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(54) Titre : METHODE ET APPAREILLAGE DE SYSTEME DE MENTONNIERE AMORTISSEUR DE CHOC
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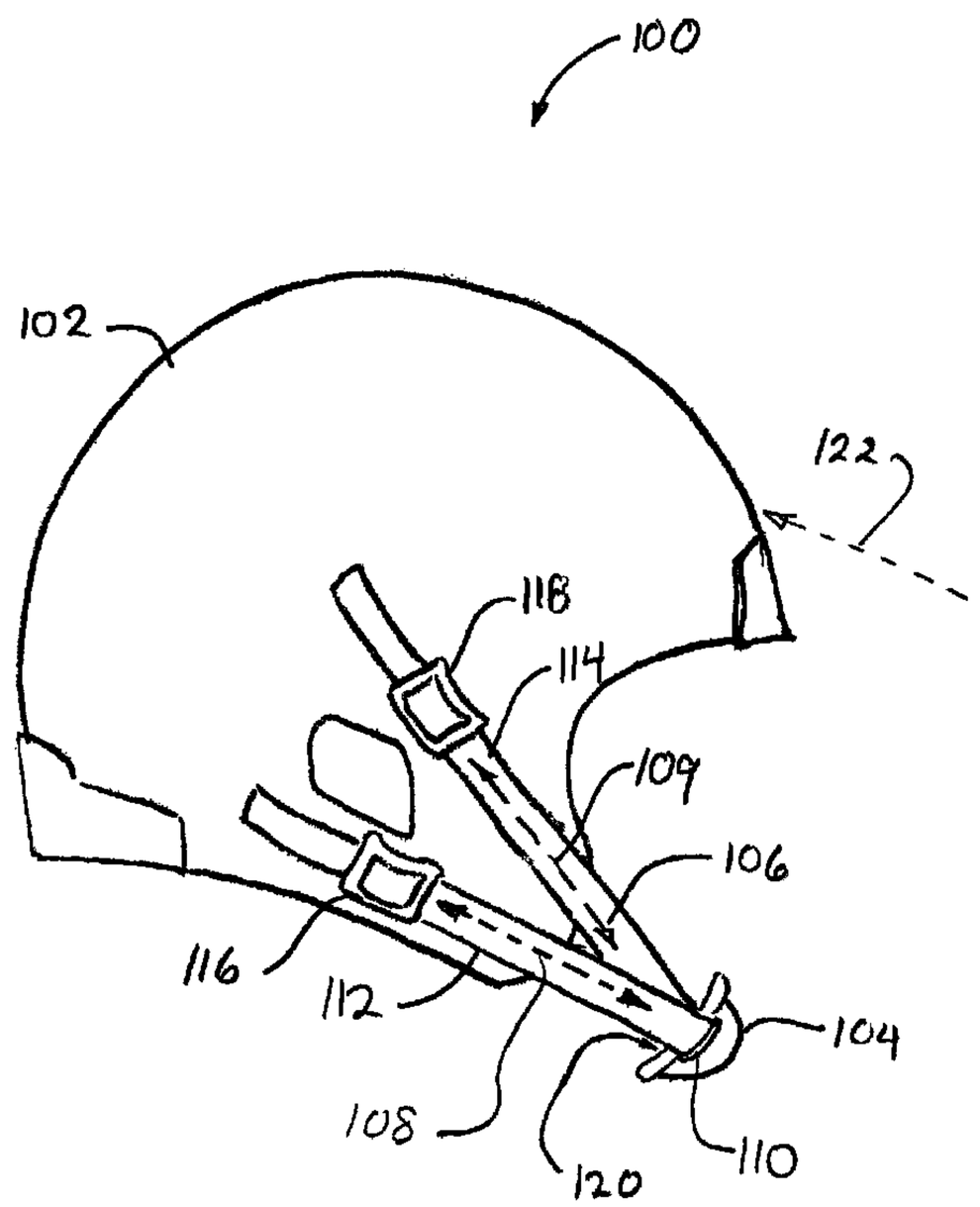


(57) Abrégé/Abstract:
A chinstrap assembly includes a chin protector coupled to protective headgear, such as a helmet, through a substantially inelastic strap member and a shock absorbing device. In the event of an impact on the protective headgear, a mechanical impulse is transferred from the headgear through the strap member and shock absorbing device to the chin protector. A maximum value of the mechanical impulse as received at the chin protector is moderated by the shock absorbing device.

Abstract

A chinstrap assembly includes a chin protector coupled to protective headgear, such as a helmet, through a substantially inelastic strap member and a shock absorbing device. In the event of an impact on the protective headgear, a mechanical impulse is transferred from the headgear through the strap member and shock absorbing device to the chin protector. A maximum value of the mechanical impulse as received at the chin protector is moderated by the shock absorbing device.

SHOCK ABSORBING CHIN STRAP SYSTEM METHOD AND APPARATUS

Cross-Reference to Related Applications

[0001] The present application claims the benefit of United States provisional patent application number 61/211,424 filed on March 30, 2009, the disclosure of which is herewith incorporated by reference in its entirety.

Field of the Invention

[0002] This application relates to impact protective attire, and more particularly to shock absorbing headwear.

Background

[0003] Shock absorbing headwear is regularly employed in circumstances where a wearer is likely to experience direct impact or other mechanical shock to the head. For example, helmets of various types and configurations are regularly used in the operation of motor vehicles including motorcycles, automobiles, aircraft, and others. Helmets are also regularly used by police and military personnel, by personnel operating in dangerous working environments such as construction, mining, and manufacturing, and in athletic activities including bicycling, football, hockey, skydiving, and others. A cursory investigation reveals a wide variety of uses for shock absorbing headwear.

[0004] Various devices are known for securing shock absorbing headwear to a user's head. Among these devices are flexible chin straps of various configurations. In some cases, chin straps are equipped with a chin guard. Typically such a chin guard includes a concave region adapted to receive a user's chin. In attempting to

provide effective shock absorbing headwear, a number of chin straps and chin guards have been developed.

[0005] For example, United States Patent 6,499,147 to Schiebl, et al. describes protective headgear including a rigid shell with face pads which may be released and removed while the headgear is still on a person's head. A protective chin guard may be attached to the headgear by way of the face pads. The chin guard includes a substantially rigid shell with a removable insert made of a flexible bladder filled with a shock absorbing fluid.

[0006] United States published patent application number 2009/0265841 A1 discusses a chinstrap assembly for a helmet having opposite sides and a face opening that includes a chin protector and first and second straps extending from the opposite sides of the helmet to opposite ends of the chin protector. A cinching device at each end of the chin protector receives an outgoing segment of the corresponding strap, grips the strap and redirects an incoming segment thereof so that by applying a lateral/rearward tensile force to that incoming segment, the length of the outgoing segment may be set to a selected value which is maintained when the tensile force is relieved. The disclosures of the foregoing patent and published application are herewith incorporated by reference.

Summary

[0007] The present application is directed to shock absorbing headwear systems and particularly to a retaining device adapted to keep the headwear in place on a user's head in the event of an impact. The invention relates to a device for securing a helmet adjacent to a user's head during use.

[0008] Many forms of headgear are equipped with a chin strap for securing the headgear in place during use. As noted above, various helmets are used in athletic activities that are adaptable to the use of a chin strap. For example football helmets, hockey helmets, and vehicle helmets, such as motorcycle and automobile racing helmet can benefit from the use of a chin strap device.

[0009] Although the various headgear presently available include a wide variety of chin straps, those straps that effectively secure a helmet share a common feature in that they provide less than optimal energy transfer during an impact. By careful and creative analysis, the present inventor has discovered and understood this limitation. Through diligent effort and further creativity, the inventor has used this knowledge to prepare an improved chin strap device.

[0010] The present invention includes a chin strap device that holds a helmet securely in a substantially fixed relation to a wearer's head during normal wear and that is adapted to absorb a portion of the impulse mechanical energy received at a surface of the helmet during an impact or collision.

[0011] According to one aspect of the invention, a shock absorbing device is provided to spread the effect of a mechanical impulse over time and therefore reduce the ultimate magnitude of that portion of the impulse transmitted to the chin protector. In certain embodiments of the invention, the shock absorber device includes a substantially elastic cushion disposed between a first portion of a strap and a surface region of a chin protector.

[0012] According to various aspects of one embodiment the invention includes a chin cup having a substantially rigid cup portion and a generally elastic edge portion. The substantially rigid cup portion includes a substantially concave inner surface bordered by an edge. A generally elastic edge portion is adapted to surround and envelop edge so as to prevent a concentration of forces at the edge and thus protect the face of a wearer generally during use, and especially during impact.

[0013] In one exemplary embodiment, first and second generally rectangular perimeter edges define respective first and second apertures through the cup portion. The apertures are adapted to receive respective longitudinal straps, or respective portions of a single longitudinal strap therethrough. The longitudinal strap(s) are adapted to couple the chin cup to a further head-protective portion of a helmet assembly.

[0014] According to a further aspect of the invention, respective substantially elastic cushion portions are adapted to absorb a portion of the energy of a mechanical shock established between the longitudinal strap(s) and the chin cup. For example, the elastic cushion portions are adapted to reduce the peak power of a mechanical impulse transmitted to the chin cup, and thus to the chin of a user, by an impact, such as a collision, between the head protective portion and an external object.

[0015] In certain embodiments, the substantially elastic cushion portions are integrally formed with the generally elastic edge portion. In other embodiments, the cushion portions are separately formed. In still other embodiments, the function of the cushion portions is provided by any alternative elastic and/or damping system such as, for example, a mechanical shock absorber system, a pneumatic shock

absorber system, a hydrostatic shock absorber system, and combinations of one or more of the same.

[0016] Equally important, in some circumstances, a displacement of the longitudinal member resulting from compression of the cushion portion(s) during a collision allows for a small displacement of the head protective portion with respect to the chin cup portion. In some circumstances, this results in a deflection of momentum and a reduction in peak mechanical impulse power transmitted through the head protective portion to a user's head.

[0017] In order to achieve the benefits indicated above, certain embodiments of the invention include a chinstrap assembly including a shell member, the shell member having a substantially rigid portion and a strap portion. The strap portion includes a substantially flexible, substantially inelastic region having a longitudinal axis. Also included is a shock absorber. The shock absorber is coupled to the strap portion and is adapted to respond to a tensile impulse applied to the strap portion.

[0018] These and other advantages and features of the invention will be more readily understood in relation to the following detailed description of the invention, which is provided in conjunction with the accompanying drawings.

[0019] It should be noted that, while the various figures show respective aspects of the invention, no one figure is intended to show the entire invention. Rather, the figures together illustrate the invention in its various aspects and principles. As such, it should not be presumed that any particular figure is exclusively related to a discrete aspect or species of the invention. To the contrary, one of skill in the art

would appreciate that the figures taken together reflect various embodiments exemplifying the invention.

Brief Description of the Drawings

[0020] Fig. 1 shows exemplary protective headwear including a helmet and a chin protector;

[0021] Fig. 2 shows an anterior view of a chin protector according to principles of the invention;

[0022] Fig. 3 shows a posterior view of a chin protector according to principles of the invention;

[0023] Fig. 4 shows a side view of a chin protector according to principles of the invention;

[0024] Fig. 5 shows a cutaway view of a portion of a chin protector according to principles of the invention;

[0025] Fig. 6 shows a cutaway view of a portion of a chin protector and strap according to principles of the invention;

[0026] Fig. 7 shows a cutaway view of a portion of a chin protector including an extension according to principles of the invention;

[0027] Fig. 8 shows a cutaway view of a portion of a chin protector including an extension having a pleated portion according to principles of the invention;

[0028] Fig. 9 shows a cutaway view of a chin protector including an extension having a fluid component according to principles of the invention;

[0029] Fig. 10 shows a cutaway view of a chin protector including an extension having a helical spring according to principles of the invention;

[0030] Fig. 11 shows a cutaway view of a chin protector including a leaf spring according to principles of the invention;

[0031] Fig. 12 shows a cutaway view of a chin protector including a plurality of features according to principles of the invention;

[0032] Fig. 13 shows a portion of a protective headwear assembly according to principles of the invention;

[0033] Fig. 14 shows an anterior view of a portion of a chin protector according to principles of the invention;

[0034] Fig. 15 shows an anterior view of a portion of a chin protector according to principles of the invention; and

[0035] Fig. 16 shows a portion of a protective headwear assembly according to principles of the invention.

Detailed Description

[0036] The following description is provided to enable any person skilled in the art to make and use the disclosed inventions and sets forth the best modes presently contemplated by the inventors of carrying out their inventions. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be apparent, however, to one skilled in the art that the present invention may be practiced without these specific details. In other instances, well-known structures and devices are shown schematically in order to avoid unnecessarily obscuring the present invention.

[0037] A variety of apparatus embodying this inventive concept have been conceived, and are described here in detail, by the inventor. Among these, are a chin strap apparatus as illustrated in the attached drawings. Accordingly, the attached

figures show various inventive aspects in one embodiment of the invention including a chin strap having a shock absorbing device.

[0038] Fig. 1 shows, in schematic elevation, a helmet system 100, adapted for use by a football player, according to one exemplary embodiment of the invention. The helmet system 100 includes a helmet 102 and a chin protector 104. The chin protector 104 is coupled to the helmet 102 by a substantially flexible strap 106. According to certain embodiments of the invention, the substantially flexible strap 106 is substantially inelastic along longitudinal axes 108 and 109 thereof.

[0039] According to the illustrated embodiment, the strap 106 is arranged so that a first portion of the strap 106 is disposed within an aperture 110 of the chin protector 104. Consequently, a second 112 and a third 114 portion of the strap 106 are disposed between the chin protector 104 and the helmet 102. Second strap portion 112 is coupled to helmet 102 at a first adjustable buckle/snap 116 according to the illustrated exemplary embodiment. In like fashion, third strap portion 114 is coupled to the helmet 102 at a second adjustable buckle/snap 118. In certain embodiments of the invention, the buckle/snap 118 includes a stainless steel material.

[0040] According to principles of the invention, an inner surface 120 of chin protector 104 is adapted to be disposed in contact with a wearer's chin, with the helmet 102 disposed about the wearer's head. When, due to an impact, the helmet 102 experiences a mechanical impulse along, e.g., a vector 122, a portion of that impulse is transmitted along the strap portions 112, 114, to the chin protector 104. The chin protector 104 interferes with the wearer's chin to limit motion of the helmet 102 with respect to the wearer's head. As will be described in additional detail

below, a chinstrap assembly according to the present invention is adapted to diffuse the shock of the impact while maintaining a desirable relationship between the helmet 102 and the wearer's head.

[0041] Fig. 2 shows in anterior perspective view, a chin-protector 200 according to one aspect of the invention. The chin protector 200 includes a first substantially rigid member 202 having a generally convex external surface 204. According to the illustrated embodiment, a peripheral cushion portion 206 is disposed about a circumferential edge of the rigid member 202. In the illustrated embodiment, first 208 and second 210 apertures open into through-holes defined within the rigid member 202. The through holes 208, 210 are adapted to receive chin-strap devices therewithin, as exemplified in figure 1.

[0042] In certain embodiments of the invention, the rigid member 202 includes further apertures, e.g., 212 coupled to respective through holes. The further apertures 212 are adapted to receive air therethrough, thereby providing ventilation of a region adjacent to the chin protector when in use.

[0043] In one device prepared according to principles of the invention, the rigid member 202 includes a polyamide material. According to another embodiment of the invention, the rigid member 202 includes a fiber reinforced polyamide material. According to one embodiment of the invention, the fiber reinforced polyamide material includes a carbon fiber reinforced polyamide material. According to yet another embodiment of the invention, and the fiber reinforced polyamide material includes a glass fiber reinforced polyamide material. In a further embodiment of the invention, the rigid member 202 includes a polyaramid material and in yet another

embodiment the rigid member 202 includes a fiber reinforced polyaramid material. According to one embodiment of the invention, the peripheral cushion portion 206 includes a thermoplastic polyurethane material.

[0044] Fig. 3 shows a corresponding posterior elevation of the chin protector 200 of Fig. 2. As illustrated, the substantially rigid member 202 of the chin protector 200 includes a generally concave posterior surface 220. In certain embodiments, the posterior surface 220 of the chin protector 200 is adapted to support a generally elastically compressible internal pad (not shown). The internal pad is adapted to provide comfort and additional shock of the controller. The cushion portion 206 is shown in partial cutaway 222, revealing a portion of a surface region 224 of rigid member 202 disposed generally within an overlying flange region 226 of the cushion portion 206.

[0045] As will be discussed in additional detail below, further extensions 228, 229 of the cushion portion 206 are disposed adjacent to apertures 208 and 210 respectively. Also illustrated are anterior apertures, e.g. 230 coupled respectively to air channels which in turn are coupled to the posterior apertures, e.g. 212.

[0046] Fig. 4 shows a further aspect 300 of a portion of the anterior surface 204 of substantially rigid member 202. This view clarifies the relationship between the substantially rigid member 202, the peripheral cushion portion 206 and the extension 228. Also clearly shown is the location of exemplary aperture 208.

[0047] Fig. 5 shows, in cutaway view, additional aspects of the invention 350. According to the illustrated embodiment, part of the cushion portion 206 and the

adjacent extension 228 are integrally formed and disposed about a bridge portion 352 of substantially rigid member 202.

[0048] The bridge portion 352 includes a surface region 354 defining one side of a through hole 356. A second surface region 358 disposed in generally parallel spaced relation to surface region 354 defines an opposite side of through hole 356. As shown, a portion 360 of extension 228 is disposed within the through hole 356, and a surface region 362 of extension 228 is disposed in generally parallel spaced relation to surface region 354. Together, surface regions 354 and 362 form opposite sides of an aperture (identified as aperture 208 in figure 3). As is evident from the illustration, aperture 208 is a subset of aperture 356. According to one embodiment of the invention, the portion of the extension within the through hole 356 has a thickness 361 of approximately 5 mm. In other embodiments of the invention, the portion of the extension within the through hole 356 has a thickness ranging between about 2 mm and about 7 mm.

[0049] Referring now to Fig. 6, which shows a further cutaway view 380 corresponding to Fig. 5 one sees how aperture 208 is adapted to receive a portion of a substantially flexible strap 106. Accordingly, tensile forces 382, 384 applied respectively to strap portions 112, 114 result in a substantially elastic deformation of extension 228 of when the balance of the chin protector 104 is held substantially immobile with respect to a user's chin. This substantially elastic deformation of extension 228 allows a slight movement of the helmet coupled to strap 106 and serves to diffuse a mechanical impulse that would otherwise be transmitted to the user's chin through the chin protector 104.

[0050] According to one embodiment of the invention, the substantially flexible strap 106 includes a polyester ribbon with a PVC exterior coating. In certain embodiments of the invention, the polyester ribbon includes a polyaramid thread such as, for example, a para-aramid thread disposed therewithin. The polyaramid thread serves to strengthen the strap and reduce any elasticity that the strap might otherwise exhibit.

[0051] Due to the substantially elastic characteristic of the extension 228, after a maximum of the mechanical impulse, the extension 228 tends to substantially resume its original configuration, returning to its original shape and restoring a desired relationship between the user's head and the helmet.

[0052] It should be emphasized that in certain embodiments, the strap 110 is substantially inelastic, as compared with the elasticity of extension 228. Consequently, the impulse handling characteristic of the helmet and chinstrap system can be engineered by appropriate selection of the characteristics of the extension 228. This contrasts with an alternative arrangement in which a generally elastic strap is provided. In such an embodiment the strap would stretch over substantially the entire distance between the chin protector 104 and snap buckles 116, 118 (as shown in Fig. 1).

[0053] As will be further discussed below, one of skill in the art will appreciate that the characteristics of extension 228 can be engineered in a variety of ways. For example, the extension 228 can be formed of a substantially uniform material of a particular chemical composition having a desirable intrinsic durometer. The characteristics can be further modified by a physical configuration of the material.

Thus, the material can be formed to include a plurality of gas-filled cavities, i.e., as an open cell foam and/or as a closed cell foam and/or as a combination thereof, with a resulting effect on durometer.

[0054] According to desired characteristics, the respective sizes of the gas-filled cavities can be substantially uniform or can vary significantly from cell to cell. In addition, the size of the cavities can vary from substantially microscopic to substantially macroscopic as compared with the overall size of the extension 228.

[0055] The material can also be configured in certain macroscopic arrangements adapted to provide a desirable overall compressibility and elasticity. Thus, for example, the extension 228 can be prepared as a macroscopic configuration including a plurality of cylinders of various cross-section.

[0056] Fig. 7 shows one such example 400 in cutaway perspective view. Figure 7 shows one exemplary arrangement in which the extension 402 includes a plurality of generally cylindrical chambers 404, 406, 408 having respective mutual walls 410, 412 so as to form an integral substantially elastic cushion. In certain embodiments, the respective internal surfaces (e.g. 410 defining the cylindrical chamber e.g. 408) exhibit a substantially circular cross-section when uncompressed. In other arrangements, those internal surfaces exhibit a substantially elliptical cross-section and it still other arrangements a substantially oval cross-section a substantially polygonal cross-section (e.g. rectangular, hexagonal, octagonal) or any other appropriate geometry according to the requirements of a particular application.

[0057] Where the requirements of a particular application suggest or demand it, one or more of the chambers 404, 406, 408 include a second material disposed therewithin. For example in certain cases, a chamber is sealed with respect to the atmosphere and contains a substantially fixed gaseous composition such as an air composition, a single gas, or a mixture of gases. In other cases, the chamber includes an elastomeric material such as a polymeric foam material. In still other cases, one or more of the chambers 404, 406, 408 is substantially evacuated.

[0058] Where it is determined to be beneficial for a particular application a portion of the substantially rigid member 202 is configured to have extended surface region 414 disposed generally normal with respect to a direction of compression 416 of the extension 402. Thus as the extension 402 is generally elastically deformed under the influence of external stresses, the surface region 414 tends to stabilize and support the extension 402.

[0059] As noted above, the profile of the chambers can be tailored to the requirements of a particular application. Thus, Fig. 8 shows, in cutaway perspective view, a further configuration 420 in which the extension 422 includes a pleated external surface 424 and a plurality of internal chambers having a generally hexagonal cross-section, eg., 426. By appropriate selection of one or more of the internal angles e.g., 428 of the pleats and by appropriate selection of the one or more bulk materials of the extension 422, as well as by appropriate selection of the filling, if any, disposed within one or more of the cavities, e.g. 426, the compressive characteristics of the extension 422 can be adapted to be requirements of a particular application.

[0060] One of skill in the art will readily appreciate that the various material characteristics described above in relation to the exemplary extension 402 of Fig. 7 are equally applicable to the extension 422 of Fig. 8. In like fashion, the expanded surface 414 of example 400 is analogous to surface 430 in example 420 of Fig. 8. Thus surface 430 is adapted to support and stabilize the pleated extension 422 in certain cases of the illustrated example 420 of Fig. 8.

[0061] Fig. 9 shows, in cutaway perspective view, an exemplary further aspect of the invention. As shown in Fig. 9, a chin guard 450 includes a substantially rigid member 202 supporting a peripheral cushion portion 206. The peripheral cushion portion 206 is disposed about a circumferential edge of the rigid member 202. As illustrated, an extension 452 of the cushion portion 206 includes an external surface region 454 and an internal surface region 456. The internal surface region 456 defines, in part, a first chamber 458. According to the exemplary device shown, a second chamber 460 is disposed within the cushion portion 206 remote from the first chamber 458.

[0062] The first chamber 458 is coupled to the second chamber 460 by a longitudinal cavity or bore 462 defined within a part of the cushion portion 206. At one end, the bore opens at an aperture 464 into the second chamber 460. At the other end, the bore is coupled via one or more grooves 466, 468, or other apertures, to the first chamber 458. In the illustrated device, the grooves for 66, 468 are formed in a surface region 470 of the substantially rigid member 202.

[0063] First chamber 458 is adapted to receive a fluid medium therewithin such as a gas or a liquid. In response to an applied force 472, a generally elastic wall 474 of

extension 452 is adapted to deform, thereby reducing in overall volume of the first chamber 458 and displacing a portion of the fluid medium through grooves 466, 468 and bore 462, and thereafter through aperture 464 into the second chamber 460. By selection of a fluid medium having an appropriate viscosity, and by a corresponding selection of a number and cross-sectional area of the grooves 466, 468, the above-noted deformation of generally elastic wall 474 can be controlled, thereby damping a mechanical impulse applied as force 472.

[0064] It should be understood that while the above-described hydraulic or pneumatic damping can be e a ffected in the illustrated chin guard 450 of figure 9, the same principles can be equally well applied to a chin guard having a tubular extension configuration as shown in Fig. 7 or to a chin guard having a pleated extension configuration as shown in Fig. 8, or to any other extension configuration within the spirit of the invention. Thus a wide variety of damping arrangements can be used in particular chin guards according to principles of the invention all such arrangements falling within the spirit and scope of the invention as a whole.

[0065] In like fashion, without deviating anyway from the invention, the elasticity of the extension portion can be further modified to meet the needs of particular applications by the inclusion of various mechanical spring arrangements within or around the extension. Accordingly, Fig. 10 shows, in cutaway perspective view, a chin guard 500 including a substantially rigid member 202 supporting a peripheral cushion portion 206. The peripheral cushion portion 206 is disposed about a circumferential edge of the rigid member 202. As illustrated, an extension 502 of the cushion portion 206 includes an external surface region 504 and an internal surface region 506. The internal surface region 506 defines, in part, a chamber 508.

[0066] Disposed within the chamber 508 is one or more substantially elastic mechanical devices; exemplified here as a plurality of helical springs e.g., 510, 512. In the exemplary illustrated device, springs 510 and 512 are located by respective pairs of projecting studs 514, 516 and 518, 520. As is evident from Fig. 10, it is possible to dispose studs 514 and 520 at a surface 522 of a further substantially rigid member 524 so as to effectively couple the corresponding ends of the helical springs 510 to each other, and to a portion of the internal surface region 506 of the extension 502.

[0067] Fig. 11 shows, in cutaway perspective view, a chin guard 550 including a substantially rigid member 202 supporting a peripheral cushion portion 206. The peripheral cushion portion 206 is disposed about a circumferential edge of the rigid member 202. As illustrated, an extension 552 of the cushion portion 206 includes an external surface region 554 and an internal surface region 556. The internal surface region 556 defines, in part, a chamber 558.

[0068] Disposed within the chamber 558 is one or more substantially elastic mechanical devices; exemplified here as a plurality of leaf springs e.g., 560, 562, 564. In the exemplary illustrated device, springs 560, 562, 564 are formed as an integral unit. In other devices, according to requirements of a particular application, however, these springs are discrete devices. Further, in certain applications, springs 560, 562 and 564 are integrally formed by a molding process as part of, an integral to, the substantially rigid member 202. Accordingly, in certain devices prepared pursuant to principles of the invention, the substantially rigid member 202 and springs 560, 562 and 564 are formed of a single substantially uniform composition.

[0069] As would be understood by one of ordinary skill in the art, the various extensions disclosed above are all adapted to provide the substantially similar function of compressing substantially elastically in response to an applied mechanical impulse, and thereafter to substantially resume a relaxed configuration substantially identical to the original uncompressed configuration. Consequently, as illustrated by exemplary chin guard 600 of Fig. 12, any of the approaches and devices discussed above can be combined together in a single chin guard. The various, devices and apparatus employed to provide the desired function are in no way mutually exclusive of one another, but are merely examples of different aspects of a single invention as herewith disclosed.

[0070] Thus, for example, Fig. 12 shows, in cutaway perspective view, a chin guard 600 including a substantially rigid member 202 supporting a peripheral cushion portion 206. The peripheral cushion portion 206 is disposed about a circumferential edge of the rigid member 202.

[0071] As illustrated, an extension 602 of the cushion portion 206 includes an external surface region 604 including a generally cylindrical portion 606 and a generally pleaded portion 608. An internal surface region 610 disposed within the generally cylindrical portion 606 defines a generally cylindrical cavity 612 therewithin. This cavity, according to the requirements of a particular application, may for example have a foam material or a gas disposed therewithin.

[0072] A further cavity 614 has a plurality of substantially elastic mechanical devices, here helical springs e.g., 616, disposed therewithin. Cavity 616 is further filled with a fluid having a desirable viscosity and adapted to be forced through a

channel of defined cross-section 618 into a further reservoir chamber 620 thereby damping a compression of the extension 602 and absorbing the energy of a corresponding mechanical impulse. In the illustrated device, the walls of the extension 602 are formed of a foamed elastomeric polymer, including a plurality of gas-filled cavities, i.e., a foamed elastomeric polymer, having a desirable durometer.

[0073] Of course the combination of features of chin guard 600 illustrated in Fig. 12 is merely exemplary of the wide variety of combinations that would become apparent to the creative practitioner of ordinary skill in the art in light of the present disclosure.

[0074] Fig. 13 shows in perspective view a portion of a chin guard 650 according to principles of the invention where a coupling device 652 is provided to establish a substantially fixed relationship between first 654 and second 656 portions of a substantially inelastic strap 658. In so doing, the coupling device 652 prevents the strap 658 from translating along a longitudinal axis thereof 660 through aperture 662. Consequently, the coupling device retains a desirable adjusted configuration of the strap 658. The coupling device includes a buckle portion 664 having first 666 and second 668 slots.

[0075] The substantially inelastic strap 658 is disposed through the slots 666, 668 and is substantially fixed in place by a detent device 670. The detent device 670 includes a lower surface adapted to frictionally contact and upper surface region 672 of the strap 658. Consequently, the strap 658 is held in place within the buckle portion 664.

[0076] Referring again to Fig. 2, one sees that the chin guard 200 includes only first 208 and second 210 apertures for receiving respective straps therewithin. Fig. 14 shows an alternative arrangement including a chin guard 700. The chin guard 700 includes a substantially rigid member 202 supporting a peripheral cushion portion 206. The peripheral cushion portion 206 is disposed about a circumferential edge of the rigid member 202. First 702, second 704, third 706 and fourth 708 apertures are adapted to receive respectively four independent substantially inelastic straps. Cushion portion 206 includes four extensions 710, 712, 714 and 716 disposed adjacent to apertures 702, 704, 706 and 708 respectively. In accordance with principles of the invention as discussed above, each of the extensions 710, 712, 714 and 716 are adapted to cushion a mechanical impulse applied to a respective one of the four independent substantially inelastic straps, each of the straps being independently coupled to a respective point at a surface of a helmet.

[0077] Extrapolating further, Fig. 15 shows a further arrangement including a chin guard 750. The chin guard 700 includes a substantially rigid member 202 supporting a peripheral cushion portion 206. The peripheral cushion portion 206 is disposed about a circumferential edge of the rigid member 202. First 752, second 754, third 756, fourth 758, fifth 760 and sixth 762 apertures are adapted to receive respectively six independent substantially inelastic straps. Cushion portion 206 includes six extensions 764, 766, 768, 770, 772 and 774 disposed adjacent to apertures 752, 754, 756, 758, 760 and 762 respectively. In accordance with principles of the invention as discussed above, each of the extensions 764, 766, 768, 770, 772 and 774 are adapted to cushion a mechanical impulse applied to a respective one of the four independent substantially inelastic straps, each of the straps being independently coupled to a respective point at a surface of a helmet.

[0078] FIG 16 shows a further approach to cushioning a mechanical impulse between a helmet and a corresponding chin protector. Illustrated in Fig. 16 is a snap buckle 800 as previously shown, for example at 116 in Fig.1. According to the present embodiment, the snap buckle includes a female snap portion 802 adapted to be coupled to a male snap portion of, for example, a helmet. Snap portion 802 is coupled with a fastener such as, for example, rivet 804 to a substantially rigid first support member 806. A peripheral edge 808 of the support member 806 is disposed within an elastomeric cushion 810. A second substantially rigid floating member 812 is disposed about and thereby coupled to the elastomeric cushion 810.

[0079] A buckle portion 814 is coupled to the second substantially rigid floating member 812 by a further fastener, e.g. further rivet 816. The buckle portion 814 is adapted to receive a substantially inelastic substantially flexible strap member 818 and to hold the same in conventional buckle fashion. Unlike a conventional snap buckle, however,, the illustrated snap buckle 800 is adapted to absorb a shock delivered along the strap member 818 and disperse a corresponding mechanical impulse so as to reduce a transmission of the shock to snap portion 802 and thereby to a helmet.

[0080] In various embodiments, the substantially elastic extensions, and in certain further embodiments the generally elastic edge portion are formed of an elastomeric material. Elastomers that may be used in various embodiments of the invention include various copolymers or block copolymers(Kratons®) available from Kraton Polymers such as styrene-butadiene rubber or styrene-isoprene rubber, EPDM (ethylene propylene diene monomer) rubber, nitrile (acrylonitrile butadiene) rubber,

polyurethane, polybutadiene, polyisobutylene, neoprene, natural latex rubber and the like. Foam materials may be closed cell foams or open cell foams, and may include, but is not limited to, a polyolefin foam such as a polyethylene foam, a polypropylene foam, and a polybutylene foam; a polystyrene foam; a polyurethane foam; any elastomeric foam made from any elastomeric or rubber material mentioned above; or any biodegradable or biocompostable polyesters such as a polylactic acid resin (comprising L-lactic acid and D-lactic acid) and polyglycolic acid (PGA); polyhydroxyvalerate/hydroxybutyrate resin (PHBV) (copolymer of 3-hydroxy butyric acid and 3-hydroxy pentanoic acid (3-hydroxy valeric acid) and polyhydroxyalkanoate (PHA) copolymers; and polyester/urethane resin. One of skill in the art will appreciate that the foregoing are merely exemplary of a wide variety of possibilities that would be applied in an appropriate applications.

[0081] In various embodiments, the substantially rigid cup portion is formed of corresponding materials and/or combinations of materials including natural and synthetic materials. For example, the chin cup is formed, in certain embodiments, of metallic materials, of natural material such as, for example, leather, and of natural and/or synthetic polymeric materials. Suitable polymers include polyethylene, polypropylene, polybutylene, polystyrene, polyester, acrylic polymers, polyvinylchloride, polyamide, or polyetherimide like ULTEM.RTM.; a polymeric alloy such as Xenoy.RTM. resin, which is a composite of polycarbonate and polybutyleneterephthalate or Lexan.RTM. plastic, which is a copolymer of polycarbonate and isophthalate terephthalate resorcinol resin (all available from GE Plastics), liquid crystal polymers, such as an aromatic polyester or an aromatic polyester amide containing, as a constituent, at least one compound selected from the group consisting of an aromatic hydroxycarboxylic acid (such as hydroxybenzoate

(rigid monomer), hydroxynaphthoate (flexible monomer), an aromatic hydroxyamine and an aromatic diamine, (exemplified in U.S. Pat. Nos. 6,242,063, 6,274,242, 6,643,552 and 6,797,198, the contents of which are incorporated herein by reference), polyesterimide anhydrides with terminal anhydride group or lateral anhydrides (exemplified in U.S. Pat. No. 6,730,377, the content of which is incorporated herein by reference) or combinations thereof.

[0082] In addition, any polymeric composite such as engineering prepregs or composites, which are polymers filled with pigments, carbon particles, silica, glass fibers, conductive particles such as metal particles or conductive polymers, or mixtures thereof may also be used. For example, a blend of polycarbonate and ABS (Acrylonitrile Butadiene Styrene) may be used.

[0083] While the exemplary embodiments described above have been chosen primarily from the field of athletic headgear, one of skill in the art will appreciate that the principles of the invention are equally well applied, and that the benefits of the present invention are equally well realized in a wide variety of other protective equipment including, for example, vehicle, police, military and hazardous environment headgear. Further, while the invention has been described in detail in connection with the presently preferred embodiments, it should be readily understood that the invention is not limited to such disclosed embodiments. Rather, the invention can be modified to incorporate any number of variations, alterations, substitutions, or equivalent arrangements not heretofore described, but which are commensurate with the spirit and scope of the invention. Accordingly, the invention is not to be seen as limited by the foregoing description, but is only limited by the scope of the appended claims.

Claims

1. A chinstrap device comprising:

a chin-cup portion;

a support strap portion; and

a shock absorber, said shock absorber being disposed between said chin-cup portion and said support strap portion.

2. A chinstrap device as defined in claim 1 wherein said shock absorber comprises a substantially elastic cushion device.

3. A chinstrap device as defined in claim 2 wherein said substantially elastic cushion device comprises an elastomeric polymer material.

4. A chinstrap device as defined in claim 3 wherein said elastomeric polymer material comprises a polyurethane material.

5. A chinstrap device as defined in claim 4 wherein said polyurethane material comprises a foamed thermoplastic polyurethane material.

6. A chinstrap device as defined in claim 1 wherein said shock absorber comprises a metallic spring portion.

7. A chin strap device as defined in claim 1 wherein said shock absorber comprises a fiber reinforced polymer spring portion.

8. A chinstrap device as defined in claim 7 wherein said fiber reinforced polymer spring portion is integrally formed with said chin-cup portion.

9. A chin strap device as defined in claim 1 wherein said shock absorber comprises a viscous damper.

10. A chinstrap device as defined in claim 1 wherein said chin-cup portion comprises a substantially rigid shell, said shell having a generally concave inner surface region and a circumferential edge region, said substantially rigid shell being adapted to support a chin-cushion device.

11. A chinstrap device as defined in claim 1 further comprising an edge cushion device, said edge cushion device being integrally formed with said shock absorber.

12. A method of preparing a helmet comprising:

providing a helmet having a substantially concave inner surface region, said inner surface region being adapted to be disposed adjacent to a user's head;

providing a chin cup having a substantially concave padded inner surface region, said substantially concave padded inner surface region being adapted to be disposed adjacent to a user's chin;

coupling a relatively inelastic longitudinal member to said chin cup through a relatively elastic shock absorbing member; and

coupling said relatively inelastic longitudinal member to said helmet.

13. A method of preparing a helmet as defined in claim 12 wherein said relatively elastic shock absorbing member is adapted to compress under impact load

conditions so as to reduce mechanical power transferred to said user's head during said impact.

14. A method of preparing a helmet as defined in claim 12 wherein said relatively elastic shock absorbing member has a response characteristic adapted to provide firm helmet retention under low load conditions and shock absorption under high load conditions.

15. A method of providing wearer protection comprising:

absorbing a portion of a shock received at a surface of a helmet in a substantially elastic shock absorbing device disposed between at least two of a head element of said helmet, a strap element of said helmet and a chin element of said helmet.

16. A method of providing wearer protection as defined in claim 15 wherein said absorbing a portion of a shock comprises rapidly compressing said substantially elastic shock absorbing device.

17. A method of providing wearer protection as defined in claim 15 wherein said absorbing a portion of a shock comprises rapidly compressing a gas within said substantially elastic shock absorbing device.

18. A method of providing wearer protection as defined in claim 15 wherein said absorbing a portion of a shock comprises rapidly displacing a substantially incompressible fluid within said substantially elastic shock absorbing device.

19. A method of providing wearer protection as defined in claim 15 wherein said substantially elastic shock absorbing device comprises an elastomeric polymer material.

20. A method of providing wearer protection as defined in claim 15 wherein said substantially elastic shock absorbing device comprises a polyurethane material.

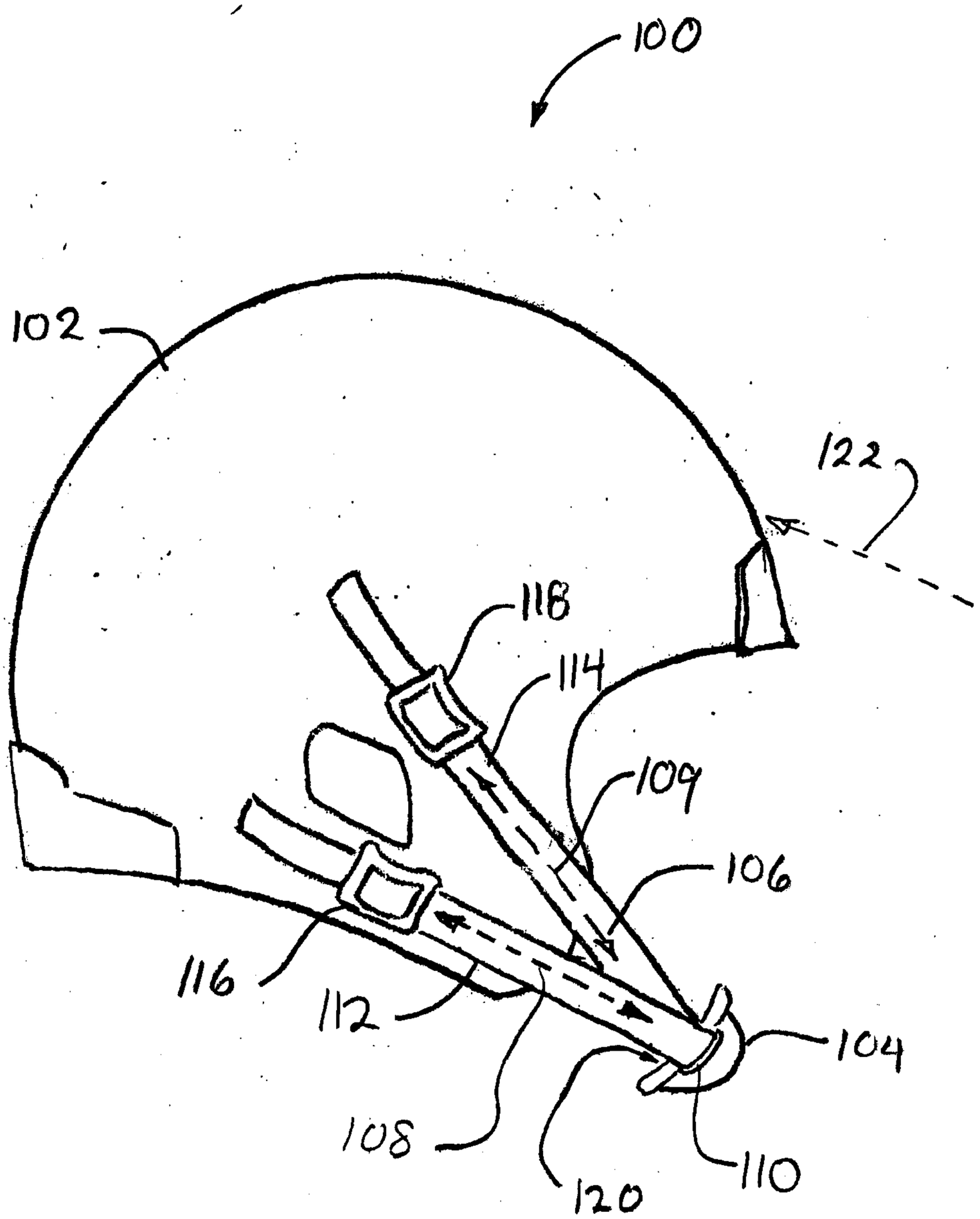


FIG. 1

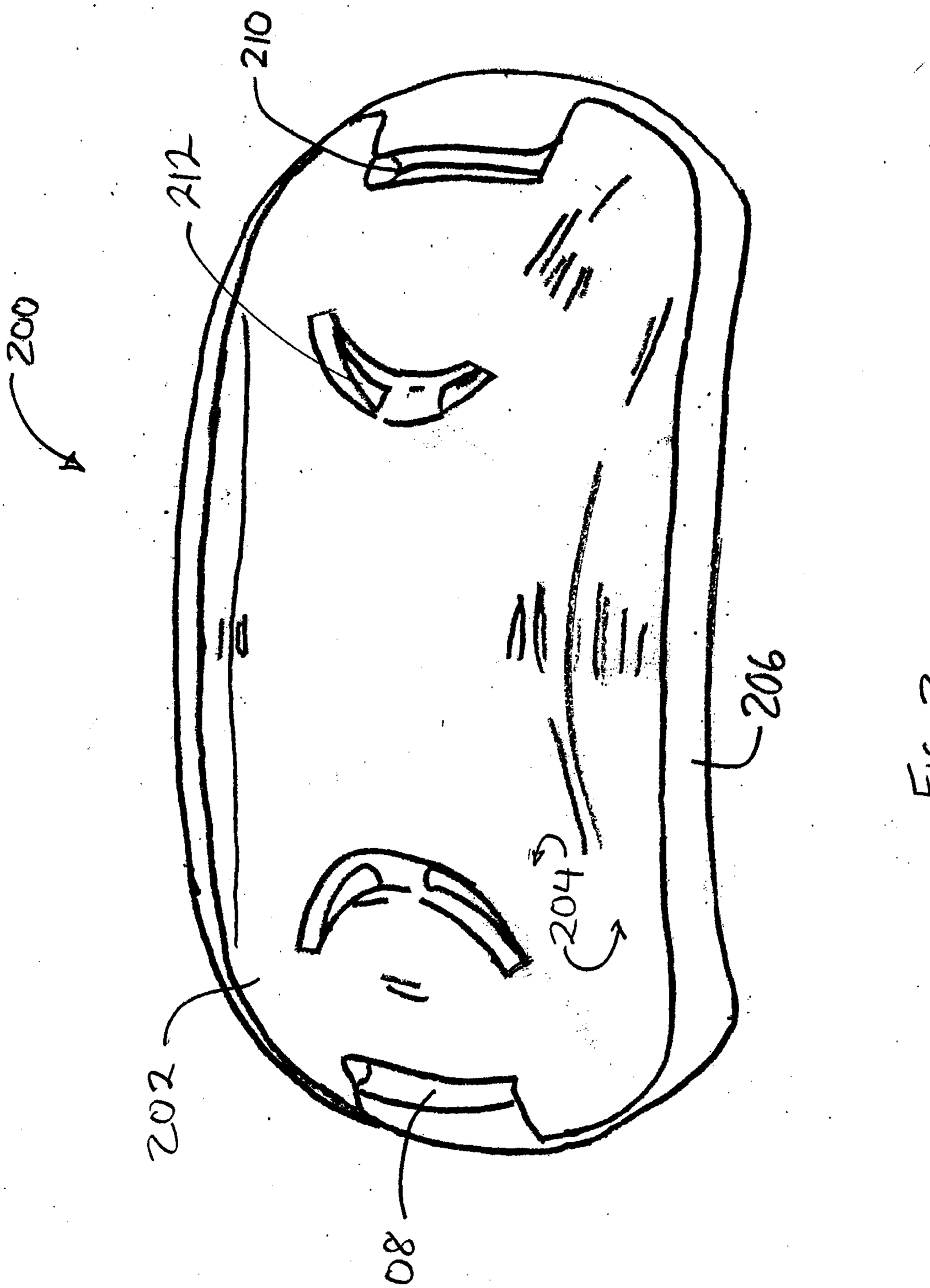


Fig. 2

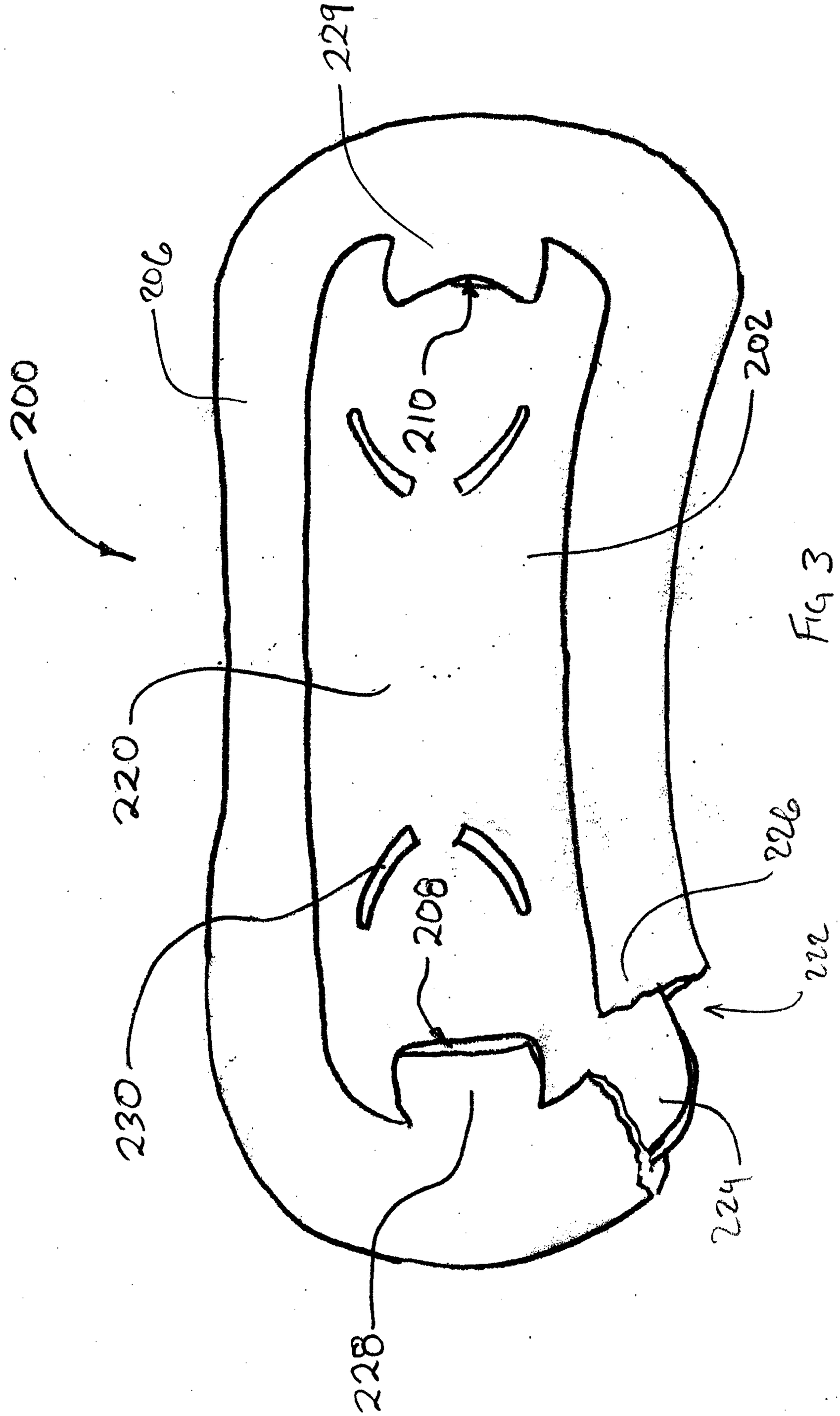


FIG 3

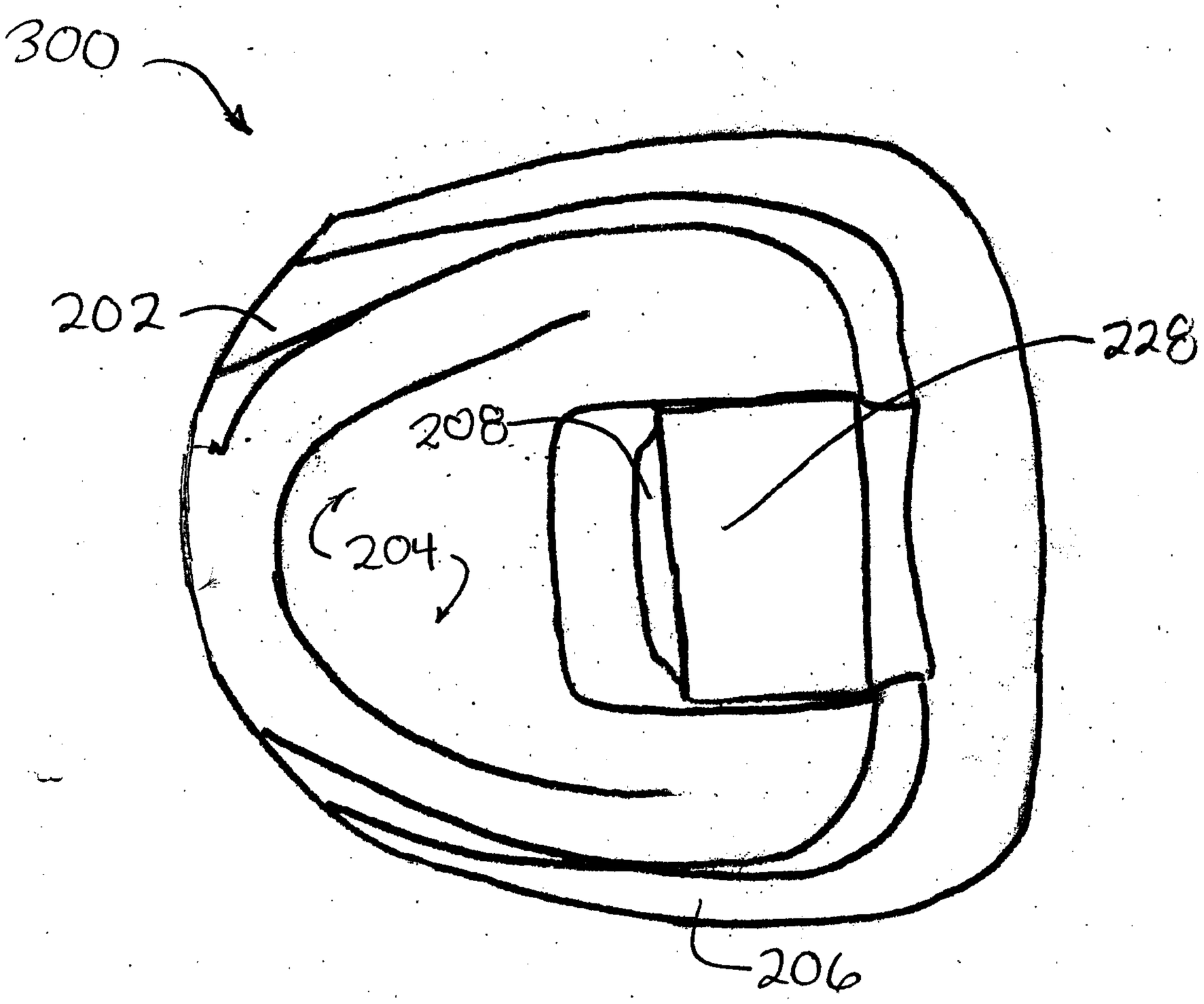


Fig. 4

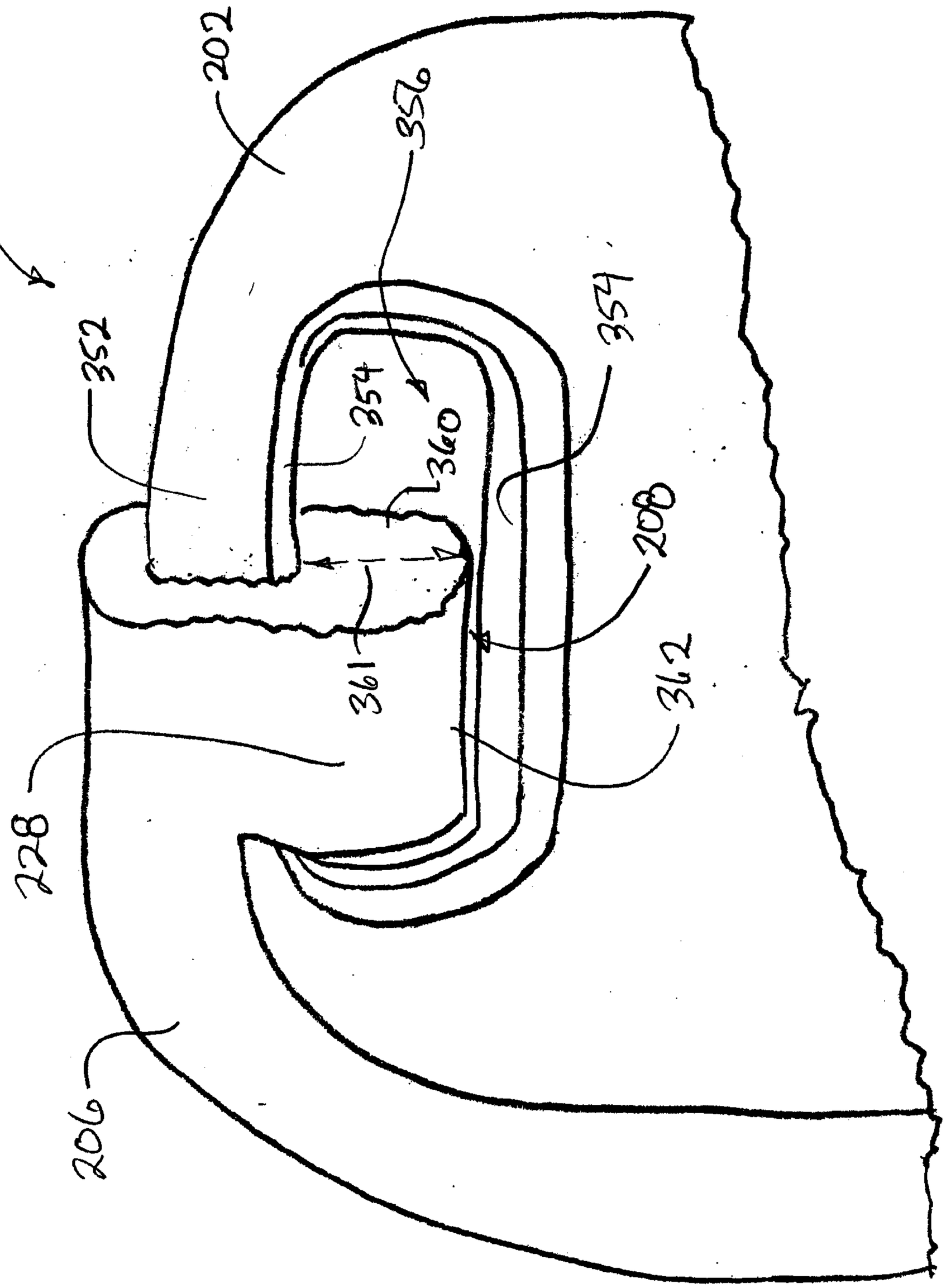


Fig 5

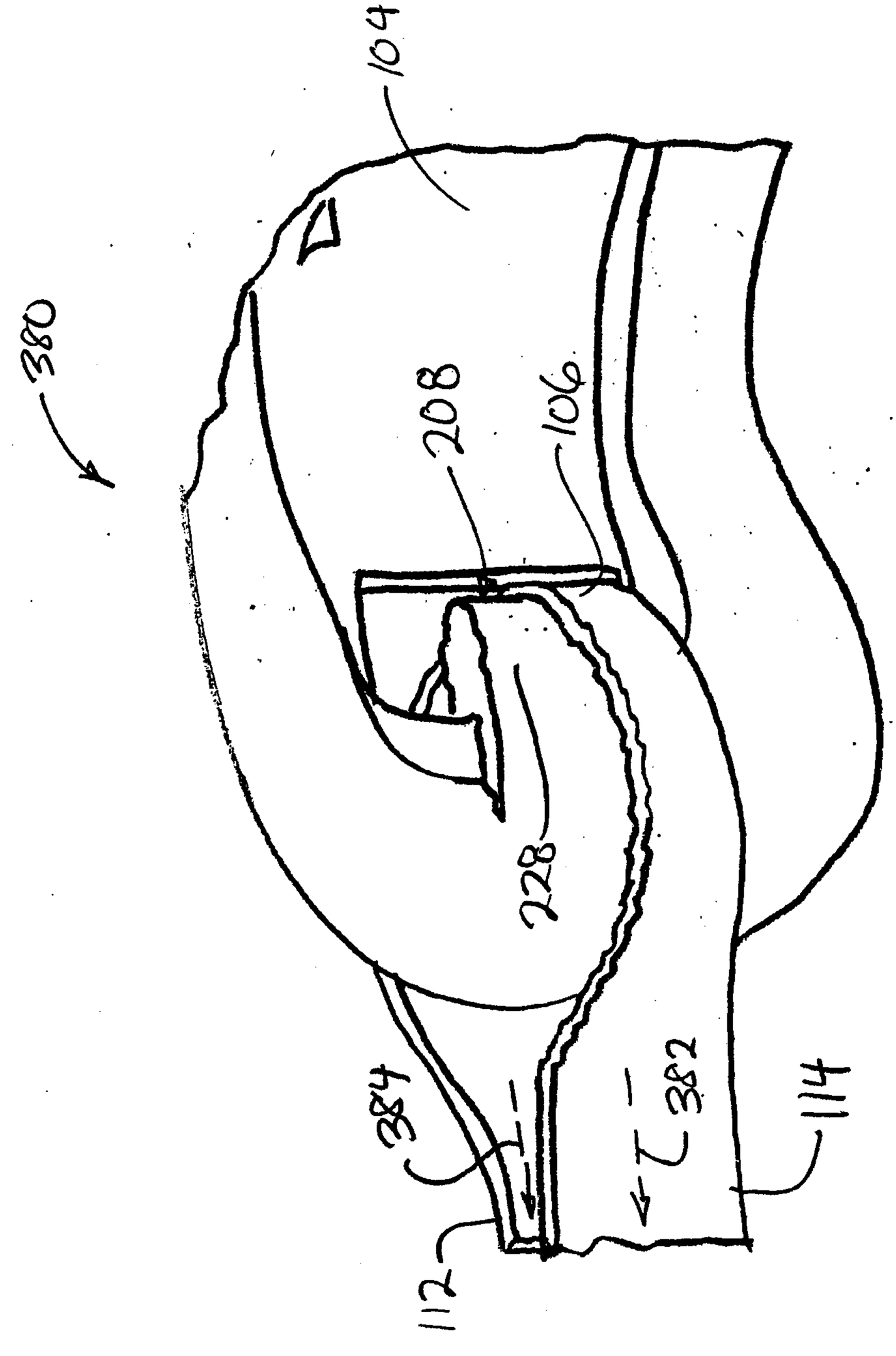


FIG. 6

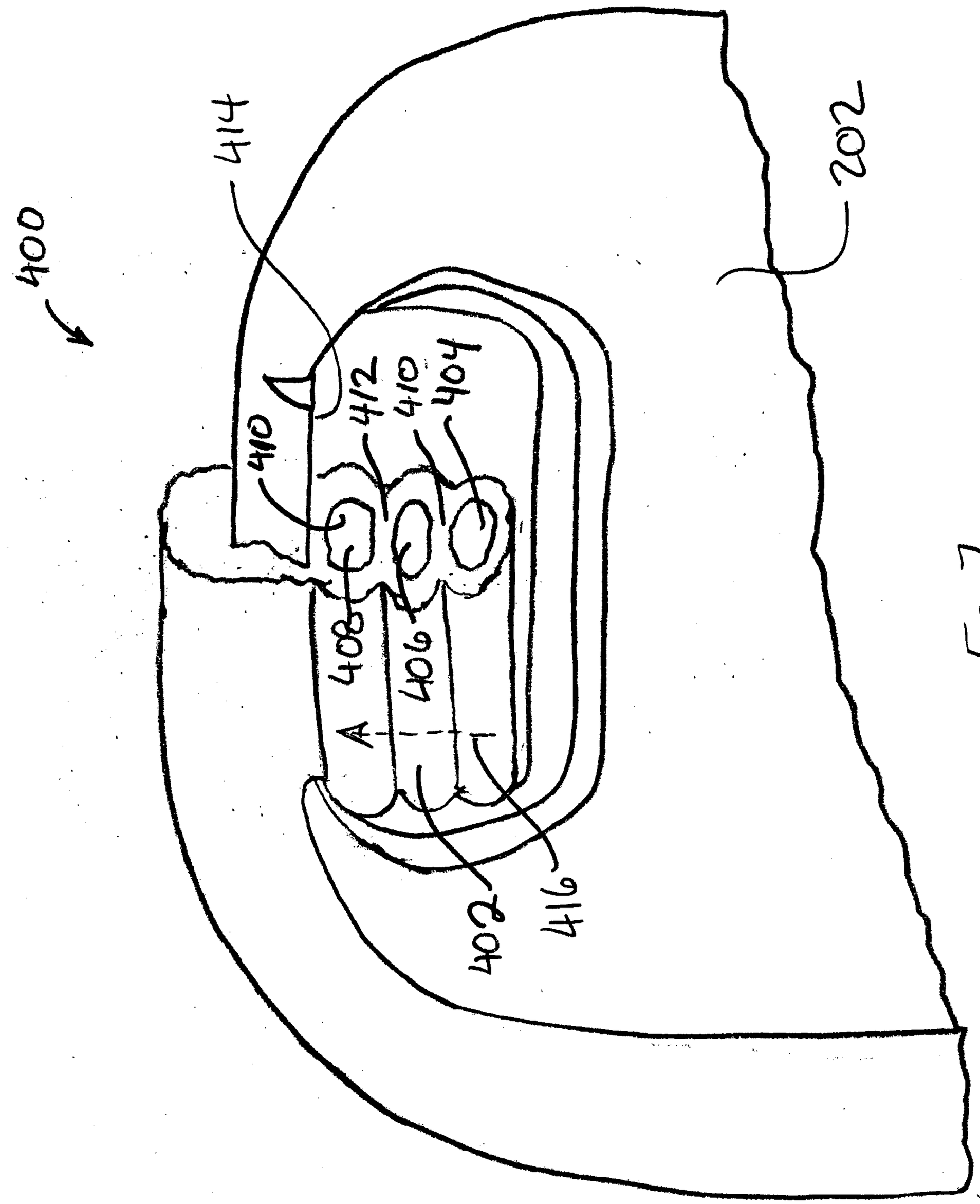


Fig. 7

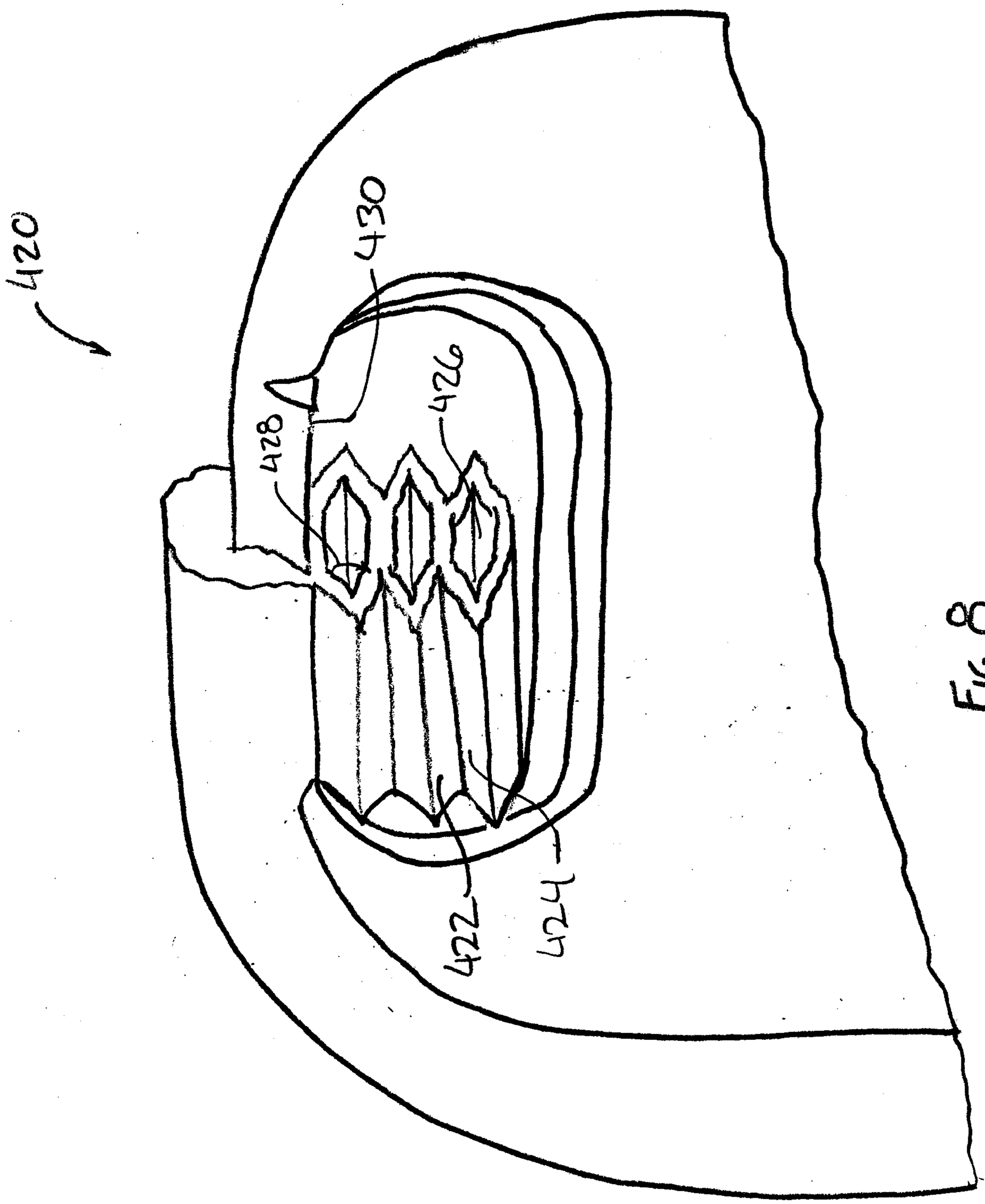


Fig. 8

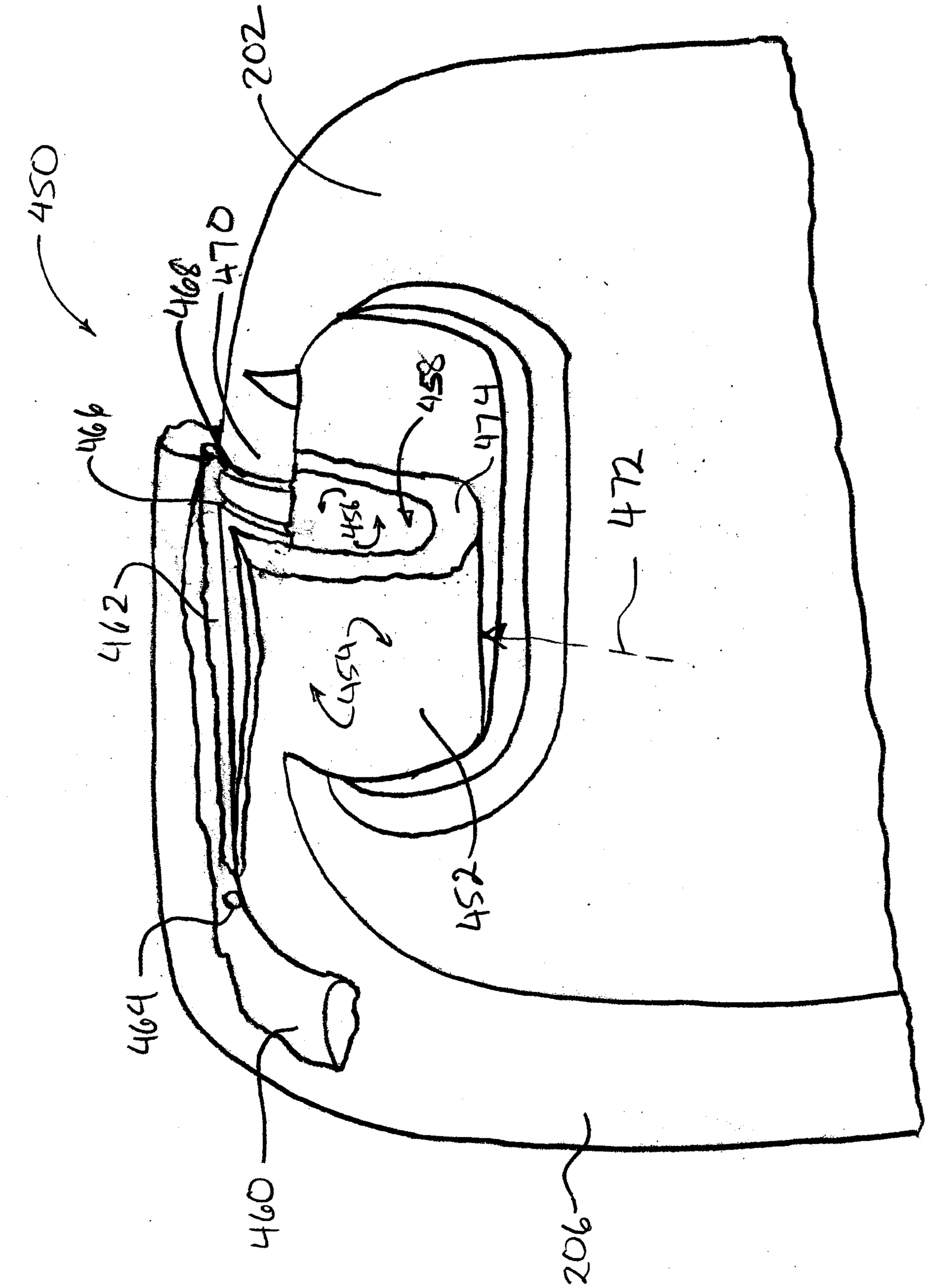


Fig. 9

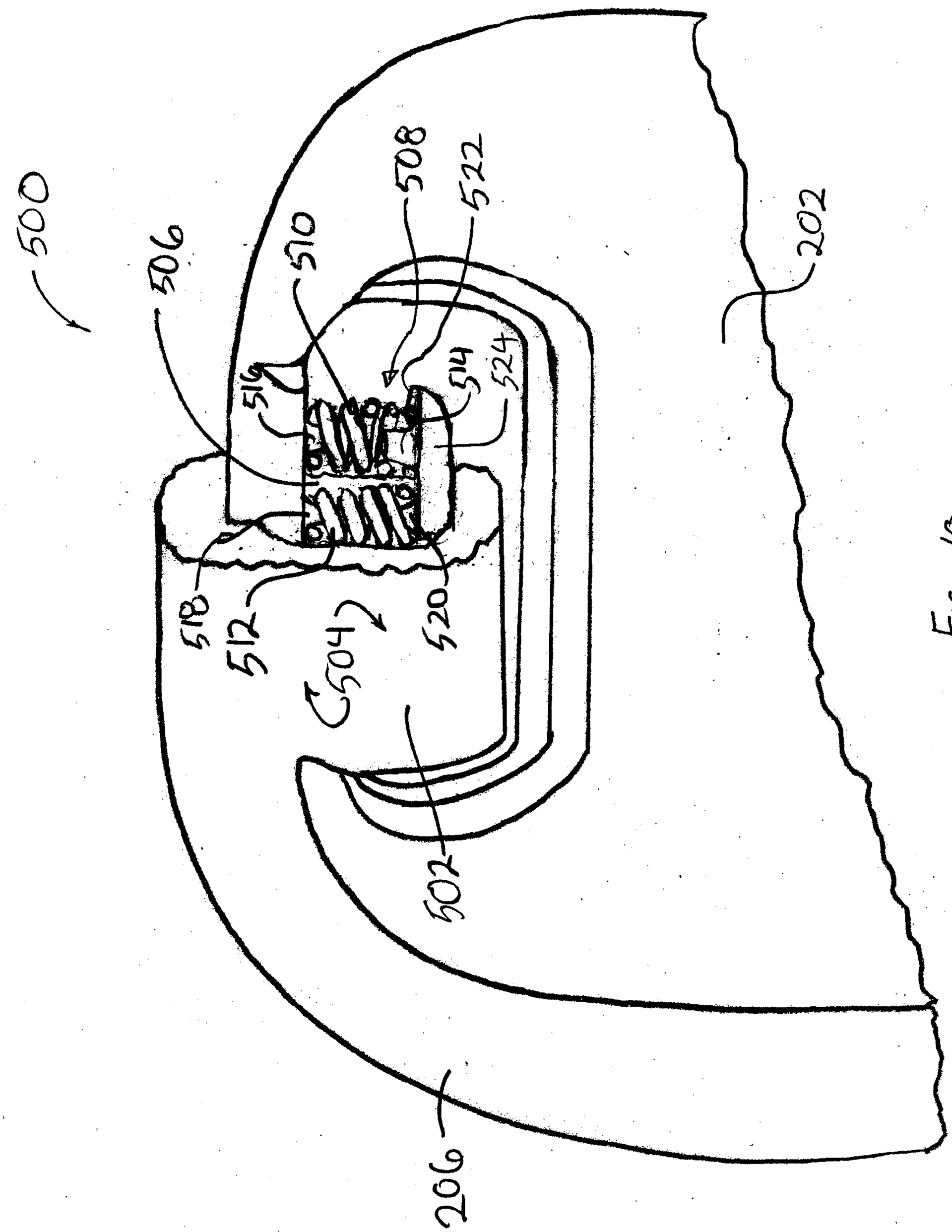


FIG. 10

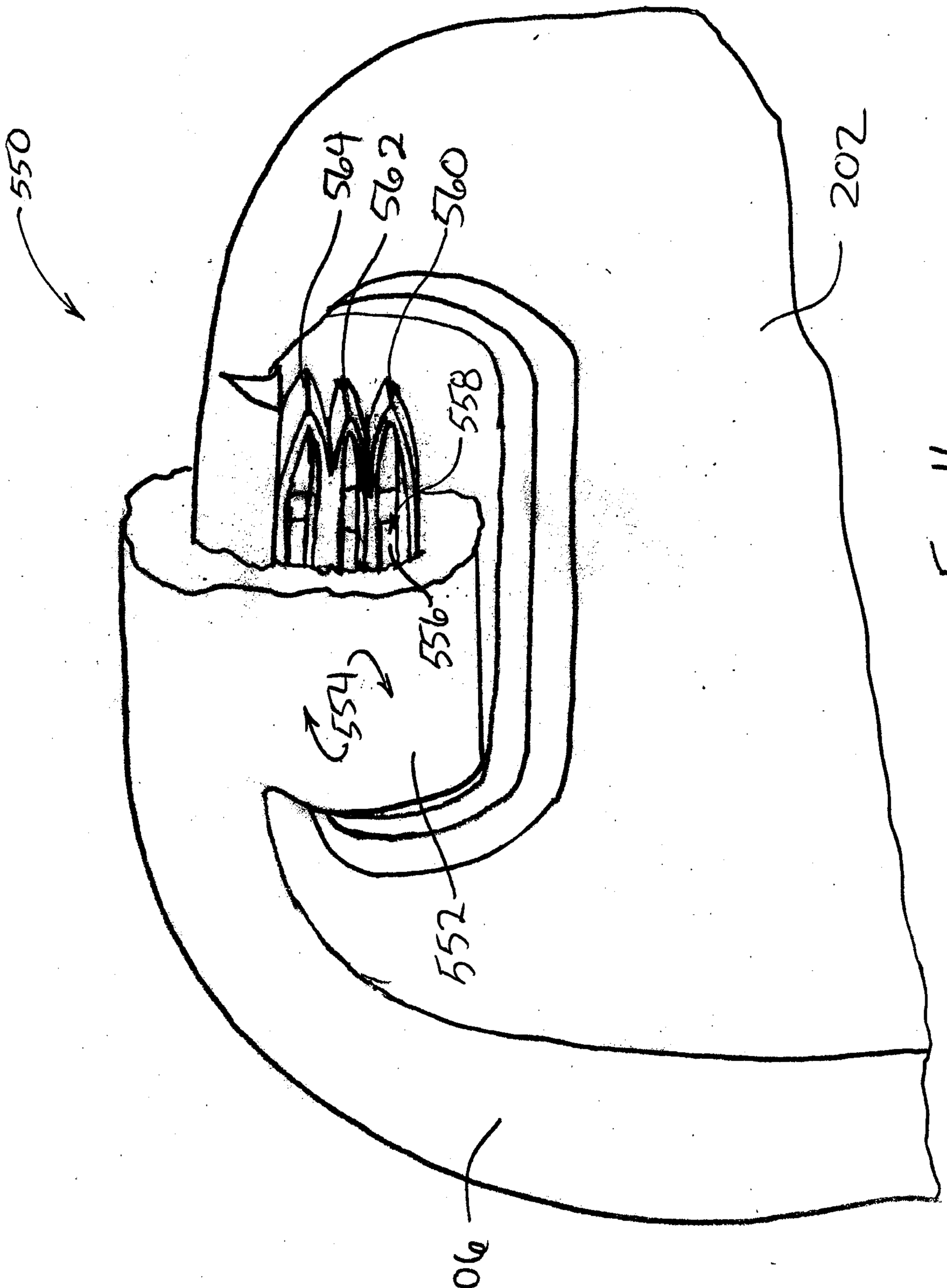


Fig. 11

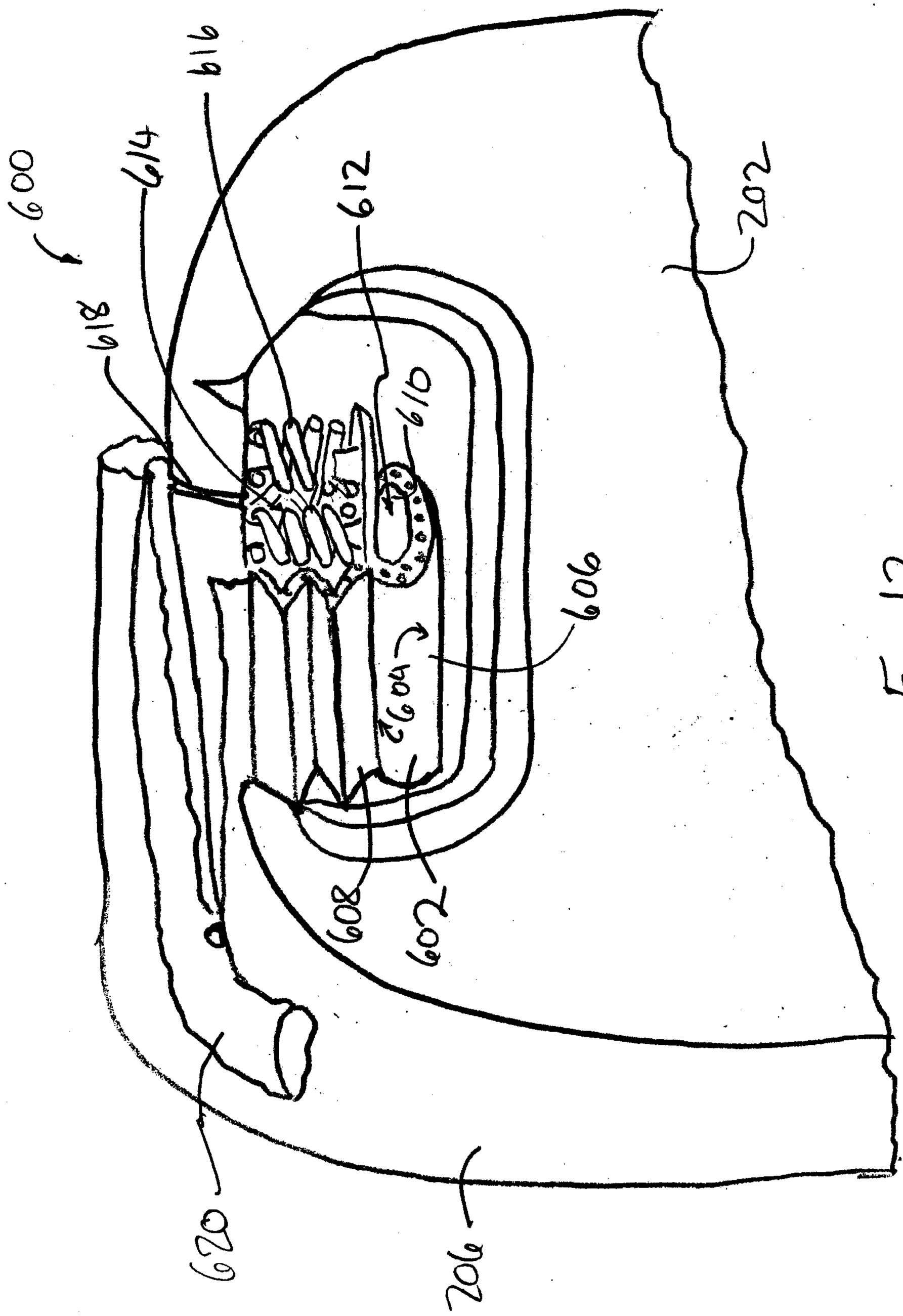


FIG. 12

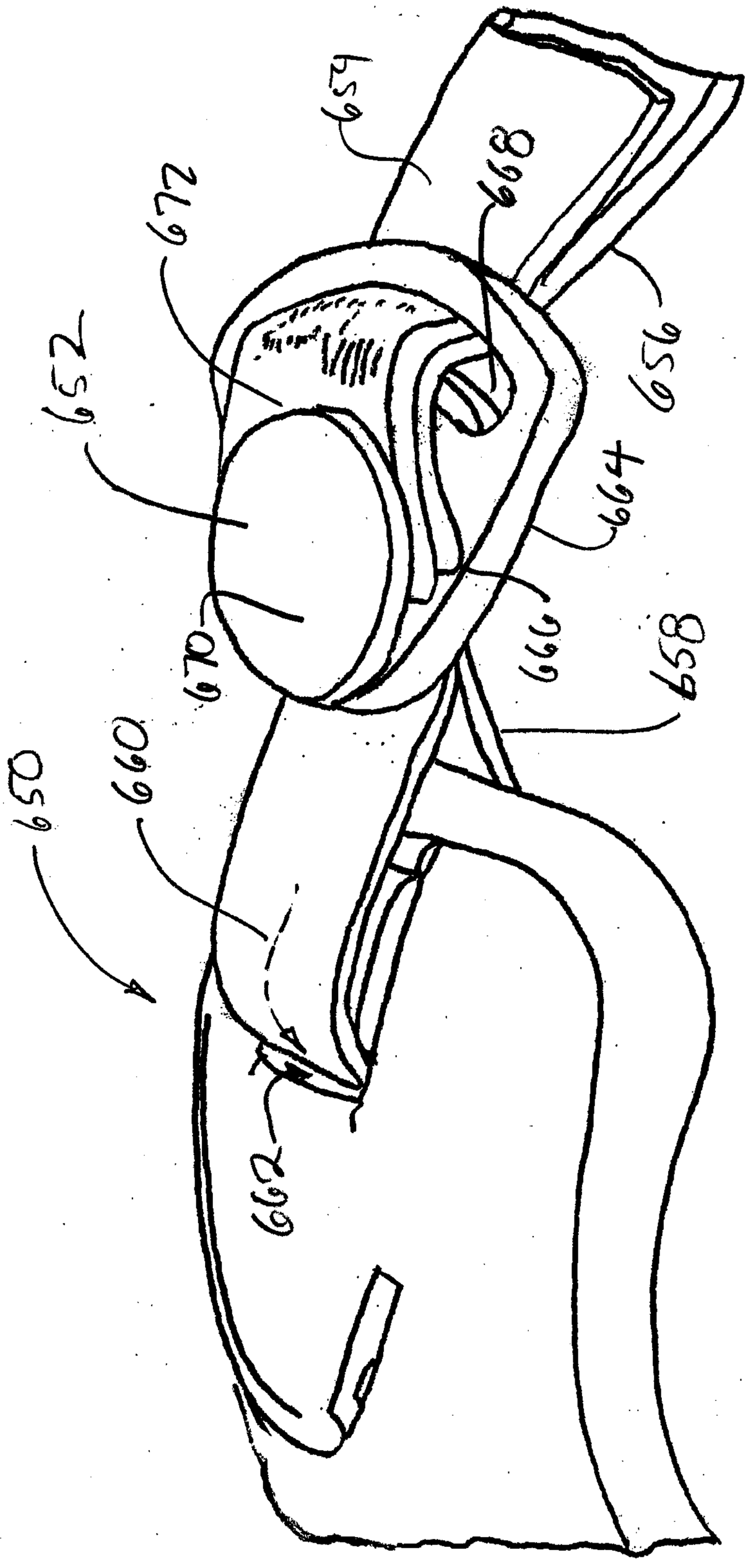


Fig. 13

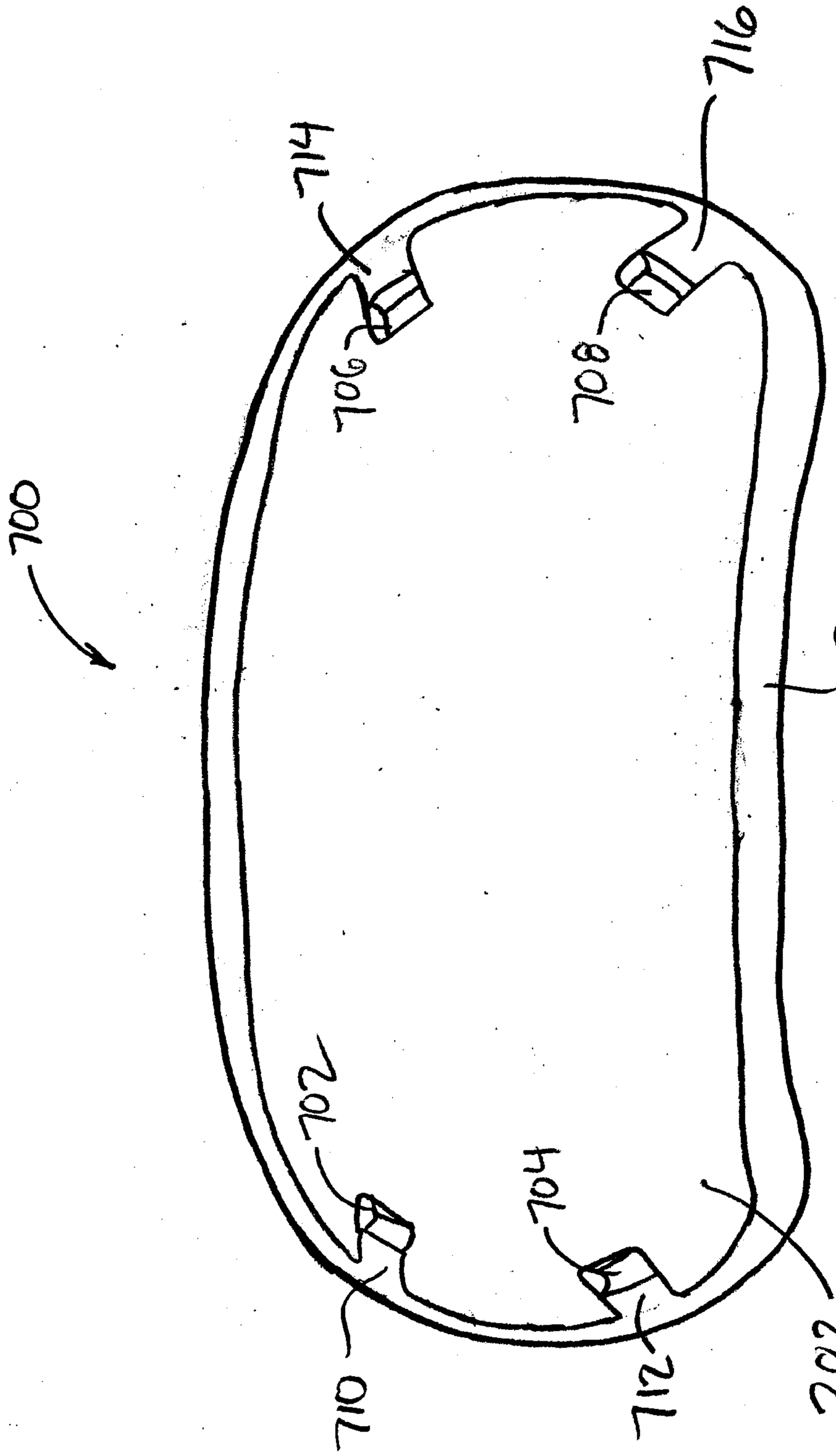


Fig. 14

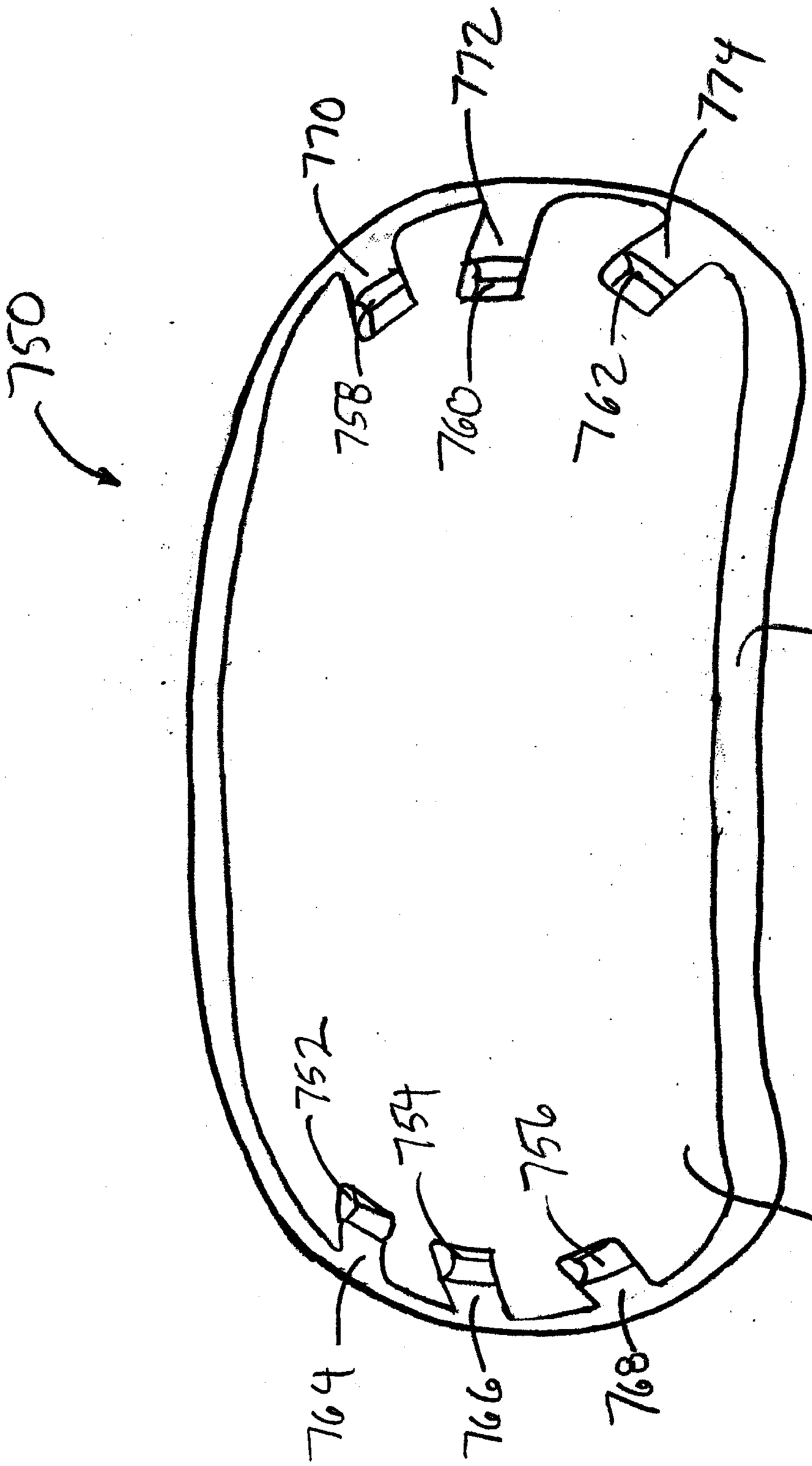


FIG. 15

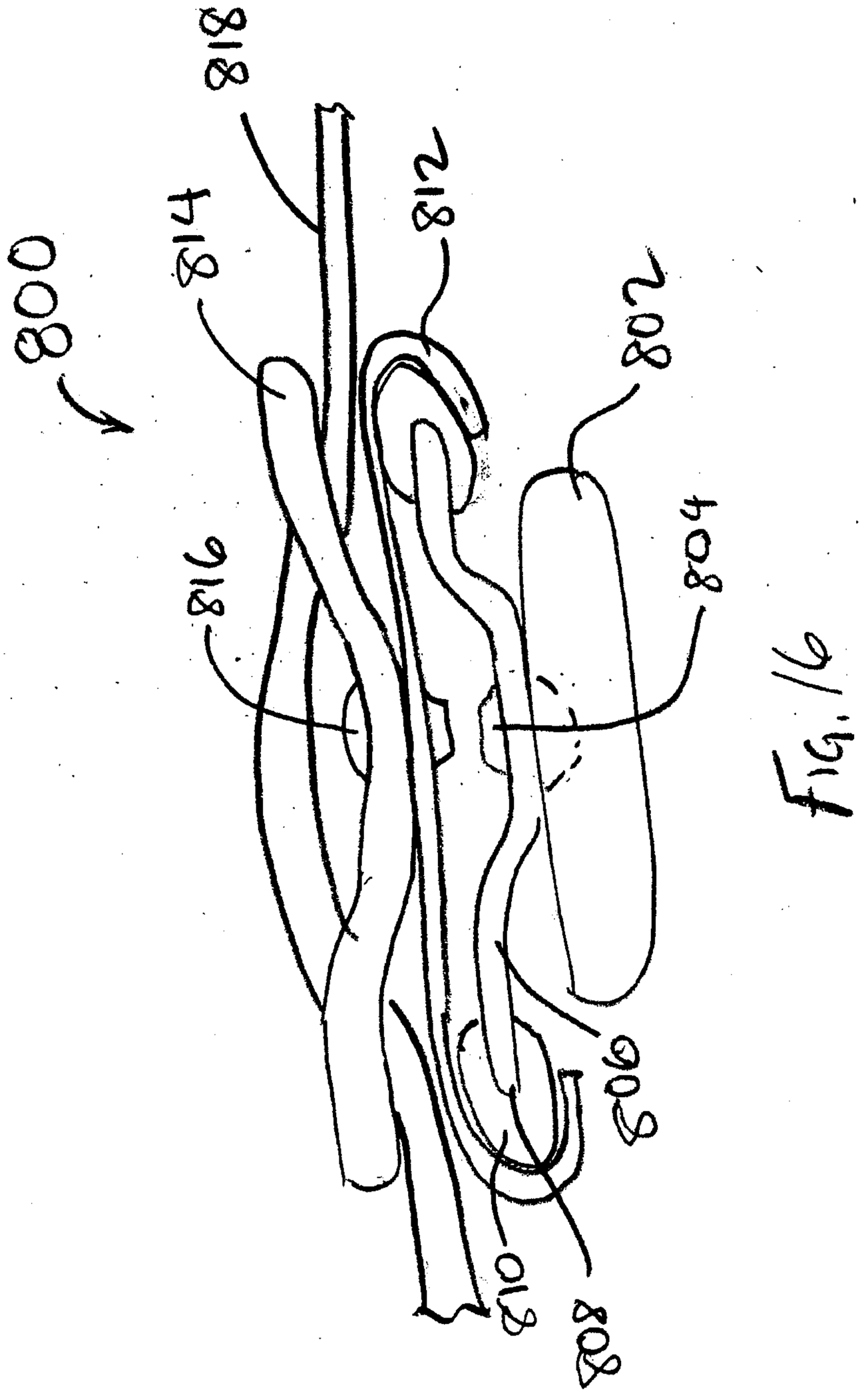
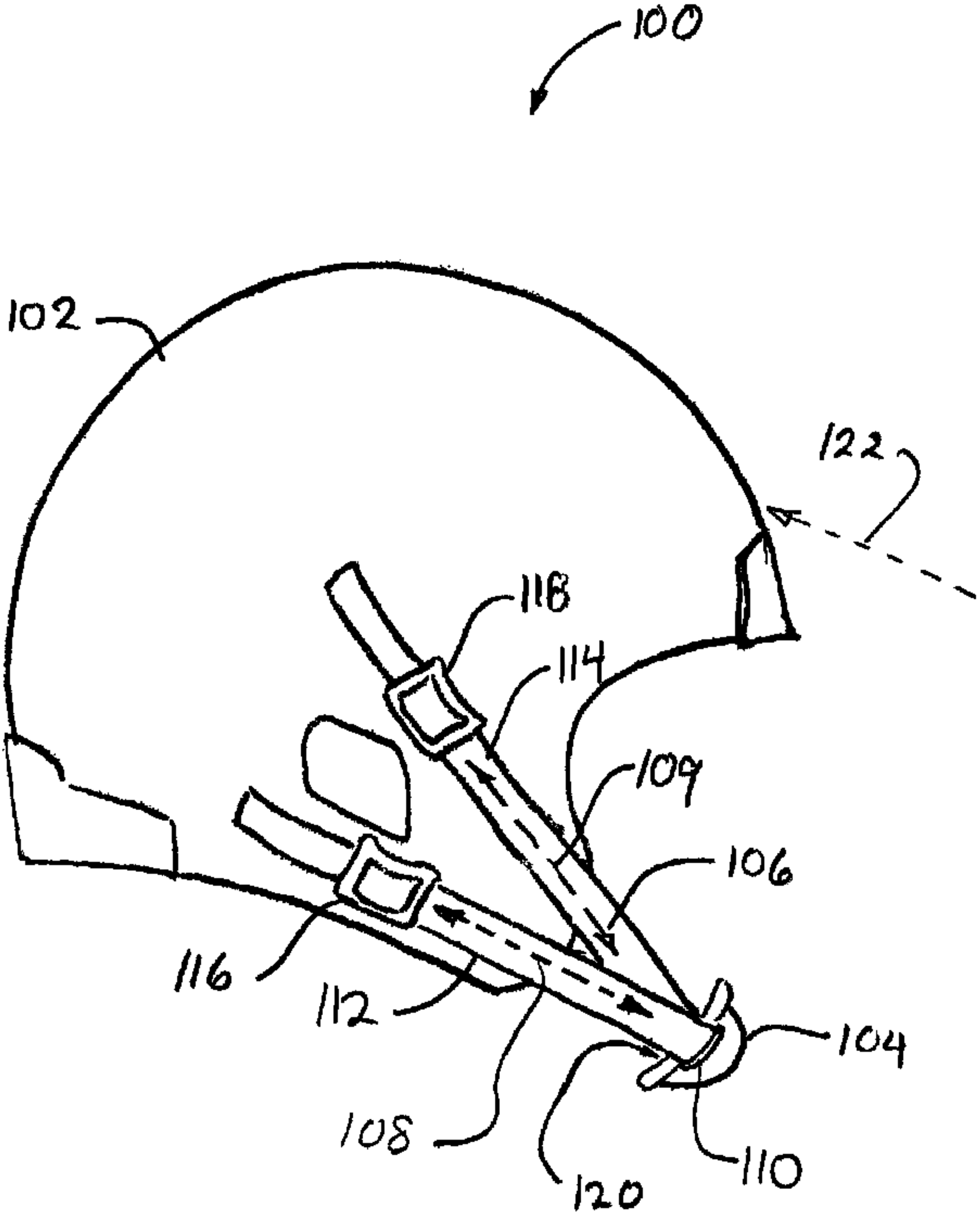


FIG. 16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