

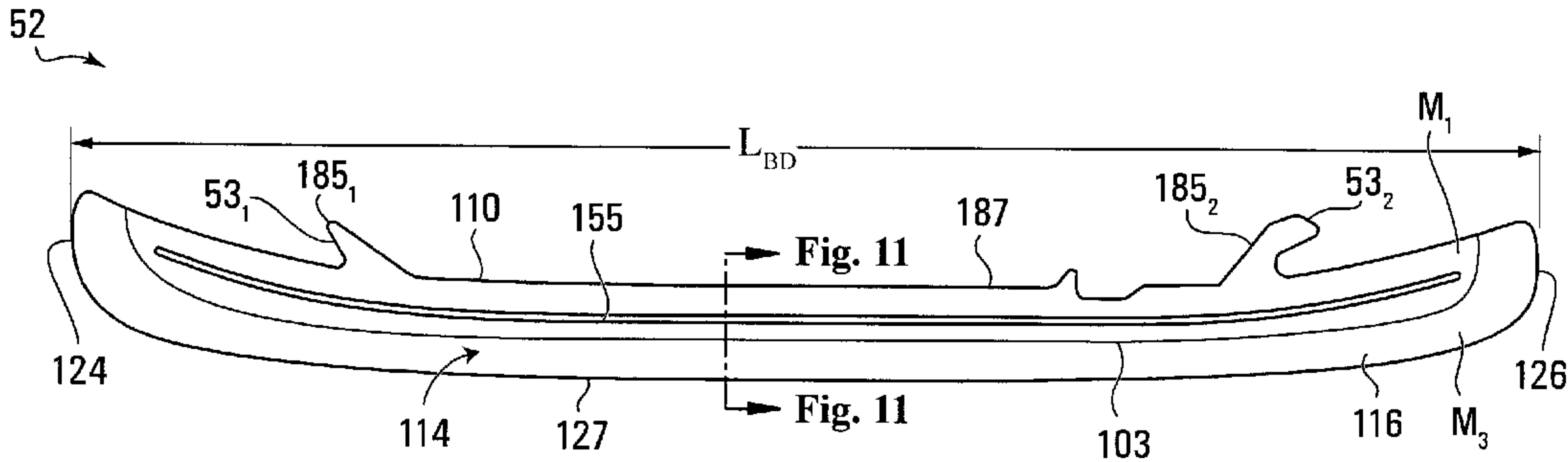


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(57) **Abrégé/Abstract:**
A blade for an ice skate (e.g., for playing hockey). The ice skate comprises a skate boot for receiving a foot of a user and a blade holder for holding the blade. The blade may be designed to be lightweight yet strong and possibly provide other performance benefits to the user, including by being made of different materials (e.g., at least three different materials) that are strategically arranged and secured to one another.

ABSTRACT

A blade for an ice skate (e.g., for playing hockey). The ice skate comprises a skate boot for receiving a foot of a user and a blade holder for holding the blade. The
5 blade may be designed to be lightweight yet strong and possibly provide other performance benefits to the user, including by being made of different materials (e.g., at least three different materials) that are strategically arranged and secured to one another.

ICE SKATE BLADE

FIELD

- 5 The invention generally relates to ice skating and, more particularly, to ice skates and their blade.

BACKGROUND

- 10 An ice skate includes a skate boot for receiving a user's foot and a blade holder connecting a blade to the skate boot such that the blade engages ice while the user skates.

The blade has to be tough as it is subject to harsh conditions, including significant
15 forces while the user skates and corrosive effects because it contacts the ice, yet should not be too heavy or bulky as this can affect skating performance. While many different types of blades have been developed, these conflicting considerations continue to pose challenges.

- 20 For these and/or other reasons, there is a need to improve ice skates, including their blades.

SUMMARY

- 25 In accordance with various aspects of the invention, there is provided a blade for an ice skate (e.g., for playing hockey). The ice skate comprises a skate boot for receiving a foot of a user and a blade holder for holding the blade. The blade may be designed to be lightweight yet strong and possibly provide other performance benefits to the user, including by being made of different materials (e.g., at least
30 three different materials) that are strategically arranged and secured to one another.

For example, in accordance with an aspect of the invention, there is provided a blade for an ice skate. The ice skate comprises a skate boot for receiving a foot of a user and a blade holder for holding the blade. The blade comprises a polymeric upper member and a metallic ice-contacting lower member secured to the polymeric upper member. The metallic-ice contacting lower member comprises a metallic base comprising an ice-contacting surface and a metallic anchor affixed to the metallic base and the polymeric upper member.

In accordance with another aspect of the invention, there is provided a blade for an ice skate. The ice skate comprises a skate boot for receiving a foot of a user and a blade holder for holding the blade. The blade comprises a polymeric upper member and a metallic ice-contacting lower member secured to the polymeric upper member. The metallic ice-contacting lower member comprises a metallic base comprising an ice-contacting surface and a metallic anchor welded to the metallic base and bonded to the polymeric upper member.

In accordance with another aspect of the invention, there is provided a blade for an ice skate. The ice skate comprises a skate boot for receiving a foot of a user and a blade holder for holding the blade. The blade comprises an upper member and an ice-contacting lower member secured to the upper member. The ice-contacting lower member comprises a base comprising an ice-contacting surface and an anchor affixed to the base and the upper member. The upper member comprises a first material. The base comprises a second material different from the first material. The anchor comprises a third material different from the first material and the second material.

In accordance with another aspect of the invention, there is provided a blade for an ice skate. The ice skate comprises a skate boot for receiving a foot of a user and a blade holder for holding the blade. The blade comprises at least three materials that are different from one another.

These and other aspects of the invention will now become apparent to those of ordinary skill in the art upon review of the following description of embodiments of the invention in conjunction with the accompanying drawings.

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BRIEF DESCRIPTION OF THE DRAWINGS

A detailed description of embodiments of the invention is provided below, by way of example only, with reference to the following drawings, in which:

10 Figure 1 is a perspective view of an example of an ice skate comprising a blade in accordance with an embodiment of the invention;

Figure 2 is an exploded view of the ice skate, including a skate boot, a blade holder, and the blade;

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Figures 3 to 9 are various views of the blade holder;

Figure 10 is a side elevation view of the blade, including an upper member and an ice-contacting lower member of the blade;

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Figure 11 is a cross-sectional view of the blade as shown in Figure 10;

Figure 12 is a side elevation view of the ice-contacting lower member of the blade;

25 Figure 13 is a cross-sectional view of the ice-contacting lower member of the blade as shown in Figure 12;

Figure 14 shows a material of the upper member in an example in which the material is a composite material;

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Figure 15 shows an example in which there is an adhesive between the upper member

and the ice-contacting lower member;

Figures 16A to 16C are partial cross-sectional views showing a blade-detachment mechanism of the blade holder;

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Figure 17 shows a variant in which an anchor of the ice-contacting lower member is fastened to a base of the ice-contacting lower member by a mechanical fastener;

10 Figure 18 shows a variant in which the material of the upper member is a composite material comprising chopped fibers;

Figure 19 shows a variant in which the material of the upper member is unreinforced;

15 Figures 20 to 23 show examples of variants of ways in which the blade holder may retain the blade;

Figures 24 and 25 show an example of a variant of the blade;

20 Figure 26 shows a cross-section of the blade in an example of a variant in which the anchor and the base are integral with one another;

Figure 27 shows a cross-section of the blade in an example of a variant in which the base comprises a plurality of layers sandwiching the anchor;

25 Figure 28 shows a cross-section of the blade in an example of a variant in which the anchor comprises a plurality of outer layers and an inner layer disposed between the outer layers;

30 Figure 29 shows a cross-section of the blade in an example of a variant in which the upper member is disposed between external layers;

Figure 30 shows a cross-section of the blade in an example of a variant in which the upper member and the base are disposed between external layers;

Figure 31 shows a cross-section of the blade in accordance with an embodiment in which a projection on each lateral surface of the upper member comprises an insert;

Figure 32 shows a side elevation view of the ice-contacting lower member in an example of a variant in which the anchor extends along a majority of a height of the upper member of the blade;

Figure 33 shows a cross-section of the blade of Figure 32;

Figures 34 and 35 show cross-sections of the blade in examples of a variant in which the anchor comprises a plurality of anchor elements affixed to the base;

Figure 36 shows a cross-section of the blade in an example of a variant in which a space between the anchor elements comprises a material different than a material of the upper member;

Figure 37 shows a cross-section of the blade in an example of a variant in which the anchor elements of the anchor define lateral surfaces of the upper member of the blade;

Figure 38 shows a cross-section of the blade in an example of a variant in which the anchor extends along the majority of the height of the upper member of the blade and the projection on each lateral surface of the upper member comprises an insert;

Figure 39 shows a side elevation view of the ice-contacting lower member of the blade in an example of a variant in which connectors configured to connect the blade to the blade holder are affixed to the anchor; and

Figures 40 and 41 are side and front views of a foot of a user with an integument of the foot shown in dotted lines and bones shown in solid lines.

In the drawings, embodiments of the invention are illustrated by way of example. It is to
 5 be expressly understood that the description and drawings are only for purposes of illustration and as an aid to understanding, and are not intended to be a definition of the limits of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS

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Figures 1 and 2 show an example of an ice skate 10 comprising a blade 52 for contacting ice 15 on which a user skates, in accordance with an embodiment of the invention. The ice skate 10 comprises a skate boot 11 for enclosing a foot of the user and a blade holder 28 for holding the blade 52. In this embodiment, the ice skate 10 is
 15 a hockey skate designed for playing ice hockey. In other embodiments, the ice skate 10 may be designed for other types of skating activities.

As further discussed below, in this embodiment, the blade 52 is designed to be lightweight yet strong and possibly provide other performance benefits to the user,
 20 including by being made of different materials (e.g., at least three different materials) that are strategically arranged and secured to one another.

The skate boot 11 defines a cavity 26 for receiving the user's foot. With additional reference to Figures 40 and 41, the user's foot includes toes T, a ball B, an arch ARC,
 25 a plantar surface PS, a top surface TS, a medial side MS and a lateral side LS. The top surface TS of the user's foot is continuous with a lower portion of the user's shin S. In addition, the user has a heel H, an Achilles tendon AT, and an ankle A having a medial malleolus MM and a lateral malleolus LM that is at a lower position than the medial malleolus MM. The Achilles tendon AT has an upper part UP and a lower part LP
 30 projecting outwardly with relation to the upper part UP and merging with the heel H. A forefoot of the user includes the toes T and the ball B, a hindfoot of the user includes

the heel H, and a midfoot of the user is between the forefoot and midfoot.

In this embodiment, the skate boot 11 comprises a front portion 17 for receiving the toes T of the user's foot, a rear portion 19 for receiving the heel H of the user's foot,
5 and an intermediate portion 21 between the front portion 17 and the rear portion 19.

More particularly, in this embodiment, the skate boot 11 comprises an outer shell 12, a toe cap 14 for facing the toes T, a tongue 16 extending upwardly and rearwardly from the toe cap 14 for covering the top surface TS of the user's foot, a rigid insert 18 for
10 providing more rigidity around the ankle A and the heel H of the user's foot, an inner lining 20, a footbed 22, and an insole 24. The skate boot 11 also comprises lace members 38 and eyelets 42 punched into the lace members 38, the outer shell 12 and the inner lining 20 vis-à-vis apertures 40 in order to receive a lace for tying on the skate
10.

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The outer shell 12 comprises a heel portion 44 for receiving the heel H, an ankle portion 46 for receiving the ankle A, and medial and lateral side portions 50, 60 for facing the medial and lateral sides MS, LS of the user's foot, respectively. In this embodiment, the outer shell 12 is molded (e.g., thermoformed) to form its heel portion
20 44, its ankle portion 46, and its medial and lateral side portions 50, 60. In this example, the medial and lateral side portions 50, 60 include upper edges 51, 61 which connect to the lace members 38. The heel portion 44 may be formed such that it is substantially cup-shaped for following the contour of the heel H. The ankle portion 46 comprises medial and lateral ankle sides 52, 54. The medial ankle side 52 has a medial cup-shaped depression 56 for receiving the medial malleolus MM and the lateral ankle side
25 54 has a lateral cup-shaped depression 58 for receiving the lateral malleolus LM of the user. The lateral depression 58 is located slightly lower than the medial depression 56, for conforming to the morphology of the user's foot. The ankle portion 46 further comprises a rear portion 47 facing the lower part LP of the Achilles tendon AT. The
30 rear portion 47 may be thermoformed such that it follows the lower part LP of the Achilles tendon AT. Furthermore, the skate boot 11 also includes a tendon guard 43

affixed to the rear portion 47 of the ankle portion 46 and extending upwardly therefrom.

The inner lining 20 is affixed to an inner surface of the outer shell 12 and comprises an inner surface 32 intended for contact with the heel H and medial and lateral sides MS, LS of the user's foot and the user's ankle A in use. The inner lining 20 may be made of a soft material (e.g., a fabric made of NYLON® fibers or any other suitable fabric). The rigid insert 18 is sandwiched between the outer shell 12 and the inner lining 20 and may be affixed in any suitable way (e.g., glued to the inner surface of the outer shell 12 and stitched along its periphery to the outer shell 12). The footbed 22 is mounted inside the outer shell 12 and comprises an upper surface 34 for receiving the plantar surface PS of the user's foot and a wall 36 projecting upwardly from the upper surface 34 to partially cup the heel H and extend up to a medial line of the user's foot. The insole 24 has an upper surface 25 for facing the plantar surface PS of the user's foot and a lower surface 23 on which the outer shell 12 may be affixed.

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The skate boot 11 may be constructed in any other suitable way in other embodiments. For example, in other embodiments, various components of the skate boot 11 mentioned above may be configured differently or omitted and/or the skate boot 11 may comprise any other components that may be made of any other suitable materials and/or using any other suitable processes.

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With additional reference to Figures 3 to 9, the blade holder 28 comprises a lower portion 64 comprising a blade-retaining base 80 that retains the blade 52 and an upper portion 62 comprising a support 82 that extends upwardly from the blade-retaining base 80 towards the skate boot 11 to interconnect the blade holder 28 and the skate boot 11. A front portion 66 of the blade holder 28 and a rear portion 68 of the blade holder 28 define a longitudinal axis 65 of the blade holder 28. The front portion 66 of the blade holder 28 includes a front 154 of the blade holder 28 and extends beneath and along the user's forefoot in use, while the rear portion 68 of the blade holder 28 includes a rear 156 of the blade holder 28 and extends beneath and along the user's hindfoot in use. An intermediate portion 74 of the blade holder 28 is

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between the front and rear portions 66, 68 of the blade holder 28 and extends beneath and along the user's midfoot in use. A length L of the blade holder 28 can be measured from a frontmost point 70 to a rearmost point 72 of the blade holder 28. The blade holder 28 comprises a medial side 71 and a lateral side 67 that are
5 opposite one another. The blade holder 28 has a longitudinal direction (i.e., a direction generally parallel to its longitudinal axis 65) and transversal directions (i.e., directions transverse to its longitudinal axis 65), including a widthwise direction (i.e., a lateral direction generally perpendicular to its longitudinal axis 65). The blade holder 28 also has a height direction normal to its longitudinal and widthwise
10 directions.

The blade-retaining base 80 is elongated in the longitudinal direction of the blade holder 28 and is configured to retain the blade 52 such that the blade 52 extends along a bottom portion 73 of the blade-retaining base 80 to contact the ice 15. To
15 that end, the blade-retaining base 80 comprises a blade-retention portion 75 to face and retain the blade 52. In this embodiment, the blade-retention portion 75 comprises a recess 76 in which an upper portion of the blade 52 is disposed.

In this embodiment, the blade-retaining base 80 comprises a plurality of apertures
20 81_1 - 81_4 distributed in the longitudinal direction of the blade holder 28 and extending from the medial side 71 to the lateral side 67 of the blade holder 28. In this example, respective ones of the apertures 81_1 - 81_4 differ in size. More particularly, in this example, the apertures 81_1 - 81_4 decrease in size towards the front portion 66 of the blade holder 28. The apertures 81_1 - 81_4 may have any other suitable configuration, or
25 may be omitted, in other embodiments.

The blade-retaining base 80 may be configured in any other suitable way in other embodiments.

30 The support 82 is configured for supporting the skate boot 11 above the blade-retaining base 80 and transmit forces to and from the blade-retaining base 80 during

skating. In this embodiment, the support 82 comprises a front pillar 84 and a rear pillar 86 which extend upwardly from the blade-retaining base 80 towards the skate boot 11. The front pillar 84 extends towards the front portion 17 of the skate boot 11 and the rear pillar 86 extends towards the rear portion 19 of the skate boot 11. The
 5 blade-retaining base 80 extends from the front pillar 84 to the rear pillar 86. More particularly, in this embodiment, the blade-retaining base 80 comprises a bridge 88 interconnecting the front and rear pillars 84, 86.

The support 82 and the skate boot 11 can be connected to one another in any
 10 suitable way. In this embodiment, the support 82 is affixed to the skate boot 11. More particularly, in this embodiment, the front and rear pillars 84, 86 are fastened to the skate boot 11 by fasteners (e.g., rivets, screws, bolts). In this example, each of the front and rear pillars 84, 86 comprises a flange 87 including a plurality of apertures 89₁-89_F to receive respective ones of the fasteners that fasten the blade
 15 holder 28 to the skate boot 11. The support 82 may be affixed to the skate boot 11 in any other suitable manner in other embodiments (e.g., by an adhesive).

The support 82 may be configured in any other suitable way in other embodiments.

20 The blade holder 28 can retain the blade 52 in any suitable way. In this embodiment, with additional reference to Figures 16A to 16C, as further discussed below, the blade holder 28 comprises a blade-detachment mechanism 55 such that the blade 52 is selectively detachable and removable from, and attachable to, the blade holder 28 (e.g., when the blade 52 is worn out or otherwise needs to be replaced or
 25 removed from the blade holder 28).

As shown in Figures 10 and 11, the blade 52 comprises an ice-contacting surface 127 that contacts the ice 15 as the user skates. In this embodiment, the blade 52 comprises a plurality of different materials M₁-M₃ that constitute respective portions
 30 of the blade 52 and are strategically disposed and secured to one another. More particularly, in this embodiment, the blade 52 comprises an upper member 110 that

includes the material M_1 and an ice-contacting lower member 114 that comprises the ice-contacting surface 127, is secured to the upper member 110, and includes the materials M_2 , M_3 . Notably, the ice-contacting lower member 114 comprises a base 116 comprising the ice-contacting surface 127 and including the material M_3 and an anchor 118 that includes the material M_2 and is affixed to the base 116 and the upper member 110. That is, in this embodiment, the base 116 and the anchor 118 are distinct structures that are affixed to one another as opposed to being integrally formed with one another.

10 In this embodiment, the material M_1 is a polymeric material such that the upper member 110 is a polymeric upper member, while the materials M_2 , M_3 are metallic materials such that the ice-contacting lower member 114 is a metallic ice-contacting lower member.

15 In this example, as shown in Figure 14, the material M_1 is a composite material comprising a polymeric matrix 120 and fibers 122₁-122_F disposed in the polymeric matrix 120 such that the polymeric upper member 110 is a composite upper member. Thus, in this example of implementation, the material M_1 is a fiber-reinforced plastic (FRP – a.k.a., fiber-reinforced polymer).

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The polymeric matrix 120 may include any suitable substance (e.g., resin). For instance, in some examples, the polymeric matrix 120 may include a thermoplastic or thermosetting resin, such as epoxy, polyethylene, polypropylene, acrylic, thermoplastic polyurethane (TPU), polyether ether ketone (PEEK) or other
 25 polyaryletherketone (PAEK), polyethylene terephthalate (PET), polyvinyl chloride (PVC), poly(methyl methacrylate) (PMMA), polycarbonate, acrylonitrile butadiene styrene (ABS), nylon, polyimide, polysulfone, polyamide-imide, self-reinforcing polyphenylene, polyester, vinyl ester, vinyl ether, polyurethane, cyanate ester, phenolic resin, etc., a hybrid thermosetting-thermoplastic resin, or any other suitable
 30 resin. In this embodiment, the polymeric matrix 120 includes an epoxy resin.

The fibers 122₁-122_F may be made of any suitable material. In this embodiment, the fibers 122₁-122_F are carbon fibers. The material M₁ is thus a carbon-fiber-reinforced plastic in this example of implementation. Any other suitable type of fibers may be used in other embodiments (e.g., polymeric fibers such as aramid fibers (e.g., Kevlar
 5 fibers), boron fibers, silicon carbide fibers, metallic fibers, glass fibers, ceramic fibers, etc.).

In this embodiment, the fibers 122₁-122_F are continuous such that they constitute a continuous fiber reinforcement of the material M₁. For example, in this embodiment,
 10 the fibers 122₁-122_F may be provided as layers of continuous fibers (e.g. pre-preg (i.e., pre-impregnated) layers of fibers held together by an amount of matrix material, which is destined to provide a respective portion of the polymeric matrix 120 of the material M₁).

15 In this example, respective ones of the fibers 122₁-122_F are oriented differently. For example, in some embodiments, the fibers 122₁-122_F are arranged in layers stacked upon one another and may extend parallel or at an oblique angle to a longitudinal axis of the blade 52. For instance, given ones of the fibers 122₁-122_F in the layers that are stacked may be oriented at 0°, +/-45° and +/-90° in an alternating manner.
 20 The fibers 122₁-122_F may be arranged in any other suitable way in other examples.

In this embodiment, the base 116 defines a front longitudinal end 124 and a rear longitudinal end 126 of the blade 52 such that a length of the base 116 corresponds to a length L_{BD} of the blade 52 measured from the front longitudinal end 124 to the
 25 rear longitudinal end 126. The base 116 has a curved shape defined by curved front and rear longitudinal end portions. The base 116 comprises a bottom edge 101 defining the ice-contacting surface 127 of the blade 52, a top edge 103 opposite the bottom edge 101, and lateral surfaces 131₁, 131₂ opposite to one another. As shown in Figure 11, in a cross-section of the blade 52 normal to the ice-contacting surface
 30 127, the base 116 has a height H_B measured from the bottom edge 101 to the top

edge 103. Moreover, the base 116 has a width W_B measured from the lateral surface 131₁ to the lateral surface 131₂.

The anchor 118 is configured to anchor the metallic ice-contacting lower member 114 to the polymeric upper member 110. Moreover, in this example, the anchor 118 also reinforces the polymeric upper member 110. In this embodiment, the anchor 118 has a shape generally corresponding to a curved shape of the base 116 (e.g., a curvature that follows a curvature of the base 116). The anchor 118 comprises a bottom edge 105 for facing the base 116 and a top edge 107 opposite the bottom edge 105 and for facing the polymeric upper member 110. Furthermore, as shown in Figures 12 and 13, in this embodiment, the anchor 118 comprises a plurality of recesses 113₁-113_R each of which extends from the bottom edge 105 towards the top edge 107. As will be discussed in more detail below, the recesses 113₁-113_R may aid in securing the metallic ice-contacting lower member 114 to the polymeric upper member 110. The anchor 118 thus comprises a plurality of non-recessed regions 129₁-129_N which are regions of the anchor 118 which do not comprise a recess 113_i. As shown in Figure 11, in a cross-section of the blade 52 normal to the ice-contacting surface 127 (in this case, taken at or near a longitudinal center of the blade 52), the anchor 118 has a height H_A measured from the bottom edge 105 to the top edge 107.

In this embodiment, the height H_A of the anchor 118 is less than the height H_B of the base 116. For instance, in some cases, a ratio of the height H_A of the anchor 118 over the height H_B of the base 116 may be no more than 0.7, in some cases no more than 0.5, in some cases no more than 0.3, in some cases no more than 0.1, and in some cases even less. Furthermore, in some cases, a ratio of the height H_A of the anchor 118 over a height H_{BD} of the blade 52 measured in a cross-section of the blade 52 normal to the ice-contacting surface 127 may be no more than 0.5, in some cases no more than 0.4, in some cases no more than 0.3, in some cases no more than 0.2, in some cases no more than 0.1, and in some cases even less.

In this embodiment, the height H_A of the anchor 118 is less than the height H_B of the base 116 for a significant portion of a length L_A of the anchor 118. More specifically, the height of the H_A of the anchor 118 is less than the height H_B of the base 116 for a majority of the length L_A of the anchor 118. Furthermore, in this embodiment, the height H_A of the anchor 118 is less than the height H_B of the base 116 for a majority of the length L_{BD} of the blade 52. Moreover, the height H_A of the anchor 118 is substantially constant for at least a majority of the length L_{BD} of the blade 52. For example, the height H_A of the anchor 118 may be substantially constant for an entirety of the length L_{BD} of the blade 52.

In some embodiments, the height H_A of the anchor 118 may be the same or greater than the height H_B of the base 116. For instance, in some cases, a ratio of the height H_A of the anchor 118 over the height H_B of the base 116 may be at least 1, in some cases at least 2, in some cases at least 3, and in some cases even more (e.g., 4).

The width W_A of the anchor 118 may be relatively small. For instance, in some cases, a ratio of the width W_A of the anchor 118 over the width W_B of the base 116 may be no more than 0.9, in some cases no more than 0.7, in some cases no more than 0.5, in some cases no more than 0.3, in some cases no more than 0.2, in some cases no more than 0.1, and in some cases even less.

The length L_A of the anchor 118 may be significant relative to the length L_{BD} of the blade 52. For instance, as shown in Figure 12, the anchor 118 extends for at least a majority of the length L_{BD} of the blade 52 in the longitudinal direction of the blade 52.

For example, the anchor 118 may extend for at least three-quarters or more (e.g., the entirety) of the length L_{BD} of the blade 52 in the longitudinal direction of the blade 52. Furthermore, the anchor 118 spans a majority of the top edge 103 of the base 116 in the longitudinal direction of the blade 52. For example, the anchor 118 may span at least three-quarters or more (e.g., an entirety) of the top edge 103 of the base 116 in the longitudinal direction of the blade 52.

In this embodiment, the metallic material M_3 of the base 116 is different from the metallic material M_2 of the anchor 118. More particularly, in this example of implementation, the metallic material M_3 of the base 116 is a stainless steel and, more specifically, a MoV stainless steel (i.e., a stainless steel with a high molybdenum and vanadium content), while the metallic material M_2 of the anchor 118 is another stainless steel and, more specifically, a 304 stainless steel.

The stainless steels M_2 , M_3 thus have different properties, and this may help to tailor behavior or performance of different parts of the blade 52.

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For example, in this embodiment, the stainless steel M_3 of the base 116 has a greater molybdenum content than the stainless steel M_2 of the anchor 118. In some cases, the molybdenum content of the stainless steel M_2 may be substantially zero (i.e., there may be substantially no molybdenum in that steel). Moreover, in this embodiment, the stainless steel M_3 of the base 116 has a greater vanadium content than the stainless steel M_2 of the anchor 118. In some cases, the vanadium content of the stainless steel M_2 may be substantially zero (i.e., there may be substantially no vanadium in that steel). However, in some cases, the vanadium content of the stainless steel M_3 may be substantially zero. Furthermore, in this embodiment, the stainless steel M_3 of the base 116 is martensitic while the stainless steel M_2 of the anchor 118 is austenitic. This may allow the stainless steel M_3 of the base 116, which is exposed (e.g., to the ice 15, impacts, etc.), to perform better than the stainless steel M_2 of the anchor 118, which is contained within the polymeric upper member 110. For example, the stainless steel M_3 may have a greater hardness (e.g., 55 HRC and over), wear resistance, "sharpenability" (i.e., may be more easily sharpened) and corrosion resistance than the stainless steel M_2 .

In this embodiment, a corrosion resistance of the metallic material M_3 of the base 116 may be greater than a corrosion resistance of the metallic material M_2 of the anchor 118.

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While in this embodiment the metallic material M_2 of the anchor 118 is a stainless steel, it should be noted that the metallic material M_2 of the anchor 118 may be another metallic material in other embodiments. For instance, in some embodiments, the metallic material M_2 of the anchor 118 may be aluminum (e.g., 6061 aluminum) or another suitable metallic material.

The metallic materials M_2 , M_3 of the anchor 118 and the base 116 may have other properties that differ. For instance, in this embodiment, a density of the metallic material M_3 of the base 116 is different from a density of the metallic material M_2 of the anchor 118. More specifically, the density of the metallic material M_3 of the base 116 may be greater than the density of the metallic material M_2 of the anchor 118. For instance, in some cases, a ratio of the density of the metallic material M_3 over the density of the metallic material M_2 may be at least 1.1, in some cases at least 1.3, in some cases at least 1.5, in some cases at least 1.7, and in some cases even more.

In other embodiments, the density of the metallic material M_2 of the anchor 118 may be equal to or greater than the density of the metallic material M_3 of the base 116.

Furthermore, in this embodiment, a strength of the metallic material M_3 of the base 116 is different from a strength of the metallic material M_2 of the anchor 118. For example, the strength of the metallic material M_3 of the base 116 may be greater than the strength of the metallic material M_2 of the anchor 118. For instance, in some cases, a ratio of the strength of the metallic material M_3 over the strength of the metallic material M_2 may be at least 1.2, in some cases at least 1.4, in some cases at least 1.6, in some cases at least 2, in some cases at least 3, in some cases at least 5, in some cases at least 10, in some cases at least 20, in some cases at least 50 and in some cases even more.

The anchor 118 is affixed to the base 116 after shaping of the base 116. This may be done in various ways. In this embodiment, the anchor 118 is welded to the base

116 (e.g., via laser welding) such that the metallic materials M_2 , M_3 of the anchor 118 and the base 116 are fused to one another. This may provide a strong bond between the anchor 118 and the base 116. To that end, the metallic materials M_2 , M_3 of the anchor 118 and the base 116 are chosen to be weldable with one another
 5 (i.e., the materials M_2 , M_3 can be welded to one another). For instance, in this example, the MoV stainless steel of the base 116 is welding compatible with the 304 stainless steel of the anchor 118.

With reference to Figure 11, the polymeric upper member 110 comprises a first
 10 lateral surface 151 and a second lateral surface 152 opposite the first lateral surface 151. In this embodiment, each of the first and second lateral surfaces 151, 152 comprises a projection 155 that projects laterally outwardly relative to an adjacent portion of a respective one of the first and second lateral surfaces 151, 152. The projection 155 acts as a reinforcement to stiffen the polymeric upper member 110. In
 15 this example, the projection 155 extends in the longitudinal direction of the blade 52 for at least a majority of the length L_{BD} of the blade 52. In this case, the projection 155 extends in the longitudinal direction of the blade 52 for at least three-quarters or more of the length L_{BD} of the blade 52.

20 In some embodiments, as shown in Figure 31, the projection 155 on a given one (or both) of the first and second lateral surfaces 151, 152 may comprise an insert 157 disposed therein. The insert 157 comprises a material 159 that is different from the material M_1 of the polymeric upper member 110. More particularly, the material 159 has density that is less than a density of the material M_1 . For instance, in one
 25 example of implementation, the material 159 may comprise foam.

In this example, as shown in Figure 11, in a cross-section of the blade 52 normal to the ice-contacting surface 127, the anchor 118 does not extend above the projection 155 in a heightwise direction of the blade 52. More particularly, in this example, in a
 30 cross-section of the blade 52 normal to the ice-contacting surface 127, the anchor

118 extends to the projection 155 in the heightwise direction of the blade 52, without extending above the projection 155.

In this embodiment, the polymeric upper member 110 comprises a plurality of
5 connectors 185₁, 185₂ to connect the blade 52 to the blade holder 28. The connectors 185₁, 185₂ are spaced apart from the metallic ice-contacting lower member 114. There is no metallic material in the connectors 185₁, 185₂, i.e., the connectors 185₁, 185₂ are free of metallic material, and are made of the polymeric material M₁ of the polymeric upper member 110. This may help to reduce the weight
10 of the blade 52, improve its flexing characteristics (i.e., the blade 52 may be more flexible), and/or facilitate manufacturing of the blade 52.

More particularly, the connectors 185₁, 185₂ extend upwardly from a top surface of the blade 52. In this embodiment, the connectors 185₁, 185₂ comprise hooks 53₁,
15 53₂ that project upwardly from a top edge 187 of the polymeric upper member 110, with the hook 53₁ being a front hook and the hook 53₂ being a rear hook. The blade-detachment mechanism 55 includes an actuator 115 and a biasing element 117 which biases the actuator 115 in a direction towards the front portion 66 of the blade holder 28. To attach the blade 52 to the blade holder 28, the front hook 53₁ is first
20 positioned within a hollow space 119 (e.g., a recess or hole) of the blade holder 28. The rear hook 53₂ can then be pushed upwardly into a hollow space 121 (e.g., a recess or hole) of the blade holder 28, thereby causing the biasing element 117 to bend and the actuator 115 to move in a rearward direction. The rear hook 53₂ will eventually reach a position which will allow the biasing element 117 to force the
25 actuator 115 towards the front portion 66 of the blade holder 28, thereby locking the blade 52 in place. The blade 52 can then be removed by pushing against a finger-actuating surface 123 of the actuator 115 to release the rear hook 53₂ from the hollow space 121 of the blade holder 28. Further information on examples of implementation of the blade-detachment mechanism 55 in some embodiments may
30 be obtained from U.S. Patent 8,454,030 hereby incorporated by reference herein.

The blade-detachment mechanism 55 may be configured in any other suitable way in other embodiments.

The polymeric upper member 110 may be secured to the metallic ice-contacting lower member 114 in various ways. For instance, in some embodiments, the polymeric upper member 110 may be bonded by adhesion to the metallic ice-contacting lower member 114. For example, in some embodiments, the adhesion may be chemical adhesion of the polymeric upper member 110 to the metallic ice-contacting lower member 114. Notably, in some embodiments, a resin constituting the polymeric matrix 120 of the material M_1 of the polymeric upper member 110 may bond to the metallic ice-contacting lower member 114 (i.e., the resin could act as an adhesive without the addition of an actual adhesive). Furthermore, in some embodiments, the base 116 and the anchor 118 may be surface treated to improve chemical bonding between the polymeric upper member 110 and the metallic ice-contacting lower member 114 (i.e., the base 116 and the anchor 118).

Alternatively or additionally, as shown in Figure 15, the adhesion may comprise an adhesive 109 disposed between the polymeric upper member 110 and the metallic ice-contacting lower member 114. The adhesive 109 may be an epoxy-based adhesive, a polyurethane-based adhesive, an acrylic-based adhesive, cyanoacrylate, silane-modified polymers, methacrylate or any suitable adhesive.

In this embodiment, the polymeric upper member 110 is overmolded onto the metallic ice-contacting lower member 114. That is, the material M_1 of the polymeric upper member 110 is overmolded onto the materials M_2 , M_3 of the anchor 118 and the base 116 of the metallic ice-contacting lower member 114. Overmolding of the material M_1 onto the materials M_2 , M_3 retains together the material M_1 to the materials M_2 , M_3 at an interface 111 between the polymeric upper member 110 and the metallic ice-contacting lower member 114. That is, as the material M_1 cures after being overmolded onto the materials M_2 , M_3 , respective surfaces of the polymeric

upper member 110 and the metallic ice-contacting lower member 114, which constitute the interface 111, are retained together.

More particularly, in this embodiment, the polymeric upper member 110 is mechanically interlocked with the metallic ice-contacting lower member 114. That is, the material M_1 of the polymeric upper member 110 and the materials M_2 , M_3 of the metallic ice-contacting lower member 114 are in a mechanical interlock relationship in which they are interconnected via an interlocking part of the blade 52 made of a given one of (i) the material M_1 of the polymeric upper member 110 and (ii) the materials M_2 , M_3 of the metallic ice-contacting lower member 114 extending into an interlocking space (e.g., one or more holes, one or more recesses, and/or one or more other hollow areas) of the blade 52 made of the other one of (i) the material M_1 of the polymeric upper member 110 and (ii) the materials M_2 , M_3 of the metallic ice-contacting lower member 114.

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In this example, a portion of the material M_1 of the polymeric upper member 110 constitutes an interlocking part that extends into, in this case, through, a plurality of openings 125_1 - 125_N of the metallic ice-contacting lower member 114 that are formed by the recesses 113_1 - 113_R of the anchor 118 and the top edge 103 of the base 116 and that constitute an interlocking space. For example, in some embodiments, respective portions of the polymeric upper member 110 comprising portions of pre-impregnated composite material are passed through the openings 125_1 - 125_N . This mechanical interlock of the polymeric upper member 110 to the metallic ice-contacting lower member 114 may further reinforce retention between the polymeric upper member 110 and the metallic ice-contacting lower member 114.

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In some embodiments, alternatively or additionally to forming the openings 125_1 - 125_N with the base 116, the anchor 118 may include one or more openings (e.g., holes) that can receive the material M_1 of the polymeric upper member 110 to mechanically interlock the polymeric upper member 110 and the metallic ice-contacting lower member 114.

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Moreover, in some embodiments, instead of or in addition to being mechanically interlocked with the metallic ice-contacting lower member 114, the polymeric upper member 110 may also be bonded by adhesion to the metallic ice-contacting lower member 114, such as by applying the adhesive 109 at the interface 111 between the polymeric upper member 110 and the ice-contacting lower member 114. This may help distribute stress at the interface 111 between the polymeric upper member 110 and the ice-contacting lower member 114 (i.e., reduce punctual stresses at particular locations of the interface 111).

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The ice skate 10, including the blade 52, may be implemented in any other suitable way in other embodiments.

For example, in some embodiments, instead of or in addition to being welded to the base 116, the anchor 118 may be fastened to the base 116. For example, as shown in Figure 17, the anchor 118 may be fastened to the base 116 via one or more fasteners 195. For instance, each of the one or more fasteners 195 may engage an opening in the base 116 and a corresponding opening in the anchor 118. The opening of the anchor 118 may be threaded to securely engage a corresponding one of the fasteners 195. Each fastener 195 may be a rivet, a screw, a bolt, or any other suitable mechanical fastener.

Furthermore, in some embodiments, as shown in Figure 26, the anchor 118 and the base 116 may be integral with one another such that the anchor 118 and the base 116 form a one-piece unitary structure (i.e., the metallic ice-contacting lower member 114 is a one-piece structure). In such embodiments, the anchor 118 and the base 116 are not welded or otherwise fastened to one another but rather are formed of a same continuous material. Thus, in one example of implementation, the anchor 118 and the base 116 may be formed from a common sheet of material. In order to form the anchor 118 such that the width W_A of the anchor 118 is smaller than the width W_B of the base 116, the common sheet of material may be selectively

compressed or machined in order to reduce a thickness of the sheet at a selected region corresponding to the anchor 118. Moreover, the openings 125_1 - 125_N may be cut-outs (i.e., holes) formed in the unitary structure constituting the metallic ice-contacting lower member 114.

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As another example, in some embodiments, as shown in Figure 18, the composite material M_1 may comprise chopped fibers. That is, rather than comprising the continuous fibers 122_1 - 122_F , the material M_1 of the polymeric upper member 110 may comprise chopped fibers 132_1 - 132_F interspersed within it (i.e., within the polymeric matrix 120). This may provide reinforcement to the material M_1 .

As yet another example, in some embodiments, the polymeric material M_1 of the polymeric upper member 110 may be a non-composite polymeric material (i.e., not a composite material). In other words, the polymeric material M_1 may not have any fibers or other reinforcement. For example, as shown in Figure 19, the polymeric material M_1 may simply comprise only a polymer without any fibers interspersed within it.

In accordance with a variant, the polymeric upper member 110 may be molded separately from the metallic ice-contacting lower member 114 and joined to the ice-contacting lower member 114 afterward. For example, this may be achieved by applying an adhesive at the interface 111 between the polymeric upper member 110 and the metallic ice-contacting lower member 114, or by welding and/or mechanically fastening the polymeric upper member 110 to the metallic ice-contacting lower member 114.

In another example of a variant, as shown in Figure 27, the base 116 may comprise two layers 117_1 , 117_2 between which the anchor 118 is disposed (i.e., the anchor 118 is sandwiched between the layers 117_1 , 117_2 of the base 116). Moreover, in this example of implementation, the height H_A of the anchor 118 is greater than the height H_B of the base 116 and, since in this example the bottom edge 105 of the

anchor 118 is flush with the bottom edge 101 of the base 116, the anchor 118 protrudes from the base 116 in the heightwise direction of the blade 52 (i.e., the top edge 107 of the anchor 118 is higher, in the heightwise direction of the blade 52, than the top edge 103 of the base 116). The layers 117₁, 117₂ of the base 116 may
 5 be connected to the anchor 118 by welding, mechanical attachment (e.g., fasteners or rivets) and/or via an adhesive.

In another example of a variant, as shown in Figure 28, the anchor 118 may comprise outer layers 119₁, 119₂ and an inner layer 121 disposed between the outer
 10 layers 119₁, 119₂ (i.e., the inner layer 121 is sandwiched between the outer layers 119₁, 119₂). The inner layer 121 may comprise a material 123 that has a density that is smaller than the density of the metallic material M₂ of the outer layers 119₁, 119₂ of the anchor 118. For instance, in this example of implementation, the material 123 may be a foam. In another example, the inner layer 121 may not comprise a material
 15 at all, but may be an empty space containing air. In other words, the anchor 118 may comprise a hollow structure. This may help reduce the weight of the blade 52.

In another example of a variant, as shown in Figure 29, the polymeric upper member 110 may be disposed, in a widthwise direction of the blade 52, between a first
 20 external layer 125₁ and a second external layer 125₂ (i.e., the polymeric upper member 110 may be sandwiched, laterally, between the external layers 125₁, 125₂). Each of the first and second external layers 125₁, 125₂ comprises a non-polymeric material 127. In this example of implementation, the non-polymeric material 127 is a metallic material (e.g., stainless steel). The first and second external layers 125₁,
 25 125₂ may be relatively thin. For instance, each external layer 125_i has a width W_E that is significantly less than the width W_B of the base 116. For example, in some cases, a ratio W_E/W_B of the width W_E of the external layer 125_i over the width W_B of the base 116 may be no more than 0.3, in some cases no more than 0.2, in some cases no more than 0.1 and in some cases even less. In such a variant, the metallic
 30 material of the blade 52 thus spans the entire height H_{BD} of the blade 52. This may help stiffen the blade 52 and, in this example, the projection 155 of the lateral

surfaces 151, 152 of the polymeric upper member 110 may thus not be included. However, in other examples, the projection 155 may still be implemented with the first and second external layers 125₁, 125₂.

- 5 In another example of a variant, as shown in Figure 30, the polymeric upper member 110 and the base 116 may be disposed, in the widthwise direction of the blade 52, between first and second external layers 129₁, 129₂. Each of the first and second external layers 129₁, 129₂ comprises a non-polymeric material 131. In this example of implementation, the non-polymeric material 131 is a metallic material (e.g.,
 10 stainless steel). The first and second external layers 129₁, 129₂ may be relatively thin. For instance, each external layer 129_i has a width W_F that is significantly less than the width W_B of the base 116. For example, in some cases, a ratio W_F/W_B of the width W_F of the external layer 129_i over the width W_B of the base 116 may be no more than 0.3, in some cases no more than 0.2, in some cases no more than 0.1
 15 and in some cases even less. The inclusion of the first and second external layers 129₁, 129₂ may help stiffen the blade 52 while offering a homogeneous appearance to the blade 52 (i.e., no visible discontinuity between the polymeric upper member 110 and the metallic ice-contacting lower member 114).
- 20 In an example of a variant, as shown in Figures 32 and 33, the anchor 118 may extend along at least a majority (i.e., a majority or an entirety) of a height H_P of the polymeric upper member 110. For instance, in some cases, a ratio H_A/H_P of the height H_A of the anchor 118 over the height H_P of the polymeric upper member 110 may be at least 0.5, in some cases at least 0.7, in some cases at least 0.9, in some
 25 cases at least 1 and in some cases even more. In this example of implementation, the height H_A of the anchor 118 corresponds to the height H_P of the polymeric upper member 110. Moreover, in this example, the top edge 107 of the anchor 118 corresponds to the top edge 187 of the polymeric upper member 110 such that the anchor 118 and the polymeric upper member 110 are co-extensive in the heightwise
 30 direction of the blade 52. This significant height of the anchor 118 may further stiffen the blade 52. As such, in this variant, the width W_A of the anchor 118 may be made

particularly small. For example, in some cases, a ratio W_A/W_B of the width W_A of the anchor 118 over the width W_B of the base 116 may be no more than 0.3, in some cases no more than 0.2, in some cases no more than 0.1 and in some cases even less.

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In other examples of the variant of Figures 32 and 33, the anchor 118 may comprise a plurality of anchor elements 135_1-135_N , each extending along at least a majority (i.e., a majority or an entirety) of the height H_P of the polymeric upper member 110. For example, as shown in Figure 34, the plurality of anchor elements 135_1-135_N may include two such anchor elements, or as shown in Figure 35, the plurality of anchor elements 135_1-135_N may include three or more such anchor elements. In such variants, the anchor elements 135_1-135_N are spaced apart from one another in the widthwise direction of the blade 52 and the material M_1 of the polymeric upper member 110 fills the space between the anchor elements 135_1-135_N . However, in another variant, as shown in Figure 36, rather than the material M_1 of the polymeric upper member 110 filling the space between the anchor elements 135_1-135_N , a material 137 different from the material M_1 of the polymeric upper member 110 fills the space between the anchor elements 135_1-135_N . For example, the material 137 may have a density that is less than the density of the material M_1 of the polymeric upper member 110. More specifically, in this example of implementation, the material 137 comprises foam. This may allow stiffening the blade 52 due to the significant height of the anchor 118 while also limiting its added weight via the smaller density of the material 137.

25 In another example of the variant of Figures 32 and 33, as shown in Figure 37, given ones of the anchor elements 135_1-135_N may constitute exterior layers $135_i, 135_j$ that enclose, in the widthwise direction of the blade 52, the material M_1 of the polymeric upper member 110. For example, the exterior layers $135_i, 135_j$ may be formed such as to conform to a shape of the polymeric upper member 110 (e.g., including the projections 155).

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In another example of the variant of Figures 32 and 33, as shown in Figure 38, the anchor 118 may extend along at least the majority (i.e., the majority or the entirety) of the height H_P of the polymeric upper member 110 while the projection 155 on a given one (or both) of the first and second lateral surfaces 151, 152 comprises the
 5 insert 157.

Furthermore, in another example of the variant of Figures 32 and 33, as shown in Figure 38, the anchor 118 may extend along at least the majority (i.e., the majority or the entirety) of the height H_P of the polymeric upper member 110

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In yet another variant, the connectors 185_1 , 185_2 which connect the blade 52 to the blade holder 28 may not be part of the polymeric upper member 110. In other words, the connectors 185_1 , 185_2 may not comprise the material M_1 of the polymeric upper member 110. For instance, as shown in Figure 39, the connectors 185_1 , 185_2 may
 15 instead be integrally built with the anchor 118 (i.e., the connectors 185_1 , 185_2 and the anchor 118 constitute a unitary structure) and/or fastened to the anchor 118 in any suitable manner (e.g., via welding). In this example, the connectors 185_1 , 185_2 comprise a metallic material such as the material M_2 of the anchor 118 or another metallic material (e.g., another stainless steel).

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The blade 52 may include any number of different materials in other embodiments, including more than three (e.g., four or five) different materials.

Furthermore, in other embodiments, the ice-contacting lower member 114 may
 25 include other types of metallic material (e.g. tungsten carbide or titanium), and/or may include one or more materials that are non-metallic, such as ceramic material (e.g. aluminum titanate, aluminum zirconate, sialon, silicon nitride, silicon carbide, zirconia and partially stabilized zirconia or a combination of two or more of these materials). For example, in some embodiments, the anchor 118 may comprise a
 30 non-metallic material. For instance, the anchor 118 may comprise foam (e.g., structural foam).

In other embodiments, the blade holder 28 may retain the blade 52 in any other suitable way. For instance, instead of being selectively detachable and removable from and attachable to the blade holder 28, in other embodiments, the blade 52 may be permanently affixed to the blade holder 28 (i.e., not intended to be detached and removed from the blade holder 28). As an example, in some embodiments, as shown in Figures 20 and 21, the blade holder 28 may retain the blade 52 using an adhesive 172 and/or one or more fasteners 175. For instance, in some embodiments, as shown in Figure 20, the recess 76 of the blade holder 28 may receive the upper part of the blade 52 that is retained by the adhesive 172. The adhesive 172 may be an epoxy-based adhesive, a polyurethane-based adhesive, or any suitable adhesive. In some embodiments, instead of or in addition to using an adhesive, as shown in Figure 21, the recess 76 of the blade holder 28 may receive the upper part of the blade 52 that is retained by the one or more fasteners 175. Each fastener 175 may be a rivet, a screw, a bolt, or any other suitable mechanical fastener. Alternatively or additionally, in some embodiments, as shown in Figure 22, the blade-retention portion 75 of the blade holder 28 may extend into a recess 181 of the upper part of the blade 52 to retain the blade 52 using the adhesive 172 and/or the one or more fasteners 175. For instance, in some cases, the blade-retention portion 75 of the blade holder 28 may comprise a projection 188 extending into the recess 181 of the blade 52. As another example, in some embodiments, as shown in Figure 23, the blade 52 and the blade-retaining base 80 of the blade holder 28 may be mechanically interlocked via an interlocking portion 191 of one of the blade-retaining base 80 and the blade 52 that extends into an interlocking void 193 of the other one of the blade-retaining base 80 and the blade 52. For instance, in some cases, the blade 52 can be positioned in a mold used for molding the blade holder 28 such that, during molding, the interlocking portion 191 of the blade-retaining base 80 flows into the interlocking void 193 of the blade 52 (i.e., the blade holder 28 is overmolded onto the blade 52).

In some embodiments, any feature of any embodiment described herein may be used in combination with any feature of any other embodiment described herein.

5 Certain additional elements that may be needed for operation of certain embodiments have not been described or illustrated as they are assumed to be within the purview of those of ordinary skill in the art. Moreover, certain embodiments may be free of, may lack and/or may function without any element that is not specifically disclosed herein.

10 Although various embodiments have been illustrated, this was for the purpose of describing, but not limiting, the invention. Various modifications will become apparent to those skilled in the art and are within the scope of this invention, which is defined more particularly by the attached claims.

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CLAIMS

1. A blade for an ice skate, the ice skate comprising a skate boot for receiving a foot of a user and a blade holder for holding the blade, the blade comprising:
 - a) a polymeric upper member; and
 - b) a metallic ice-contacting lower member secured to the polymeric upper member and comprising:
 - a metallic base comprising an ice-contacting surface; and
 - a metallic anchor affixed to the metallic base and the polymeric upper member.
2. The blade of claim 1, wherein the metallic base comprises a first metallic material and the metallic anchor comprises a second metallic material different from the first metallic material.
3. The blade of claim 2, wherein the first metallic material is a first stainless steel and the second metallic material is a second stainless steel different from the first stainless steel.
4. The blade of claim 3, wherein a molybdenum content of the first stainless steel is greater than a molybdenum content of the second stainless steel.
5. The blade of claim 3, wherein a vanadium content of the first stainless steel is greater than a vanadium content of the second stainless steel.
6. The blade of claim 3, wherein the first stainless steel is martensitic and the second stainless steel is austenitic.
7. The blade of claim 2, wherein a density of the first metallic material is different from a density of the second metallic material.

8. The blade of claim 7, wherein the density of the first metallic material is greater than the density of the second metallic material.
9. The blade of claim 8, wherein a ratio of the density of the first metallic material over the density of the second metallic material is at least 1.1.
10. The blade of claim 8, wherein a ratio of the density of the first metallic material over the density of the second metallic material is at least 1.3.
11. The blade of claim 8, wherein a ratio of the density of the first metallic material over the density of the second metallic material is at least 1.5.
12. The blade of claim 2, wherein a corrosion resistance of the first metallic material is greater than a corrosion resistance of the second metallic material.
13. The blade of claim 2, wherein a strength of the first metallic material is different from a strength of the second metallic material.
14. The blade of claim 13, wherein the strength of the first metallic material is greater than the strength of the second metallic material.
15. The blade of claim 14, wherein a ratio of the strength of the first metallic material over the strength of the second metallic material is at least 1.2.
16. The blade of claim 14, wherein a ratio of the strength of the first metallic material over the strength of the second metallic material is at least 1.4.
17. The blade of claim 14, wherein a ratio of the strength of the first metallic material over the strength of the second metallic material is at least 1.6.

18. The blade of claim 1, wherein the polymeric upper member is a composite upper member comprising a polymeric matrix and fibers disposed in the polymeric matrix.

5 19. The blade of claim 18, wherein the fibers are continuous fibers.

20. The blade of claim 18, wherein the fibers are chopped fibers.

21. The blade of claim 18, wherein the fibers are carbon fibers.

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22. The blade of claim 18, wherein the polymeric matrix and the fibers are provided as pre-impregnated composite material.

23. The blade of claim 1, wherein the metallic anchor is welded to the metallic base.

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24. The blade of claim 1, wherein the metallic anchor is bonded by adhesion to the polymeric upper member.

25. The blade of claim 24, wherein the adhesion is chemical adhesion of the metallic anchor and the polymeric upper member.

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26. The blade of claim 24, wherein the adhesion comprises an adhesive between the metallic anchor and the polymeric upper member.

25 27. The blade of claim 24, wherein the polymeric upper member is overmolded onto the metallic anchor.

28. The blade of claim 1, wherein the metallic anchor is mechanically interlocked with the polymeric upper member.

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29. The blade of claim 28, wherein the polymeric upper member is overmolded onto the metallic anchor.

5 30. The blade of claim 24, wherein the metallic anchor is mechanically interlocked with the polymeric upper member.

31. The blade of claim 1, wherein the metallic ice-contacting lower member comprises a plurality of openings receiving respective portions of the polymeric upper member.

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32. The blade of claim 31, wherein given ones of the openings are disposed between the metallic base and the metallic anchor.

15 33. The blade of claim 31, wherein the metallic anchor includes given ones of the openings.

34. The blade of claim 32, wherein the metallic anchor includes individual ones of the openings.

20 35. The blade of claim 31, wherein the respective portions of the polymeric upper member comprise portions of pre-impregnated composite material extending through the given ones of the openings.

25 36. The blade of claim 1, wherein, in a cross-section of the blade normal to the ice-contacting surface, a height of the metallic anchor is less than a height of the metallic base.

30 37. The blade of claim 36, wherein, in the cross-section of the blade normal to the ice-contacting surface, a ratio of the height of the metallic anchor over the height of the metallic base is no more than 0.7.

38. The blade of claim 36, wherein, in the cross-section of the blade normal to the ice-contacting surface, a ratio of the height of the metallic anchor over the height of the metallic base is no more than 0.5.

5 39. The blade of claim 36, wherein, in the cross-section of the blade normal to the ice-contacting surface, a ratio of the height of the metallic anchor over the height of the metallic base is no more than 0.3.

10 40. The blade of claim 1, wherein, in a cross-section of the blade normal to the ice-contacting surface, a ratio of a height of the metallic anchor over a height of the blade is no more than 0.5.

15 41. The blade of claim 1, wherein, in a cross-section of the blade normal to the ice-contacting surface, a ratio of a height of the metallic anchor over a height of the blade is no more than 0.4.

20 42. The blade of claim 1, wherein, in a cross-section of the blade normal to the ice-contacting surface, a ratio of a height of the metallic anchor over a height of the blade is no more than 0.3.

43. The blade of claim 1, wherein, in a cross-section of the blade normal to the ice-contacting surface, a height of the metallic anchor is less than a height of the metallic base for at least a majority of a length of the metallic anchor.

25 44. The blade of claim 1, wherein, in a cross-section of the blade normal to the ice-contacting surface, a height of the metallic anchor is less than a height of the metallic base for at least a majority of a length of the blade.

30 45. The blade of claim 1, wherein, in a cross-section of the blade normal to the ice-contacting surface, a height of the metallic anchor is substantially constant for at least a majority of a length of the blade.

46. The blade of claim 1, wherein, in a cross-section of the blade normal to the ice-contacting surface, a height of the metallic anchor is substantially constant for substantially an entirety of a length of the blade.

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47. The blade of claim 1, wherein, in a cross-section of the blade normal to the ice-contacting surface, a ratio of a width of the metallic anchor over a width of the metallic base is no more than 0.7.

10 48. The blade of claim 1, wherein, in a cross-section of the blade normal to the ice-contacting surface, a ratio of a width of the metallic anchor over a width of the metallic base is no more than 0.5.

15 49. The blade of claim 1, wherein, in a cross-section of the blade normal to the ice-contacting surface, a ratio of a width of the metallic anchor over a width of the metallic base is no more than 0.3.

50. The blade of claim 1, wherein the metallic anchor extends for at least a majority of a length of the blade in a longitudinal direction of the blade.

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51. The blade of claim 1, wherein the metallic anchor extends for at least three-quarters of the length of the blade in the longitudinal direction of the blade.

25 52. The blade of claim 1, wherein the metallic anchor spans at least a majority of a top edge of the metallic base in a longitudinal direction of the blade.

53. The blade of claim 52, wherein the metallic anchor spans at least three-quarters of the top edge of the metallic base in the longitudinal direction of the blade.

30 54. The blade of claim 52, wherein the metallic anchor spans substantially an entirety of the top edge of the metallic base in the longitudinal direction of the blade.

55. The blade of claim 1, wherein: the polymeric upper member comprises a first lateral surface and a second lateral surface opposite one another; and the first lateral surface comprises a projection projecting laterally outwardly relative to an adjacent portion of the first lateral surface.

56. The blade of claim 55, wherein the projection extends in a longitudinal direction of the blade for at least a majority of a length of the blade holder.

57. The blade of claim 55, wherein, in a cross-section of the blade normal to the ice-contacting surface, the metallic anchor does not extend above the projection in a heightwise direction of the blade.

58. The blade of claim 57, wherein, in the cross-section of the blade normal to the ice-contacting surface, the metallic anchor extends to the projection in a heightwise direction of the blade.

59. The blade of claim 55, wherein the projection is a first projection and the second lateral surface comprises a second projection projecting laterally outwardly relative to an adjacent portion of the second lateral surface.

60. The blade of claim 1, wherein the polymeric upper member comprises a connector to connect the blade to the blade holder, and the connector is spaced apart from the metallic ice-contacting lower member.

61. The blade of claim 60, wherein the connector comprises a hook projecting upwardly from a top edge of the polymeric upper member.

62. The blade of claim 1, wherein the polymeric upper member comprises a plurality of connectors to connect the blade to the blade holder, and the connectors are spaced apart from the metallic ice-contacting lower member.

63. The blade of claim 62, wherein each of the connectors comprises a hook projecting upwardly from a top edge of the polymeric upper member.

5 64. In combination, the blade of claim 1 and a blade holder holding the blade.

65. An ice skate comprising the blade of claim 1.

66. A blade for an ice skate, the ice skate comprising a skate boot for receiving a
10 foot of a user and a blade holder for holding the blade, the blade comprising:

a) a polymeric upper member; and

b) a metallic ice-contacting lower member secured to the polymeric upper member and comprising:

- a metallic base comprising an ice-contacting surface; and

15 - a metallic anchor welded to the metallic base and bonded to the polymeric upper member.

67. A blade for an ice skate, the ice skate comprising a skate boot for receiving a foot of a user and a blade holder for holding the blade, the blade comprising:

20 a) an upper member; and

b) an ice-contacting lower member secured to the upper member and comprising:

- a base comprising an ice-contacting surface; and

- an anchor affixed to the base and the upper member;

25 the upper member comprising a first material, the base comprising a second material different from the first material, and the anchor comprising a third material different from the first material and the second material.

68. The blade of claim 67, wherein the first material is a polymeric material and the
30 second material is a metallic material.

69. The blade of claim 68, wherein the polymeric material is a composite material.

70. The blade of claim 68, wherein the second material is a first metallic material and the third material is a second metallic material.

5

71. The blade of claim 70, wherein the polymeric material is a composite material.

72. A blade for an ice skate, the ice skate comprising a skate boot for receiving a foot of a user and a blade holder for holding the blade, the blade comprising at
10 least three materials that are different from one another.

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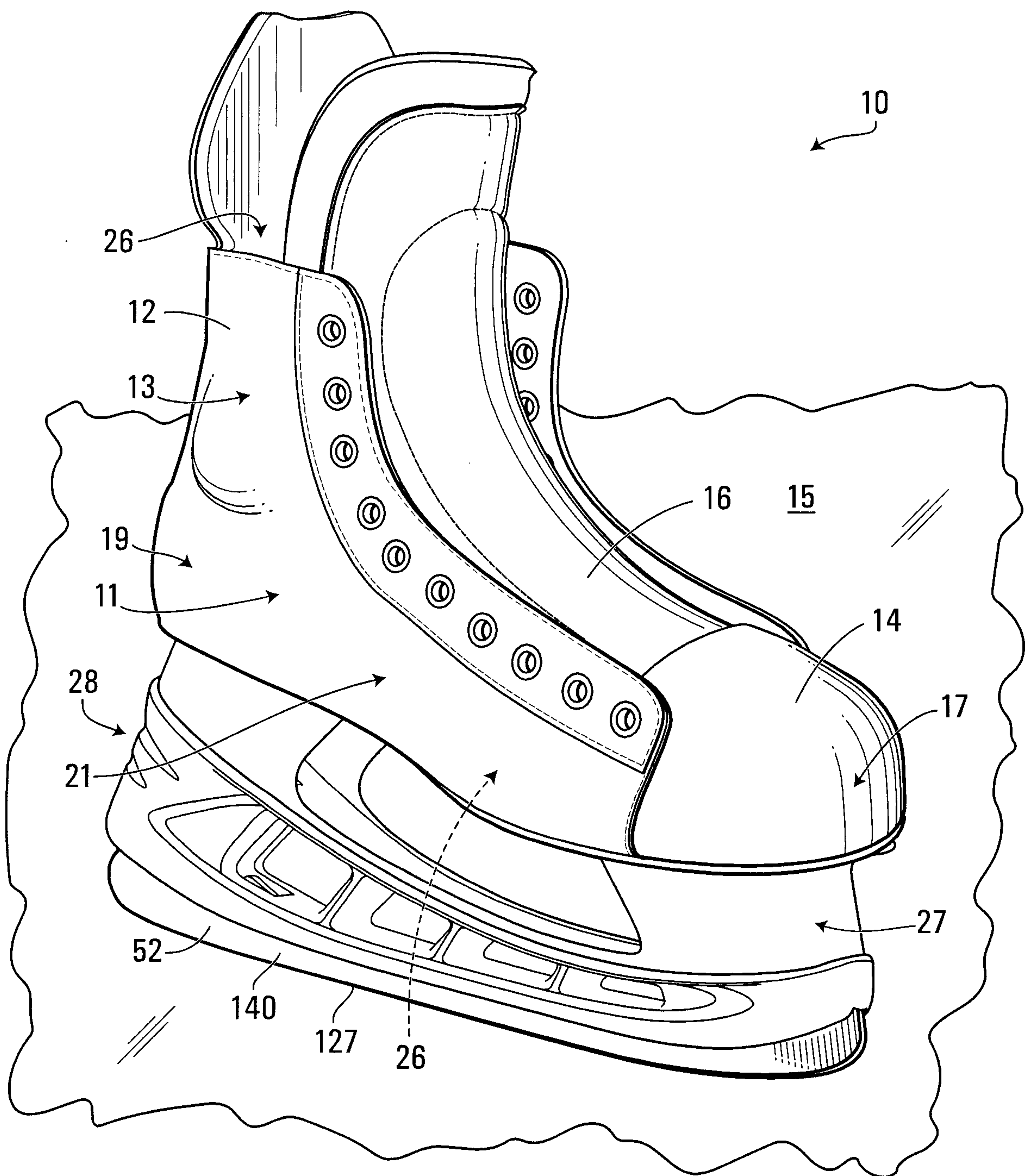
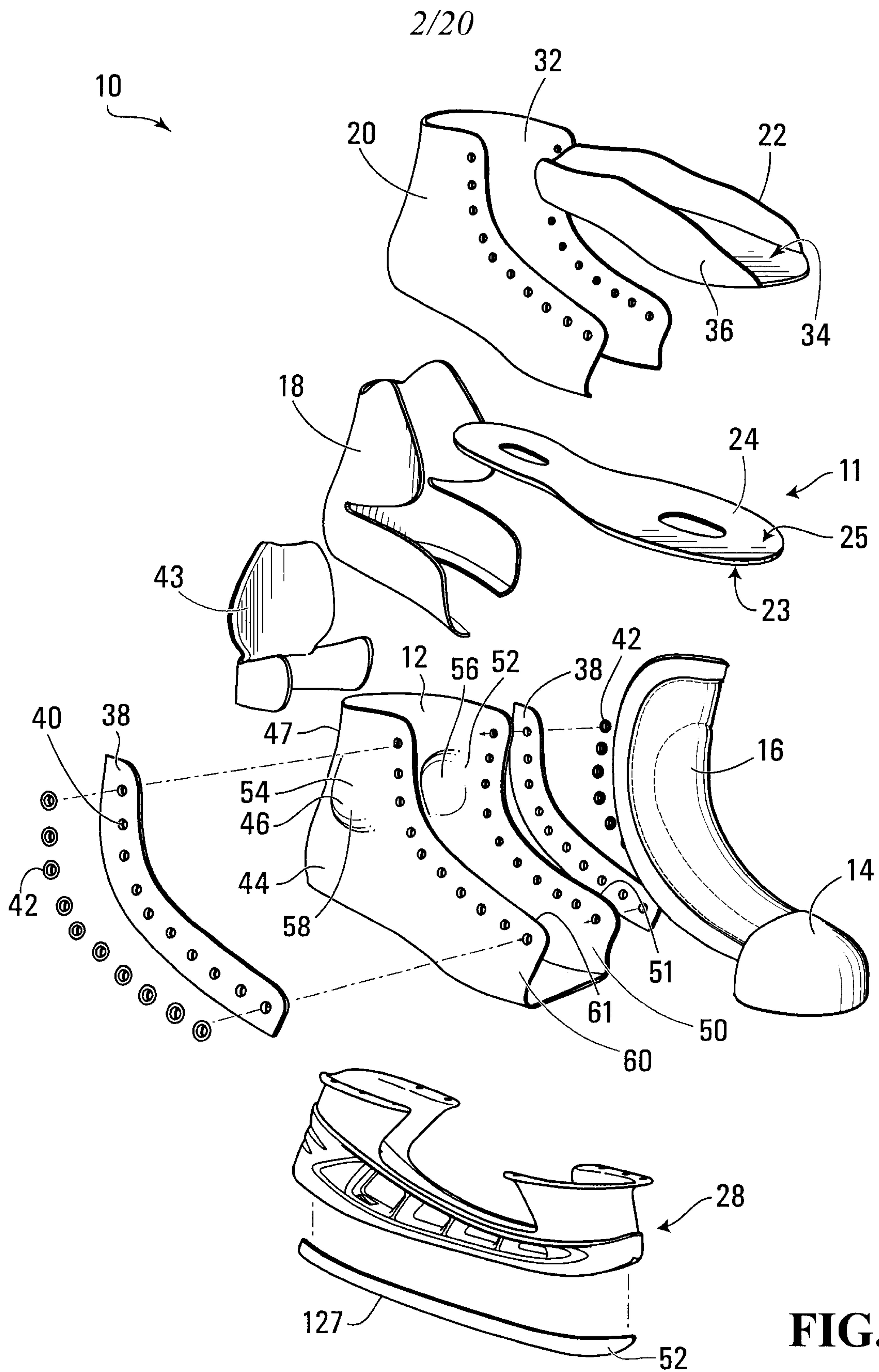


FIG. 1



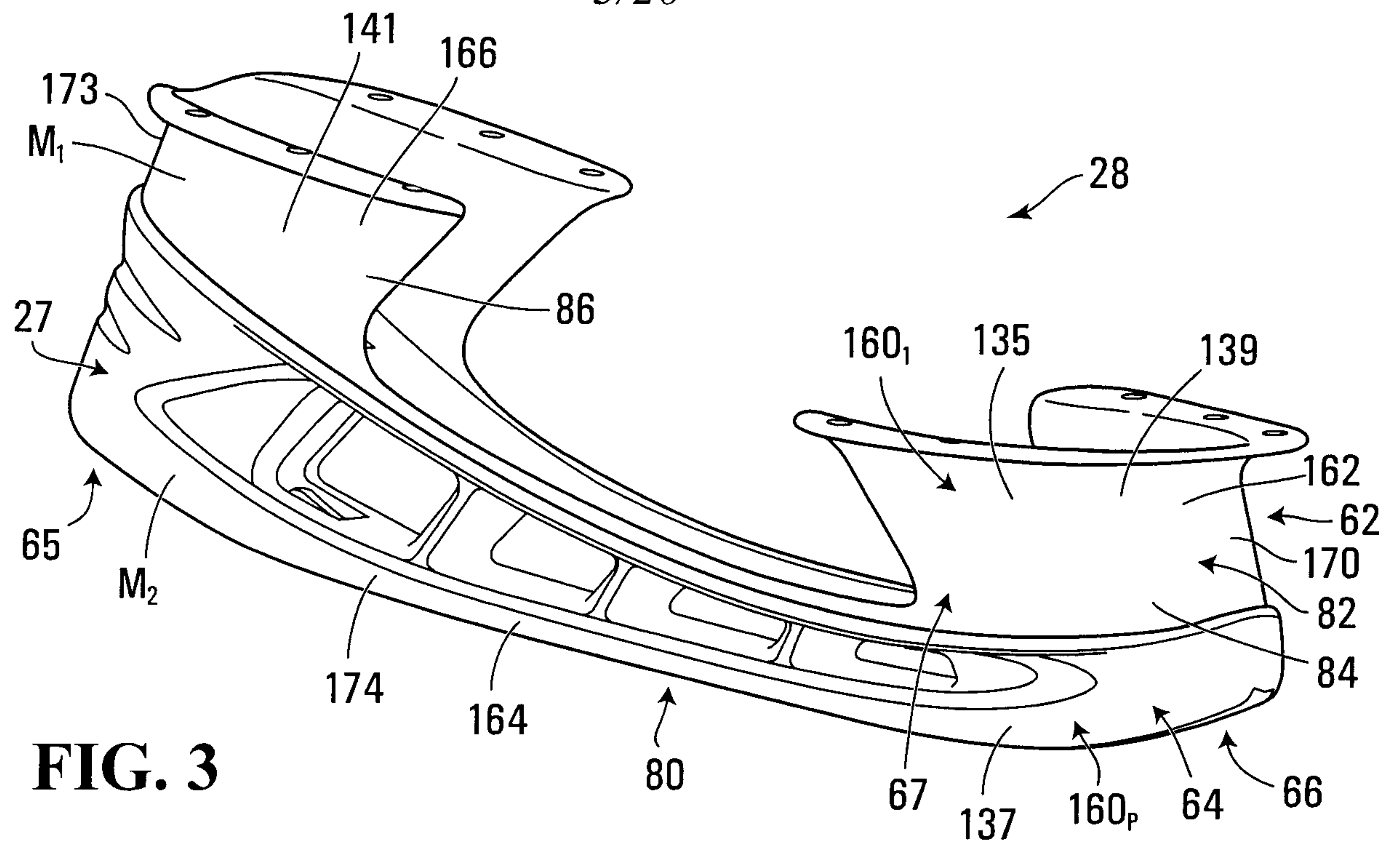


FIG. 3

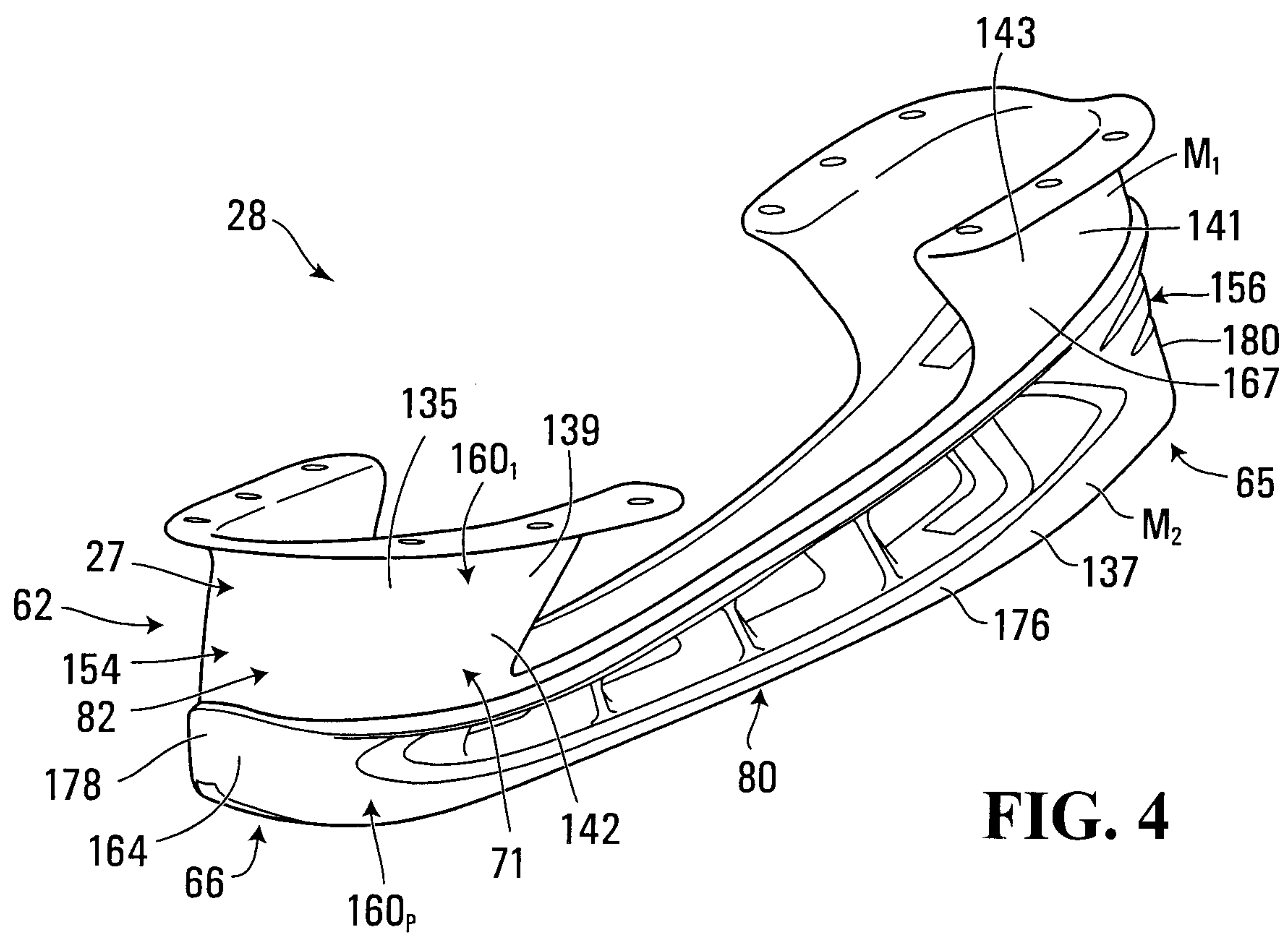


FIG. 4

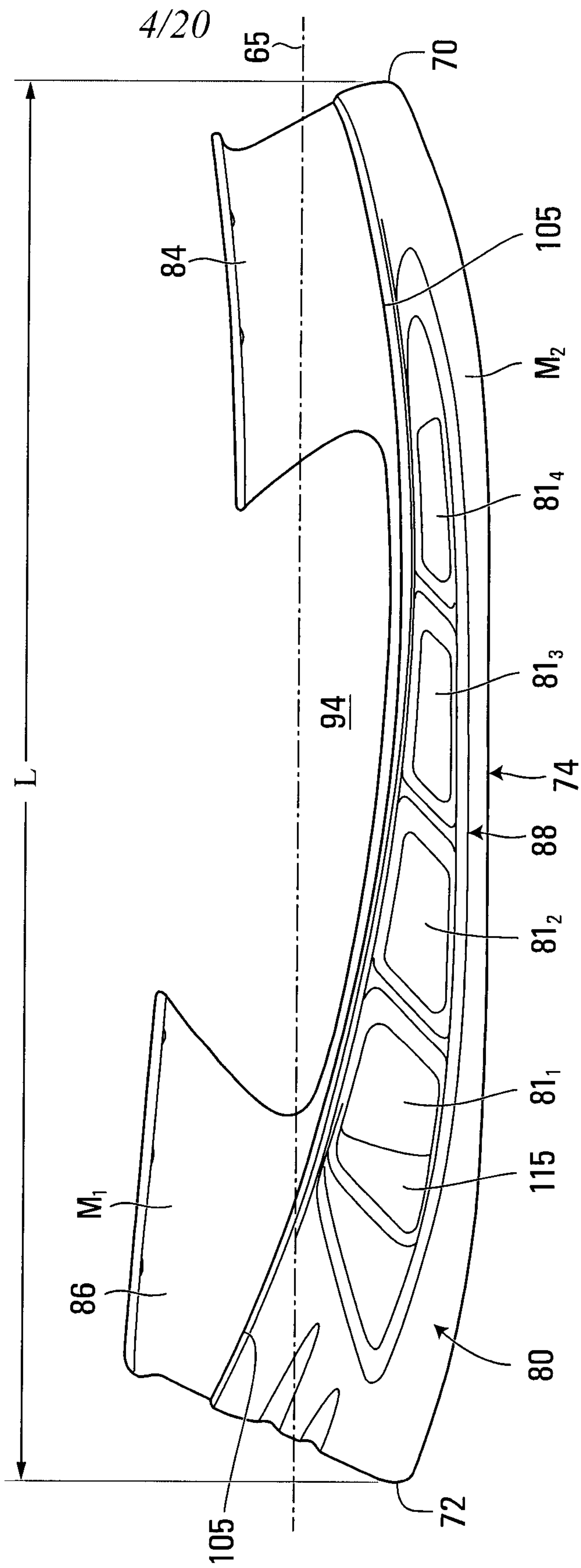


FIG. 5

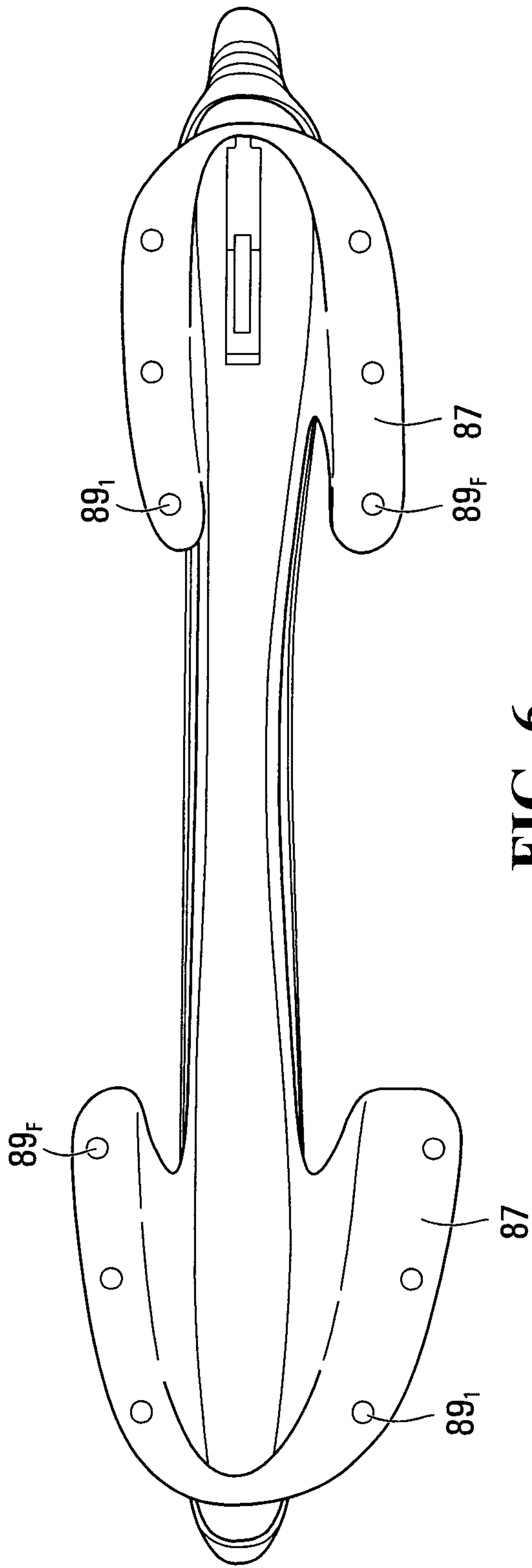


FIG. 6

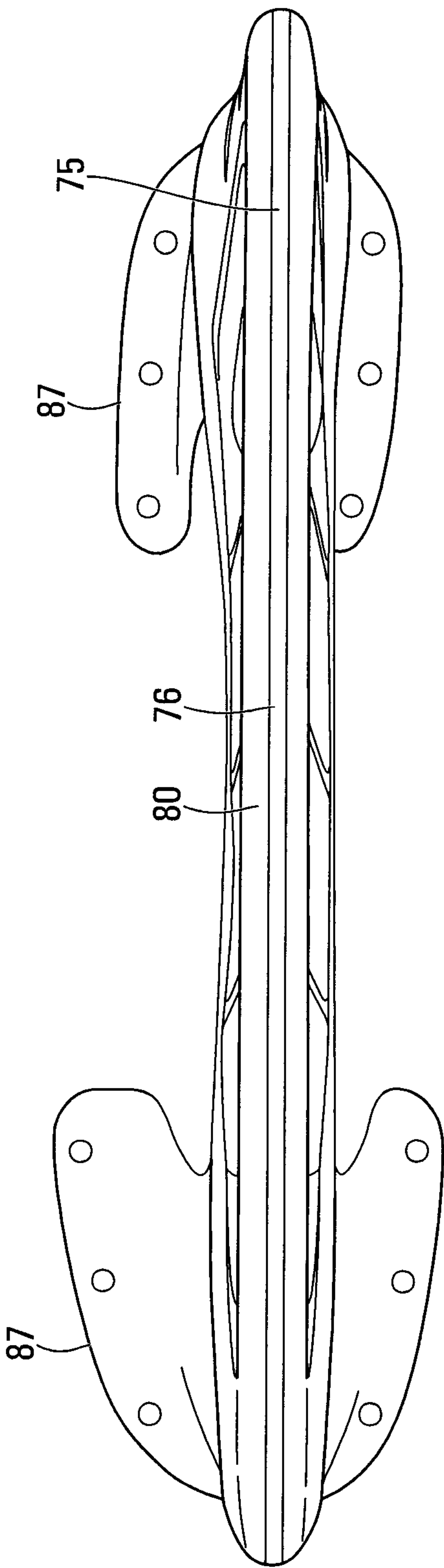


FIG. 7

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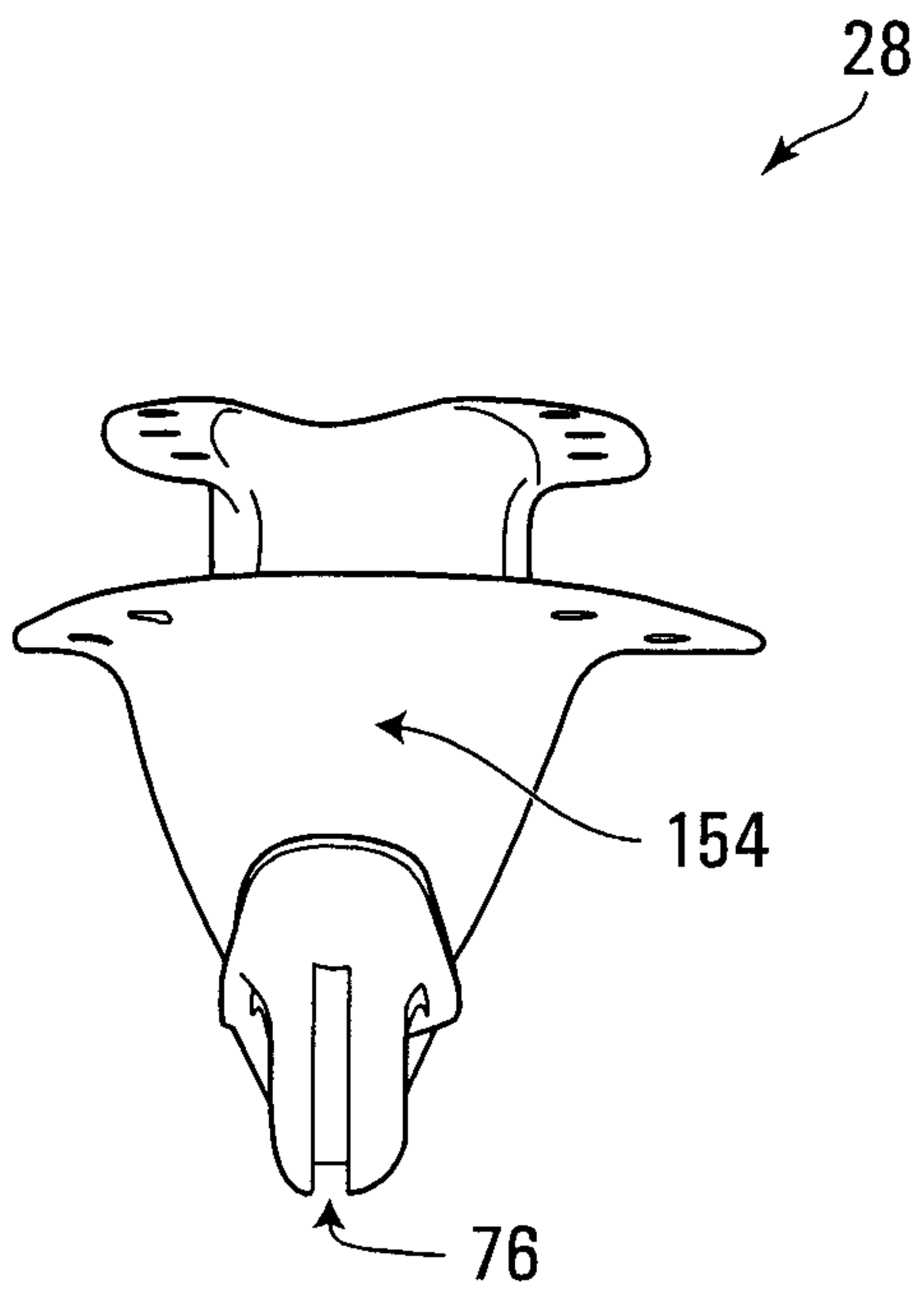


FIG. 8

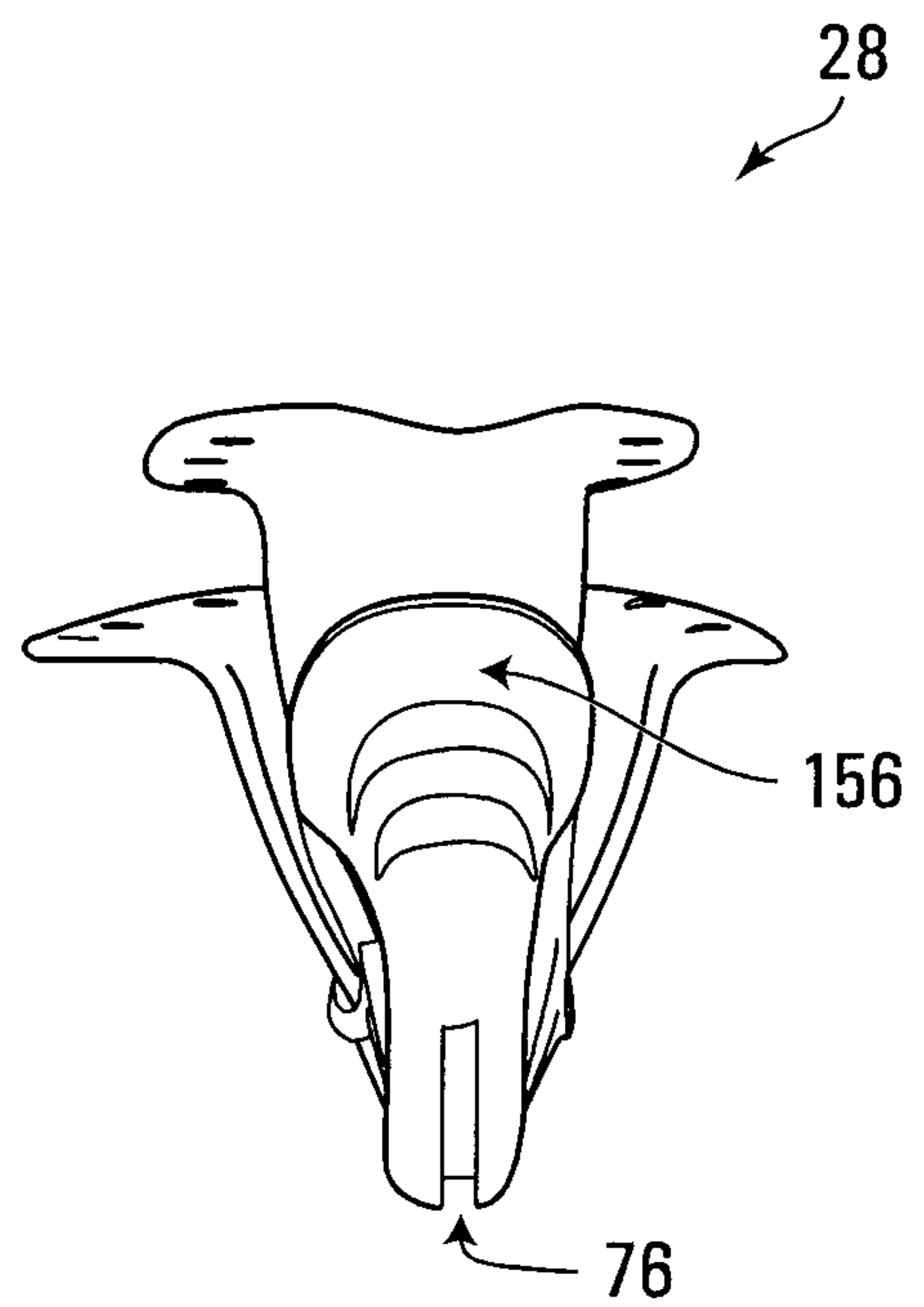


FIG. 9

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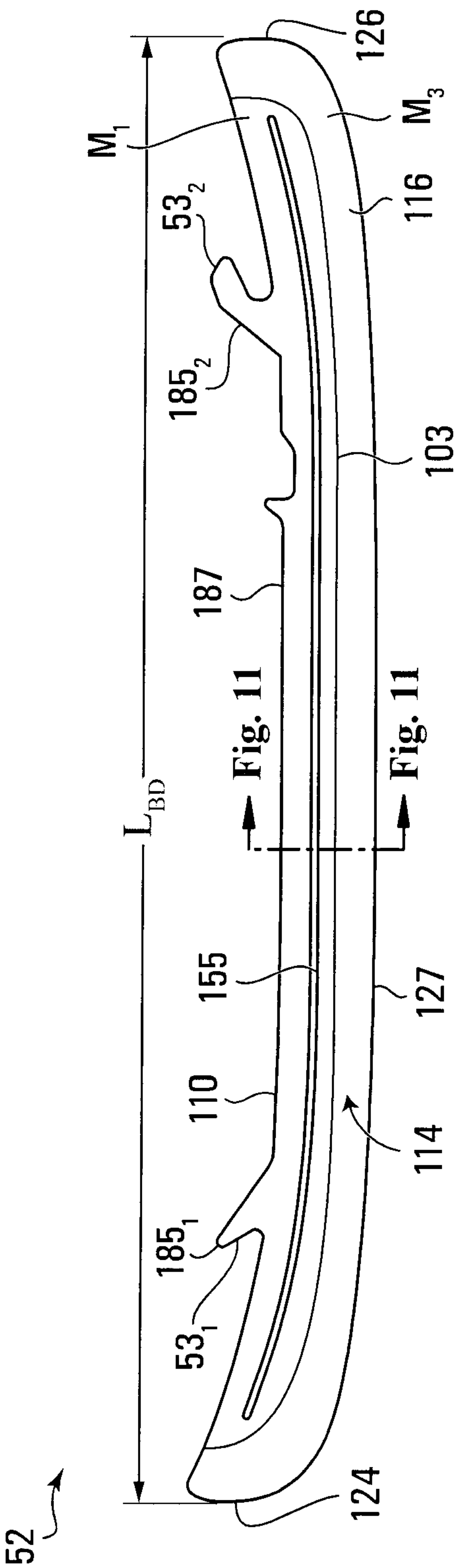


FIG. 10

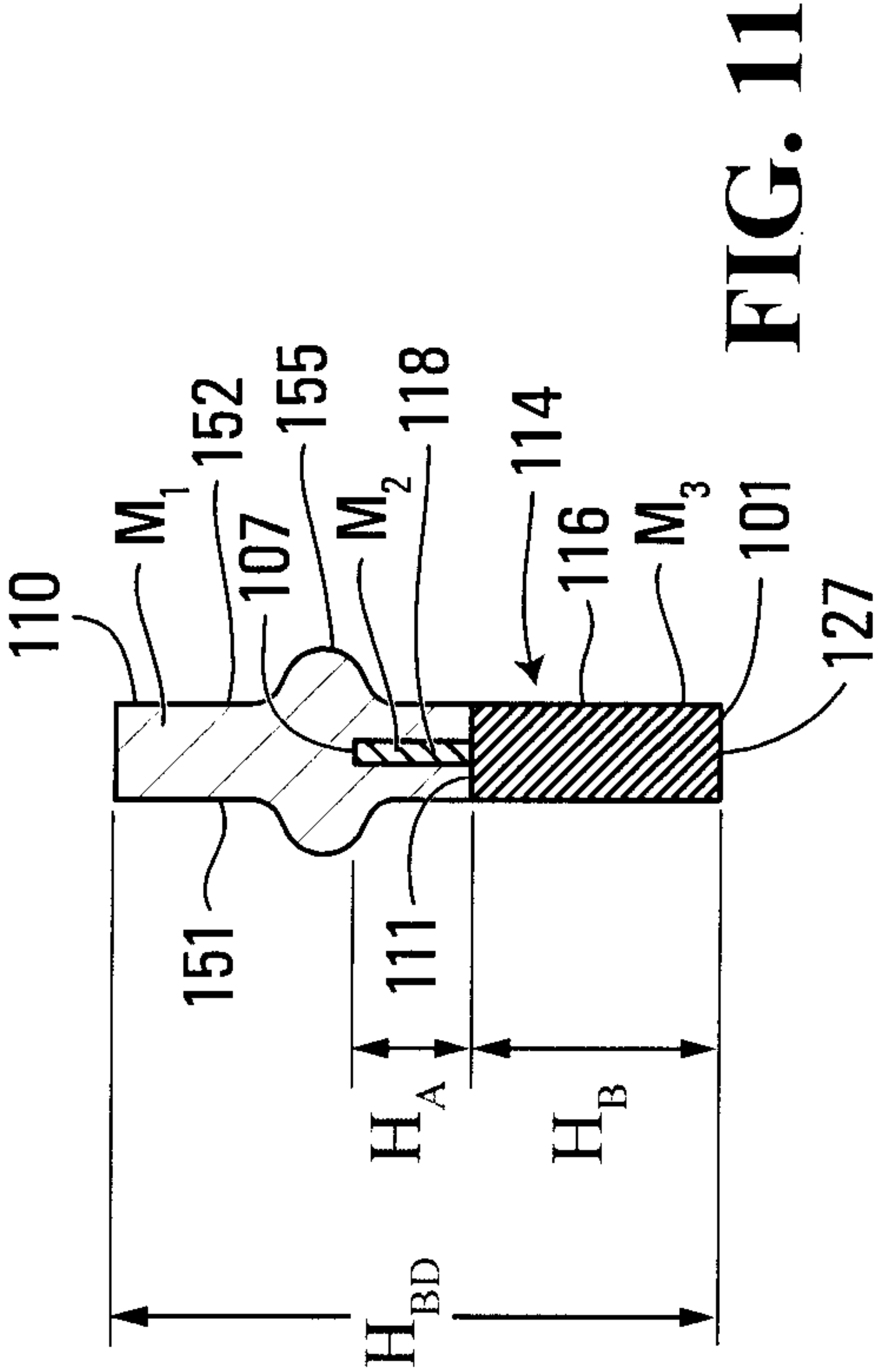


FIG. 11

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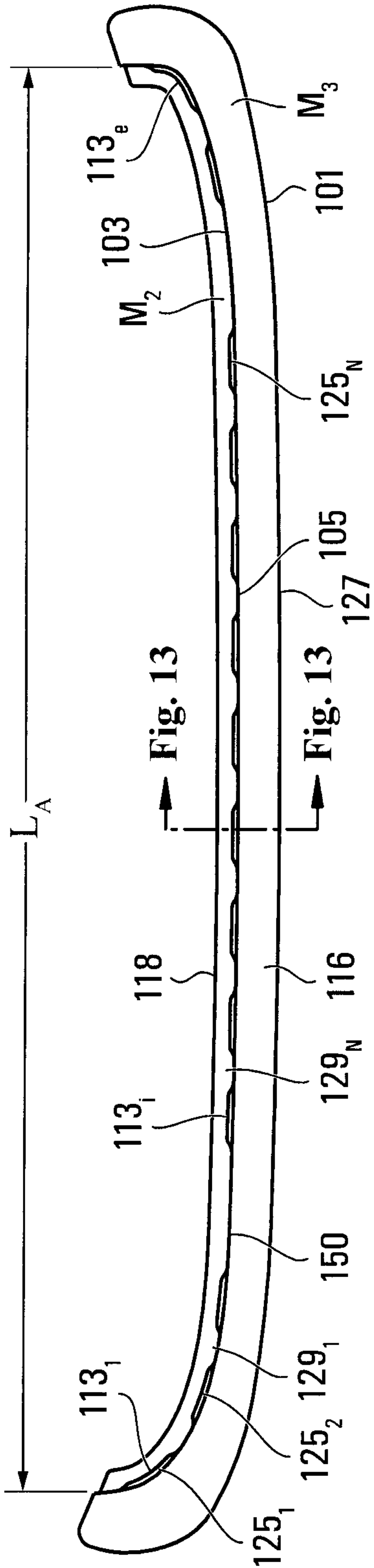


FIG. 12

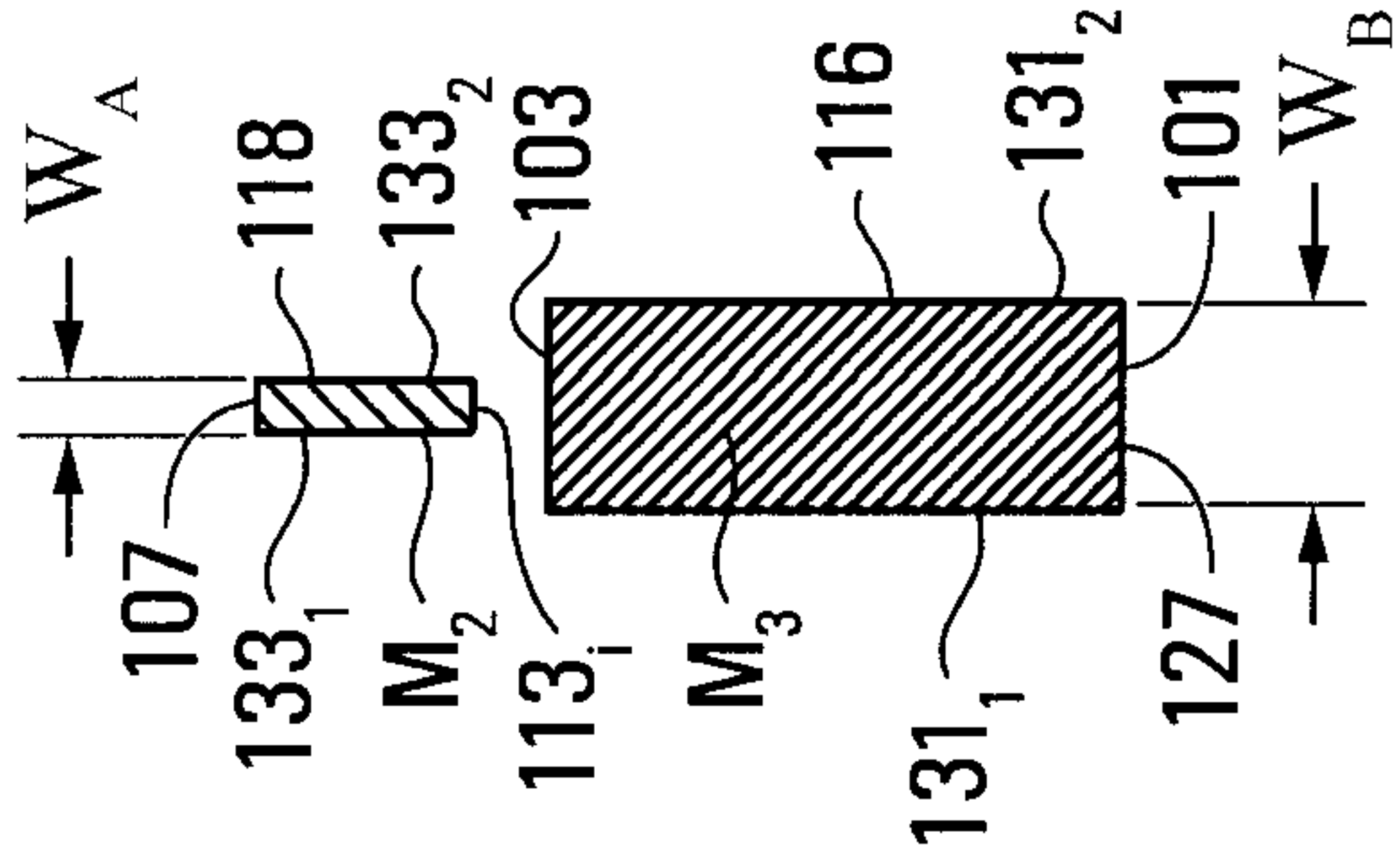
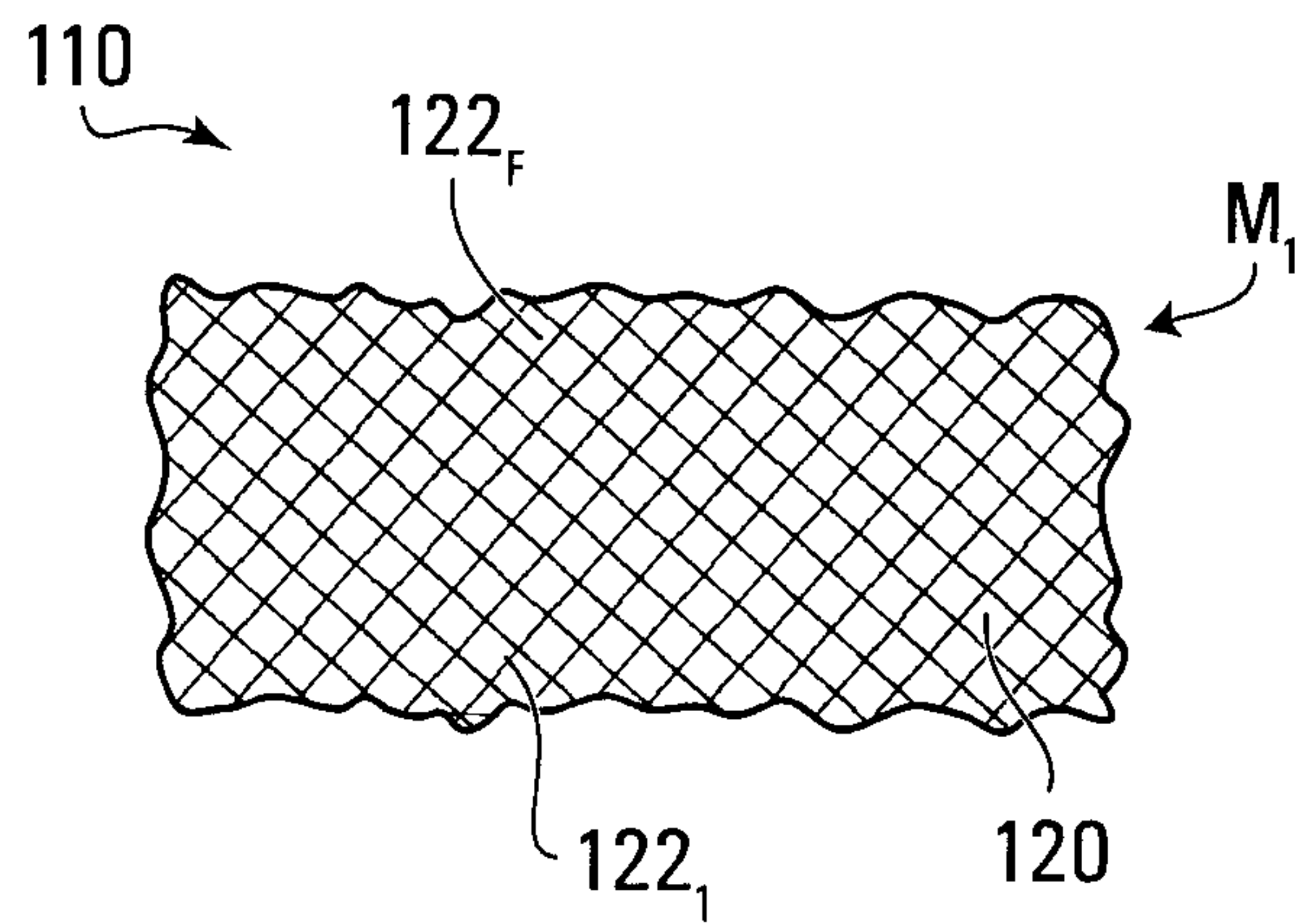
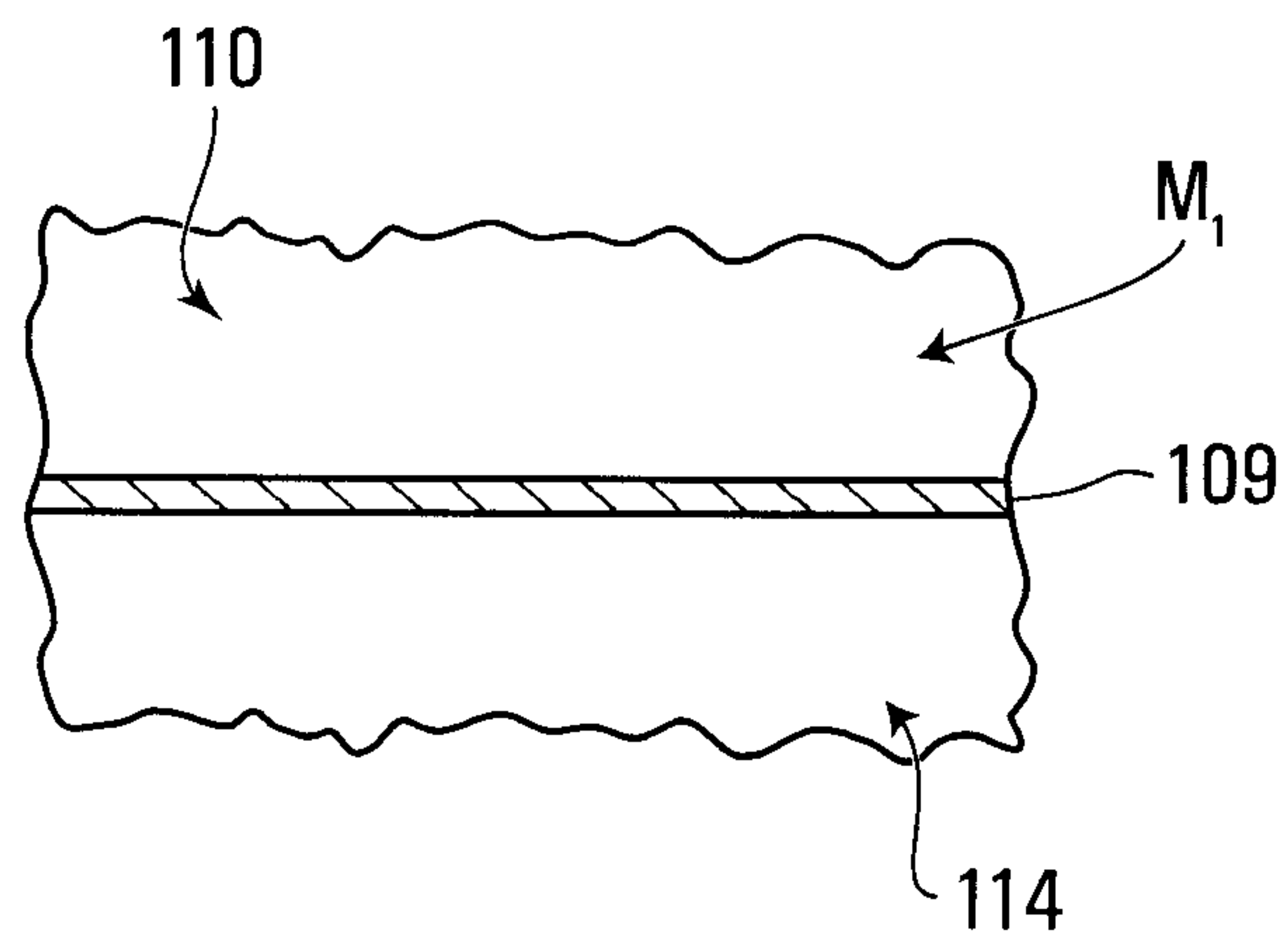


FIG. 13

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**FIG. 14****FIG. 15**

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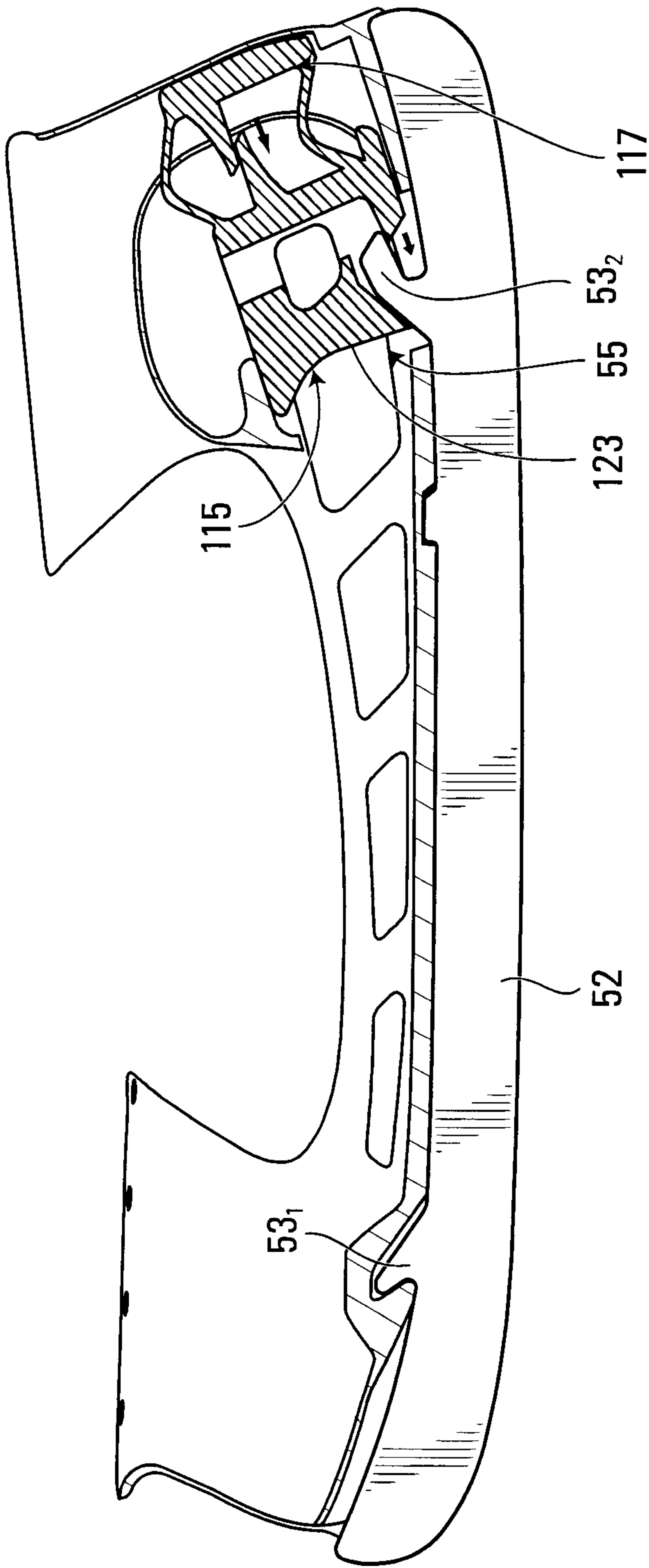


FIG. 16A

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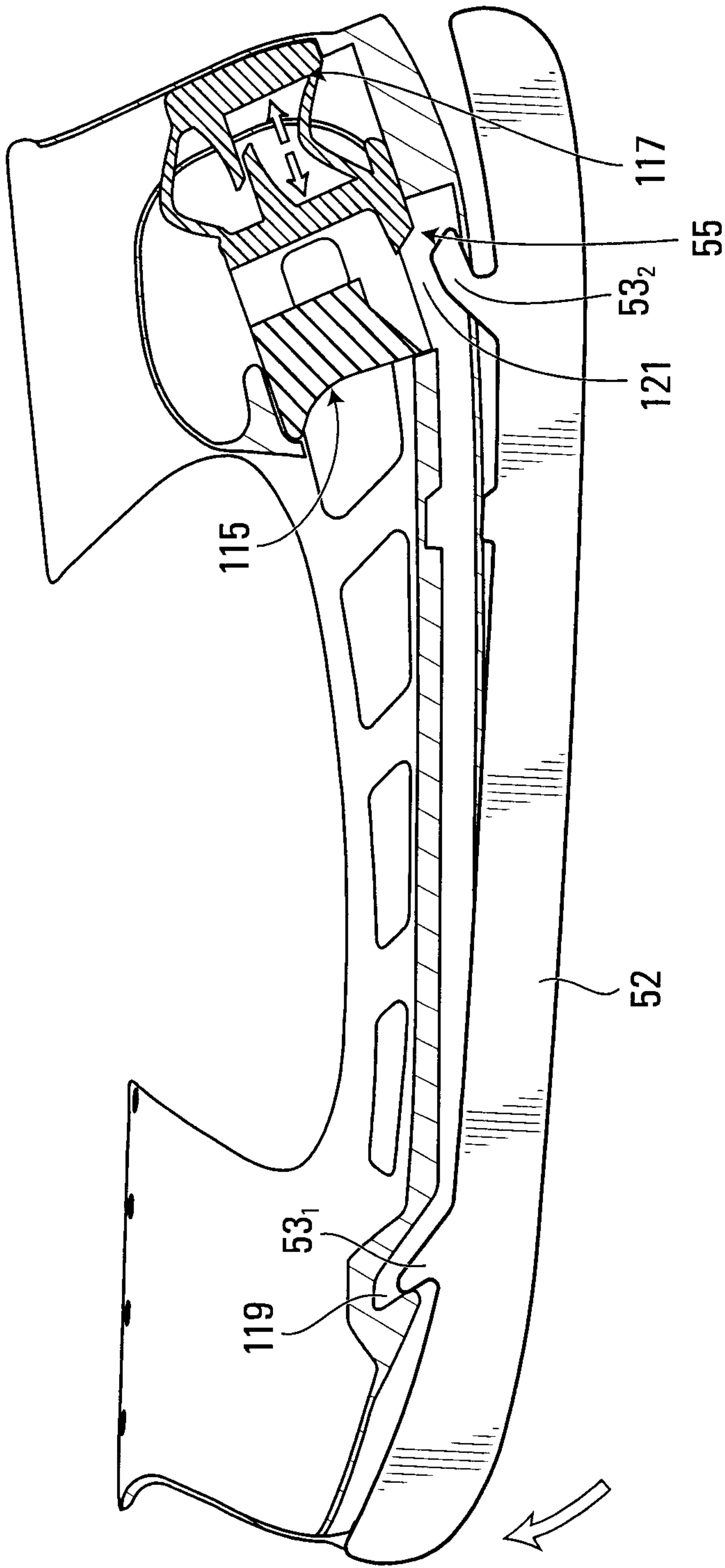


FIG. 16B

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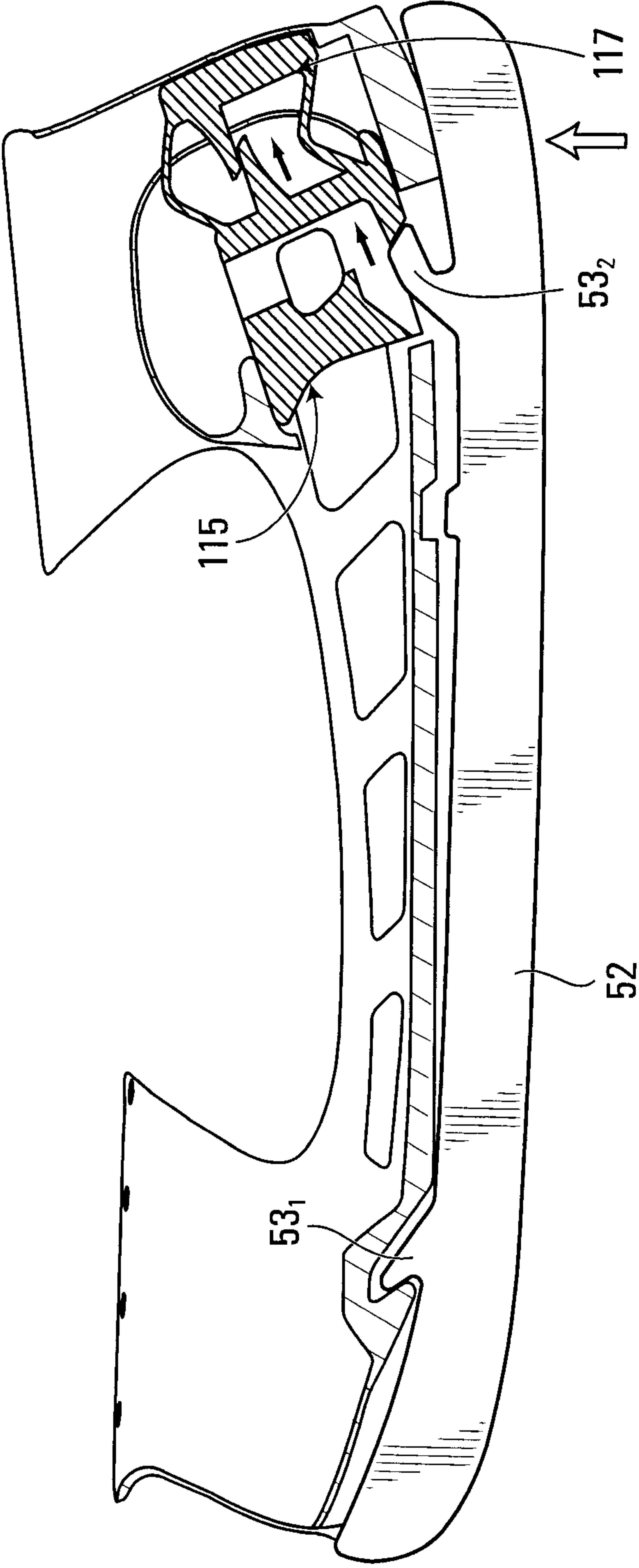
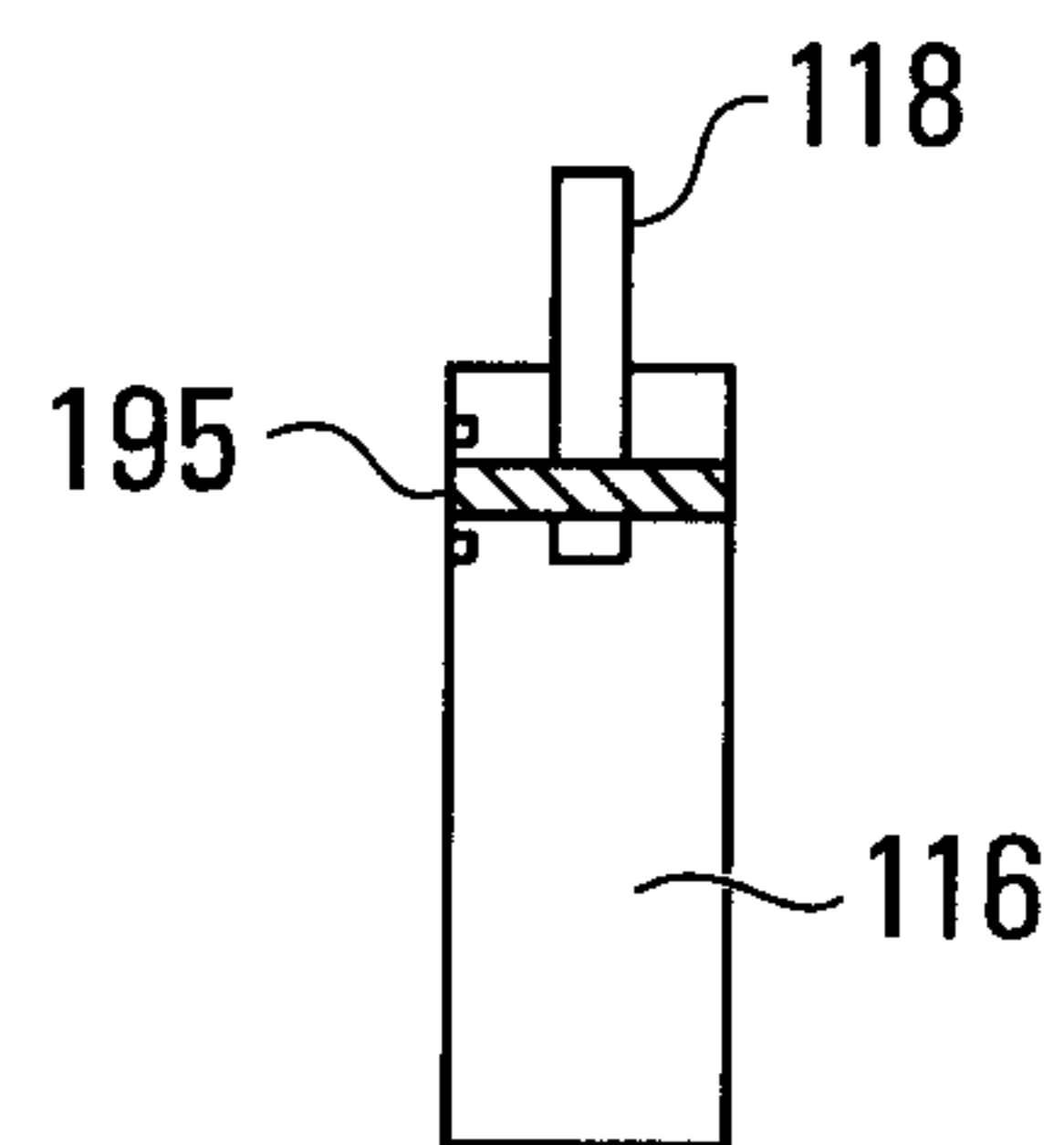
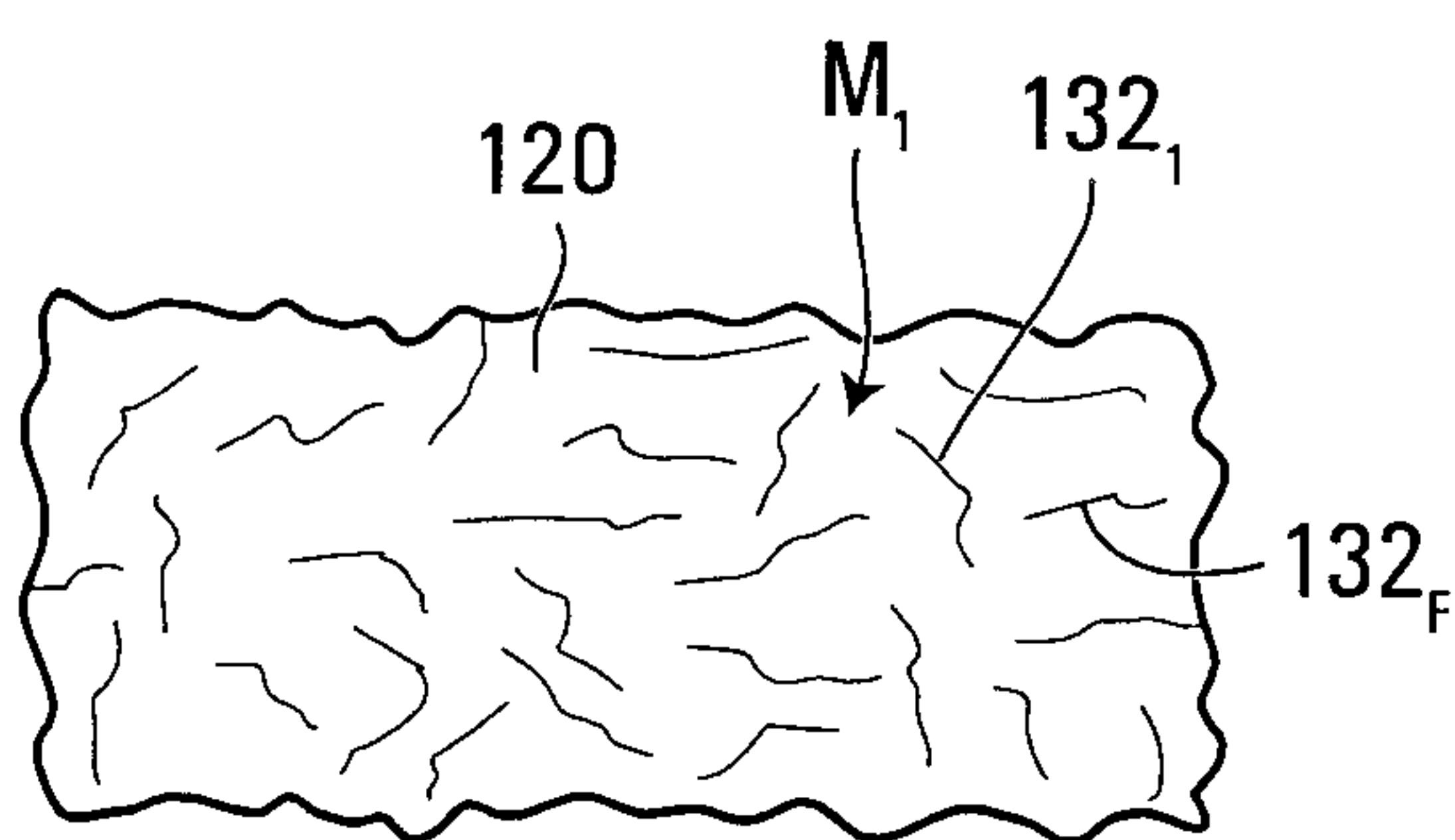
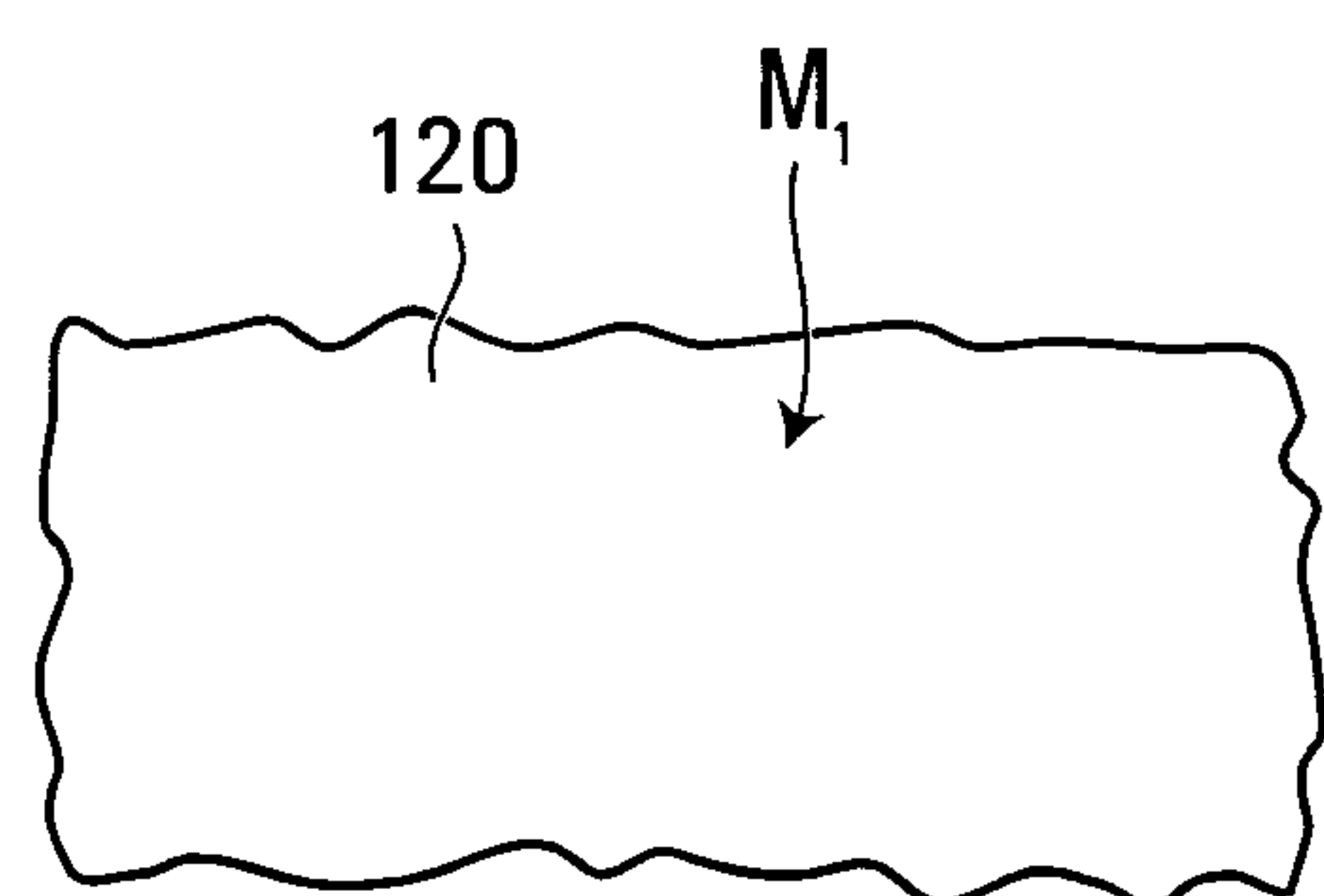


FIG. 16C

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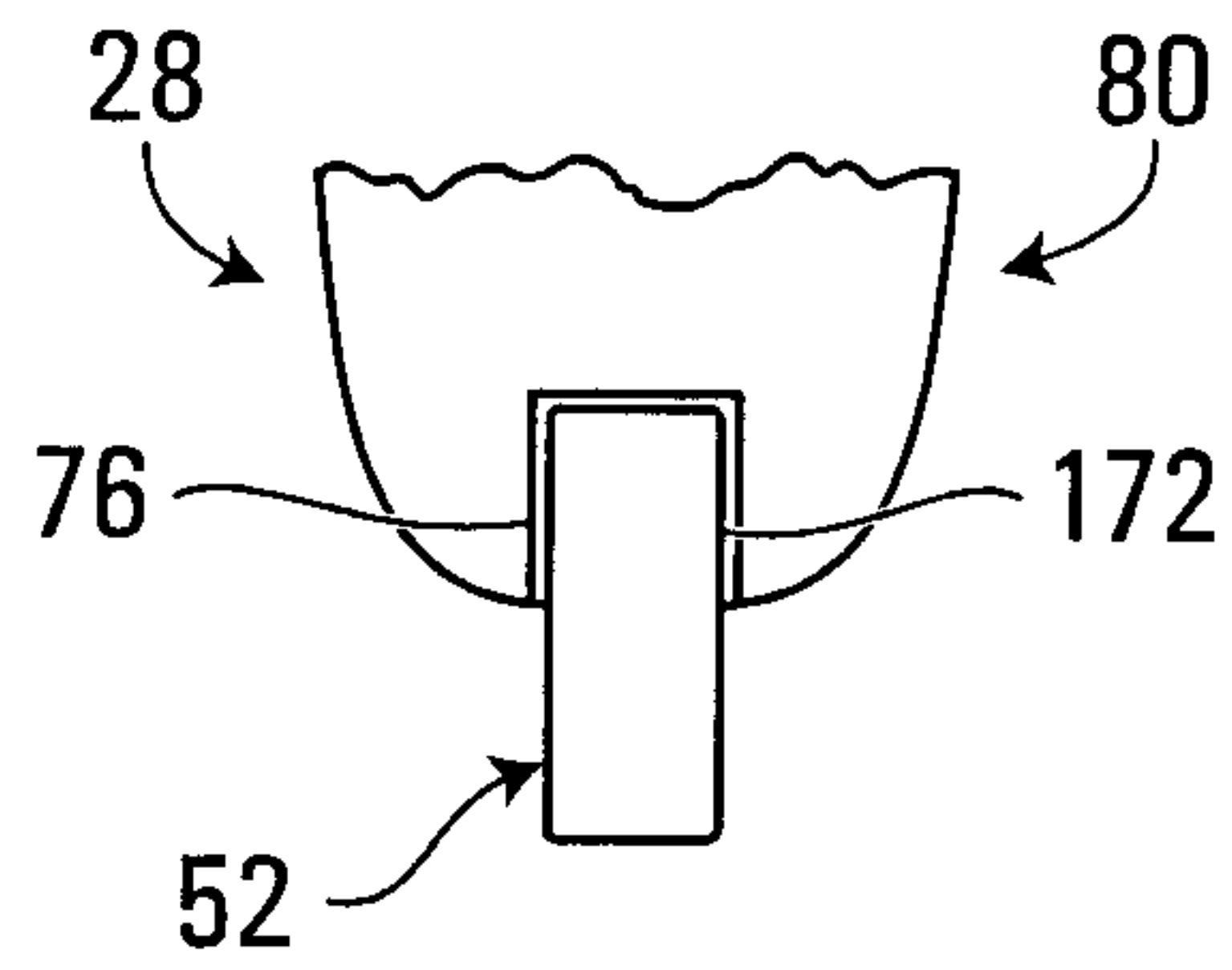
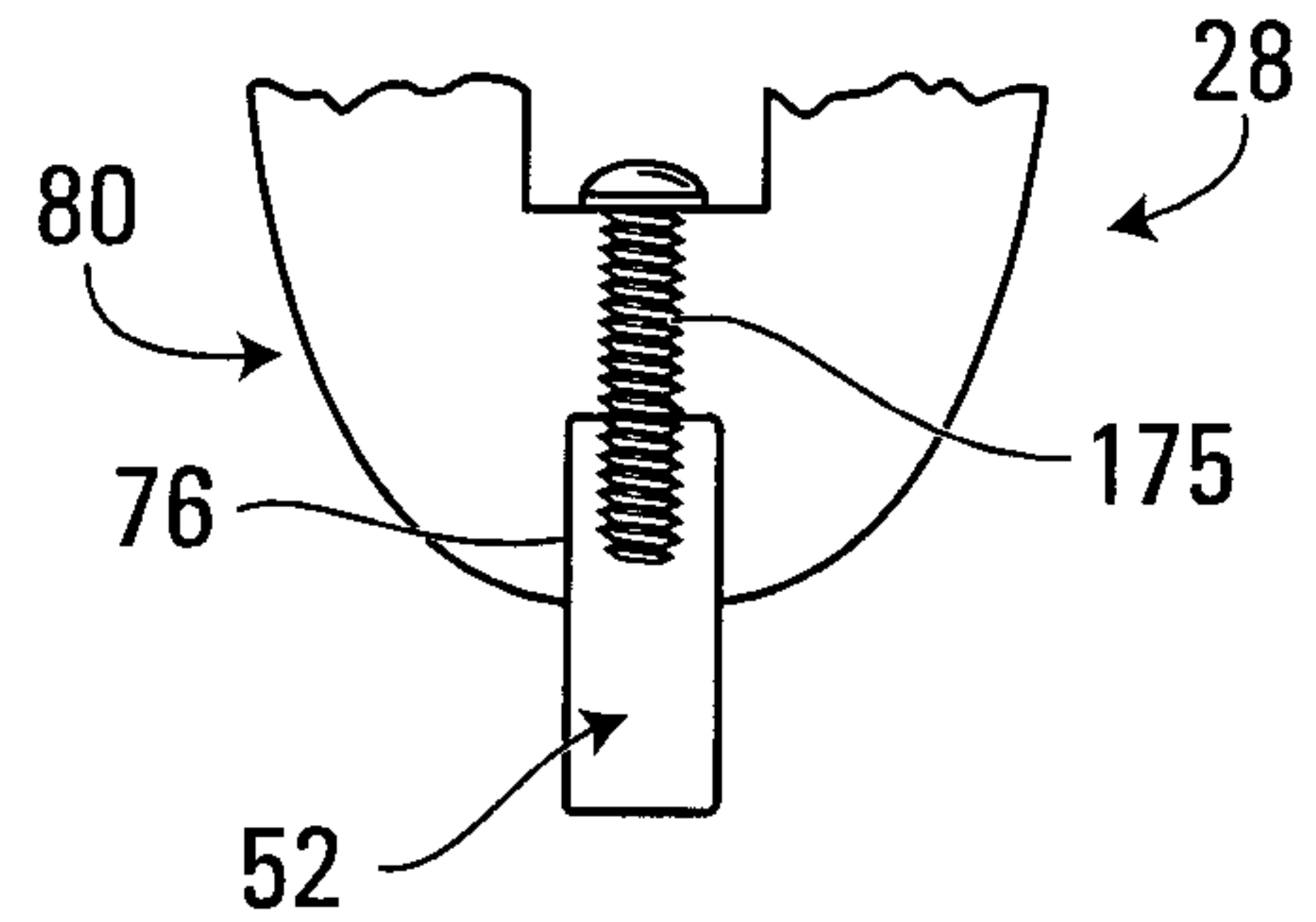
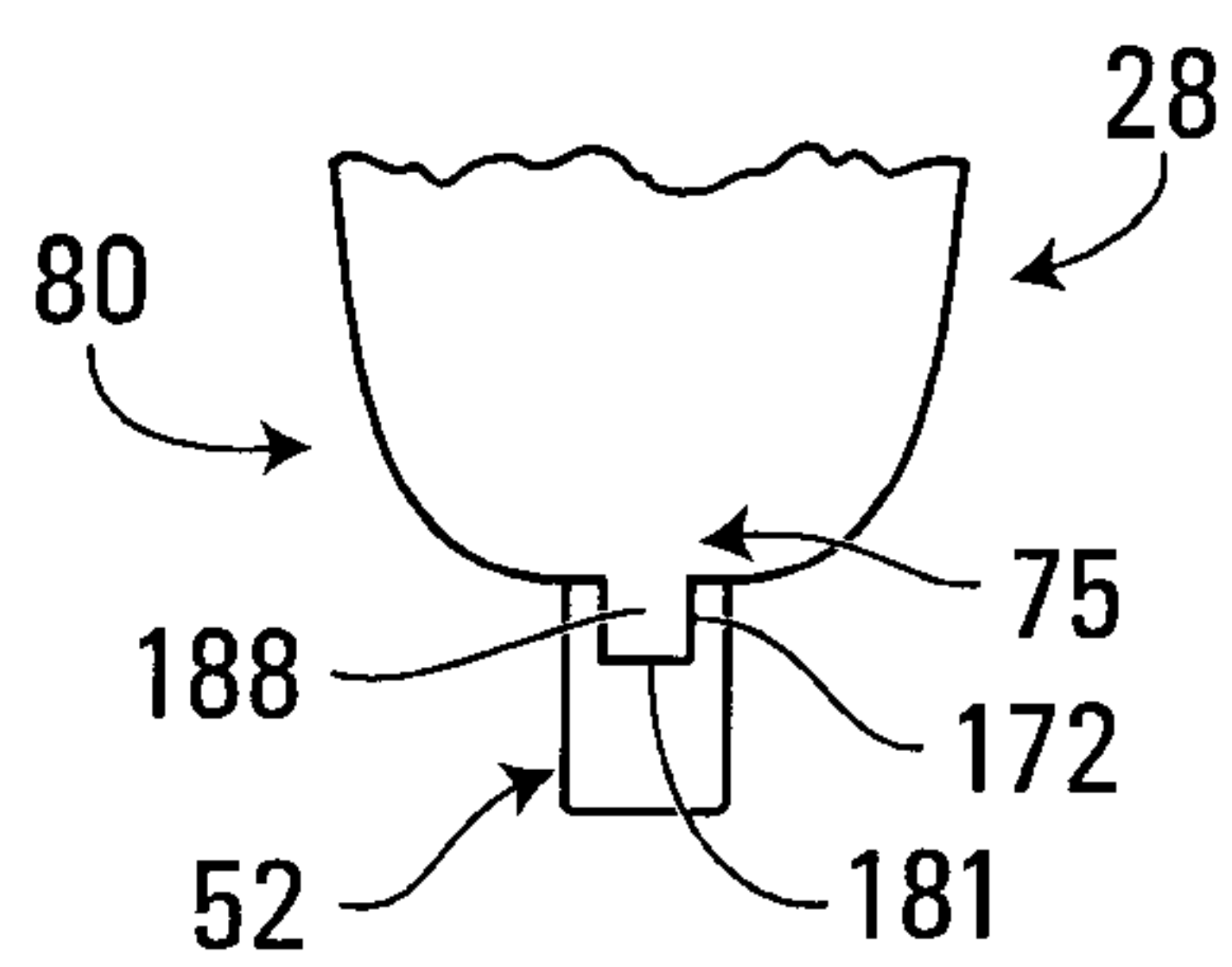
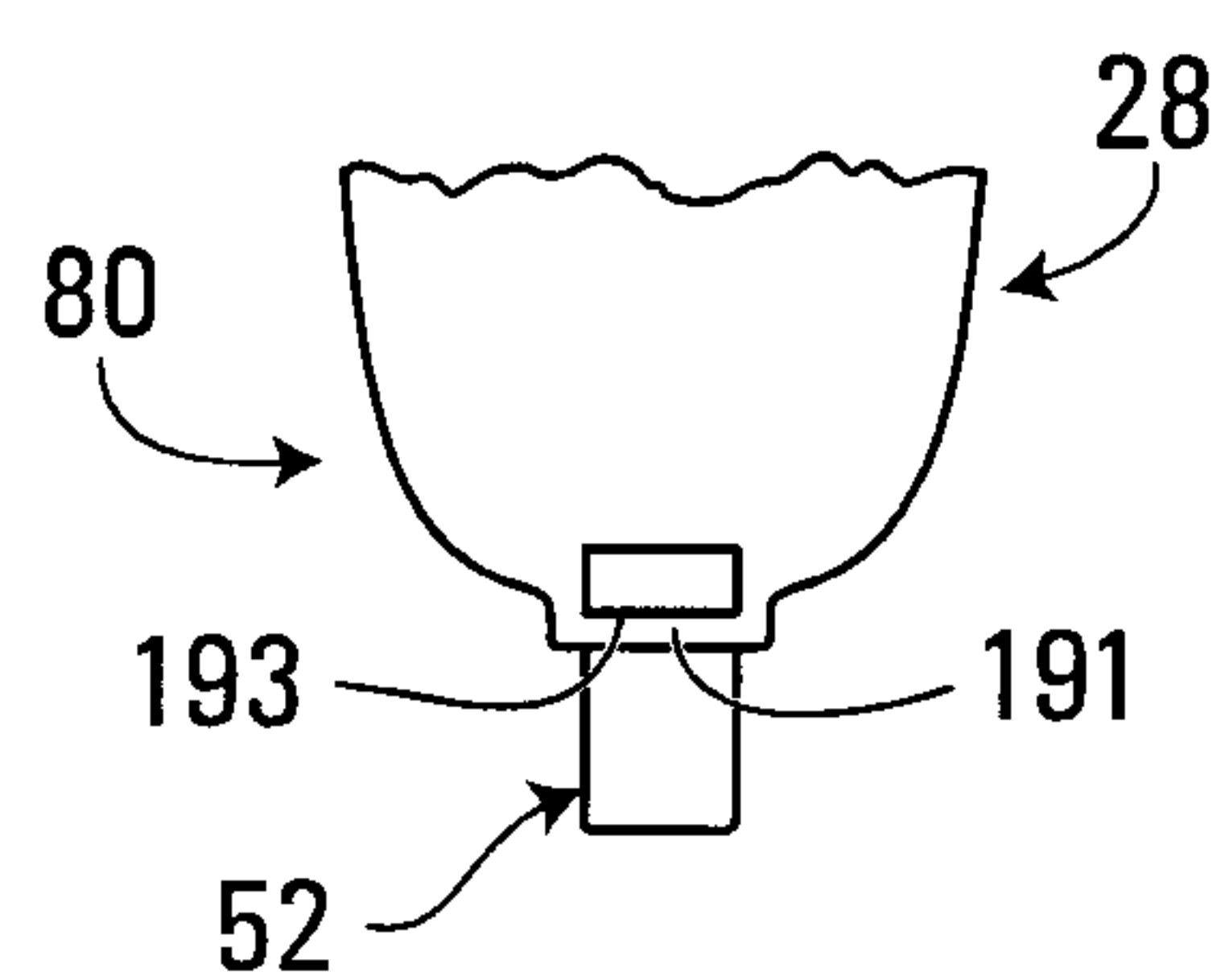
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**FIG. 17****FIG. 18****FIG. 19**

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**FIG. 20****FIG. 21****FIG. 22****FIG. 23**

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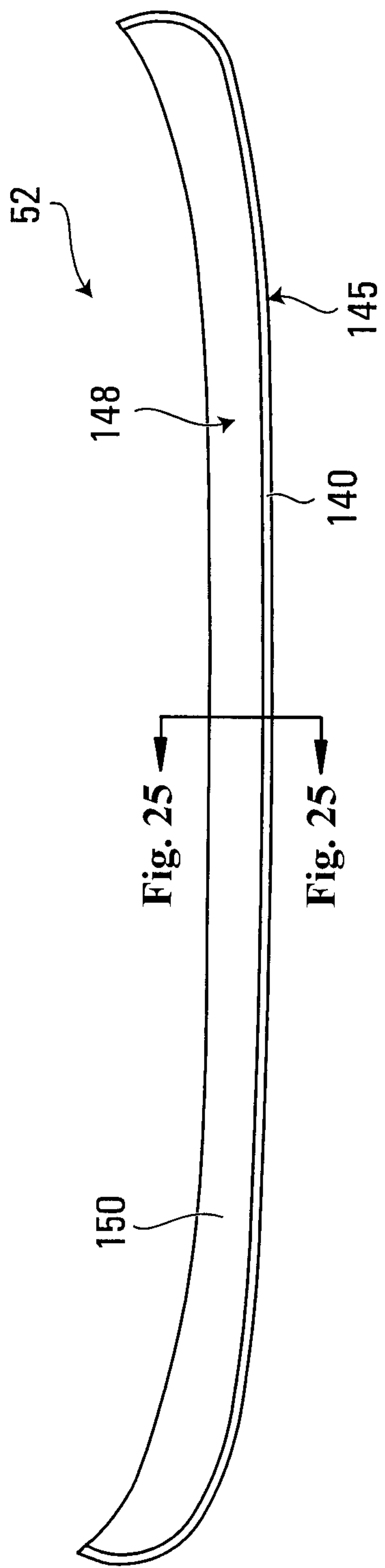


FIG. 24

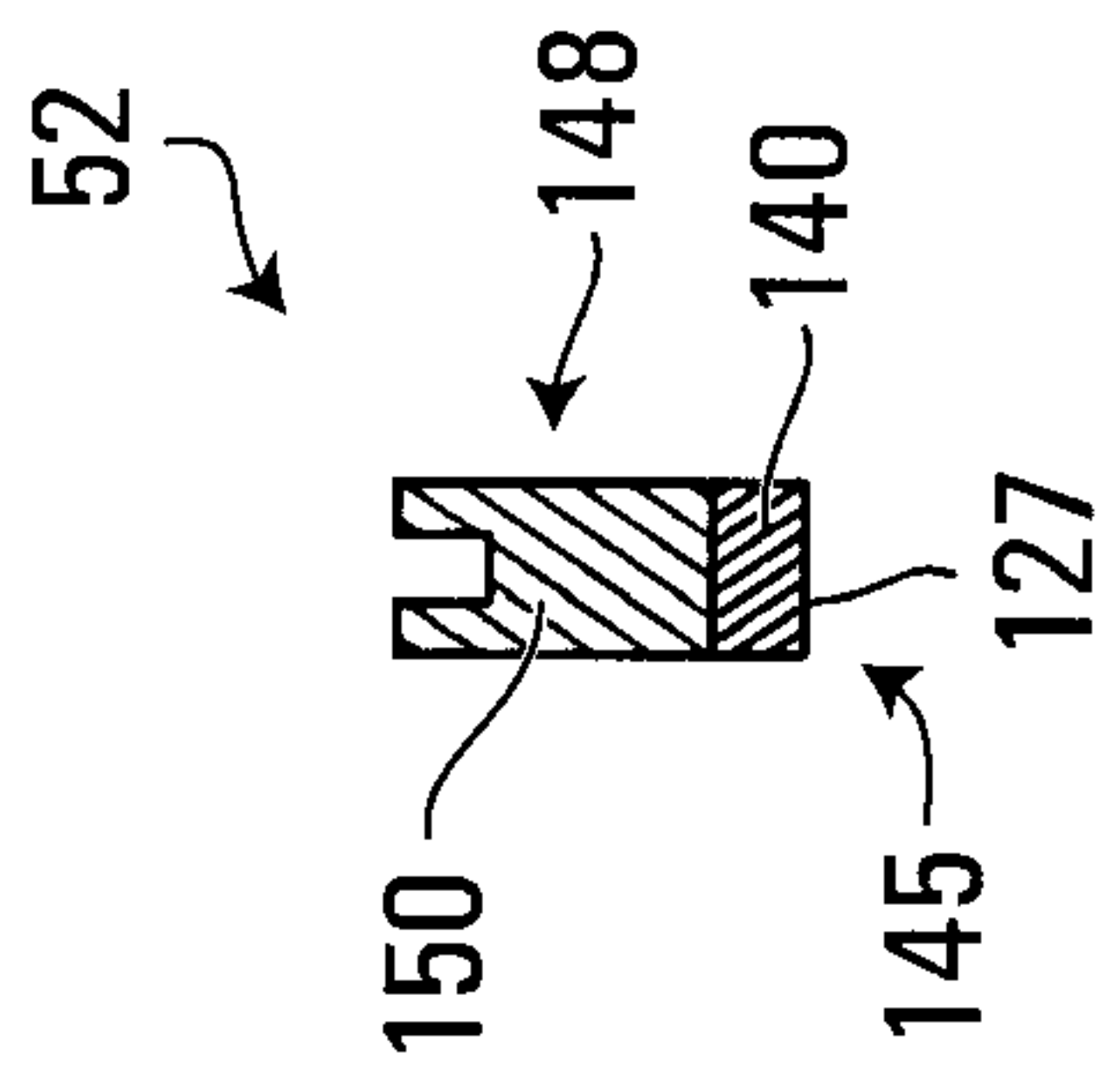


FIG. 25

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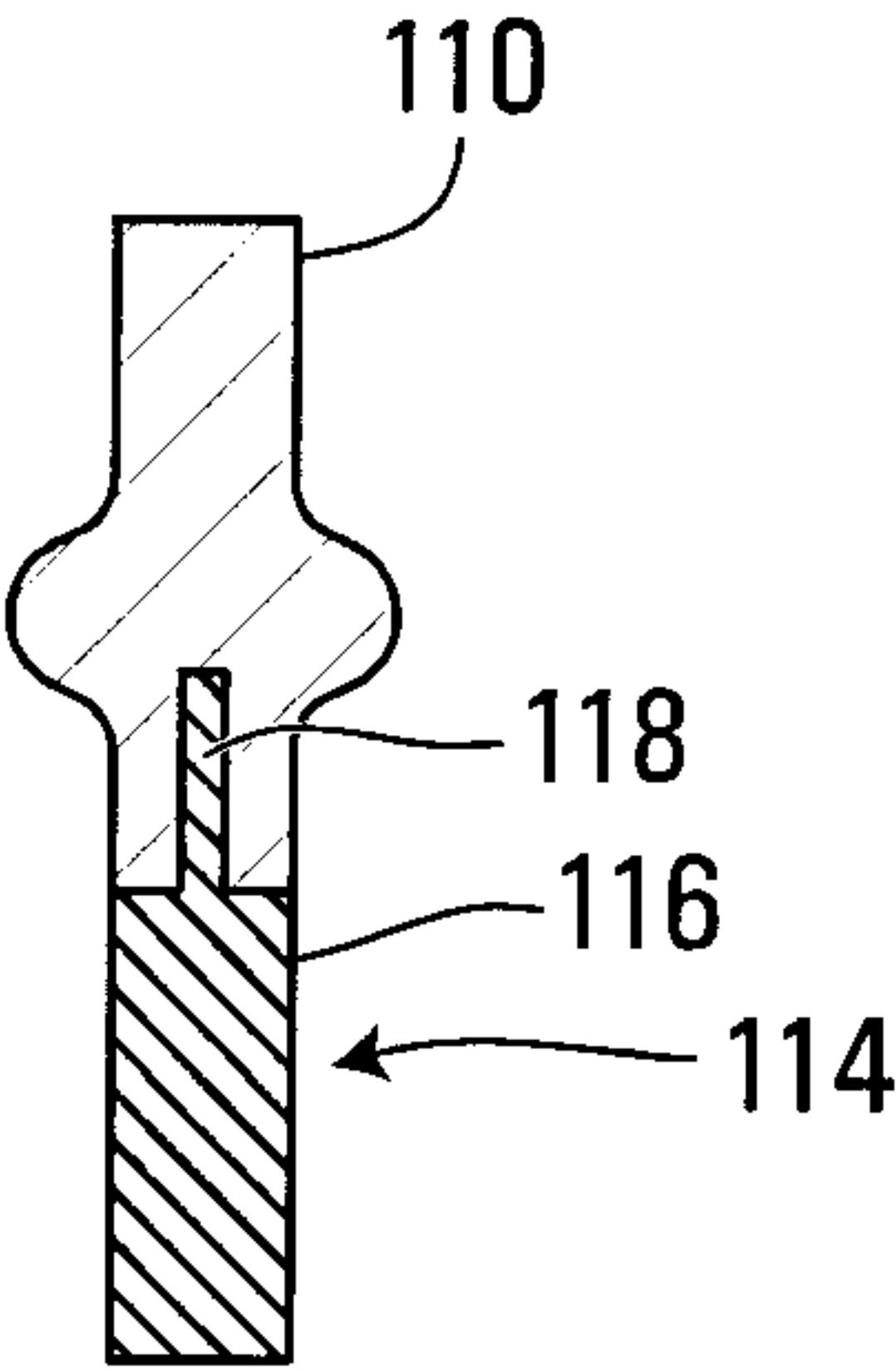


FIG. 26

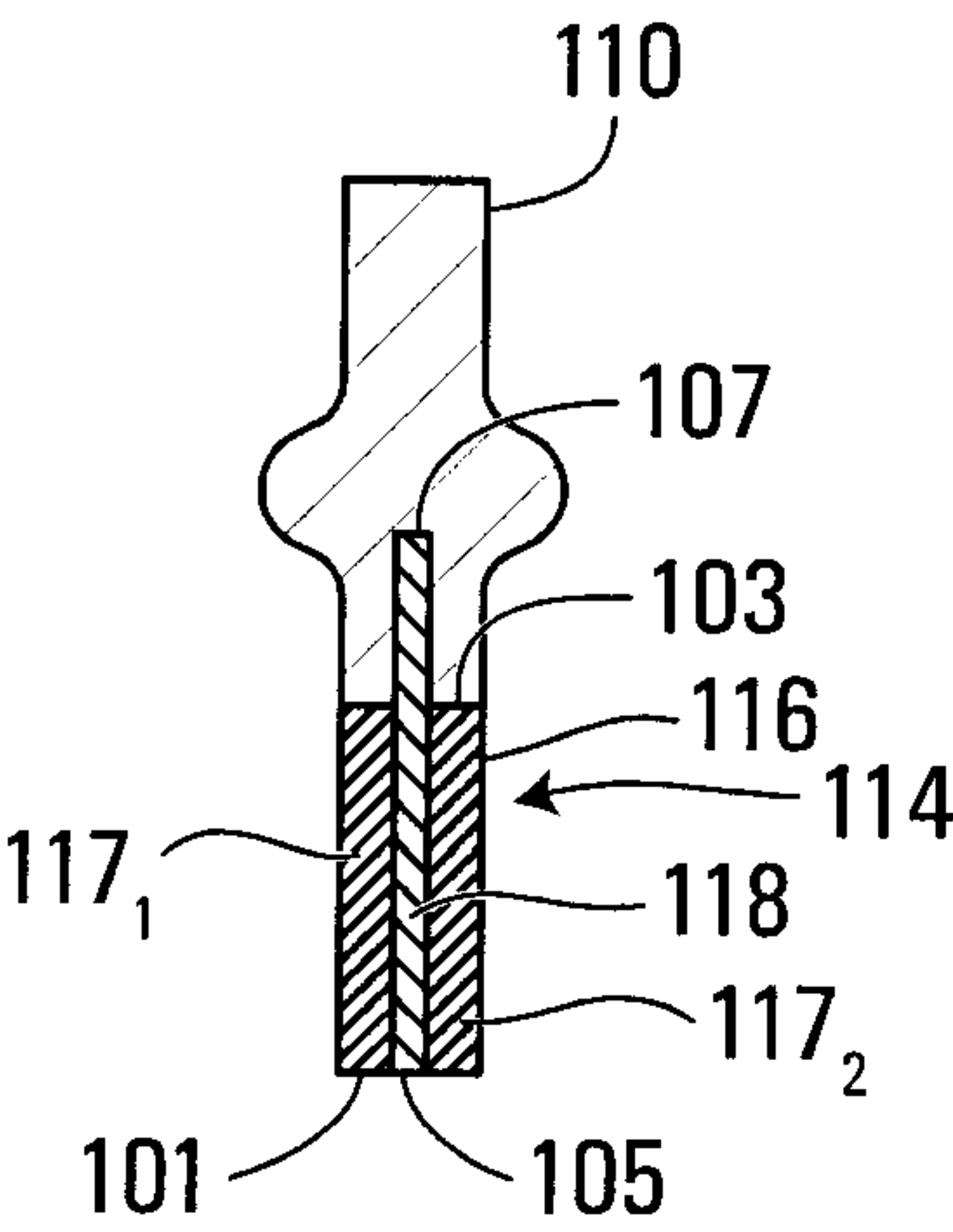


FIG. 27

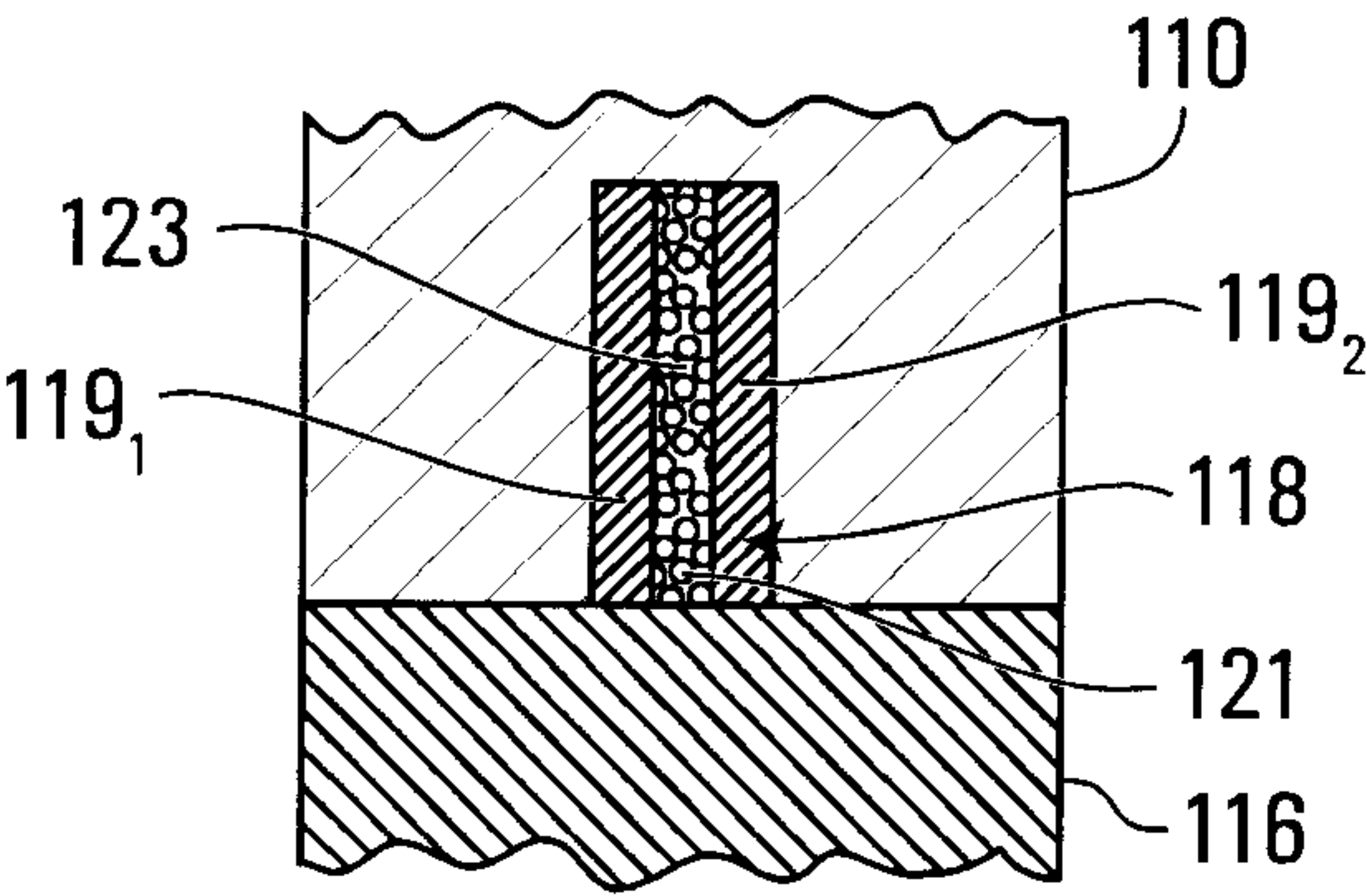


FIG. 28

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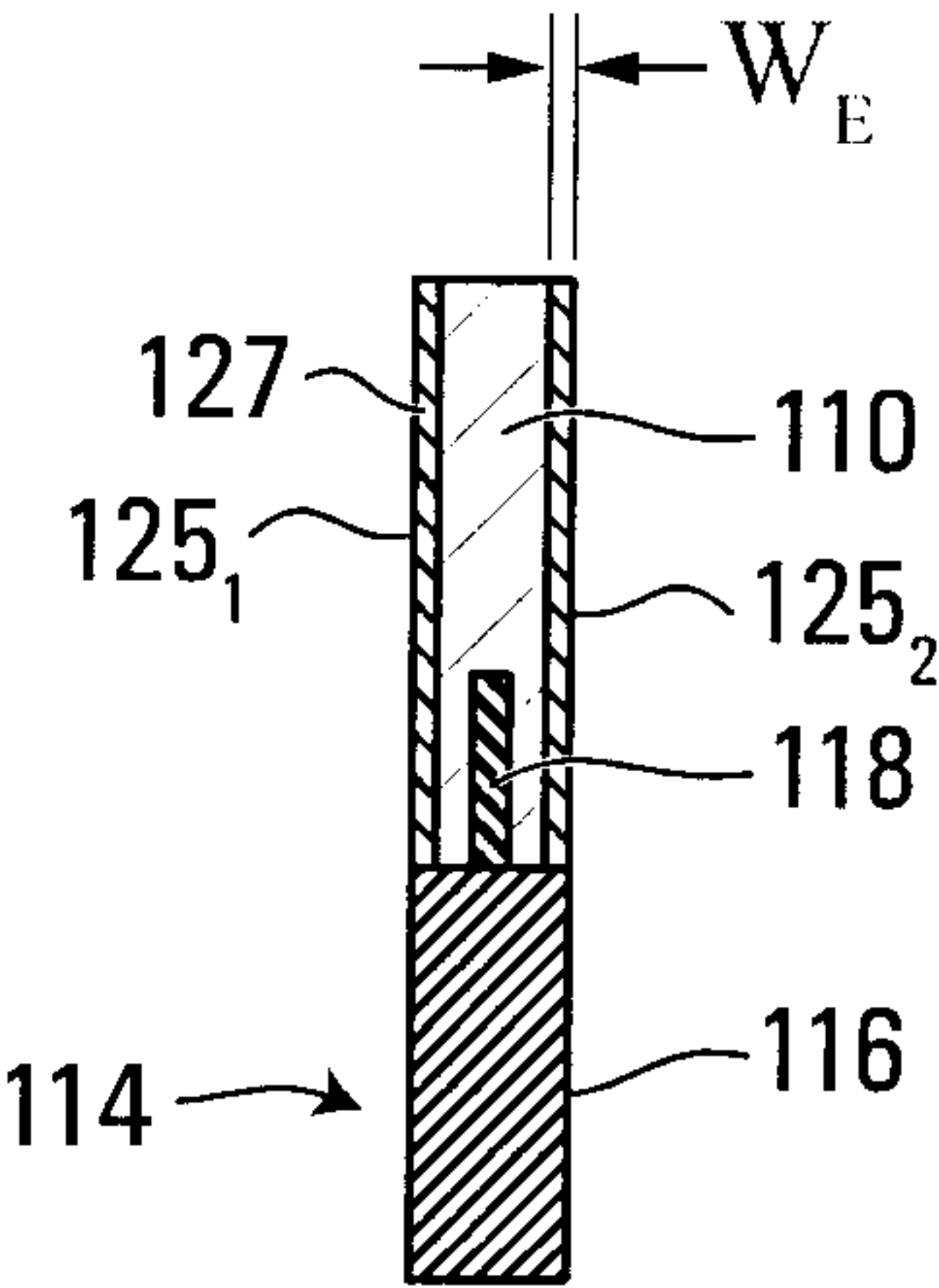


FIG. 29

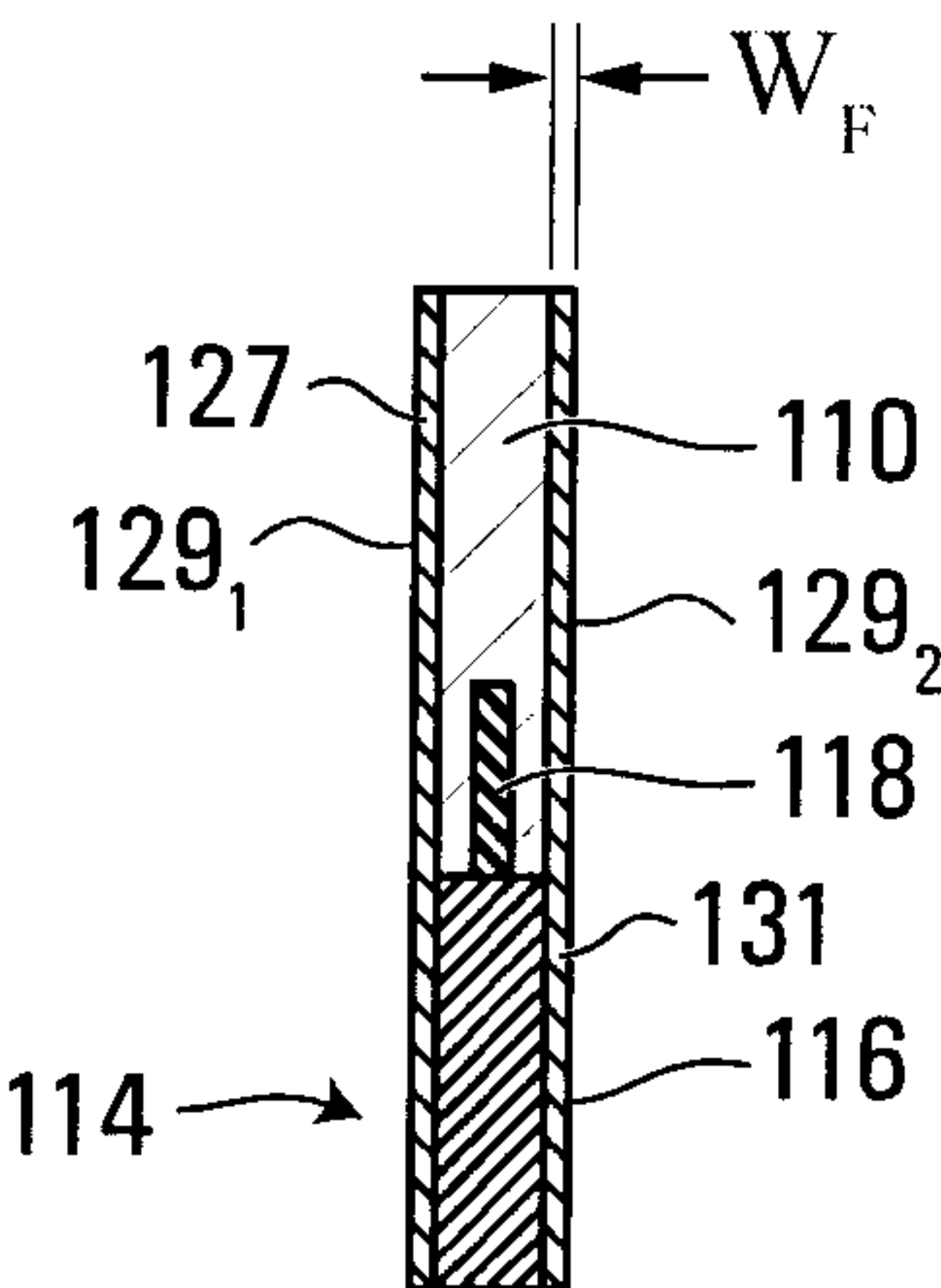


FIG. 30

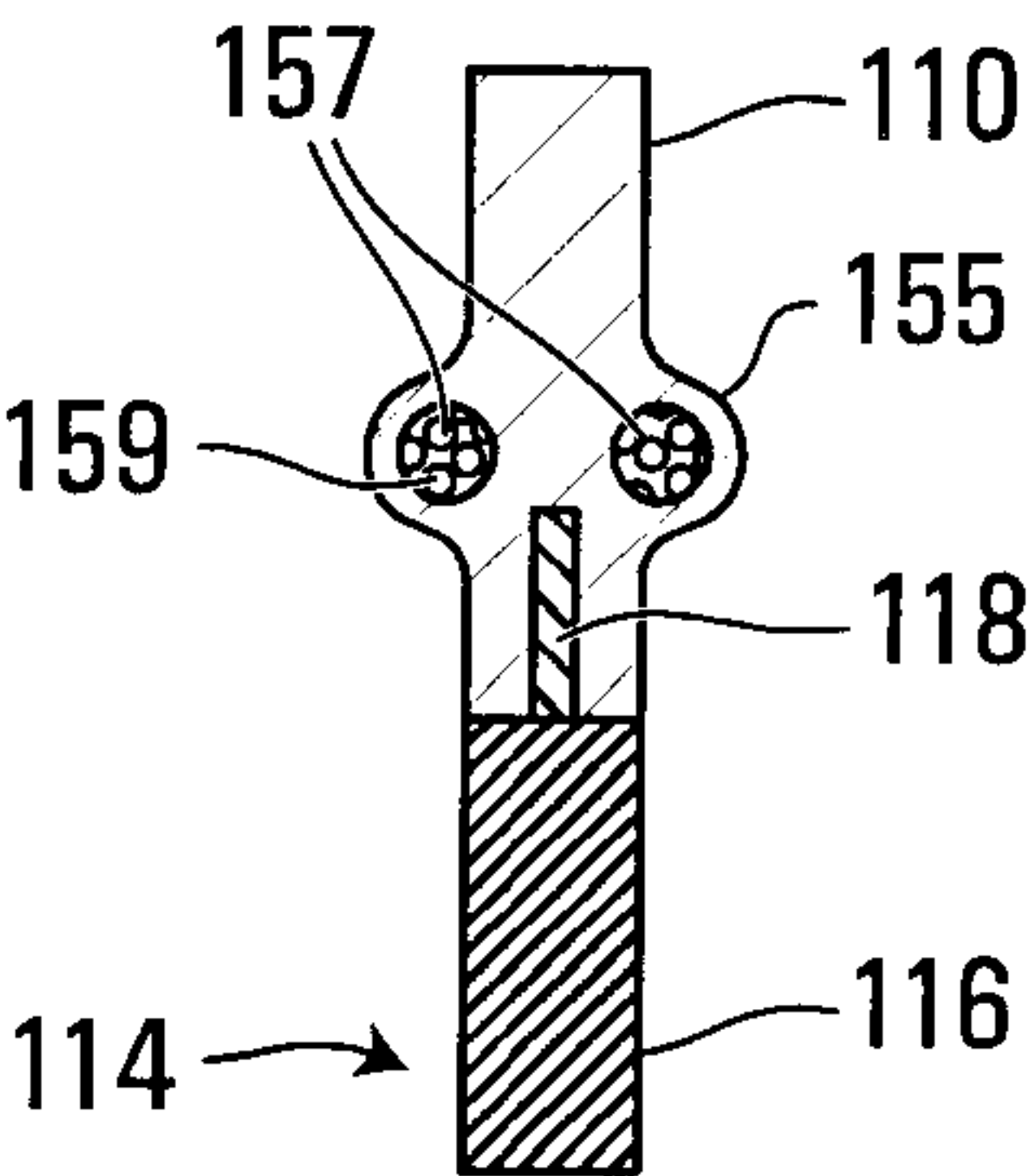


FIG. 31

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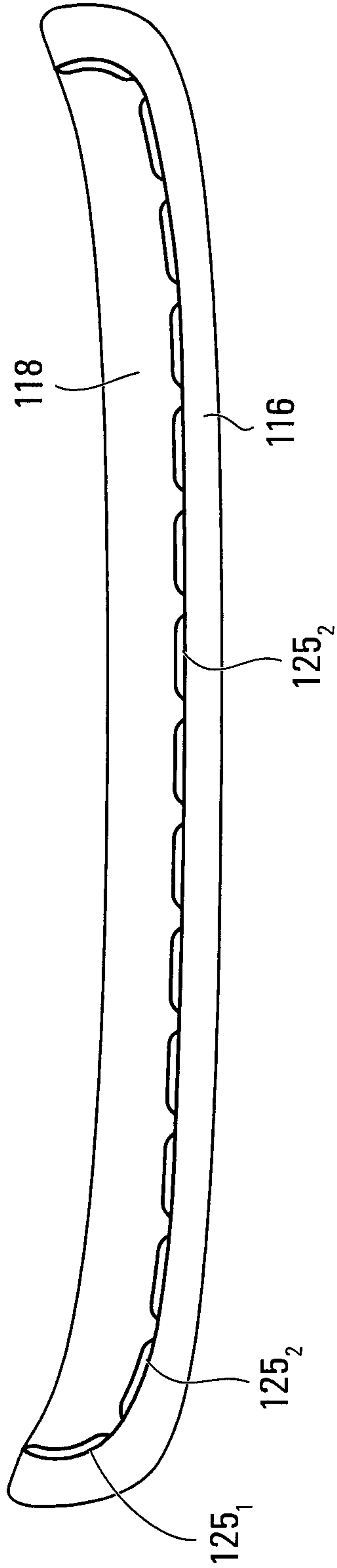


FIG. 32

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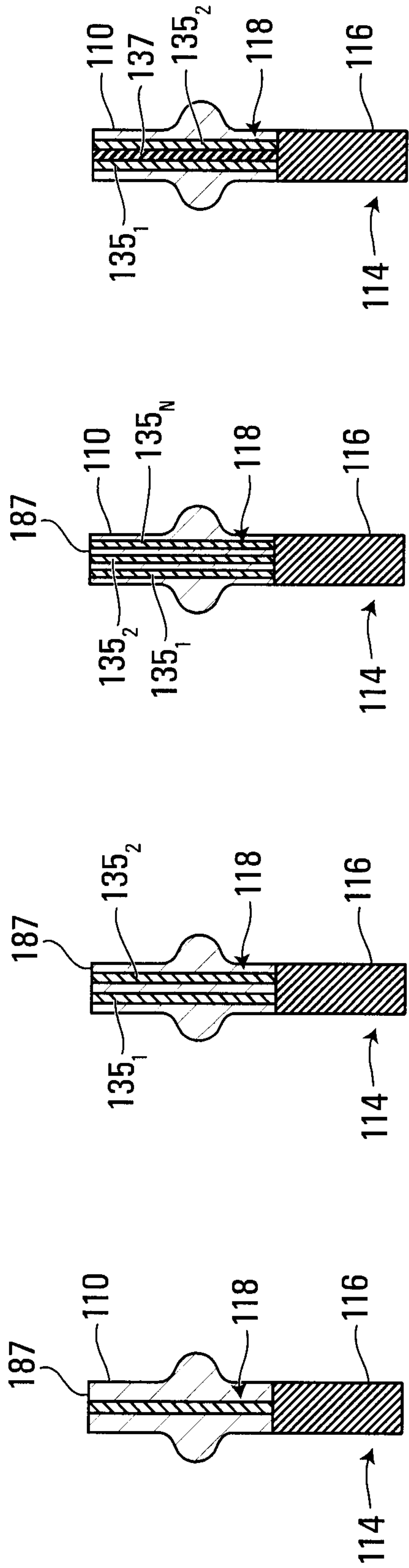


FIG. 33

FIG. 34

FIG. 35

FIG. 36

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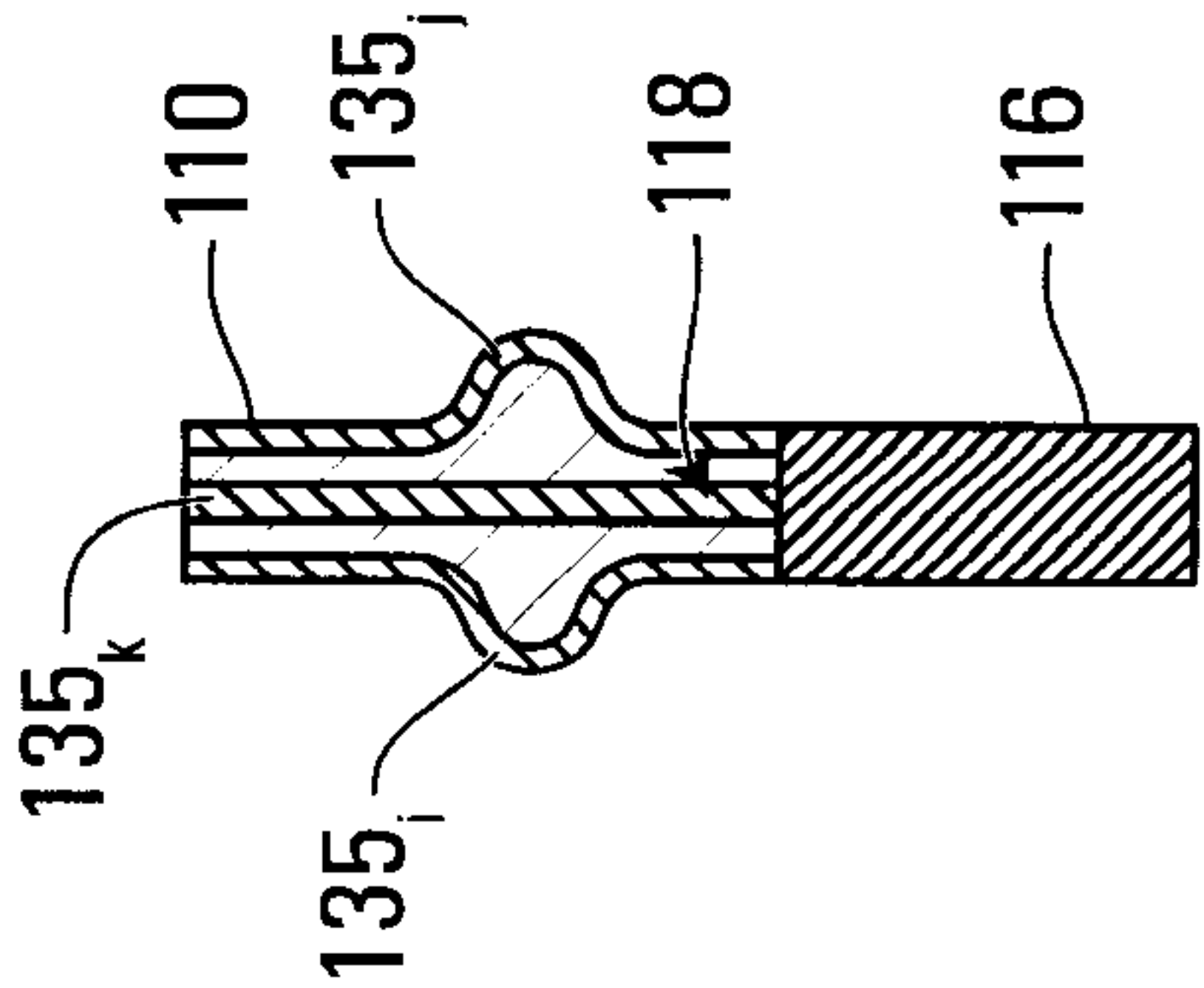


FIG. 37

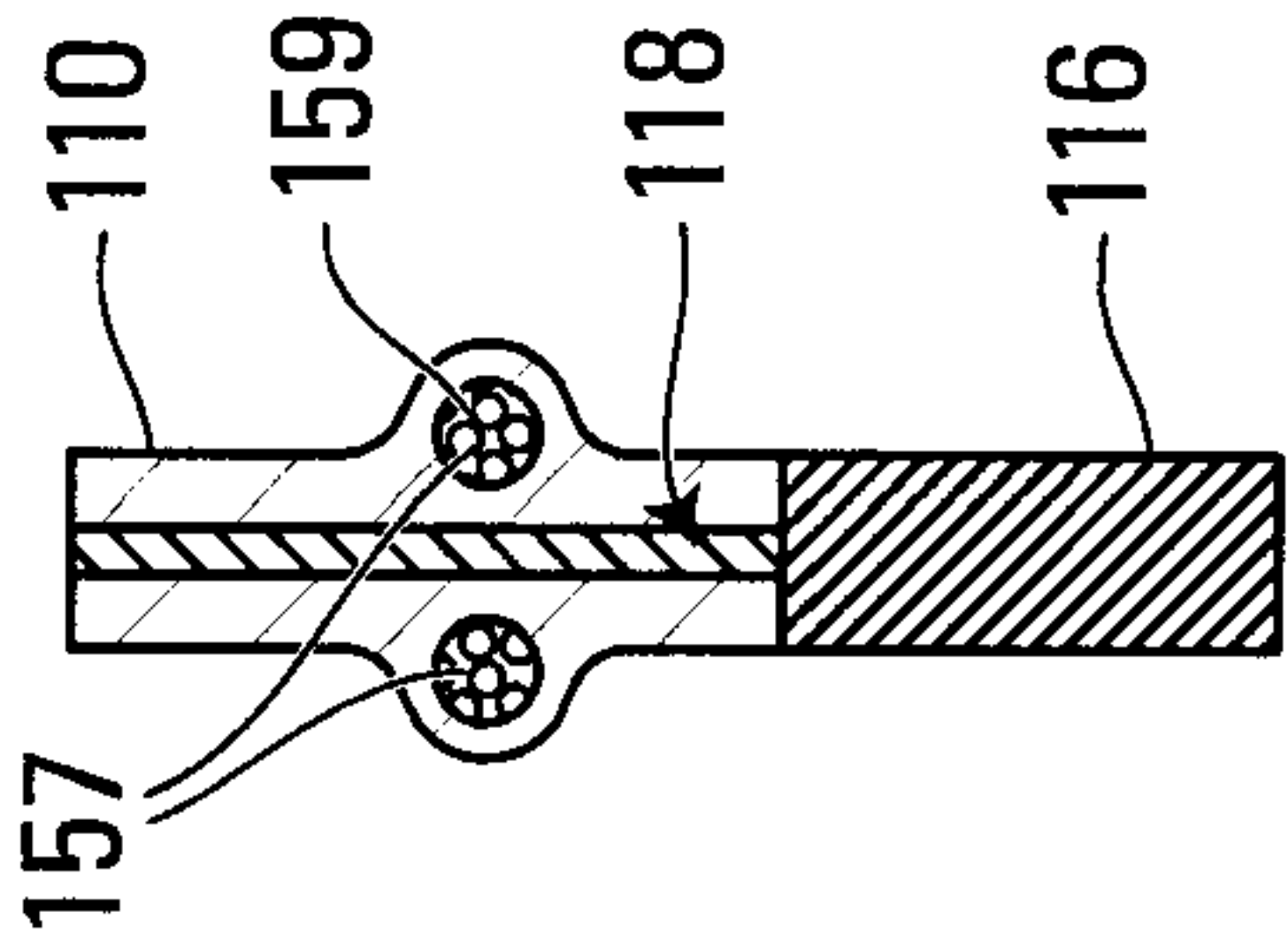


FIG. 38

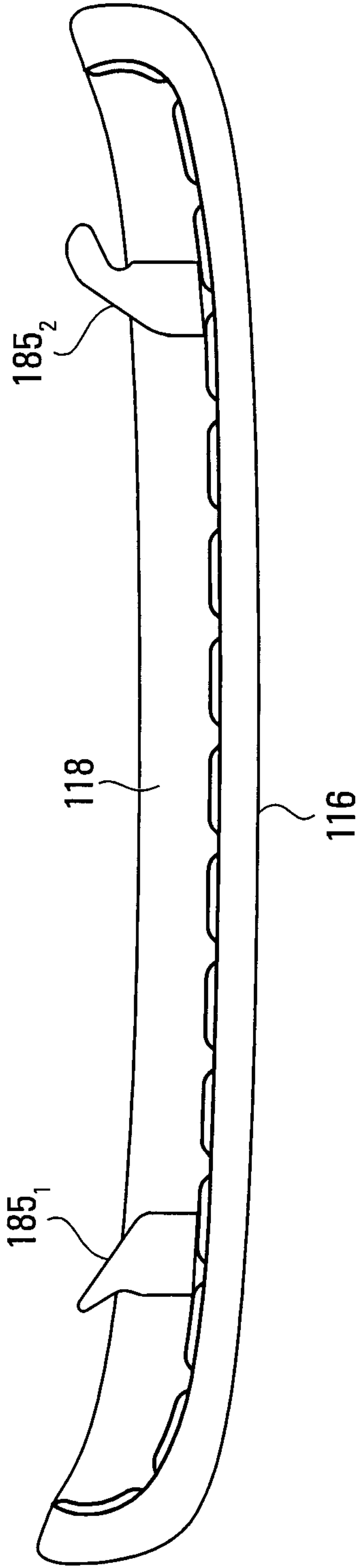


FIG. 39

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