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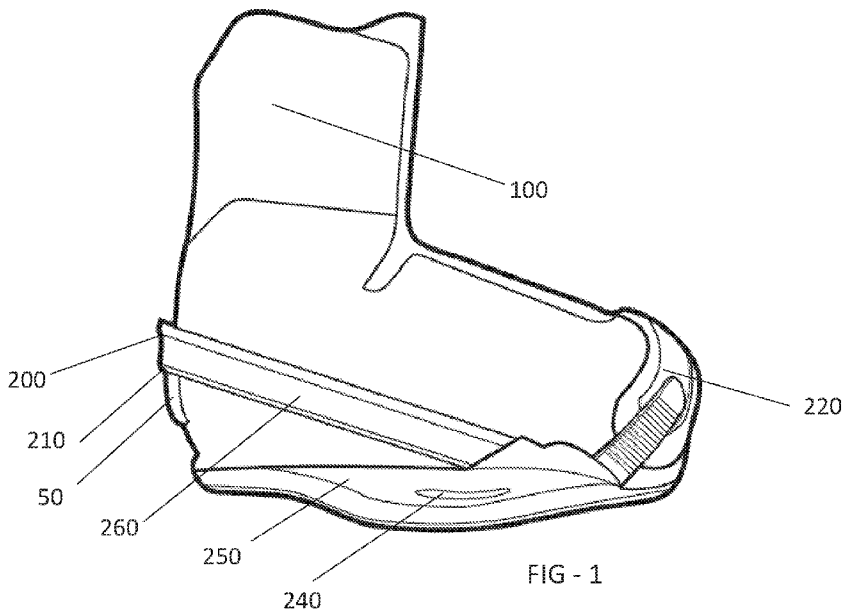

FIG - 1

(57) Abstract: Provided herein are various embodiments for a boot for releasable engagement with a binding having a downwardly facing ledge and a toe strap. The boot preferably contains a sole, a toe portion, and a heel portion. The boot preferably also contains a heel retaining device extending rearwardly from the heel portion of the boot and having an upwardly facing engagement surface at the top of the device which engages with the downwardly facing ledge of the binding to prevent vertical movement of the boot relative to the binding while allowing forward horizontal movement of the boot relative to the binding.

[Continued on next page]

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RELEASABLE BINDING ASSEMBLY FOR VARIOUS SPORTS

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Cross-Reference to Related Applications

[0001] This application claims priority to US Provisional Application No. 62/325,101 filed on April 20, 2016 which is herein incorporated by reference in its entirety. This application also claims priority to US Provisional Application No. 62/357,658 filed on July 1, 2016 which is herein incorporated by reference in its entirety.

Technical Field

[0002] Embodiments generally relate to releasable boot and binding assemblies for various sports, including but not limited to action sports such as kiteboarding, kitesurfing, wakeboarding, surfing, landboarding, splitboarding, and snowboarding.

Background of the Art

[0003] Binding systems are generally used to attach a user to an object, generally a planar object that is placed below their feet. Some action sports require a binding system that can quickly and easily be both inserted/attached as well as removed/released. Prior art binding systems that were easily released and inserted did not provide enough support to many users. Prior art binding systems that provided adequate support were not easily released and inserted.

Summary of the Exemplary Embodiments

[0004] Exemplary embodiments provide a releasable boot and binding system for use with various sports. The boot preferably contains a heel retaining device which engages with the heel portion of the binding. In a preferred embodiment, the binding contains a ledge which engages with a wedge that forms a portion of the heel retaining device. The heel retaining device could be a separate component that attaches to a traditional boot or it could be embedded within a portion of the boot. The bindings would preferably contain some type of toe strap, which can take on many forms. An exemplary embodiment would engage the toe of the boot with the toe strap first, then by lowering the heel of the boot the heel retaining device can engage with the binding. The boot could then be released by simply removing the toe strap and sliding the boot horizontally and forward (towards the toe side of a board).

[0005] The foregoing and other features and advantages of the present invention will be apparent from the following more detailed description of the particular embodiments, as illustrated in the accompanying drawings.

Brief Description of the Drawings

[0006] A better understanding of an exemplary embodiment will be obtained from a reading of the following detailed description and the accompanying drawings wherein identical reference characters refer to identical parts and in which:

[0007] **FIGURE 1** provides a left side plan view of an exemplary embodiment of a boot while engaged with an exemplary embodiment of the binding.

[0008] **FIGURE 2** provides a right side plan view of the embodiments shown in Figure 1.

[0009] **FIGURE 3** provides a left side plan view of the embodiment of the boot shown in Figures 1-2.

[0010] **FIGURE 4** provides an exploded view of an exemplary embodiment of the heel retaining device.

[0011] **FIGURE 5** provides a rear view of a boot that includes the heel retaining device shown in Figure 4.

[0012] **FIGURE 6** provides a rear perspective view of an exemplary embodiment of a boot engaged with an exemplary embodiment of the binding, and indicating the location of section line A-A, which cuts horizontally through the center of the boot and binding, along with the location of Detail A.

[0013] **FIGURE 7** provides a detailed section view taken along the section line A-A and indicating the features in Detail A.

[0014] **FIGURE 8** provides a left side plan view of an exemplary embodiment of a heel retaining device.

[0015] **FIGURE 9** provides a perspective illustration of another embodiment of the binding.

[0016] **FIGURES 10A through 10D** provide a sequence of illustrations showing one embodiment for engaging the boot within the binding.

[0017] **FIGURES 11A through 11D** provide a sequence of illustrations showing one embodiment for disengaging the boot from the binding.

[0018] **FIGURE 12** provides a rear perspective view of another embodiment of the heel retaining device and binding.

[0019] **FIGURE 13** provides a left side plan view of another embodiment of the heel retaining device and binding.

[0020] **FIGURE 14** provides a right side plan view of several alternative embodiments for the wedge.

Detailed Description

[0021] The invention is described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the exemplary embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, the size and relative sizes of layers and regions may be exaggerated for clarity.

[0022] 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 singular forms "a", "an" and "the" are intended to include the plural forms as well, 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, integers, steps, operations, elements, and/ or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0023] Embodiments of the invention are described herein with reference to illustrations that are schematic illustrations of idealized embodiments (and intermediate structures) of the invention. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, embodiments of the invention should not be construed as limited to the particular shapes of regions illustrated herein but are to include deviations in shapes that result, for example, from manufacturing.

[0024] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of 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 will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0025] **FIGURE 1** provides a left side plan view of an exemplary embodiment of a boot 100 while engaged with an exemplary embodiment of the binding 200. In this embodiment, the binding 200 contains a traditional slot 240 for mounting the binding 200 to a planar surface, typically a board of some type. A plate 250 may connect with the slot 240 and may traverse underneath the entire sole of the boot 100, or only underneath a small portion of the sole of the boot 100. A toe strap 220 may be used to secure the toe portion of the boot 100. The binding 200 preferably contains a rear ledge or ledge 210, which is elevated above the top surface of the board and generally faces downwardly. The ledge 210 preferably engages with the heel retaining device 50 once the heel of the boot 100 has been lowered to a point where the heel retaining device 50 is below the

ledge 210. It should be noted that the bindings 200 can have the traditional "high back" (as used in snowboarding and wakeboarding) or no high back (as shown in Figure 1). However, as shown and described further below, many different types of bindings could be used with the various embodiments herein, as the presence of a high back or lack of a high back can be effective with any embodiment depending on the application. In an exemplary embodiment, no high back would be used, only the arms 260 as shown and described below. It should also be noted that in a preferred embodiment, each element of the binding 200 is rigidly fixed relative to one another, with the exception of the toe strap 220. Thus, the ledge 210 should be rigidly fixed relative to the arm 260, which is rigidly fixed relative to the plate 250, making the ledge 210 also rigidly fixed relative to the plate 250. In this way, when the binding 200 is attached to a board, the ledge 210 should preferably not move relative to the top surface of the board 400.

[0026] **FIGURE 2** provides a right side plan view of the embodiments shown in Figure 1. The toe strap 220 preferably connects between two opposing sides of the binding 200 and is placed over the toe area of the boot 100. It should be noted that the toe strap 220 could wrap around the front surface of the toe of the boot 100, the top surface of the toe of the boot 100, or a combination of the top surface and the front surface of the toe of the boot 100 (as shown). Any version of the toe strap 220 would work with the exemplary embodiments herein. In this embodiment of the binding 200, the plate 250 is shown extending under the toe and heel portions of the boot 100.

[0027] **FIGURE 3** provides a left side plan view of the embodiment of the boot 100 shown in Figures 1-2. The boot 100 preferably contains a sole 110, a toe portion 111, a heel portion 112, and securing devices 125 which can be any combination of hook and

loop fasteners, tightening clips, a traditional knot in laces, a boa system (cables which are tightened onto the user's foot by rotating a knob), or anything similar that could be used to secure the boot 100 onto the foot of a user. The sole 110 is preferably smooth all around the perimeter with nothing protruding outwardly from the sole 110. An engagement surface 65 is preferably located as the top surface of the heel retaining device 50, and preferably engages with the ledge 210 on the binding 200 as shown and described herein.

[0028] **FIGURE 4** provides an exploded view of an exemplary embodiment of the heel retaining device 50. The wedge 60 contains the engagement surface 65 as described above and preferably contains a plurality of teeth on the back side of the wedge 60 to engage with a plurality of teeth which extend from the interior plate 70. Generally, the interior plate 70 is fixed relative to the boot 100 and may be effectively sewn into the boot 100. The interior plate 70 preferably contains a flat portion 71 which extends around the perimeter of a central portion 72 which extends rearwardly and contains the teeth which engage with the teeth on the back side of the wedge 60. The exterior boot wrap 105 may contain an aperture 106 which is sized to allow the central portion 72 of the interior plate 70 to be accessible.

[0029] A female threaded fastener 75 may be fixed within the central portion 72 or may slide within a slot found in the central portion 72. When using a female threaded fastener 75 that can slide within the slot, the fastener 75 can be located at various vertical heights to account for the user's boot size/binding size combination, or other factors that could result in the boot 100 engaging with the binding 200 at different vertical heights. Thus, to attach the wedge 60 to the boot 100 initially or re-locate the vertical height of the wedge

60, a male threaded fastener 66 may pass through the center of the wedge 60 to engage with the female threaded fastener 75. As the male fastener 66 is threaded into the female fastener 75, the opposing teeth of the wedge 60 and interior plate 70 become interlocked so that the wedge 60 can no longer move relative to the interior plate 70 (or the boot 100). The underside of the head of the male fastener 66 preferably contains the rear surface of the wedge 60, in order to draw the wedge 60 against the interior plate 70.

[0030] It is preferred that the heel retaining device 50 is rigidly attached to the boot 100 so that the device 50 cannot substantially move relative to the boot 100 (other than the adjustment of the height of the cleat 60 by adjusting the fasteners 66/75) upon installation.

[0031] **FIGURE 5** provides a rear view of a boot 100 that includes the heel retaining device 50 shown in Figure 4. As shown, the flat portion 71 of the interior plate 70 is preferably located behind/underneath the exterior boot wrap 105 while the aperture 106 allows access to the central portion 72 of the interior plate 70. By loosening the male fastener 66, the wedge can either be removed or can be re-located to a different vertical height by engaging with teeth on the wedge 60 and central portion 72 that are at different vertical heights.

[0032] **FIGURE 6** provides a rear perspective view of an exemplary embodiment of a boot 100 engaged with an exemplary embodiment of the binding 200, and indicating the location of section line A-A, which cuts horizontally through the center of the boot 100 and binding 200, along with the location of Detail A. Here we see a plate 250 which extends from the slots 240 and passes underneath a portion of the sole of the boot 100, but not the entire boot 100. An arm 260 preferably wraps behind the heel of the boot 100 and is attached to the plate 250, at a position close to the slots 240, on the left and right hand

sides of the binding 200. In this embodiment, a bottom surface of the arm 260 preferably provides the ledge 210 for engagement with the engagement surface 65 on the wedge 60.

[0033] **FIGURE 7** provides a detailed section view taken along the section line A-A and indicating the features in Detail A. In this embodiment, a bottom surface of the arm 260 preferably provides the ledge 210 for engagement with the engagement surface 65 on the wedge 60. Here, the angle θ_2 is defined as the angle of the ledge 210 relative to a vertical axis 10 and rotated away from the rear of the boot 100. The angle θ_2 will be described further below.

[0034] **FIGURE 8** provides a left side plan view of an exemplary embodiment of a heel retaining device 50. As noted above, the wedge 60 also preferably contains an engagement surface 65 at the top of the wedge 60. Here, the angle θ_1 is defined as the angle of the engagement surface 65 relative to a vertical axis 10 and rotated away from the rear of the boot 100. The engagement surface 65 can be substantially horizontal (i.e. θ_1 is approximately 90 degrees from the vertical axis 10). However, in a preferred embodiment, the engagement surface 65 would have θ_1 between 80 degrees and 85 degrees rearwardly away from the vertical axis 10. Regarding θ_2 from above, whatever angle is chosen for θ_1 would also be the preferred angle for θ_2, or at least making θ_1 substantially equal to θ_2 or within a few degrees of each other. This is not required however, as some embodiments could use different values for the two, as an example, 80 degrees for θ_1 with 90 degrees for θ_2. Generally speaking, θ_1 and/or θ_2 could be anywhere between 60 degrees and 90 degrees in various embodiments, depending on the application.

[0035] In a preferred embodiment, the engagement surface 65 would be upwardly facing as shown and would be fixed relative to the boot so that the engagement surface 65 does not move relative to the boot 100. As shown and described herein, the engagement surface 65 should prevent an upward vertical movement of the boot 100 relative to the binding 200, but would not substantially prevent forward horizontal movement of the boot 100 relative to the binding 200.

[0036] The bottom portion of the wedge 60 preferably contains a transition portion 57 which begins at the lowest point on the wedge 60 and continues upwardly until the full width of the wedge 60 has been reached. As shown, when beginning at the bottom point and moving upwardly, the cross-sectional thickness 56 increases as you move upwardly towards the engagement surface 65. Thus, the transition portion 57 begins at zero and then increases to 56A. As you continue to move upwardly, the cross-sectional thickness increases to 56B. As you continue to move upwardly, eventually the cross-sectional thickness of the transition portion 57 becomes substantially equal to the cross-sectional thickness of the wedge 60, which is shown as 56C. It should be noted, that although shown as a smooth rounded shape, the transition portion 57 can take on any number of different shapes, including a triangular or trapezium shape. All that is required is that the transition portion 57 increases in cross-sectional thickness as you move upwardly towards the engagement surface 65.

[0037] **FIGURE 9** provides a perspective illustration of another embodiment of the binding 200. In this embodiment, the plate 250 only passes underneath a small toe portion of the boot 100, where otherwise the boot 100 is resting atop the board surface 400 for all other areas of the boot 100, once engaged with the binding 200. Further, this

embodiment includes a notch 211 within the arm 260 of the binding 200, to further secure the heel retaining device 50 within the binding 200. The notch 211 can add some lateral strength to the connection between the boot 100 and binding 200, if necessary.

[0038] FIGURES 10A through 10D provide a sequence of illustrations showing one embodiment for engaging the boot 100 within the binding 200. During insertion, the toe of the boot 100 is inserted under a portion of the toe strap 220, which can take on many forms. A traditional ratchet strap (shown here) could be used, or a basic semi-rigid strap, or an elastomeric strap. Here, we have a ratchet toe strap 220, but it is not necessary to ratchet the strap during insertion of the boot 100. Thus, for an exemplary embodiment, when the toe of the boot 100 is inserted into the toe strap 220, the toe of the boot 100 can simply be slipped under the toe strap 220 without needing to ratchet (or otherwise tighten) the toe strap 220. Once the toe of the boot 100 has been inserted under a portion of the toe strap 220, the heel of the boot 100 is lowered until the heel retaining device 50 engages with the ledge 210. In this embodiment, the heel retaining device 50 would preferably slip past the arm 260 while the heel of the boot 100 is lowered, but would extend rearwardly once it has passed the ledge 210 on the arm 260, so that the top portion of the heel retaining device 50 is adjacent to (and possibly contacting) the ledge 210. Once inserted, the top portion of the heel retaining device 50 may contact the ledge 210 when there is an upward movement by the user, but the boot 100 would be retained within the binding 200.

[0039] FIGURES 11A through 11D provide a sequence of illustrations showing one embodiment for disengaging the boot 100 from the binding 200. During removal, the toe strap 220 can be removed or disengaged, and the boot 100 can slide laterally

(horizontally) forward to slide the heel retaining device 50 underneath the ledge 210. As shown below, the toe strap 220 could be removed in a number of ways, depending on the precise type of toe strap 220 that is selected. Using the ratchet strap shown, this would simply be released, and it could be released entirely (so that the toe strap 220 becomes two separate pieces for the boot 100 to slide in between) or simply released/loosened enough so that the toe strap 220 could rotate and slide off the toe of the boot 100, again allowing the boot to move laterally (horizontally) forward and disengage the heel retaining device 50. As noted above, in this way the wedge 60 can be described as constraining the vertical movement of the boot 100 relative to the binding 200, but does not constrain the horizontal or forward movement of the boot 100 relative to the binding 200 in a substantial way. This movement is restrained mostly by the toe strap 220 alone, in an exemplary embodiment.

[0040] **FIGURE 12** provides a rear perspective view of another embodiment of the heel retaining device 51 and binding 200. Here, we see the use of the notch 211 in the arm 260 of the binding along with a different embodiment for the heel retaining device 51. As shown, this embodiment is attached through a series of fasteners and contains a shape at the top of the device 51 which matches the shape used by the notch 211, in order to further secure the device 51 into the arm 260 of the binding 200. Here, notch 211 is sized and shaped similar to the top portion of the heel retaining device 51, which here is a wedge with a pyramid shaped top portion

[0041] **FIGURE 13** provides a left side plan view of another embodiment of the heel retaining device 52 and binding. First, note that this embodiment of the binding 200 does not contain the slots for mounting, but instead has the traditional snowboarding mounting

holes in the center of the binding. Further, an intermediary element 410 has been placed between the board surface 400 and the binding 200. In this embodiment, the heel retaining device 52 is made of a flexible material so that it can deform slightly in order to slip past the arm 260 when inserting the boot 100 into the binding 200. Here, thin sheet metal has been used, but other flexible plastics, polymers, and composites could also be used. This embodiment of the heel retaining device 52 is simply attached to the heel portion of a traditional boot, without having to sew the device 52 into the exterior wrap of the boot.

[0042] **FIGURE 14** provides a right side plan view of several alternative embodiments for the wedge.

[0043] The components herein can be composed of many different materials. Specifically, the heel retaining device could be a solid feature and could be comprised of any rigid or semi-rigid material including but not limited to plastics (sometimes filled with glass or other types of strengthening fibers), metals, and composites. In some embodiments, the wedge may have some flexibility, to aid insertion of the boot into the bindings (as described below) but this is not required at all. Preferably, the heel retaining devices are comprised of a material that will not rust, rot, or otherwise degrade in water or substantially degrade from UV exposure, but this is not required. For the exemplary embodiments herein, the heel retaining device is substantially rigid and does not have much flexibility, other than the flex of the boot itself. In some embodiments, the flex of the boot itself provides the ability for the heel retaining device to slip past the arm of the binding (or for the wedge to slip past the ledge on the binding).

[0044] Having shown and described a preferred embodiment of the invention, those skilled in the art will realize that many variations and modifications may be made to affect the described invention and still be within the scope of the claimed invention. Additionally, many of the elements indicated above may be altered or replaced by different elements which will provide the same result and fall within the spirit of the claimed invention. It is the intention, therefore, to limit the invention only as indicated by the scope of the claims.

CLAIMS

I claim:

1. A boot for releasable engagement with a binding having a downwardly facing ledge and a toe strap, the boot comprising:

a boot having a sole, a toe portion, and a heel portion; and

a heel retaining device extending rearwardly from the heel portion of the boot and having an upwardly facing engagement surface at the top of the device which engages with the downwardly facing ledge of the binding to prevent vertical movement of the boot relative to the binding while allowing forward horizontal movement of the boot relative to the binding.

2. The boot of claim 1 wherein:

the engagement surface does not move relative to the boot.

3. The boot of claim 1 wherein the heel retaining device comprises:

an interior plate which has a flat portion that is inside the boot and a central portion which is accessible from outside the boot; and

a wedge that is attached to the interior plate and provides the upwardly facing engagement surface at a top portion of the wedge.

4. The boot of claim 3 further comprising:

a transition portion near a bottom portion of the wedge which begins with a small cross-sectional thickness at the bottom and increases in cross-sectional thickness as it extends upwardly towards the engagement surface.

5. A boot for releasable engagement with a binding having a downwardly facing ledge and a toe strap, the boot comprising:

a boot having a sole, a toe portion, and a heel portion; and

a heel retaining device extending rearwardly from the heel portion of the boot and having an engagement surface at the top of the device which is angled away from a vertical axis and towards the rear of the boot between 90 degrees and 60 degrees from the vertical axis.

6. The boot of claim 5 wherein:

the sole has a smooth perimeter with no protrusions.

7. The boot of claim 5 wherein:

the engagement surface does not move relative to the boot.

8. The boot of claim 5 wherein the heel retaining device comprises:

an interior plate which has a central portion with a plurality of teeth; and

a wedge that is engaged with the plurality of teeth and provides the upwardly facing engagement surface at a top portion of the wedge.

9. The boot of claim 8 further comprising:

exterior boot wrap which surrounds the heel portion of the boot;

an aperture in the exterior boot wrap which permits access to the central portion of the interior plate from outside of the boot.

10. A boot for releasable engagement with a binding having a downwardly facing ledge and a toe strap, the boot comprising:

a boot having a sole, a toe portion, and a heel portion; and

a heel retaining device extending rearwardly from the heel portion of the boot and arranged so that when engaging the boot with the binding, the toe portion of the boot can slip underneath a portion of the toe strap while the heel portion of the boot can be lowered vertically until the heel retaining device is below the downwardly facing ledge of the binding.

11. The boot of claim 10 wherein:

the heel retaining device is rigidly fixed to the boot.

12. The boot of claim 10 wherein:

the boot is permitted to slide horizontally once the toe strap is disengaged.

13. The boot of claim 10 wherein:

the downwardly facing ledge of the binding does not move relative to the binding.

14. The boot of claim 10 wherein the heel retaining device comprises:

an interior plate which has a flat portion that is underneath an exterior boot wrap; and

a wedge that is removably attached to the interior plate at various different positions relative to one another.

15. A boot for releasable engagement with a binding having a downwardly facing ledge, the boot comprising:

a boot having a sole, a toe portion, and a heel portion; and

a wedge that extends from the heel portion of the boot and contains a top portion having an engagement surface and a bottom portion having a transition portion where the cross-sectional thickness of the transition portion increases as it extends upwardly towards the engagement surface.

16. The boot of claim 15 wherein:

the transition portion has a smooth curve that transitions from a small cross-sectional thickness to a larger cross-sectional thickness.

17. The boot of claim 15 wherein:

the transition portion has a triangular shape.

18. The boot of claim 15 wherein:

the wedge is removably attached to the boot at various vertical heights relative to the boot.

19. The boot of claim 15 wherein:

the transition portion extends further away from the boot as it extends upwardly.

20. A boot and binding combination for board sports comprising:

a binding having a substantially flat plate, a toe strap connected to the plate, an arm that connects to the substantially flat plate, and a ledge on a bottom side of the arm that does not move relative to the flat plate;

a boot having a sole, a toe portion, and a heel portion; and

a heel retaining device extending rearwardly from the heel portion of the boot and having an upwardly facing engagement surface at the top of the device which contacts the ledge on the bottom side of the arm if the boot is lifted upwardly once engaged with the binding.

21. The boot and binding combination of claim 20 wherein:

the upwardly facing engagement surface is rigidly fixed relative to the boot.

22. The boot and binding combination of claim 20 wherein:

the upwardly facing engagement surface is angled away from a vertical axis at θ_1; and

the ledge is angled away from a vertical axis at θ_2;

where θ_1 is substantially equal to θ_2.

23. The boot and binding combination of claim 20 wherein:

the boot can slide horizontally out of the binding once the toe strap is disengaged.

24. The boot and binding combination of claim 20 wherein:

the ledge permits the boot to move forward horizontally while prohibiting the boot from moving upward vertically.

25. A binding for use with a boot having a wedge extending from a heel portion of the boot and containing an upwardly facing engagement surface, the binding comprising:

a substantially flat plate;

a toe strap connected to the plate;

an arm that connects to the substantially flat plate; and

a ledge on a bottom side of the arm that does not move relative to the flat plate and prohibits the boot from moving upward vertically but allows the boot to move forward horizontally.

26. The binding of claim 25 wherein:

the upwardly facing engagement surface of the boot is angled away from a vertical axis at θ_1; and

the ledge of the binding is angled away from a vertical axis at θ_2;

where θ_1 is substantially equal to θ_2.

27. The binding of claim 25 wherein:

the arm wraps around a heel portion of the boot when the boot is engaged with the binding.

28. A boot comprising:

a sole, a toe portion, a heel portion, and an exterior wrap layer;

a heel retaining device extending rearwardly from the heel portion of the boot and comprising

an interior plate having a flat portion which is underneath the exterior wrap layer and a central portion which extends rearwardly from the interior plate and is accessible through an aperture in the exterior wrap,

a wedge attached to the central portion of the interior plate and having a top portion with an engagement surface and a bottom portion with a transition portion,

a set of opposing teeth on the wedge and central portion of the interior plate which engage at various vertical heights,

a female fastener placed within the central portion, and

a male fastener which passes through the wedge and the interior plate to engage with the female fastener.

29. A boot comprising:

a sole, a toe portion, a heel portion, and an exterior wrap layer;

a heel retaining device extending rearwardly from the heel portion of the boot and comprising

an interior plate having a flat portion which is underneath the exterior wrap layer and a central portion which extends rearwardly from the interior plate,

a wedge attached to the central portion of the interior plate and having a top portion and bottom portion where the top portion contains an engagement surface and the bottom portion contains a small cross-sectional thickness which transitions to a larger cross-sectional thickness as the wedge moves upwardly towards the engagement surface, and

a female and male fastener which combine to squeeze the wedge and interior plate together.

30. The boot of claim 29 wherein:

the wedge does not move relative to the heel portion of the boot.

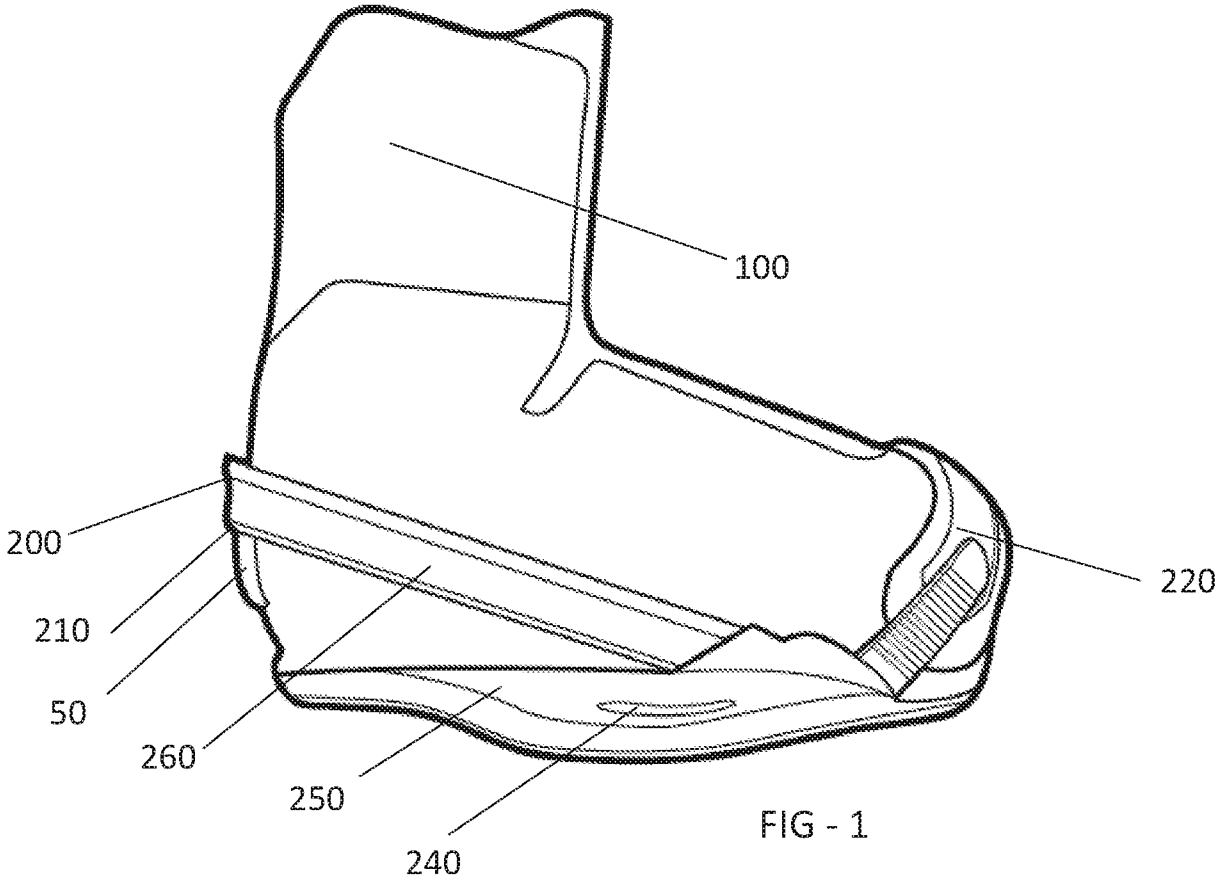


FIG - 1

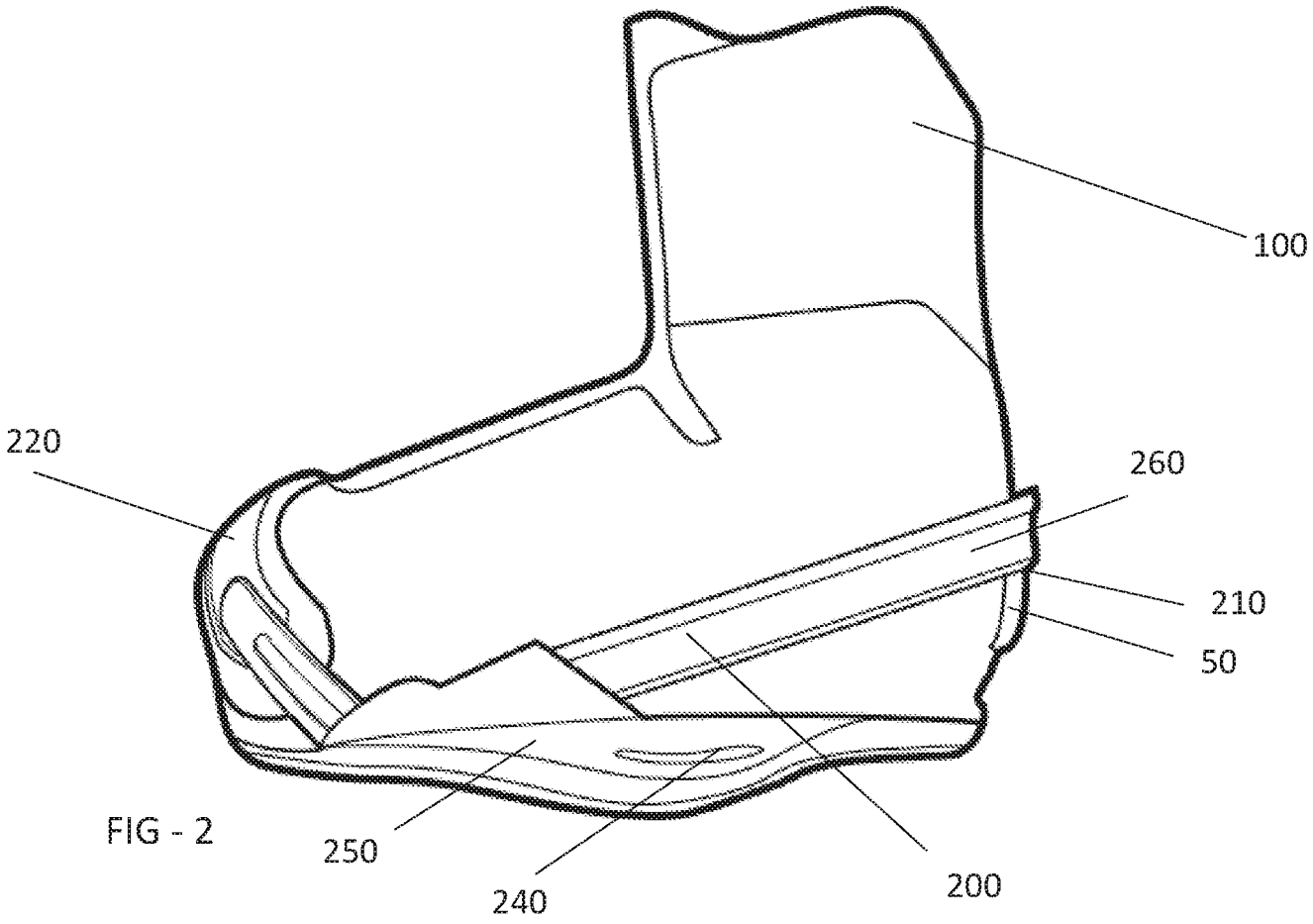


FIG - 2

FIG - 3

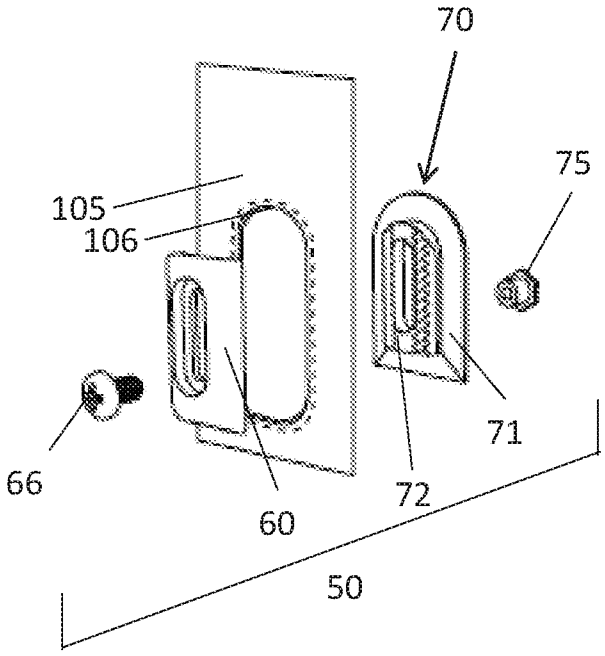


FIG - 4

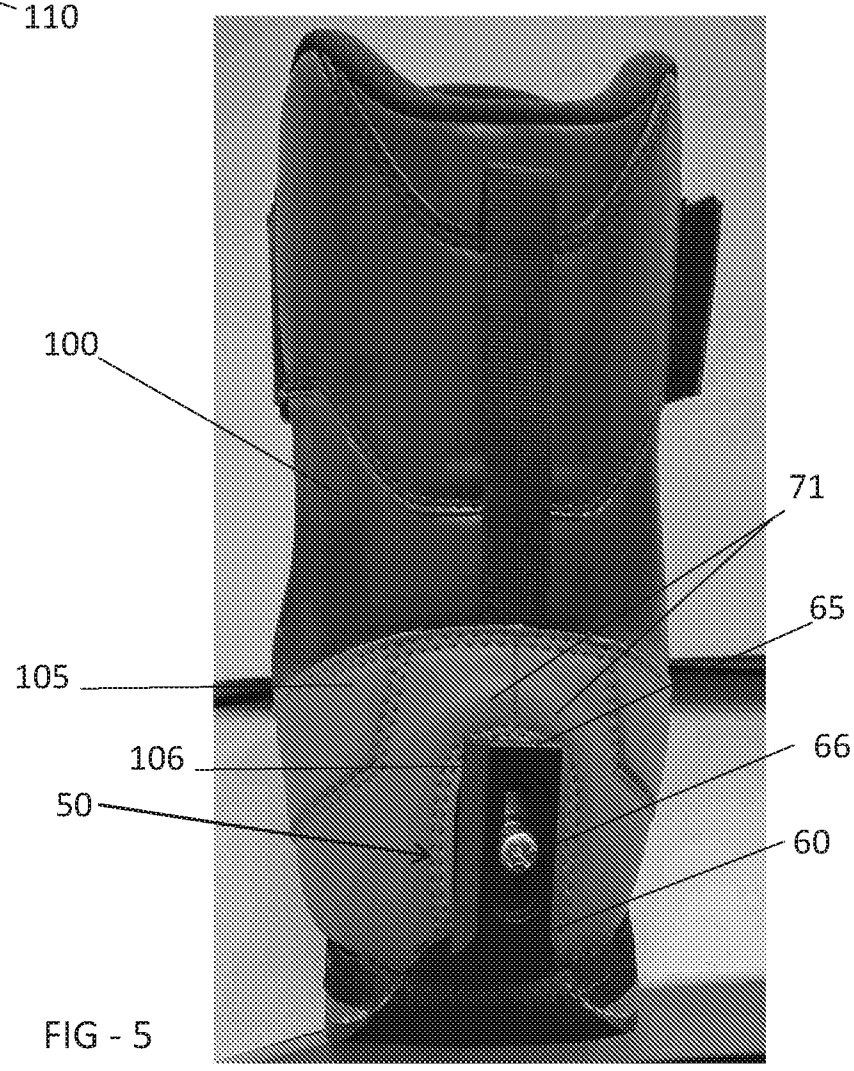


FIG - 5

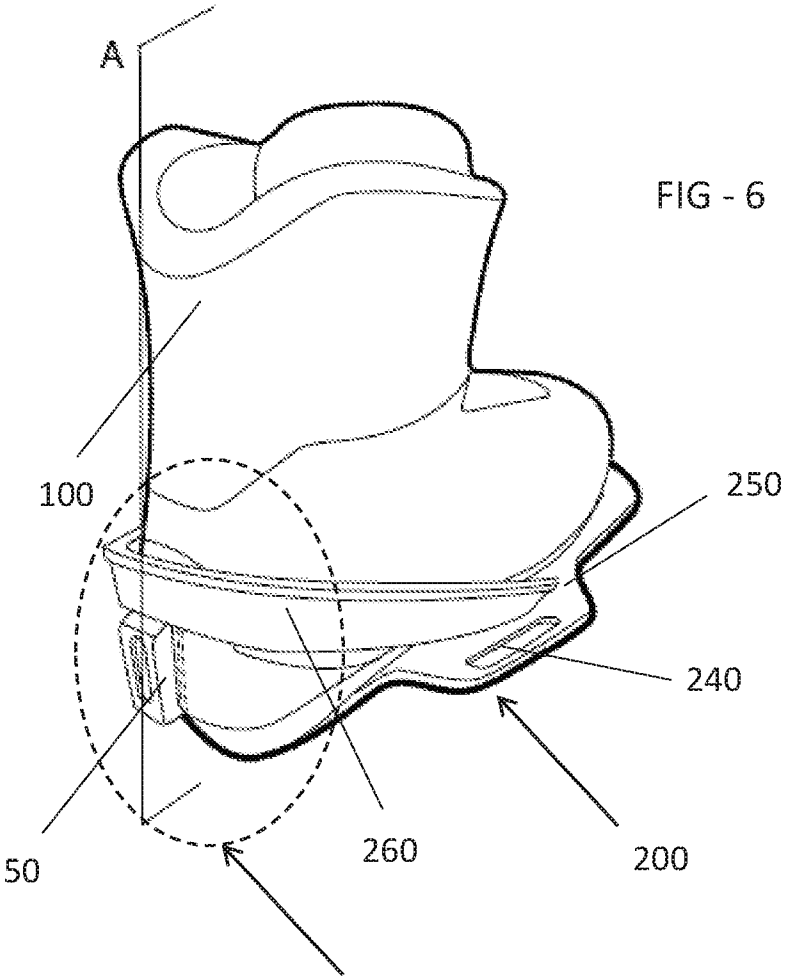

A
100
250
240
50
260
200
DETAIL A

FIG - 6

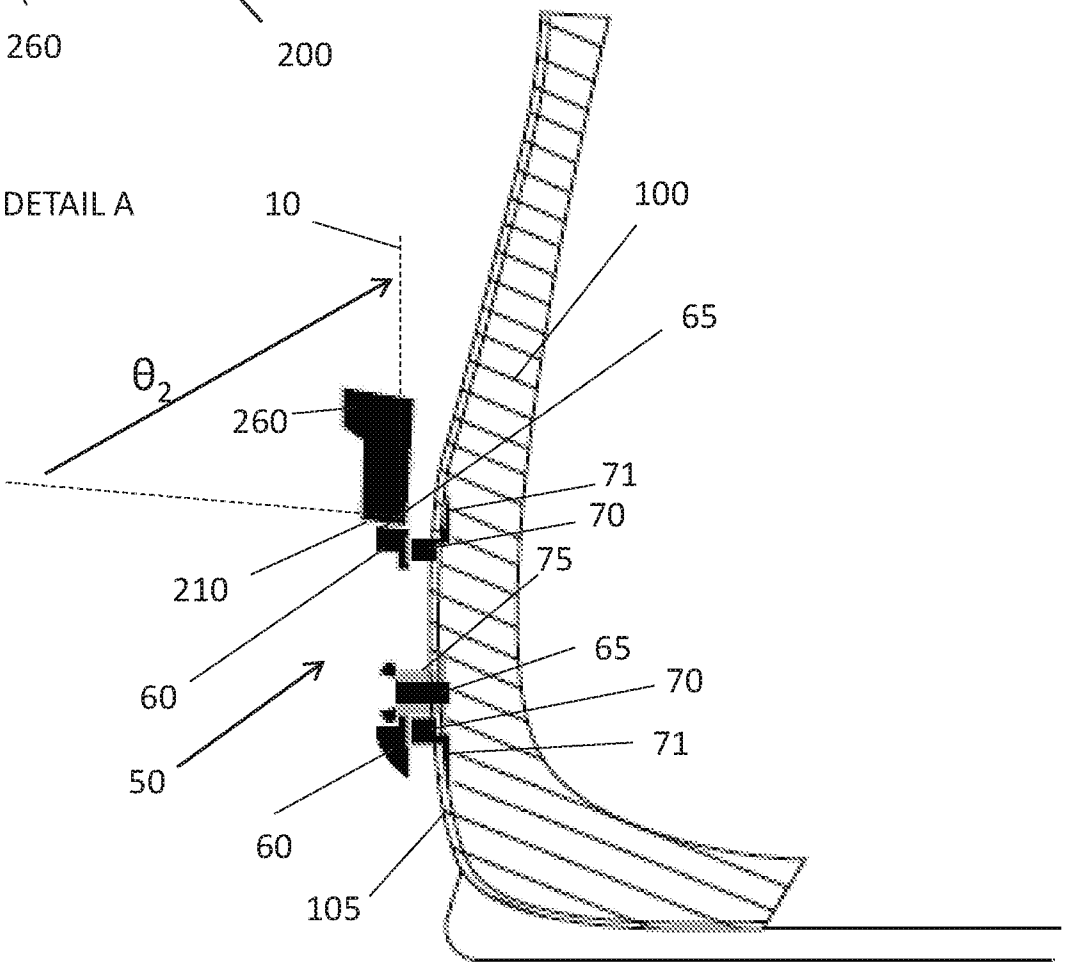

10
100
65
θ2
260
71
70
75
210
65
60
70
50
71
60
105

FIG - 7

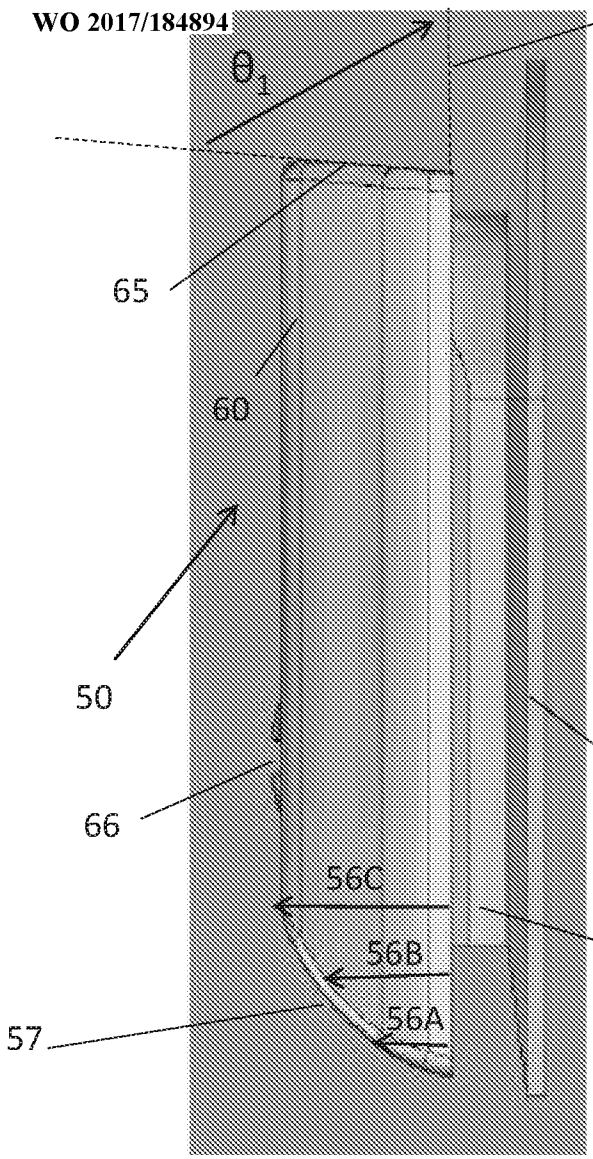

10
θ_1
65
60
50
71
66
56C
56B
56A
72
57

FIG - 8

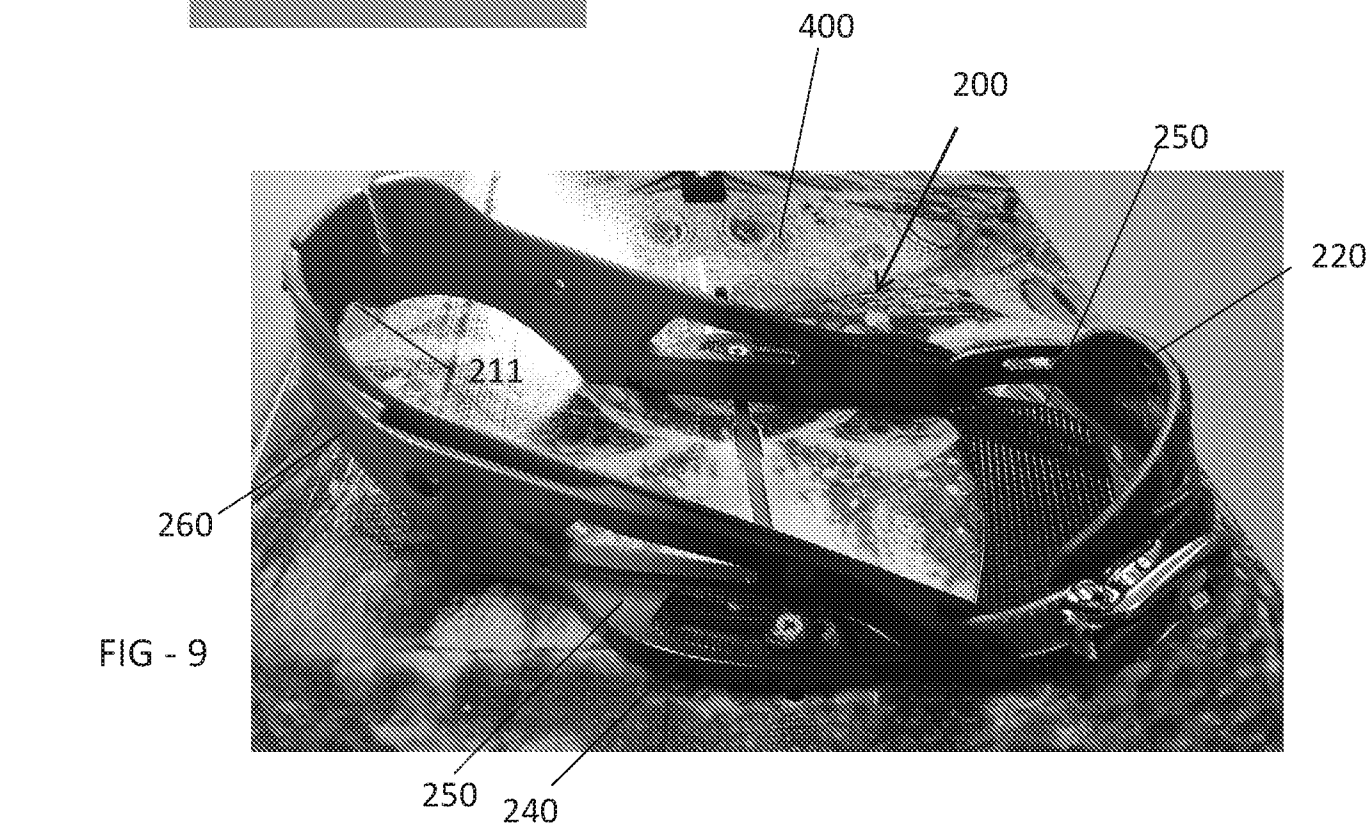

400
200
250
220
211
260
250
240

FIG - 9

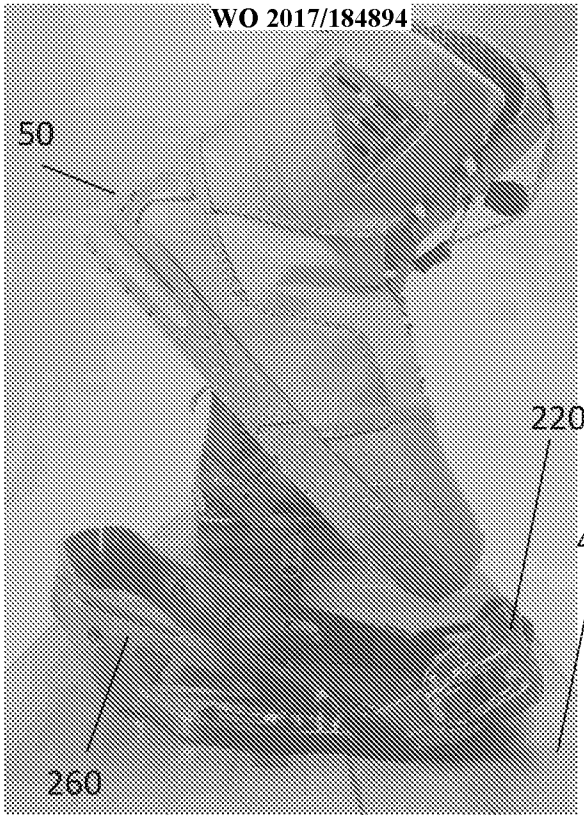


FIG – 10A

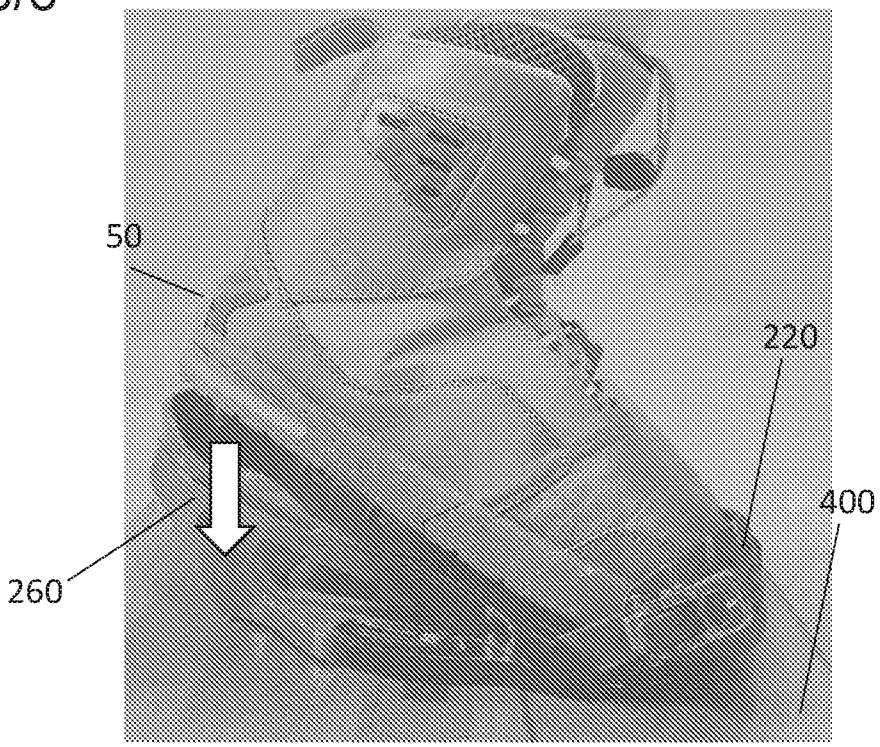


FIG – 10B

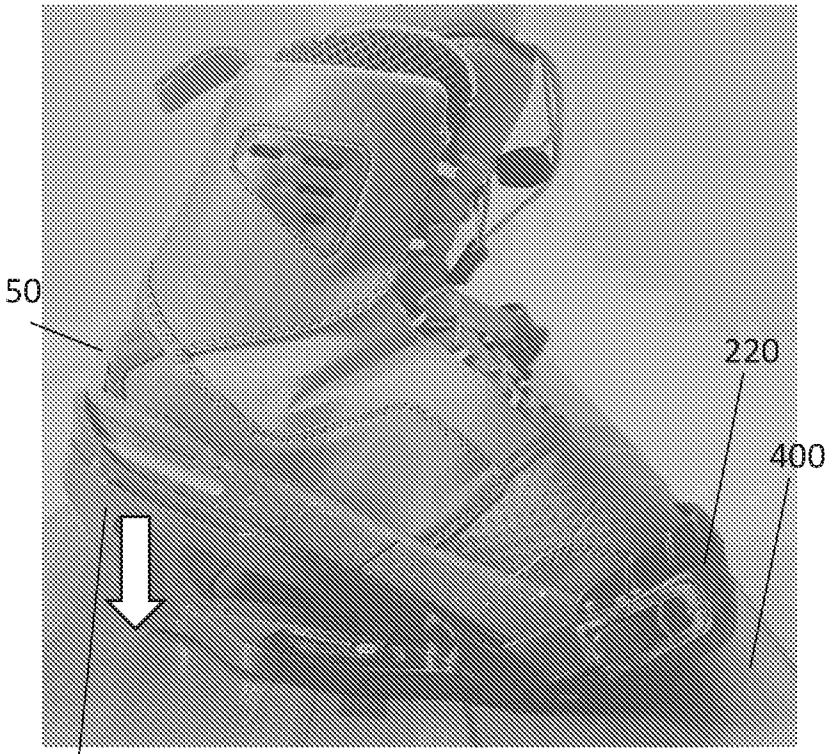


FIG – 10C

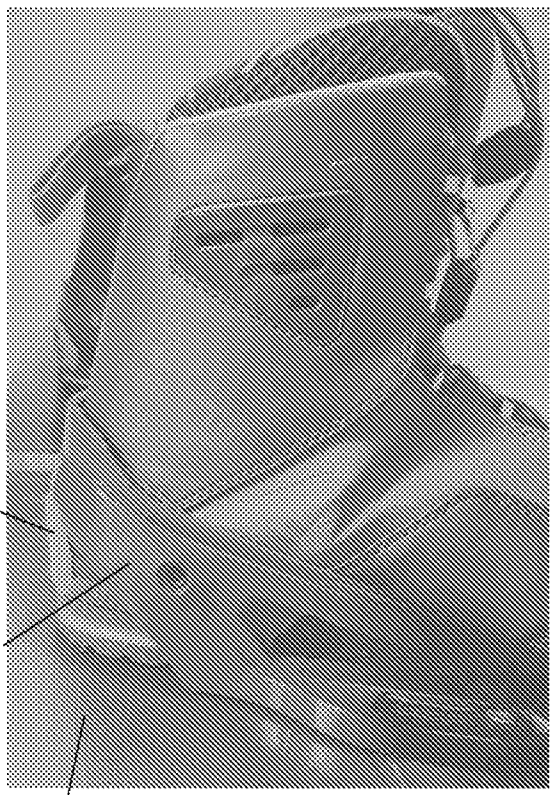


FIG – 10D

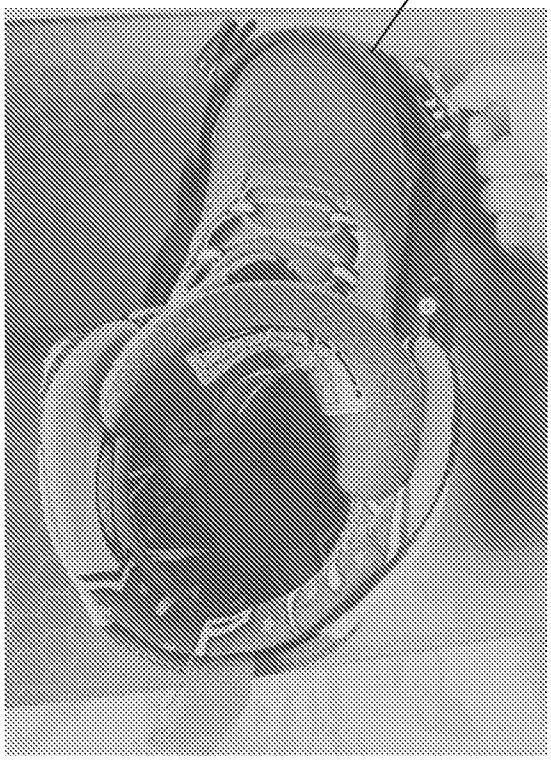


FIG – 11A

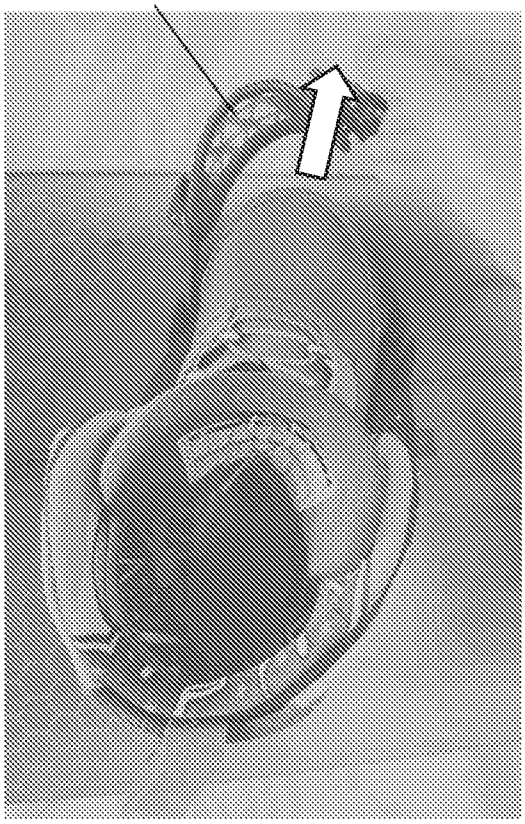


FIG – 11B

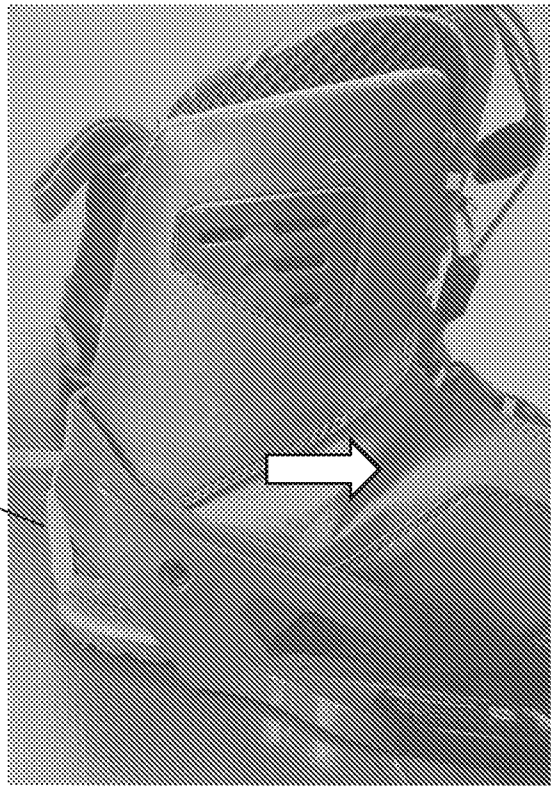


FIG – 11C

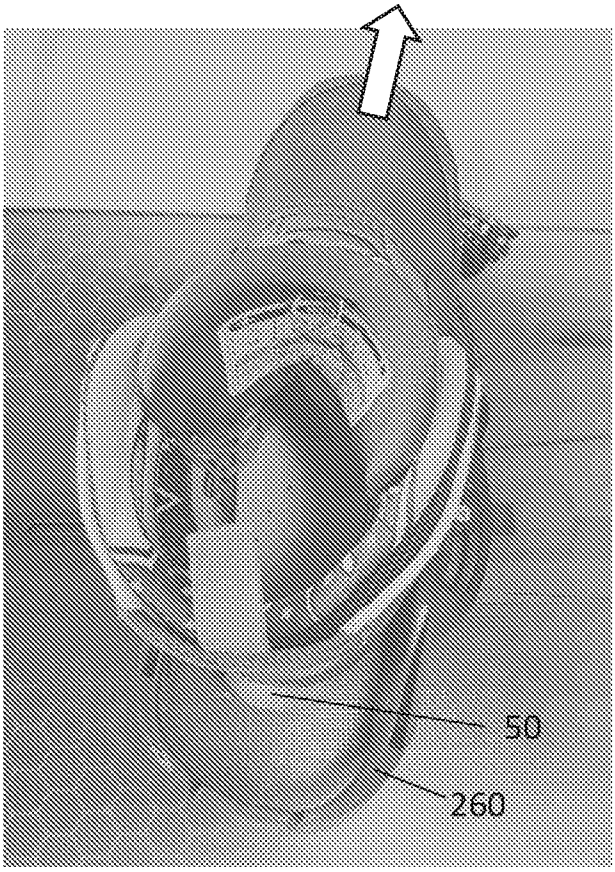


FIG – 11D

FIG – 12

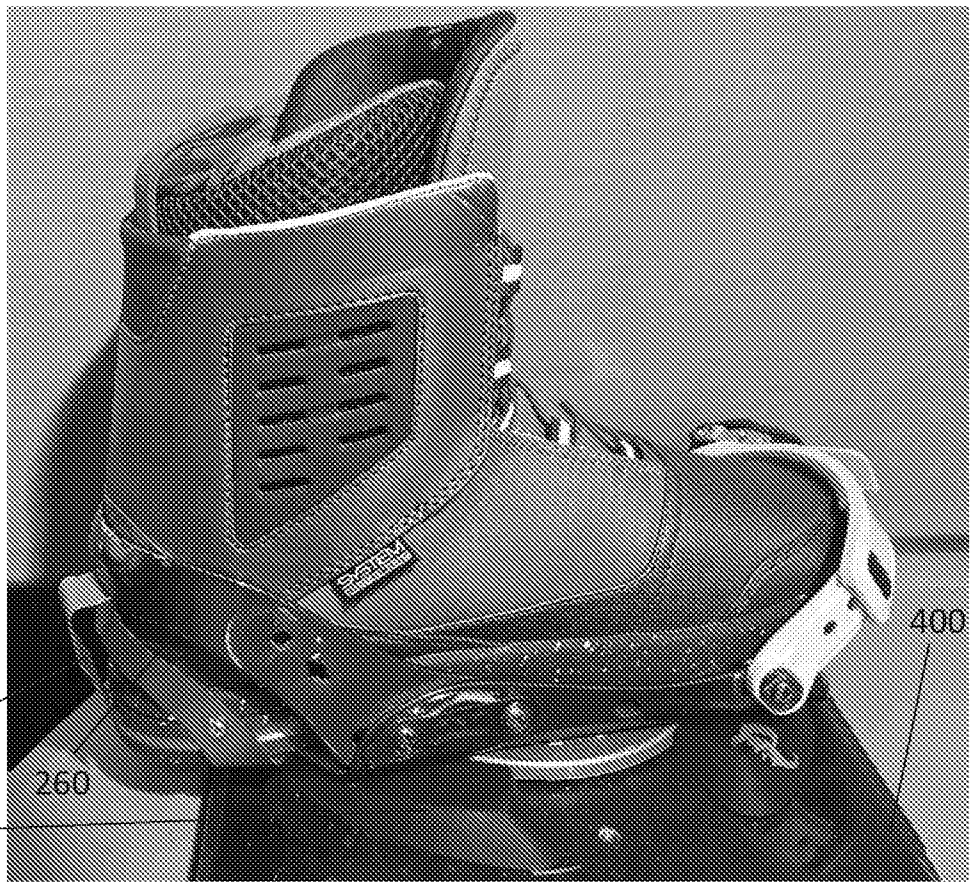
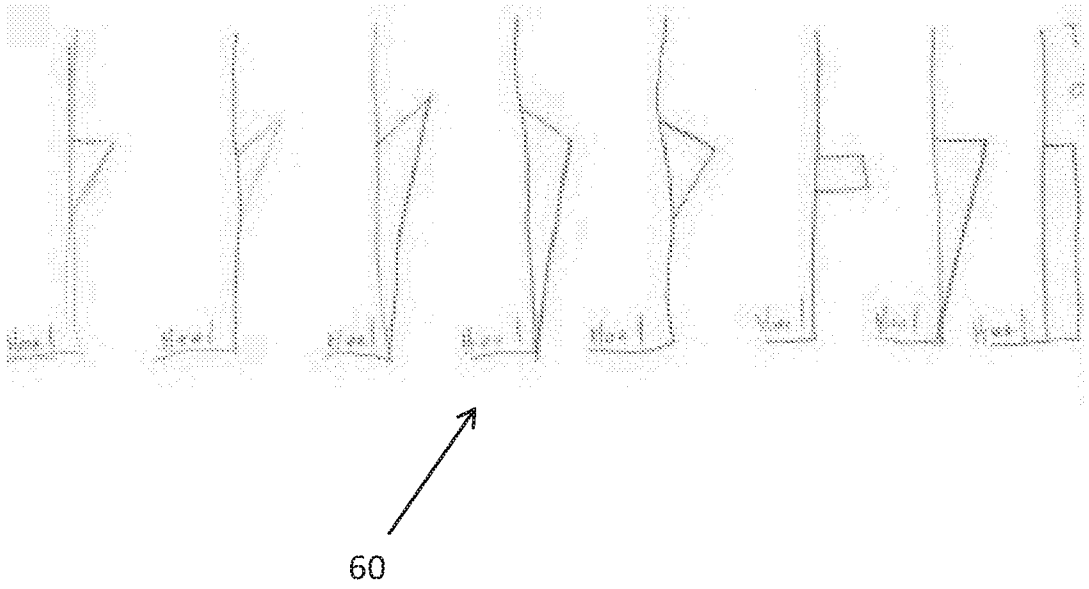


FIG – 13



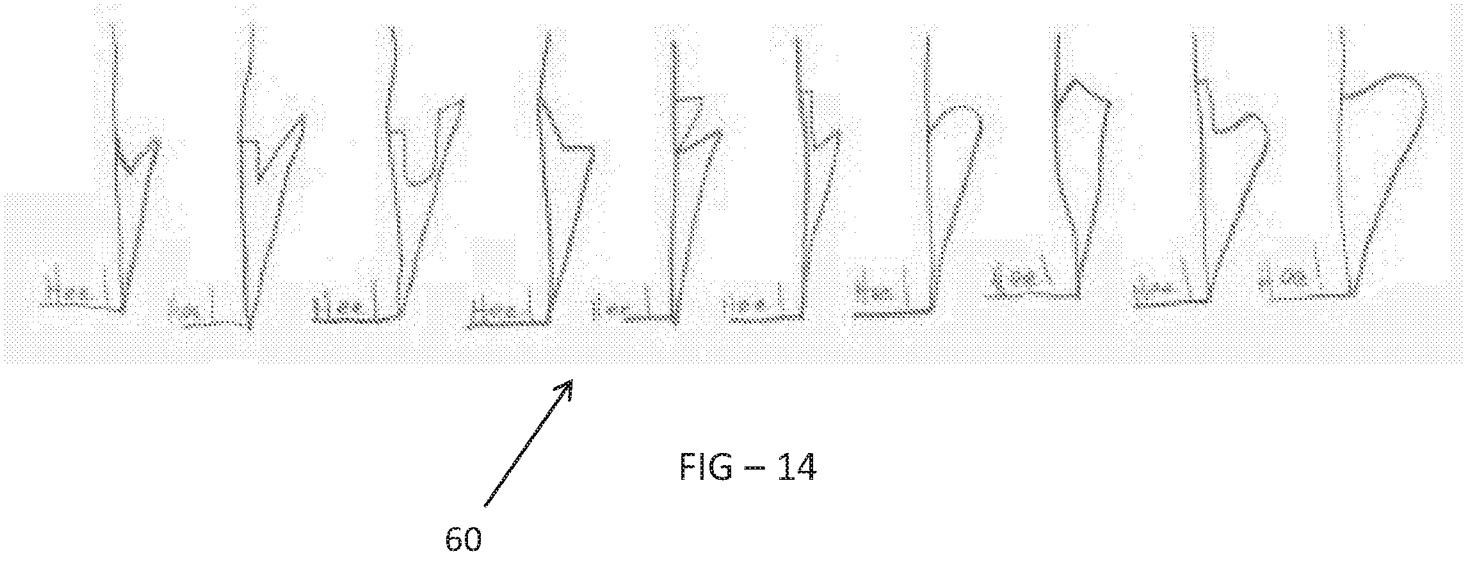


FIG – 14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US17/28685

A. CLASSIFICATION OF SUBJECT MATTER

IPC - A63C 9/08, 9/084, 9/085, 9/086, 9/20, 10/10 (2017.01)

CPC - A63C 9/0805, 9/0807, 9/084, 9/0844, 9/0846, 9/085, 9/086, 9/20, 10/10, 10/103, 10/106

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 9,242,168 B1 (THE BURTON CORPORATION) January 26, 2016; figures 1, 5, 8, 15-17; column 9, lines 25-28; column 11, lines 20-25; column 18, lines 63-67	1, 2, 10-13 --- 3, 4, 20, 21, 24, 25, 27
Y	US 6,213,493 B1 (KORMAN N. M.) April 10, 2001; figure 1; column 4, lines 34-47	3, 4
Y	US 2002/0180182 A1 (DENNIS B. D. et al.) December 5, 2002; abstract; figure 6; paragraphs [0036]-[0038], [0047]	20-22, 24-27
Y	US 5,901,971 A (EATON E. L.) May 11, 1999; abstract; figures 9, 10	20, 22, 25, 26
A	US 2002/0153704 A1 (OKAJIMA S. et al.) October 24, 2002; entire document	1-4, 10-14, 20-27
A	US 2004/0155433 A1 (SANDERS M.) August 12, 2004; entire document	1-4, 10-14, 20-27
A	US 5,474,322 A (PERKINS R. W. et al.) December 12, 1995; entire document	1-4, 10-14, 20-27

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 June 2017 (21.06.2017)	29 AUG 2017
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US17/28685

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
-***-Please See Next Supplemental Box-***-

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-4 AND 10-14 AND 20-27

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/US17/28685

-***-Continued from Box No. III Observations where unity of invention is lacking -***-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-4 AND 10-14 AND 20-27 are directed toward the binding comprising: a substantially flat plate; an arm that connects to the substantially flat plate; and a ledge on a bottom side of the arm that does not move relative to the flat plate.

Group II: Claims 5-9 are directed toward an engagement surface at the top of the device which is angled away from a vertical axis and towards the rear of the boot between 90 degrees and 60 degrees from the vertical axis.

Group III: Claims 15-19 AND 28-30 are directed toward a wedge attached to the central portion of the interior plate and having a bottom portion with a transition portion, a set of opposing teeth on the wedge and central portion of the interior plate which engage at various vertical heights, a female fastener placed within the central portion.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Group I include a boot for releasable engagement with a binding having wedge with a downwardly facing ledge and a toe strap for board sports, the boot comprising: a heel retaining device having an upwardly facing engagement surface at the top of the device which engages with the downwardly facing ledge of the binding to prevent vertical movement of the boot relative to the binding while allowing forward horizontal movement of the boot relative to the binding; the heel retaining device arranged so that when engaging the boot with the binding, the toe portion of the boot can slip underneath a portion of the toe strap while the heel portion of the boot can be lowered vertically until the heel retaining device is below the downwardly facing ledge of the binding; the binding having a substantially flat plate, the toe strap connected to the plate, an arm that connects to the substantially flat plate, and a ledge on a bottom side of the arm that does not move relative to the flat plate and prohibits the boot from moving upward vertically but allows the boot to move forward horizontally; the upwardly facing engagement surface at the top of the device which contacts the ledge on the bottom side of the arm if the boot is lifted upwardly once engaged with the binding, which are not present in Groups II-III.

Group II include a boot for releasable engagement with a binding having a downwardly facing ledge and a toe strap, the boot comprising: the heel retaining device which is angled away from a vertical axis and towards the rear of the boot between 90 degrees and 60 degrees from the vertical axis, which are not present in Groups I and III.

Group III include a boot for releasable engagement with a binding having a downwardly facing ledge, the boot comprising: an exterior wrap layer, a set of opposing teeth on the wedge and central portion of the interior plate which engage at various vertical heights; the heel retaining device comprising an interior plate having a flat portion which is underneath the exterior wrap layer and a central portion which extends rearwardly from the interior plate and is accessible through an aperture in the exterior wrap, a wedge attached to the central portion of the interior plate and having a top portion with an engagement surface and a bottom portion with a transition portion the bottom portion contains a small cross-sectional thickness which transitions to a larger cross-sectional thickness as the wedge moves upwardly towards the engagement surface, a set of opposing teeth on the wedge and central portion of the interior plate which engage at various vertical heights, a female fastener placed within the central portion, and a male fastener which passes through the wedge and the interior plate to engage with the female fastener, the female and male fastener which combine to squeeze the wedge and interior plate together, which are not present in Groups I-II.

The common technical features of Groups I, II and III are a boot for releasable engagement with a binding having a downwardly facing ledge and a toe strap, the boot comprising: a boot having a sole, a toe portion, and a heel portion; and a heel retaining device extending rearwardly from the heel portion of the boot and having an engagement surface at the top of the device; a wedge that extends from the heel portion of the boot and contains a top portion having the engagement surface.

These common technical features are disclosed by US 9,242,168 B1 to The Burton Corporation (hereinafter 'Burton'). Burton discloses a boot (102; figure 1) for releasable engagement with (releasable as shown; figures 1, 2) a binding (104) having a downwardly facing ledge (engagement surface 228 of pawl 222 which is shown to face downward; figure 15) and a toe strap (the bindings may also include a toe strap; column 18, lines 63-67), the boot comprising: a boot (102) having a sole (sole of boot 102 as shown; figure 1; column 6, lines 9-11), a toe portion (right toe portion of boot 102; figure 1), and a heel portion (110); and a heel retaining device (108) extending rearwardly from the heel portion of the boot (extends leftward (rearwardly) from backstay 110 (heel portion) of boot 102 as shown; figure 1) and having an engagement surface (top surface 225a, shown to face upwardly, which engages with engagement surface 228 of pawl 222; figures 8, 17; column 11, lines 20-25) at the top of the device (top surface 225a is near the top of boot engagement member 108 as shown; figures 8, 17); a wedge (serration (wedge) that includes top surface 225a; figures 8, 17) that extends from the heel portion of the boot (as shown; figure 8) and contains a top portion having the engagement surface (the top of the serration (wedge) includes the top surface 225a as shown; figures 8, 17).

Since the common technical features are previously disclosed by the Burton reference, the common features are not special and so Groups I, II and III lack unity.