



(22) Date de dépôt/Filing Date: 2001/12/21
(41) Mise à la disp. pub./Open to Public Insp.: 2002/07/11
(45) Date de délivrance/Issue Date: 2018/01/30
(62) Demande originale/Original Application: 2 431 659
(30) Priorité/Priority: 2000/12/29 (US60/259,114)

(51) Cl.Int./Int.Cl. *A61F 11/14* (2006.01),
A41D 13/05 (2006.01), *A42B 1/06* (2006.01)

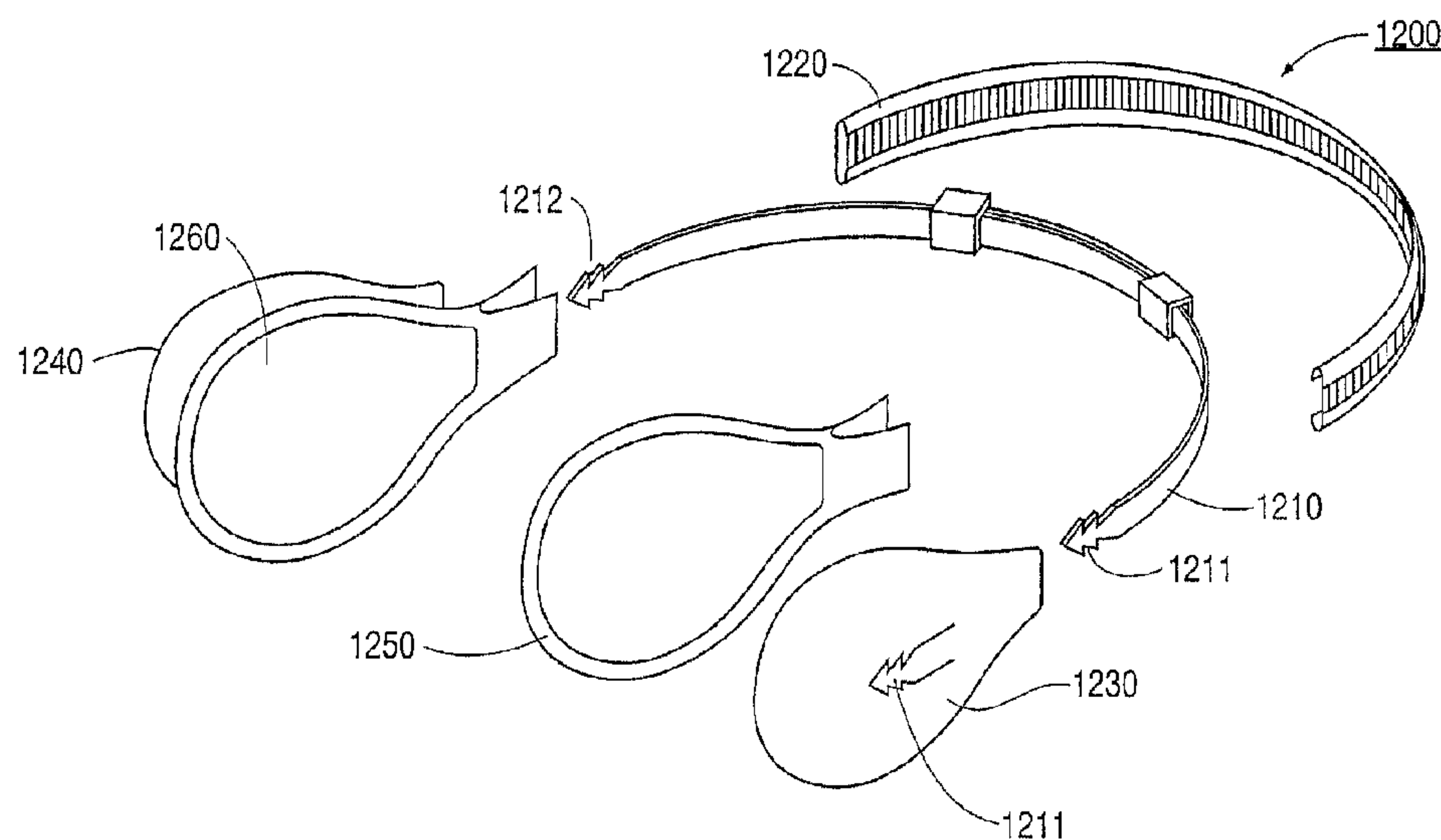
(72) Inventeurs/Inventors:
BAVETTA, DEAN, US;
KAY, PAUL, US;
PROKOP, GARY F., US;
REMY, STEVE, US;
LE GETTE, BRIAN E., US

(73) Propriétaire/Owner:
180S, INC., US

(74) Agent: RIDOUT & MAYBEE LLP

(54) Titre : DISPOSITIF DE PROTECTION POUR LES OREILLES

(54) Title: EAR PROTECTION DEVICE



(57) Abrégé/Abstract:

An apparatus comprising a first curved band portion and a second curved band portion. The first curved band portion has a first end, a second end, an inner curved side and an outer curved side. The first curved band portion defines a passageway between the first end and the second end of the first curved band portion. The passageway has a first opening. The second curved band portion has a first end, a second end, an inner curved side and an outer curved side. A motion-restraint portion is proximate to the first end of the second curved band portion. The first end of the second curved band portion is insertable into the first opening of the passageway of the first curved band portion. The first curved band portion has a range of motion within the passageway of the second curved band portion.

ABSTRACT

An apparatus comprising a first curved band portion and a second curved band portion. The first curved band portion has a first end, a second end, an inner curved side and an outer curved side. The first curved band portion defines a passageway between the first end and the second end of the first curved band portion. The passageway has a first opening. The second curved band portion has a first end, a second end, an inner curved side and an outer curved side. A motion-restraint portion is proximate to the first end of the second curved band portion. The first end of the second curved band portion is insertable into the first opening of the passageway of the first curved band portion. The first curved band portion has a range of motion within the passageway of the second curved band portion.

TITLE OF THE INVENTION**EAR PROTECTION DEVICE**

This application is a divisional of Canadian patent application Serial No. 2,431,659 filed internationally on December 21, 2001 and entered into the National Phase in Canada on June 16, 2003.

BACKGROUND OF THE INVENTION

The invention in general relates to an ear protection device. More specifically, the invention relates to an ear protection device with adjustable bands.

Ear muffs that are worn over the top or around the back of a user's head are generally known. For example, U.S. Patent 1,628,483 to Wiegand discloses an ear protector. The ear protector includes a pair of oval-shaped plates, each plate being formed with an inwardly extending continuous flaring flange. The flange provides a conical profile. The plates are connected together via slidably connected resilient arms. The ear protector includes a hold fast device or rivet for coupling each of the resilient arms to a respective oval plate. The resilient arms each include a band for slidably receiving the other overlapping resilient arm. The bands hold the resilient arms together and allow for the sliding movement between the two resilient arms to allow the ear protector to be adjusted for a specific user. The ear protector can be worn with the resilient arms extending around the back of the head.

This known ear muff, however, does not effectively maintain its position on a user's head. In addition, this ear muff does not allow a fabric member to cover entirely the frame structure of the ear muff.

Thus, a need exists for frames for ear protection devices that maintain their position on a user's head. In addition, a need exists for a shell (e.g., made of fabric) that entirely covers the ear-protection-device frame.

SUMMARY OF THE INVENTION

An apparatus comprising a first curved band portion and a second curved band portion. The first curved band portion has a first end, a second end, an inner curved side and an outer curved side. The first curved band portion defines a passageway between the first end and the second end of the first curved band portion. The passageway has a first opening. The second curved band portion has a first end, a second end, an inner curved side and an outer curved side. A motion-restraint portion is proximate to the first end of the second curved band portion. The first end of the second curved band portion is insertable into the first opening of the passageway of the first curved band portion. The first curved band portion has a range of motion within the passageway of the second curved band portion.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a perspective view of an ear protection device, according to an embodiment of the invention.

FIGS. 2A-2D show a perspective view, a side view, a top view and a front view, respectively, of a first band portion, according to an embodiment of the invention.

FIGS. 3A-3E show a top perspective view, bottom perspective view, a side view, a top view and a front view, respectively, of a second band portion, according to an embodiment of the invention.

FIGS. 4A-4D show a perspective view, a side view, a rear view and a front view, respectively, of two band portions, according to an embodiment of the invention.

FIG. 5 shows a perspective view of an ear cup portion, according to an embodiment of the invention.

FIG. 6A shows a top view of shell membranes, according to an embodiment of the invention.

FIG. 6B shows a top view of the shell membranes shown in FIG. 6A while assembled into a shell.

FIG. 7 shows a top view of shell membranes, according to another embodiment of the invention.

FIG. 8 shows a top view of an assembled shell, according to another embodiment of the invention.

FIG. 9 shows a top view of shell membranes, according to another embodiment of the invention.

FIG. 10 shows a top view of shell membranes of FIG. 9 partially sewn during an immediate step of assembling an ear protection device.

FIG. 11 shows a top view of shell membranes, according to another embodiment of the invention.

FIG. 12 shows a top view of the assembled shell based on the shell membranes shown in FIG. 11.

FIG. 13 shows a top view of shell membranes, according another embodiment of the invention.

FIG. 14 shows a top view of an assembled shell based on the shell membranes shown in FIG. 13.

FIG. 15 shows a top view of shell membranes, according to another embodiment of the invention.

FIG. 16 shows a top view of an assembled shell based on the shell membranes shown in FIG. 15.

FIG. 17 shows a perspective view of two band portions, according to an embodiment of the invention.

FIG. 18 shows an assembly view of a frame, according another embodiment of the invention.

FIG. 19 shows an assembly view of an ear protection device, according to another embodiment of the invention.

FIG. 20 shows an assembly view of an ear protection device, according to another embodiment of the invention.

FIG. 21 shows an assembly view of an ear protection device, according to another embodiment of the invention.

FIG. 22 shows an assembly view of an ear protection device, according to another embodiment of the invention.

DETAILED DESCRIPTION

FIG. 1 shows a perspective view of an ear protection device, according to an embodiment of the invention. As shown in FIG. 1, the ear protection device 10 includes a head band portion 12 having an inner side 14 and an outer side 16. Ear protection device 10 also includes a first end portion 18 and a second end portion 20. The first end portion 18 and second end portion 20 are connected to respective ear portions 22. Each ear portion 22 has an inner side 24 and an outer side 26. The ear protection device 10 is covered in a textile material, such as fleece. Note that the head band portion 12 is covered by excess material that gathers.

FIGS. 2A-2D show a perspective view, a side view, a top view and a front view, respectively, of a first band portion, according to an embodiment of the invention. Band portion 200 includes a first end 34, a second end 36, an inner side 35 and an outer side 37. Band portion 200 includes a raised mounting surface 38 disposed at the outer side 37 and proximate to the first end 34. Band portion 200 also includes a motion-restraint portion 40 disposed at the outer side 37 and proximate to the second end 36 of band portion 200. Although the mounting surface 38 and motion-restraint portion 40 are shown as being integrally formed with the band portion 200, they can be formed separately and attached to the band portion 200. In an alternative embodiment, the motion-restraint portion can be a detent that is integrally formed with the band portion along only a single side of the detent while the remaining sides of the detent are separated (or cut out) from the band portion.

FIGS. 3A-3E show a top perspective view, bottom perspective view, a side view, a top view and a front view, respectively, of a second band portion, according to an embodiment of the invention. Band portion 210 includes a first end 42, a second end 44, an inner side 45 and an outer side 47. Band portion 210 includes a raised mounting surface 46 disposed at the outer side 47 and proximate to the second end 44. Band portion 210 further includes a base member 211, side members 212 and upper members (or flanges) 50. The side members 212 are connected along both sides 52 of the base member 211. The upper members 50 are connected to the side members 212 and protrude over base member 211.

The base member 211, side members 212 and upper members 50 define a passageway 215 along the band portion 210, lengthwise. In other words, the base member 211, side members 212 and upper members 50 bound a channel on various sides into which the band portion 200 can be slideably engaged. Thus, as the band portion 200 is moved through the passageway 215, the movement of band portion 200 is limited by the base member 211, side members 212 and upper members 50. The passageway 215 includes an opening 216 into which the band portion 200 can be initially inserted.

FIGS. 4A-4D show a perspective view, a side view, a rear view and a front view, respectively, of two band portions, according to an embodiment of the invention. As shown in FIGS. 4A-4D, band portion 200 is inserted into the passageway of band portion 210 through opening 216 to provide a band that has an adjustable length. More specifically, the motion-restraint portion 40 of band portion 200 is engagable with the opening 216 of passageway 215 of band portion 210. Once band portion 200 has been inserted through opening 216, the motion-restraint portion 40 engages the portions of band portion 210 that defines opening 216. This allows motion-restraint portion 40 to prevent band portion 200 from exiting passageway 215 of band portion 210. Consequently, the band portion 200 has a range of motion within the passageway 215 of band portion 210 once the band portion 200 has been inserted into passageway 215 of band portion 210. This range of motion within the passageway 215 is limited on the end with the opening 216 by the engagement of motion-restraint portion 40 of band portion 210.

In an alternative embodiment, the motion-restrain portion can removably engage the passageway of the other embodiment. For example, the motion-restraint portion can be a detent integrally formed with the band portion along only a single side of the detent while the remaining sides of the detent are separated (or cut out) from the band portion. This allows the band portion to be removably inserted into the passageway of the other band portion. In other words, the detent can be depressed to disengage from the opening of the passageway thereby allowing the one band portion to be removed from the other band portion.

In another alternative embodiment, the motion-restraint portion of one band portion can at least partially engage other openings within the passageway of the other band portion. For example, the motion-restraint portion can be a detent and the upper members of the band portion that defines the passageway can extend so that they overlap slightly with the detent. This allows the detent to engage partially the openings defined by the upper members thereby causing a slight hesitation due to friction when the band portions are moved within the range of motion. Once this partial engagement is overcome, the band portions can move within the range of motion.

In yet another alternative embodiment, the upper members that define the passageway of one band portion can further extend so that the detent of the other band portion removably engages the openings defined by the upper members. In such an embodiment, the two band portions will have a range of motion that includes one or more positions where the detent removably engages the openings in the passageway. This removable engagement allows the position of the band portion to be temporarily locked within the passageway of the other band portion.

In yet another alternative embodiment, detent-engageable openings of the passageway of one band portion and the detent of the other band portion can be located on any of their respective sides. For example, the detent can be located on either side or both sides of the band portion where the detent-engageable openings of the passageway are disposed at corresponding locations on the other band portion (i.e., on the matching side or on both sides of the passageway). Alternatively, the detent can be located on the inner side the band portion where the detent-engageable openings of the passageway are disposed at corresponding location(s) on the inner side of the other band portion. In yet another embodiment, multiple detents can be located at different locations (i.e., one detent on the outer side and another detent on the inner side) of the band portion where the detent-engageable openings of the passageway are disposed at a corresponding locations on the other band portion.

Although motion-restraint portion 40 of band portion 200 is shown in FIGS. 2A-2D as a detent, other configurations are possible. For example, the motion-restraint portion can be a rivet that is coupled to the band portion once the band portion is inserted into the passageway of the other band portion. Such a rivet can be, for example, fixedly attached or removably attached to the band portion once the band portion is inserted into the passageway of the other band portion.

FIG. 5 shows a perspective view of an ear cup portion, according to an embodiment of the invention. As shown in FIG. 5, ear cup portion 54 includes a conical portion 56 having a transition portion 58 extending from the side of the conical

portion 56. The transition portion 56 is integrally formed with mount portion 60, which includes a hole 62.

Two ear cup portions 54 can each be attached to an end of the band portions 200 and 210. In other words, one ear cup portion 54 can be attached to the raised mounting surface 38 of band portion 200 and another ear cup portion 54 can be attached to the raised mounting surface 46 of band portion 210. Ear cup portions 54 can be attached to band portions 200 and 210 by a fastener, such as for example, rivet 64. In an alternative embodiment, either the ear cup portion or the raised mounted surface of the band portions can include an integrally formed rivet for snap-action engagement with a hole in the corresponding mating structure. Note that band portions 200 and/or 210, and/or ear cup portions 54 collectively are sometimes referred to herein as a “frame”.

FIG. 6A shows a top view of shell membranes, according to an embodiment of the invention. The shell membranes include outer membrane 310, inner membrane 320, and ear membranes 330 and 340. FIG. 6B shows a top view of the shell membranes shown in FIG. 6A while assembled into a shell. As shown in FIG. 6B, the membranes 310, 320, 330 and 340 can be arranged together and then sown with a seam along the perimeter. The assembled shell 300 includes two openings 350 and 360 into which portions of the frame can be inserted. For example, the band portion 200 with the attached ear cup portion 54 can be inserted into opening 350, and the band portion 210 with the attached ear cup portion 54 can be inserted into opening 360. Additional details and variations of the shell membranes are described in U.S. Patent 5,835,609 to Le Gette et al. entitled “Ear Protection Device;”.

After being inserted into shell 300, the band portions 200 and 210 can have an adjustable length to accommodate the use of the ear protection device 10 by users having different size heads or by the same user while extending over the top or around the band of that user's head. In other words, once the band portions 200 and 210 are inserted into and assembled within the shell 300, the length of the band portions 200

and 210 can be adjusted by moving band portion 200 within the passageway 215 of band portion 210.

In some embodiments, the band portions can be separated from each other while disposed within shell 300. For example, where the motion-restraint portion of one band portion is a disengageable detent, the detent can be disengaged from an opening of the passageway of the other band portion, and the band portion can be removed from the passageway of the other band portion. Then, the band portion with the attached ear cup portion 54 can be removed from shell 300 through opening 350, and the other band portion with the attached ear cup portion 54 can be removed from shell 300 through opening 360.

This allows the ear protection device 10 to have interchangeable shells. In other words, different shells can be used to cover the same frame because the band portions can be separated from each other while disposed within one shell and reassembled in another shell. Such interchangeable shells, for example, can have different colors or logos for use with a single frame.

FIG. 7 shows a top view of shell membranes, according to another embodiment of the invention. As shown in FIG. 7, the shell 400 includes outer membrane 410 and inner membrane 420. To assemble an ear protection device using shell 400, the outer membrane 410 and inner membrane 420 can be positioned over the other, with the components of the frame disposed between the two membranes 410 and 420, and then the membranes 410 and 420 can be sown along their perimeter.

FIG. 8 shows a top view of an assembled shell, according to another embodiment of the invention. As shown in FIG. 8, the shell 500 has an inner membrane 510, outer membrane 520 and elastic membranes 530 and 540 (shown in phantom). The membranes 510, 520, 530 and 540 are sown along the perimeter. The elastic membranes 530 and 540 can be disposed between the inner membrane 510 and the outer membrane 520. The elastic membranes 530 and 540 can form “gathers” in the central portion of the shell 500. The elastic membranes 530 and 540 can gather any

additional material of membranes 510 and 520 when the ear protection device is in a configuration other than open. In other words, membranes 510 and 520 can be fully stretched when the ear protection device is in an open configuration and less than fully stretched when the ear protection device is in a closed configuration. Thus, when in the closed configuration, the elastic membranes 530 and 540 can gather membranes 510 and 520.

FIG. 9 shows a top view of shell membranes, according to another embodiment of the invention. As shown FIG. 9, the shell 600 includes outer 610 membrane and inner membrane 620. Outer membrane 610 includes end portions 611 and 612. Inner membrane 620 includes end portions 621 and 622. The end portions 611, 612, 621 and 622 can include, for example, an elastic material and can be folded over the related frame portion when assembled. The doubled-over arrangement of the end portions 611, 612, 621 and 622 can provide cushioning for the frame against the wearer's head. The elastic material can affect the appearance of the ear protection device by pulling the outer membrane 610 and inner membrane 620 tight around the perimeter of the ear cup portions of the frame. In other words, the elastic material can be pulled over the related frame portions so that the outer membrane 610 and inner membrane 620 are removeably secured to the related frame portions without being sewn along a seam.

FIG. 10 shows a top view of shell membranes of FIG. 9 partially sewn during an immediate step of assembling an ear protection device. As shown in FIG. 10, the ear protection device can be assembled by initially sewing a portion of the perimeter 630 and leaving a portion of the perimeter 640 and 650 not sewn. Two ear cup portions of the frame each can be connected to a respective band portion. Each band portion with its attached ear cup portion of the frame can then be positioned within the shell by insertion through the portions 640 and 650. The inner band portion can then be removably inserted into the passageway of the outer band (as described above, for example, in reference to FIGS. 4A-4D). In an alternative embodiment, the shell 600 can be turned inside out after the portions of perimeter 630 have been sewn.

FIG. 11 shows a top view of shell membranes, according to another embodiment of the invention. The shell 700 includes outer membrane 710 and ear membranes 720 and 730. Outer membrane 710 includes middle portion 715, which is integrally formed with the remaining portions of outer membrane 710. Ear membranes 720 and 730 each have their own elastic membrane attached to a portion of the perimeter of the respective ear membrane. In addition, the outer membrane 710 can have its own elastic membrane attached to the perimeter of the ear portions of outer membrane 710. Note that although elastic membranes are shown on both the outer membrane 710 and ear membranes 720 and 730, alternative embodiments are possible where the elastic membrane is disposed at only the outer membrane or only the ear membranes.

Shell 700 can be assembled by attaching the edge portions 721 and 731 of ear membranes 720 and 730, respectively, to portions 711 and 712 of outer membrane 710. The middle portion 715 of outer membrane 710 can be folded over and attached to the portion 716 of the outer membrane 710. This is shown in FIG. 12, which shows a top view of the assembled shell based on the shell membranes shown in FIG. 11. The ear membranes 720 and 730 optionally can be turned inside out with regards to the corresponding portions of outer membrane 710. Consequently, the attachment (e.g., a sewn seam) is disposed in the interior formed by outer membrane 710 and ear membranes 720 and 730. The frame can then be inserted into the interior formed by outer membrane 710 and ear membranes 720 and 730. The elastic membranes attached to outer membrane 710 and ear membranes 720 and 730 tend to draw the perimeter of the outer membrane 710 and ear membranes 720 and 730 inwardly. Thus, the corresponding portions of shell 700 close in around the ear cup portions of the frame. Although not shown explicitly in FIG. 12, the ear protection device will have a curvature corresponding to the shape of the frame.

In an alternative embodiment, the ear membranes need not be attached to portions of the outer membrane. Rather, the middle portion of the outer membrane can be folded over and attached. Then, the frame can be inserted into the interior formed by the outer membrane and the middle portion of the outer membrane. Finally, the ear

membranes can be disposed and maintained over the ear cup portions of the frame by the elastic membranes attached to the ear membranes and the outer membrane.

FIG. 13 shows a top view of shell membranes, according to another embodiment of the invention. As shown in FIG. 13, shell 800 includes an outer membrane 810 and an inner membrane 820. The lengths of band portions 811 and 821 of outer membrane 810 and inner membrane 820, respectively, are greater than the corresponding portion of the frame. This extra length allows the shell 800 to gather with extra material about the portions 811 and 821.

In addition, the ear portions 822 and 823 of inner membrane 820 can have lengths along direction 824 greater than the corresponding ear cup portions of the frame. An elastic membrane, while stretched, can be attached to the perimeter of ear portions 822 and 823. This extra size of ear portions 822 and 823 along direction 824 and the stretched elastic membrane allows the ear portions 822 and 823 to draw inwardly.

FIG. 14 shows a top view of an assembled shell based on the shell membranes shown in FIG. 13. As shown in FIG. 14, the outer membrane 810 and inner membrane 820 can be attached together at the positions 830 and 831. The frame can be inserted into an interior defined between the outer membrane 810 and inner membrane 820. The inward draw of the elastic membrane of ear portions 822 and 823 allows these to gather about the ear cup portions of the frame when inserted into an interior formed by inner membrane 810 and outer membrane 820.

FIG. 15 shows a top view of shell membranes, according to another embodiment of the invention. As shown in FIG. 15, shell 900 includes ear membranes 910, 920, 930 and 940, and middle membrane 950. The middle membrane 950 can be a knit tube or a membrane folded over to form a tube shape. Ear membranes 910 and 930 can be attached together, and ear membranes 920 and 940 can be attached together. Once attached, for example, by sewing, these attached ear membranes can be attached to middle membrane 950. Alternatively, these attached ear membranes can be turned

inside out and then attached to middle membrane 950. In yet another alternative, the attached ear membranes can include additional elastic membranes as discussed above in reference to, for example, FIG. 11. FIG. 16 shows a top view of an assembled shell based on the shell membranes shown in FIG. 15.

FIG. 17 shows a perspective view of two band portions, according to an embodiment of the invention. As shown in FIG. 17, band portion 1000 includes a first end 1001, a second end 1002, an inner side 1003 and an outer side 1004. The first end 1001 of band portion 1000 includes an opening. The second end 1002 of band portion 1000 includes a mounting portion 1005. Band portion 1000 has a base member 1006, side members 1007 and upper member 1008. Base member 1006, side members 1007 and upper members 1008 define a passageway along the band portion 1000, lengthwise. The passageway includes openings along the base member 1006, side members 1007 and upper member 1008.

Band portion 1010 includes a first end 1011 and a second end 1012. Band portion 1010 also includes a motion-restraint portion 1013 (shown as a detent in phantom) on the outer side of the first end 1011 of band portion 1010. Band portion 1010 also includes a mounting portion 1015 on the second end 1012.

Band portion 1010 can be slidably engaged into the passageway of band portion 1000. The motion-restraint portion 1013 of band portion 1010 can be engaged through opening 1009 of the passageway. Note that the band portion 1000 can easily flex either inwardly or outwardly because both the base member 1006 and the upper member 1008 have openings. In other words, as the band portions 1000 and 1010 are adjusted (e.g., while band portion 1010 is slidably engaged within the passageway of band portion 1000), these band portions can easily flex inwardly or outwardly due to the openings in the base member 1006 and the upper member 1008 of band portion 1000. In an alternative embodiment, the motion-restraint portion can be integrally formed with the band portion along only a single side of the detent while the remaining sides of the detent are separated (or cut out) from the band portion. Such an

embodiment allows the one band portion to be removably and slideably engaged into the passageway of the other band portion.

In another alternative embodiment, the motion-restraint portion can be a disengageable detent. The detent can be removably engageable with any of the openings of the passageway of the other band portion. Thus, the detent can be removably engageable into the openings of the upper member of the other band portion. This allows the band portions to be temporarily locked in multiple possible positions within the range of motion for the one band portion within the passageway of the other band portion. Note also that although the detent can be on the outer side of the band portion thereby corresponding to detent-engageable openings on the upper member of the other band portion, other arrangements are possible. For example, a detent can be located on any of the four sides of the band portion (either alone or in combination with detents on other sides) because the band portion includes openings on its four sides: the base member, the side members and the upper member.

FIG. 18 shows an assembly view of a frame, according another embodiment of the invention. As shown FIG. 18, the frame 1100 includes a band 1110 and ear cup portion 1120. Note that although a single ear cup portion 1120 is shown in FIG. 18, the frame 1100 includes a second ear cup portion that is attached to the band 1110 on the side opposite from ear cup portion 1120.

Ear cup portion 1120 includes attachment portions 1121 and 1122, ear cup 1124 and cushion insert 1126. Cushion insert 1126 can be made of, for example, urethane foam. The cushion insert 1126 can be attached to ear cup 1124 by, for example, glue. Cushion insert 1126 can provide cushioning between the ear cup 1124 and the user's head.

Attachment portions 1121 and 1122 of ear cup portion 1120 are proximal and distal, respectively, to the band 1110. The end of the band 1110 can be inserted into the attachment portions 1121 and 1122 so that band 1110 is attached to ear cup portion

1120 by, for example, a friction fit. Such a friction fit allows the band 1110 to be removed from and reattached to ear cup portion.

FIG. 19 shows an assembly view of an ear protection device, according to another embodiment of the invention. As shown in FIG. 19, ear protection device 1200 includes a band 1210, a band membrane 1220, ear cup portions 1230 and 1240 and ear cup membranes 1250 and 1260. The band membrane 1220 can be, for example, elastic piping with binding on the upper and lower side of the piping that allows the band membrane 1220 to fit over the band 1210. The band 1210 can be, for example, an adjustable spring-like band having two portions. Each end of the band 1210 can have a protrusion-locking portion 1211 and 1212. More specifically, protrusion-locking portions 1211 and 1212 can have a barbed shape.

Ear cup portions 1230 and 1240 can be made of, for example, a semi-rigid material such as foam. Protrusion-locking portions 1211 and 1212 can be inserted into ear cup portions 1230 and 1240, respectively. Note that protrusion-locking portion 1211' is shown in phantom within ear cup portion 1230 for illustrative purposes. The barbed shape of protrusion-locking portions 1211 and 1212 allows the protrusion-locking portions 1211 and 1212 to be retained within the ear cup portions 1230 and 1240. In one embodiment, protrusion-locking portions 1211 and 1212 can be inserted into ear cup portions 1230 and 1240, respectively, with glue to provide additional retention.

The ear cup membranes 1250 and 1260 each can be made of, for example, a fabric material on both sides thereby forming an interior into which ear cup portions 1230 and 1240, respectively, can be inserted. In other words, ear cup membranes 1250 and 1260 can be covers into which ear cup portions 1230 and 1240, respectively, can be inserted.

FIG. 20 shows an assembly view of an ear protection device, according to another embodiment of the invention. As shown in FIG. 20, ear protection device 1300 includes a band 1310, a band membrane 1320, ear cup portions 1330 and 1340 and ear

cup membranes 1350 and 1360. The band membrane 1320 can be, for example, elastic piping with a binding on the upper and lower side of the piping that allows the band membrane 1320 to fit over the band 1310. The band 1310 can be, for example, an adjustable spring-like band having two portions. Each end of the band 1310 can be coupled to a protrusion-locking portion 1311 and 1312. More specifically, protrusion-locking portions 1311 and 1312 can have a ball connector configured to lock into a ball-joint connection with the ear cup portions 1330 and 1340. The protrusion-locking portions 1311 and 1312 can have a post configuration that can friction fit into the clip ends of the band 1310. Such a post-clip configuration allows the ear cup portions 1330 and 1340 to rotate about the ends of band 1310 when in a closed configuration.

Ear cup portions 1330 and 1340 can be made of, for example, molded plastic. Ear cup portions 1330 and 1340 each can include a joint portion of a ball-joint connection that is configured to connect with protrusion-locking portions 1311 and 1312. The joint portion of each ear cup portions 1330 and 1340 can be disposed at an end proximal to protrusion-locking portions 1311 and 1312. Thus, protrusion-locking portions 1311 and 1312 can be removably connected to ear cup portions 1330 and 1340, respectively.

The ear cup membranes 1350 and 1360 each can be made of, for example, a fabric material on both sides thereby forming an interior into which ear cup portions 1330 and 1340, respectively, can be inserted. In other words, ear cup membranes 1350 and 1360 can be covers into which ear cup portions 1330 and 1340, respectively, can be inserted.

FIG. 21 shows an assembly view of an ear protection device, according to another embodiment of the invention. As shown in FIG. 21, ear protection device 1400 includes a band 1410, a band membrane 1420, ear cup portions 1430 and 1440 and ear cup membrane 1450. The band membrane 1420 can be, for example, elastic piping with a binding on the upper and lower side of the piping that allows the band membrane 1420 to fit over the band 1410. The band 1410 can be, for example, an adjustable spring-like band having two portions. Each end of the band 1410 can be coupled to a

protrusion-locking portion 1411 and 1412. More specifically, protrusion-locking portions 1411 and 1412 each can have a clamp connector configured to lock by a friction fit into a post within the ear cup portions 1430 and 1440. Such a hinge-post configuration allows the ear cup portions 1430 and 1440 to rotate about the ends of band 1410 when in a closed configuration.

Ear cup portions 1430 and 1440 can be made of, for example, molded plastic. Protrusion-locking portions 1411 and 1412 can be removably connected to ear cup portions 1430 and 1440, respectively.

The ear cup membrane 1450 can be made of, for example, a fabric material on both sides thereby forming an interior into which ear cup portion 1430 can be inserted. In other words, ear cup membrane 1450 can be a cover into which ear cup portion 1430 can be inserted. Note that although not shown in FIG. 21, an additional ear cup membrane can be used to cover ear cup portion 1440.

FIG. 22 shows an assembly view of an ear protection device, according to another embodiment of the invention. As shown in FIG. 22, ear protection device 1500 includes a band 1510, a band membrane 1520, ear cup portions 1530 and 1540 and ear cup membranes 1550 and 1560. The band membrane 1520 can be, for example, a cloth tube into which band 1510 can be inserted. The band membrane 1520 can include ends 1521 and 1522 that can be made of, for example, lycra or similar elastic material. The band 1510 can be, for example, an adjustable spring-like band having two portions. One end of the band 1510 includes a protrusion-locking portion 1511 and the other end of band 1510 includes a protrusion-locking portion 1512. More specifically, protrusion-locking portions 1511 and 1512 each can have a knob configured to lock by a snap fit into a hole in the ear cup portions 1530 and 1540. Such a snap-fit configuration allows the ear cup portions 1530 and 1540 to rotate about the ends of band 1510 when in a closed configuration.

Ear cup portions 1530 and 1540 can be made of, for example, molded plastic. The ear cup membranes 1550 and 1560 each can be made of, for example, a fabric

material on both sides thereby forming an interior into which ear cup portions 1530 and 1540 can be inserted. In other words, ear cup membranes 1550 and 1560 can be a cover into which ear cup portions 1530 and 1540 can be inserted.

While various embodiments of the invention have been described above, it should be understood that they have been presented by way of example only, and not limitation. Thus, the breadth and scope of the present invention should not be limited by any of the above-described embodiments, but should be defined only in accordance with the following claims and their equivalents.

The previous description of the embodiments is provided to enable any person skilled in the art to make or use the invention. While the invention has been particularly shown and described with reference to embodiments thereof, the scope of the claims should not be limited by the preferred embodiments set forth in the examples.

For example, although certain frame embodiments are described as being inserted into certain shell embodiments, other arrangements are possible. Any of the frame embodiments described above can be inserted into other shell configurations disclosed in, for example, U.S. Patent 5,835,609; and U.S. Patents 6,332,223 and 6,502,247, both of which are entitled “Apparatus and Method for Making an Ear Warmer Having Interior Seams.” In addition, any of the shell embodiments described above can be used in combination with the frames described in U.S. Patent 5,835,609.

WHAT IS CLAIMED IS:

1. An ear protection device comprising:
 - a band, said band including a first end, a second end, a first locking protrusion located proximate to said first end, and a second locking protrusion located proximate to said second end, the band and the first locking protrusion being unitarily formed;
 - a band membrane, said band membrane covering a portion of said band;
 - a first ear cup portion, the first end of the band configured to be inserted into said first ear cup portion such that a portion of the first ear cup portion contacts said first locking protrusion such that the portion of the first ear cup portion resists removal of the first end of the band when the first end of the band is inserted into said first ear cup portion to fixedly couple the first ear cup portion to the band; and
 - a second ear cup portion, said second ear cup portion being configured to receive said second locking protrusion, each of said first locking protrusion and said second locking protrusion including a barbed shape.
2. The ear protection device of claim 1, wherein said first locking protrusion is configured to be inserted into and retained within said first ear cup portion.
3. The ear protection device of claim 1, wherein said first ear cup portion is formed of a semi-rigid material, said first locking protrusion being configured to be inserted into and retained within said first ear cup portion.
4. The ear protection device of claim 3, wherein said semi-rigid material is foam.
5. The ear protection device of claim 1, further comprising:
 - a first ear cup membrane, said first ear cup membrane defining an interior configured to receive said first ear cup portion; and
 - a second ear cup membrane, said second ear cup membrane defining its own interior configured to receive said second ear cup portion.
6. An ear protection device, comprising:

a band having a first band member and a second band member, the first band member being slideably coupled to the second band member,

the first band member including:

a first end portion and a second end portion opposite the first end portion,

a first locking protrusion including a barbed shape unitarily formed with the first band member and located proximate to the first end portion of the first band member,

a second locking protrusion located proximate to the first end portion of the first band member; and

an ear cup portion, the ear cup portion being configured to receive the first locking protrusion and the second locking protrusion.

7. The ear protection device of claim 6, further comprising: a band membrane configured to cover at least a portion of the band.

8. The ear protection device of claim 6, wherein the first locking protrusion and the second locking protrusion are configured to be inserted into and fixedly retained within the ear cup portion.

9. The ear protection device of claim 6, wherein the ear cup portion is formed of a semi-rigid material, the locking protrusion is configured to be inserted into and fixedly retained within the ear cup portion.

10. The ear protection device of claim 9, wherein the semi-rigid material is foam.

11. An ear protection device, comprising:

a band, the band including a first end, a second end, a first locking protrusion located proximate to the first end of the band, a second locking protrusion located proximate to the second end of the band, the first locking protrusion and the second locking protrusion extending from the band in substantially the same direction;

a first ear cup portion, the first ear cup portion being configured to receive the first locking protrusion to fixedly couple the first ear cup portion to the band, the first locking protrusion including a barbed shape; and

a second ear cup portion, the second ear cup portion being configured to receive the second locking protrusion.

12. The ear protection device of claim 11, further comprising: a band membrane configured to cover at least a portion of the band.

13. The ear protection device of claim 11, wherein the first locking protrusion is configured to be inserted into and retained within the first ear cup portion.

14. The ear protection device of claim 11, wherein the first ear cup portion is formed of a semi-rigid material, the first locking protrusion is configured to be inserted into and retained within the first ear cup portion.

15. The ear protection device of claim 14, wherein the semi-rigid material is foam.

16. The ear protection device of claim 11, wherein the band has a first band member and a second band member, the first band member is slideably coupled to the second band member.

17. The ear protection device of claim 11, wherein the band and the first locking protrusion are unitarily formed.

18. An apparatus, comprising:

a band having a first locking-protrusion end and a second locking-protrusion end, the first locking-protrusion end of the band includes a first locking protrusion, a second locking protrusion, and a third locking protrusion;

a first ear cup, the first locking-protrusion end of the band being connected to a proximal end of the first ear cup; and

a second ear cup, the second locking-protrusion end of the band being connected to a proximal end of the second ear cup.

19. The apparatus of claim 18, wherein:

at least one of the first locking protrusion, the second locking protrusion, or the third locking protrusion includes a barbed portion; and

the second locking-protrusion end of the band includes a barbed portion.

20. The apparatus of claim 18, wherein:

at least one of the first locking protrusion, the second locking protrusion, or the third locking protrusion includes a barbed portion;

the second locking-protrusion end of the band includes a barbed portion;

the band is adjustable; and

the first ear cup and the second ear cup are constructed from a substantially rigid material into which the barbed portion of the first locking-protrusion end of the adjustable band and the barbed portion of the second locking-protrusion end of the adjustable band can be fixedly inserted.

21. The ear protection device of claim 1, wherein:

the band further includes a third locking protrusion disposed between the first locking protrusion and the second end of the band; and

the band further includes a fourth locking protrusion disposed between the second locking protrusion and the first end of the band.

22. The ear protection device of claim 1, wherein:

the first locking protrusion and the second locking protrusion are each disposed on a first side of the band;

the band further includes a third locking protrusion located proximate to said first end, the third locking protrusion disposed on a second side of the band opposite from the first side of the band; and

the band further includes a fourth locking protrusion located proximate to said second end, the fourth locking protrusion disposed on the second side of the band.

23. The ear protection device of claim 1, wherein:

the first locking protrusion and the second locking protrusion are each disposed on a first side of the band;

the band further includes a third locking protrusion located proximate to said first end, the third locking protrusion disposed on a second side of the band opposite from the first side of the band;

the band further includes a fourth locking protrusion located proximate to said second end, the fourth locking protrusion disposed on the second side of the band;

the band further includes a fifth locking protrusion located proximate to said first end, the fifth locking protrusion disposed on the first side of the band, the first locking protrusion disposed between the fifth locking protrusion and the first end of the band; and

the band further includes a sixth locking protrusion located proximate to said second end, the sixth locking protrusion disposed on the first side of the band, the second locking protrusion disposed between the sixth locking protrusion and the second end of the band.

24. The ear protection device of claim 1, wherein the first end of the band is configured to be inserted into said first ear cup portion such that the first locking protrusion abuts directly against the first ear cup portion.

25. The ear protection device of claim 6, wherein the second locking protrusion is disposed between the first locking protrusion and the second end of the first band member.

26. The ear protection device of claim 6, wherein:

the first locking protrusion is disposed on a first side of the first band member;

the second locking protrusion disposed on a second side of the first band member opposite the first side; and

the first band member further includes a third locking protrusion disposed on the first side of the first band member.

27. The ear protection device of claim 26, wherein the first band member further includes a fourth locking protrusion disposed on the second side of the first band member.

28. The ear protection device of claim 26, wherein the ear cup portion is configured to receive each of the first locking protrusion, the second locking protrusion, and the third locking protrusion.

29. The ear protection device of claim 26, wherein the third locking protrusion is disposed between the first locking protrusion and the first end of the first band member.

30. The ear protection device of claim 11, wherein the band further includes a third locking protrusion located proximate to the first end of the band, the first locking protrusion and the third locking protrusion extending from the band in substantially the same direction.

31. The ear protection device of claim 30, wherein the third locking protrusion is disposed between the first locking protrusion and the second locking protrusion.

32. The ear protection device of claim 30, wherein the first ear cup portion is configured to receive the third locking protrusion to fixedly couple the first ear cup portion to the band.

32. The ear protection device of claim 30, wherein the first ear cup portion is configured to be in direct contact with the first locking protrusion and the third locking protrusion when the first ear cup portion is fixedly coupled to the band.

34. The ear protection device of claim 30, wherein the band further includes a fourth locking protrusion located proximate to the first end of the band, the first locking protrusion and the second locking protrusion extending from the band in substantially opposite directions.

35. The ear protection device of claim 18, wherein the second locking-protrusion end of the band includes a fourth locking protrusion, a fifth locking protrusion, and a sixth locking protrusion.

36. The ear protection device of claim 18, wherein the first locking protrusion and the second locking protrusion extend from the band in substantially the same direction.

37. The ear protection device of claim 18, wherein the first locking protrusion and the third locking protrusion extend from the band in substantially opposite directions.

38. The ear protection device of claim 18, wherein the second locking protrusion is disposed between the first locking protrusion and the second locking-protrusion end.

39. The ear protection device of claim 18, wherein the first locking-protrusion end is directly connected to the proximal end of the first ear cup via the first locking protrusion, the second locking protrusion, and the third locking protrusion.

40. An ear protection device comprising:

a band including:

a first end portion opposite a second end portion,

a first locking protrusion including a barb unitarily formed with the band and located on the first end portion,

a second locking protrusion including a barb and located on the second end portion;

a band membrane covering at least a portion of the band;

a first ear cup configured to be coupled to the first end portion of the band, the barb of the first locking portion configured to resist movement of the first ear cup in a first direction defined by a centerline of the first end portion while permitting movement of the first ear cup in a second direction opposite the first direction; and

a second ear cup portion configured to be coupled to the second end portion of the band, the barb of the second locking protrusion configured to resist movement of

the second ear cup in a third direction defined by an centerline of the second end portion while permitting movement of the second ear cup in a fourth direction opposite the third direction.

41. The ear protection device of claim 40, wherein the barb of the first locking protrusion includes a first surface substantially orthogonal to the centerline of the first end portion and a second surface at an acute angle to both of the first surface and the centerline of the first end portion.

42. The ear protection device of claim 40, wherein the barb of the first locking protrusion includes a first surface configured to resist movement of the first ear cup in the first direction and a second surface configured to permit movement of the first ear cup in the second direction.

43. The ear protection device of claim 40, wherein:
the first end portion includes a band surface substantially parallel to the centerline of the first end portion; and
the barb of the first locking portion includes a first barb surface and a second barb surface, the first barb surface and the second barb surface each projecting from the band surface.

44. An ear protection device, comprising:
a band having a first band member and a second band member, the first band member being slideably coupled to the second band member, the first band member including a first end portion and a second end portion opposite the first end portion, a locking protrusion located on the first end portion of the first band member, the first band member and the locking protrusion being unitarily formed; and
an ear cup configured to slide in a first direction defined by a centerline of first end portion of the first band member to receive the locking protrusion, the locking protrusion including a barb configured to resist movement in a second direction defined by the centerline of the first end portion and opposite the first direction.

45. The ear protection device of claim 44, wherein the barb includes a first surface substantially orthogonal to the centerline of the first end portion and a second surface at an acute angle to both of the first surface and the centerline of the first end portion.

46. The ear protection device of claim 45, wherein the barb of the locking protrusion includes a first surface configured to resist movement of the ear cup in the first direction and a second surface configured to permit movement of the ear cup in the second direction.

47. The ear protection device of claim 44, wherein:

the first end portion includes a band surface substantially parallel to the centerline of the first end portion; and

the barb of the locking portion includes a first barb surface and a second barb surface, the first barb surface and the second barb surface each projecting from the band surface.

48. An ear protection device, comprising:

a band, the band including:

a first surface,

a second surface opposite the first surface,

a first end portion,

a second end portion opposite the first end portion,

a first locking protrusion including a barb located on the first end portion

and the first surface,

a second locking protrusion located on the second end portion and the second surface;

a first ear cup configured to receive the first locking protrusion to fixedly couple the first ear cup to the band; and

a second ear cup configured to receive the second locking protrusion.

49. The ear protection device of claim 48, wherein the band further includes:

a third locking protrusion located on the first end portion and the second surface, and

a fourth locking protrusion located on the second end portion and the first surface.

50. The ear protection device of claim 49, wherein the barb includes a first barb surface and a second barb surface each projecting from the first surface of the band.

51. The ear protection device of claim 50, wherein:

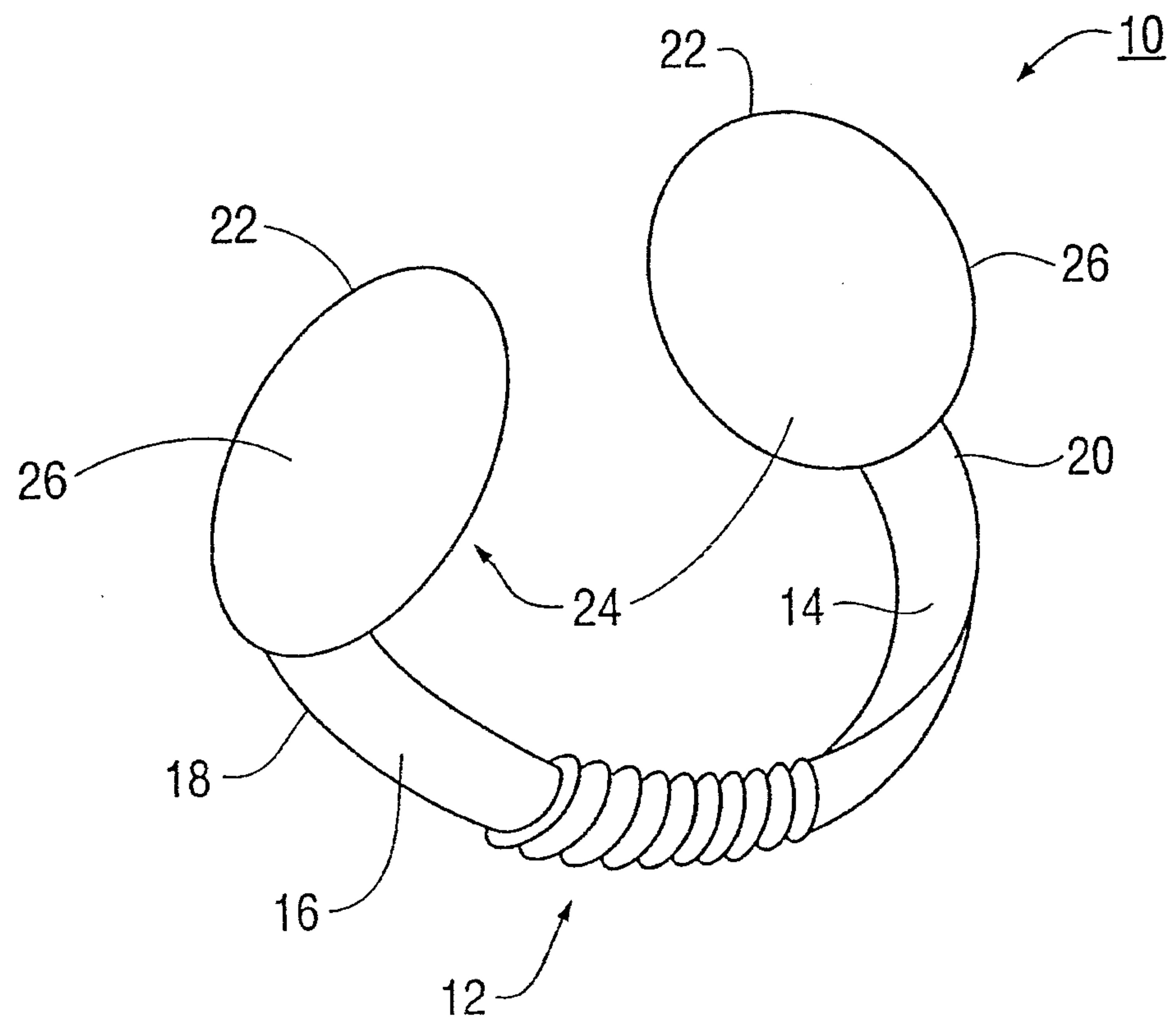
the barb is a first barb, the third locking protrusion including a second barb,

the second barb includes a third barb surface and a fourth barb surface each projecting from the second surface of the band.

52. The ear protection device of claim 48, wherein the barb includes a first barb surface substantially orthogonal to the first surface of the band at the first end portion and a second barb surface at an acute angle to both of the first barb surface and the first surface of the band at the first end portion.

1/17

FIG. 1



2/17

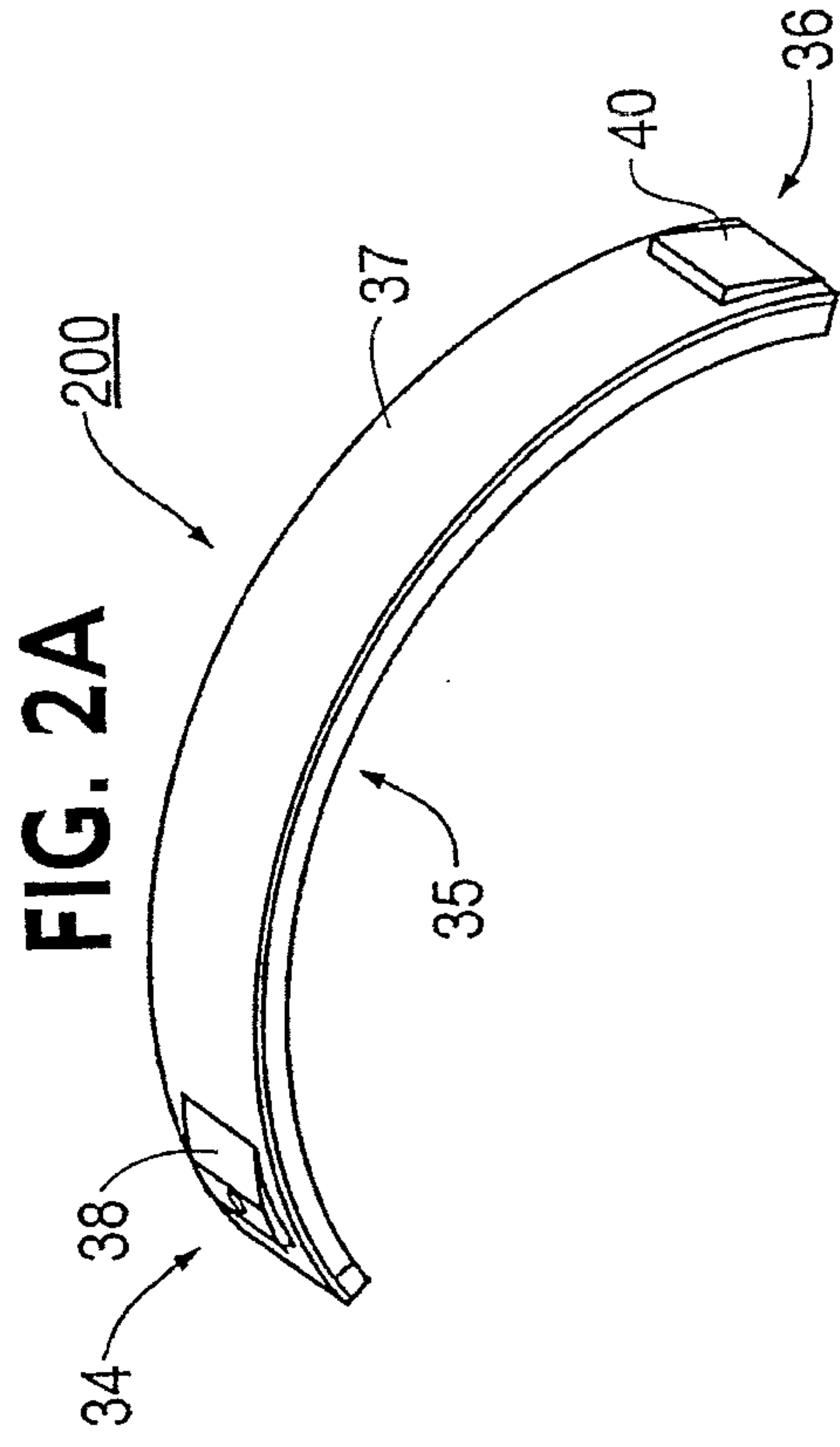


FIG. 2C

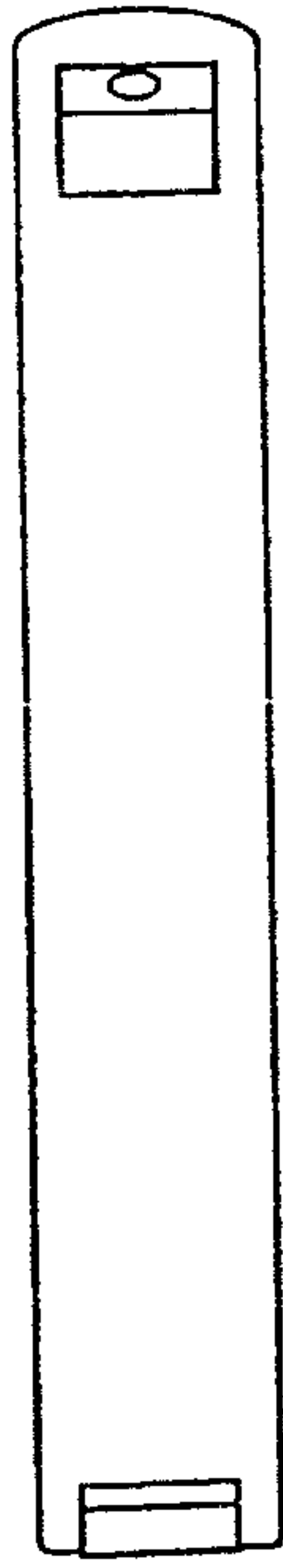


FIG. 2B

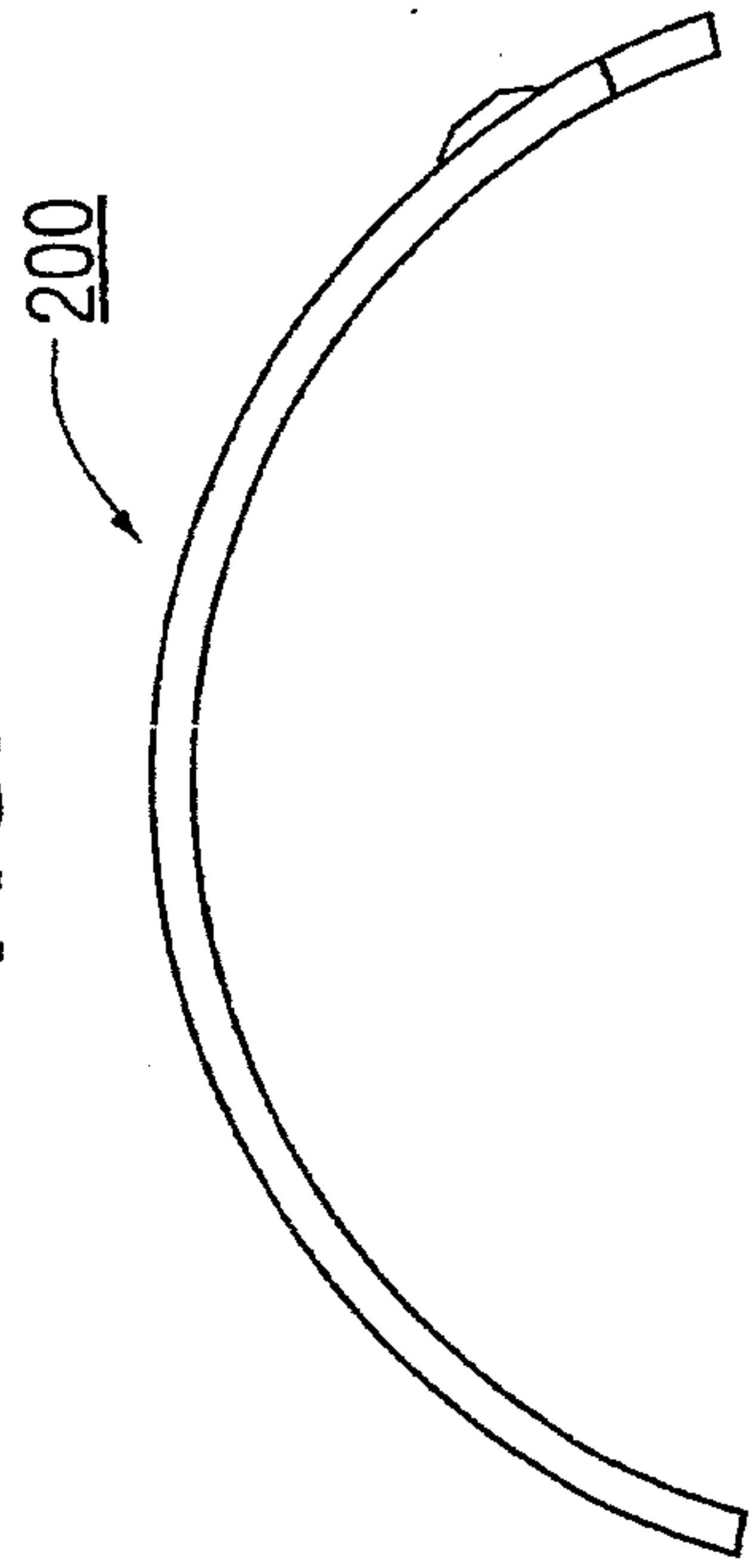
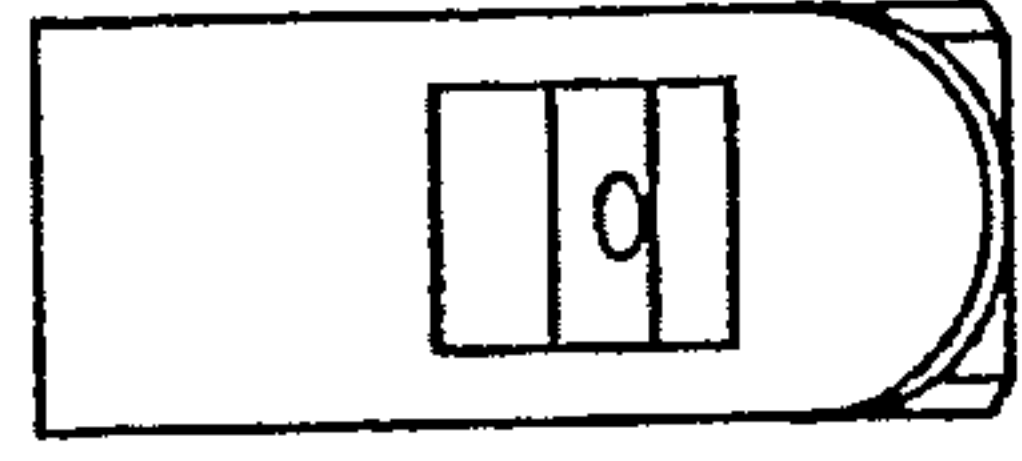
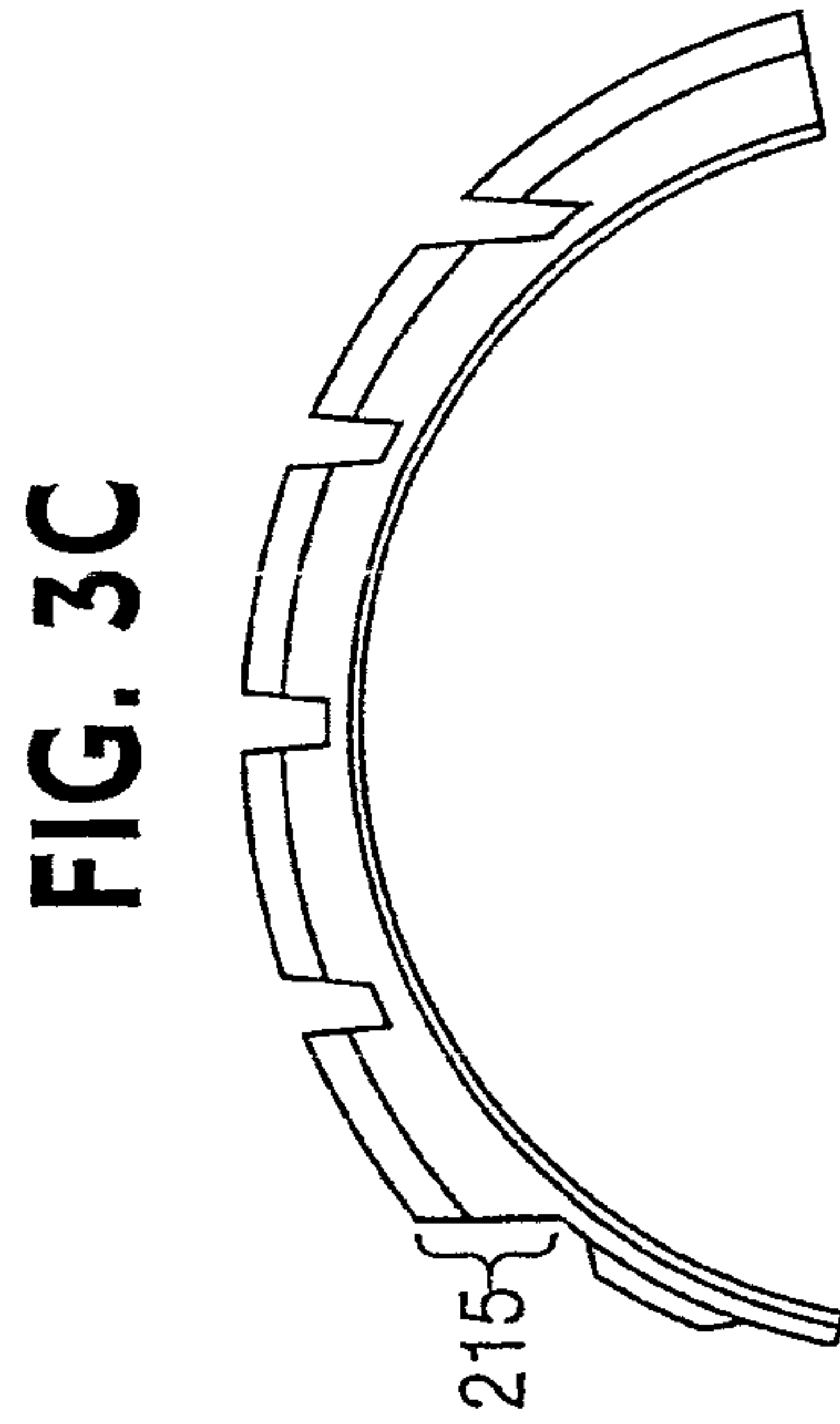
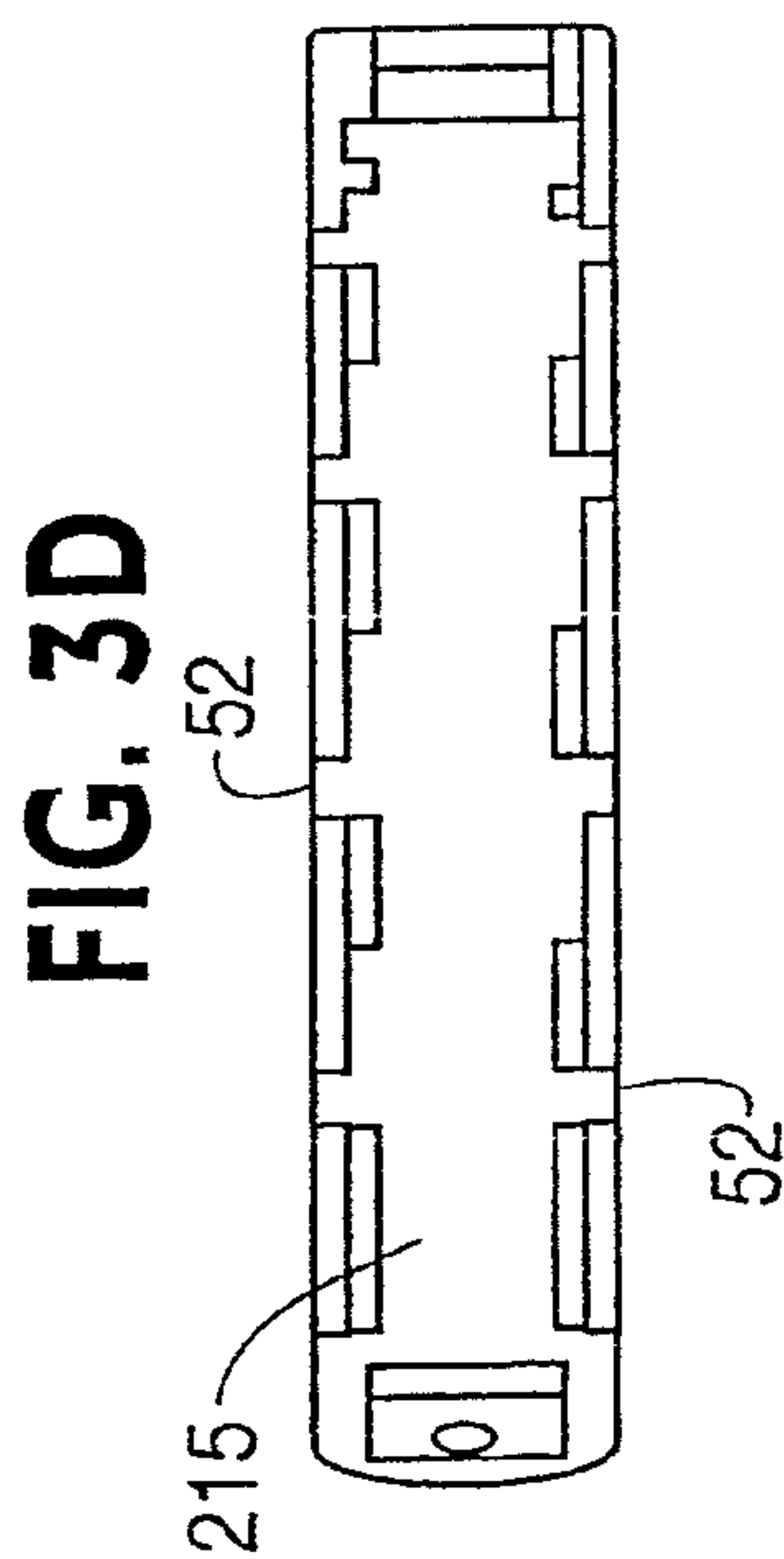
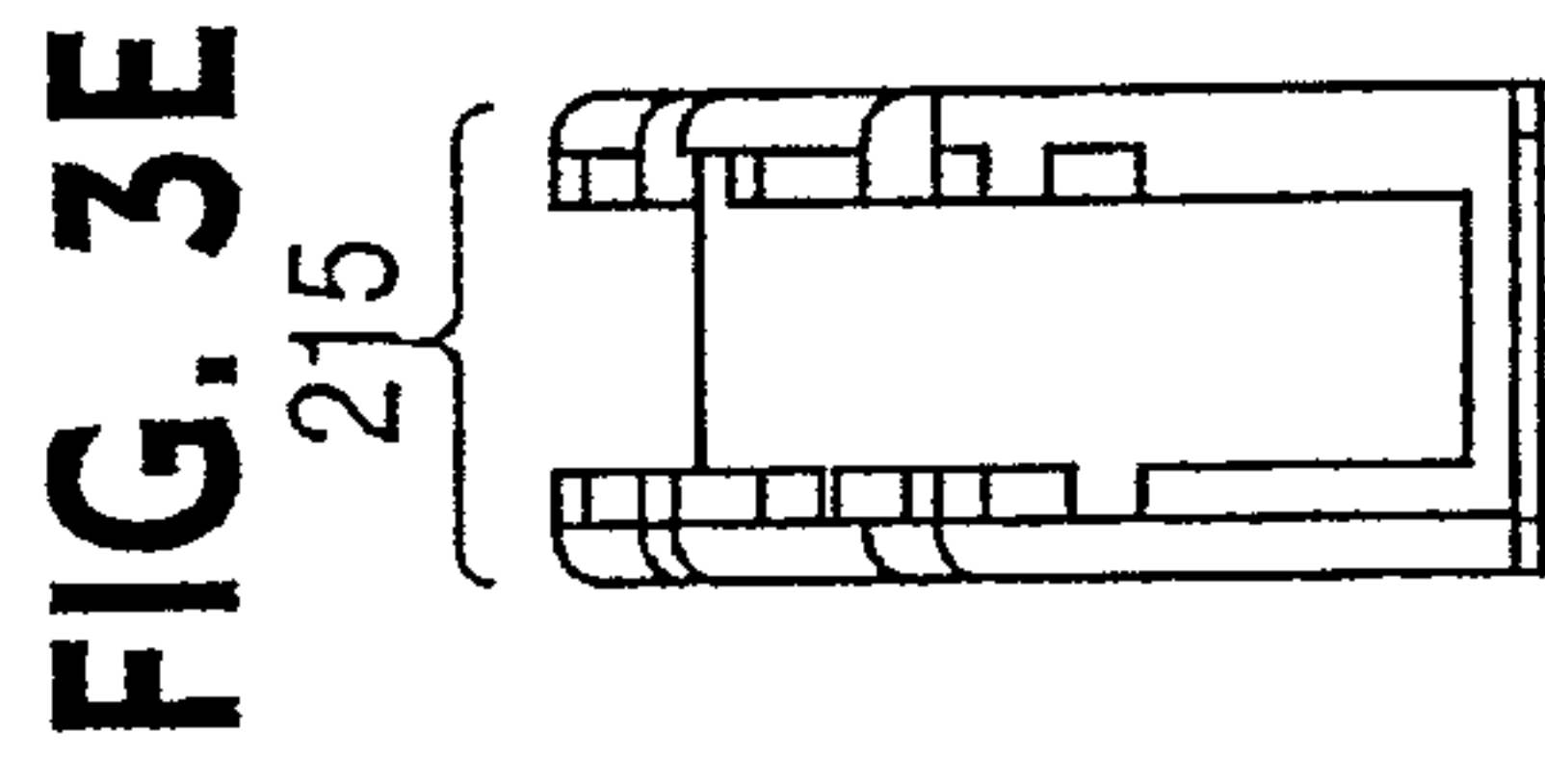
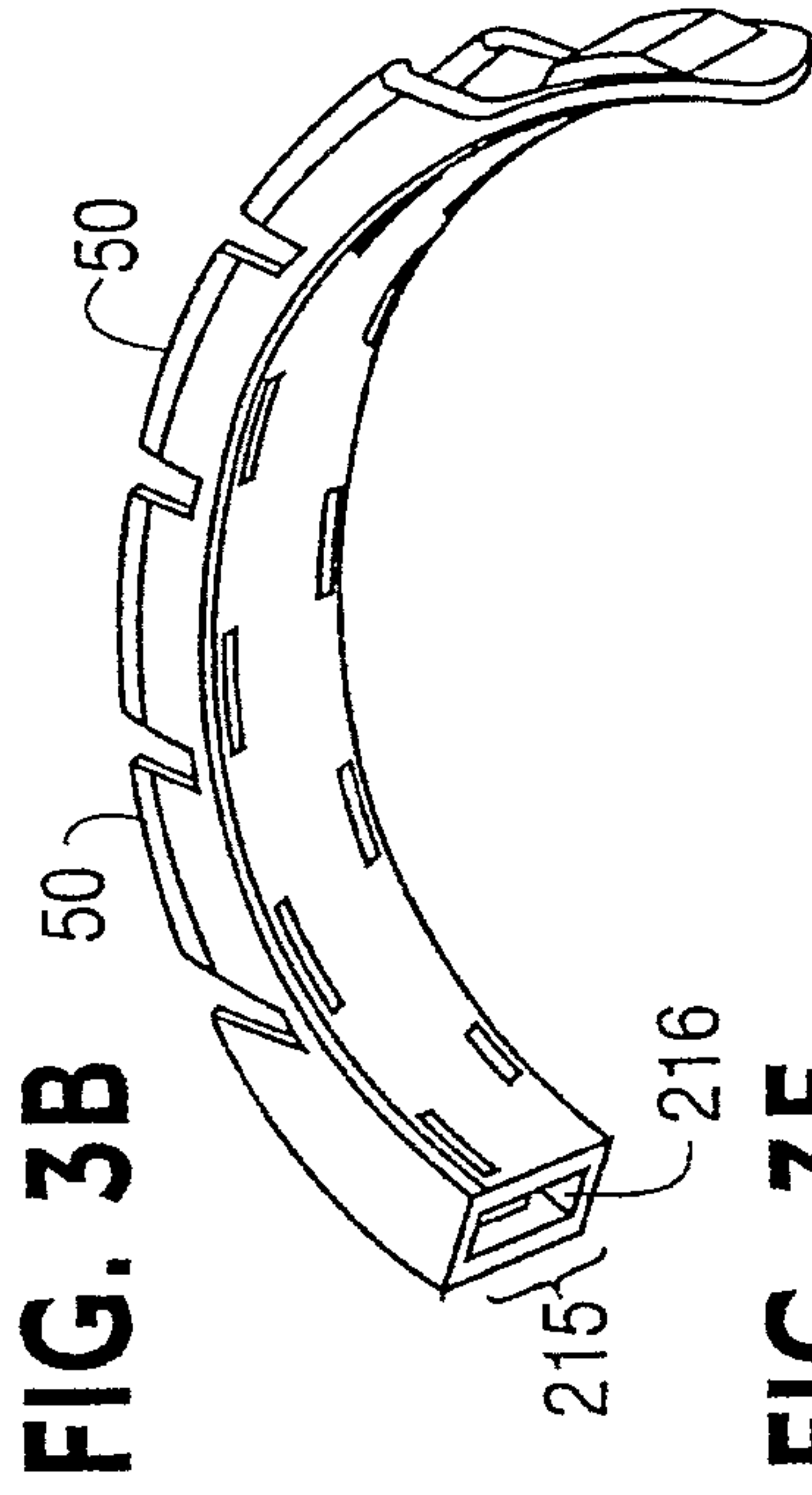
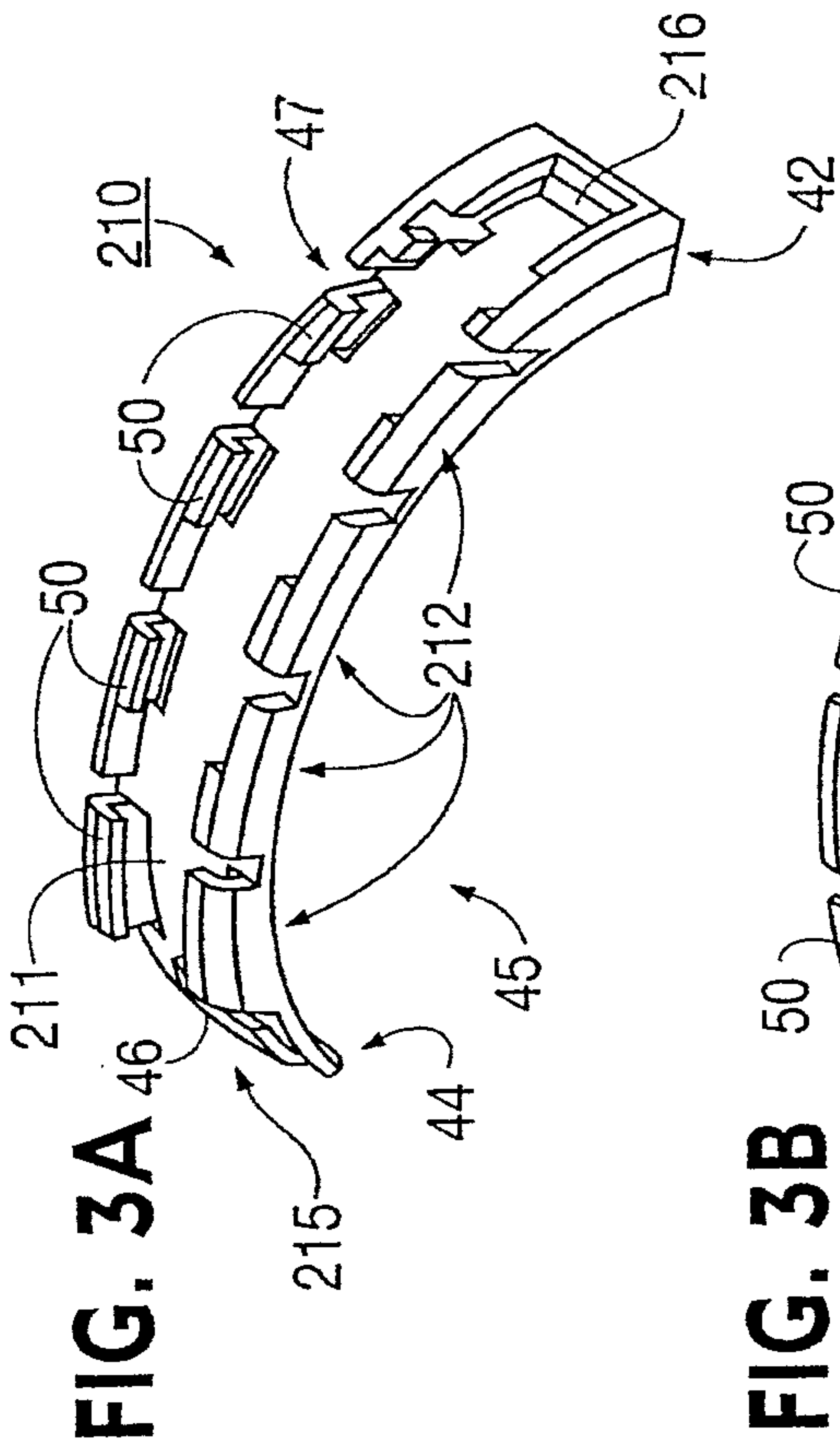
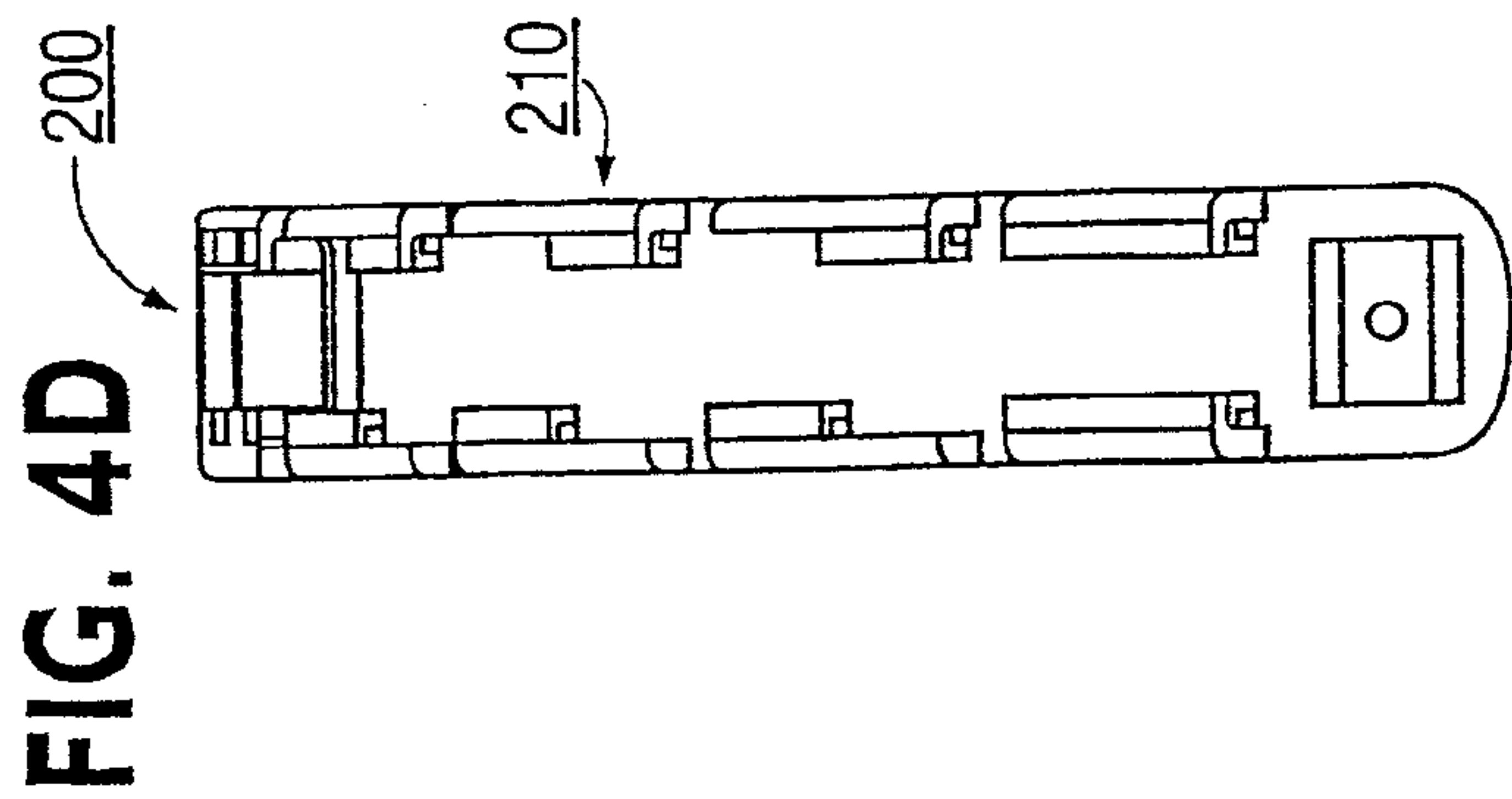
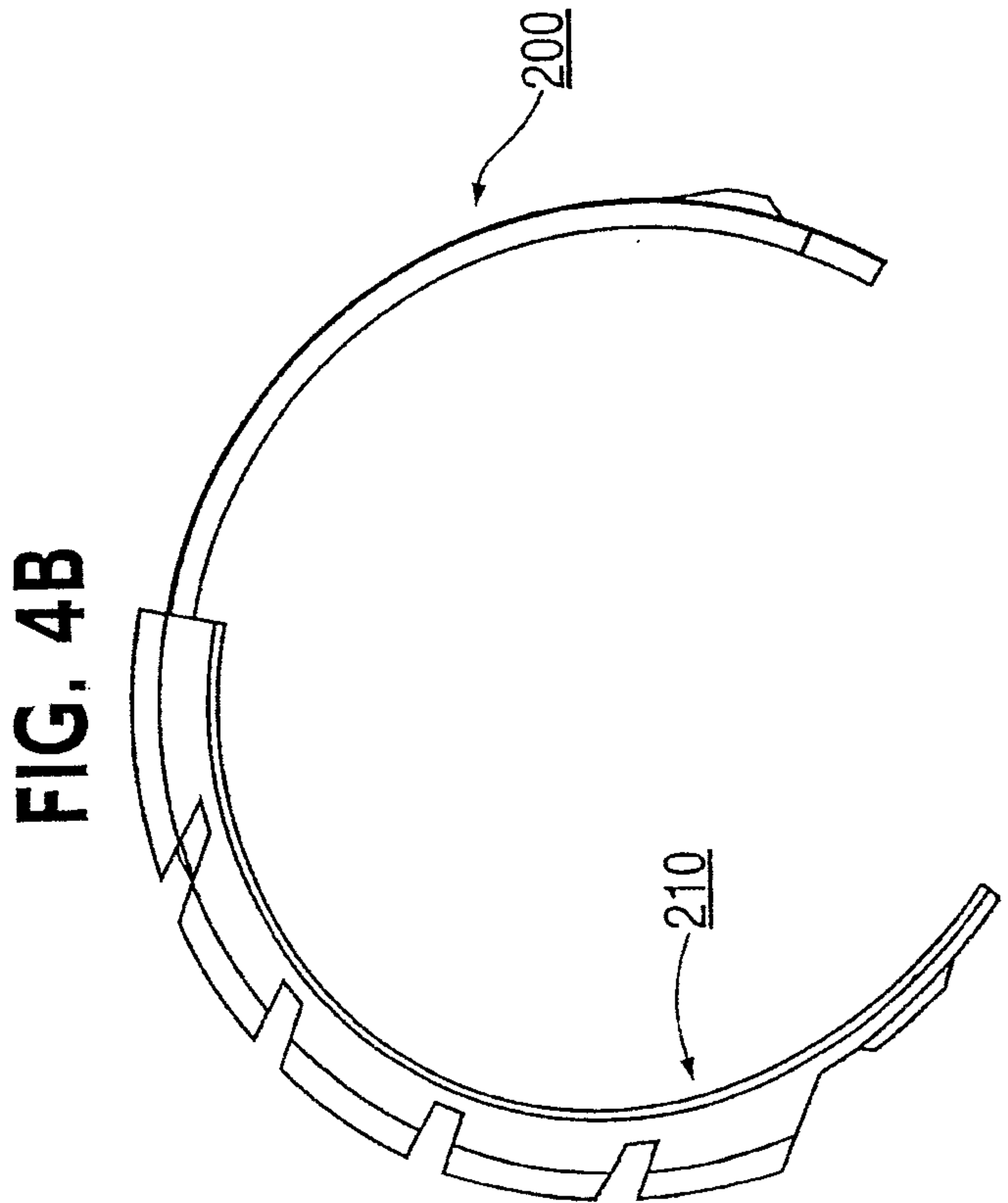
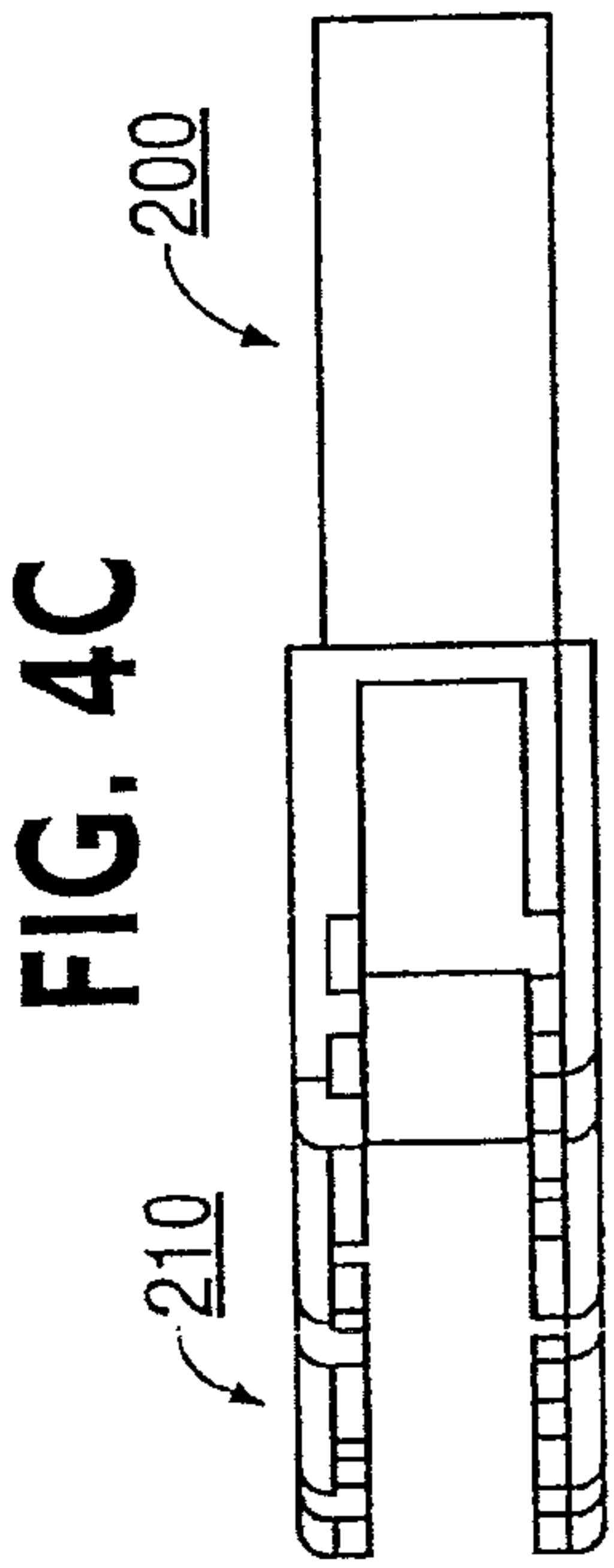
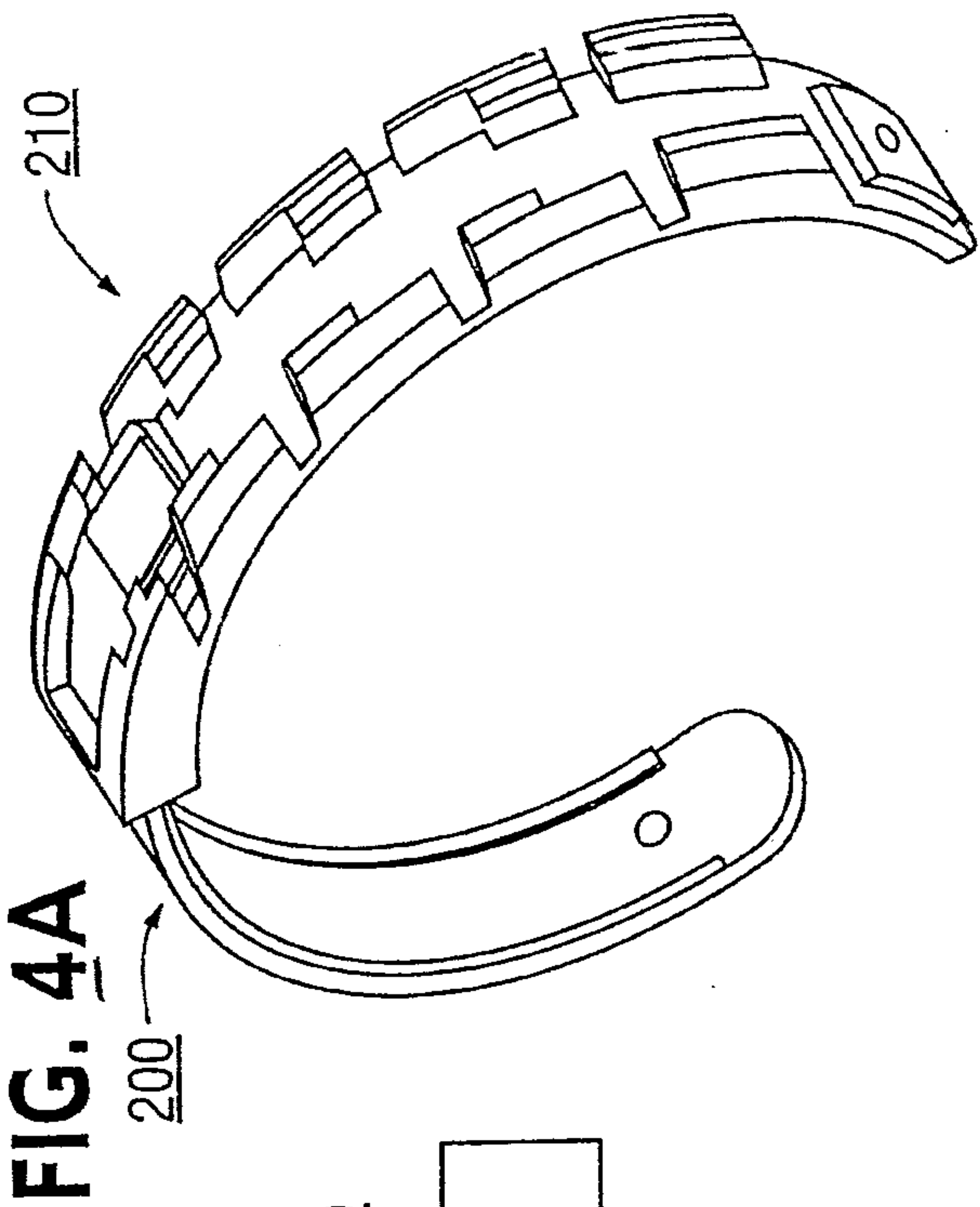


FIG. 2D

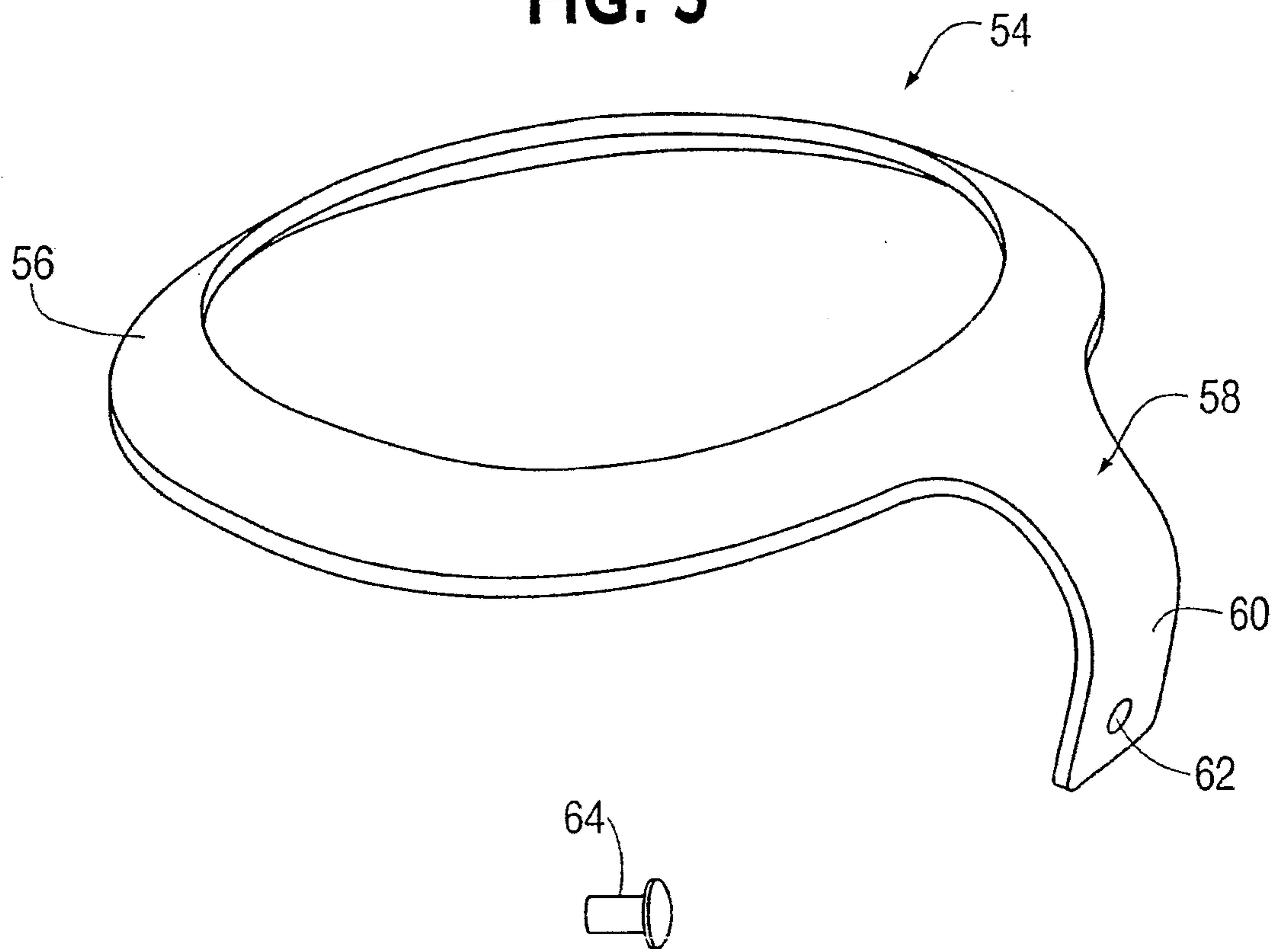






5 / 17

FIG. 5



6 / 17

FIG. 6A

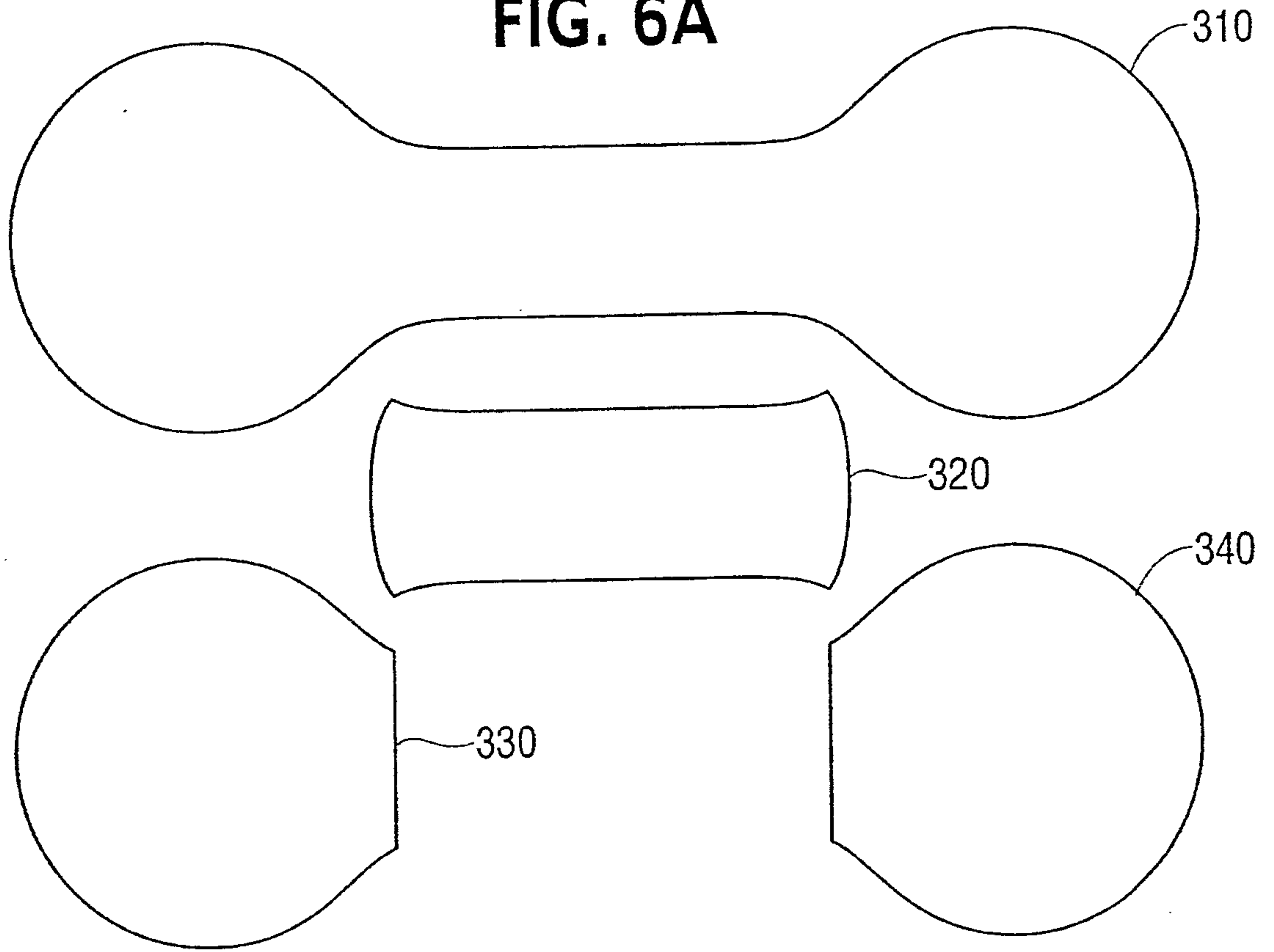
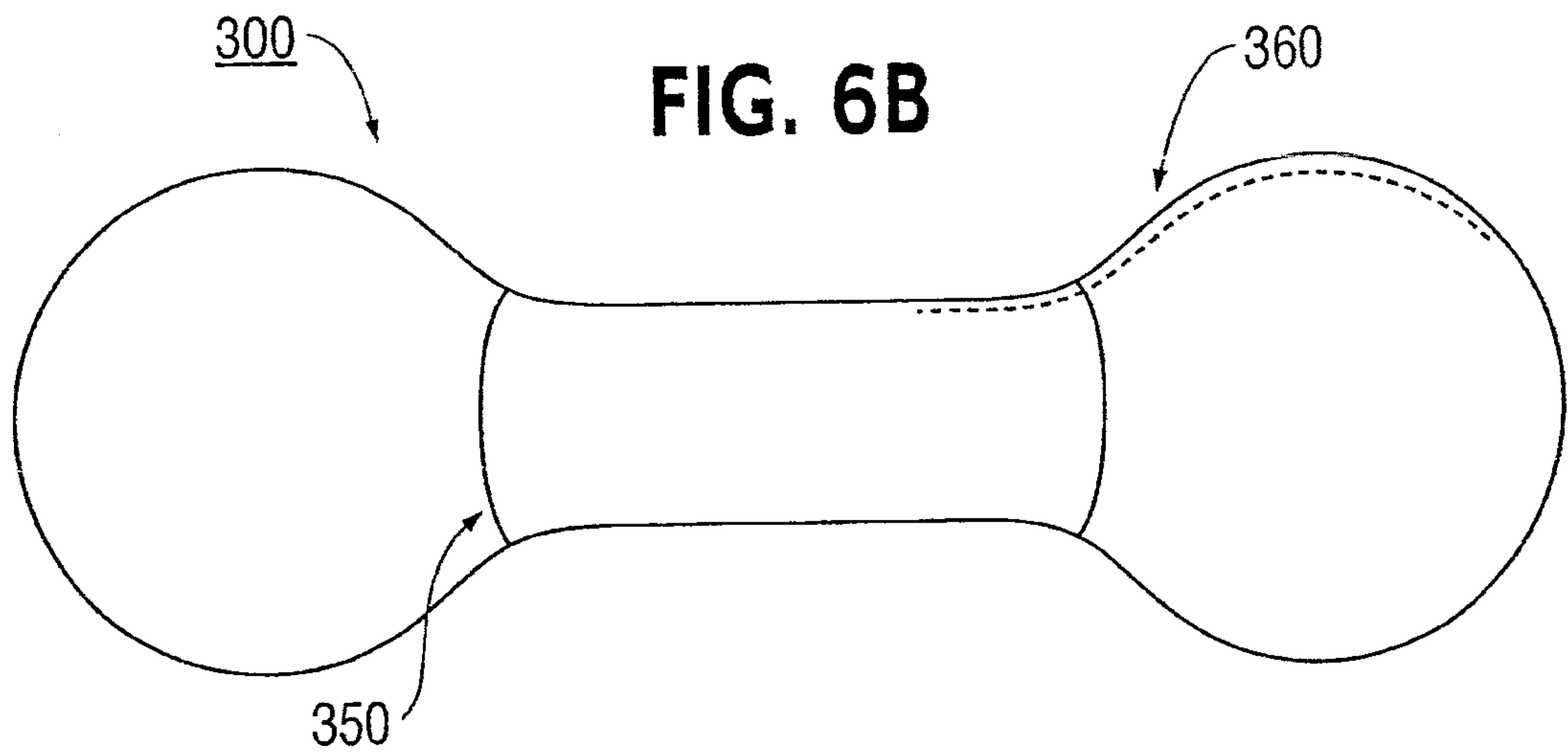


FIG. 6B



7 / 17

FIG. 7

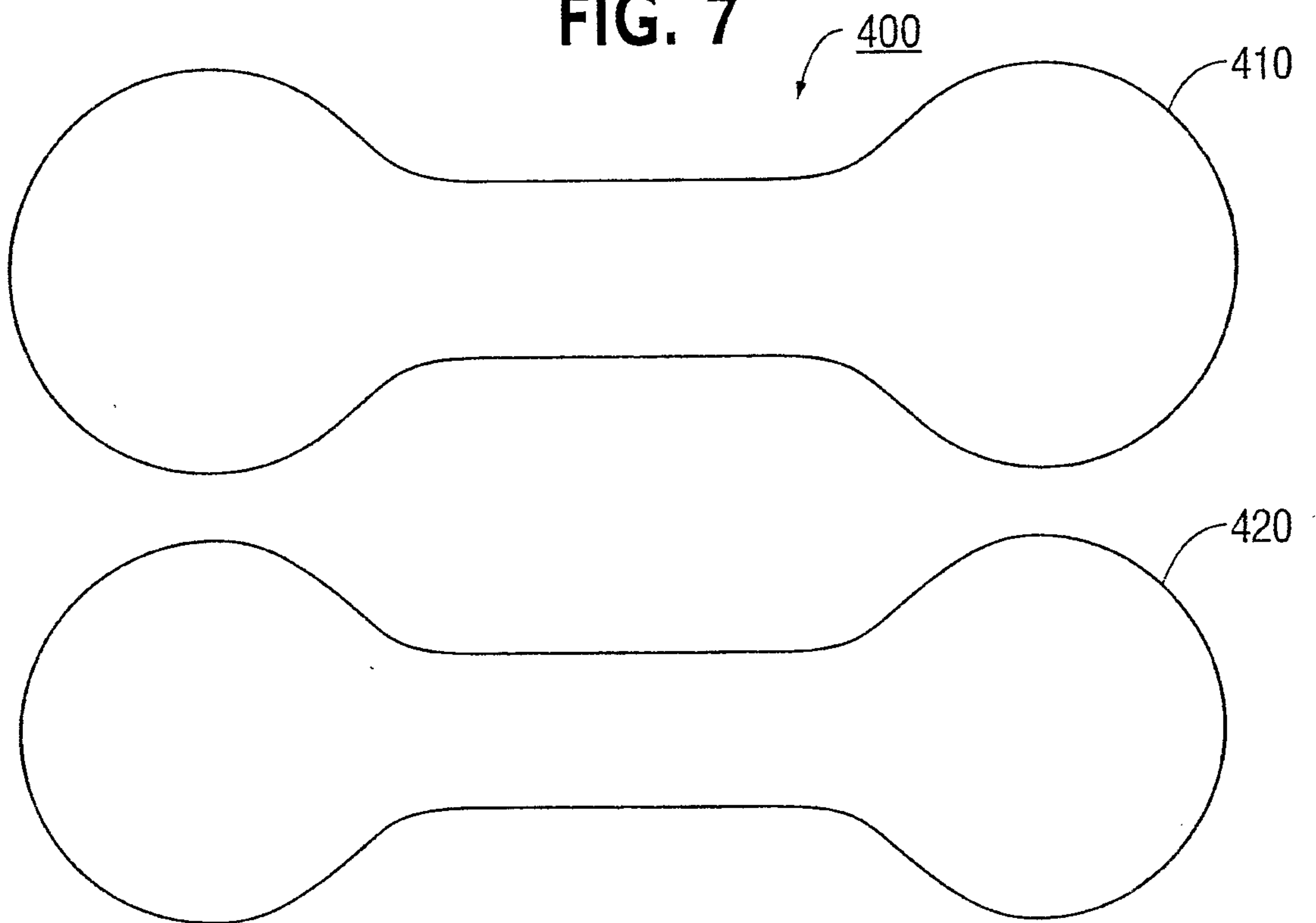
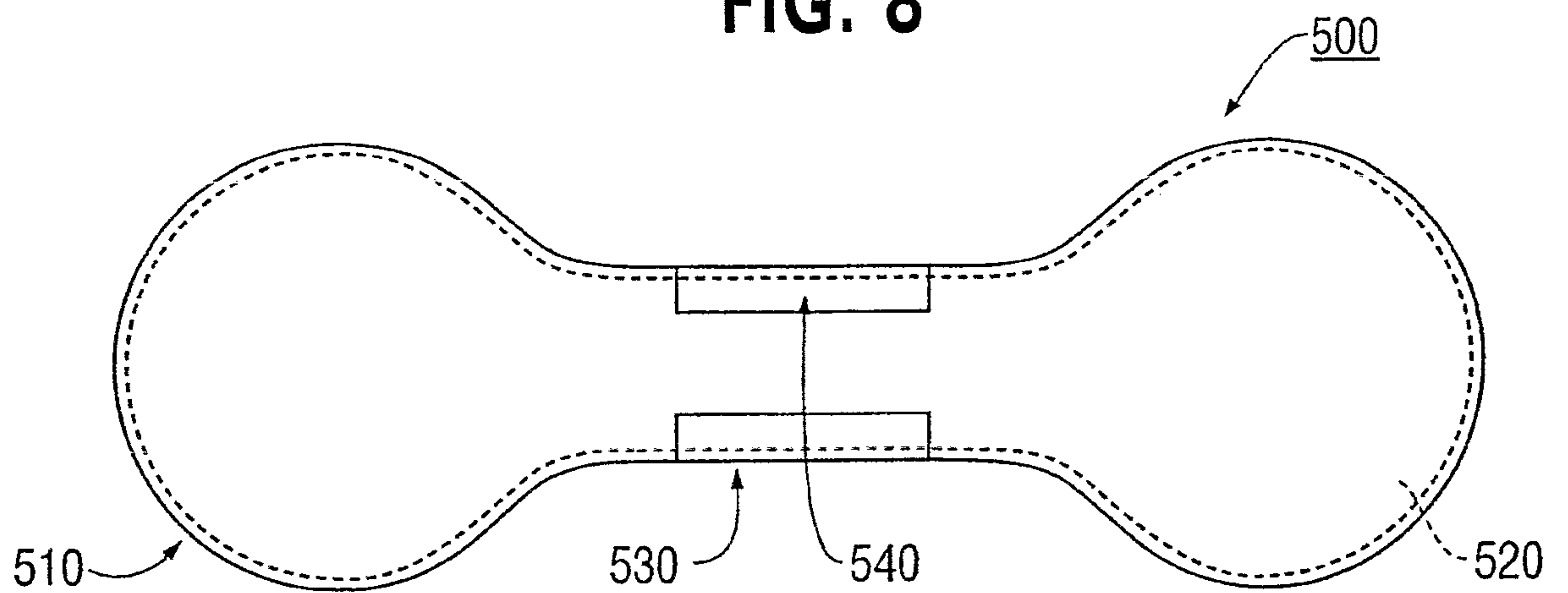
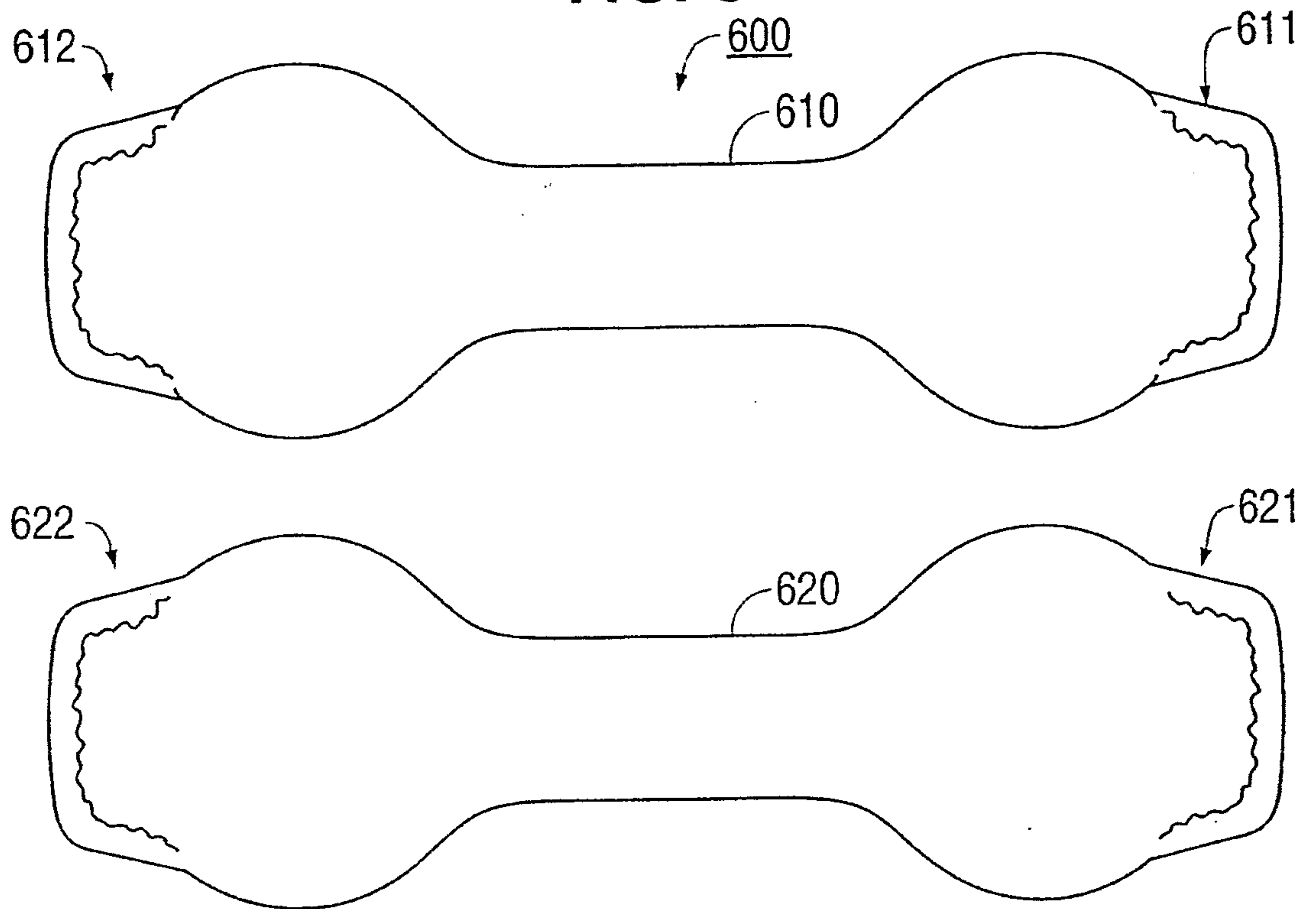
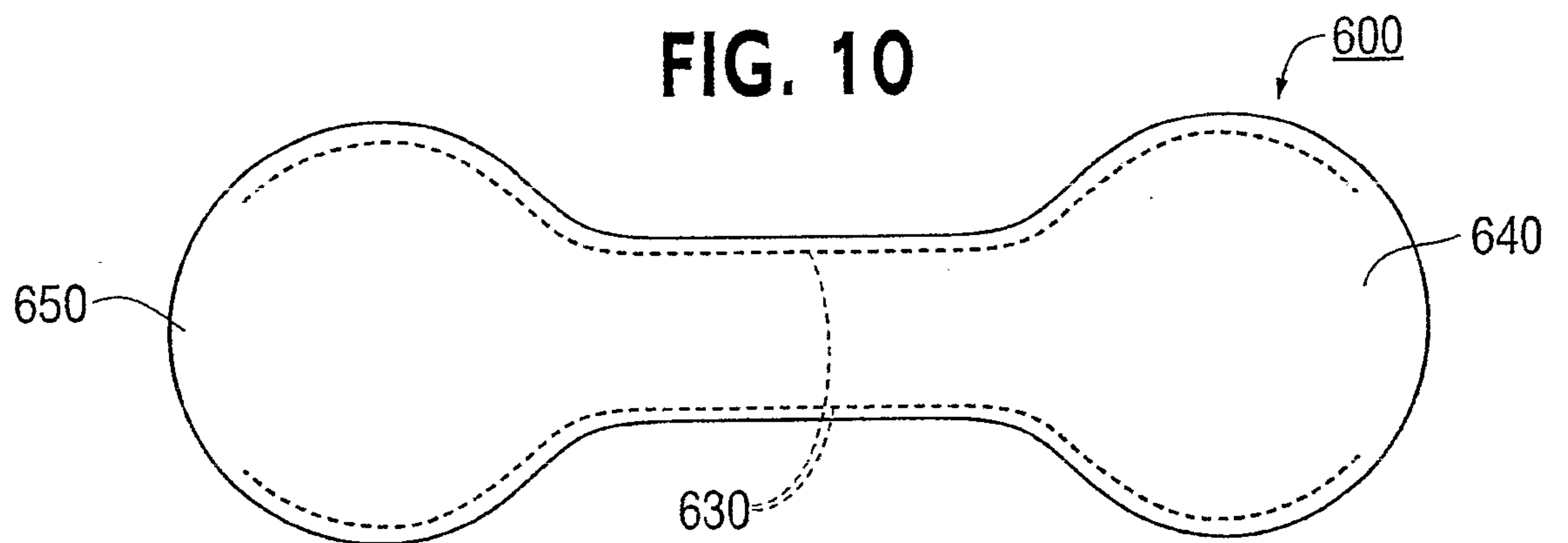


FIG. 8



8 / 17

FIG. 9**FIG. 10**

9 / 17

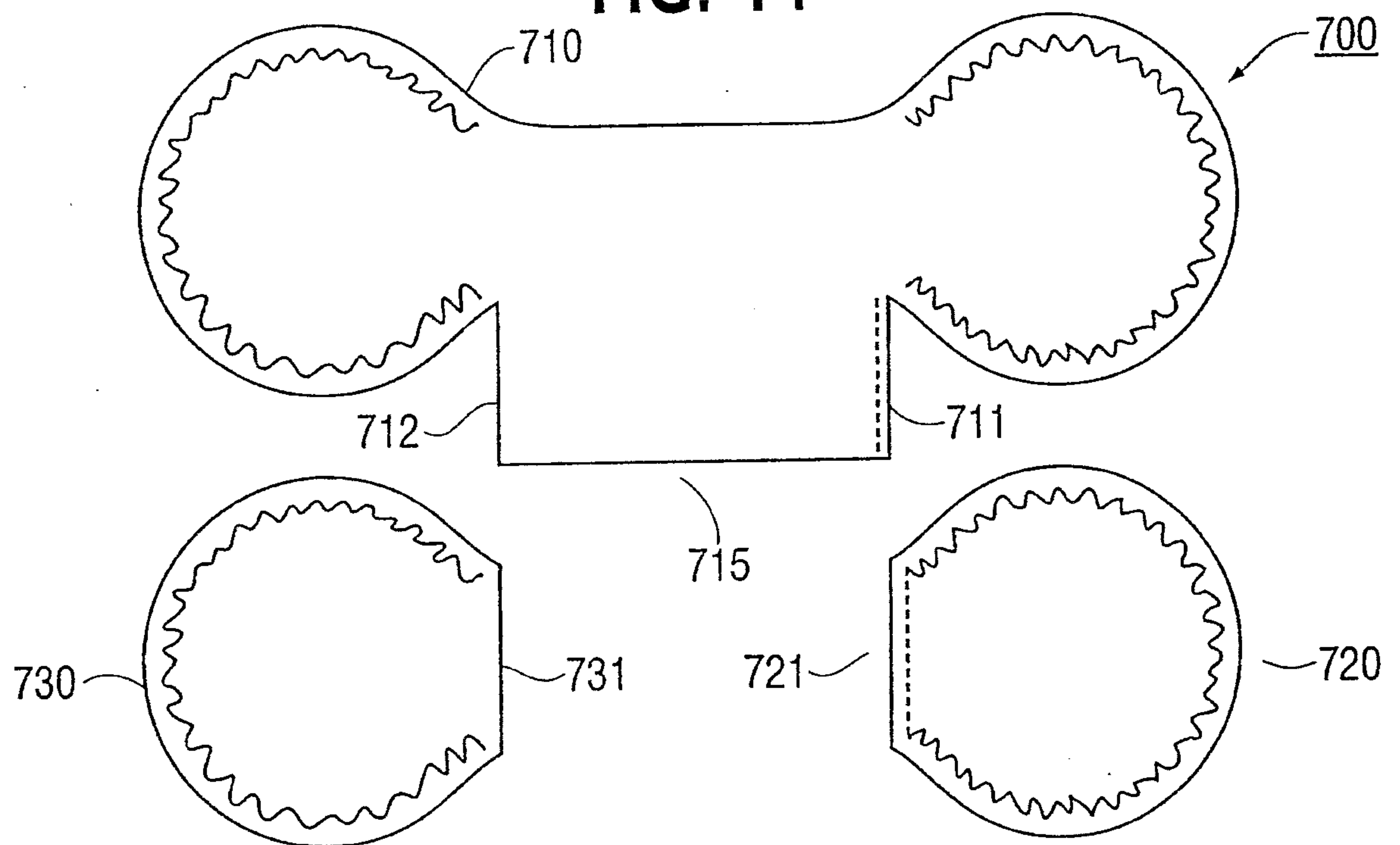
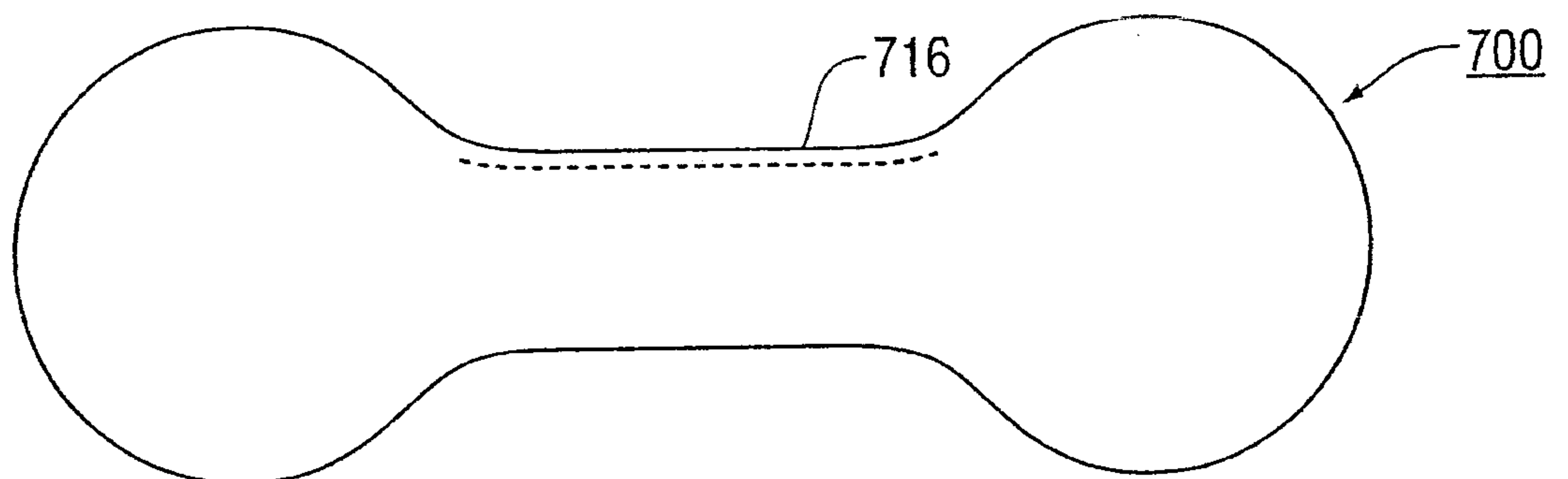
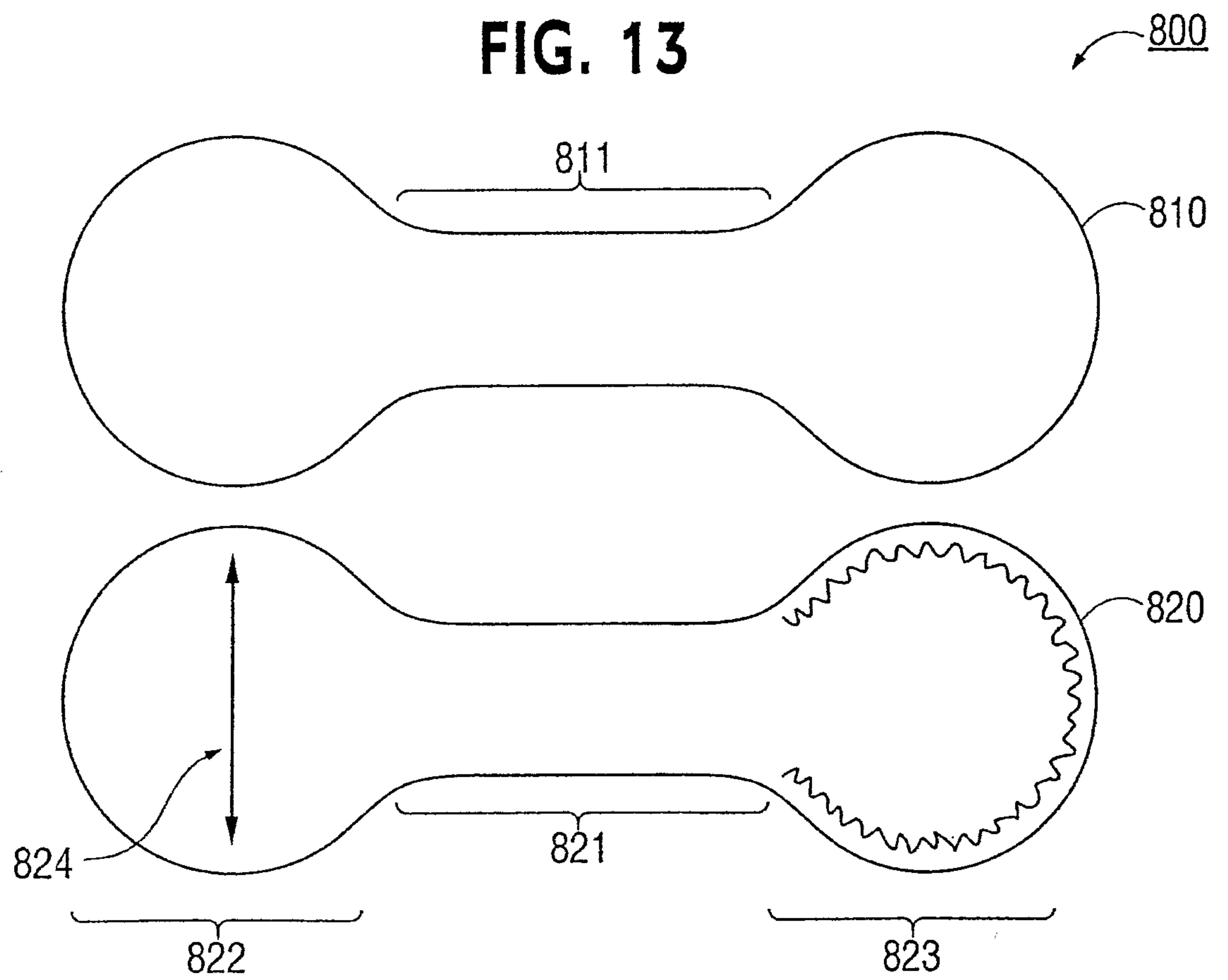
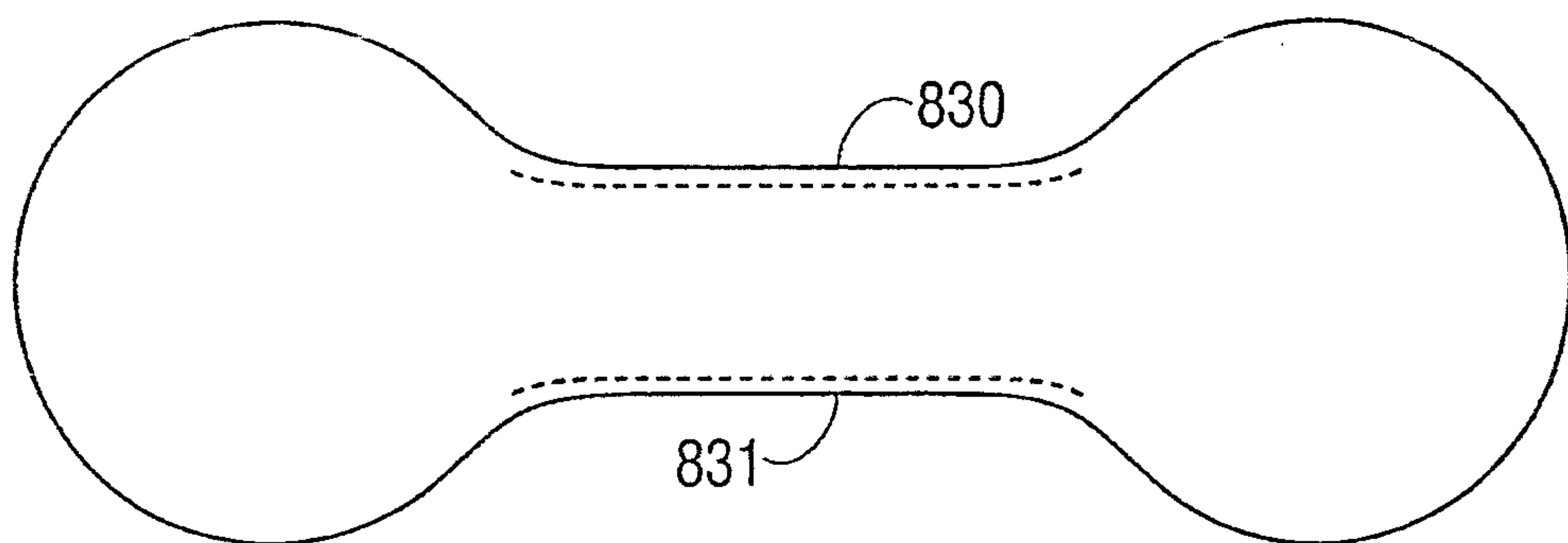
FIG. 11**FIG. 12**

FIG. 13**FIG. 14**

11/17

FIG. 15

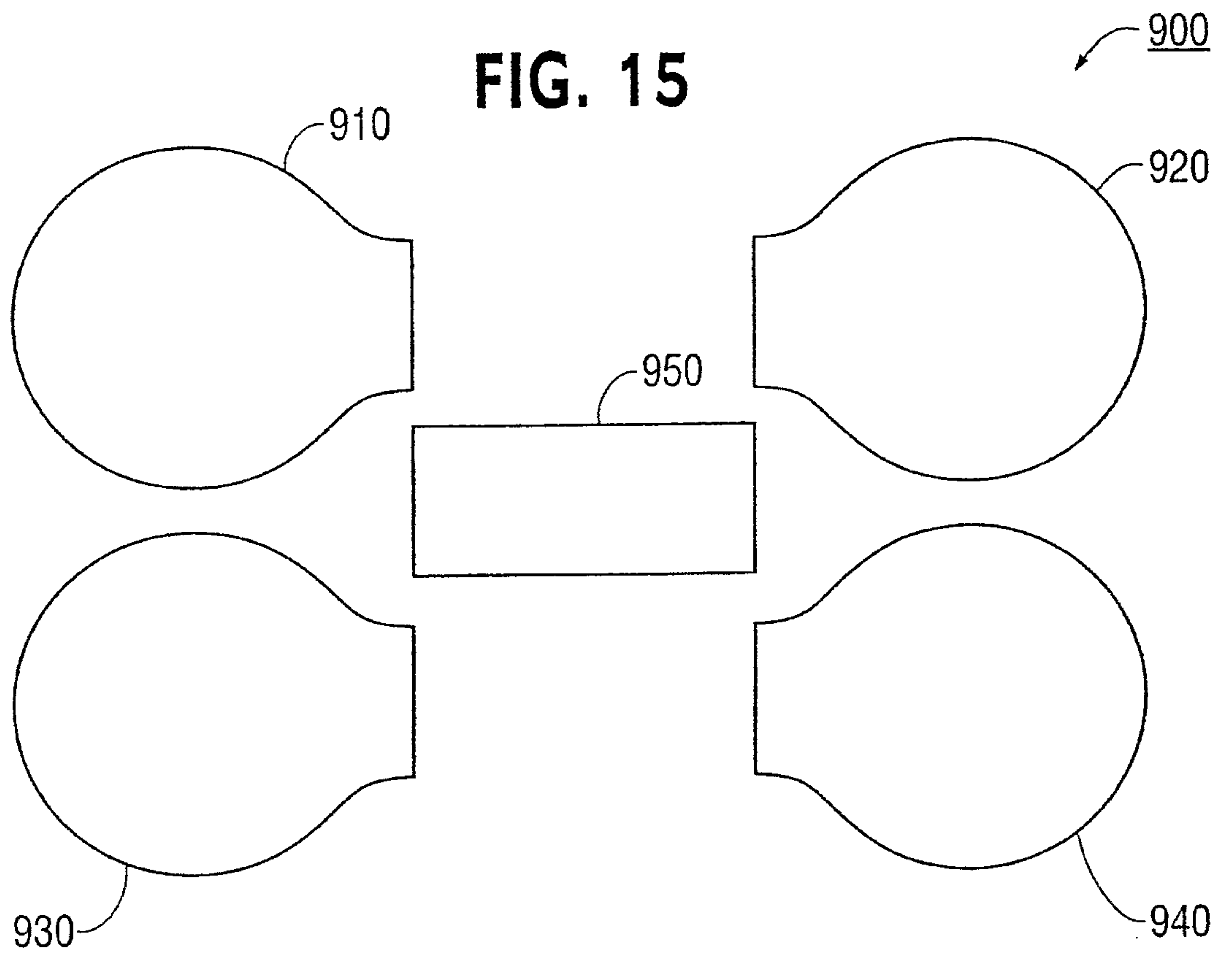
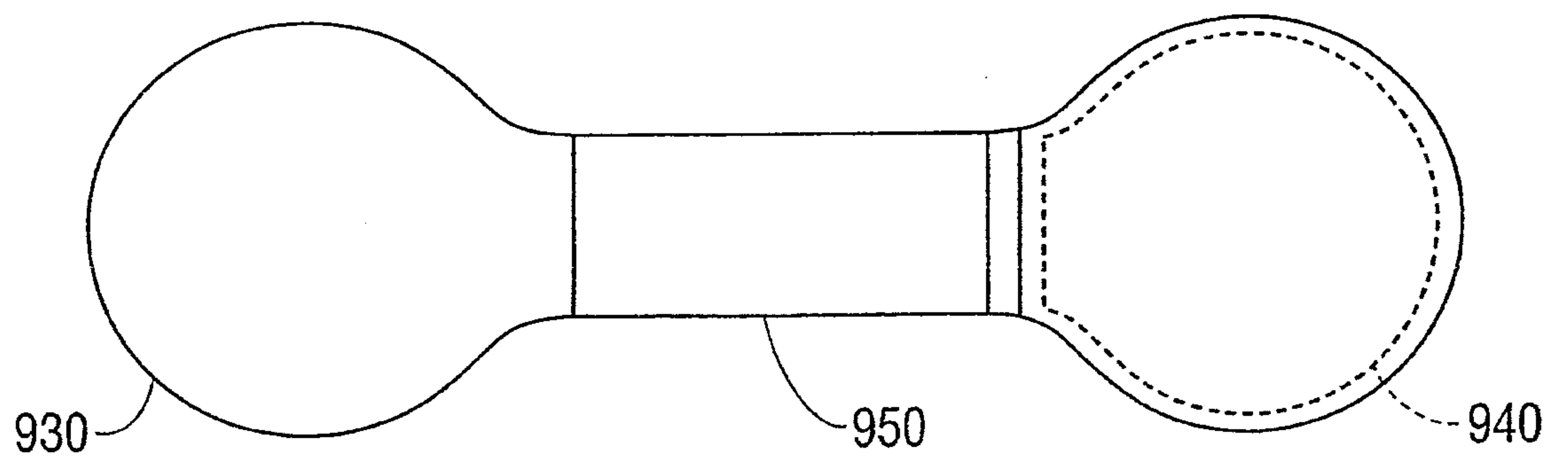
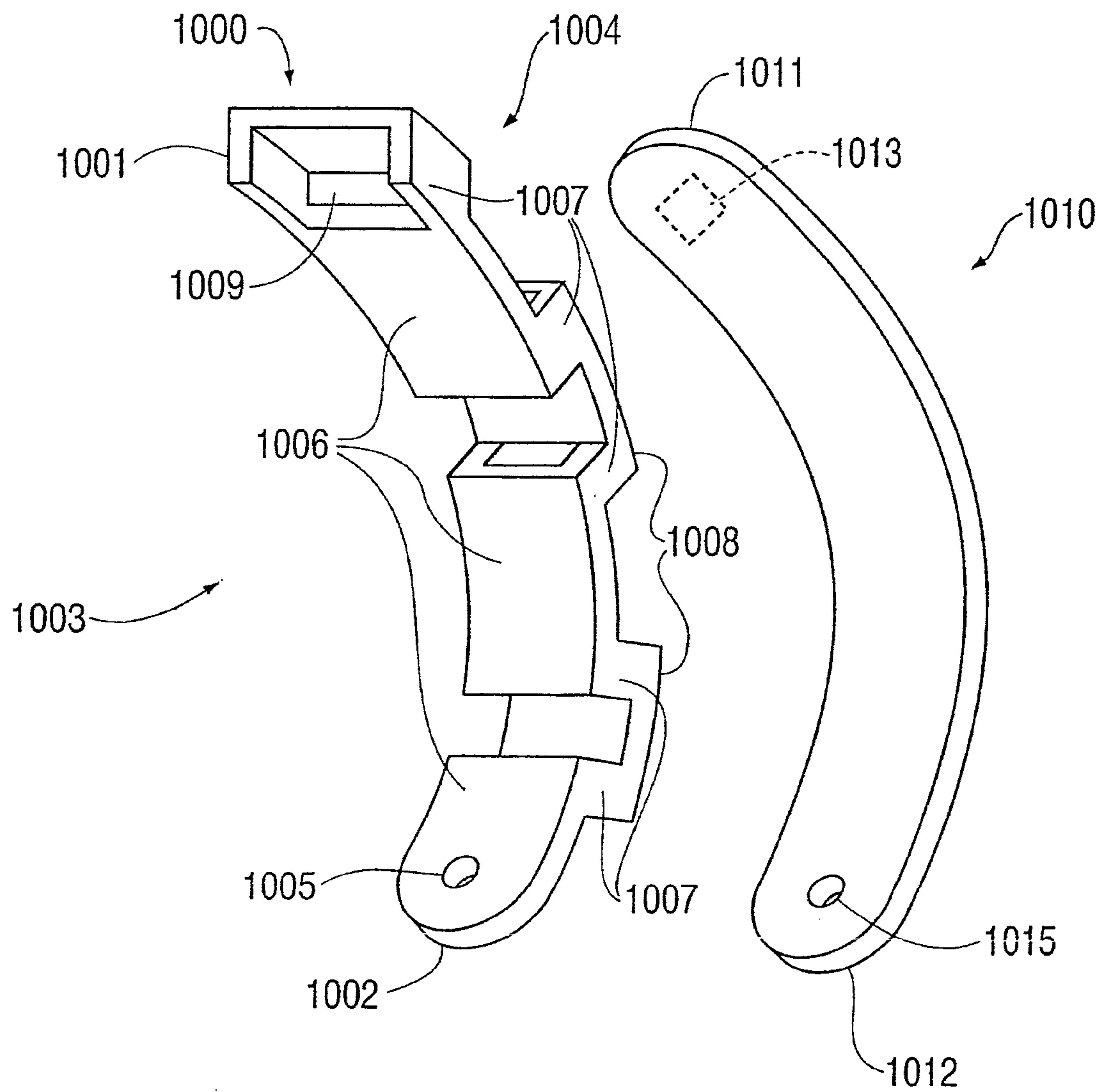


FIG. 16

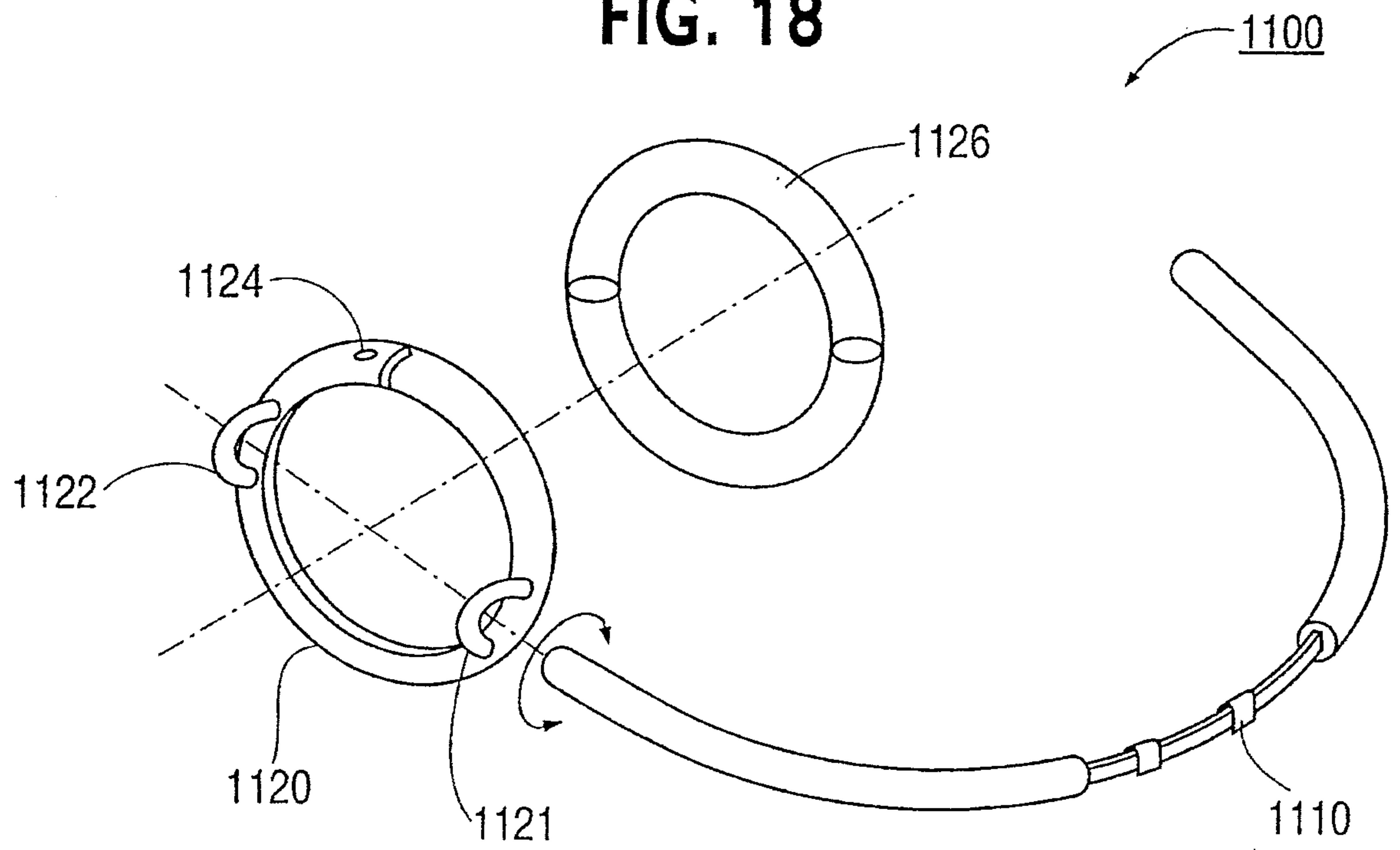


12 / 17

FIG. 17

13 / 17

FIG. 18



14 / 17

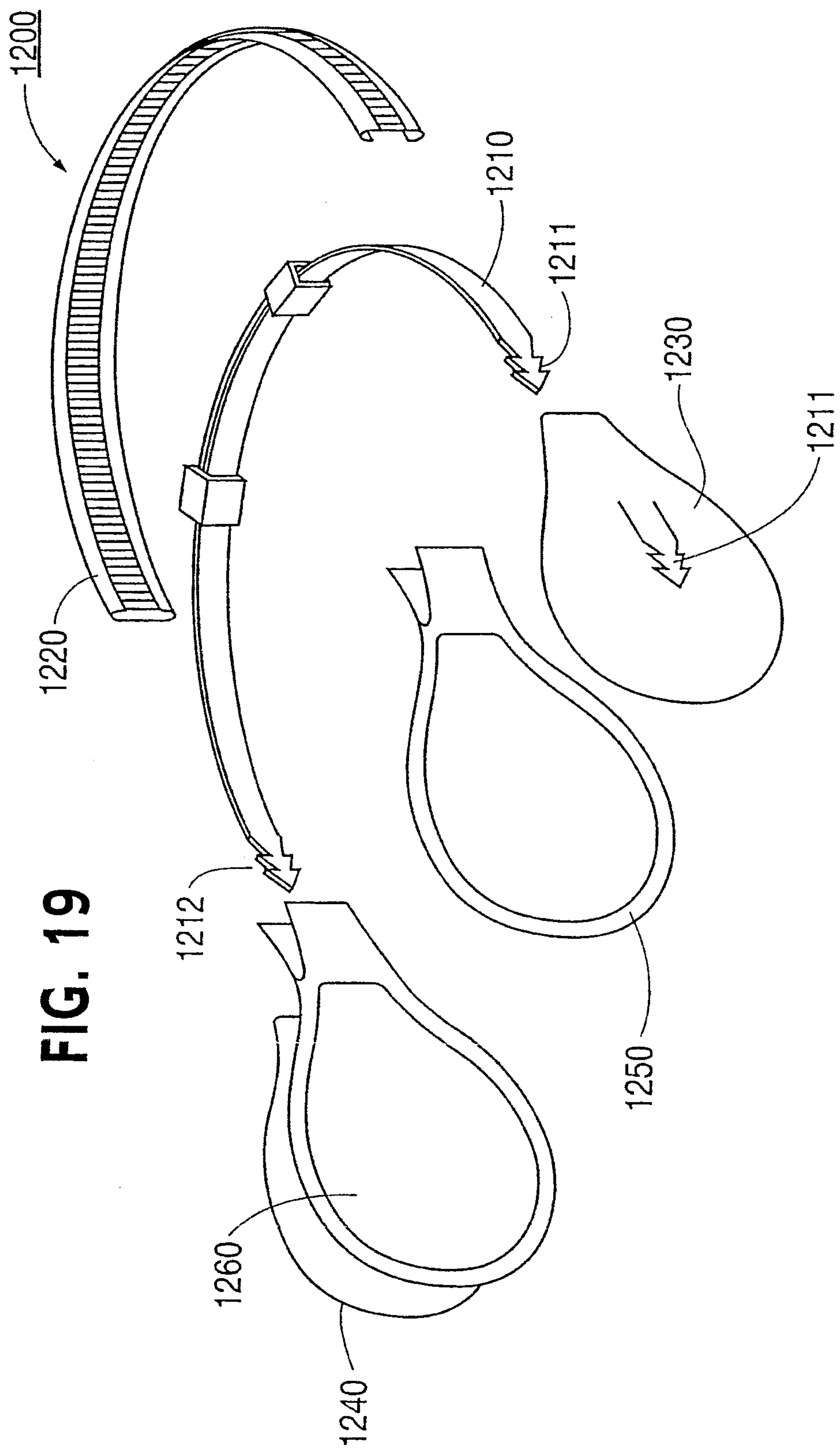


FIG. 20

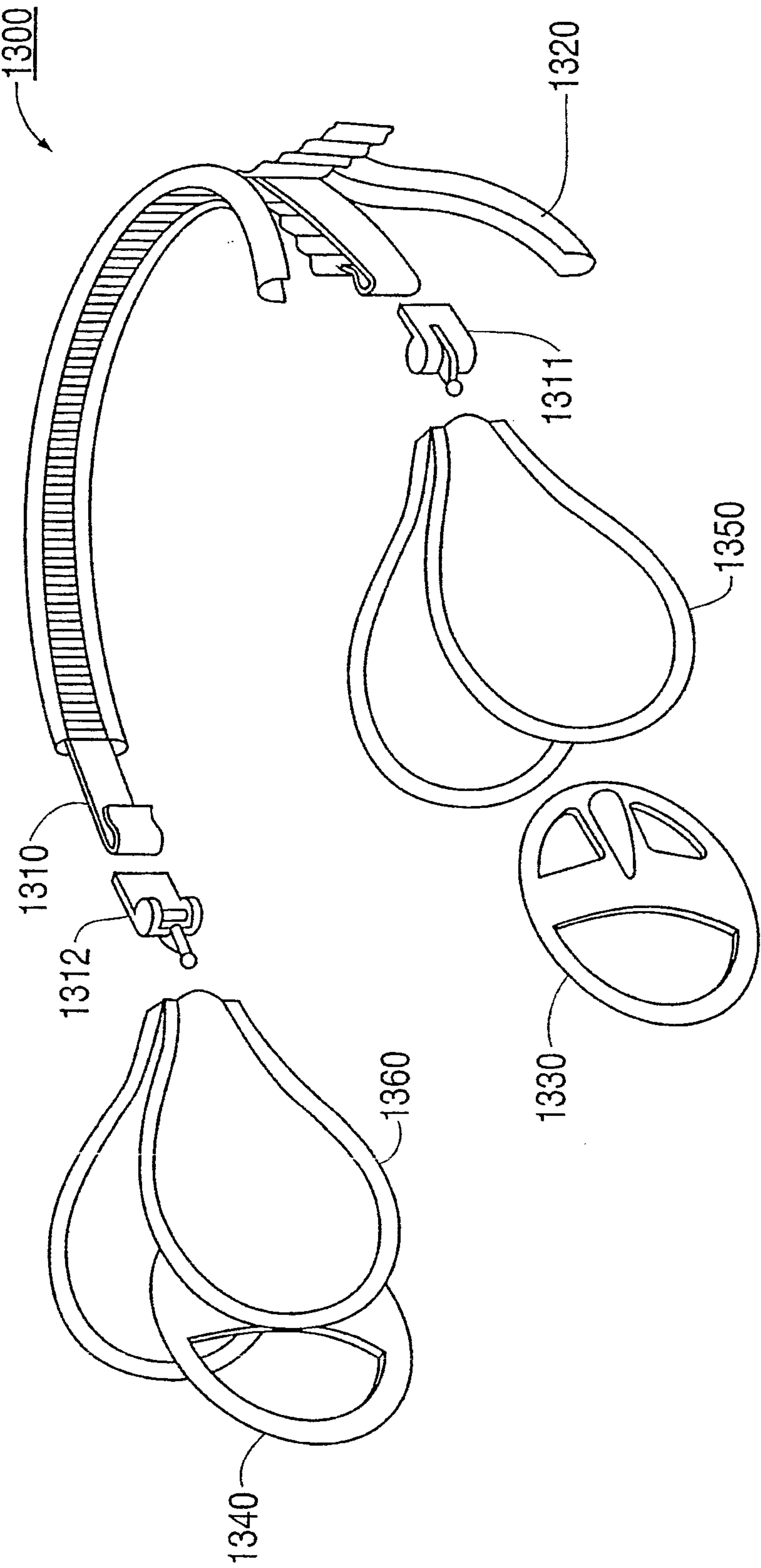


FIG. 21

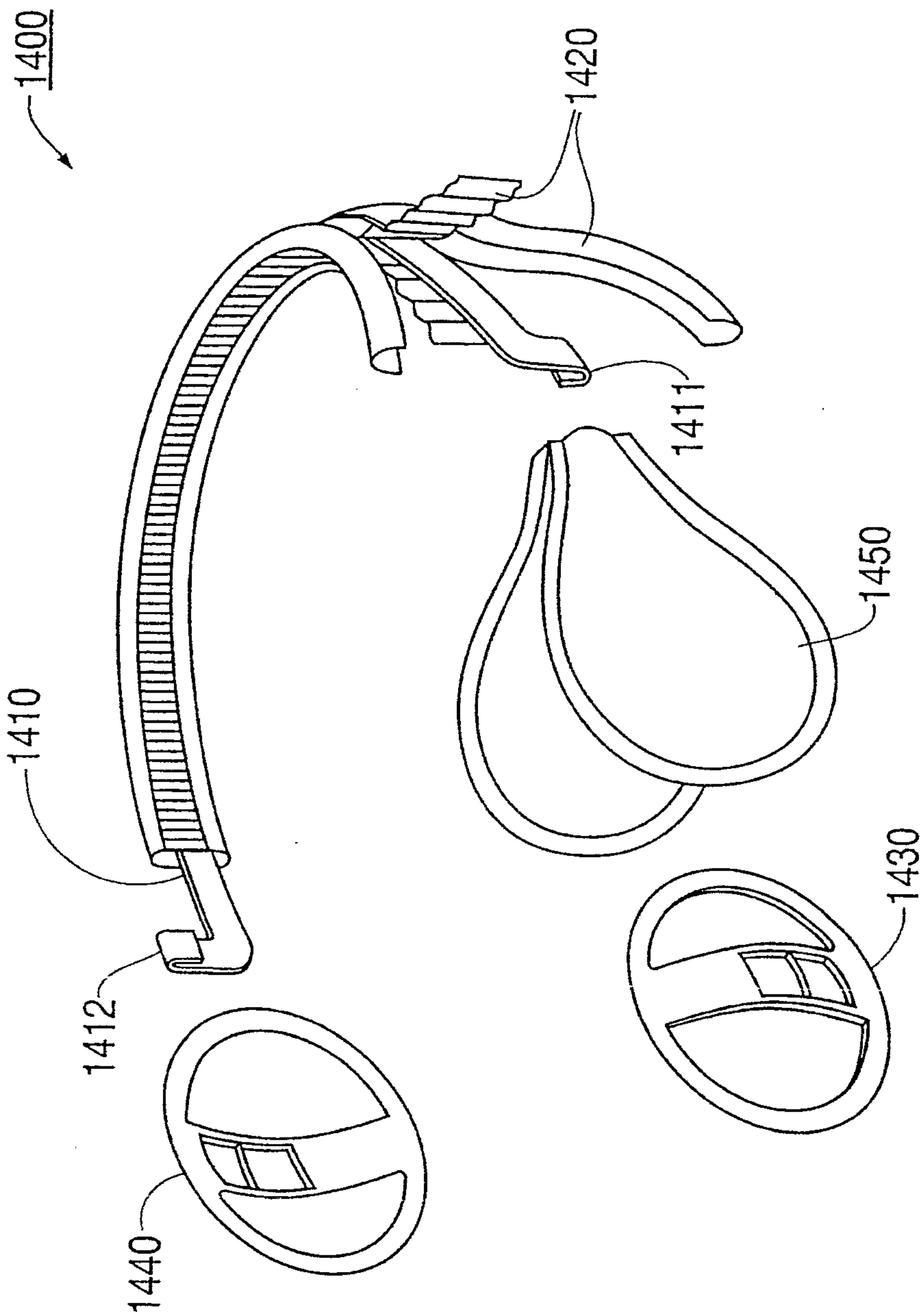


FIG. 22

