[0074] Various alterations and/or modifications of the inventive features illustrated herein, and additional applications of the principles illustrated herein, which would occur to one skilled in the relevant art and having possession of this disclosure, can be made to the illustrated embodiments without departing from the spirit and scope of the invention as defined by the claims, and are to be considered within the scope of this disclosure. Thus, while various aspects and embodiments have been disclosed herein, other aspects and embodiments are contemplated. While a number of methods and components similar or equivalent to those described herein can be used to practice embodiments of the present disclosure, only certain components and methods are described herein.

[0075] It will also be appreciated that systems, devices, products, kits, methods, and/or processes, according to certain embodiments of the present disclosure may include, incorporate, or otherwise comprise properties, features (e.g., components, members, elements, parts, and/or portions) described in other embodiments disclosed and/or described herein. Accordingly, the various features of certain embodi-

ments can be compatible with, combined with, included in, and/or incorporated into other embodiments of the present disclosure. Thus, disclosure of certain features relative to a specific embodiment of the present disclosure should not be construed as limiting application or inclusion of said features to the specific embodiment. Rather, it will be appreciated that other embodiments can also include said features, members, elements, parts, and/or portions without necessarily departing from the scope of the present disclosure.

[0076] Moreover, unless a feature is described as requiring another feature in combination therewith, any feature herein may be combined with any other feature of a same or different embodiment disclosed herein. Furthermore, various well-known aspects of illustrative systems, methods, apparatus, and the like are not described herein in particular detail in order to avoid obscuring aspects of the example embodiments. Such aspects are, however, also contemplated herein.

[0077] The present disclosure may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. While certain embodiments and details have been included herein and in the attached disclosure for purposes of illustrating embodiments of the present disclosure, it will be apparent to those skilled in the art that various changes in the methods, products, devices, and apparatus disclosed herein may be made without departing from the scope of the disclosure or of the invention, which is defined in the appended claims. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed is:

1. A kneeling support apparatus, comprising:

a first arcuate securing member configured in size and shape to conform to a contour defined by an anterior portion of an upper leg of a user, the first arcuate securing member comprising an adjustable strap for selectively connecting opposing sides of the first arcuate securing member;

a second arcuate securing member pivotally connected to the first arcuate securing member, the second arcuate securing member configured in size and shape to conform to a contour defined by an anterior portion of a lower leg of a user and comprising a second adjustable strap for selectively connecting opposing sides of the second arcuate securing member; and

a bracing member coupled to at least one of the first arcuate securing member and the second arcuate securing member, the bracing member comprising:

a pair of arms, each first end of the pair of arms being disposed on and coupled to one of the opposing sides of the first arcuate securing member; and

a stabilizer connected to the pair of arms and configured to contact a kneeling surface when the kneeling support apparatus is configured in a kneeling position.

2. The kneeling support apparatus of claim **1**, wherein the first arcuate securing member further comprises a first assembly piece and a second assembly piece joined by a spacer.

3. The kneeling support apparatus of claim **2**, wherein the spacer comprises any of a plurality of sizes such that each size of the plurality of sizes results in a different distance between the first and second assembly pieces and a different arc length formed between the first and second assembly pieces when coupled thereto.

4. The kneeling support apparatus of claim **1**, wherein at least one of the first arcuate securing member and the second arcuate securing member comprise a padded interior.

5. The kneeling support apparatus of claim **1**, wherein the stabilizer is additionally operable to transfer a force applied to the stabilizer by the kneeling surface to the one or both of the first arcuate securing member and the second arcuate securing member.

6. The kneeling support apparatus of claim **5**, wherein the stabilizer comprises one or more of: a roller ball, an elongate pad, a cup-shaped pad, or a spike.

7. The kneeling support apparatus of claim **5**, wherein the stabilizer includes a gripping surface that comprises one more of a rubber pad, sandpaper, an abrasive material, an elastomer, an etched thermoplastic, or a silicone pad.

8. The kneeling support apparatus of claim **1**, wherein the kneeling position comprises a configuration of the second arcuate securing member relative to the first arcuate securing member such that an angle formed therebetween is less than 135°.

9. The kneeling support apparatus of claim **8**, wherein when the kneeling support apparatus is configured in a standing position, the pair of arms contact the second arcuate securing member, preventing a 180° extension between the first arcuate securing member and the second arcuate securing member.

10. A kneeling support apparatus, comprising:

a first arcuate securing member, comprising:

a first assembly piece;

a second assembly piece;

a spacer disposed between and joining the first and second assembly pieces; and

an adjustable strap for selectively connecting the first assembly piece to the second assembly piece;

a second arcuate securing member pivotally connected to the first arcuate securing member, the second arcuate securing member comprising:

a third assembly piece;

a fourth assembly piece; and

a second adjustable strap for selectively connecting the third assembly piece to the fourth assembly piece; and

a bracing member coupled to at least one of the first arcuate securing member and the second arcuate securing member, the bracing member comprising:

a pair of arms, each first end of the pair of arms being disposed on and coupled to an opposing side of the first arcuate securing member;

an adaptor coupled to the pair of arms; and

a stabilizer coupled to the adaptor.

11. The kneeling support apparatus of claim **10**, wherein the spacer is sized such that the joined first and second assembly pieces form an arcuate surface configured in size and shape to conform to a contour defined by an anterior portion of an upper leg of a user.

12. The kneeling support apparatus of claim **10**, further comprising a second spacer disposed between and joining the third and fourth assembly pieces, the joined third and

fourth assembly pieces forming an arcuate surface configured in size and shape to conform to a contour defined by an anterior portion of a lower leg of a user.

13. The kneeling support apparatus of claim **10**, wherein the stabilizer further comprises a selectively detachable gripping surface selected from the group consisting of: a rubber pad, sandpaper, an abrasive material, an elastomer, an etched thermoplastic, or a silicone pad.

14. The kneeling support apparatus of claim **10**, wherein the bracing member further comprises a lateral adjustment member connected to the pair of arms, the lateral adjustment member operable to selectively increase or decrease a length of the pair of arms.

15. The kneeling support apparatus of claim **14**, wherein the lateral adjustment member comprises a rack and pinion, the pinion connected to an arm of the pair of arms and to an adjustment knob for advancing the pinion along the rack to selectively increase or decrease the length of the pair of arms.

16. A kneeling support apparatus, comprising:

a first arcuate securing member, comprising:

a first assembly piece;

a second assembly piece;

a spacer disposed between and joining the first and second assembly pieces, the joined first and second assembly pieces forming an arcuate surface configured in size and shape to conform to a contour defined by an anterior portion of an upper leg of a user;

a cushion coupled at least partially to the arcuate surface defined by the first and second assembly pieces; and

an adjustable strap for selectively connecting the first assembly piece to the second assembly piece;

a second arcuate securing member pivotally connected to the first arcuate securing member, the second arcuate securing member comprising:

a third assembly piece;

a fourth assembly piece;

a second spacer disposed between and joining the third and fourth assembly pieces, the joined third and fourth assembly pieces forming a second arcuate surface configured in size and shape to conform to a contour defined by an anterior portion of a lower leg of a user;

a second cushion coupled at least partially to the second arcuate surface defined by the third and fourth assembly pieces; and

a second adjustable strap for selectively connecting the third assembly piece to the fourth assembly piece; and

a bracing member coupled to at least one of the first arcuate securing member and the second arcuate securing member, the bracing member comprising:

a pair of arms, each first end of the pair of arms being disposed on and coupled to an opposing side of the first arcuate securing member;

an adaptor comprising a first coupling region and a second coupling region, the first coupling region having one or more receptacles for receiving and coupling second ends of the pair of arms; and

a stabilizer connected to the second coupling region of the adaptor.

17. The kneeling support apparatus of claim **16**, wherein the bracing member further comprises an adjustable gear operable to pivot the pair of arms from a first position to a second position relative to the first arcuate securing member.

18. The kneeling support apparatus of claim **17**, wherein the bracing member further comprises a switch for engaging the adjustable gear.

19. The kneeling support apparatus of claim **17**, wherein the bracing member further comprises a lateral adjustment member associated with the pair of arms, the lateral adjustment member operable to selectively increase or decrease a length of the pair of arms.

20. The kneeling support apparatus of claim **19**, wherein the lateral adjustment member comprises a rack and pinion, the pinion connected to an arm of the pair of arms and to an adjustment knob for advancing the pinion along the rack.

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