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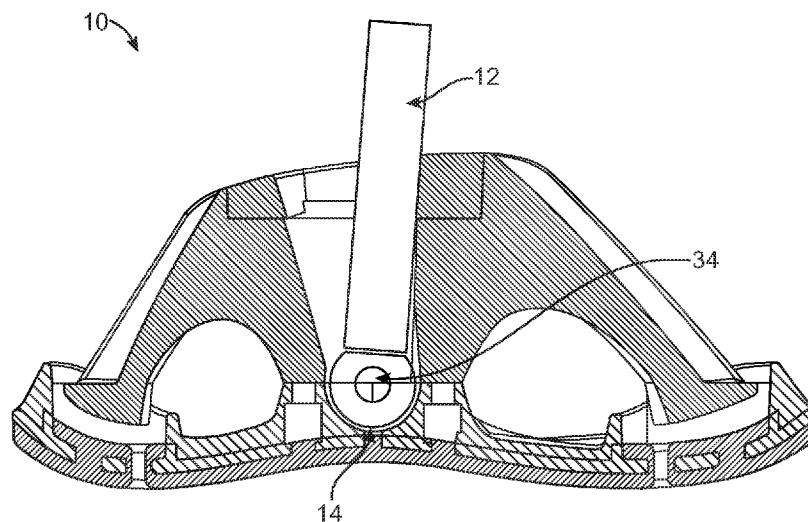


FIG. 4

(57) Abstract: Mobility aid devices, such as crutches, provide improved ergonomics, comfort and support for the user. The crutches can include a foot having a joint that allows the mobility aid device frame to rotate forward and backward in the direction of walking gait, providing a range of motion where the foot base is horizontal and stationary on the ground. The foot can include spring and damping mechanisms in the front and rear of the foot, wherein the rear spring and damping mechanisms are configured to engage and dampen impact upon initial ground contact, both front and rear mechanisms are engaged when the foot base is horizontal on the ground, and the front mechanism assists in release and propulsion from the ground. The foot further can include a mechanism that holds the position of the foot rotation while the foot is not in contact with the ground.



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DYNAMIC FOOT SUPPORT FOR WALKING AID DEVICES

BACKGROUND OF THE INVENTION

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1. Field of the Invention

One or more embodiments of the invention relates generally to mobility aid devices. More particularly, the invention relates to improvements to crutches and canes, walking sticks, substitute crutches, walkers and leg/foot prosthesis regarding the foot or base component that
10 contacts the ground.

2. Description of Prior Art and Related Information

The following background information may present examples of specific aspects of the prior art (e.g., without limitation, approaches, facts, or common wisdom) that, while expected to
15 be helpful to further educate the reader as to additional aspects of the prior art, is not to be construed as limiting the present invention, or any embodiments thereof, to anything stated or implied therein or inferred thereupon.

For all the extraordinary technological advances made in medical devices over the past half century, crutches (including axilla and forearm styles), and canes walking sticks, substitute
20 crutches and leg/foot prosthesis, walkers have fallen dangerously behind. The basic design of standard crutches, canes and walkers hasn't changed for decades, going back to when the first medical advice given to new patients was "take it easy and go slow." Unstable, uncomfortable, inflexible and unattractive at best, their design actually impedes a user's return to max-mobility potential. It also contributes to something most mobility device designers don't think about: the
25 loss of dignity the user feels at having to rely on these archaic devices in the first place.

First, they're uncomfortable and fatiguing. This not only limits the time a patient is able to use them but also puts stress on the hands, wrists, forearms, neck and back, which can lead to upper back ailments and other physical disorders, such as rotator cuff tears.

Second, because they so poorly conform to the body's natural physiology, they're
30 awkward to maneuver and thus inherently unstable. This especially applies to children where the majority of hospitals prescribe walkers instead of crutches to kids under age eleven because of

this instability. Adolescents, the elderly, the overweight, the out-of-shape and/or those who have been prescribed painkillers or other medications are also affected—which covers just about all of us. The result is often a loss of balance and an awkward, nasty fall that can reinjure the patient or cause new trauma to the head, wrists, ankles and other areas of the body.

5 These devices have for years been associated with discomfort and instability. What hasn't been addressed up to now is their basic inflexible, "static" nature. That is, they've been designed to accommodate a patient at his/her initial (and therefore worst) point of pain and discomfort; they aren't designed to "adjust" as the user heals and desires greater mobility. This disadvantage actually retards the recovery of the user who's capable of moving more freely than
10 the device will accommodate.

 A user walking with crutches will take a minimum of 2,400 steps, with children taking closer to 3,000. The jarring staccato of each of these steps reverberating wave after wave of pain through though the crutches, further causes discomfort to the entire body however specifically irritates the hands, wrists, elbows, shoulder joints and upper back. These inadequacies no nothing
15 to enhance healing and lead to accelerated fatigue.

 Not to be overlooked, these stark, Spartan-like devices, which put users in slumped over, clumsy-looking positions, almost seem purposely designed to make the user feel self-conscious and even stigmatized. Nothing about how they look—nor how they make the tottering user look when trying to stay upright—lends dignity to the patient.

20 Over recent years, however, medical professionals have learned that the key to rapid recovery from surgery, injury or any incident impacting mobility is to get patients up and walking as naturally as their pain will allow, as quickly as possible. Put it all together and medical professionals who must prescribe the use of these particular mobility aids actually find themselves unintentionally violating their sacred oath "to do no harm."

25 In view of the foregoing, there is a need for an improved mobility aid device that addresses various design flaws found in conventional mobility aids.

SUMMARY OF THE INVENTION

Embodiments of the present invention provide a foot support for a mobility aid device comprising a rotation joint that allows a frame of the mobility aid device to rotate forward and rearward in the direction of a walking gait of a user, providing a range of motion including a position where a foot base is nominally horizontal and stationary on the ground; and a front spring mechanism and a rear spring mechanism in the front and rear of the foot, wherein the rear spring mechanism is configured to engage upon the initial contact with the surface – partially and progressively absorbing the impact and front spring mechanism is configured to engage progressively and then release propelling the user forward. The spring mechanism is effective in mitigating the jarring caused by the typical staccato crutch movement, however it may be insufficient to dampen the energy wave caused by impact upon initial ground contact, so both front and rear spring mechanisms may be augmented by a dampening system that mutes the wave energy when the spring mechanisms are engaged. This produces a smother experience for the user.

During the walking gait when using a crutch, cane or walking stick there is a transition phase of moving from the device(s) to the good foot. This device allows the device fulcrum to articulate to keep the foot base horizontal on the ground, and the front spring mechanism assists in release and propulsion form the ground.

In some embodiments, the foot support further includes a mechanism holding a position of rotation of the foot about the rotation joint while the foot is not in contact with the ground.

In some embodiments, the foot support further includes a damping mechanism for each of the front spring mechanism and the rear spring mechanism.

In some embodiments, the rotation joint is offset from a center position along the front to rear of the foot base. The rotation joint may be offset from center, or located anywhere along the foot base. In some embodiments, the rotation joint may be at a position from about 35% to about 45% of a length of the foot base from the rear thereof.

Embodiments of the present invention further provide a foot support for a mobility aid device comprising a rotation joint that allows a frame of the mobility aid device to rotate forward and rearward, as well as, optionally, laterally, in the direction of a walking gait of a user, providing a range of motion including a position where a foot base is horizontal and stationary on the ground; a front spring mechanism and a rear spring mechanism along with the dampening

system in the front and rear of the foot, wherein the rear spring mechanism is configured to engage and dampen impact upon initial ground contact, both front and rear spring mechanisms are engaged when the foot base is horizontal on the ground, and the front spring mechanism assists in release and propulsion from the ground; and a mechanism holding a position of rotation
5 of the foot about the rotation joint while the foot is not in contact with the ground, wherein the rotation of the mobility device frame is within about 20 degrees of vertical.

These and other features, aspects and advantages of the present invention will become better understood with reference to the following drawings, description and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Some embodiments of the present invention are illustrated as an example and are not limited by the figures of the accompanying drawings, in which like references may indicate similar elements.

5 FIG. 1 is a top view of a mobility aid foot according to an exemplary embodiment of the present invention;

 FIG. 2 is a side view of the mobility aid foot of FIG. 1;

 FIG. 3 is a cross-sectional side view of the mobility aid foot of FIG. 1, illustrating rearward rotation of the mobility aid frame pole;

10 FIG. 4 is a cross-sectional side view of the mobility aid foot of FIG. 1, illustrating forward rotation of the mobility aid frame pole;

 FIG. 5 is a cross-sectional side view of the mobility aid foot of FIG. 1, illustrating a heel strike position;

15 FIG. 6 is a cross-sectional side view of the mobility aid foot of FIG. 1, illustrating a flat foot position;

 FIG. 7 is a cross-sectional side view of the mobility aid foot of FIG. 1, illustrating a toe-off position;

 FIG. 8 is a cross-sectional side view of a mobility aid foot using springs according to an exemplary embodiment of the present invention; and

20 FIGS. 9A through 9C illustrate the use of a mobility aid device having the foot of FIG. 1 for use in assisting a user to move between seated and standing positions, according to an exemplary embodiment of the present invention.

 Unless otherwise indicated illustrations in the figures are not necessarily drawn to scale.

25 The invention and its various embodiments can now be better understood by turning to the following detailed description wherein illustrated embodiments are described. It is to be expressly understood that the illustrated embodiments are set forth as examples and not by way of limitations on the invention as ultimately defined in the claims.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS AND BEST MODE OF INVENTION

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items. As used herein, the singular forms "a," "an," and "the" are intended to include the plural forms as well as the singular forms, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, steps, operations, elements, components, and/or groups thereof.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one having ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and the present disclosure and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be evident, however, to one skilled in the art that the present invention may be practiced without these specific details.

The present disclosure is to be considered as an exemplification of the invention, and is not intended to limit the invention to the specific embodiments illustrated by the figures or description below.

As is well known to those skilled in the art, many careful considerations and compromises typically must be made when designing for the optimal configuration of a commercial implementation of any system, and in particular, the embodiments of the present invention. A commercial implementation in accordance with the spirit and teachings of the present invention may be configured according to the needs of the particular application, whereby any aspect(s), feature(s), function(s), result(s), component(s), approach(es), or step(s) of

the teachings related to any described embodiment of the present invention may be suitably omitted, included, adapted, mixed and matched, or improved and/or optimized by those skilled in the art, using their average skills and known techniques, to achieve the desired implementation that addresses the needs of the particular application.

5 Broadly, embodiments of the present invention provide mobility aid devices, such as crutches, improved ergonomics, comfort and support for the user. The crutches can include a foot having a joint that allows the mobility aid device frame to rotate forward and backward in the direction of walking gait, providing a range of motion where the foot base is horizontal and stationary on the ground. The foot can include spring and damping mechanisms in the front and
10 rear of the foot, wherein the rear spring and damping mechanisms are configured to engage and dampen impact upon initial ground contact, both front and rear mechanisms are engaged when the foot base is horizontal on the ground, and the front mechanism assists in release and propulsion from the ground. The foot further can include a mechanism that holds the position of the foot rotation while the foot is not in contact with the ground.

15 As described above, current basic crutches and canes suffer from static and uncomfortable designs that do not accommodate typical walking gate motion. The foot device of the present invention provides a dynamic motion during the walking gate, while improving stability and providing comfort from ground contact impact. The foot device can be used for various mobility aid devices, such as canes, axilla crutches, cuff crutches, and hybrid
20 combinations thereof.

An example embodiment of a foot device 10 of the present invention is shown in FIGS. 1 and 2. The foot device 10 can attach to the base pole 12 (also referred to as frame 12, see FIG 3) of a crutch or cane mobility device aid, replacing the standard rubber end-cap found on the majority of crutches and canes.

25 The foot device 10 can include a rotation joint 14 on an inside of a base pole receptacle 16 for rotatably retaining the base pole. Friction areas 18 may be formed on either side of the base pole receptacle 16 for increasing friction between the base pole and the foot 10.

A front end 20 of the foot 10 can include a front suspension area 22 and a front support 24 extending upwardly from the front suspension area 22. A foot upper 26 can be disposed on
30 either side of the base pole receptacle 16 and the foot upper 26 may connect the front support 24

with a rear support 28. A rear suspension area 30 may be disposed between the rear support 28 and a foot base 32.

A first feature of the foot according to embodiments of the present invention, the foot rotation, is further detailed in the exemplary embodiment shown in FIGS. 3 and 4. The base pole 12 of the mobility aid is connected to a bushing 34 of the rotation joint 14 that rotates in a direction generally parallel to the walking gate of a user. This rotation may be up to about 20 degrees from vertical in the rear and forward directions, thus allowing for the foot base to lie horizontal, contacting the ground, during the movement of this rotation. This rotation greatly adds to the stability of the mobility aid, firmly planting the foot base 32 on the ground during movement, instead of having the standard or other static tips roll forward, changing their grip during movement. The increased area of the foot 10, according to embodiments of the present invention, further improves ground grip by providing a large contact patch area.

The rotation joint 14 can be offset from the center of the foot up to 35% in either direction from center. FIG. 3 shows an example rotation joint 14 positioned a distance D roughly 40% of the total length of the foot 10, from the rear of the foot 10. This feature of the invention allows for propulsion or stability (retarding forward motion early in the gate) depending on the location. The configuration shown in FIG. 3 tends to help user stability when stepping forward, adding to user confidence and safety.

The limits to the rotational motion provided by the foot upper 26 provide stability at the forward (FIG. 4) and rear (FIG. 3) positions of the mobility aid. Upon toe-off for example, as shown in FIG. 4, the forward rotation limit is engaged, forcing the entire foot to roll forward, and creating a strong push-off. If the rotation could still go forward, the push off would be unstable. This also works the in the opposite manner during heel strike, providing a firm plant upon the foot contacting the ground. The limits shown for the exemplary configuration shown in FIGS. 3 and 4 are optimized to 17 degrees rearward and 2 degrees forward. In some embodiments, the rearward angle maximum is greater than the forward angle maximum. In some embodiments, the rearward angle maximum is at least two or more times greater than the forward angle maximum.

It should be noted that the exemplary embodiment shown in FIGS. 1 and 2 is symmetric, and can be used for right and left configurations. In some embodiments, the rotational axis can also be tilted inward toward the user, requiring separate right and left feet. This could be used to

provide a more flat contact with the ground, because walking aids are rarely vertical with respect to the body and are splayed outward roughly 10-15 degrees. In some embodiments, the foot may be designed to allow the base pole 12 to articulate not only in the direction of walking, but also side-to-side so that the foot 10 can rest flat on the ground during use, even with the base pole 12 angled inward.

The foot 10 of the present invention may also include a mechanism to hold the rotation of the base pole 12 at the forward or rear limits when not in contact with the ground. For example, when toe-off occurs, the base pole 12 is in the forward position. To avoid the foot 10 “flopping” around and potentially catching on the floor, the foot 10 may be held in the forward position.

Upon heel strike, the foot 10 can rotate quickly to the rear limit. FIG. 1 shows an exemplary embodiment of this aspect, illustrating the friction areas 18 that may be present in the foot upper 26 that rub against the base pole 12. In some embodiments, the friction areas 18 can include a curvature that holds the base pole 12 at the rotation limits.

It should be noted that the motion of the rotation of the foot 10 of the present invention mimics the rotational action of a human foot, further providing the user with confidence due to the familiarity of the movement.

Referring now to FIGS. 5 through 7, another feature of the foot 10 of the present invention is a suspension system. The pounding of crutches, especially during heel strike (initial ground contact) is jarring and causes discomfort and bruising for the user. The suspension system of the foot 10 of the present invention can reduce impact not only during heel strike but during all phases of motion, while storing energy to be released during toe-off, helping to propel the user forward. The suspension system includes rear spring areas 50 and front spring areas 70 in the front and rear of the foot 10 as shown in FIGS. 5 and 7, respectively. The rear and front spring areas 50, 70 can be created using any spring mechanism. In some embodiments, as shown in FIG. 6, spring mechanism may be basically a flexible base 62 that is connected in the center of the foot 10. This acts like an open leaf spring or beam spring, with flex limits dictated by the rear and front supports 60, 64. One or more coil springs 80, 82 (see FIG. 8) in these areas can provide a similar spring motion. The motion may be limited for safety and to provide a hard stop stability at the impact extremes. The resiliency of the spring areas 50, 70 may be tunable based on the user preferences, weight, or the like. The tuning may be performed by various methods, such as choice of material, thickness of material or the like.

Upon heel strike, as shown in FIG. 5, the rear spring area 60 compresses, reducing the impulse of impact. The rear spring area 50 remain compressed, storing energy as the foot roll forward to flat (horizontal with the ground), as shown in FIG. 6. During rotation, while the foot 10 is flat, both the front spring area 70 and the rear spring area 50 are compressed by the weight of the user, providing an overall softer feel through the mobility aid frame. As the foot 10 rolls forward towards toe-off, the stored energy in the rear spring area 50 helps to propel the user forward. Then, during toe-off, the front spring area 70 unloads, providing a final push forward.

The rear spring area 50 and the front spring area 70 may be customized in their resiliency based upon various factors, including, for example, the user's weight or preference. For example, a heavier user may desire a spring area that provides increased resistance and resiliency. The spring action with the mobility aid devices of the present invention may be further altered through the use of a spring action on the base pole 12 itself. For example, a coil spring or hydraulic shock absorber type design may be used on the base pole 12 to provide additional absorption of energy as the mobility aid device is used. Typically, such base pole resiliency is provided between the grip of the mobility aid device and the foot.

Suspension damping can also be used in combination with the spring areas 50, 70 to provide a more stable action. This is provided (but not shown) by including elastomer and or foam inserts in a region 60 between the foot base pockets and the upper supports as shown in FIG. 6.

In some embodiments, the articulation of the base pole 12 in the foot 10 may be limited, or locked in a fixed position. In other embodiments, one or both of the spring areas 50, 70 may be fixed to limit or remove the resiliency thereof.

As shown in FIGS. 9A through 9C, a user 90 can use a crutch 92 having the foot 10, as described above to help them move between seated and standing positions. While a crutch 92 is shown, the embodiments of FIGS. 9A through 9C may be used with a variety of mobility aid devices incorporating the foot 10, such as a cane, walking stick, or the like. A handle region 94 of the crutch 92 may be positioned below the grip. The handle region 94 may include a padding wrapped around the frame, as shown, may include a textured region, or may simply be formed from the same material and design of the crutch. Regardless, the user may use the articulation feature of base pole 12 in the foot 10 to help them move between seated and standing positions. As the crutch becomes angled during seating, as shown in FIG. 9B, the foot still rests flatly on

the ground to prevent slipping. With a conventional crutch, as the crutch becomes angled, the surface area contacting the ground decreases, increasing the likelihood of slippage.

As described above, the foot 10 may be used not only with crutches, but with any variety of mobility aid devices, prosthetics, or the like. For example, the foot 10 may be used with a cane or arm crutch as described in U.S. Patent Application Number _____, entitled “Frame Configurations for Mobility Aid Devices”, the contents of which are herein incorporated by reference. Moreover, the foot 10 may be used with various types of mobility aid devices, including those described in commonly-owned, concurrently filed U.S. Patent Application No. _____, entitled “Ergonomic Grip and Axilla for Walking Aid Devices”, and Number _____, entitled “Link Support for Walking Aid Devices”, the contents of which are herein incorporated by reference.

While the Figures show a single frame member articulatably attached to the foot, in some embodiments, more than one frame member may attach to the foot. In other embodiments, multiple frame members may connect to multiple feet, where each may articulate as described above.

While the Figures show an elongated foot shape, this shape may vary according to embodiments of the present invention. A triangular base may be used where each corner of the triangle may include a spring area similar to the spring areas 50, 70 described above.

While the Figures show front and rear supports 24, 28, these features may not be required in various aspects of the present invention. In some embodiments, the front and rear supports 24, 28 may be replaced by springs or other such materials so that once maximum deflection of the spring areas 50, 70 is reached, the motion is not simply stopped, but, instead, may be further allowed through resistance of the front and rear supports 24, 28.

While the above description focuses on the use of the feet on mobility aid devices, the feet may be useful on various other products. For example, the foot as described above may prove especially useful as a foot on a prosthetic leg, where the movements of the foot of the present invention can mimic a person’s ankle movements.

The foot, according to aspects of the present invention, can be made from a variety of materials as may be understood by one skilled in the art. Components of the foot may be made of metal, plastic, composites, or the like, and combinations thereof.

In summary, the rotational motion and the integrated suspension of the foot of the present invention may provide the following features and benefits: 1) More natural motion, mimicking the action of a human foot, 2) maximal contact area during loading, with a firm and stationary grip to the floor during central gate movement, 3) and a rotational offset providing confidence and propulsion at different positions in the walking gate.

All the features disclosed in this specification, including any accompanying abstract and drawings, may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

Claim elements and steps herein may have been numbered and/or lettered solely as an aid in readability and understanding. Any such numbering and lettering in itself is not intended to and should not be taken to indicate the ordering of elements and/or steps in the claims.

Many alterations and modifications may be made by those having ordinary skill in the art without departing from the spirit and scope of the invention. Therefore, it must be understood that the illustrated embodiments have been set forth only for the purposes of examples and that they should not be taken as limiting the invention as defined by the following claims. For example, notwithstanding the fact that the elements of a claim are set forth below in a certain combination, it must be expressly understood that the invention includes other combinations of fewer, more or different ones of the disclosed elements.

The words used in this specification to describe the invention and its various embodiments are to be understood not only in the sense of their commonly defined meanings, but to include by special definition in this specification the generic structure, material or acts of which they represent a single species.

The definitions of the words or elements of the following claims are, therefore, defined in this specification to not only include the combination of elements which are literally set forth. In this sense it is therefore contemplated that an equivalent substitution of two or more elements may be made for any one of the elements in the claims below or that a single element may be substituted for two or more elements in a claim. Although elements may be described above as acting in certain combinations and even initially claimed as such, it is to be expressly understood that one or more elements from a claimed combination can in some cases be excised from the

combination and that the claimed combination may be directed to a subcombination or variation of a subcombination.

Insubstantial changes from the claimed subject matter as viewed by a person with ordinary skill in the art, now known or later devised, are expressly contemplated as being
5 equivalently within the scope of the claims. Therefore, obvious substitutions now or later known to one with ordinary skill in the art are defined to be within the scope of the defined elements.

The claims are thus to be understood to include what is specifically illustrated and described above, what is conceptually equivalent, what can be obviously substituted and also what incorporates the essential idea of the invention.

What is claimed is:

1. A foot support for a mobility aid device comprising:
a rotation joint that allows a frame of the mobility aid device to rotate forward and
5 rearward in the direction of a walking gait of a user, providing a range of motion
including a position where a foot base is substantially horizontal and stationary on the
ground; and
at least one of a front spring mechanism and a rear spring mechanism in the front
and rear of the foot, wherein the rear spring mechanism is configured to engage and
10 absorb impact upon initial ground contact, both front and rear spring mechanisms are
engaged when the foot base is horizontal on the ground, and the front spring mechanism
assists in release and propulsion from the ground.
2. The foot support of claim 1, further comprising a mechanism holding a
15 position of rotation of the foot about the rotation joint while the foot is not in contact with
the ground.
3. The foot support of claim 1, further comprising a mechanism holding a
position of rotation of the foot about the rotation joint.
20
4. The foot support of claim 1, further comprising a damping mechanism for
at least one of the front spring mechanism and the rear spring mechanism.
5. The foot support of claim 1, wherein the rotation joint is offset from a
25 center position along the front to rear of the foot base.
6. The foot support of claim 5, wherein the rotation joint is offset, from the
rear of the foot base, at a position from about 35% to about 45% of a length of the foot
base.

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7. The foot support of claim 5, wherein the rotation joint is offset, from the front of the foot base, is a position from about 35% to about 45% of the length of the foot base.

5 8. The foot support of claim 1, wherein the rotation of the mobility device frame is within 20 degrees of vertical.

9. The foot support of claim 1, wherein a forward rotation of the frame is restricted in the range between vertical and about 5 degrees from vertical.

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10. The foot support of claim 1, wherein a rear rotation of the frame is restricted in the range between 15 and 25 degrees from vertical.

11. The foot support of claim 1, wherein a rear rotation of the frame is greater
15 than a forward rotation of the frame.

12. The foot support of claim 1, wherein the rear spring mechanism is created using a flexing beam attached towards a center of the foot base.

20 13. The foot support of claim 12, wherein the flexing beam is constrained when fully compressed by a support beam which originates from a top of the foot base.

14. The foot support of claim 1, wherein the front spring mechanism is created using a flexing beam attached towards a center of the foot base.

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15. The foot support of claim 14, wherein the flexing beam is constrained when fully compressed by a support beam which originates from a top of the foot base.

16. The foot support of claim 1, wherein the rear spring mechanism is created
30 using a coil spring.

17. The foot support of claim 1, wherein the front spring mechanism is created using a coil spring.

18. The foot support of claim 4, wherein the damping mechanism towards the rear of the device is created using compression of an elastic material.

19. The foot support of claim 4, wherein the damping mechanism towards the front of the device is created using compression of an elastic material.

20. The foot support of claim 2, wherein the mechanism that hold the position of the frame relative to the foot support is a friction based mechanism that holds the position of the frame at either end of its range of motion.

21. The foot support of claim 1, wherein the frame extends from the foot support at an angle directed toward the user.

22. A foot support for a mobility aid device comprising:
a rotation joint that allows a frame of the mobility aid device to rotate forward and rearward in the direction of a walking gait of a user, providing a range of motion including a position where a foot base is horizontal and stationary on the ground;
a front spring mechanism and a rear spring mechanism in the front and rear of the foot, wherein the rear spring mechanism is configured to engage and dampen impact upon initial ground contact, both front and rear spring mechanisms are engaged when the foot base is horizontal on the ground, and the front spring mechanism assists in release and propulsion from the ground; and
a mechanism holding a position of rotation of the foot about the rotation joint while the foot is not in contact with the ground

23. The foot support of claim 22, wherein the rotation of the mobility device frame is within 20 degrees of vertical.

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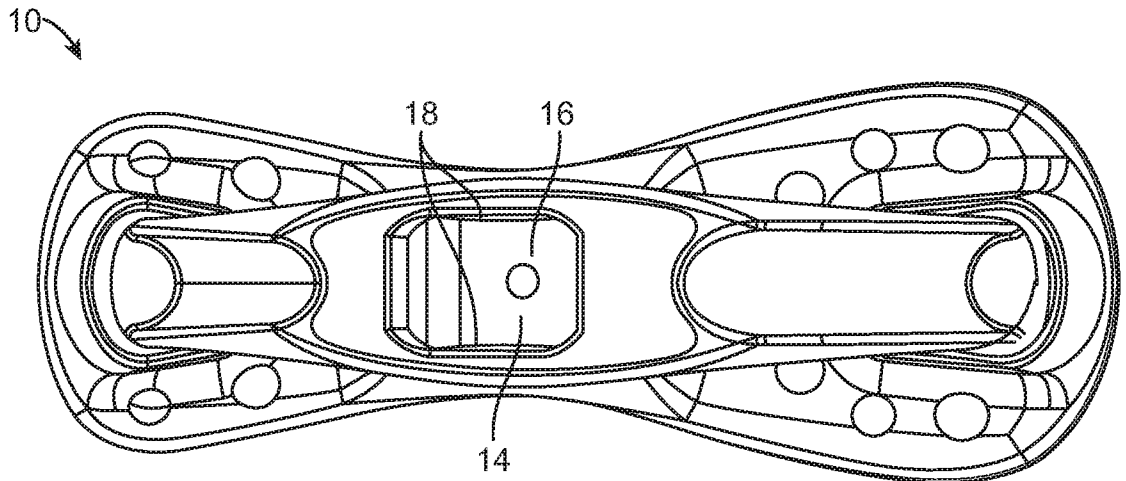


FIG. 1

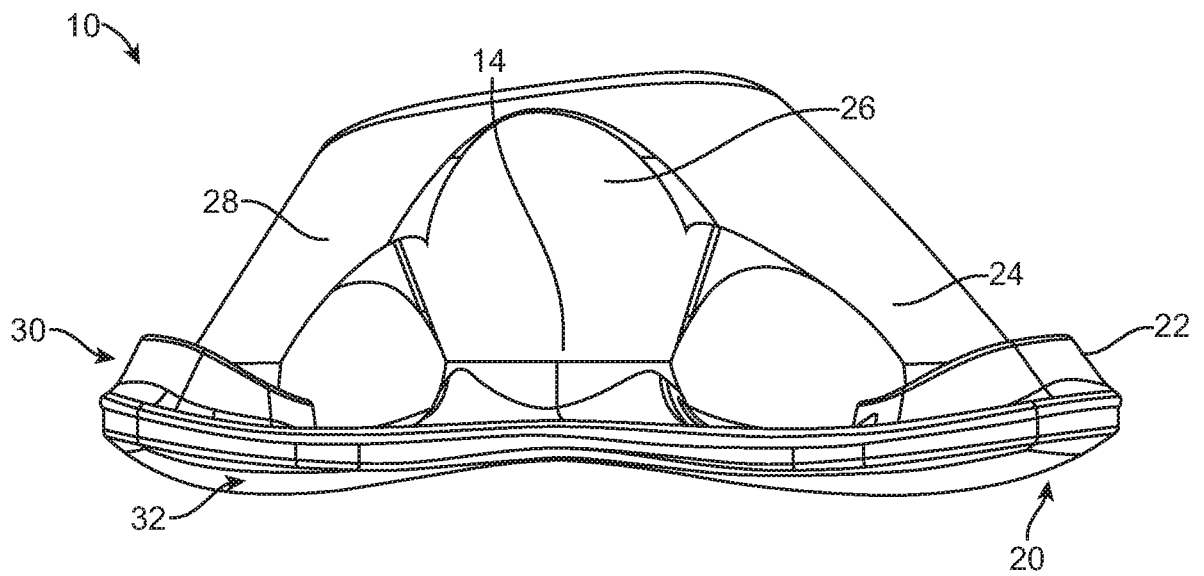


FIG. 2

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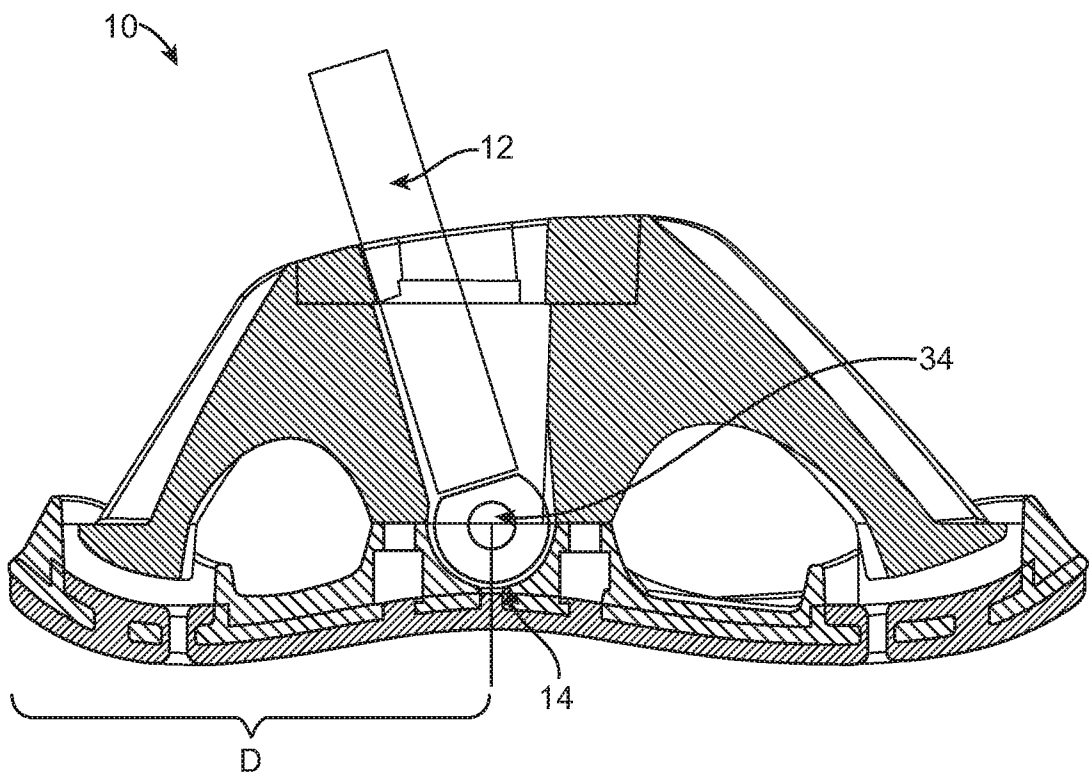


FIG. 3

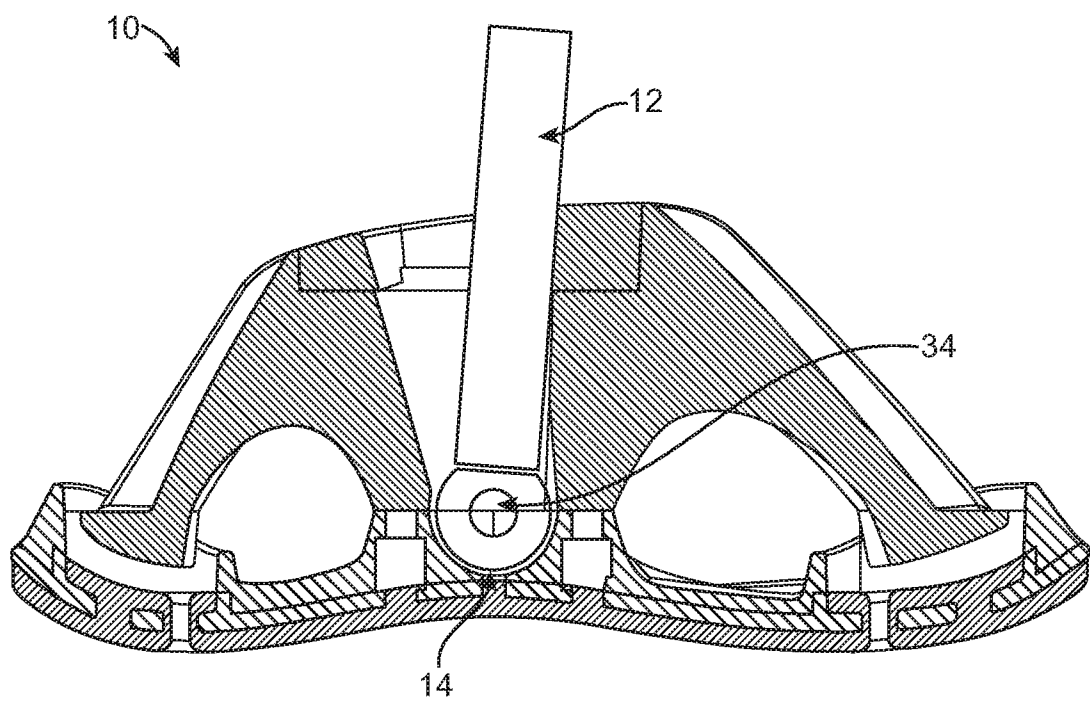


FIG. 4

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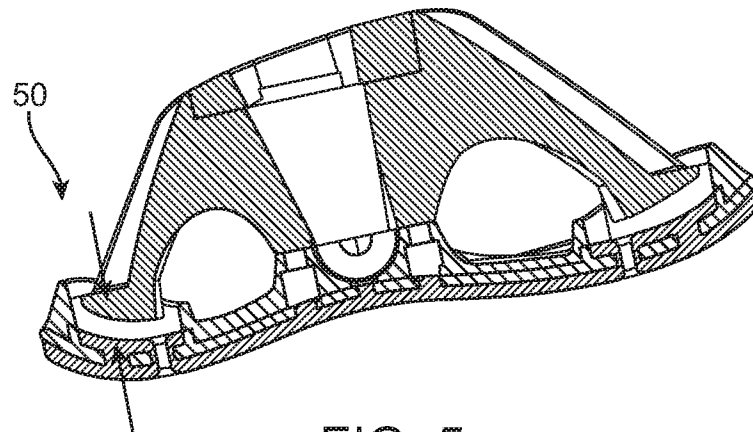


FIG. 5

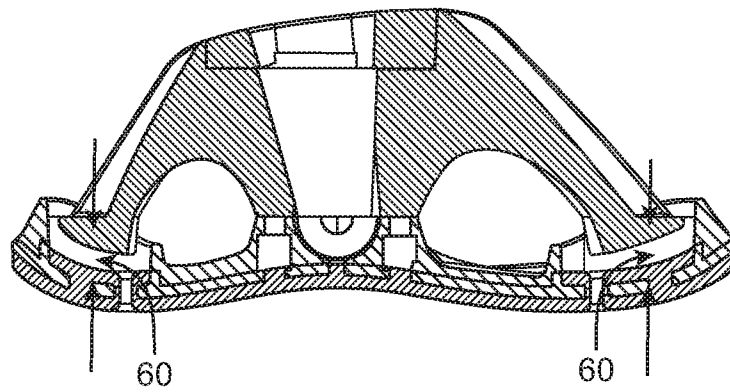


FIG. 6

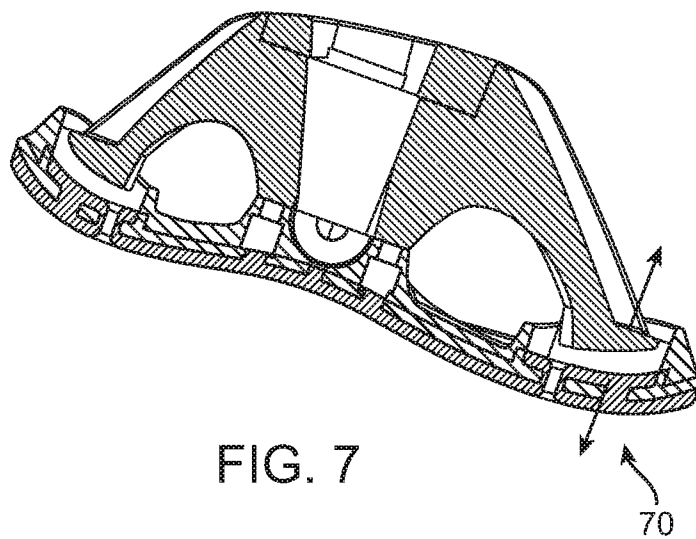


FIG. 7

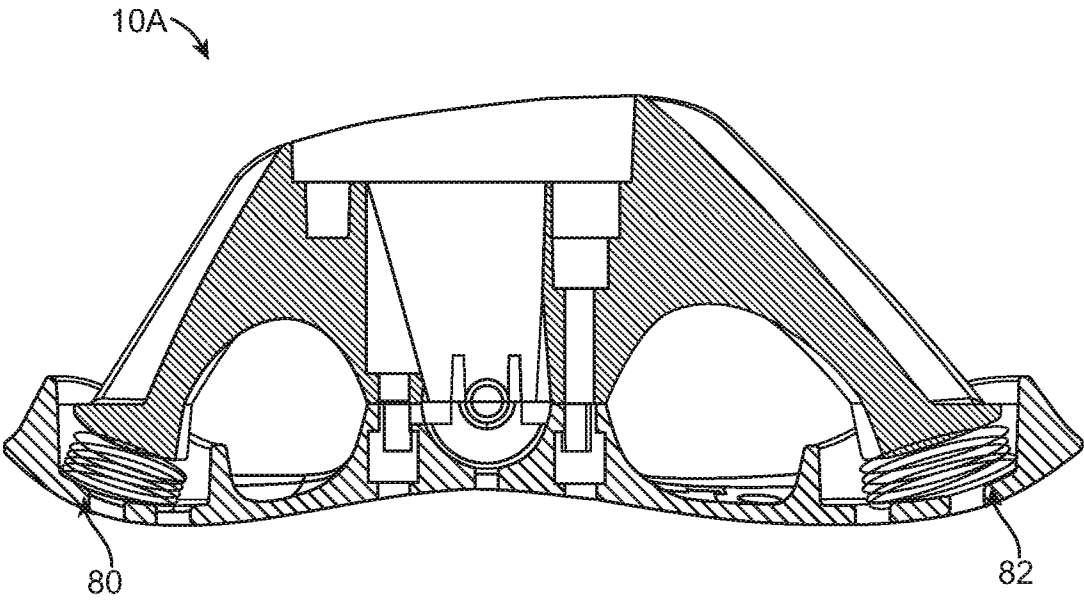


FIG. 8

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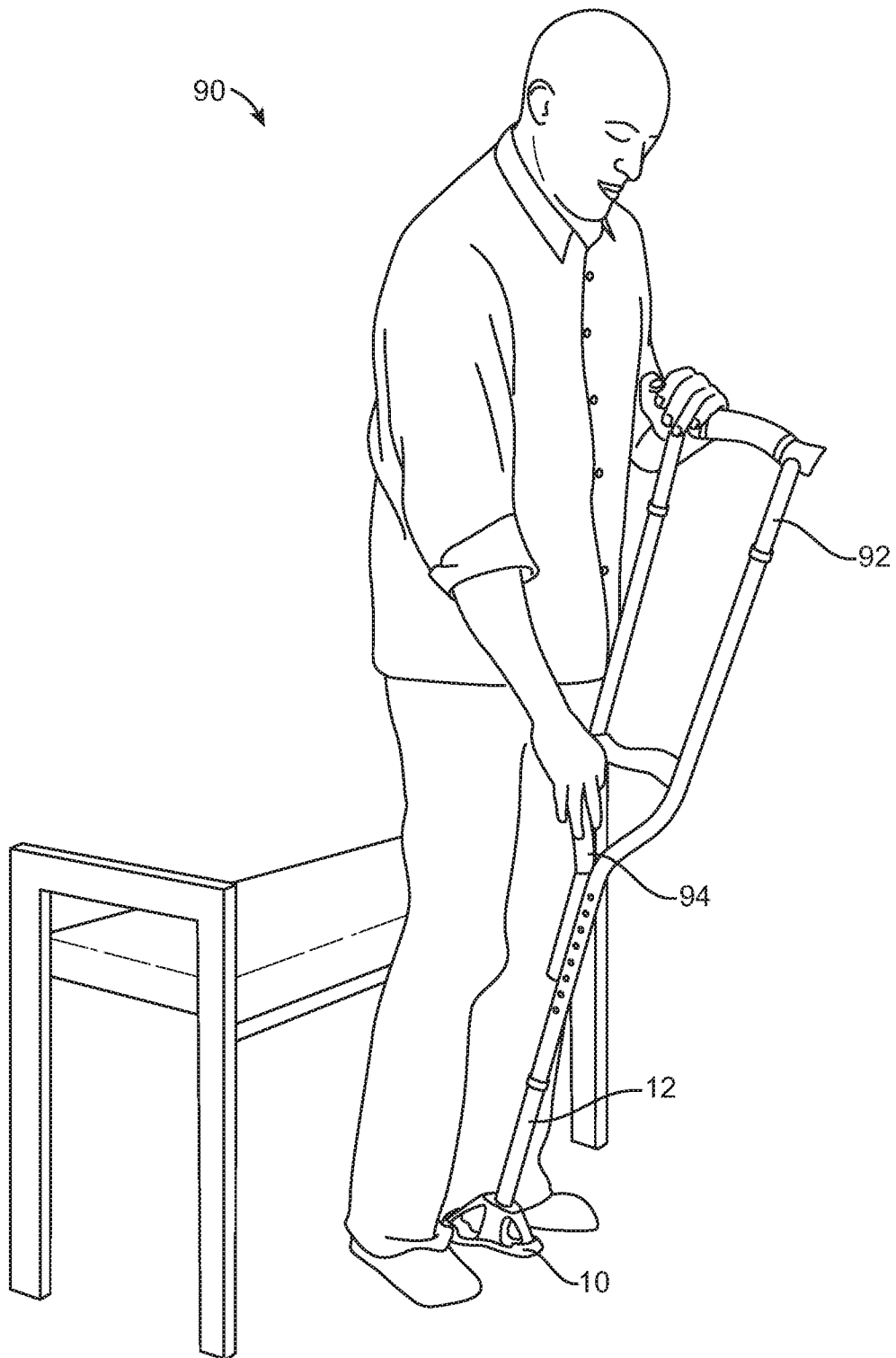


FIG. 9A

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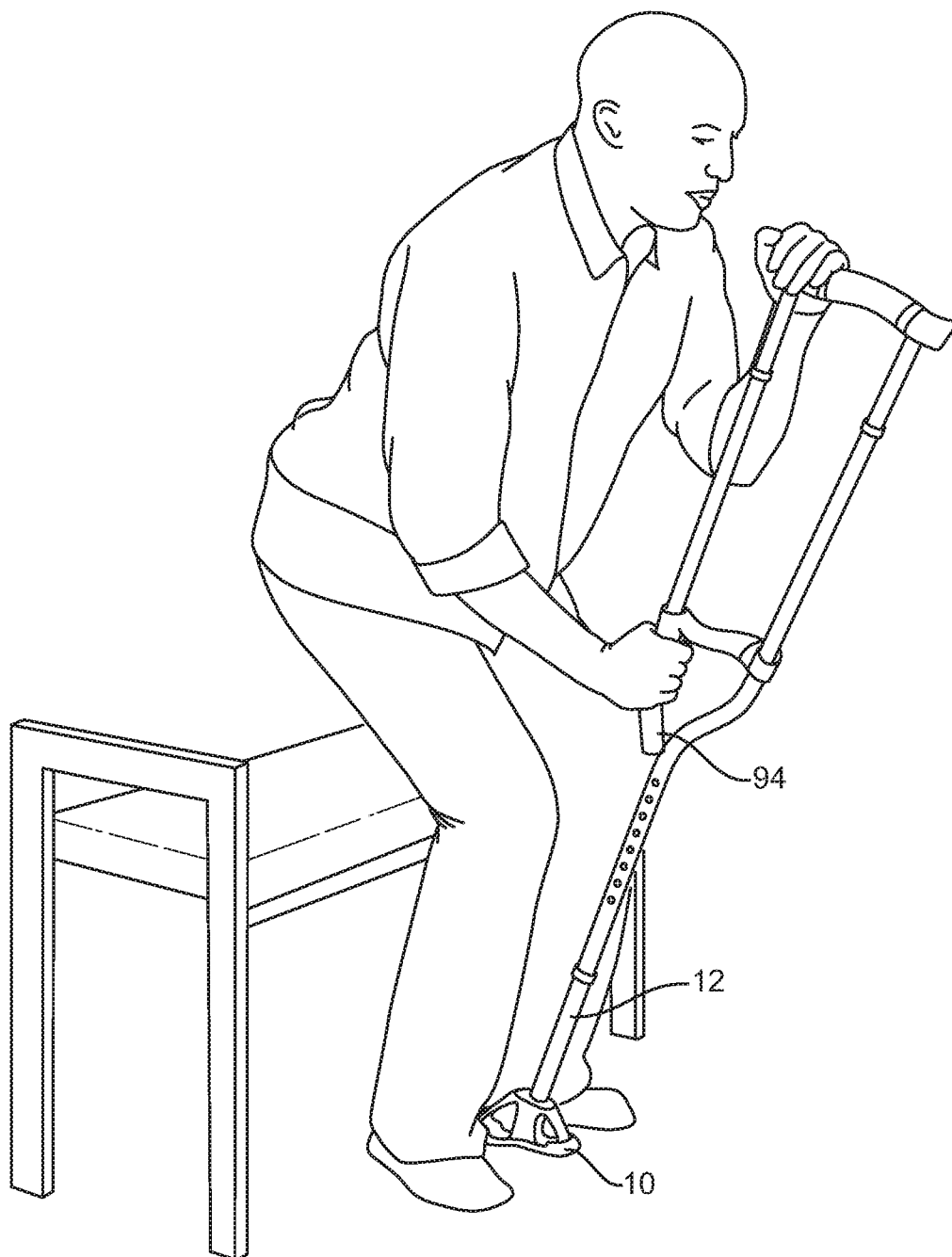


FIG. 9B

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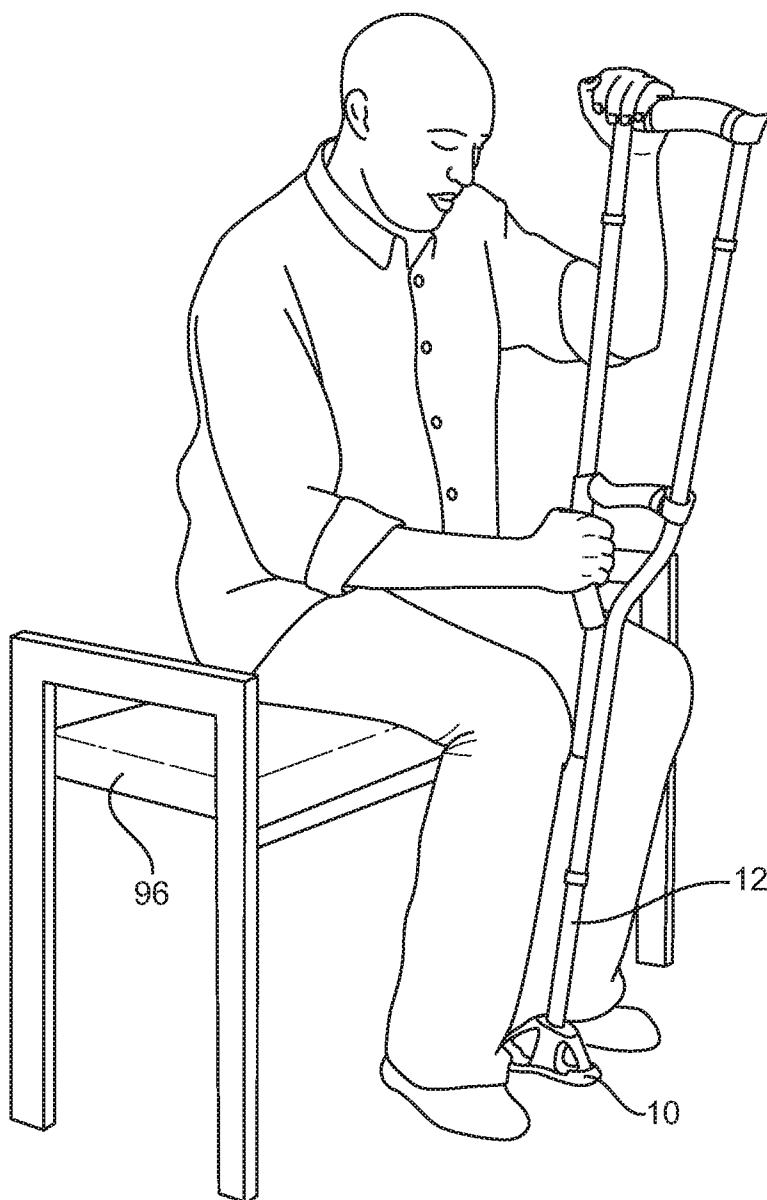


FIG. 9C