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 (71) Demandeur/Applicant:
HIP TECHNOLOGIES, LLC, US
 (72) Inventeurs/Inventors:
FASK, RICHARD J., US;
SMITH, GEORGE T., II, US;
BOUDREAU, JAMES M., US
 (74) Agent: BORDEN LADNER GERVAIS LLP

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(57) **Abrégé/Abstract:**

An improved runner and method of manufacture are provided. The runner is formed by insert injection molding a steel insert blade, by which the total weight of the runner may be reduced substantially in comparison to conventional steel runners having similar size and shape. A skate blade and an ice skate including the improved runners are also provided.

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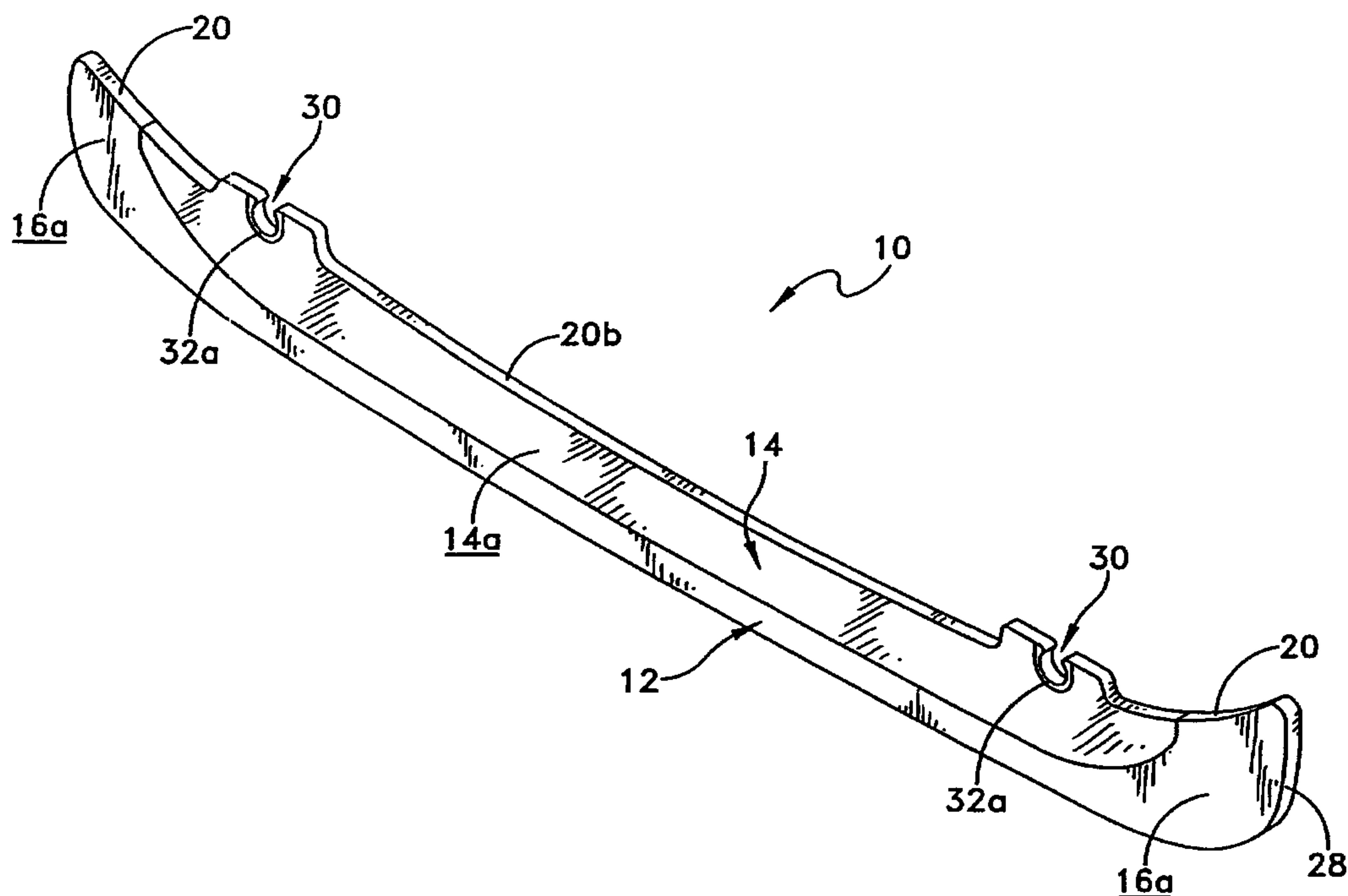
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- (71) Applicant (for all designated States except US): HIP TECHNOLOGIES, LLC. [US/US]; 697 Hartford Turnpike, Shrewsbury, MA 01545 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): FASK, Richard, J.
- (74) Agents: YOUNG, Michele, J. et al.; Salter & Michaelson, 321 South Main Street, Providence, RI 02903-7128 (US).
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(54) Title: IMPROVED SKATE-BLADE AND METHOD OF MANUFACTURE



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IMPROVED RUNNER AND METHOD OF MANUFACTURE

BACKGROUND

TECHNICAL FIELD

The present disclosure is related to a runner and skate blade and, in particular, to a runner and skate blade in which the runner is formed by insert injection molding.

RELATED CASES

Priority under 35 U.S.C. § 119(e) is hereby claimed to U.S. Provisional Patent Application No. 60/234,462 to Fask et al., which was filed on September 21, 2000.

RELATED ART

Ice skating encompasses several sports including ice hockey, figure skating, speed skating, ice dancing, and exhibition skating, each of which may use slightly different ice skates that have been developed in response to the different requirements for each sport. Traditional ice skate construction includes a leather laced boot supported by a steel skate blade. "Skate blade," as used herein, refers to the entire assembly of the bridge components and the runner. "Bridge," as used herein, refers to the entire assembly attached to the runner and which attaches the runner to the boot.

The runner of a skate blade is generally formed from hardened steel which is able to withstand the forces encountered during each ice skating sport. "Runner," as used herein, refers to that portion of the ice skate in contact with the ice. Experienced and/or professional skaters generally develop a preference for a particular contour or profile of the bottom edge of the runner, which contacts the ice. Therefore, runners must be able to withstand periodic contouring according to the preferences of each skater. In addition, runners typically require periodic sharpening to maintain a sharp edge, which maintains its glide characteristics. Both sharpening and contouring involve removing a portion of the steel from which the runner is formed. The amount

1 of material removed may vary substantially based on the condition of the runner and
2 the force used when the runner is sharpened. Thus, runners eventually wear out and
3 must be replaced after repeated sharpening and/or contouring.

4 Over time, much attention has been given to reducing the overall weight of ice
5 skates in general, regardless of the sport in which they are used. Some improvements
6 related to reducing the overall weight of ice skates have involved replacing the
7 materials of construction with newer, more lightweight materials as they are
8 developed. For example, some improvements have been related to replacing leather
9 components with more lightweight man-made materials such as plastic.

10 One improvement involved replacing a portion of the steel skate blade with
11 a plastic bridge while attaching a steel runner to the runner holder portion of the
12 bridge. "Runner holder," as used herein, refers to that portion of the bridge which
13 is attached to the upper part of the runner and provides rigidity to the runner. In
14 addition to the advantages of weight reduction, another advantage of a skate blade
15 comprising a plastic bridge and steel runner is that the runner can be removed for
16 sharpening, contouring, and/or replacement.

17 Many commercially available ice skates include such skate blades, variations
18 of which are available under product names such as TUUK™ (available from Nike-
19 Bauer), CROW™, PROLITE™ (available from CCM), COBRA™ (available from Graf),
20 as well as others from manufacturers such as Mission and Easton. Typically, such
21 commercially available plastic bridges include at least two spaced apart fastening
22 apertures into which the steel runner may be attached using well known fasteners.

23 Although steel has been the most widely used material for runners, it remains
24 one of the heavier components of an ice skate. Thus, more recent attempts to reduce
25 the overall weight of an ice skate have focused on decreasing the weight of the runner
26 itself. One attempt involved providing a plurality of apertures in the runner, as in the
27 BAUER VAPOR ice skate (available from TUUK), and the NIKE QUEST ice skate.

28 Other attempts to reduce the weight of the skate blade involved applying a
29 relatively thin strip of steel to the bridge, as disclosed in U.S. Patent No. 5,248,156

1 to Cann et al. and as in the T'BLADE™ ice skate (disclosed in U.S. Patent
2 No. 5,769,434 to Würthner) and REBELLION™ ice skates. Because the steel strip on
3 such ice skates is relatively thin, the runner cannot be sharpened or contoured
4 according to the preferences of individual skaters.

5 Any improvement relating to reducing the weight of ice skates or components
6 of ice skates which allows for sharpening and contouring is desirable.

7 8 BRIEF DESCRIPTION OF THE DRAWINGS

9 It should be understood that the drawings are provided for the purpose of
10 illustration only and are not intended to define the limits of the disclosure. The
11 foregoing and other objects and advantages of the embodiments described herein will
12 become apparent with reference to the following detailed description when taken in
13 conjunction with the accompanying drawings in which:

14 FIG. 1 is a perspective view of one embodiment of an insert injection molded
15 runner according to the present disclosure;

16 FIG. 2 is a perspective view of the insert blade of the runner of FIG. 1, before
17 insert injection molding;

18 FIG. 3 is a side view of the insert blade shown in FIG. 2;

19 FIG. 4 is a cross-sectional view along line 4-4 of the insert blade shown in
20 FIG. 3;

21 FIG. 5 is a cross-sectional view along line 5-5 of the insert blade shown in
22 FIG. 3;

23 FIG. 6 is a side view of the runner of FIG. 1, showing the insert blade of
24 FIG. 3 in outline;

25 FIG. 7 is a cross-sectional view along line 7-7 of the runner shown in FIG. 6;

26 FIG. 8 is a cross-sectional view along line 8-8 of the runner shown in FIG. 6;

27 FIG. 9 is a top view of the runner of FIG. 1;

28 FIG. 10 is a side view of another embodiment of a runner according to the
29 present disclosure;

1 FIG. 11 is a side view of the insert blade used to form the runner shown in
2 FIG. 10;

3 FIG. 12 is a side view of another embodiment of a runner according to the
4 present disclosure;

5 FIG. 13 is a side view of the insert blade used to form the runner shown in
6 FIG. 12;

7 FIG. 14 is a perspective view of a runner according to the present disclosure
8 attached to one type of a commercially available bridge;

9 FIG. 15 is a perspective view of a runner according to the present disclosure
10 attached to one type of a commercially available bridge;

11 FIG. 16 is a perspective view showing the attachment of the runner and bridge
12 shown FIG.14;

13 FIG. 17 is a perspective view showing the attachment of the runner and bridge
14 shown FIG.15;

15 FIG. 18 is a side view of the assembly shown in FIG. 15, showing the runner
16 in outline;

17 FIG. 19 is a side view of an ice skate according to the present disclosure,
18 showing the runner in outline;

19 FIG. 20 is a perspective view of a figure skate according to the present
20 disclosure;

21 FIG. 21 is a perspective view of the insert blade used to make the skate blade
22 of the figure skate shown in FIG. 20.

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SUMMARY

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In one embodiment, the present disclosure is directed to a runner that includes an insert blade having an upper edge extending between a toe end and a heel end, a lower, skating edge, and opposed side surfaces. Each opposed side surface includes a recessed region having a recessed surface. Each recessed region is spaced apart

1 from the lower, skating edge and extends between the toe end and the heel end for a
2 preselected distance.

3 A polymeric material covers at least a portion of each recessed region.

4 In another embodiment, the disclosure is directed to a runner that includes a
5 first surface and a second surface substantially parallel to the first surface. Each
6 surface includes an insert blade portion and a polymeric portion. The runner is
7 capable of being sharpened and contoured.

8 In yet another embodiment, the disclosure is directed to runner that includes
9 an insert blade having substantially parallel opposed side surfaces and a polymeric
10 portion having substantially parallel opposed side surfaces. At least a portion of the
11 polymeric portion is in direct contact with the insert blade. The opposed side surfaces
12 of the insert blade are substantially flush with the opposed side surfaces of the
13 polymeric portion.

14 In another embodiment, the disclosure is directed to, in combination, a bridge
15 and a runner. The runner has substantially parallel opposed side surfaces and includes
16 an insert blade at least partially encased in a polymeric material. The runner is
17 removably attached to the bridge.

18 In another embodiment, the disclosure is directed to a skate blade. The skate
19 blade includes a bridge and a runner. The runner has substantially parallel opposed
20 surfaces. Each of the opposed surfaces includes a steel portion and a polymeric
21 portion. At least about 1/4 inch of steel extends from a lower edge of the polymeric
22 material to a skating edge of the runner.

23 In another embodiment, the disclosure is directed to an ice skate that includes
24 a boot, a bridge, and a runner. The runner has substantially parallel opposed surfaces.
25 Each surface includes a metal portion and a polymeric portion. At least about 1/4 inch
26 of metal extends from a lower edge of the polymeric material to a skating edge of the
27 runner.

1 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

2 The present disclosure is directed to a runner that is substantially lighter in
3 weight than most commercially available runners and that is capable of being
4 sharpened and contoured according to individual preferences. A portion of the
5 runners according to the present disclosure are plastic, resulting from the insert
6 injection molding of an insert blade. The runners of the present disclosure are formed
7 with substantially parallel sides that allow sharpening and contouring of the skating
8 edge using conventional sharpening equipment.

9 The present disclosure may be applied to any type of ice skate, for example,
10 ice hockey skates, figure skates, speed skates, and the like. Thus, in some instances,
11 the disclosure is directed to a runner and other instances, to a runner holder or bridge,
12 at least a portion of which has been insert injection molded in order to reduce the total
13 weight of the ice skate, while allowing the runner to be sharpened and contoured using
14 conventional sharpening equipment.

15 The present disclosure is also directed to a runner holder, a skate blade
16 including the runner or the runner holder, and to ice skates that include the runner,
17 runner holder, and/or skate blade. The present disclosure is also directed to methods
18 of forming the same.

19 FIG. 1 illustrates a perspective view of an exemplary unitary ice hockey runner
20 10 according to the present disclosure. The present embodiment of ice hockey runner
21 10 may be compatible with bridges manufactured by, for example, TUUK and CROW.
22 Those of ordinary skill in the art will recognize that an ice hockey runner is used
23 herein for illustrative purposes only, and that the present disclosure applies to runners
24 used in other ice skates as well, for example, figure skate runners, speed skate runners,
25 and the like. As shown, runner 10 has a narrow, elongated shape and includes an
26 insert blade indicated generally at 12 and a polymeric portion indicated generally at
27 14. Preferably, runner 10 may be formed by insert injection molding a polymeric
28 material about the insert blade using a well known process such that the insert blade
29 is at least partially encased in a high strength polymeric material. "Insert blade," as

1 used herein, refers to that portion of the runner or runner holder that is insert injection
2 molded.

3 Insert blade 12 is shown in greater detail in FIGS. 2 and 3 without the
4 polymeric portion 14. Insert blade 12 includes an upper edge 20 extending between
5 a toe end 22 and a heel end 24, and substantially parallel opposed surfaces 16a,b.
6 Each opposed surface 16a,b includes a recessed region 18a,b having a lower edge
7 defined by a lip 19a,b and an upper edge 20a defined by the recessed regions 18a,b,
8 and having a thickness less than that of upper edge 20, as will be described in greater
9 detail below.

10 With continued reference to FIGS. 2 and 3, upper edge 20a of upper edge 20
11 includes three tabs 26. It is not necessary to include tabs 26, but it has been found that
12 the tabs provide stabilization to runner 10 when assembled in a bridge, as will be
13 described in greater detail below. Those of skill in the art will recognize that the
14 shape, size, number, and placement of the tabs may be varied as needed. Insert blade
15 12 also has a lower, skating edge 28 which is contoured to extend upwardly to
16 intersect upper edge 20 at toe end 22 and heel end 24.

17 With continued reference to FIGS. 2 and 3, upper edge 20a includes at least
18 two fastening apertures 30, which are designed to receive a fastener (not illustrated)
19 to allow attachment of runner 10 to a bridge, which will be illustrated in greater detail
20 below. Although illustrated herein with two fastening apertures, those of ordinary
21 skill in the art will recognize that any number may be included, as needed for
22 attachment to a particular bridge. Apertures 30 include flanges 32a,b extending
23 outwardly from recessed regions 18a,b, which facilitate attachment of the fasteners
24 to runner 10. Adjacent each fastening aperture 30 are shoulders 33a, which extend
25 from upper edge 20a by about 0.050 inch.

26 With continued reference to FIGS. 2 and 3, insert blade 12 also includes a
27 plurality of bores 34 disposed within and extending through recessed regions 18a,b
28 transversely to the longitudinal axis of the runner. The purpose of bores 34 is to allow
29 molten polymeric material to flow transversely through the bores during the insert

1 injection molding process, as is well known in the art. Those of skill in the art will
2 recognize that the size, shape, number, and placement of the bores may be varied as
3 needed.

4 Referring now to FIG. 3, the portion of insert blade 14 below lips 19a,b and
5 extending to lower edge 28 has a length L_1 . Generally, it is desirable to maximize the
6 length of L_1 , which will allow repeated sharpenings of the runner before replacement
7 is necessary and will allow individuals sufficient material to contour the runner
8 according to individual preferences. Preferably, L_1 is at least about 1/8 inch, more
9 preferably at least about 1/4 inch, and more preferably still at least about 3/8 inch.
10 Those of ordinary skill in the art will recognize that L_1 can be varied by varying the
11 position of lip 19a,b and consequently the dimensions of recessed regions 18a,b.

12 With continued reference to FIG. 3, in the present embodiment, fastening
13 apertures 30 are preferably spaced apart from a midpoint "M" of insert blade 12 and
14 from toe and heel ends 22,24. The shape of the runner and the number and type of
15 fasteners may be varied in order to conform to bridges available by a number of
16 different manufacturers. Thus, runners according to the present disclosure may be
17 tailored to be compatible with any of the previously mentioned commercially
18 available bridges by changing, for example, the shape of the runner or the position of
19 the fasteners. The distance " D_1 " between apertures 30 may vary depending upon a
20 variety of factors including, but not limited to, the size of the boot support holder to
21 which the runner will be attached as well as other practical considerations which
22 would be apparent to those of ordinary skill in the art. Those of skill in the art will
23 recognize that the distance " D_1 " between fastening apertures 30 may be adjusted
24 according to the size of the boot support holder to which the runner may be attached.
25 The distance " D_1 " between apertures 30 may be determined using routine
26 experimentation by those of skill in the art.

27 Referring now to the cross-sectional views of insert blade 12 (before injection
28 molding) shown in FIGS. 4 and 5, insert blade 12 preferably has a thickness " T_1 "
29 between opposing side surfaces 16a,b ranging from about 0.115 inch to about 0.125

1 inch, more preferably about 0.120 inch. Insert blade 12 preferably has a thickness
2 " T_2 " between recessed regions 18a,b, ranging from about 0.030 inch to about 0.060
3 inch, more preferably about 0.045 inch.

4 Suitable materials from which insert blade 12 may be formed include any
5 material capable of withstanding the stresses of ice skating. Preferably, insert blade
6 12 may be formed from a material having a Rockwell hardness ranging from about 45
7 to about 60, more preferably about 55. Insert blade 12 is preferably formed from a
8 metallic material. Some materials that have been found suitable are steel, stainless
9 steel, carbon steel, and combinations thereof. In a preferred embodiment, insert blade
10 12 may be carbon steel having a Rockwell hardness ranging from about 52 to about
11 57, more preferably about 55. In some embodiments, insert blade 12 may include a
12 non-corrosive layer on the exterior surface to prevent the formation of rust. Examples
13 of suitable non-corrosive layers include nickel, nickel-chrome, chrome, and
14 combinations thereof.

15 FIGS. 6, 7, and 8 when taken together illustrate side and cross-sectional views
16 of runner 10, after insert injection molding of insert blade 12 to form polymeric
17 portion 14, having opposed side surfaces 14a,b. Preferably, polymeric portion 14
18 extends above upper edge 20a of insert blade 12 and has a length L_2 of about 0.500
19 inch to about 1.000 inch, more preferably about 0.750 inch. Upper edge 20b of
20 polymeric portion 14 has a thickness T_2 which is substantially the same as that T_1 ,
21 which is the thickness of the insert blade between opposing side surfaces 16a,b. Thus,
22 the region of polymeric portion 14 extending above upper edge 20a has a thickness
23 T_2 ranging from about 0.115 inch to about 0.125 inch, most preferably about 0.120
24 inch, and the region of polymeric portion 14 adjacent recessed regions 18a,b has a
25 thickness T_3 ranging from about 0.0250 inch to about 0.0450 inch, more preferably
26 about 0.0375 inch. Consequently, as best seen in FIG. 9, opposed edges 16a,b of
27 insert blade 12 and opposed surfaces 14a,b of polymeric portion 14 are flush with one
28 another, or coplanar, resulting in a runner having substantially parallel side surfaces

1 such that thickness of runner 10 is substantially the same from upper edge 20b to
2 lower edge 28.

3 After insert injection molding, the ice hockey runner according to the present
4 embodiment may weigh from about 2 percent to about 75 percent less than a
5 conventional steel runner having substantially the same size and shape. In general,
6 for an ice hockey runner, the insert blade may comprise about 40 percent to about 98
7 percent by weight of the runner and the polymeric portion may comprise about 2
8 percent to about 60 percent, by weight, based on the total weight of the runner. Ice
9 hockey runners come in a range of sizes, specified by the length of the runner, i.e. 296
10 mm, 288 mm, 280 mm, etc. Each size corresponds generally to the size of the bridge
11 or skate to which the runner may be attached. Those of skill in the art will recognize
12 that the amount of weight reduction depends, in part, upon the area of the recessed
13 regions. Thus, the weight of the runner may be decreased by increasing the proportion
14 of polymeric portion in relation to that of the material from which the insert blade is
15 formed. Examples of ways in which weight reduction may be maximized include
16 increasing the area of regions 18a,b by moving lips 19a,b closer to the skating edge
17 28 or to toe and heel ends, increasing the number of transverse bores, etc.

18 Any polymeric material may be used for polymeric portion 14, limited only
19 by practical considerations such as the weight, strength, and processing method. Both
20 thermoplastic and thermosetting polymeric materials may be used, although
21 thermoplastic are preferred because they are generally harder than thermosetting.
22 Examples of such materials include high impact polystyrene, polyamide, acrylonitrile
23 butadiene styrene, or any other relatively lightweight high-strength polymeric
24 material, as well as combinations thereof. Nylon 66 is particularly preferred due to
25 its relatively light weight, relatively high impact strength, toughness, stiffness, and
26 tensile strength.

27 Other materials may be added to the polymeric material in order to modify its
28 properties, to the extent that they do not interfere with the strength and/or weight
29 reduction of the runner. For example, reinforcing materials such as carbon fiber,

1 fiberglass, talc, metal powder, and the like may be used. In general, more lightweight
2 materials such as fiberglass are preferred. Thus, one preferred additive is fiberglass
3 which may be used to increase the impact strength of the material. When fiberglass
4 is added to the polymeric material, is it preferably added in the range of about 5
5 percent to about 30 percent. Examples of commercially available products that have
6 been found suitable for the present runners include Nylon 6613GF (a nylon 66
7 reinforced with about 13% glass fiber available from Oxford Polymers); and ZYTEL™
8 Grade ST801 (a nylon 66 reinforced with about 13% glass fiber available from
9 DuPont Chemicals). Products with similar characteristics may be available from other
10 manufacturers such as Bayer Chemical.

11 The present ice hockey runner is substantially lighter than other runners
12 having a similar size and shape that are formed solely from steel or other metal.
13 Commercially available ice hockey runners come in a variety of sizes generally
14 expressed in millimeters, (e.g. 250 mm, 254 mm, 263 mm) and corresponding to foot
15 or boot sizes. The weight of commercially available ice hockey runners formed solely
16 from steel typically ranges from about 180 grams to about 200 grams for the larger
17 sizes (296 mm and larger) to about 40 grams to about 60 grams for the smaller,
18 children's sizes. The weight of the ice hockey runners according to the present
19 disclosure may range from about 30 grams to about 150 grams, depending on the size,
20 shape, and amount of plastic used to form the runner. For practical purposes, the
21 lower limit of the weight of the ice hockey runners according to the present disclosure
22 is limited by the amount of steel required to form the insert blade which may vary
23 depending on the size, shape, and area of the recessed region. Thus, ice hockey
24 runners according to the present disclosure may weigh from about 2 percent up to
25 about 90 percent less, by weight, than conventional steel runners having the same size
26 and shape, again depending on the type of runner and the size, shape, area of the
27 recessed region, and the amount of plastic used to form the runner.

28 As discussed above, it is not necessary to include tabs 26, or to have the same
29 arrangement of tabs as in runner 10, as illustrated by the following embodiments

1 shown in FIGS. 10-13. FIGS. 10-11 when taken together illustrate another exemplary
2 runner 110 which includes the same elements as in the previous embodiment,
3 preceded by the number "1." FIG. 11 illustrates a side view of an insert blade 112
4 used to manufacture runner 110, as described above. Runner 110 is substantially the
5 same as runner 10, with the exception of tabs 26, which are not included in runner
6 110. Similarly, the method of forming runner 110 is substantially the same as for
7 runner 10.

8 FIGS. 12-13 when take together illustrate another exemplary runner 210 which
9 includes the same elements as in the previous embodiment, preceded by the number
10 "2." FIG. 13 is a side view of an insert blade 212 that includes one stabilizing tab 226
11 extending from upper edge 220a, disposed between and spaced apart from fastening
12 apertures 230. As in the previous embodiment shown in FIGS. 10-11, runner 210 is
13 substantially the same as runner 10, with the exception that it includes only one tabs
14 226, rather than the three included in runner 10. Likewise, the method of forming
15 runner 110 is substantially the same as for runner 10 and 110.

16 The method for forming runners according to the present disclosure involves
17 first forming an insert blade having the desired shape and thickness by cutting,
18 stamping, or machining, preferably by CNC machining, the foregoing recessed
19 regions, fastening apertures, bores, and any other desired features according to the
20 desired specifications. The insert blade is positioned in a suitable insert injection
21 mold and a molten polymeric material is allowed to flow at least partially around the
22 insert blade and transversely through the bores, after which the molten polymeric
23 material is allowed to harden. As a result, the hardened polymeric material fixes the
24 recessed regions of insert blade within the hardened polymeric material, and the insert
25 blade may not be removed therefrom without cutting either the insert blade or the
26 polymeric material.

27 Any of the foregoing embodiments of runners according to the present
28 disclosure may be used in a variety of commercially available plastic bridges, which
29 makes the present runners adaptable to a variety of existing ice skates. Moreover,

1 because the runner has substantially parallel opposed side surfaces, it may be
2 sharpened and contoured using conventional ice skate sharpening equipment.

3 FIGS. 14 and 15 illustrate two different skate blades 300, 400 in which any of
4 the foregoing runners 10, 110, and 210 may be attached, as is well-known in the art.
5 FIGS. 16 and 17 illustrate the method of attachment of the foregoing runners to the
6 foregoing plastic bridges.

7 FIG. 18 is a side view of the foregoing plastic bridges showing a phantom
8 outline of runner 10 when inserted into the bridge. As shown, the upper portion of
9 runner 10 extends into the base of the bridge where it may be attached and secured
10 by conventional means. Stabilizing tab 26 of runner 10 also fits into the base to
11 provide additional stabilization at roughly the midpoint of the runner.

12 FIG. 19 shows a side view of an ice skate 500 that includes a plastic bridge
13 502 to which runner 10 is attached in a conventional manner. As shown, ice skate 500
14 includes an upper 504, which is supported on the plastic bridge 502. As previously
15 indicated, any of the foregoing runners may be used in such an arrangement.

16 FIGS. 20 and 21, when taken together, illustrate a figure skate 600 that
17 includes an upper 602 supported on a skate blade 604. Skate blade 604 includes
18 recessed areas 606 into which plastic may be insert injection molded, in a manner
19 similar to that described previously, to form polymeric portion 608. In this manner,
20 the weight of the figure skate may be reduced in a similar manner to that described
21 with respect to the ice hockey skates. The foregoing applies to speed skate blades and
22 figure skate blades as well.

23 The weight of commercially available figure skating and speed skating bridges
24 formed solely from steel is much higher than that of a typical commercially available
25 ice hockey runner or ice hockey skate blade, and may range up to about 400 grams for
26 the larger sizes. Again, for practical purposes, the lower limit of the weight of the
27 figure skate blades and speed skate blades according to the present disclosure is
28 limited by the amount of steel required to form the insert blade which may vary
29 depending on the size, shape, and area of the recessed region. Figure and speed skate

1 blades according to the present disclosure may weigh from about 2 percent up to
2 about 90 percent less, by weight, than conventional steel skate blades having the same
3 size and shape, again depending on the type of skate blade, the size, shape, area of the
4 recessed region, and the amount of plastic used to form the skate blade.

6 WORKING EXAMPLES

7 Ice hockey runners according to the present disclosure and compatible with a
8 commercially available bridge (Crow) were formed and compared to a conventional
9 stainless steel runner compatible with the same bridge. All weights recorded in the
10 examples below are approximate, measured in grams, and all percentages are
11 percentages by weight based on the total weight of the runners.

13 EXAMPLE 1

14 Two stainless steel 280 mm ice hockey runner blanks were selected. The
15 weight of each of the blanks before machining were both measured and recorded.

16 One blank was machined in accordance with conventional practice to its final
17 form. The weight of the conventional runners after machining was measured and
18 recorded.

19 The remaining blank was CNC machined to form the recessed regions,
20 transverse bores, and fastening apertures to obtain an insert blade according to the
21 present disclosure. The weight of the insert blade was measured and recorded. The
22 insert blade was then insert injection molded using the foregoing Nylon 6613GF. The
23 weight of the runner was measured and recorded.

24 The results of the foregoing are shown below in Table 1.

TABLE 1

280 mm size ice hockey runner	Present Runner	Conventional Runner
Weight of Blank	162	162
Weight of conventional Blade after machining	--	145
Weight of Insert Blade after CNC machining	82	--
Weight Present Runner after insert injection molding	92	--
Final Weight	92	145
Weight % insert blade	89.1 %	--
Weight % polymeric portion	10.9 %	--
Reduction in Weight as percentage of total weight of conventional runner	37%	--

Thus, it can be seen that including about 11 percent by weight of polymeric material in a 280 mm ice hockey runner provides a 37% reduction in weight in comparison to a conventional stainless steel 280 mm ice hockey runner having substantially the same shape, size, and thickness.

EXAMPLE 2

Two stainless steel 296 mm ice hockey runner blanks were selected and processed as in Example 1. The results of the foregoing are shown below in the Table 2.

TABLE 2

296 mm size ice hockey runner	Present Runner	Conventional Runner
Weight of Blank	170	170
Weight of conventional Blade after machining	-	158
Weight of Insert Blade after CNC machining	89	--
Weight Present Runner after insert injection molding	101	--
Final Weight	101	158
Weight % insert blade	88.1 %	--
Weight % polymeric portion	11.9 %	--
Reduction in Weight as percentage of total weight of conventional runner	36 %	--

Thus, it can be seen that including about 12 percent by weight of polymeric material in a 296 mm ice hockey runner provides about a 36% reduction in weight in comparison to a conventional stainless steel 296 mm ice hockey runner having substantially the same shape, size, and thickness.

Although particular embodiments of the disclosure have been described in detail for purposes of illustration, various changes and modifications may be made without departing from the scope and spirit of the disclosure. All combinations and permutations of the structures and methods are available for practice in various applications as the need arises. Accordingly, the disclosure is not to be limited except as by the appended claims. For example, the apparatus and method of the disclosure may be applied to processes that are presently not practically feasible. Accordingly, the disclosure is not to be limited except as by the appended claims.

What is claimed is:

CLAIMS

- 1 1. A runner, comprising:
2 an insert blade having an upper edge extending between a toe end and
3 a heel end, a lower, skating edge, and opposed side surfaces;
4 each opposed side surface including a recessed region having a
5 recessed surface, each recessed region being spaced apart from the lower, skating edge
6 and extending between the toe end and the heel end for a preselected distance; and
7 a polymeric material covering at least a portion of each recessed
8 region.
- 1 2. The runner of claim 1, wherein a lower edge of each recessed region
2 is defined by a lip.
- 1 3. The runner of claim 1, wherein the polymeric material covering at least
2 a portion of each recessed region is contiguous with the recessed surface of each
3 recessed region.
- 1 4. The runner of claim 1, further comprising at least one bore disposed
2 transversely to a longitudinal axis of the runner and extending through the recessed
3 regions of the insert blade.
- 1 5. The runner of claim 1, further comprising at least two apertures
2 constructed and arranged to receive a fastener.
- 1 6. The runner of claim 1, further comprising means for fastening the
2 runner to a bridge.

1 7. The runner of claim 1, wherein the opposing sides surfaces are
2 substantially parallel.

1 8. The runner of claim 2, wherein the distance from the lip of each
2 recessed region to the lower, skating edge of the insert blade is at least about 1/8 inch.

1 9. The runner of claim 2, wherein the distance from the lip of each
2 recessed region to the lower, skating edge of the insert blade is at least about 1/4 inch.

1 10. The runner of claim 2, wherein the distance from the lip of each
2 recessed region to the lower, skating edge of the insert blade is at least about 3/8 inch.

1 11. The runner of claim 1, wherein the insert blade comprises less than
2 about 98 percent by weight of the runner and the polymeric portion comprises at least
3 about 2 percent by weight of the runner, based on the total weight of the runner.

1 12. The runner of claim 1, wherein the insert blade comprises less than
2 about 95 percent by weight of the runner and the polymeric portion comprises at least
3 about 5 percent by weight of the runner, based on the total weight of the runner.

1 13. The runner of claim 1, wherein the insert blade comprises less than
2 about 90 percent by weight of the runner and the polymeric portion comprises at least
3 about 10 percent by weight of the runner, based on the total weight of the runner.

1 14. The runner of claim 1, wherein the runner is a figure skating runner.

1 15. The runner of claim 1, wherein the runner is a speed skating runner.

1 16. The runner of claim 1, wherein the runner is an ice hockey runner.

1 17. The runner of claim 16, wherein the runner has a total weight of less
2 than about 125 grams.

1 18. The runner of claim 16, wherein the runner has a total weight of less
2 than about 100 grams.

1 19. The runner of claim 16, wherein the runner has a total weight of less
2 than about 75 grams.

1 20. A runner, comprising:
2 a first surface and a second surface substantially parallel to the first
3 surface, each surface including an insert blade portion and a polymeric portion;
4 wherein the runner is capable of being sharpened and contoured.

1 21. The runner of claim 20, wherein the insert blade portion includes a
2 recessed region contiguous with the polymeric portion.

1 22. The runner of claim 21, further comprising at least one bore extending
2 transversely through the recessed region.

1 23. The runner of claim 22, wherein the polymeric portion extends through
2 the at least one bore.

1 24. The runner of claim 20, further comprising a fastening aperture
2 disposed on an upper edge of the runner.

1 25. The runner of claim 20, further comprising means for fastening the
2 runner to a bridge.

- 1 26. The runner of claim 20, wherein the runner is an ice hockey runner.
- 1 27. The runner of claim 20, wherein the runner is a figure skating runner.
- 1 28. The runner of claim 20, wherein the runner is a speed skating runner.
- 1 29. A runner, comprising:
2 an insert blade having substantially parallel opposed side surfaces;
3 a polymeric portion having substantially parallel opposed side surfaces,
4 at least a portion of the polymeric portion in direct contact with the insert blade;
5 wherein the opposed side surfaces of the insert blade are substantially
6 flush with the opposed side surfaces of the polymeric portion.
- 1 30. The runner of claim 29, wherein each side surface of the insert blade
2 includes a recessed region having a surface.
- 1 31. The runner of claim 30, wherein the polymeric portion is contiguous
2 with the surface of the recessed region.
- 1 32. In combination, a bridge and a runner having substantially parallel
2 opposed side surfaces, the runner including an insert blade at least partially encased
3 in a polymeric material, wherein the runner is removably attached to the bridge.
- 1 33. A skate blade, comprising:
2 a bridge; and
3 a runner having substantially parallel opposed surfaces, each
4 surface including a steel portion and a polymeric portion;

5 wherein at least about 1/4 inch of steel extends from a lower
6 edge of the polymeric material to a skating edge of the runner.

1 34. The runner of claim 33, wherein the runner is an ice hockey runner.

1 35. The runner of claim 33, wherein the runner is a figure skating runner.

1 36. The runner of claim 33, wherein the runner is a speed skating runner.

1 37. An ice skate, comprising:
2 a boot;
3 a bridge; and
4 a runner having substantially parallel opposed surfaces, each
5 surface including a metal portion and a polymeric portion;
6 wherein at least about 1/4 inch of metal extends from a lower
7 edge of the polymeric material to a skating edge of the runner.

1 38. The ice skate of claim 37, wherein the ice skate is an ice hockey skate.

1 39. The ice skate of claim 37, wherein the ice skate is a figure skate.

1 40. The ice skate of claim 37, wherein the ice skate is a speed skate.

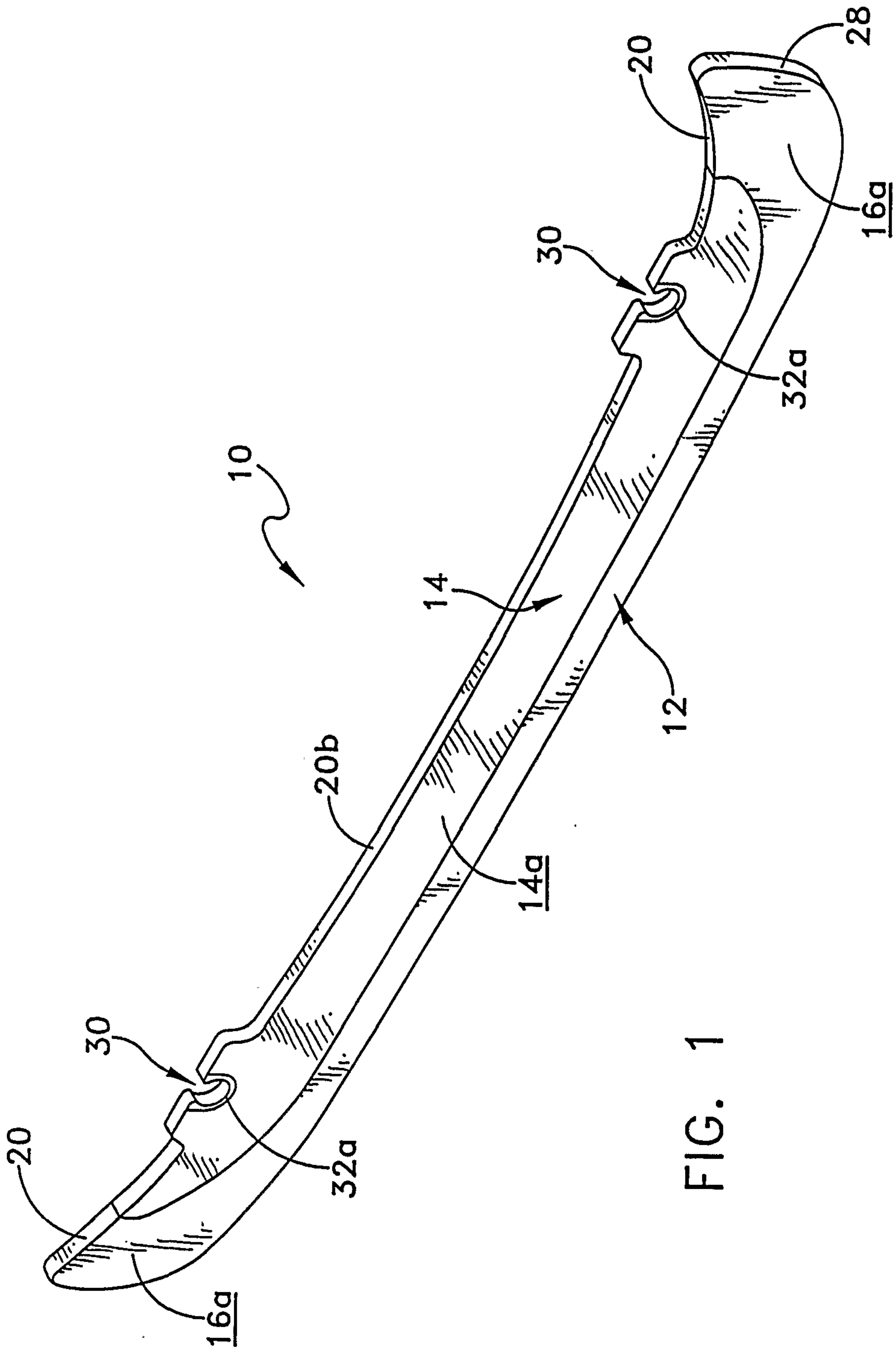


FIG. 1

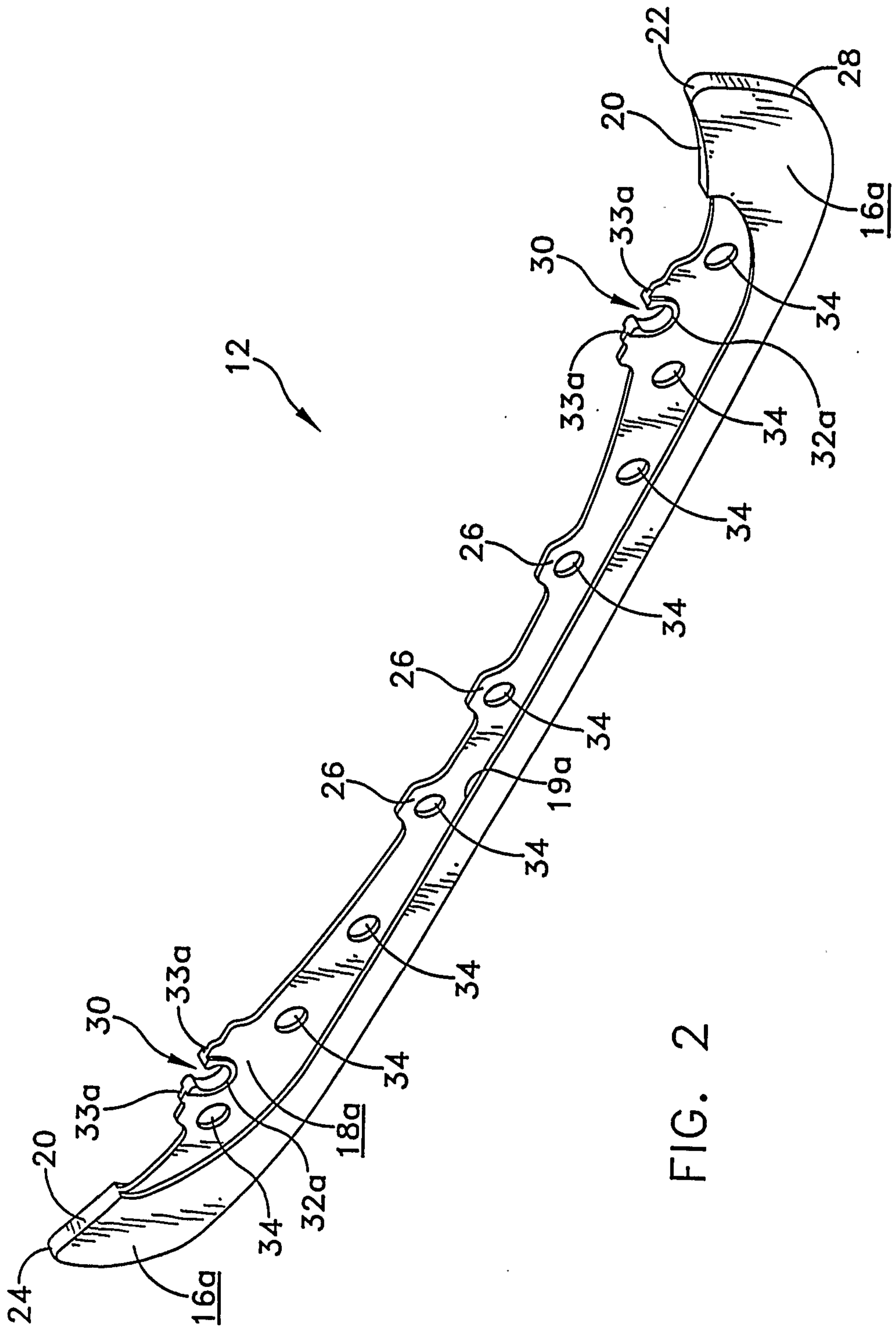


FIG. 2

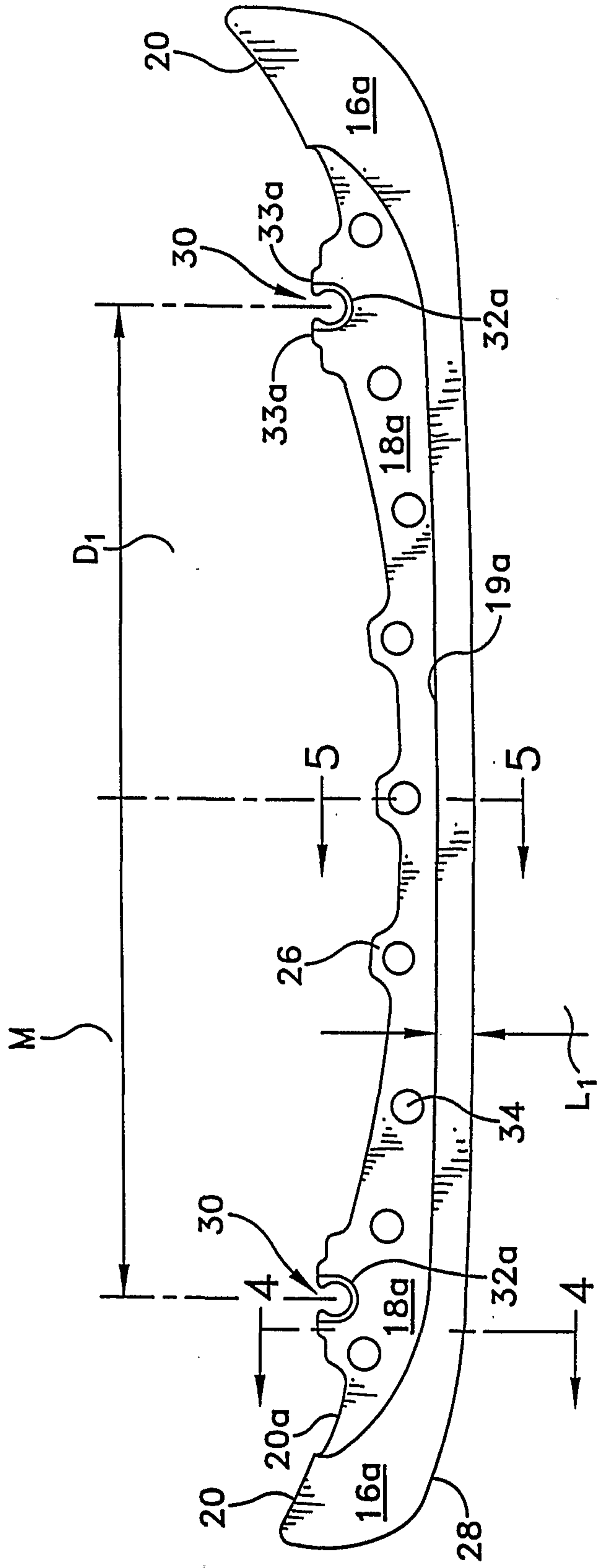


FIG. 3

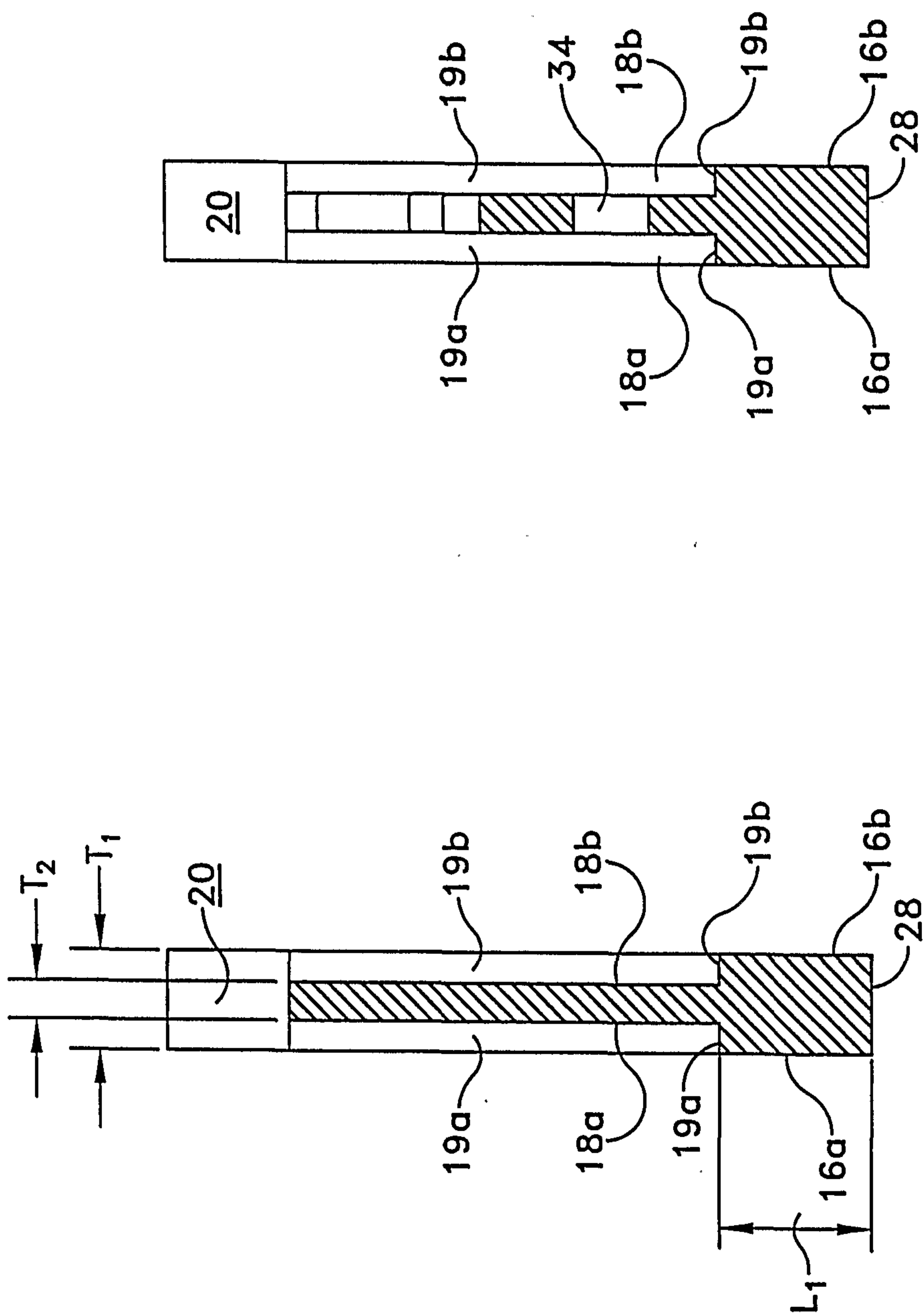


FIG. 5

FIG. 4

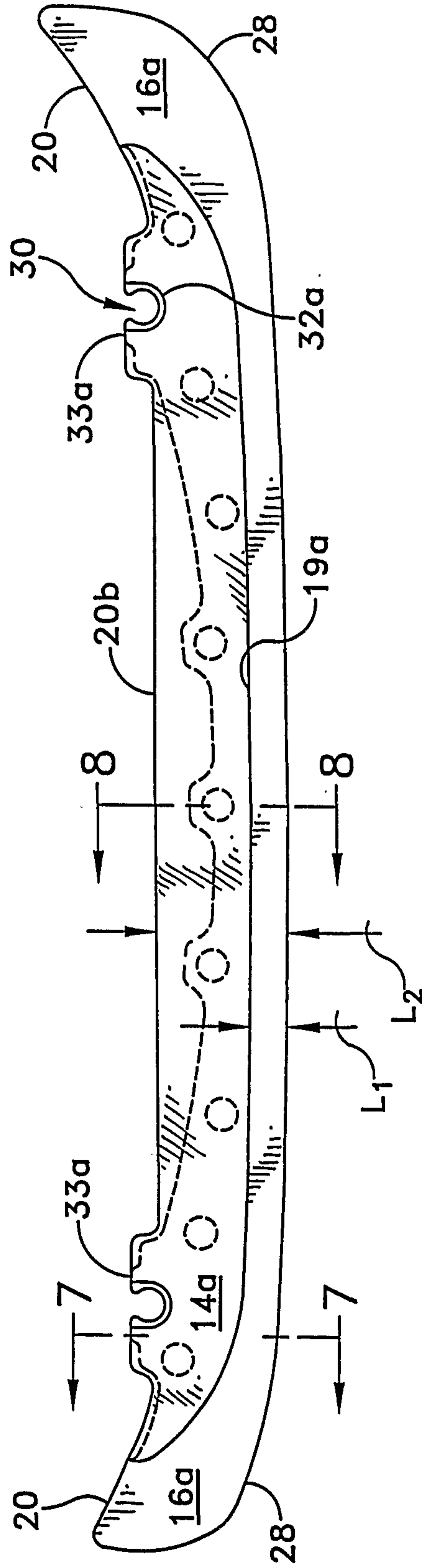


FIG. 6

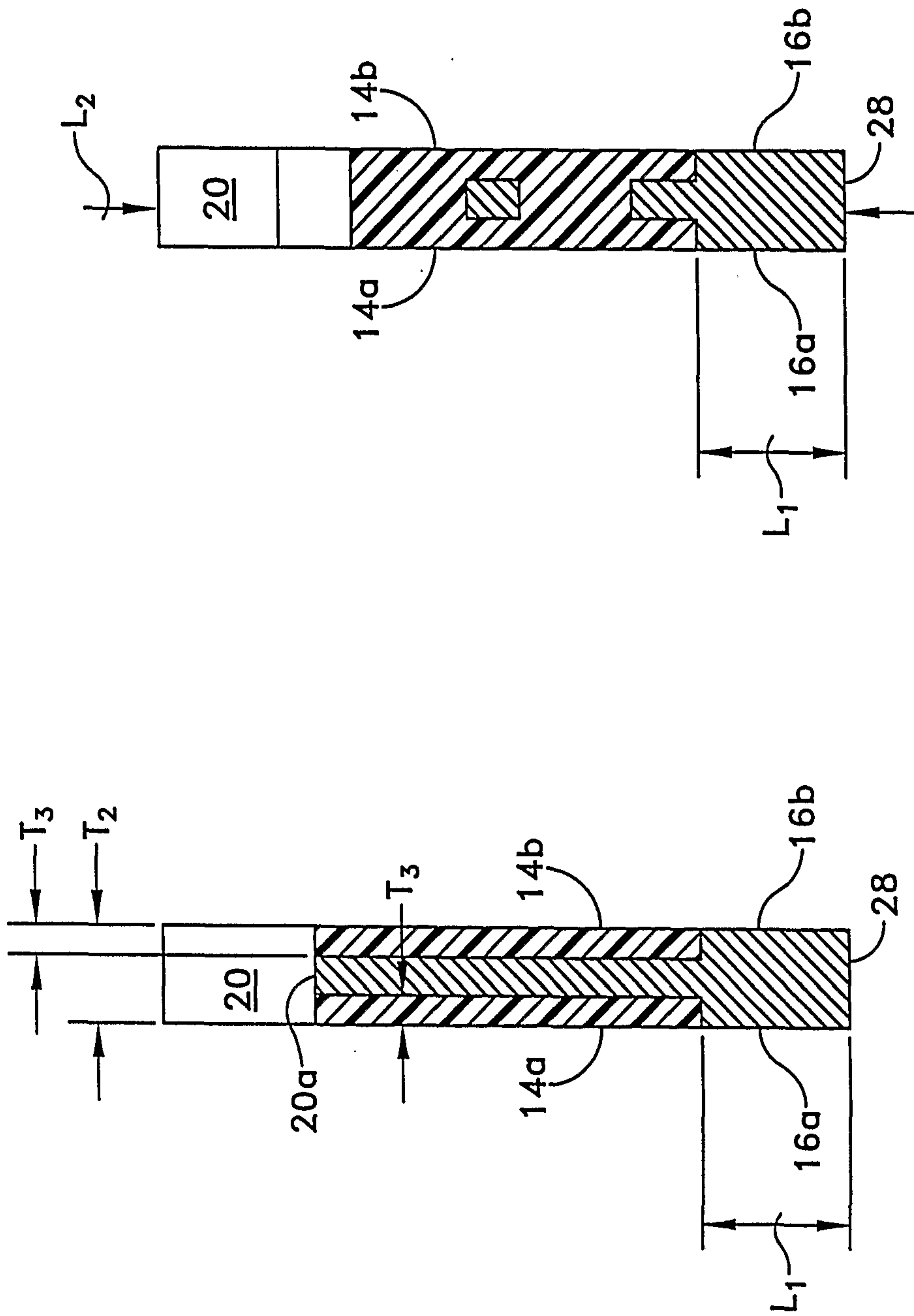


FIG. 8

FIG. 7

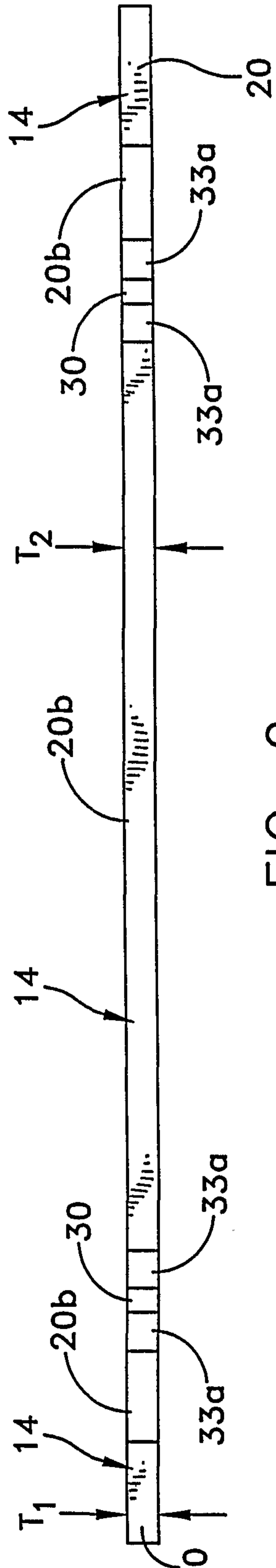
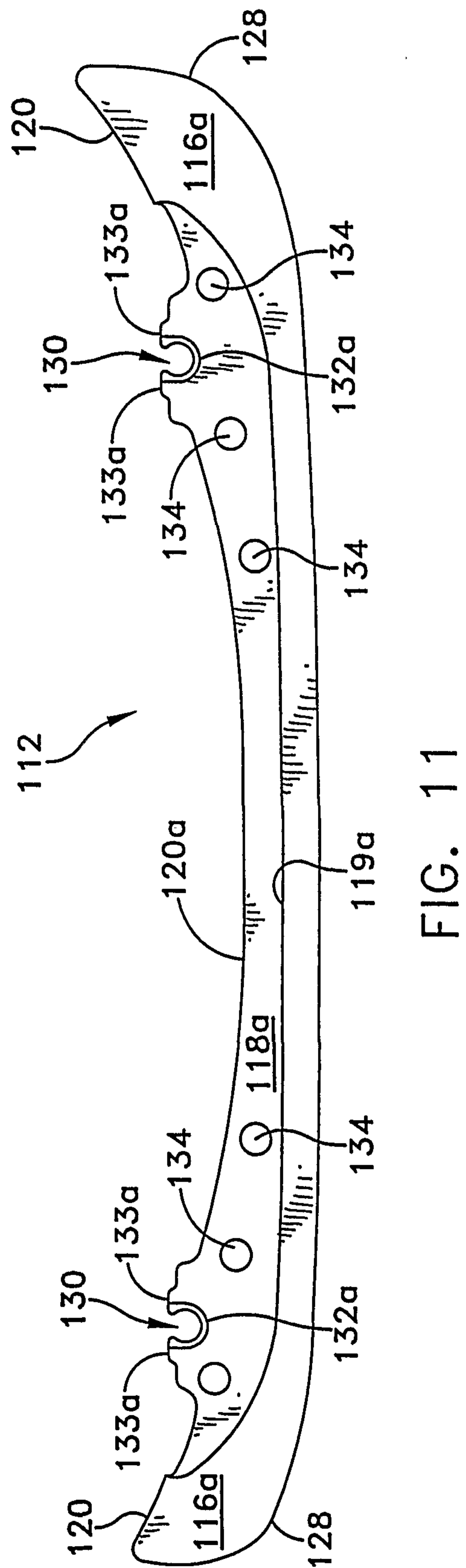
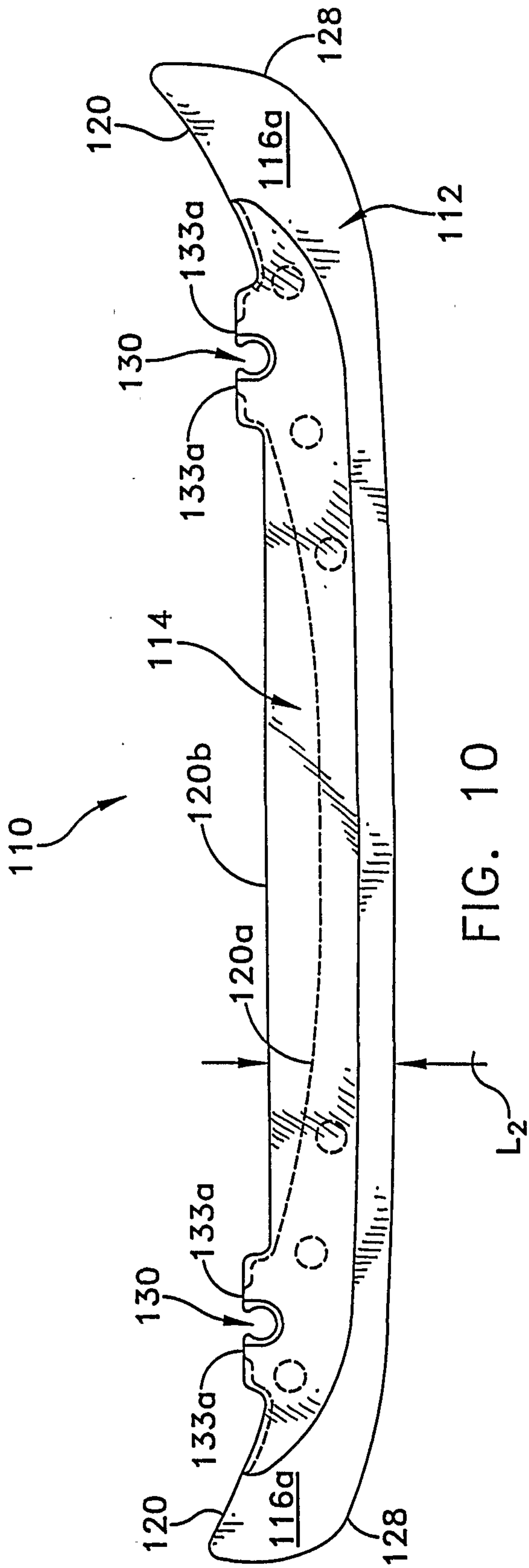


FIG. 9



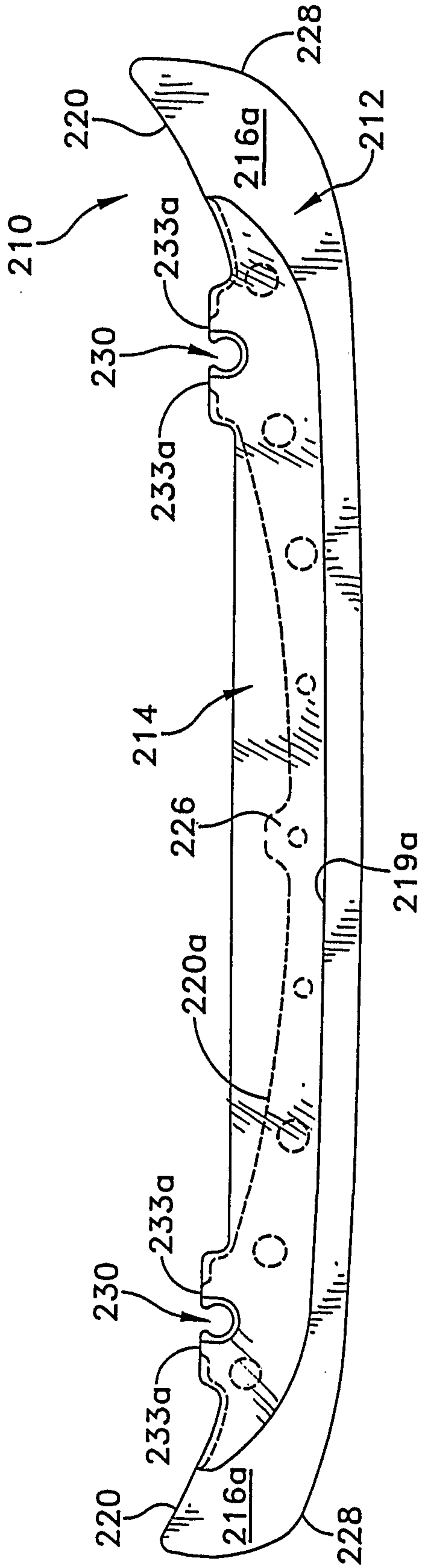


FIG. 12

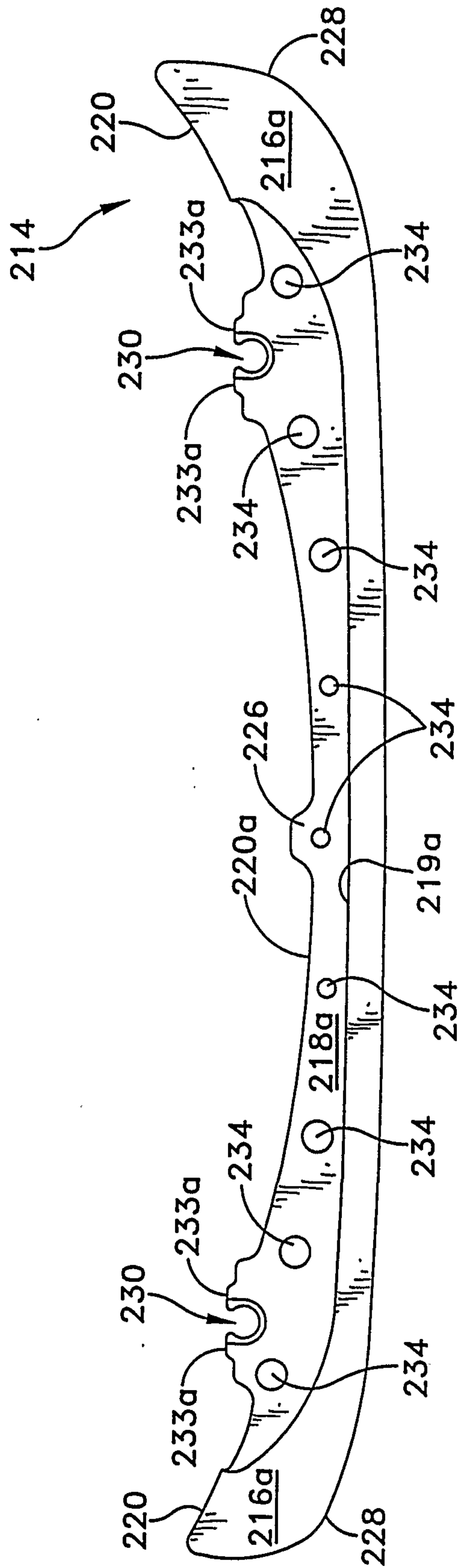


FIG. 13

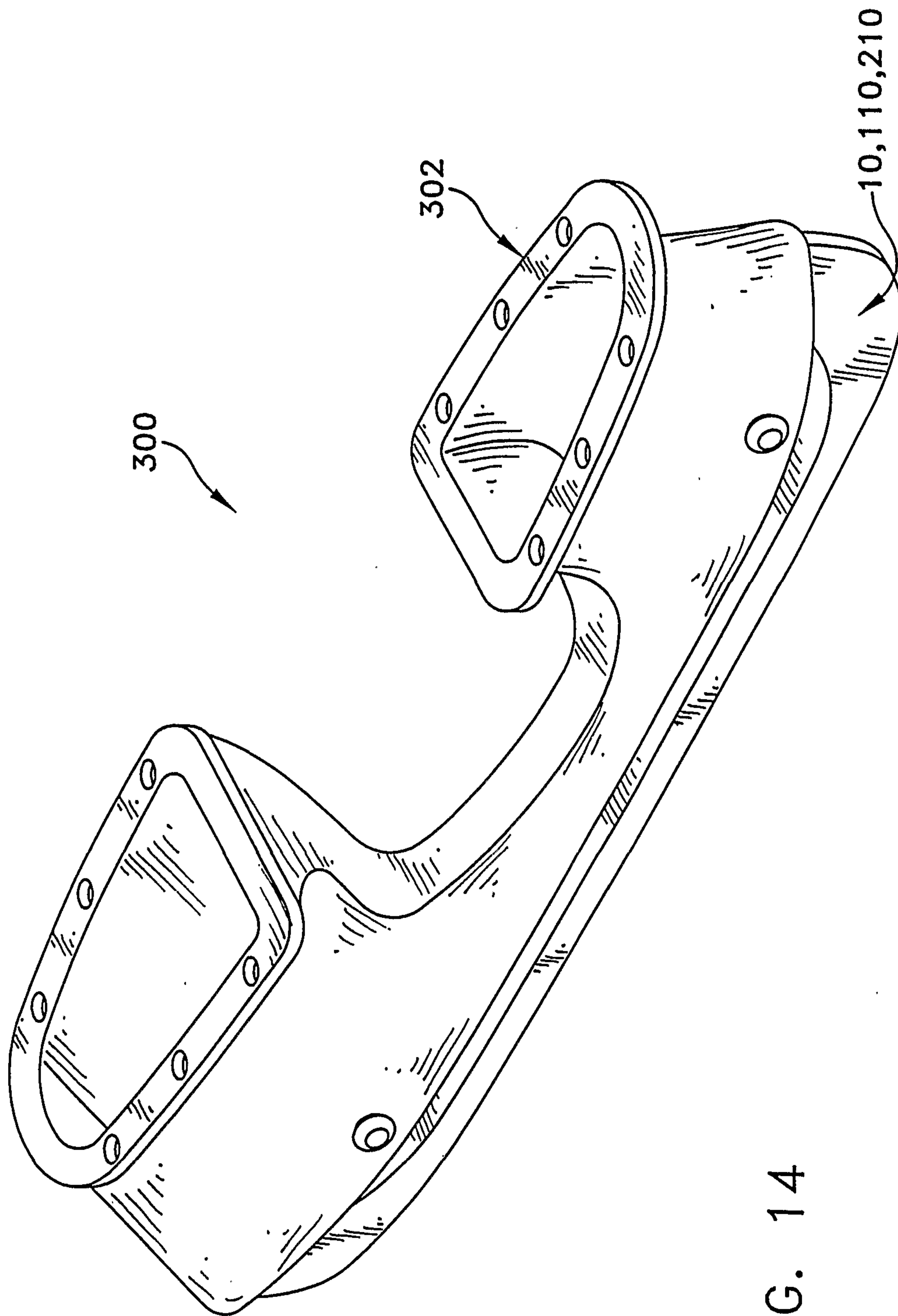


FIG. 14

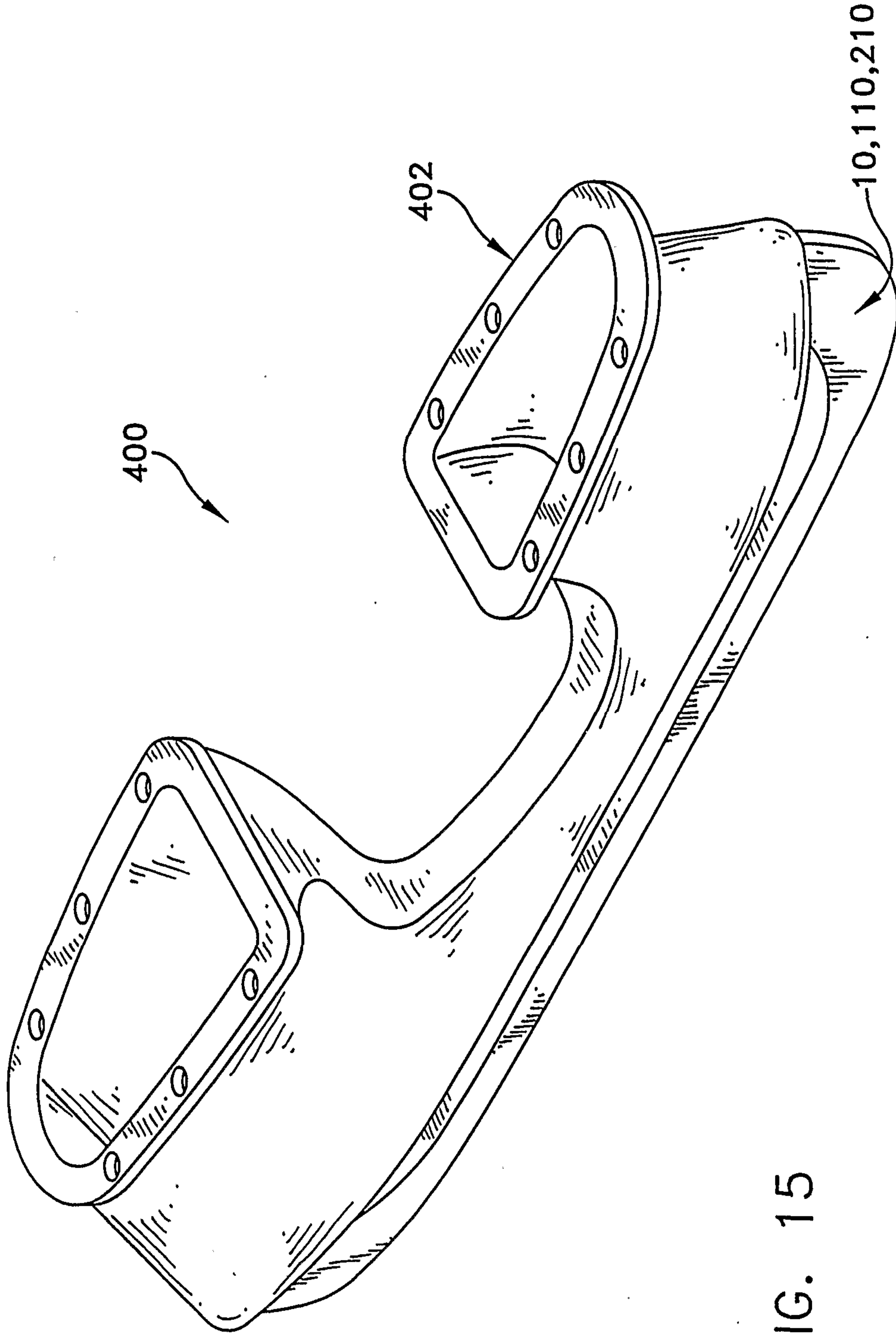


FIG. 15

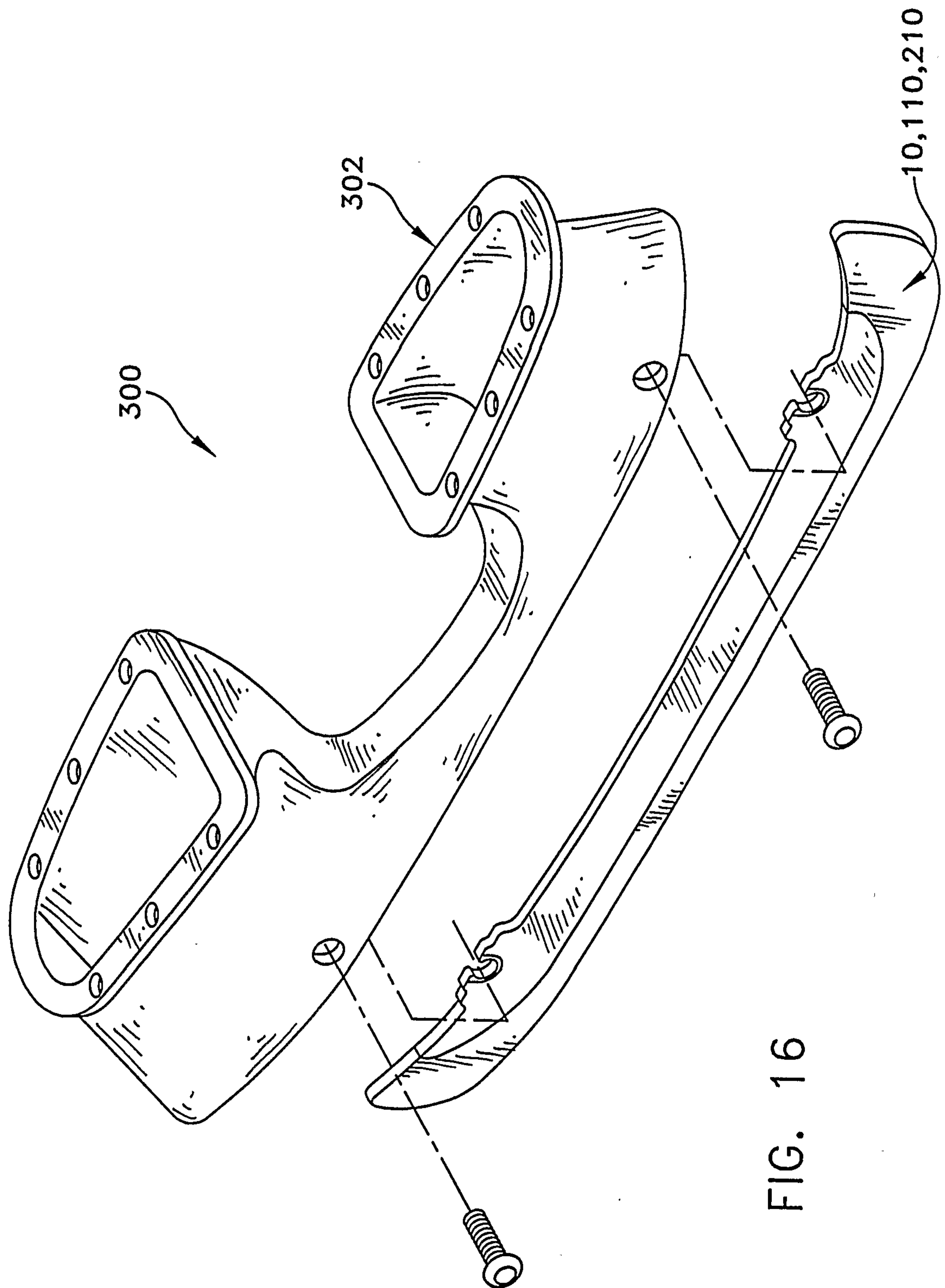


FIG. 16

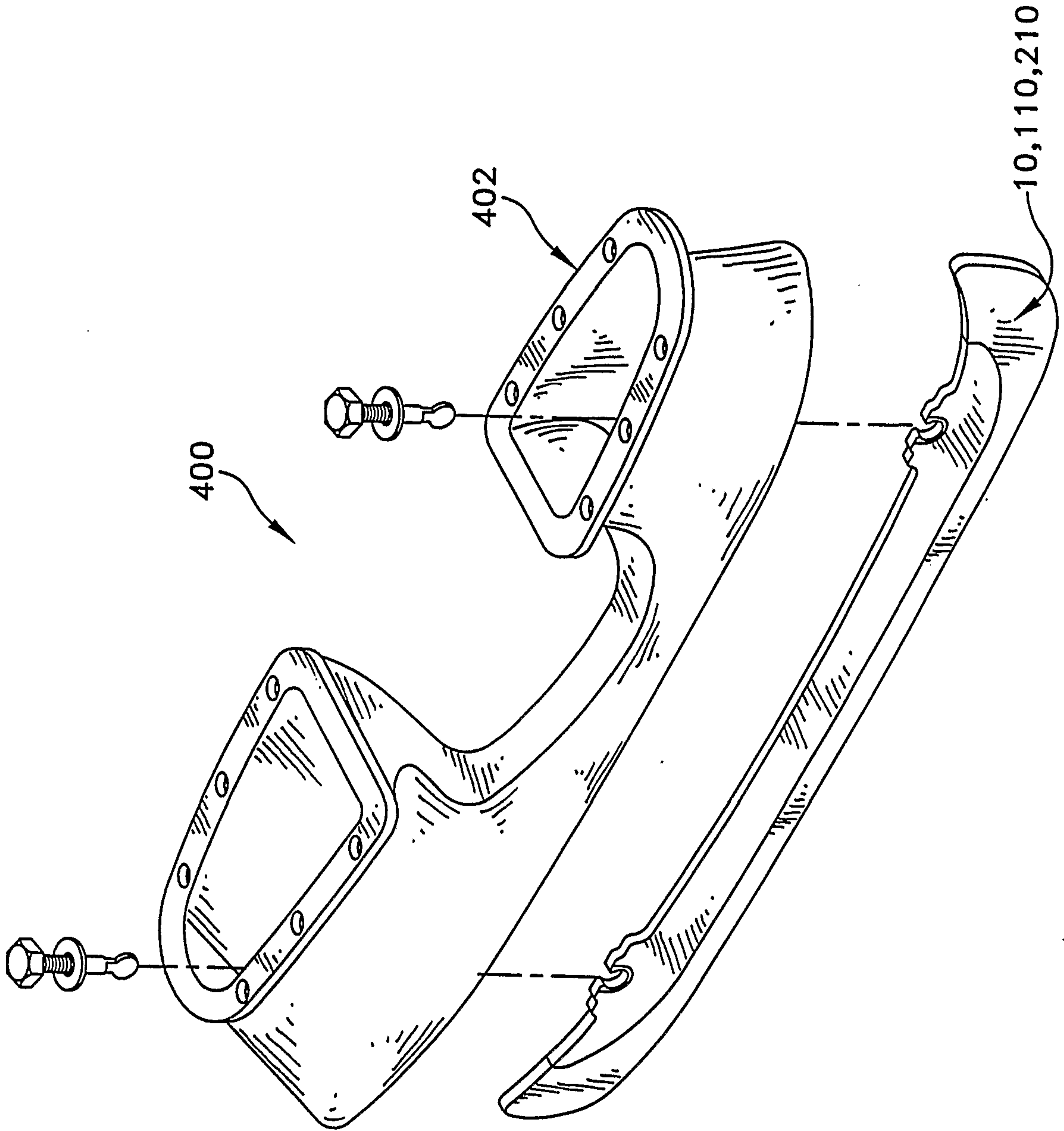


FIG. 17

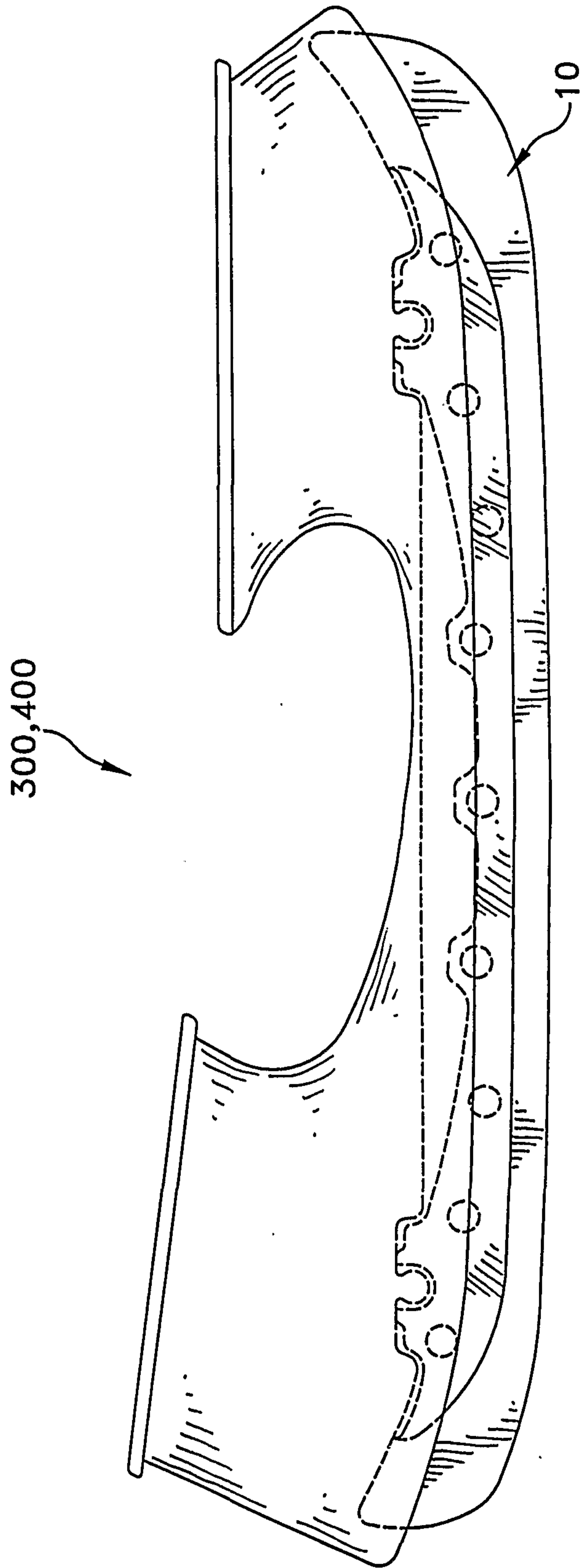
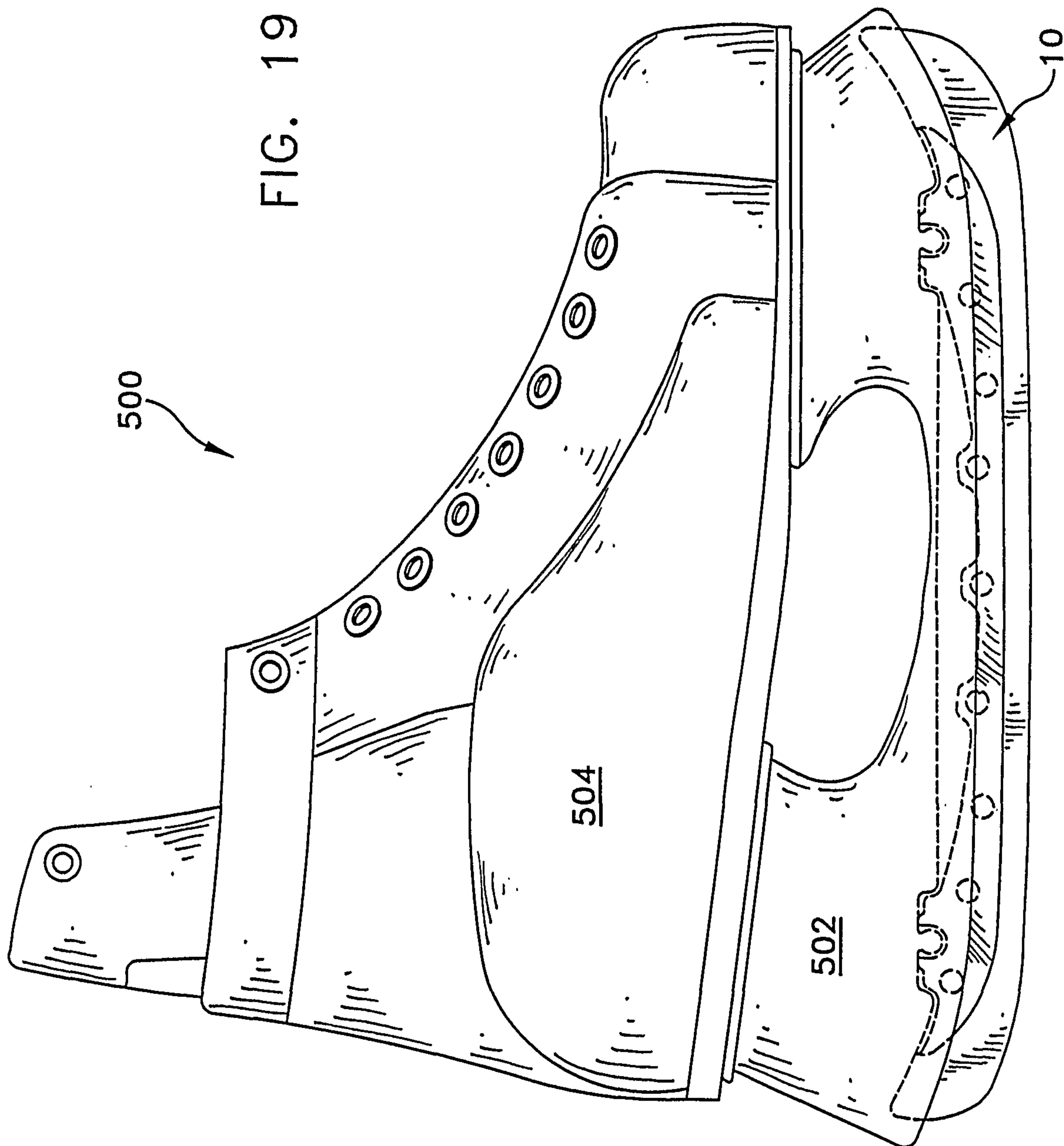
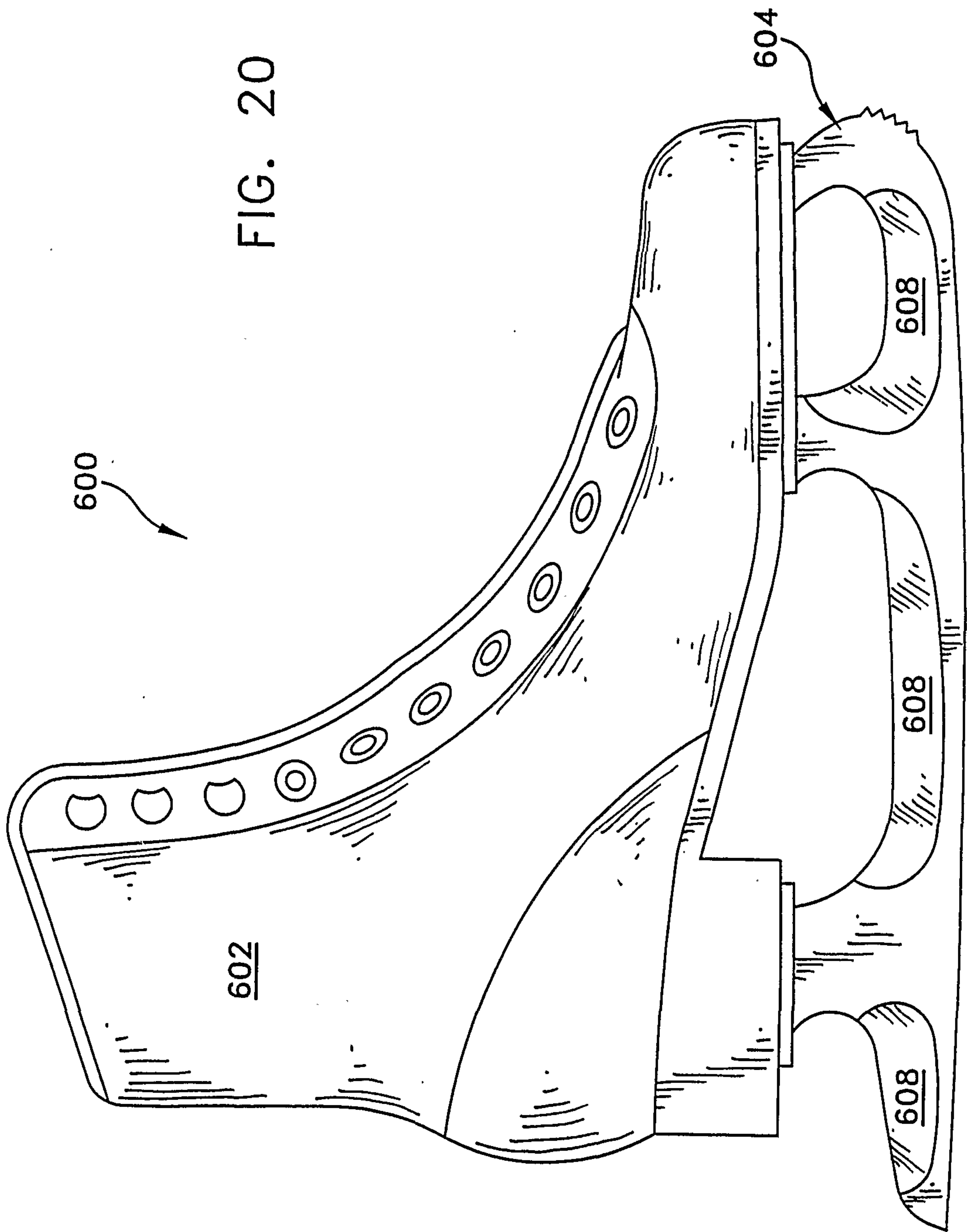


FIG. 18





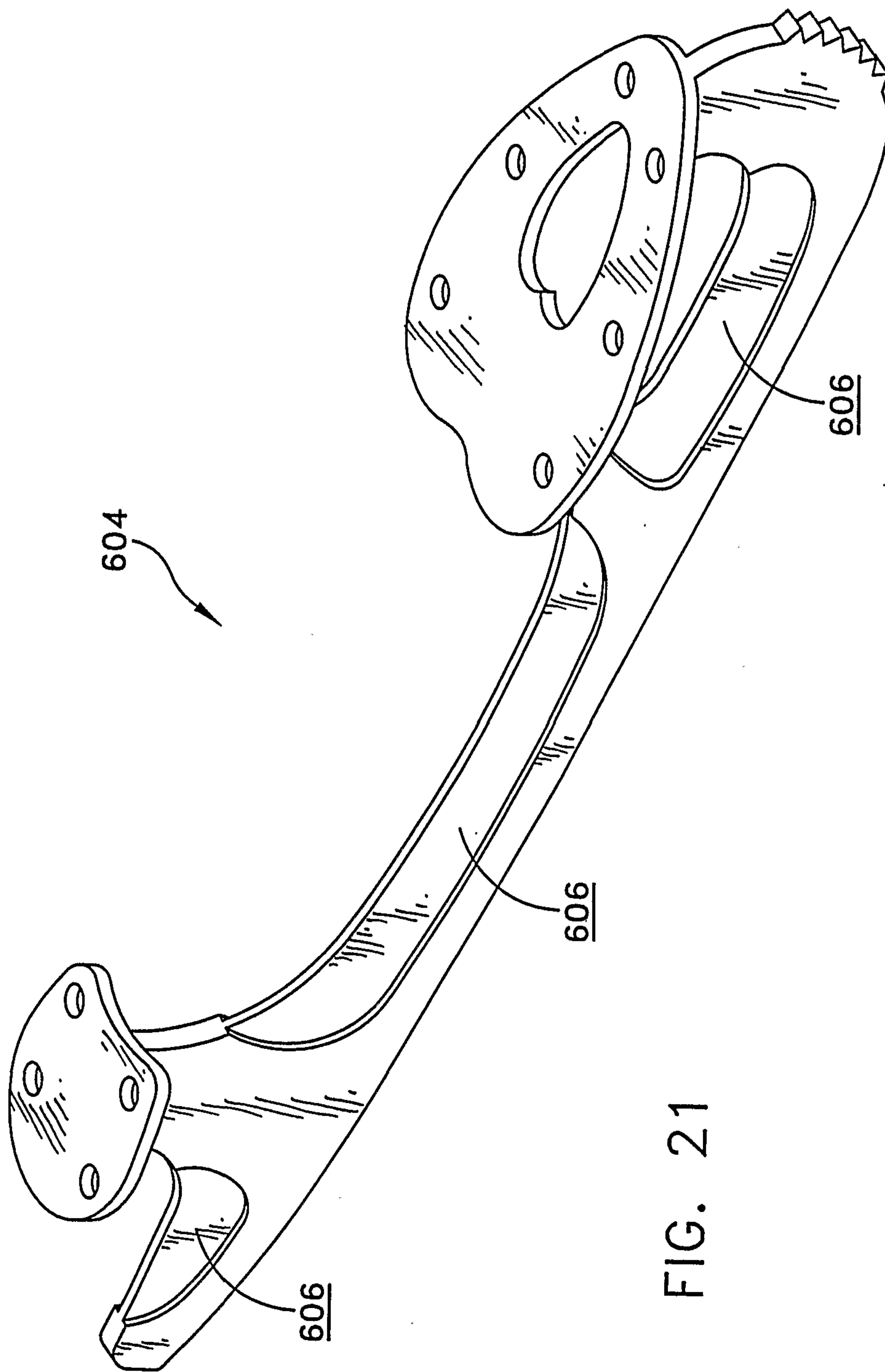


FIG. 21

