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(54) **Title:** THUMB BRACE

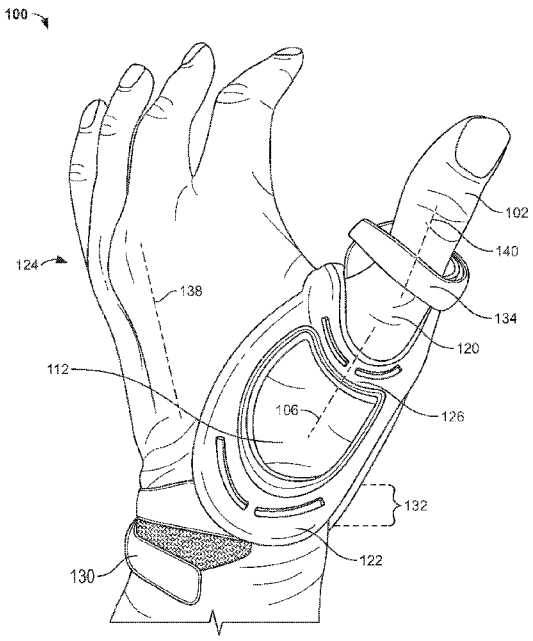

FIG. 2

(57) **Abstract:** A thumb brace for at least partially immobilizing a thumb of a user is provided. The thumb brace includes a first curved support element configured to be disposed on a heel of a hand along an intercarp al articulation of the thumb and in a palmar gutter of the hand. The thumb brace includes a second curved support element coupled to the first curved support element and configured to be disposed on a palm of the hand along a metacarpophalangeal joint of the thumb. The thumb brace includes a third curved support element configured to be disposed on a backside of the hand along the intercarpal articulation of the thumb. The thumb brace includes a fourth curved support element coupled to the third curved support element and configured to be disposed on the backside of the hand along the metacarpophalangeal joint of the thumb. Related methods are also provided.

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THUMB BRACE

BACKGROUND

Field of the Disclosure

[0001] The present disclosure relates to braces for immobilizing an appendage of a user. Specifically, the apparatuses and methods described herein provide a thumb brace for at least partially immobilizing a thumb of the user.

Description of the Related Technology

[0002] Thumb braces have been used in the past to partially or fully immobilize a thumb of a hand of a user in treating or avoiding any number of injuries to the thumb, hand or particular joints of the same. However, conventional thumb braces may be bulky, uncomfortable or extend across a larger portion of the hand than desirable if the user wishes to retain as much use of the affected hand as possible.

[0003] Accordingly, there is a need for solutions that provide a less bulky, more comfortable and less intrusive brace that sufficiently supports, immobilizes and/or protects a thumb, hand, or particular joints of the same while maintaining a greater use of the affected hand.

SUMMARY

[0004] According to some embodiments, a thumb brace for at least partially immobilizing a thumb of a user is provided. The thumb brace includes a first curved support element configured to be disposed on a heel of a hand along an intercarpal articulation of the thumb and in a palmar gutter of the hand. The thumb brace includes a second curved support element coupled to the first curved support element and configured to be disposed on a palm of the hand along a metacarpophalangeal joint of the thumb. The thumb brace includes a third curved support element configured to be disposed on a backside of the hand along the intercarpal articulation of the thumb. The thumb brace includes a fourth curved support element coupled to the third curved support element and configured to be disposed on the backside of the hand along the metacarpophalangeal joint of the thumb.

[0005] According to some other embodiments, a method of using a thumb brace for at least partially immobilizing a thumb of a user is provided. The method includes disposing a

first curved support element on a heel of a hand along an intercarpal articulation of the thumb and in a palmar gutter of the hand. The method includes disposing a second curved support element, coupled to the first curved support element, on a palm of the hand along a metacarpophalangeal joint of the thumb. The method includes disposing a third curved support element on a backside of the hand along the intercarpal articulation of the thumb. The method includes disposing a fourth curved support element, coupled to the third curved support element, on the backside of the hand along the metacarpophalangeal joint of the thumb.

[0006] According to some other embodiments, a method of manufacturing a thumb brace for at least partially immobilizing a thumb of a user is provided. The method includes forming a first curved support element configured to be disposed on a heel of a hand along an intercarpal articulation of the thumb and in a palmar gutter of the hand. The method includes forming a second curved support element coupled to the first curved support element and configured to be disposed on a palm of the hand along a metacarpophalangeal joint of the thumb. The method includes forming a third curved support element configured to be disposed on a backside of the hand along the intercarpal articulation of the thumb. The method includes forming a fourth curved support element coupled to the third curved support element and configured to be disposed on the backside of the hand along the metacarpophalangeal joint of the thumb.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] **FIG. 1** illustrates a palm-side view of at least a portion of a thumb brace for at least partially immobilizing a thumb of a user, according to some embodiments;

[0008] **FIG. 2** illustrates a back-side view of at least a portion of the thumb brace of **FIG. 1**, according to some embodiments;

[0009] **FIG. 3** illustrates a view of at least a portion of the thumb brace of **FIGs. 1** and **2** along a side of the hand defined by a thumb metacarpal of the hand, according to some embodiments;

[0010] **FIG. 4** illustrates a flowchart of a method for using a thumb brace for at least partially immobilizing a thumb of a user, according to some embodiments.

[0011] **FIG. 5** illustrates a flowchart of a method for manufacturing a thumb brace for at least partially immobilizing a thumb of a user, according to some embodiments.

DETAILED DESCRIPTION

[0012] Various aspects of the novel braces and associated methods are described more fully hereinafter with reference to the accompanying drawings. However, the disclosure may contemplate many different forms of such braces and associated methods and should not be construed as limited to any specific structure or function presented throughout this disclosure. Rather, these aspects are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the disclosure to those skilled in the art. Based on the teachings herein one skilled in the art should appreciate that the scope of the disclosure is intended to cover any aspect of the novel braces and methods disclosed herein, whether implemented independently of or combined with any other aspect of the disclosure. For example, a brace may be implemented, or a method may be practiced using any number of the aspects set forth herein. In addition, the scope of the disclosure is intended to cover such a brace or method which is practiced using other structure, functionality, or structure and functionality in addition to or other than the various aspects of the disclosure set forth herein. It should be understood that any aspect disclosed herein may be embodied by one or more elements of a claim.

[0013] Although particular aspects are described herein, many variations and permutations of these aspects fall within the scope of the disclosure. Although some benefits and advantages of the preferred aspects are mentioned, the scope of the disclosure is not intended to be limited to particular benefits, uses, or objectives. Rather, aspects of the disclosure are intended to be broadly applicable to different applications, some of which are illustrated by way of example in the figures and in the following description of the preferred aspects. The detailed description and drawings are merely illustrative of the disclosure rather than limiting, the scope of the disclosure being defined by the appended claims and equivalents thereof.

[0014] Several aspects of a thumb brace for at least partially immobilizing a thumb of a user will now be described in connection with **FIGs. 1-3** together below. **FIG. 1** illustrates a palm-side view of at least a portion of a thumb brace 100 for at least partially immobilizing a thumb 102 of a user, according to some embodiments. **FIG. 2** illustrates a back-side view of at least a portion of thumb brace 100 of **FIG. 1**, according to some embodiments. **FIG. 3** illustrates a view of at least a portion of thumb brace 100 of **FIGs. 1** and **2** along a side of a hand 104 defined by a thumb metacarpal 106 of hand 104, according to some embodiments.

[0015] Thumb brace 100 comprises a first curved support element 108 configured to be disposed on a heel 110 of hand 104 along an intercarpal articulation 112 of thumb 102 and in a palmar gutter 114 of hand 104. First curved support element 108 secures thumb brace 100 within palmar gutter 114 and substantially surrounds at least a proximal portion of a thumb metacarpal 140 on a palm 118 and/or heel 110 of hand 104. Disposing first curved support element 108 along intercarpal articulation 112 of thumb 102 and in palmar gutter 114 of hand 104 ensures first curved support element 108 does not move substantially with respect to hand 104 once secured.

[0016] Thumb brace 100 comprises a second curved support element 116 coupled to first curved support element 108 and configured to be disposed on palm 118 of hand 104 along a metacarpophalangeal joint 120 of thumb 102. Second curved support element 116 substantially surrounds at least a proximal portion of metacarpophalangeal joint 120 of thumb 102 on palm 118 of hand 104 between a thumb phalange 106 and thumb metacarpal 140. Disposing second curved support element 116 on palm 118 of hand 104 along a metacarpophalangeal joint 120 of thumb 102 ensures second curved support element 116 secures thumb phalange 106 at substantially it's most distal extent, thereby providing a greater amount of leverage in preventing thumb 102 from substantially moving with respect to the rest of hand 104 once secured.

[0017] As seen best with reference to Figure 2, thumb brace 100 comprises a third curved support element 122 configured to be disposed on a backside 124 of hand 104 along intercarpal articulation 112 of thumb 102. Third curved support element 122 substantially surrounds a proximal portion of intercarpal articulation 112 of thumb 102 along a backside and/or side of a wrist 132 of hand 104. Disposing third curved support element 122 to substantially surround the proximal portion of intercarpal articulation 112 of thumb 102 along the backside and/or side of wrist 132 of hand 104 ensures third curved support element 122 secures thumb phalange 106 at substantially it's most proximal extent.

[0018] Thumb brace 100 comprises a fourth curved support element 126 coupled to third curved support element 122 and configured to be disposed on backside 124 of hand 104 along metacarpophalangeal joint 120 of thumb 102. Fourth curved support element 126 substantially surrounds at least a proximal portion of metacarpophalangeal joint 120 of thumb 102 on backside 124 of hand 104 between thumb phalange 106 and thumb metacarpal 140. Disposing fourth curved support element 126 on backside 124 of hand 104 along

metacarpophalangeal joint 120 of thumb 102 ensures fourth curved support element 126 secures thumb phalange 106 at substantially it's most distal extent, thereby providing a greater amount of leverage in preventing thumb 102 from substantially moving with respect to the rest of hand 104 once secured.

[0019] In some embodiments, first curved support element 108, second curved support element 116, third curved support element 122, and fourth curved support element 126 may each have a concave curvature that corresponds to a respective local curvature of a portion of hand 104 on which that element is configured to contact, thereby allowing each element 108, 116, 122, 126 to seat securely against respective portions of hand 104 and/or thumb 102.

[0020] In some embodiments, one or more of first curved support element 108, second curved support element 116, third curved support element 122, and fourth curved support element 126 may comprise respective strips of an elastomeric material or a fabric reinforced, internally or externally, with a semi-rigid material, such as metal, for example, aluminum. However, the present disclosure is not so limited and first curved support element 108, second curved support element 116, third curved support element 122, and fourth curved support element 126 may comprise any suitable material and may be reinforced internally, externally, or both with any suitable semi-rigid or rigid material, such as but not limited to plastic, ceramic, or acrylic materials.

[0021] Thumb brace 100 comprises a joining element 128 coupling first curved support element 108, second curved support element 116, third curved support element 122, and fourth curved support element 126 along a side of hand 104 defined by thumb metacarpal 106 of hand 104. Joining element 128 allows first curved support element 108 and second curved support element 116 to align properly on palm 118 and thumb 102 of the hand, and third curved support element 122 and fourth curved support element 126 to align properly on backside 124 and thumb 102 of hand 104. Moreover, joining element 128 ensures that none of first curved support element 108, second curved support element 116, third curved support element 122, and fourth curved support element 126 wrap around thumb 102 from palm 118 to backside 124 of hand 104. As shown in **FIGs. 1-3**, first curved support element 108 does not extend laterally toward a digitus minimus manus (hereinafter, "little finger") 136 of hand 104 substantially beyond palmar gutter 114. Similarly, third curved support element 122 does not extend laterally toward little finger 136 of hand 104 substantially beyond a midline 138 of backside 124 of hand 104. Accordingly, thumb brace 100 does not unnecessarily contact portions of hand 104

that would prevent, hinder or complicate use of hand 104 in ways that do not require substantial movement of thumb 102 with respect to hand 104. In some embodiments, two or more of joining element 128, first curved support element 108, second curved support element 116, third curved support element 122, and fourth curved support element 126 may be formed as a single or unitary piece.

[0022] Thumb brace 100 comprises a first strap 130 coupled to first curved support element 108 and configured to wrap around wrist 132 of hand 104 and couple to third curved support element 122. First strap 130 secures thumb brace 100, and specifically first and third curved support elements 108, 122 and joining element 128 against respective portions of hand 104. Thumb brace 100 comprises a second strap 134 coupled to joining element 128 and configured to wrap around thumb 102 and couple to at least one of second and fourth curved support elements 112, 126. Second strap 134 secures thumb brace 100, and specifically joining element 128 and so second and fourth curved support elements 116, 126 against respective portions of hand 104 and/or thumb 102. By disposing second strap 134 such that it secures to and/or around thumb 102, thumb 102 is secured at a position distal of metacarpophalangeal joint 120 of thumb 102, thereby ensuring substantially immobility of thumb 102 with respect to hand 102.

[0023] First strap 130 and second strap 134 may comprise fabric, leather, plastic, or any other suitable material having sufficient strength and durability to secure portions of thumb brace 100 as described above. In some embodiments, first strap 130 and second strap 134 may comprise hook and loop fasteners, buttons, snaps, pins or any other suitable type of fastener.

[0024] **FIG. 4** illustrates a flowchart 400 of a method for using a thumb brace for at least partially immobilizing a thumb of a user, according to some embodiments. Flowchart 400 will now be described in connection with thumb brace 100 as previously described in connection with **FIGs. 1-3** above.

[0025] Block 402 includes disposing a first curved support element on a heel of a hand along an intercarpal articulation of a thumb and in a palmar gutter of the hand. For example, as previously described in connection with **FIGs. 1-3**, first curved support element 108 may be configured to be disposed on heel 110 of hand 104 along intercarpal articulation 112 of thumb 102 and in palmar gutter 114 of hand 104.

[0026] Block 404 includes disposing a second curved support element, coupled to the first curved support element, on a palm of the hand along a metacarpophalangeal joint of the

thumb. For example, as previously described in connection with **FIGs. 1-3**, second curved support element 116 may be coupled to first curved support element 108 and may be configured to be disposed on palm 118 of hand 104 along metacarpophalangeal joint 120 of thumb 102.

[0027] Block 406 includes disposing a third curved support element on a backside of the hand along the intercarpal articulation of the thumb. For example, as previously described in connection with **FIGs. 1-3**, third curved support element 122 may be configured to be disposed on backside 124 of hand 104 along intercarpal articulation 112 of thumb 102.

[0028] Block 408 includes disposing a fourth curved support element, coupled to the third curved support element, on the backside of the hand along the metacarpophalangeal joint of the thumb. For example, as previously described in connection with **FIGs. 1-3**, fourth curved support element 126 may be coupled to third curved support element 122 and configured to be disposed on backside 124 of hand 104 along metacarpophalangeal joint 120 of thumb 102.

[0029] Block 410 includes disposing a joining element coupling the first curved support element, the second curved support element, the third curved support element, and the fourth curved support element along a side of the hand defined by a thumb metacarpal of the hand. For example, as previously described in connection with **FIGs. 1-3**, joining element 128 may be disposed to couple first curved support element 108, second curved support element 116, third curved support element 122, and fourth curved support element 126 along a side of hand 104 defined by thumb metacarpal 106 of hand 104.

[0030] Block 412 includes wrapping a first strap, coupled to the first curved support element, around a wrist of the hand and coupling the first strap to the third curved support element. For example, as previously described in connection with **FIGs. 1-3**, first strap 130 may be coupled to first curved support element 108 and first strap 130 may be configured to wrap around wrist 132 of hand 104 and couple to third curved support element 122.

[0031] Block 414 includes wrapping a second strap, coupled to the joining element, around the thumb and coupling the second strap to at least one of the second and fourth curved support elements. For example, as previously described in connection with **FIGs. 1-3**, second strap 134 may be coupled to joining element 128 and second strap 134 may be configured to wrap around thumb 102 and may be coupled to at least one of second and fourth curved support elements 116, 126.

[0032] **FIG. 5** illustrates a flowchart 500 of a method for manufacturing a thumb brace for at least partially immobilizing a thumb of a user, according to some embodiments.

Flowchart 500 will now be described in connection with thumb brace 100 as previously described in connection with **FIGs. 1-3** above.

[0033] Block 502 includes forming a first curved support element configured to be disposed on a heel of a hand along an intercarpal articulation of the thumb and in a palmar gutter of the hand. For example, as previously described in connection with **FIGs. 1-3**, upon proper formation, first curved support element 108 may be configured to be disposed on heel 110 of hand 104 along intercarpal articulation 112 of thumb 102 and in palmar gutter 114 of hand 104.

[0034] Block 504 includes forming a second curved support element coupled to the first curved support element and configured to be disposed on a palm of the hand along a metacarpophalangeal joint of the thumb. For example, as previously described in connection with **FIGs. 1-3**, upon proper formation, second curved support element 116 may be coupled to first curved support element 108 and may be configured to be disposed on palm 118 of hand 104 along metacarpophalangeal joint 120 of thumb 102.

[0035] Block 506 includes forming a third curved support element configured to be disposed on a backside of the hand along the intercarpal articulation of the thumb. For example, as previously described in connection with **FIGs. 1-3**, upon proper formation, third curved support element 122 may be configured to be disposed on backside 124 of hand 104 along intercarpal articulation 112 of thumb 102.

[0036] Block 508 includes forming a fourth curved support element coupled to the third curved support element and configured to be disposed on the backside of the hand along the metacarpophalangeal joint of the thumb. For example, as previously described in connection with **FIGs. 1-3**, upon proper formation, fourth curved support element 126 may be coupled to third curved support element 122 and may be configured to be disposed on backside 124 of hand 104 along metacarpophalangeal joint 120 of thumb 102.

[0037] Block 510 includes forming a joining element coupling the first curved support element, the second curved support element, the third curved support element, and the fourth curved support element along a side of the hand defined by a thumb metacarpal of the hand. For example, as previously described in connection with **FIGs. 1-3**, upon proper formation, joining element 128 may couple first curved support element 108, second curved support element 116, third curved support element 122, and fourth curved support element 126 along a side of hand 104 defined by thumb metacarpal 106 of hand 104.

[0038] Block 512 includes coupling a first strap to the first curved support element such that the first strap is configured to wrap around a wrist of the hand and couple to the third curved support element. For example, as previously described in connection with **FIGs. 1-3**, upon proper coupling, first strap 130 may be coupled to first curved support element 108 and first strap 130 may be configured to wrap around wrist 132 of hand 104 and couple to third curved support element 122.

[0039] Block 514 includes coupling a second strap to the joining element such that the second strap is configured to wrap around the thumb and couple to at least one of the second and fourth curved support elements. For example, as previously described in connection with **FIGs. 1-3**, upon proper coupling, second strap 134 may be coupled to joining element 128 and second strap 134 may be configured to wrap around thumb 102 and may be coupled to at least one of second and fourth curved support elements 116, 126.

[0040] Various modifications to the implementations described in this disclosure can be readily apparent to those skilled in the art, and any generic principles defined herein can be applied to other implementations without departing from the spirit or scope of this disclosure. Thus, the disclosure is not intended to be limited to the implementations shown herein but is to be accorded the widest scope consistent with the claims, the principles and the novel features disclosed herein. The word "exemplary" is used exclusively herein to mean "serving as an example, instance, or illustration." Any implementation described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other implementations.

[0041] Certain features that may be described in the context of separate implementations also can be implemented in combination in a single implementation. Conversely, various features that are described in the context of a single implementation also can be implemented in multiple implementations separately or in any suitable sub-combination. Moreover, although features can be described above as acting in certain combinations and even initially claimed as such, one or more features from a claimed combination can in some cases be excised from the combination, and the claimed combination can be directed to a sub-combination or variation of a sub-combination.

[0042] In addition, the methods disclosed herein comprise one or more steps or actions for achieving the described method. The method steps and/or actions may be interchanged with one another without departing from the scope of the claims. In other words, unless a

specific order of steps or actions is specified, the order and/or use of specific steps and/or actions may be modified without departing from the scope of the claims.

[0043] While the foregoing is directed to aspects of the present disclosure, other and further aspects of the disclosure may be devised without departing from the basic scope thereof, and the scope thereof is determined by the claims that follow.

WHAT IS CLAIMED IS:

1. A thumb brace (100) for at least partially immobilizing a thumb (102) of a user, comprising:

a first curved support element (108) configured to be disposed on a heel (110) of a hand (104) along an intercarpal articulation (112) of the thumb and in a palmar gutter (114) of the hand;

a second curved support element (116) coupled to the first curved support element and configured to be disposed on a palm (118) of the hand along a metacarpophalangeal joint (120) of the thumb;

a third curved support element (122) configured to be disposed on a backside (124) of the hand along the intercarpal articulation of the thumb; and

a fourth curved support element (126) coupled to the third curved support element and configured to be disposed on the backside of the hand along the metacarpophalangeal joint of the thumb.

2. The thumb brace of claim 1, further comprising a joining element (128) coupling the first curved support element, second curved support element 116, the third curved support element, and the fourth curved support element along a side of the hand defined by a thumb metacarpal (106) of the hand.

3. The thumb brace of claim 1, further comprising a first strap (130) coupled to the first curved support element, the first strap configured to wrap around a wrist (132) of the hand and couple to the third curved support element.

4. The thumb brace of claim 2, further comprising a second strap (134) coupled to the joining element, the second strap configured to wrap around the thumb and coupled to at least one of the second and fourth curved support elements.

5. The thumb brace of claim 1, wherein one or more of the first curved support element, the second curved support element, the third curved support element, and the fourth curved support element has a concave curvature.

6. The thumb brace of claim 5, wherein the concave curvature corresponds to a respective local curvature of a portion of the hand on which at least one of the one or more of the first, second, third and fourth curved support elements is configured to contact.

7. The thumb brace of claim 1, wherein the first curved support element does not extend laterally toward a little finger (136) of the hand substantially beyond the palmar gutter.

8. The thumb brace of claim 1, wherein the third curved support element does not extend laterally toward a little finger (136) of the hand substantially beyond a midline (138) of the hand.

9. The thumb brace of claim 1, wherein the first curved support element substantially surrounds at least a proximal portion of a thumb metacarpal (140) on the palm and/or the heel of the hand.

10. The thumb brace of claim 1, wherein second curved support element 116 substantially surrounds at least a proximal portion of the metacarpophalangeal joint of the thumb on the palm of the hand between a thumb phalange (106) and a thumb metacarpal (140).

11. The thumb brace of claim 1, wherein the third curved support element substantially surrounds a proximal portion of the intercarpal articulation of the thumb along a backside and/or a side of a wrist (132) of the hand.

12. The thumb brace of claim 1, wherein the fourth curved support element substantially surrounds at least a proximal portion of the metacarpophalangeal joint of the thumb on the backside of the hand between a thumb phalange (106) and a thumb metacarpal (140).

13. The thumb brace of claim 1, wherein the first, second, third and fourth curved support elements comprise strips of an elastomeric material or a fabric, the elastomeric material or the fabric reinforced with a semi-rigid material.

14. The thumb brace of claim 1, wherein none of the first, second, third or fourth curved support elements wrap around the thumb from the palm to the backside of the hand.

15. A method of using a thumb brace (100) for at least partially immobilizing a thumb (102) of a user, the method comprising:

disposing a first curved support element (108) on a heel (110) of a hand (104) along an intercarpal articulation (112) of the thumb and in a palmar gutter (114) of the hand;

disposing a second curved support element (116), coupled to the first curved support element, on a palm (118) of the hand along a metacarpophalangeal joint (120) of the thumb;

disposing a third curved support element (122) on a backside (124) of the hand along the intercarpal articulation of the thumb; and

disposing a fourth curved support element (126), coupled to the third curved support element, on the backside of the hand along the metacarpophalangeal joint of the thumb.

16. The method of claim 15, further comprising disposing a joining element (128) coupling the first curved support element, the second curved support element, the third curved support element, and the fourth curved support element along a side of the hand defined by a thumb metacarpal (106) of the hand.

17. The method of claim 15, further comprising at least one of:

wrapping a first strap (130), coupled to the first curved support element, around a wrist (132) of the hand and coupling the first strap to the third curved support element; and

wrapping a second strap (134), coupled to the joining element, around the thumb and coupling the second strap to at least one of the second and fourth curved support elements.

18. A method of manufacturing a thumb brace (100) for at least partially immobilizing a thumb (102) of a user, the method comprising:

forming a first curved support element (108) configured to be disposed on a heel (110) of a hand (104) along an intercarpal articulation (112) of the thumb and in a palmar gutter (114) of the hand;

forming a second curved support element (116) coupled to the first curved support element and configured to be disposed on a palm (118) of the hand along a metacarpophalangeal joint (120) of the thumb;

forming a third curved support element (122) configured to be disposed on a backside (124) of the hand along the intercarpal articulation of the thumb; and

forming a fourth curved support element (126) coupled to the third curved support element and configured to be disposed on the backside of the hand along the metacarpophalangeal joint of the thumb.

19. The method of claim 18, further comprising forming a joining element (128) coupling the first curved support element, the second curved support element, the third curved support element, and the fourth curved support element along a side of the hand defined by a thumb metacarpal (106) of the hand.

20. The method of claim 18, further comprising at least one of:

coupling a first strap (130) to the first curved support element such that the first strap is configured to wrap around a wrist (132) of the hand and couple to the third curved support element; and

coupling a second strap (134) to the joining element such that the second strap is configured to wrap around the thumb and couple to at least one of the second and fourth curved support elements.

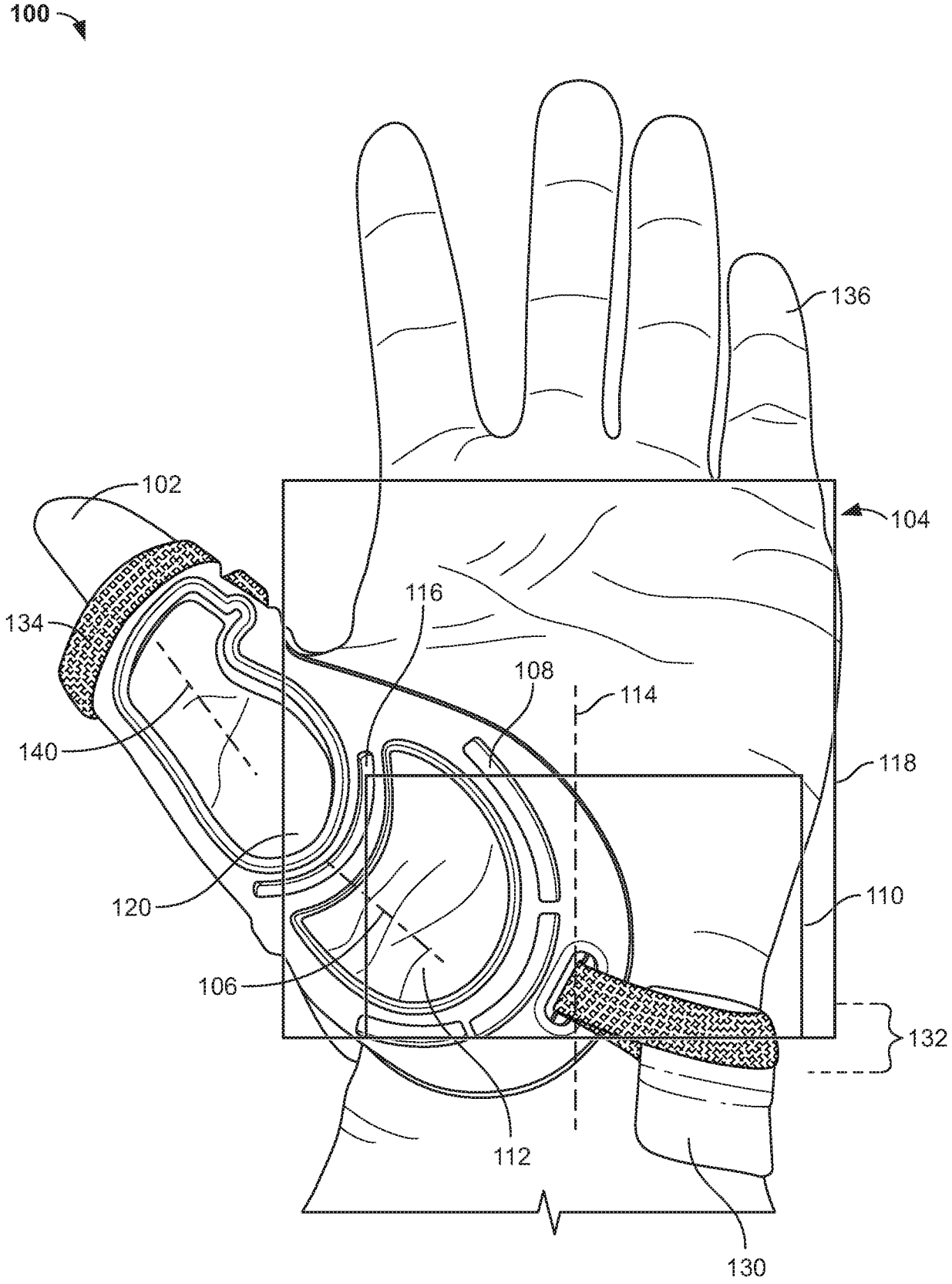

FIG. 1

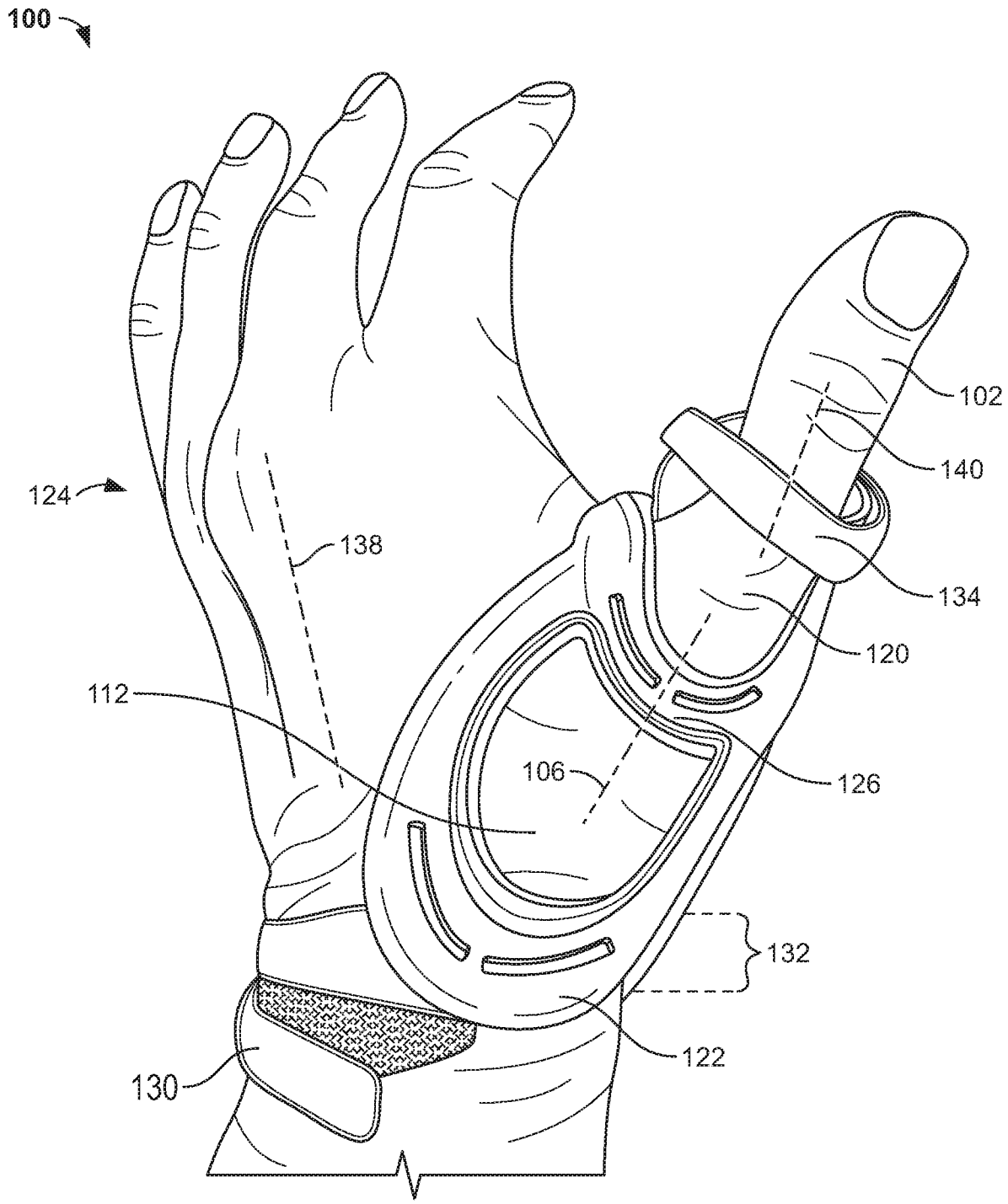

FIG. 2

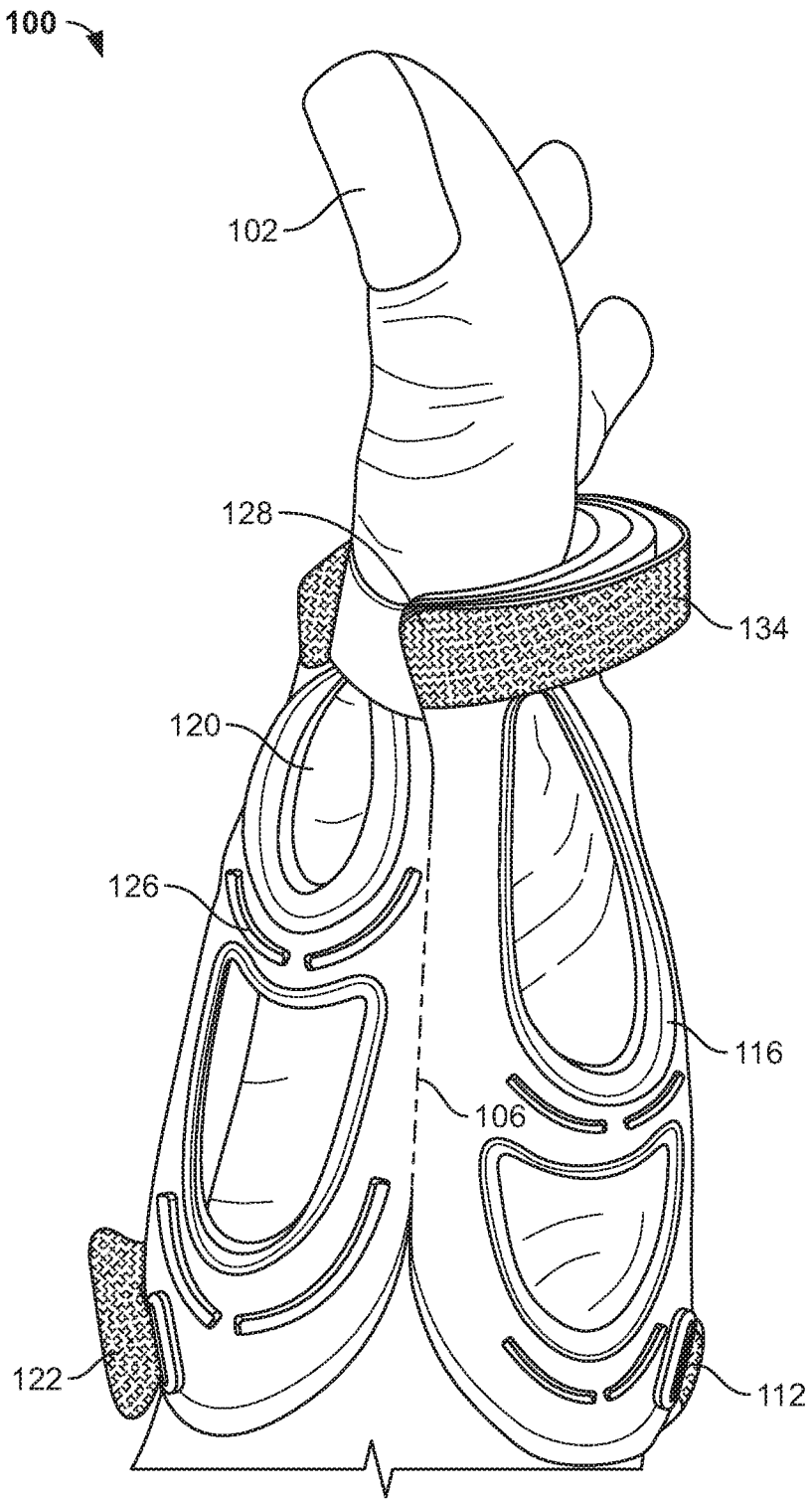

FIG. 3

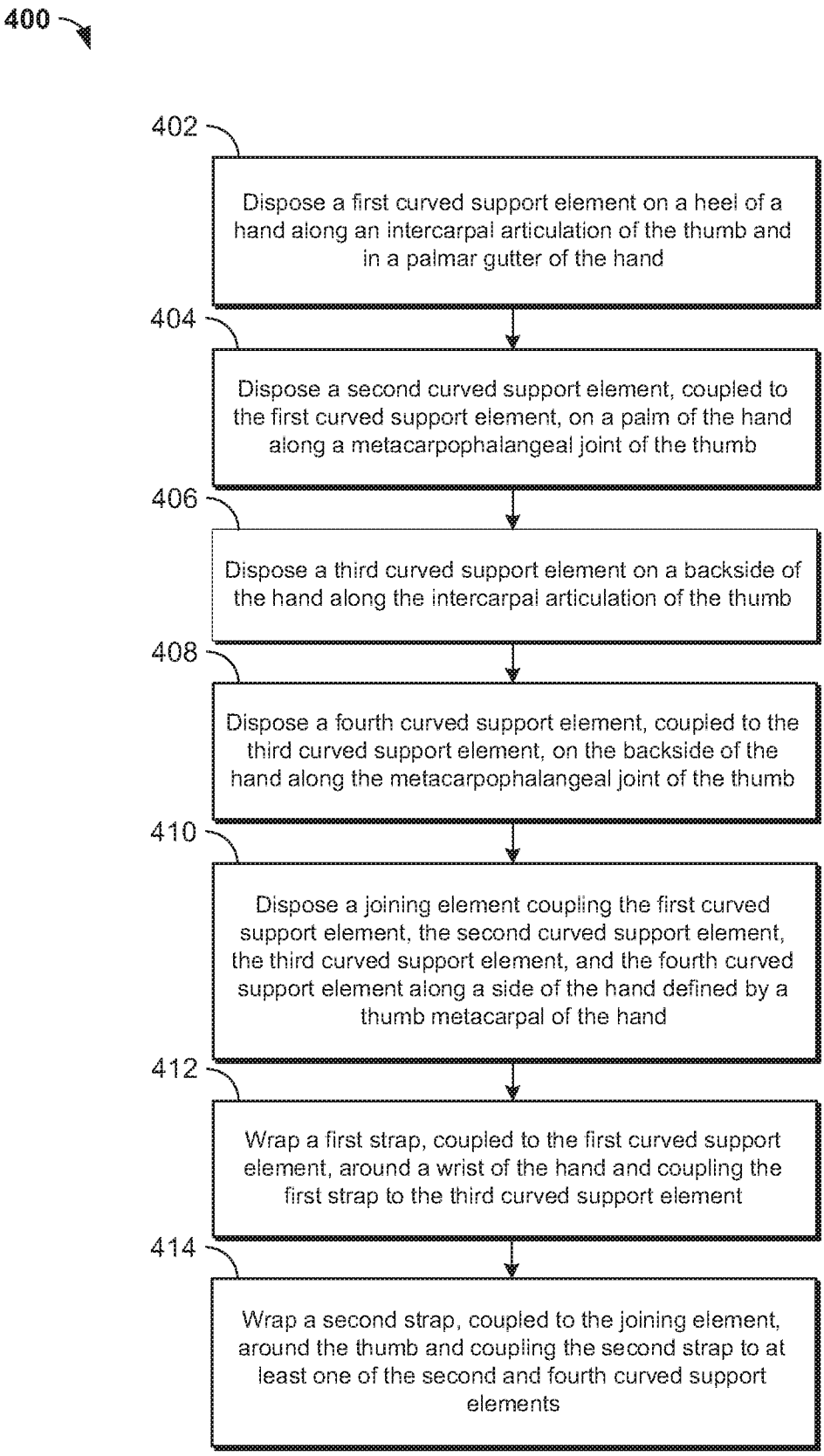
400
402
Dispose a first curved support element on a heel of a hand along an intercarpal articulation of the thumb and in a palmar gutter of the hand
404
Dispose a second curved support element, coupled to the first curved support element, on a palm of the hand along a metacarpophalangeal joint of the thumb
406
Dispose a third curved support element on a backside of the hand along the intercarpal articulation of the thumb
408
Dispose a fourth curved support element, coupled to the third curved support element, on the backside of the hand along the metacarpophalangeal joint of the thumb
410
Dispose a joining element coupling the first curved support element, the second curved support element, the third curved support element, and the fourth curved support element along a side of the hand defined by a thumb metacarpal of the hand
412
Wrap a first strap, coupled to the first curved support element, around a wrist of the hand and coupling the first strap to the third curved support element
414
Wrap a second strap, coupled to the joining element, around the thumb and coupling the second strap to at least one of the second and fourth curved support elements

FIG. 4

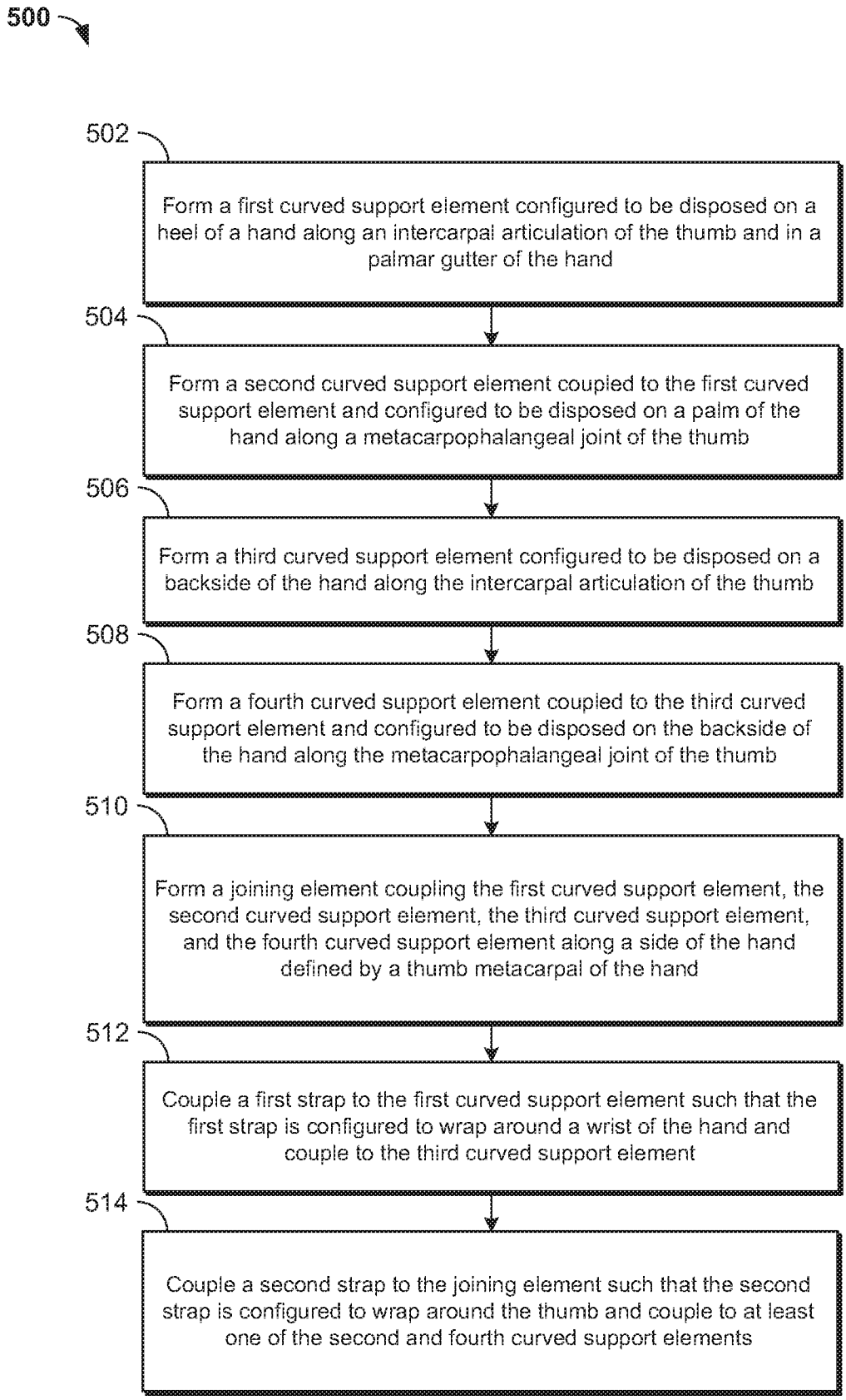
500
502
Form a first curved support element configured to be disposed on a heel of a hand along an intercarpal articulation of the thumb and in a palmar gutter of the hand
504
Form a second curved support element coupled to the first curved support element and configured to be disposed on a palm of the hand along a metacarpophalangeal joint of the thumb
506
Form a third curved support element configured to be disposed on a backside of the hand along the intercarpal articulation of the thumb
508
Form a fourth curved support element coupled to the third curved support element and configured to be disposed on the backside of the hand along the metacarpophalangeal joint of the thumb
510
Form a joining element coupling the first curved support element, the second curved support element, the third curved support element, and the fourth curved support element along a side of the hand defined by a thumb metacarpal of the hand
512
Couple a first strap to the first curved support element such that the first strap is configured to wrap around a wrist of the hand and couple to the third curved support element
514
Couple a second strap to the joining element such that the second strap is configured to wrap around the thumb and couple to at least one of the second and fourth curved support elements

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2019/043441

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. [X] Claims Nos.: 15-17
because they relate to subject matter not required to be searched by this Authority, namely:

see FURTHER INFORMATION sheet PCT/ISA/210

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:

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 an 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.:

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

International application No
PCT/US2019/043441

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61F5/01 A61F5/058
ADD.

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)
A61F

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2017/348191 A1 (SALSTEIN-BEGLEY KAREN [US] ET AL) 7 December 2017 (2017-12-07) Figures	1-3, 7-14, 18-20
X	WO 2013/160478 A1 (BSN MEDICAL GMBH [DE]) 31 October 2013 (2013-10-31) Figures	1-3, 7-14, 18-20
A	NL 2 016 047 B1 (WE DESIGN B V [NL]) 13 March 2017 (2017-03-13) the whole document	1-14, 18-20

☐ 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
27 November 2019	04/12/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Foged, Søren

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2019/043441

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2017348191 A1	07-12-2017	US 2017348191 A1	07-12-2017
		WO 2018039649 A1	01-03-2018
WO 2013160478 A1	31-10-2013	AU 2013254634 A1	04-12-2014
		BR 112014026489 A2	27-06-2017
		CA 2875407 A1	31-10-2013
		CN 104519839 A	15-04-2015
		CN 108095881 A	01-06-2018
		DE 102012008565 A1	31-10-2013
		EP 2841030 A1	04-03-2015
		US 2015157483 A1	11-06-2015
		US 2019053931 A1	21-02-2019
		WO 2013160478 A1	31-10-2013
NL 2016047 B1	13-03-2017	---	---

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.1

Claims Nos.: 15-17

Claims 15-17 relate to subject-matter considered by this Authority to be covered by the provisions of Rule 67.1(iv) PCT. Consequently, no opinion will be formulated with respect to the industrial applicability of the subject-matter of these claims (Article 34(4)(a)(I) PCT) which are also not searched, see Rule 39.1(iv) PCT (method for treatment of the human or animal body by surgery and possibly by therapy, in this case a method of using a thumb brace for at least partially immobilizing a thumb of a user).