United States of America

To Promote the Progress of Science and Useful Arts

The Director

of the United States Patent and Trademark Office has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this United States

Patent

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Acting Director of the United States Patent and Trademark Office

Maintenance Fee Notice

If the application for this patent was filed on or after December 12, 1980, maintenance fees are due three years and six months, seven years and six months, and eleven years and six months after the date of this grant, or within a grace period of six months thereafter upon payment of a surcharge as provided by law. The amount, number and timing of the maintenance fees required may be changed by law or regulation. Unless payment of the applicable maintenance fee is received in the United States Patent and Trademark Office on or before the date the fee is due or within a grace period of six months thereafter, the patent will expire as of the end of such grace period.

Patent Term Notice

If the application for this patent was filed on or after June 8, 1995, the term of this patent begins on the date on which this patent issues and ends twenty years from the filing date of the application or, if the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121, 365(c), or 386(c), twenty years from the filing date of the earliest such application ("the twenty-year term"), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b), and any extension as provided by 35 U.S.C. 154(b) or 156 or any disclaimer under 35 U.S.C. 253.

If this application was filed prior to June 8, 1995, the term of this patent begins on the date on which this patent issues and ends on the later of seventeen years from the date of the grant of this patent or the twenty-year term set forth above for patents resulting from applications filed on or after June 8, 1995, subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b) and any extension as provided by 35 U.S.C. 156 or any disclaimer under 35 U.S.C. 253.

US012250511B2

(12) **United States Patent**
Chenal

(10) **Patent No.: US 12,250,511 B2**
(45) **Date of Patent: *Mar. 11, 2025**

(54) **APPARATUS AND METHOD FOR TUNED-FREQUENCY-SPECTRUM EARPIECE**

(71) Applicant: **JMJ Holdings, LLC**, Frederic, WI (US)

(72) Inventor: **David M. Chenal**, Frederic, WI (US)

(73) Assignee: **JMJ Holdings, LLC**, Frederic, WI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **18/781,794**

(22) Filed: **Jul. 23, 2024**

(65) **Prior Publication Data**

US 2024/0397250 A1 Nov. 28, 2024

Related U.S. Application Data

(63) Continuation of application No. 18/371,400, filed on Sep. 21, 2023, now Pat. No. 12,047,732.
(Continued)

(51) **Int. Cl.**
A61F 11/06 (2006.01)
H04R 1/10 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***H04R 1/1083*** (2013.01); ***H04R 1/1016*** (2013.01); ***H04R 1/22*** (2013.01); ***H04R 1/30*** (2013.01)

(58) **Field of Classification Search**
CPC H04R 1/1083; H04R 1/1016; H04R 1/22; H04R 1/30
See application file for complete search history.

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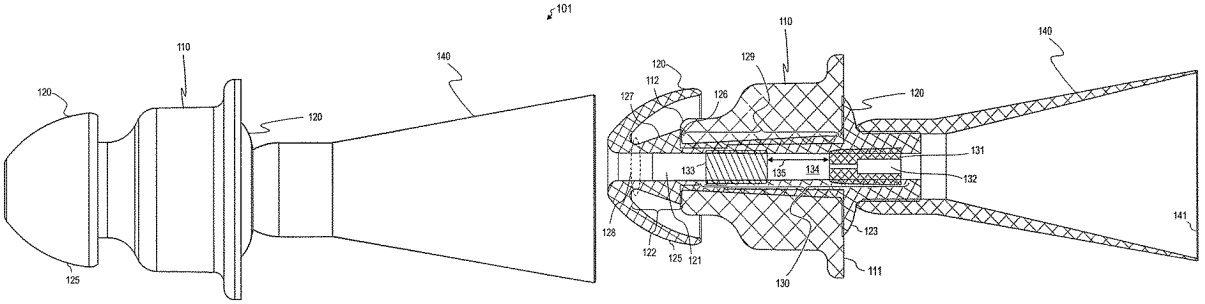
Primary Examiner — Simon King
(74) *Attorney, Agent, or Firm* — Charles A. Lemaire; Lemaire Patent Law Firm, P.L.L.C.

(57) **ABSTRACT**

A tuned-frequency-spectrum earpiece for selectively tuning audio frequencies that enter an inner ear of a user wearing the earpiece, the earpiece including a base having an emitter end and receiver end, the base including a channel that passes through an entirety of the base; a sound-attenuation plug, wherein the sound-attenuation plug is configured to couple to the base such that the sound-attenuation plug surrounds at least a portion of the channel of the base; a first filter device configured to insert into the channel of the base and to selectively reject undesired frequencies of the audio frequencies that enter the earpiece; and a frequency-selective sound collector operatively coupled to the receiver end of the base and configured to increase an amount of desired frequencies of the audio frequencies that enter the first filter device. Some embodiments increase the amount of sound from some directions while reducing sound from other directions.

20 Claims, 43 Drawing Sheets



Related U.S. Application Data

(60) Provisional application No. 63/409,408, filed on Sep. 23, 2022.

(51) **Int. Cl.**
H04R 1/22 (2006.01)
H04R 1/30 (2006.01)

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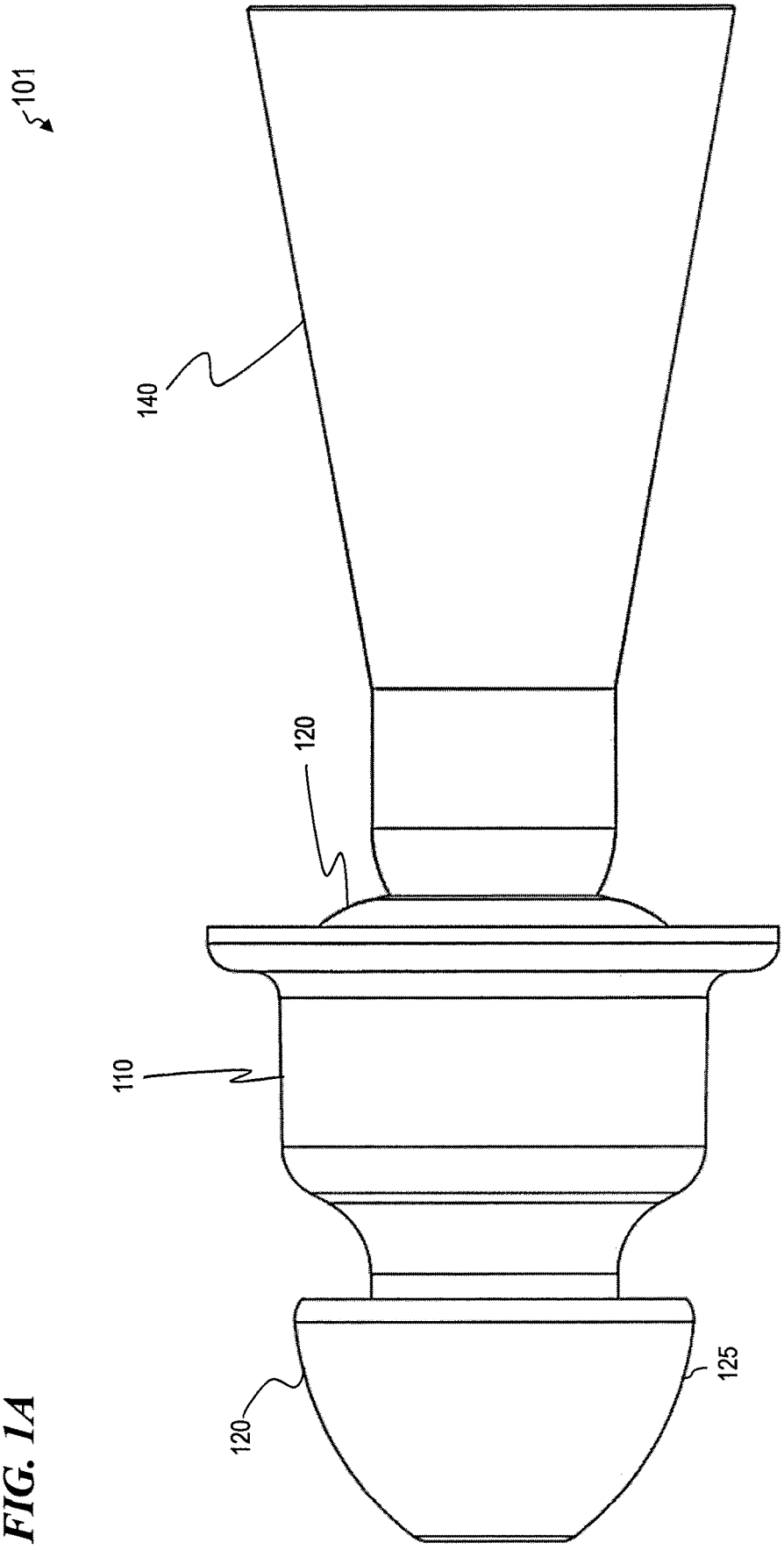

FIG. 1A

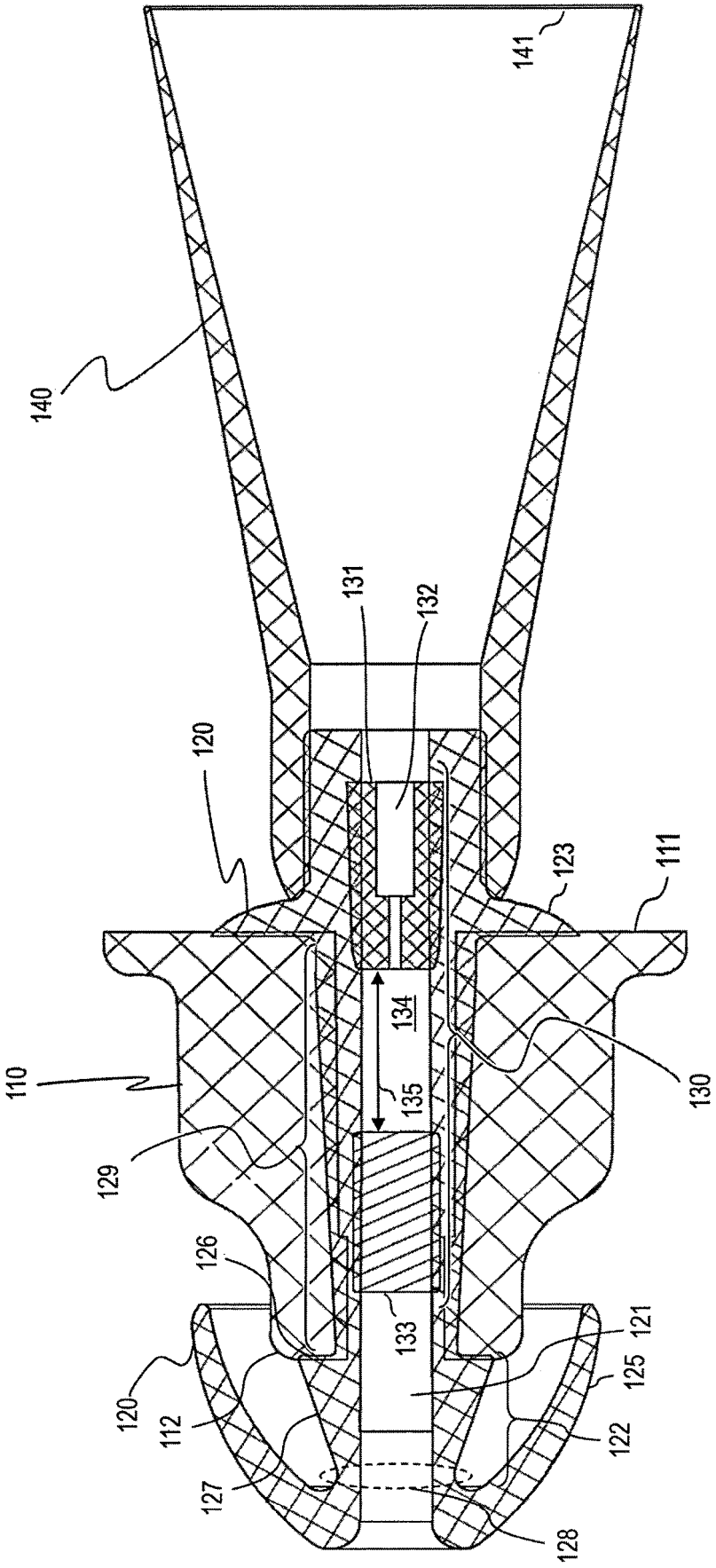
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FIG. 1B

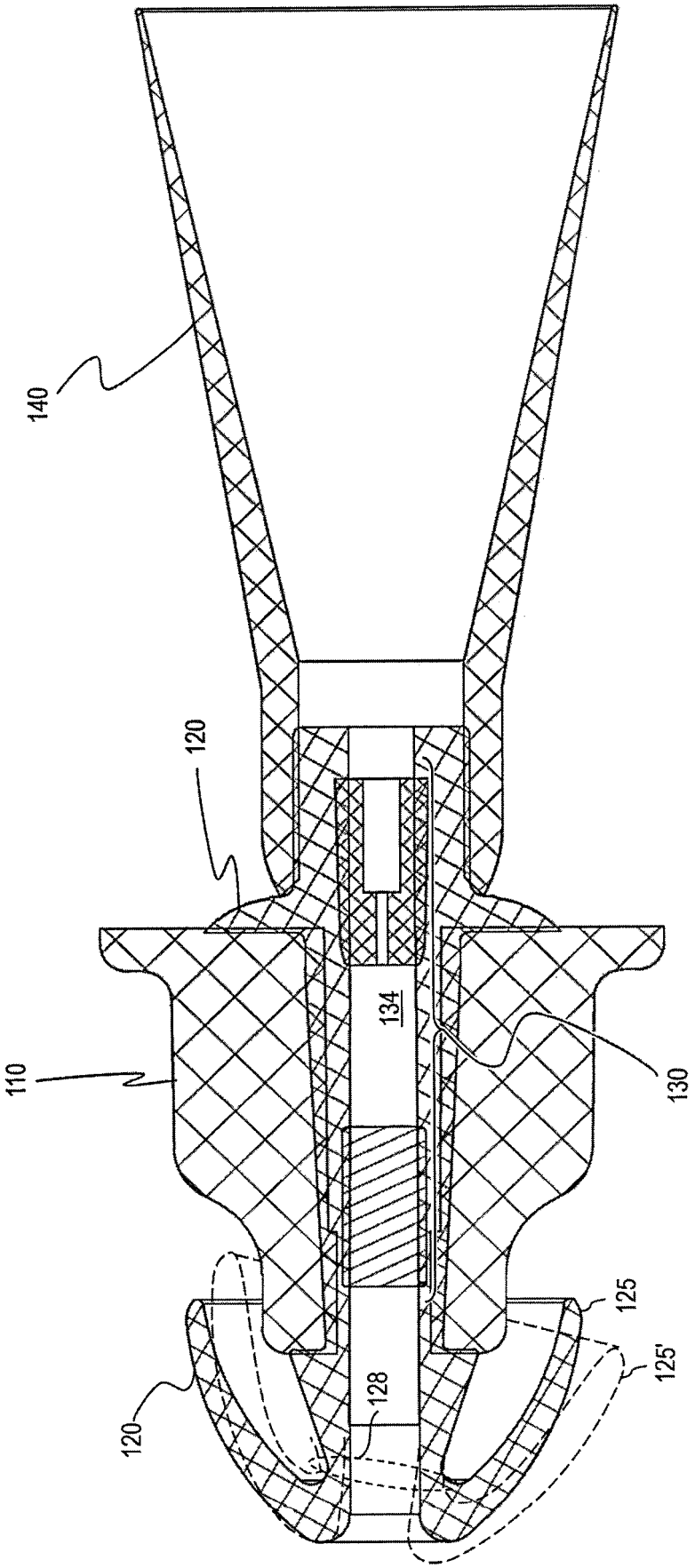


FIG. 1C

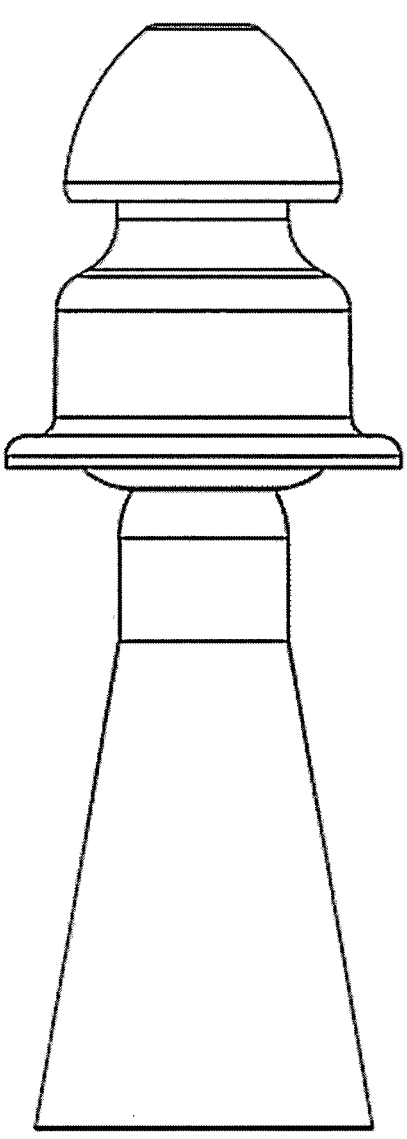


FIG. 1D

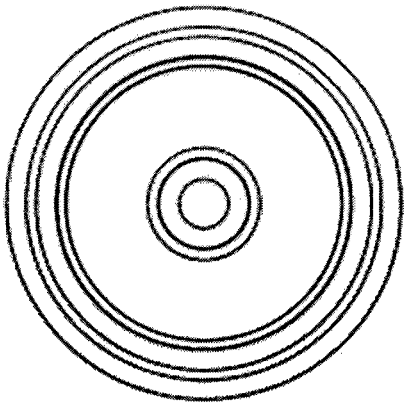


FIG. 1F

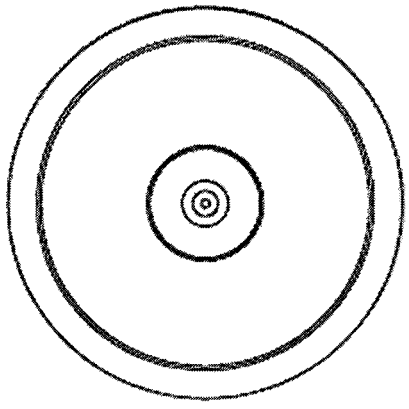


FIG. 1E

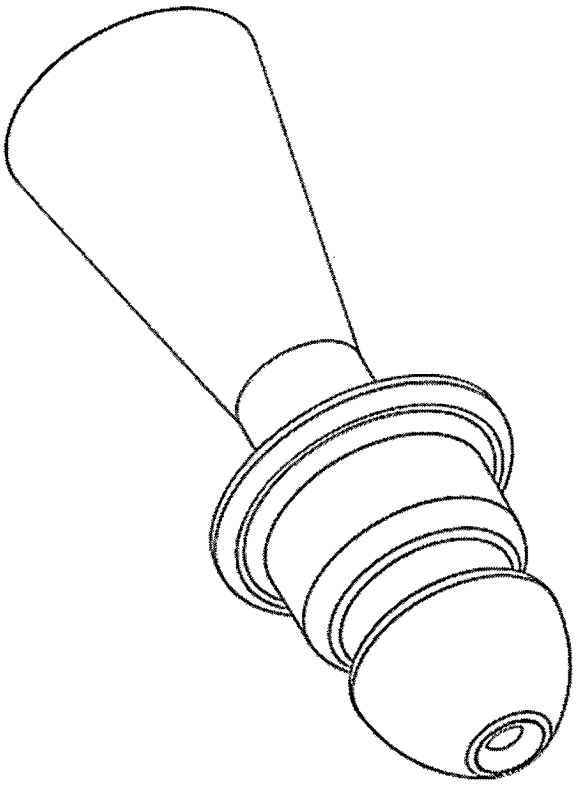


FIG. 1H

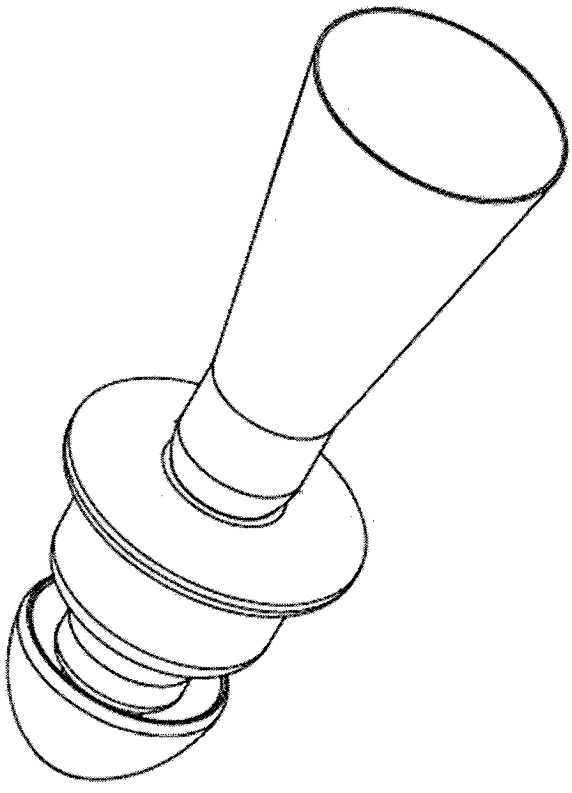


FIG. 1G

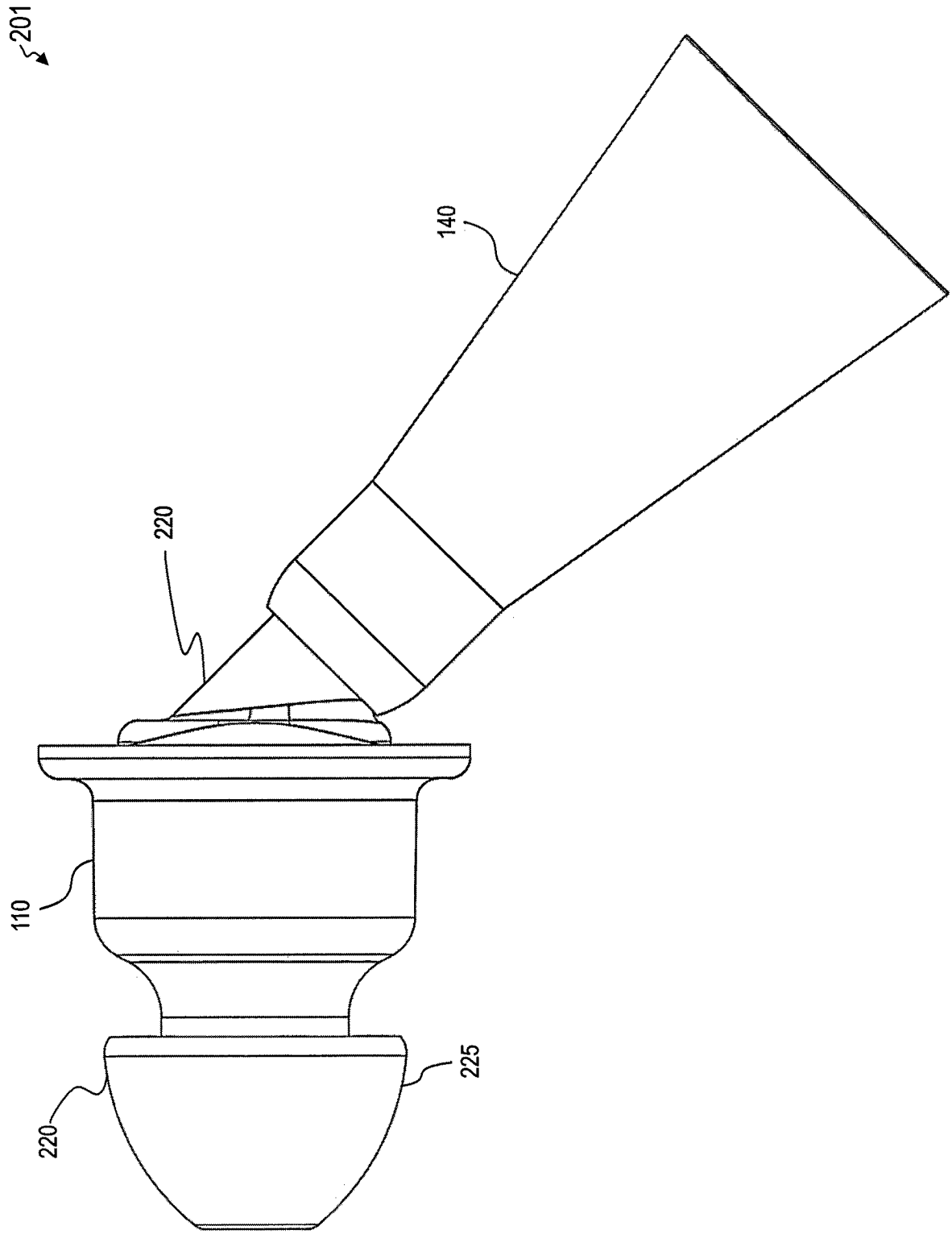


FIG. 2A

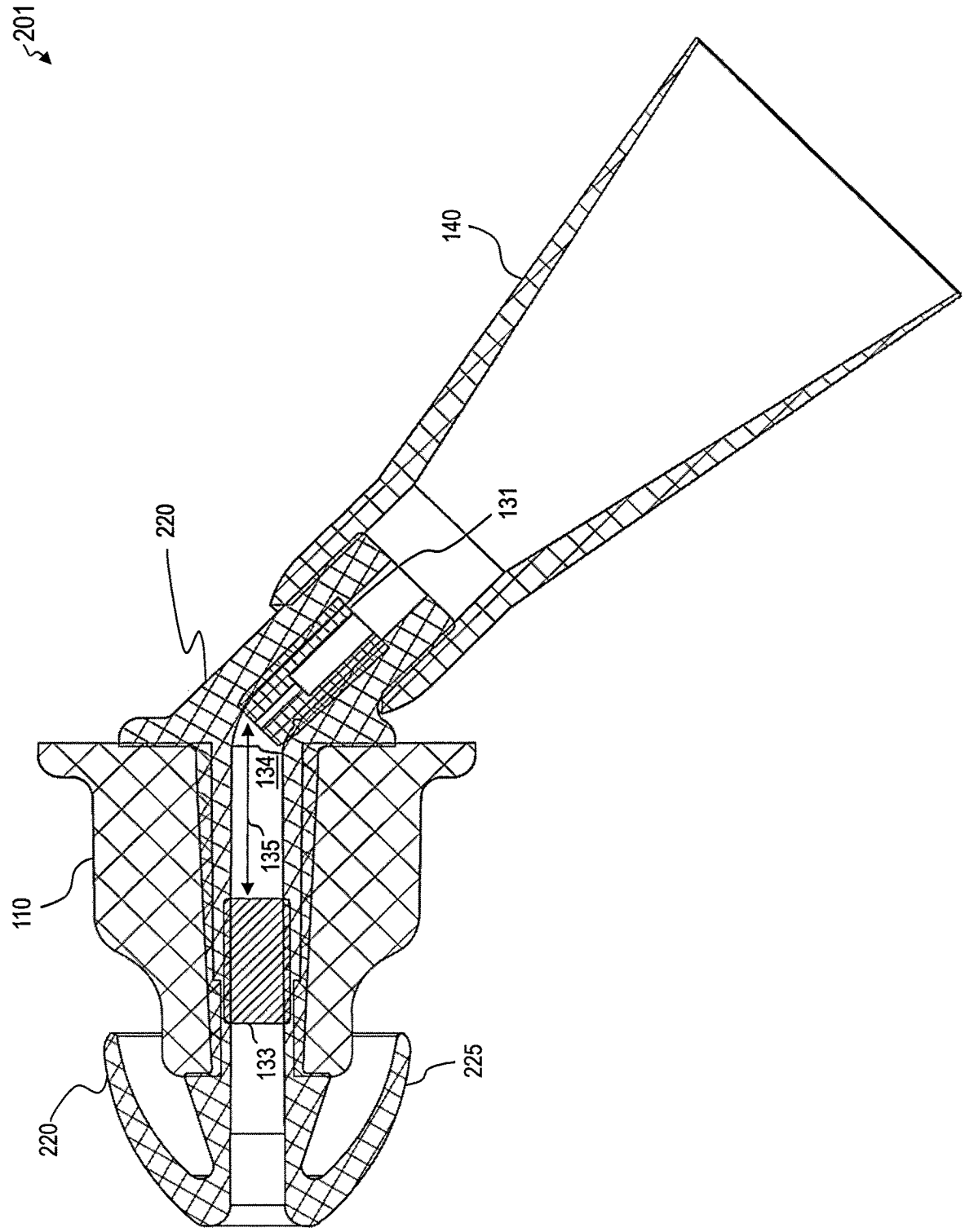


FIG. 2B

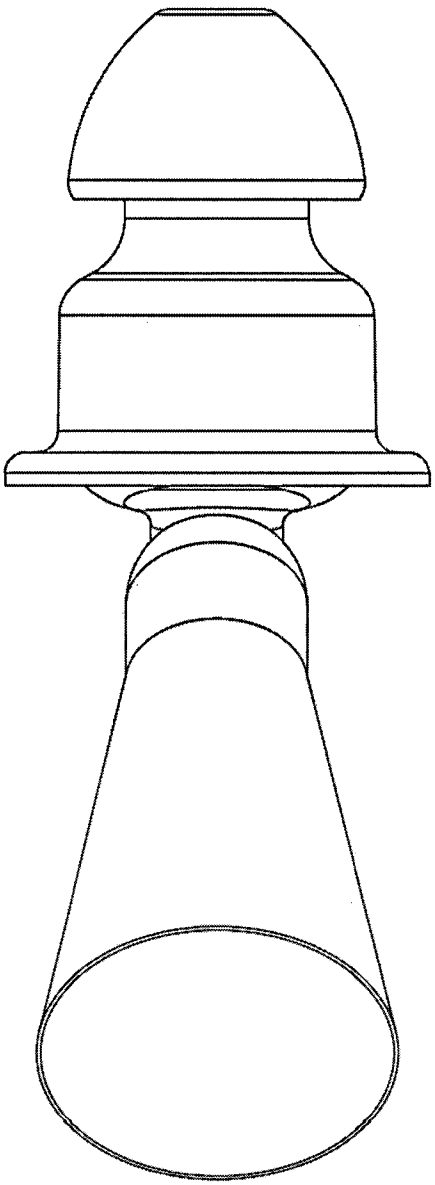


FIG. 2C

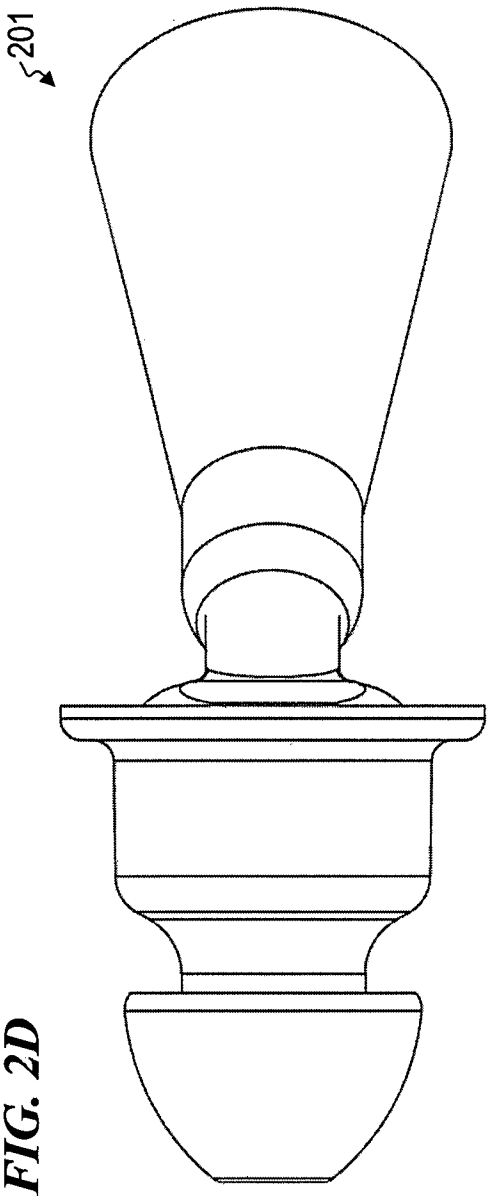
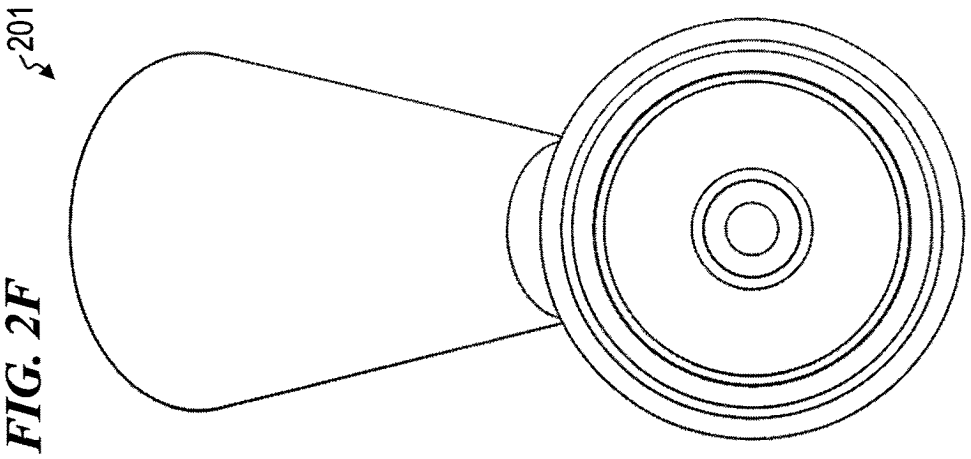


FIG. 2D



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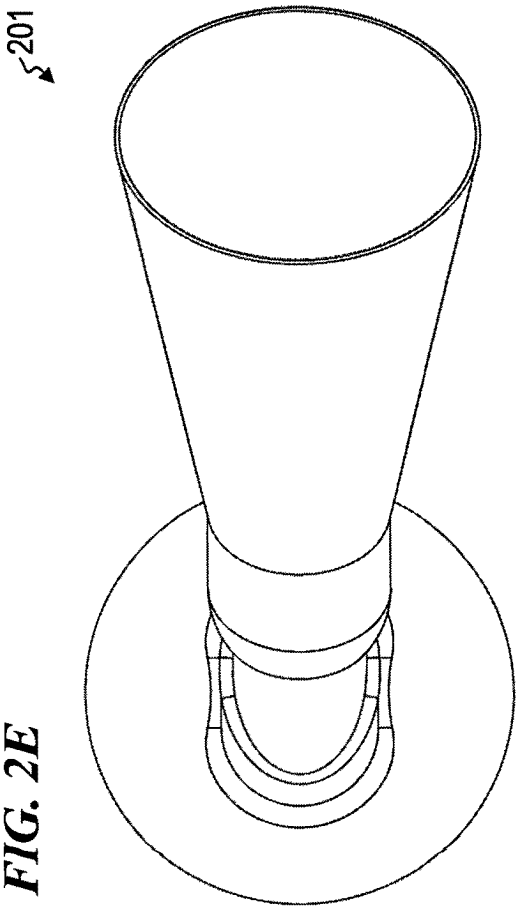

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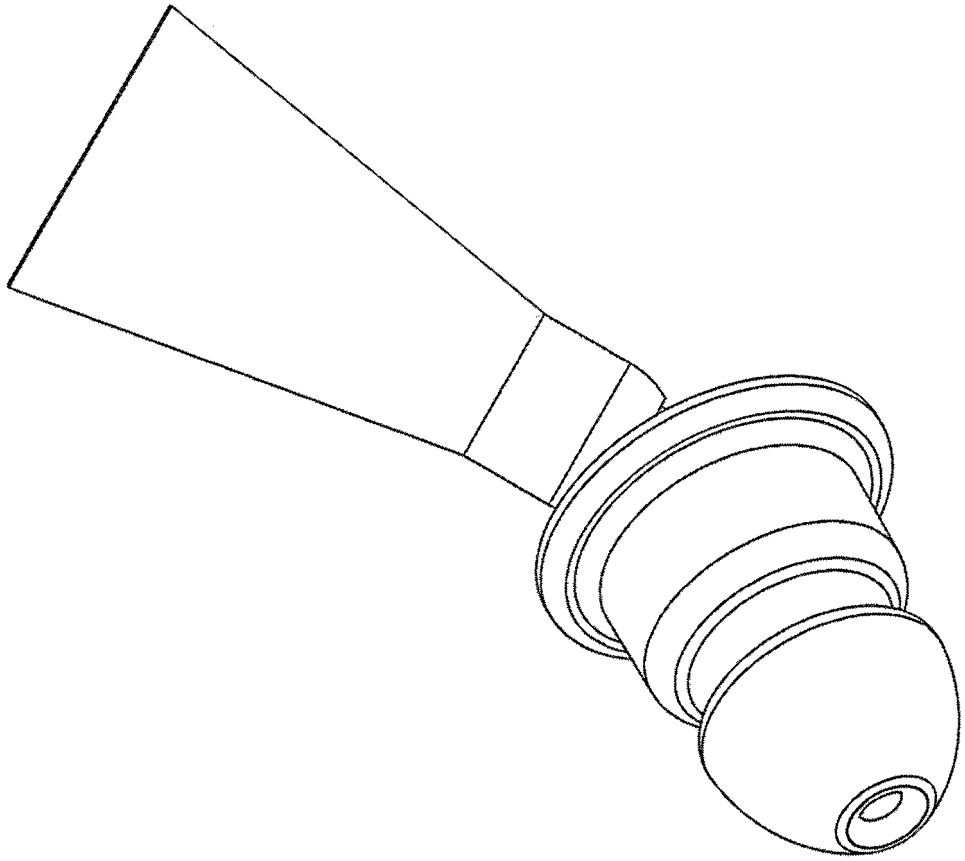

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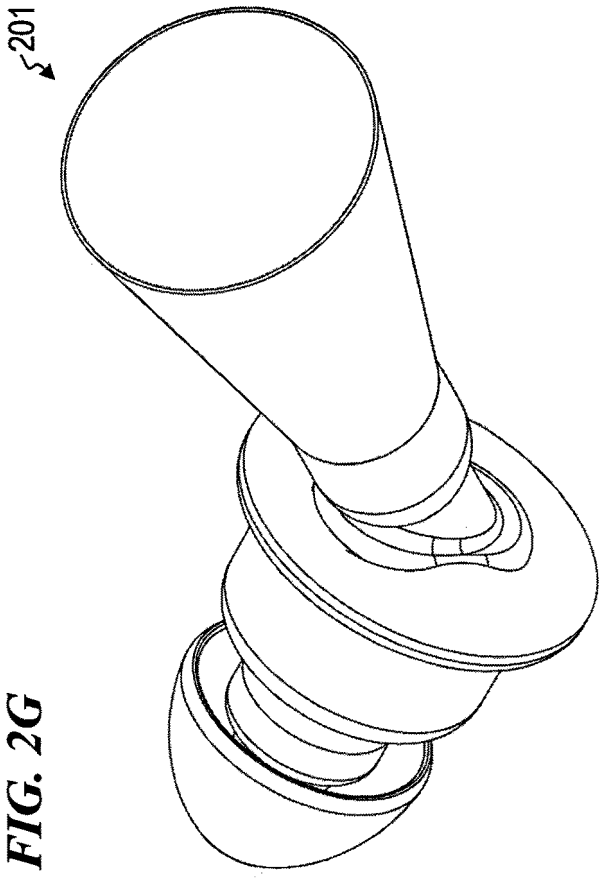


FIG. 2G

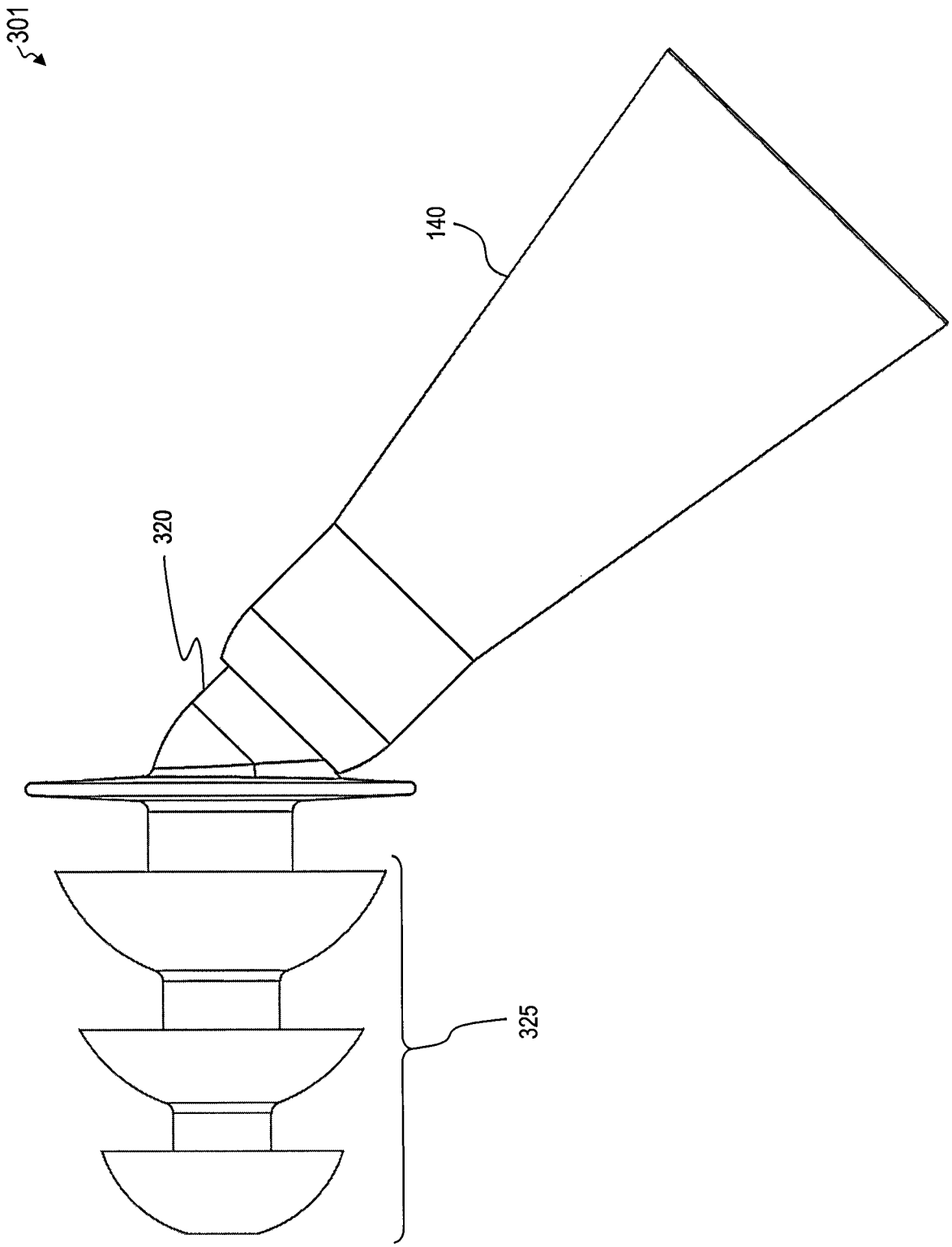


FIG. 3A

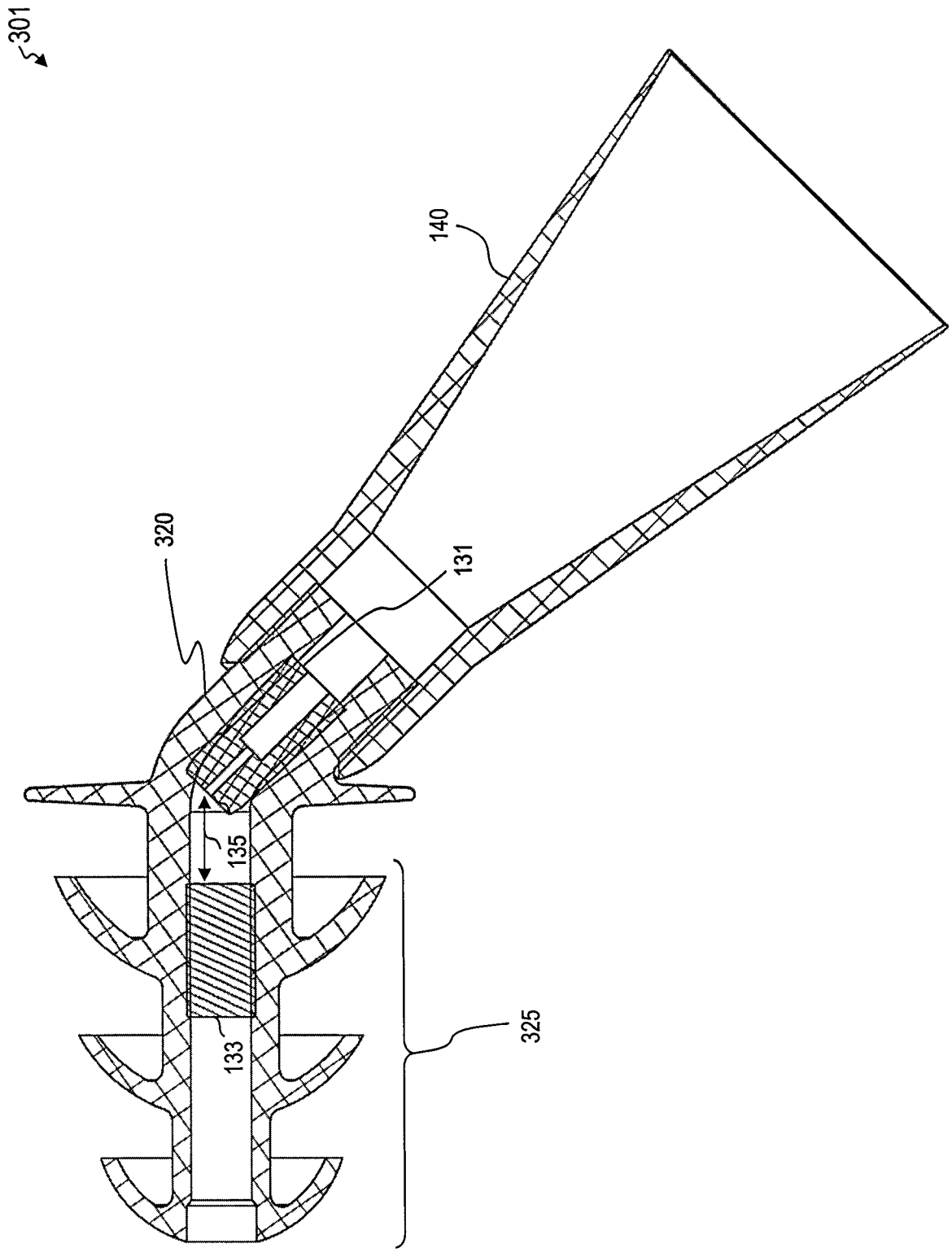


FIG. 3B

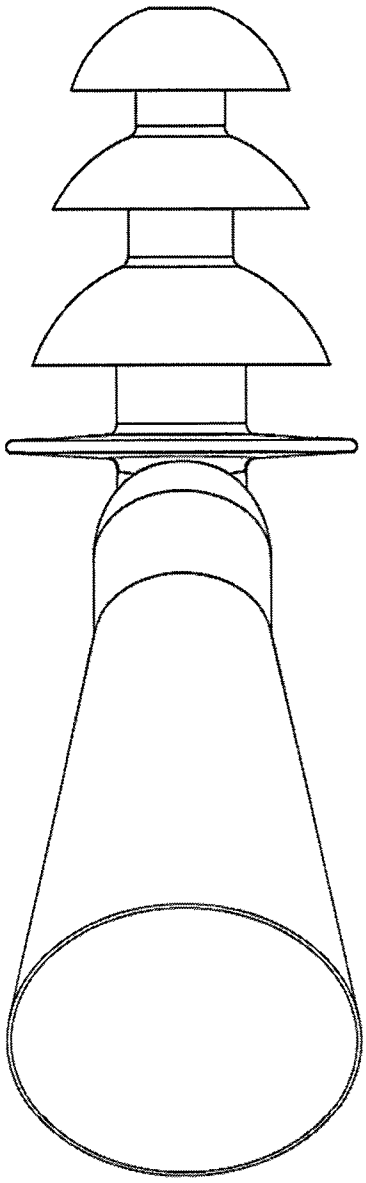
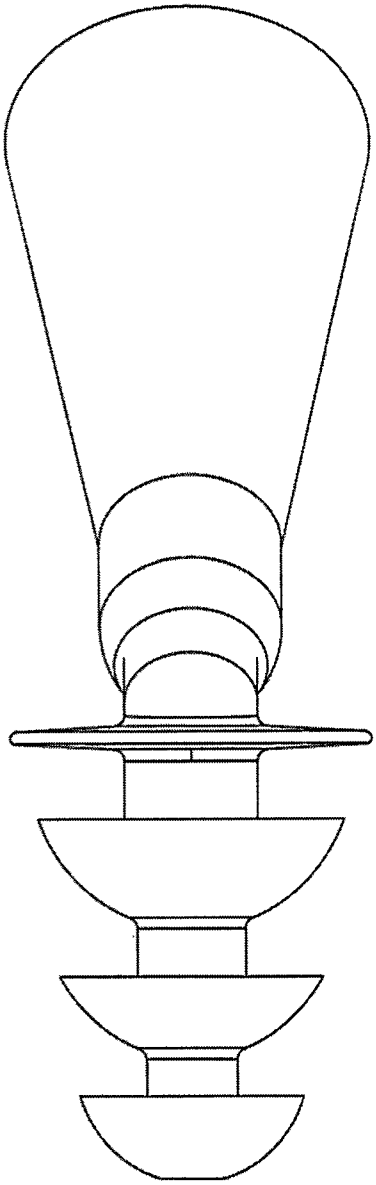


FIG. 3C



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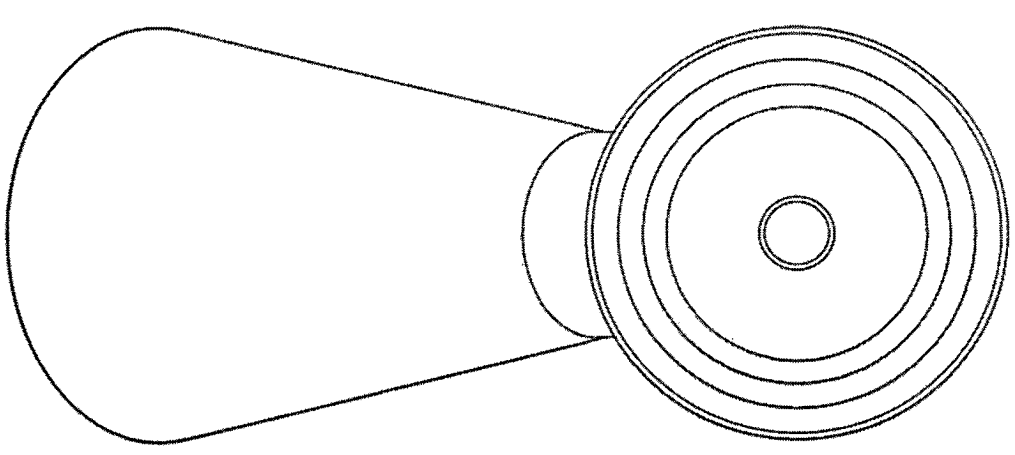
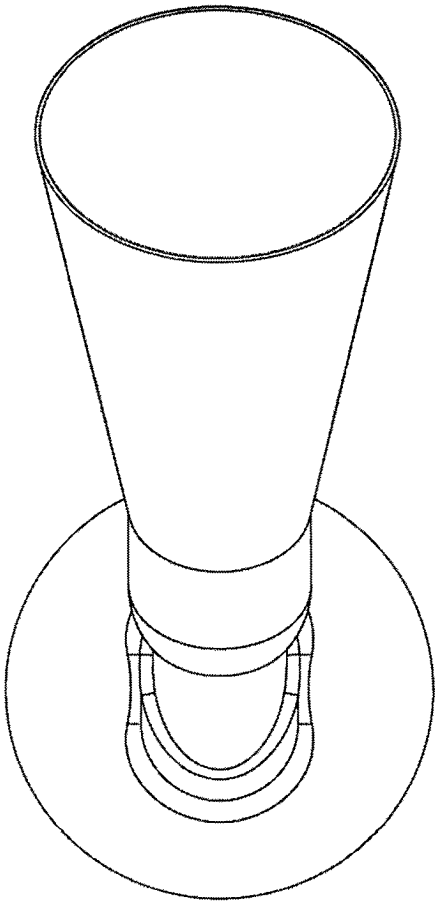


FIG. 3F



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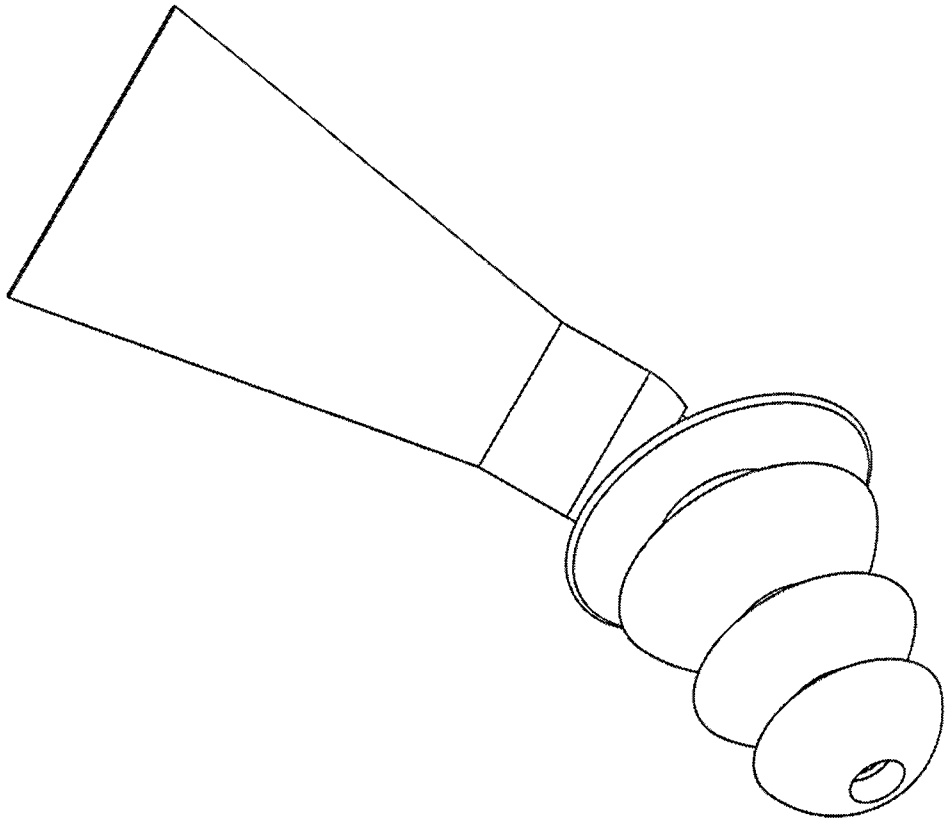

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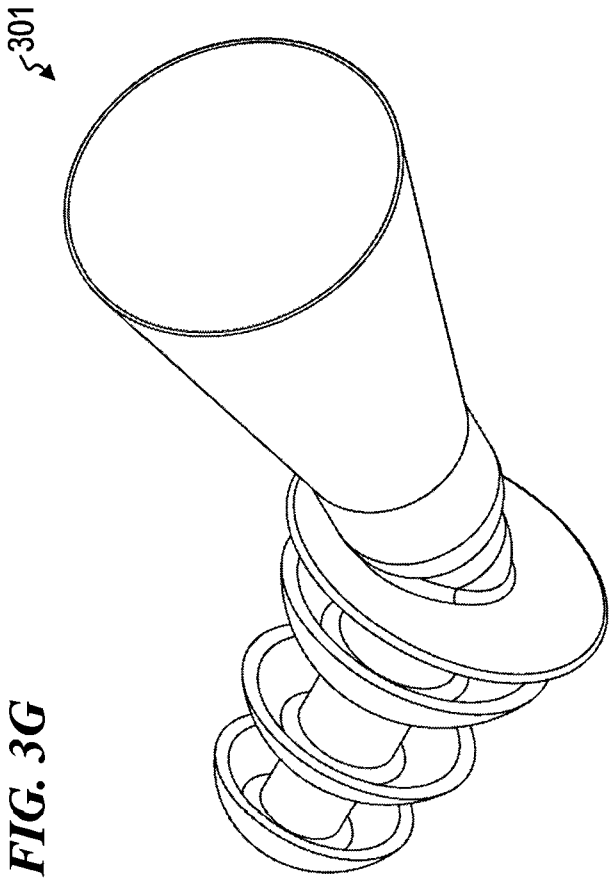


FIG. 3G

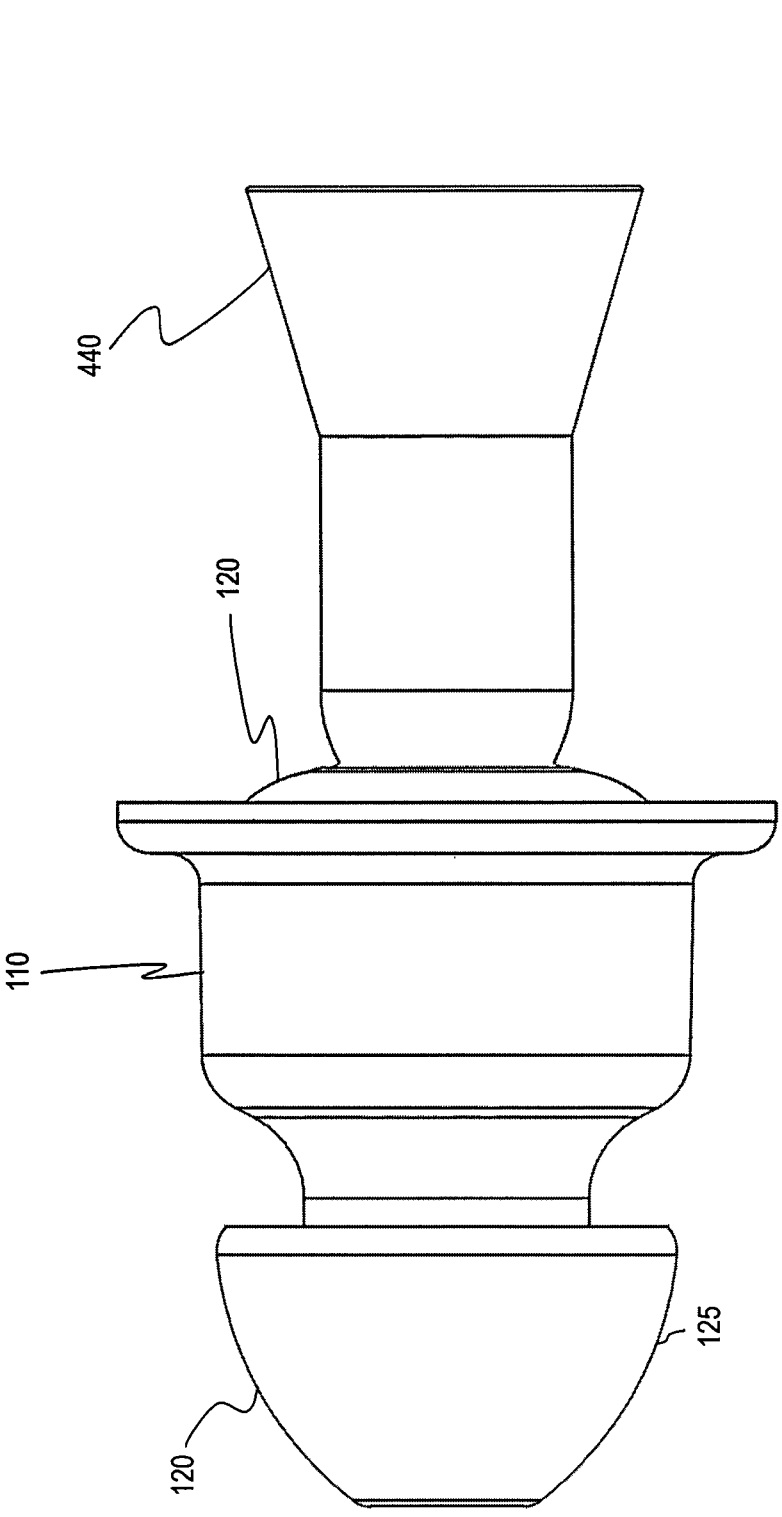


FIG. 4A

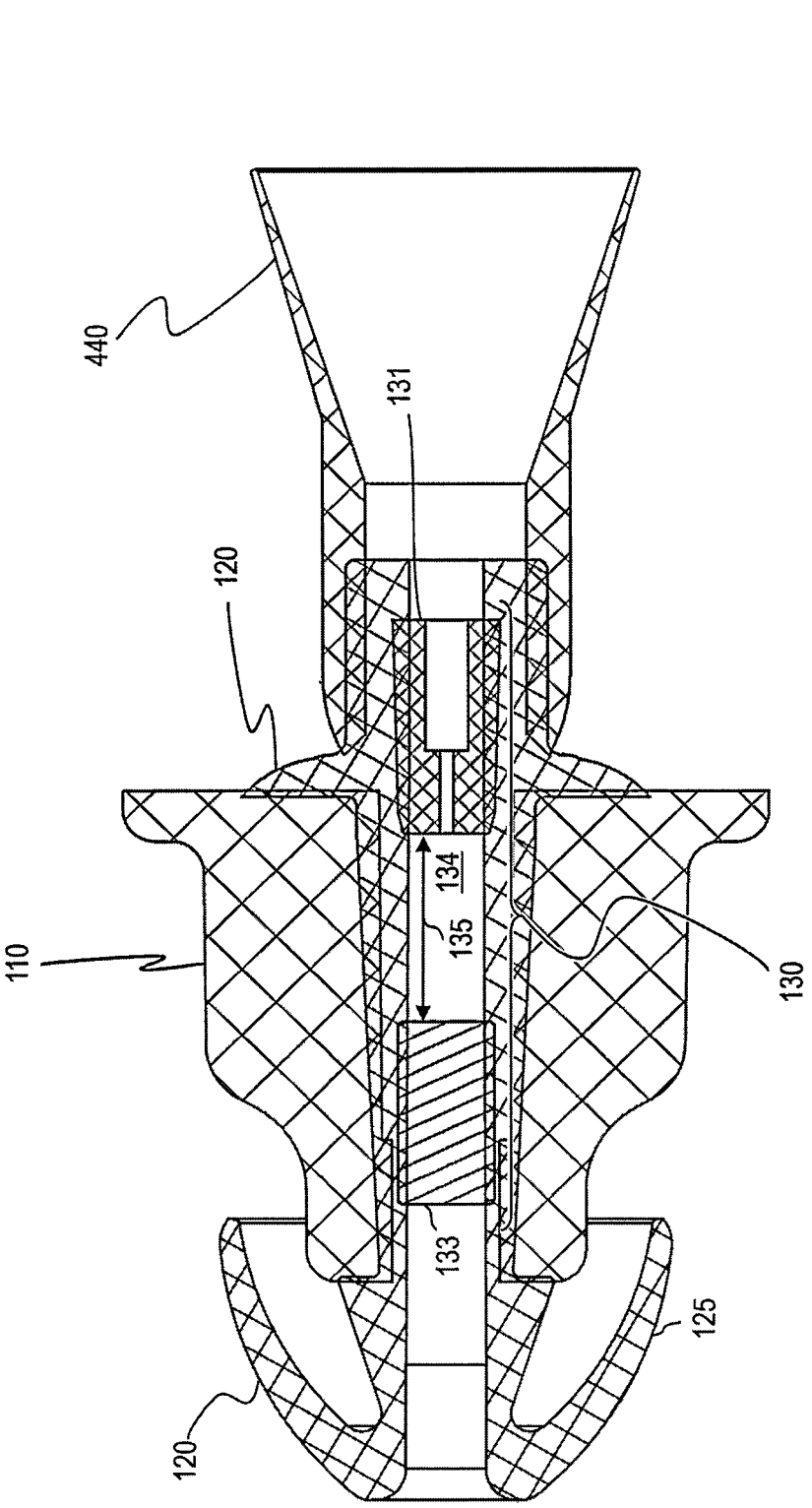
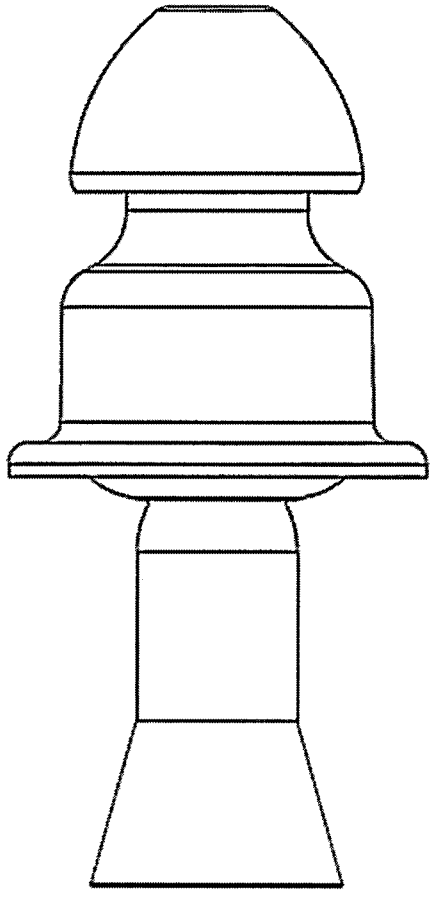


FIG. 4B



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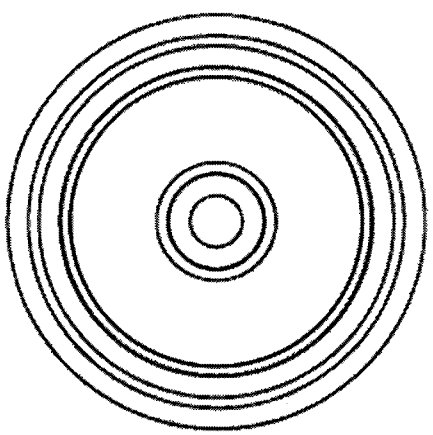


FIG. 4E

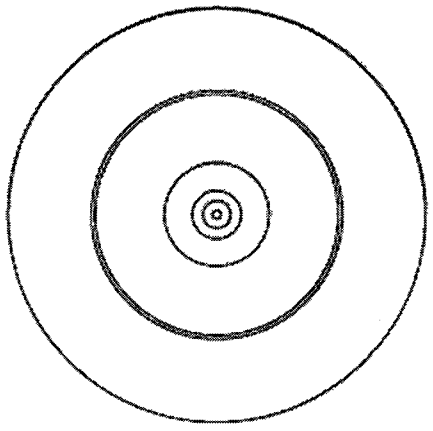


FIG. 4D

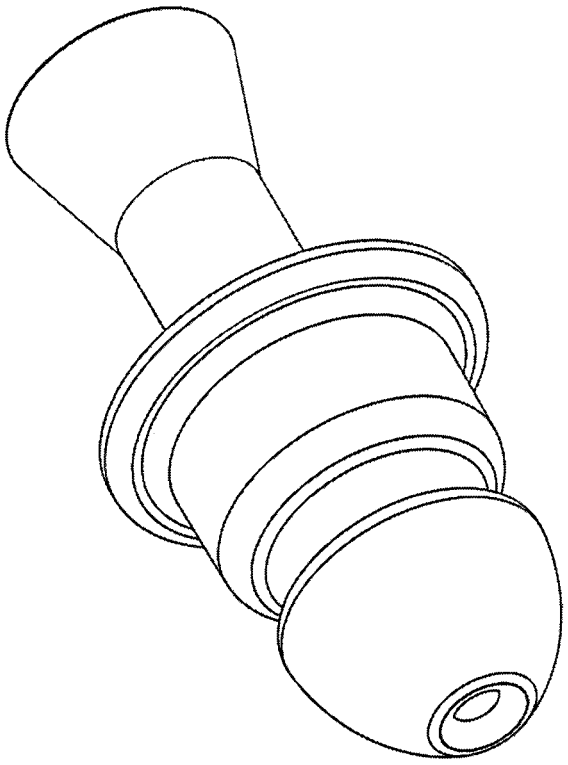
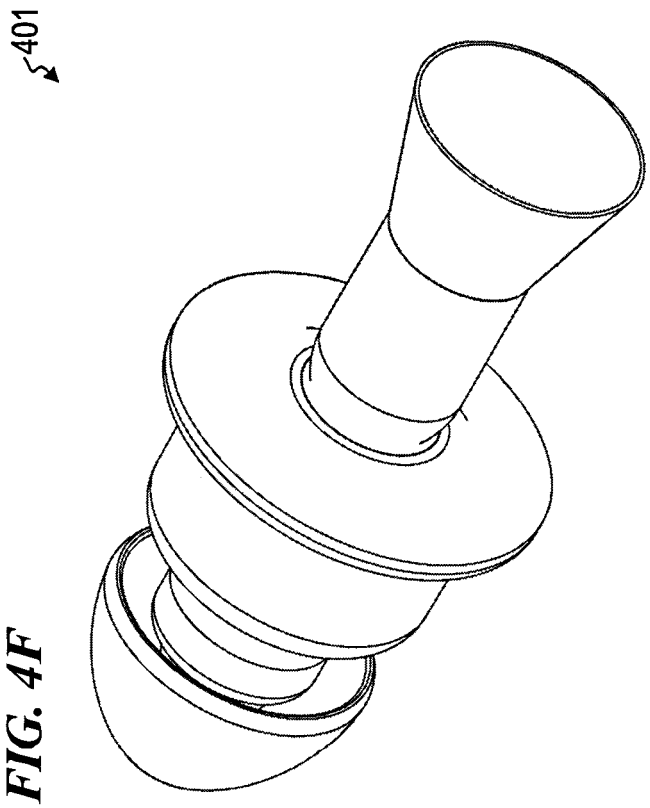


FIG. 4G



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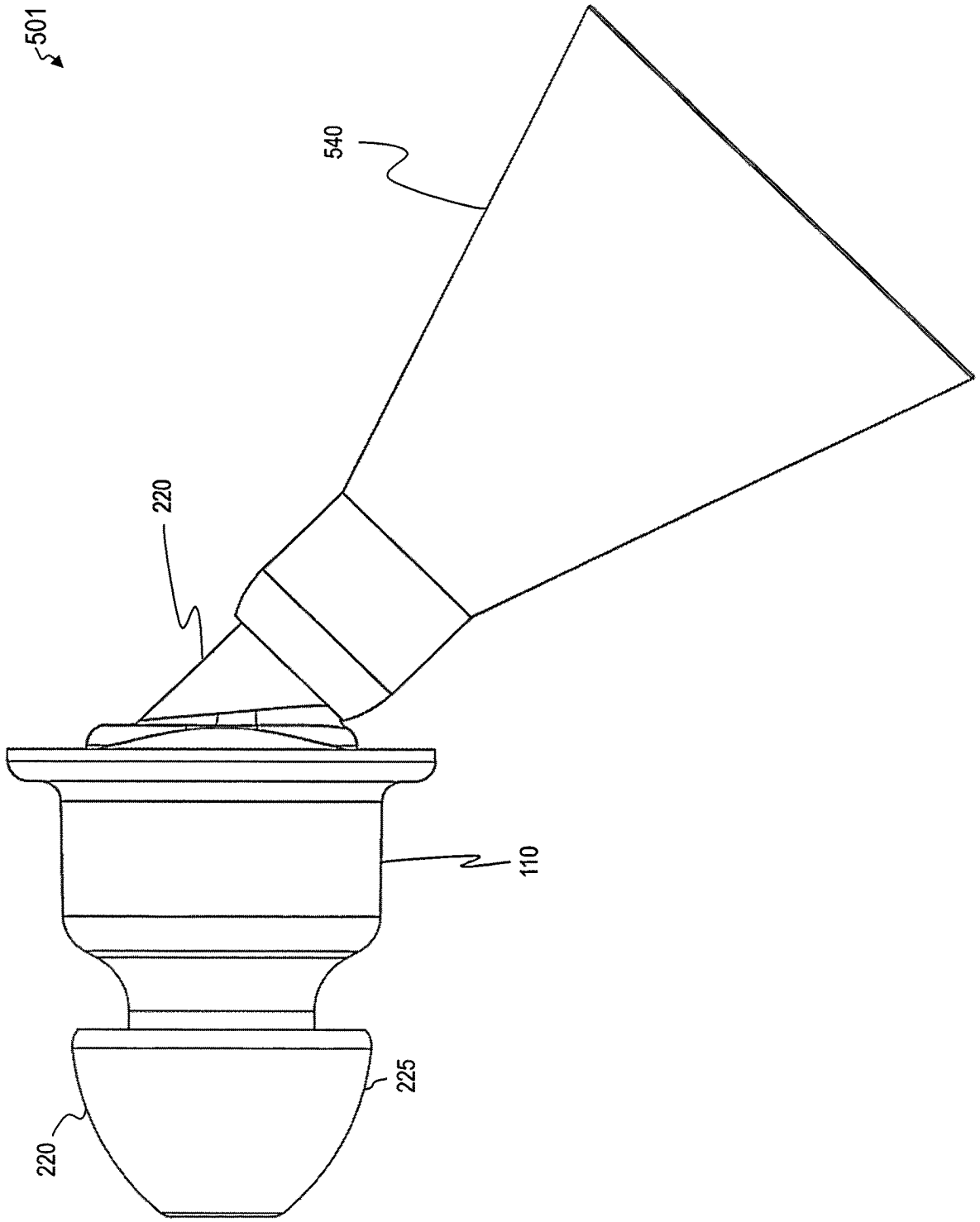

FIG. 5A

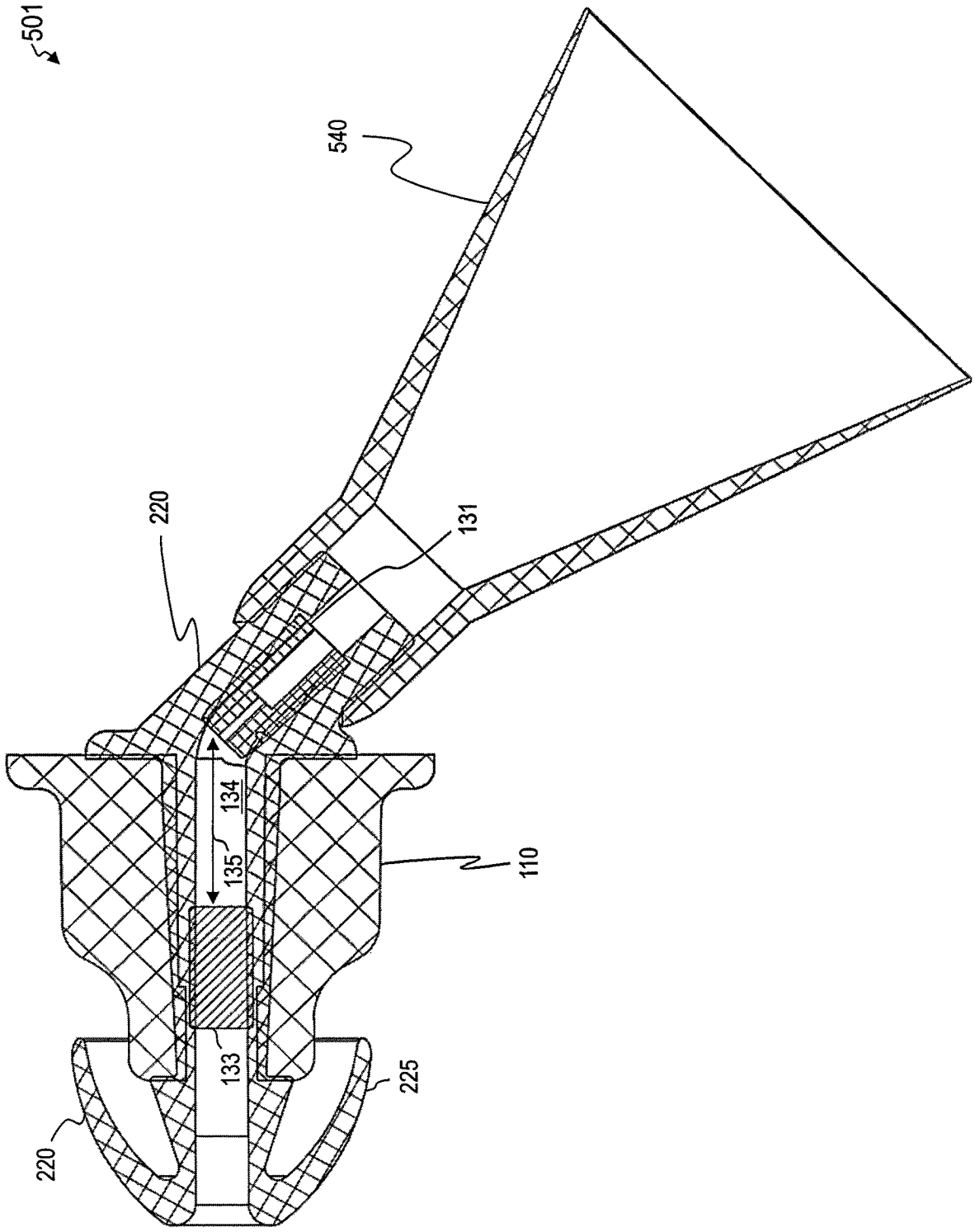

FIG. 5B

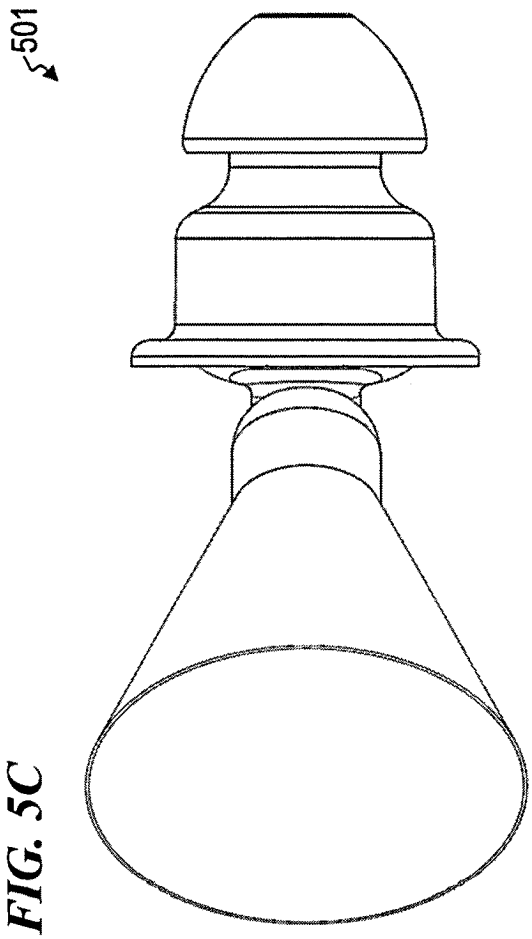

FIG. 5C

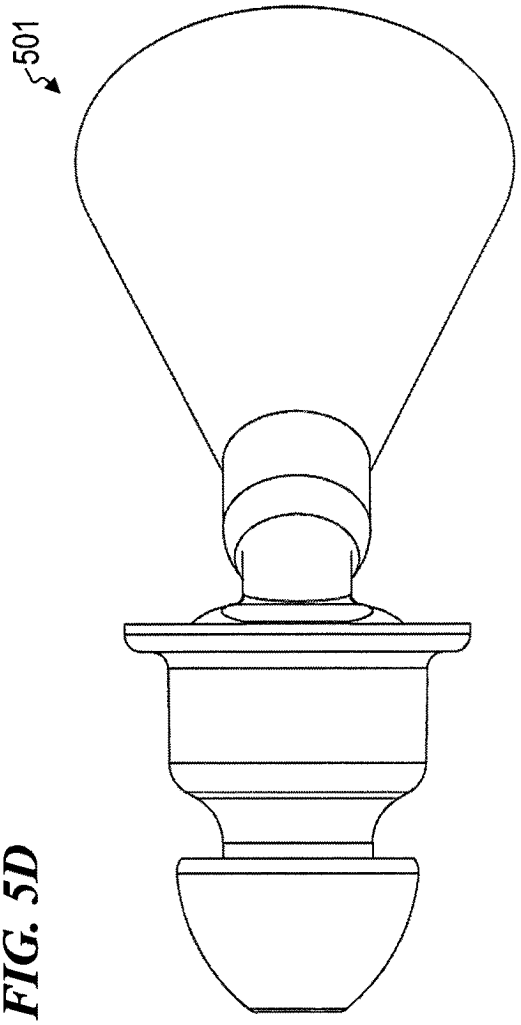

FIG. 5D

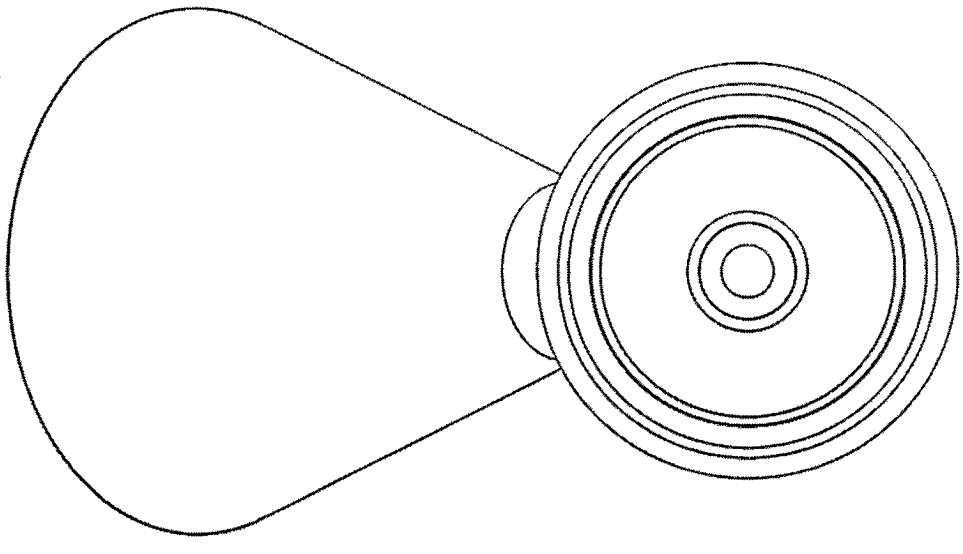

FIG. 5F

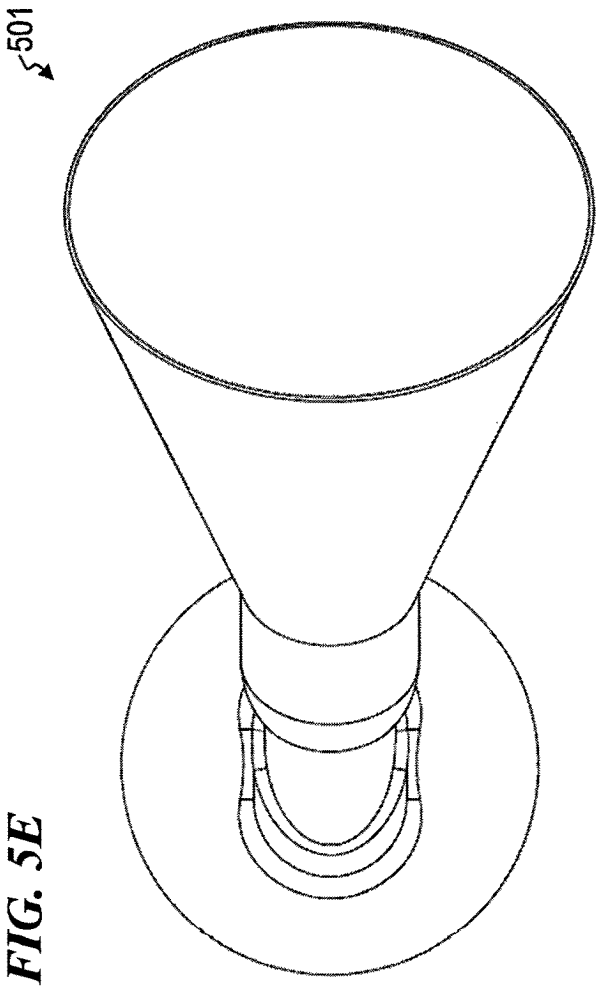

FIG. 5E

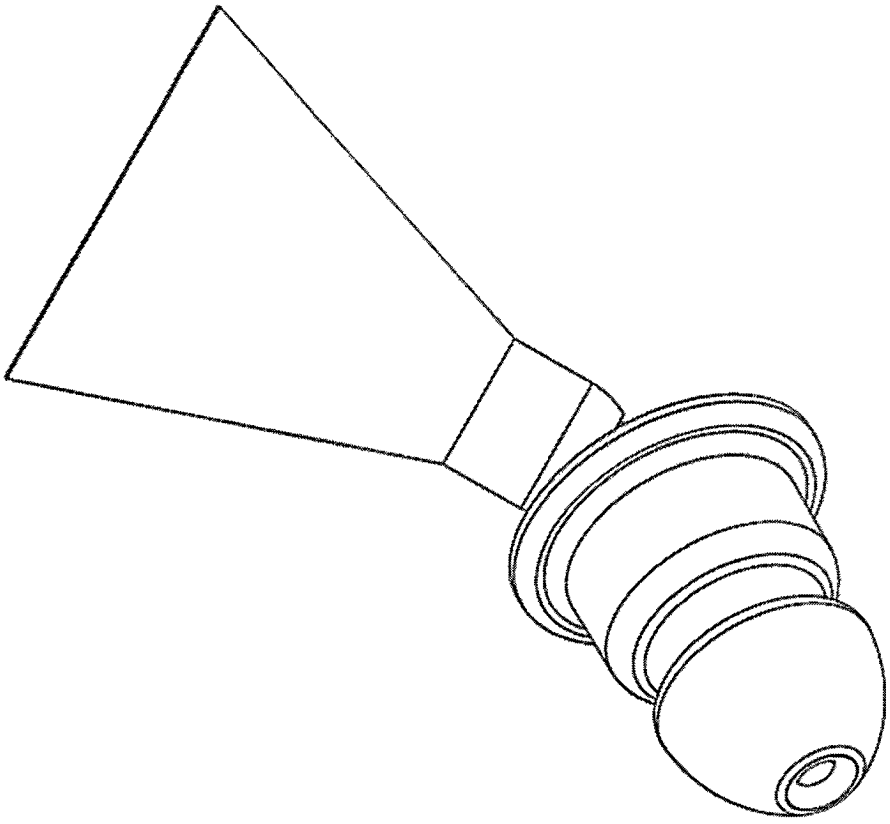

FIG. 5H

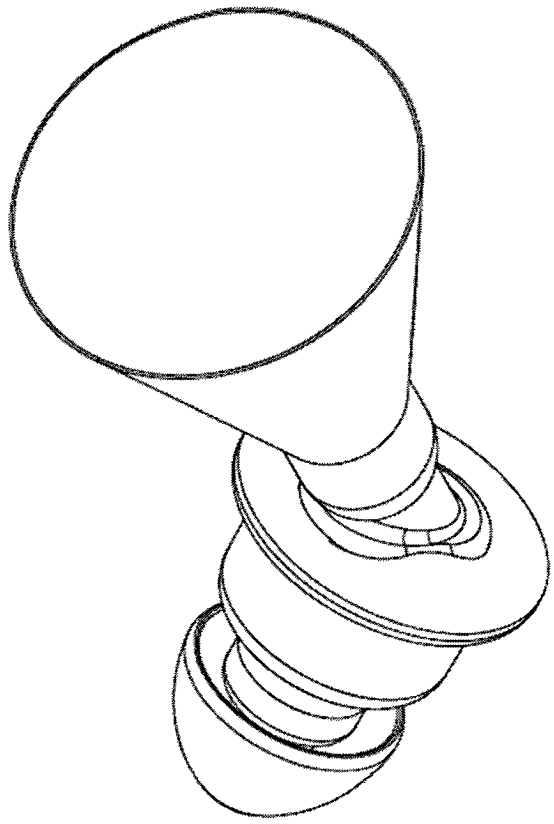

FIG. 5G

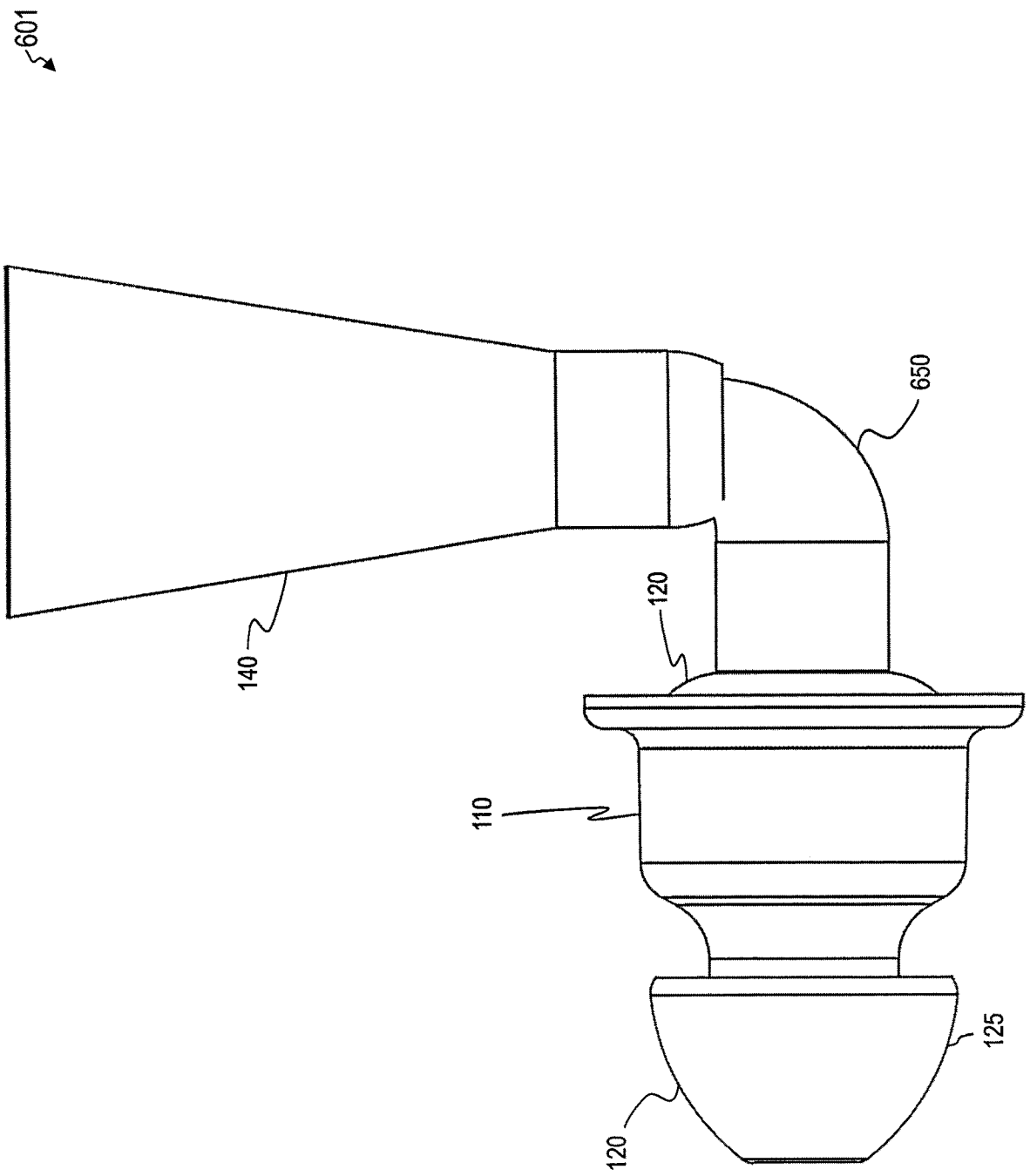

FIG. 6A

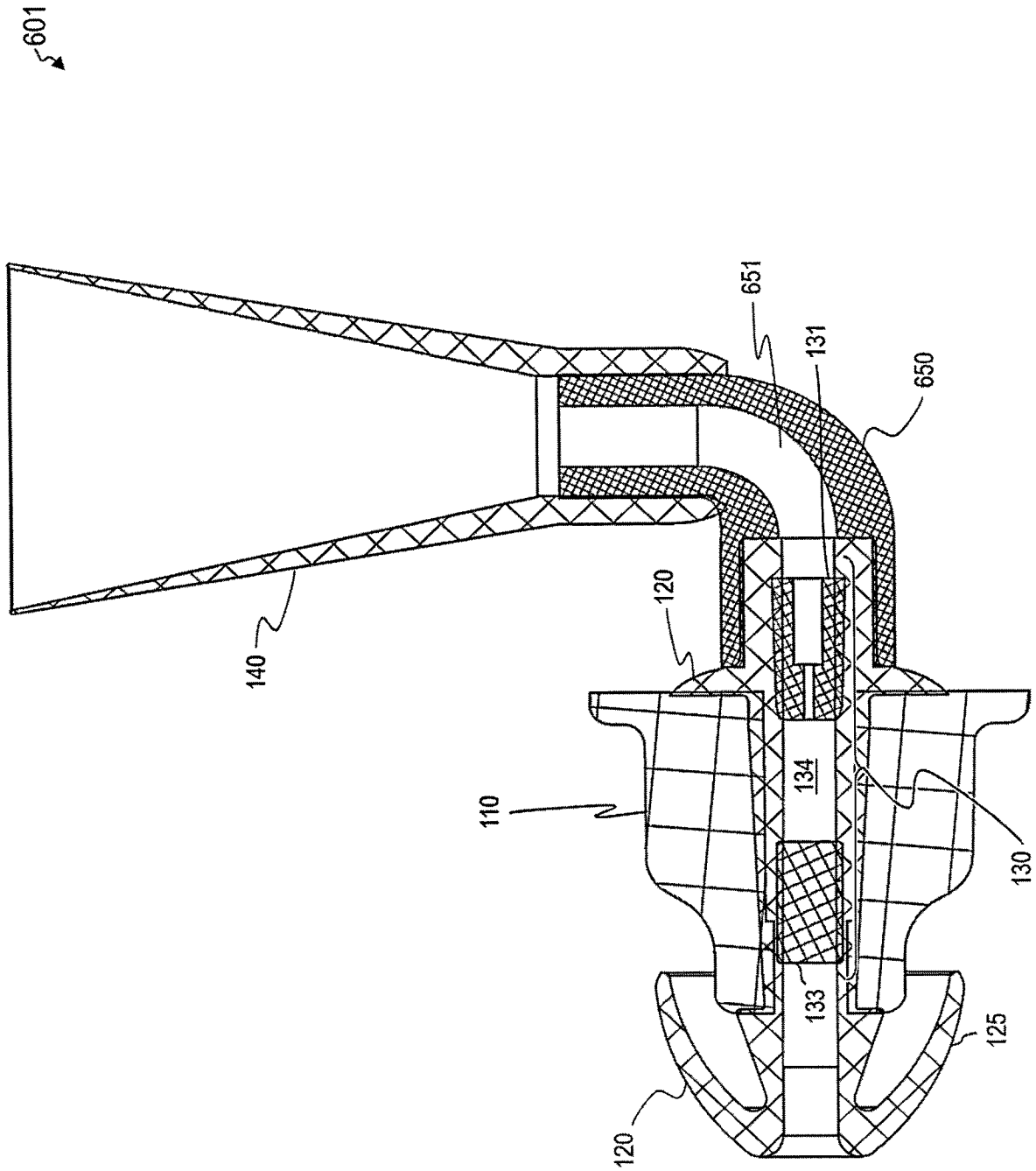

FIG. 6B

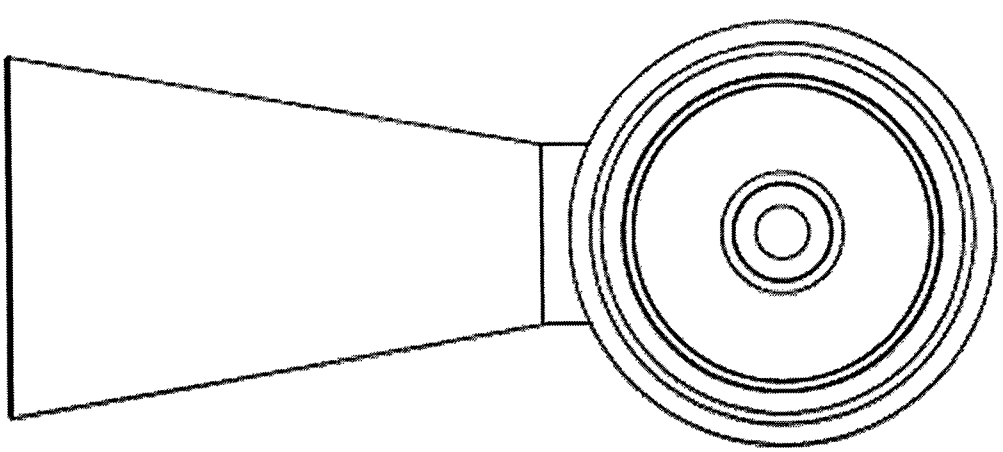

FIG. 6D

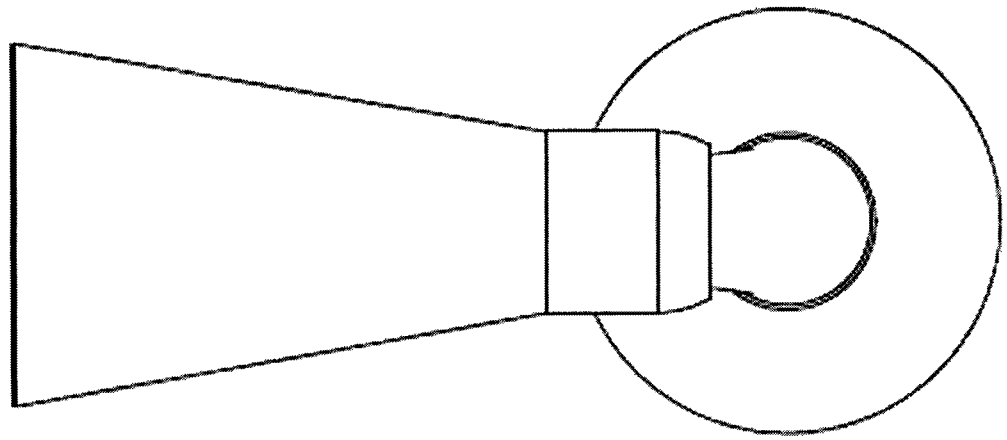

FIG. 6C

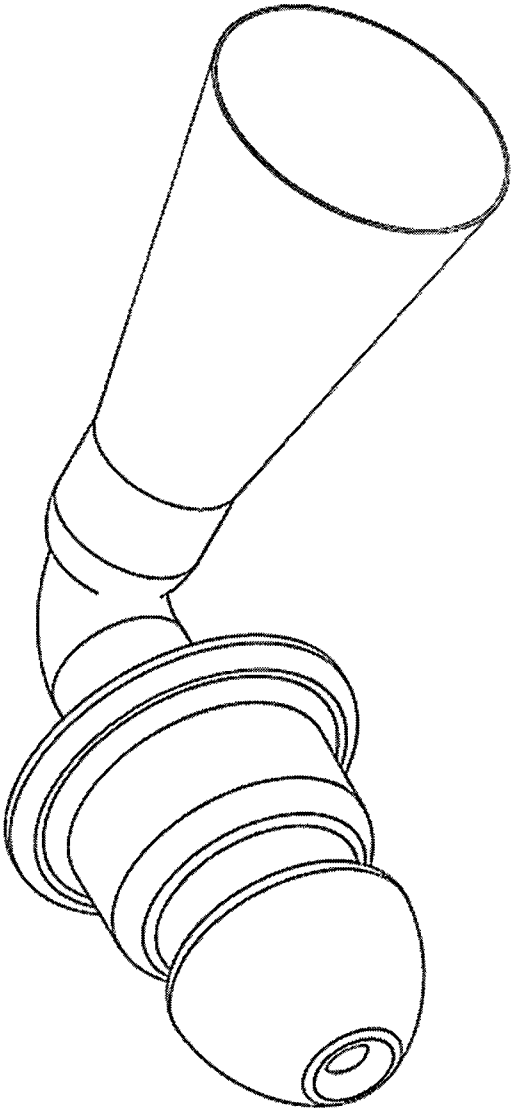

FIG. 6F

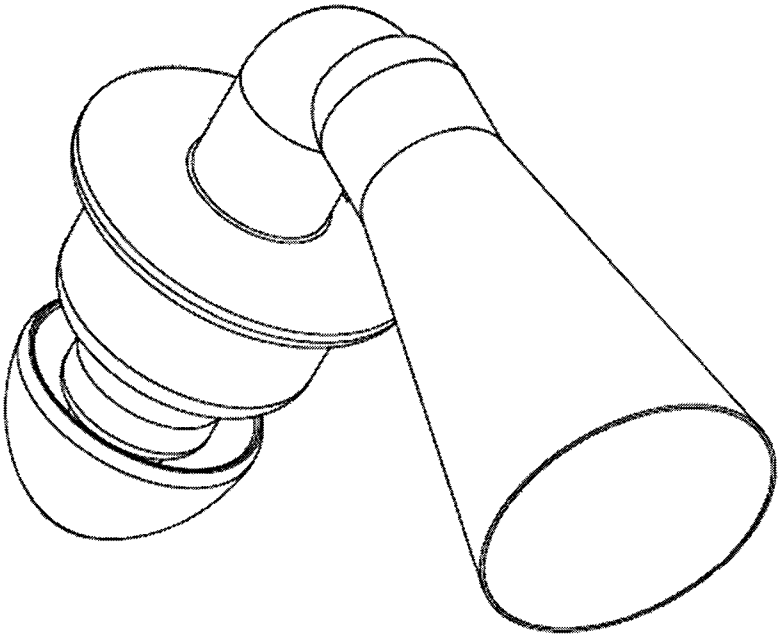

FIG. 6E

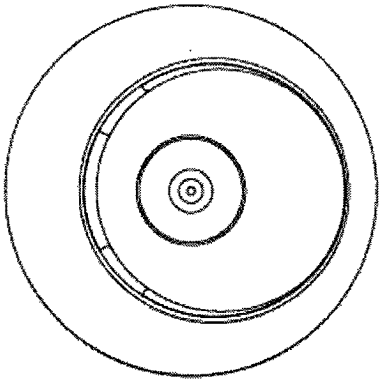

FIG. 7C

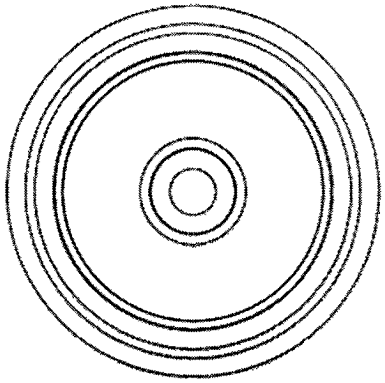

FIG. 7D

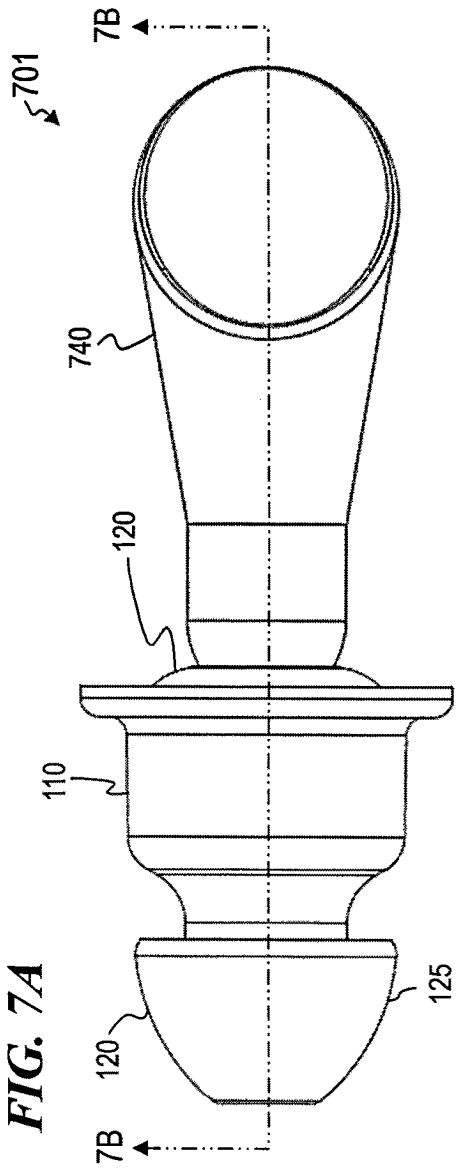

FIG. 7A

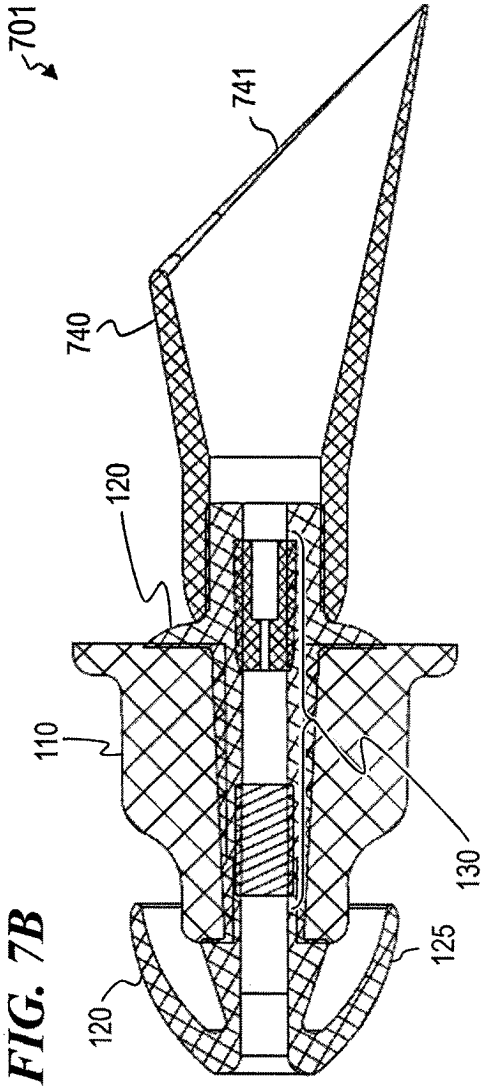

FIG. 7B

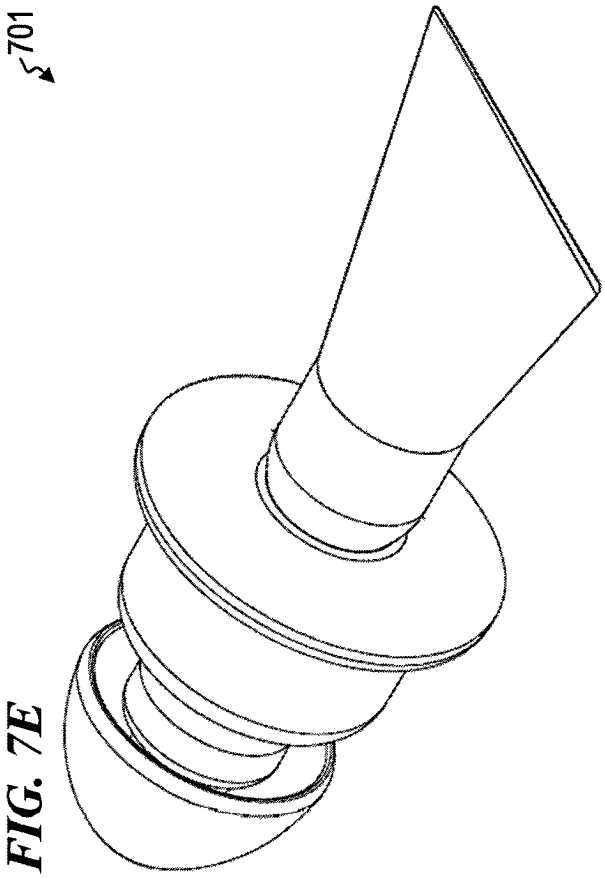

FIG. 7E

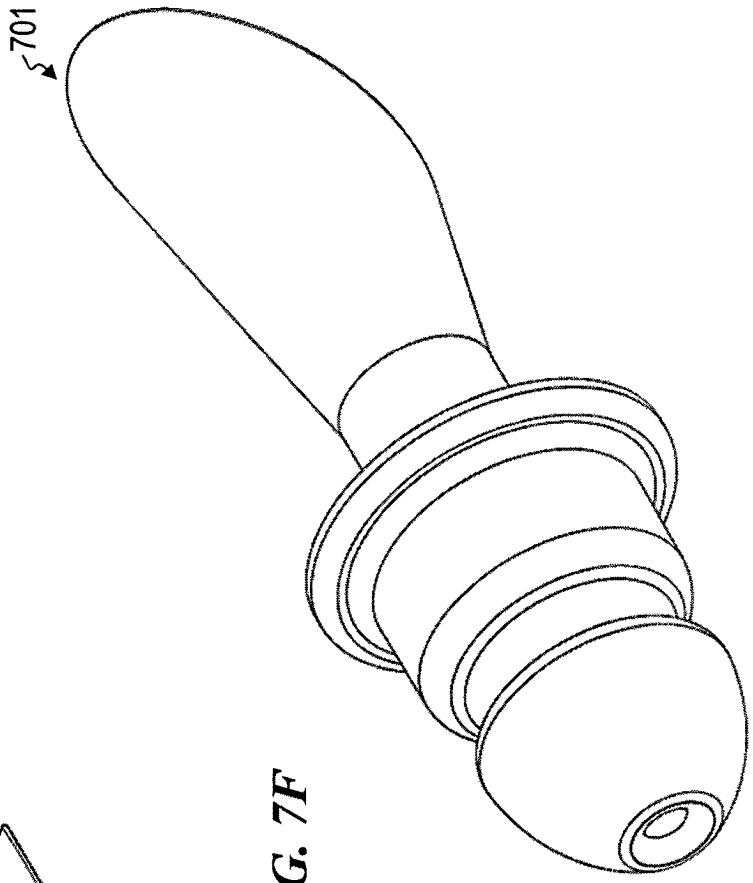

FIG. 7F

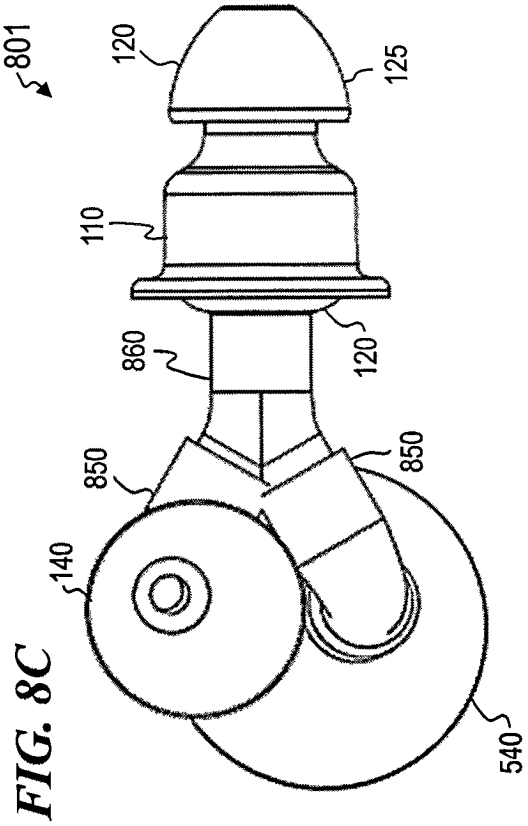

FIG. 8C

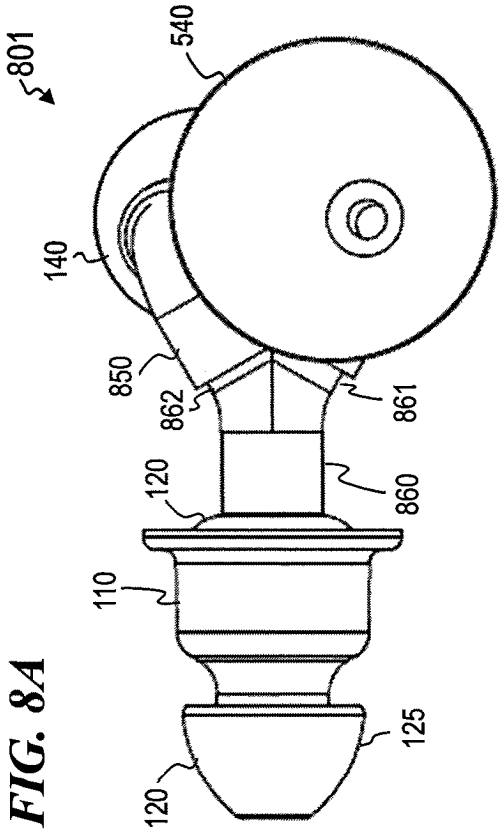

FIG. 8A

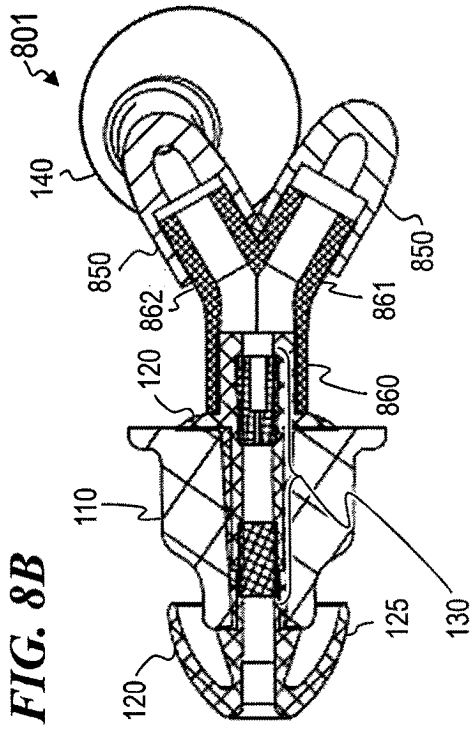

FIG. 8B

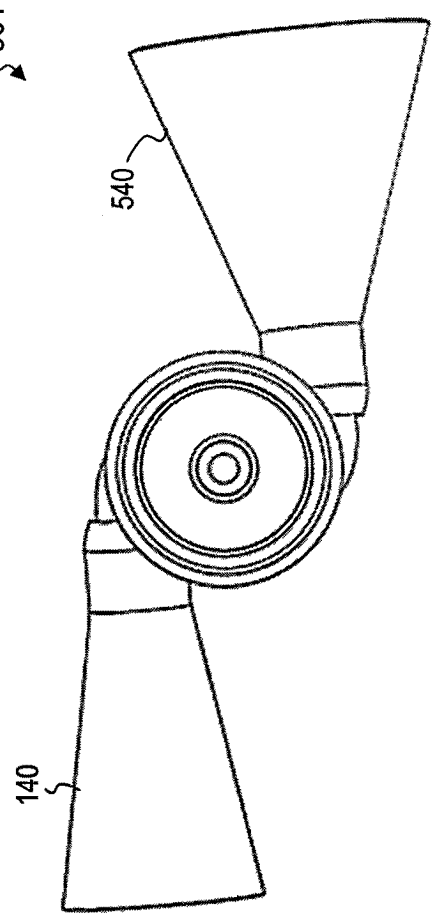

FIG. 8E

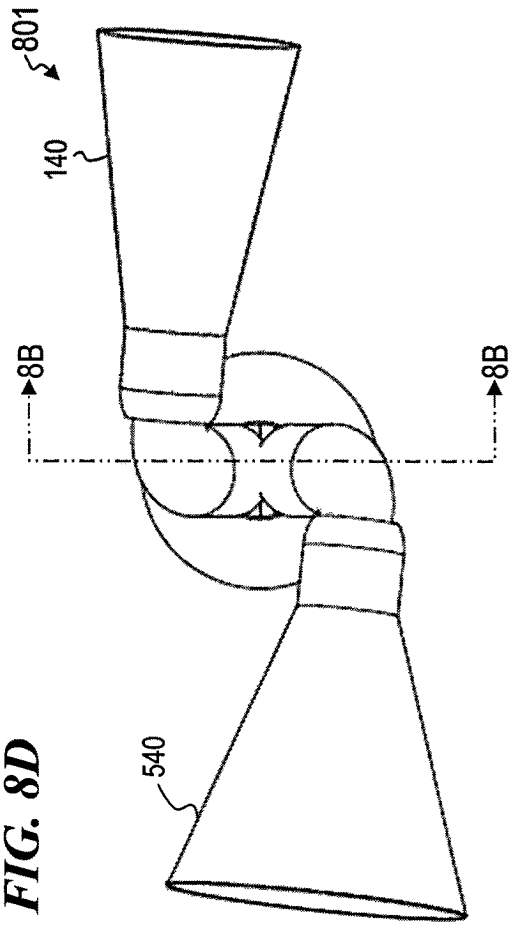

FIG. 8D

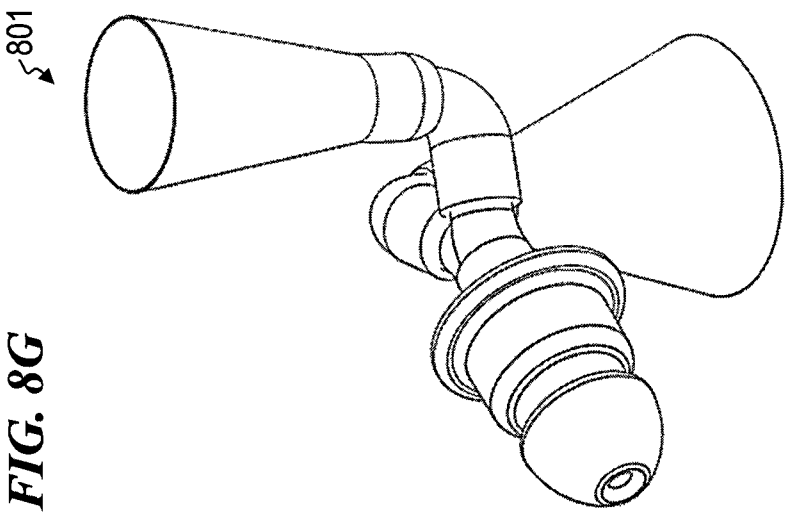

FIG. 8G

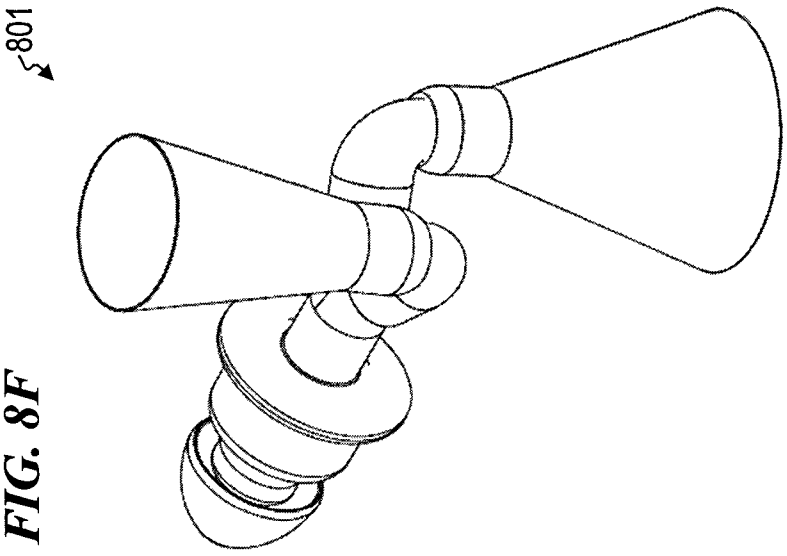

FIG. 8F

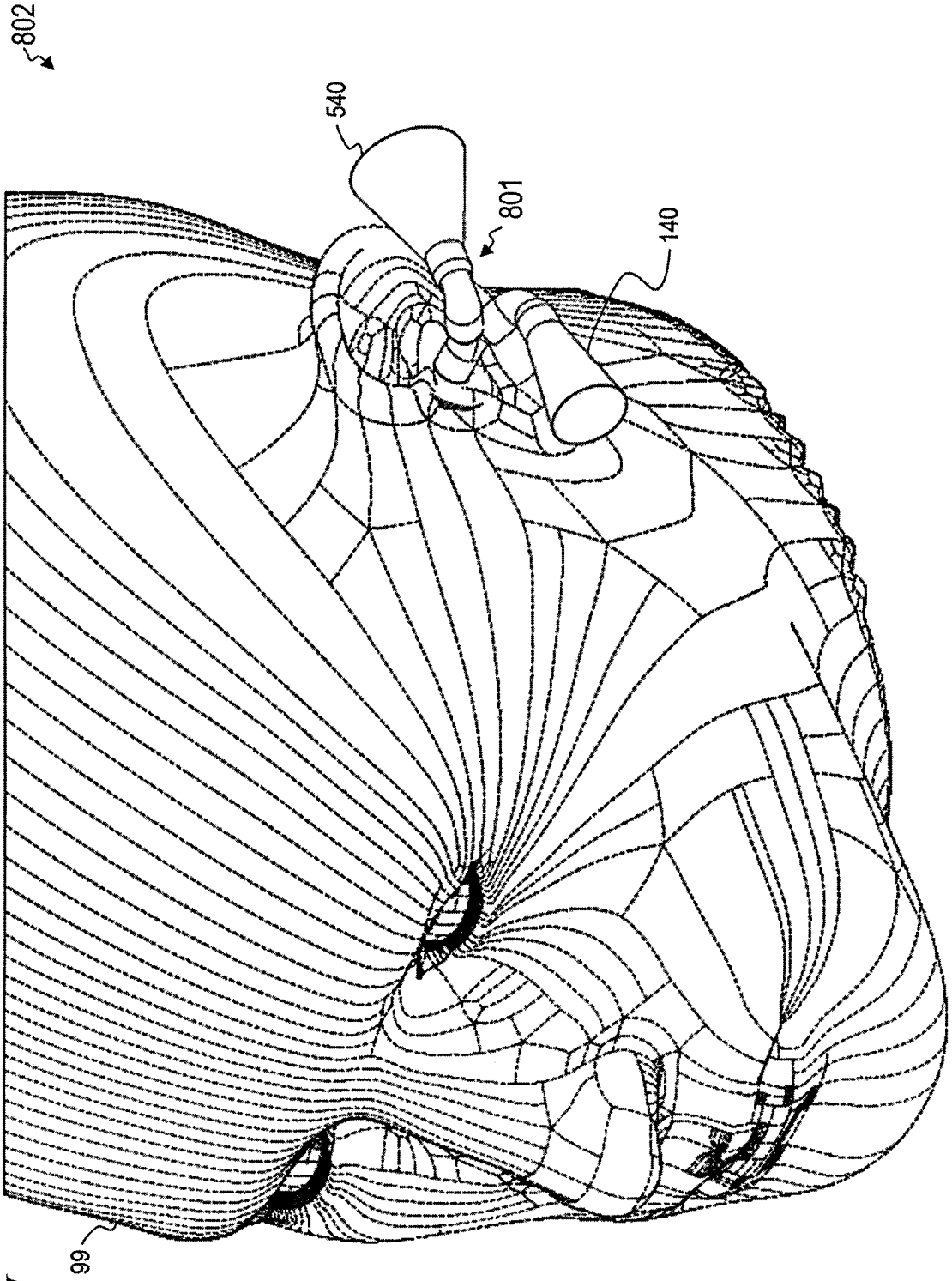

FIG. 8H

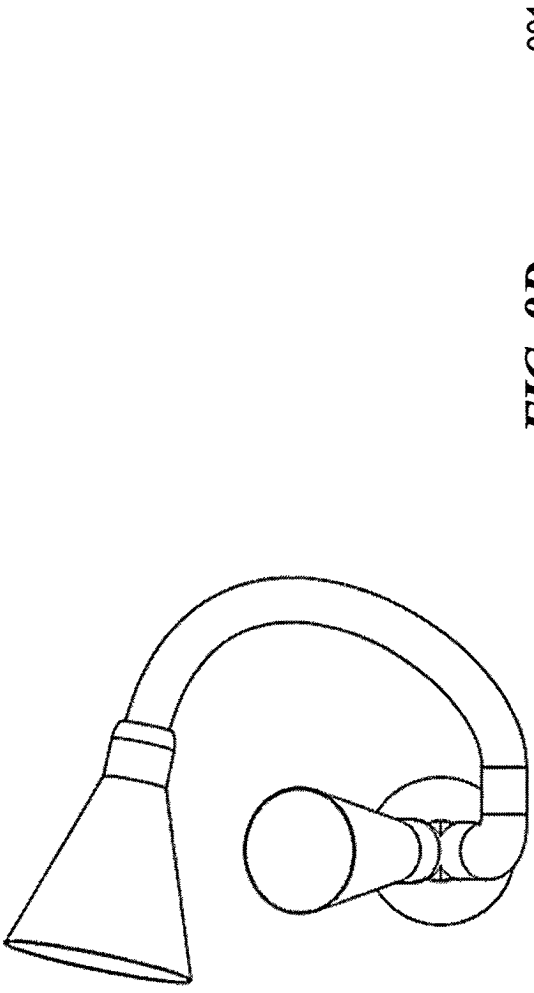

FIG. 9A

FIG. 9C

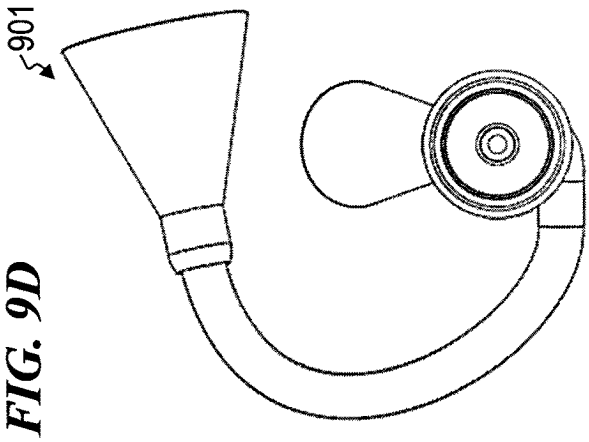

FIG. 9D

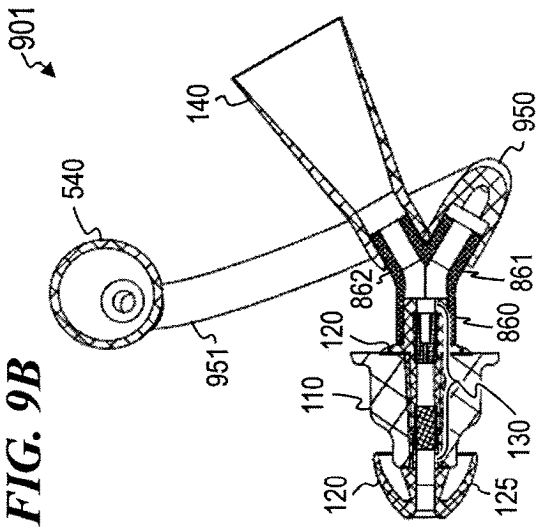

FIG. 9B

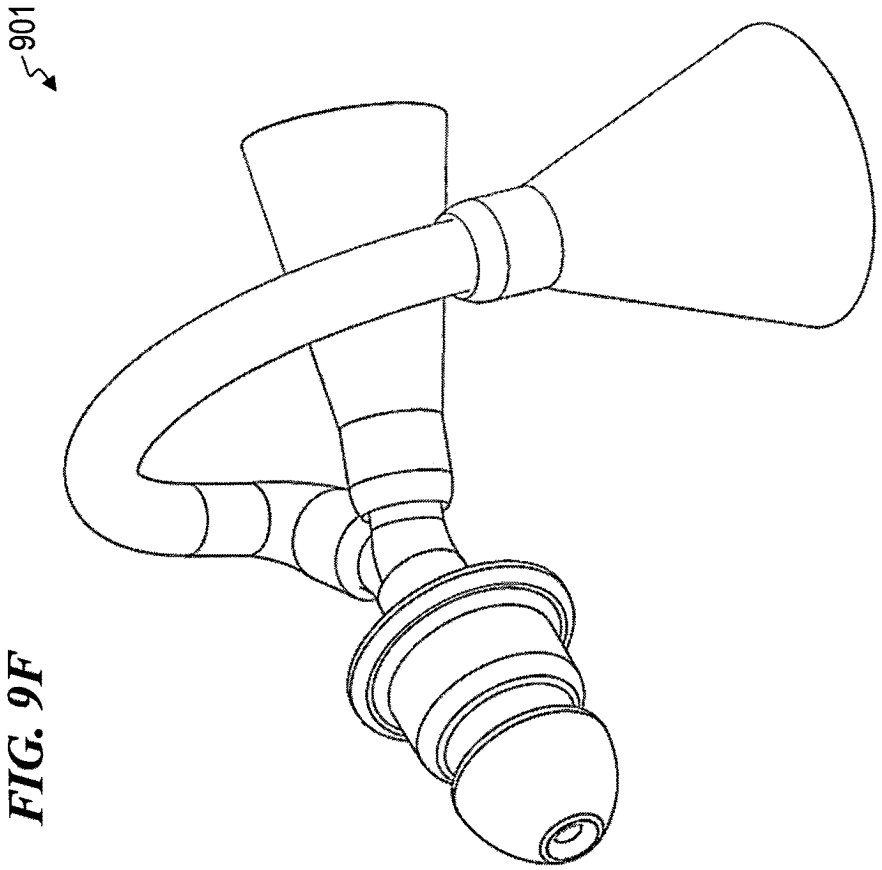

FIG. 9F

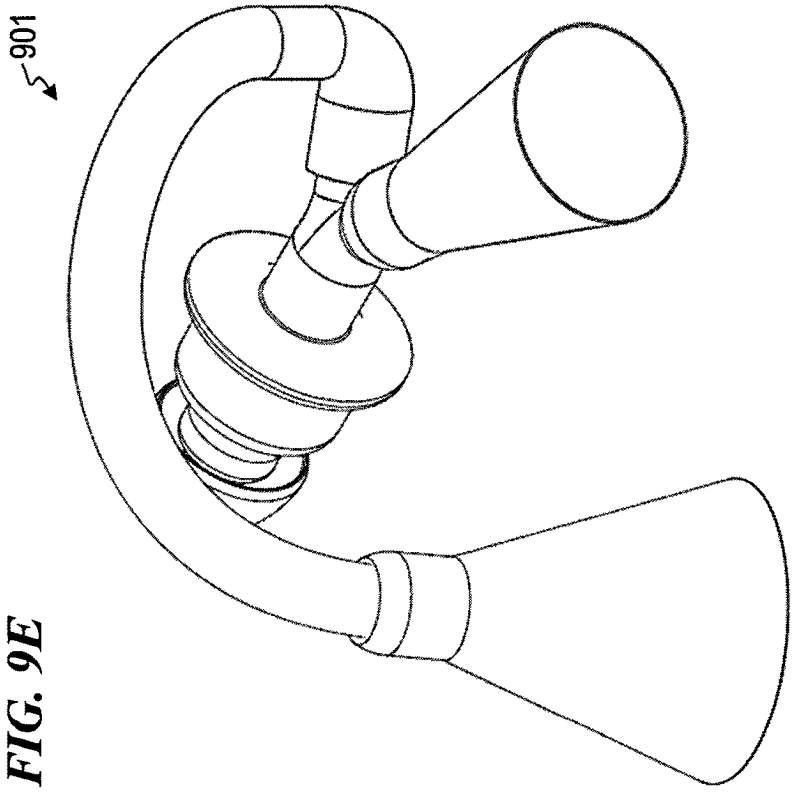

FIG. 9E

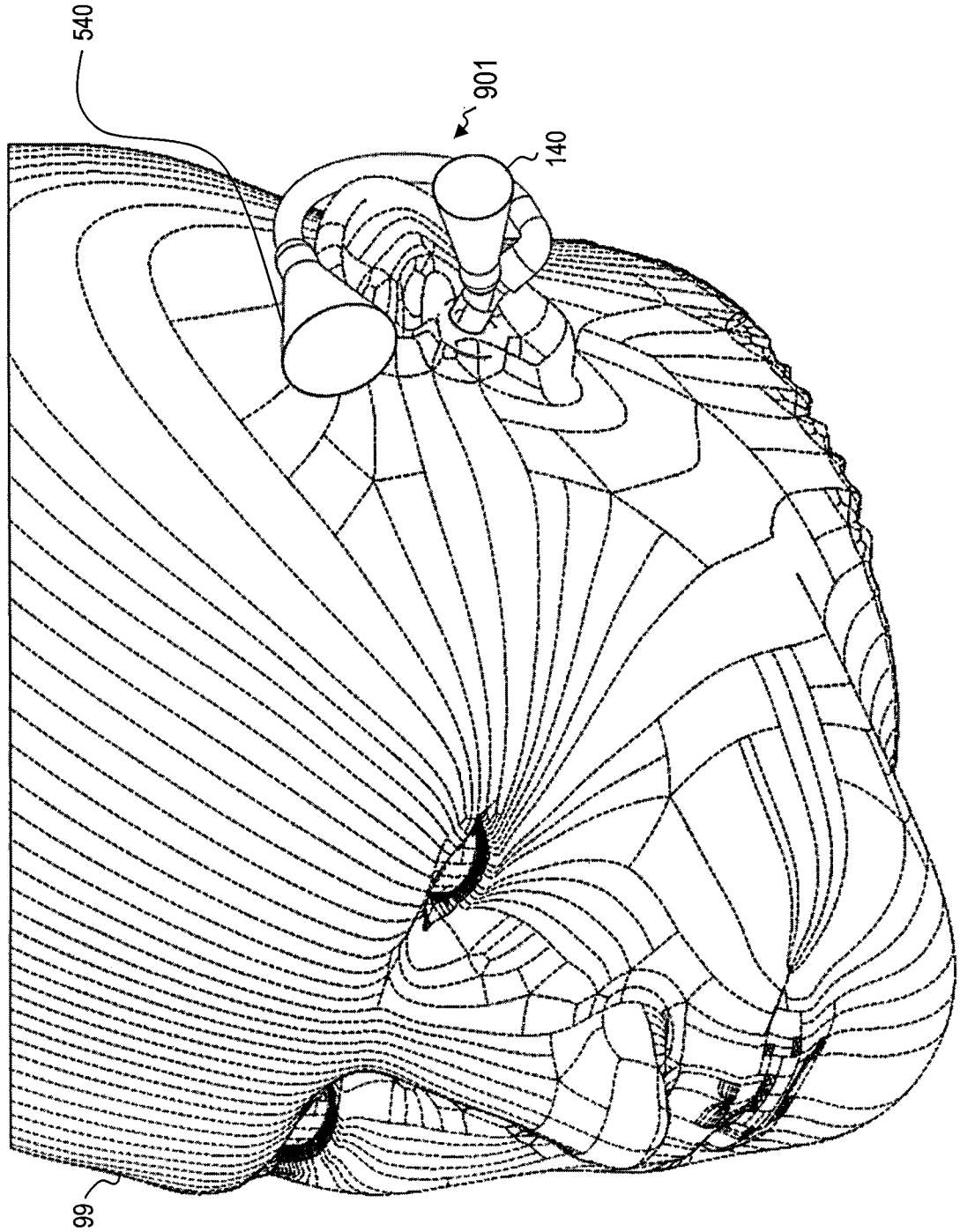

FIG. 9G

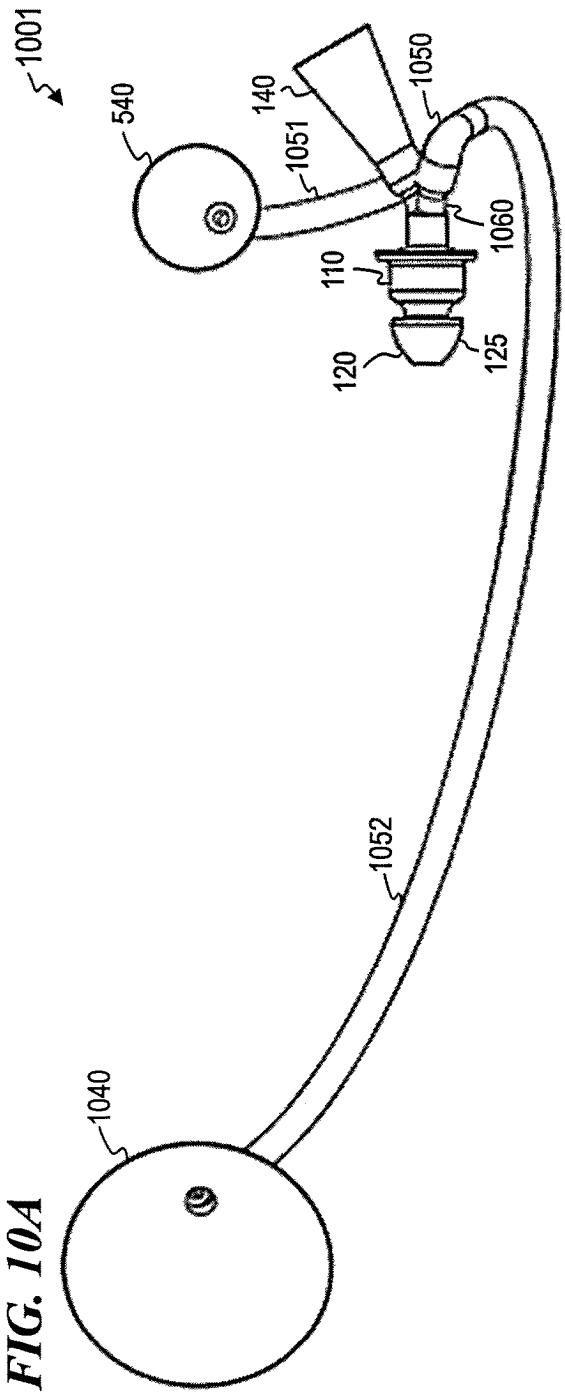

FIG. 10A

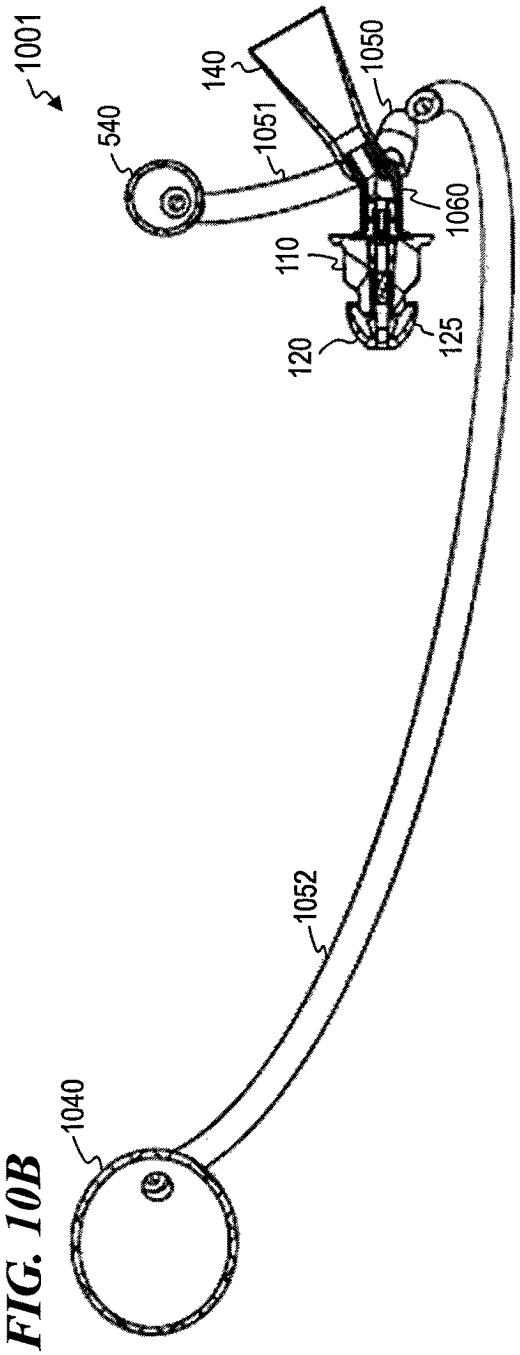

FIG. 10B

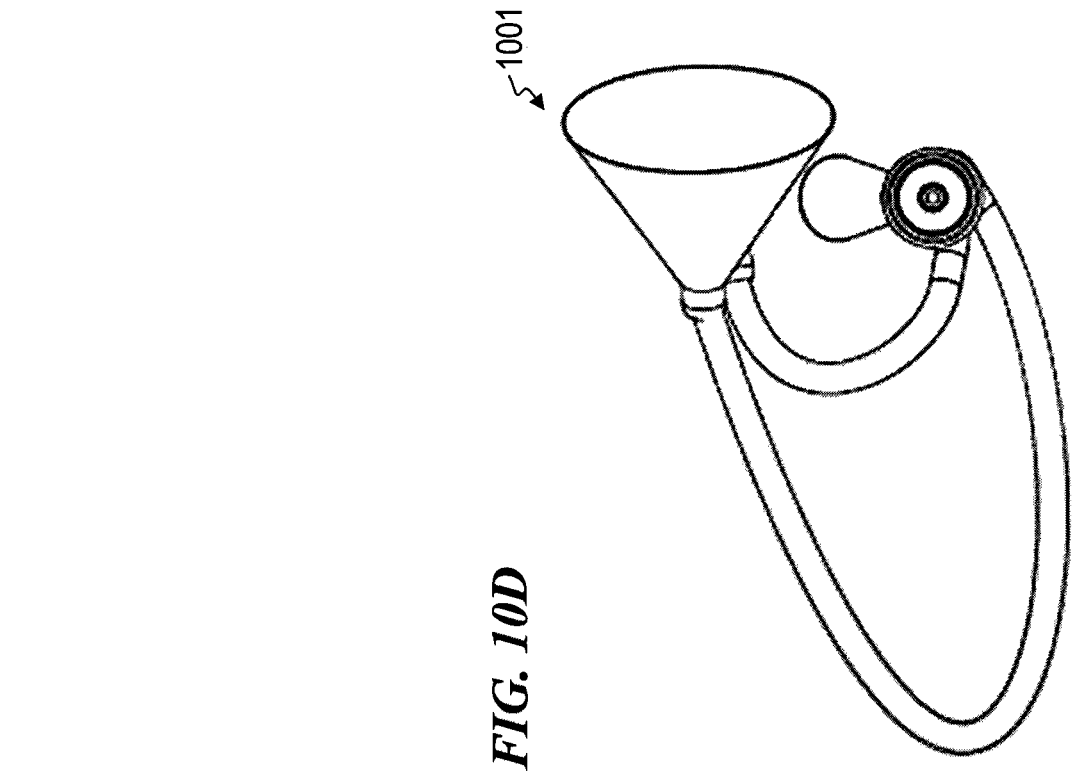

FIG. 10D

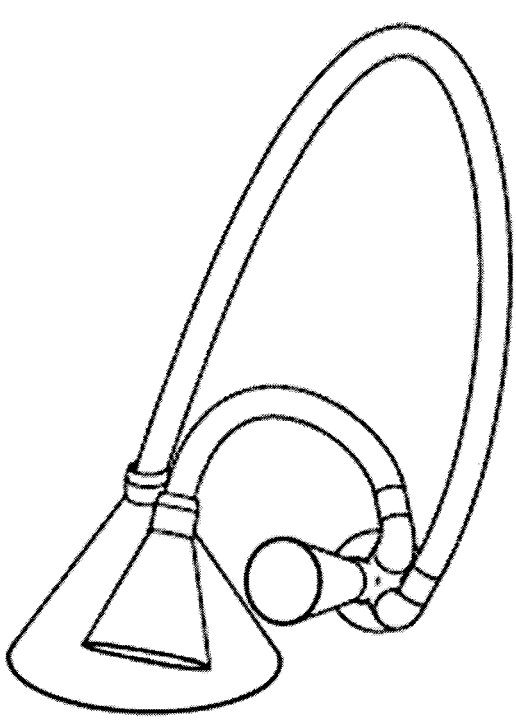

FIG. 10C

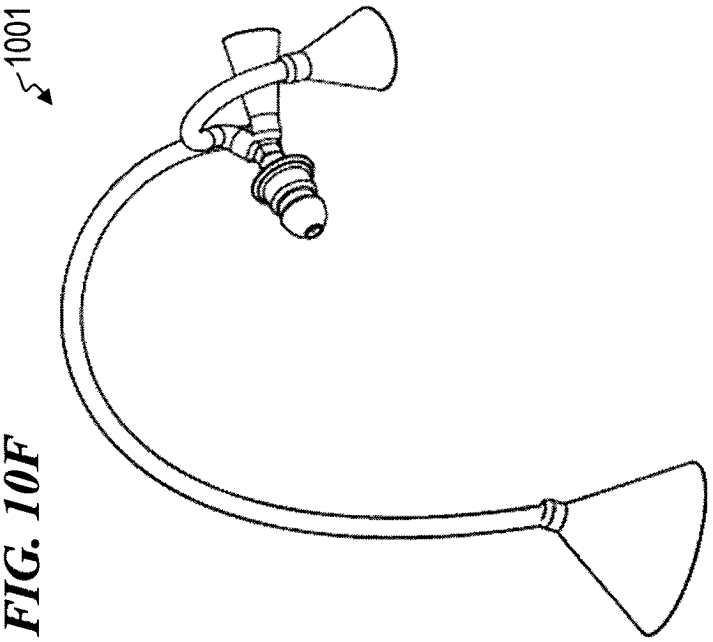

FIG. 10F

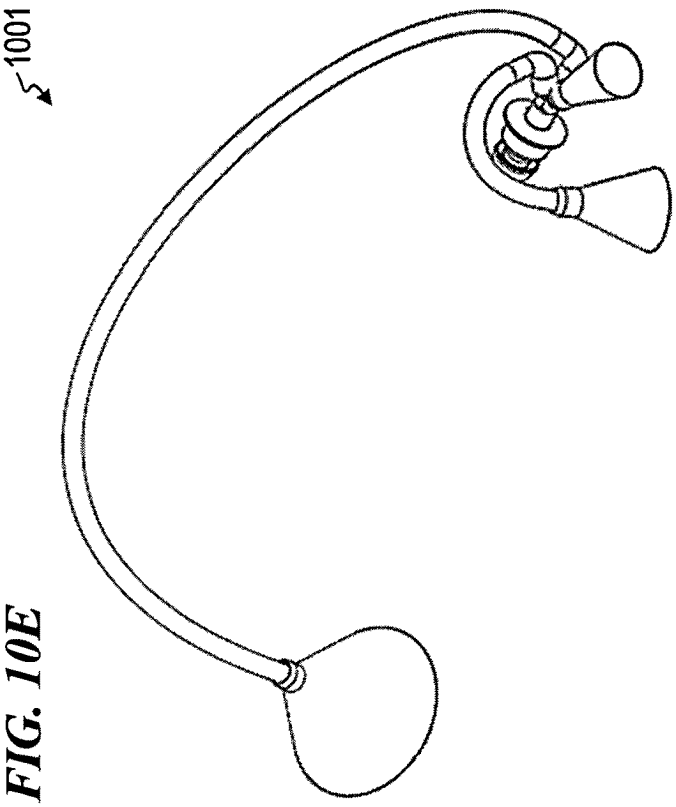

FIG. 10E

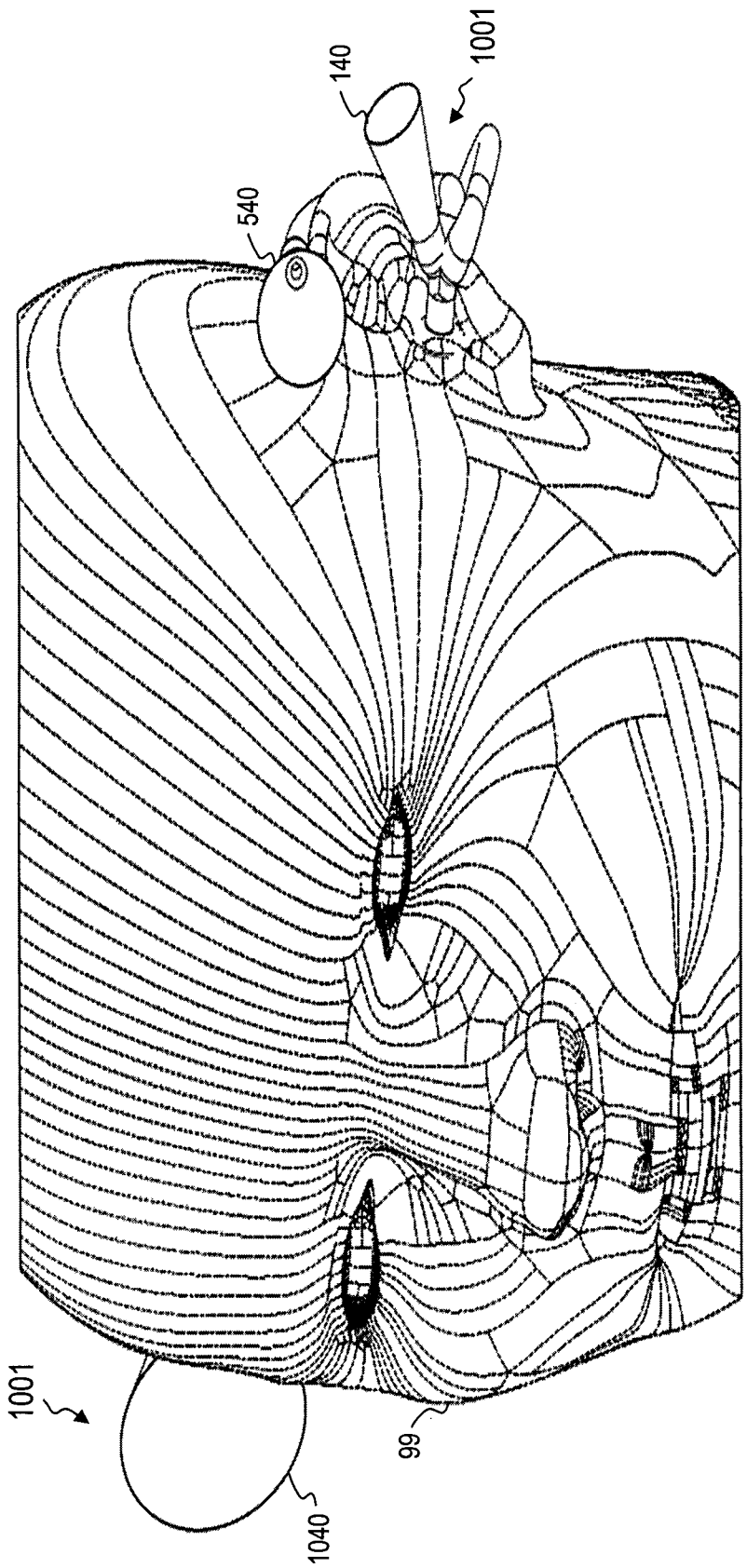

FIG. 10G

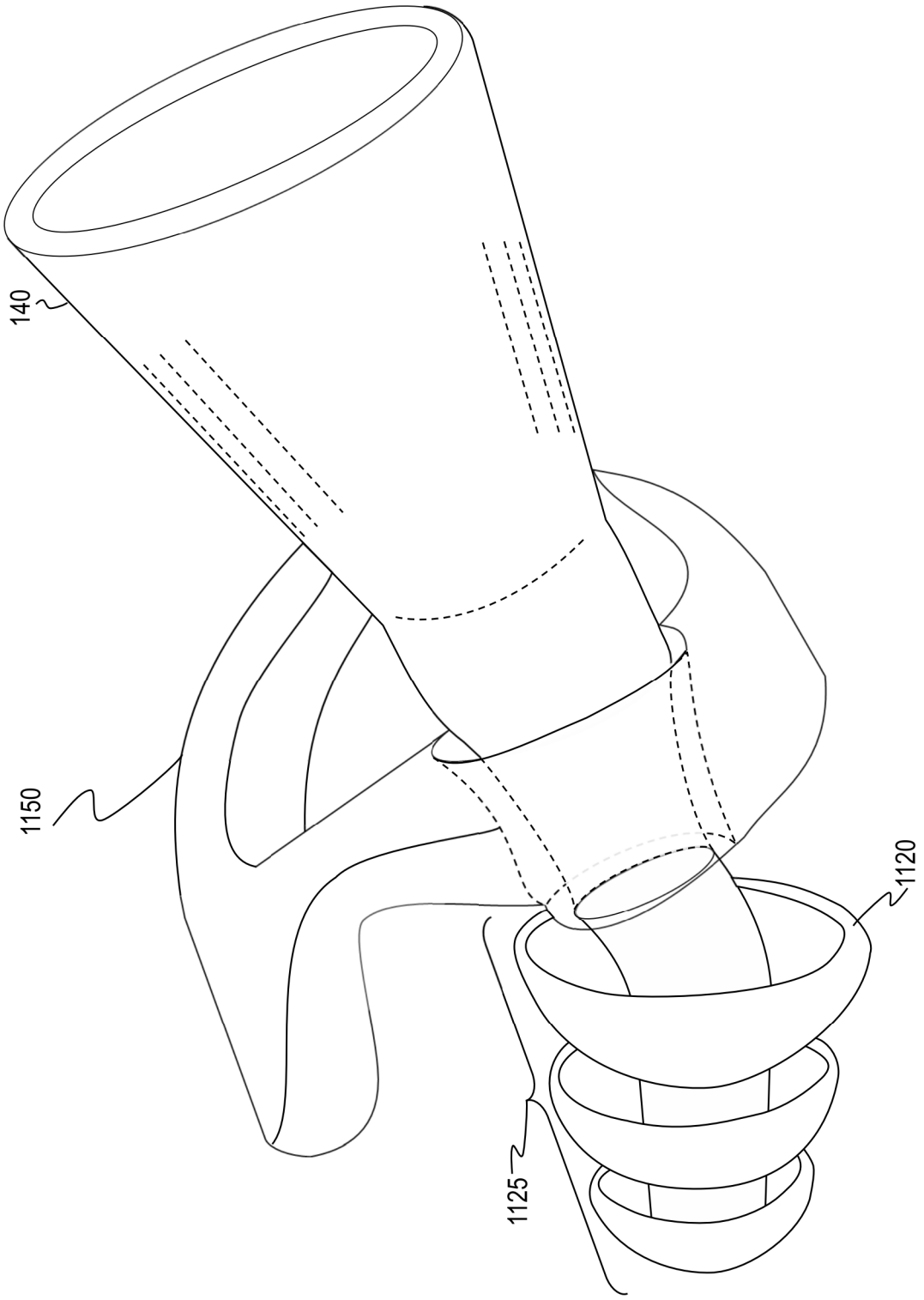

FIG. 11

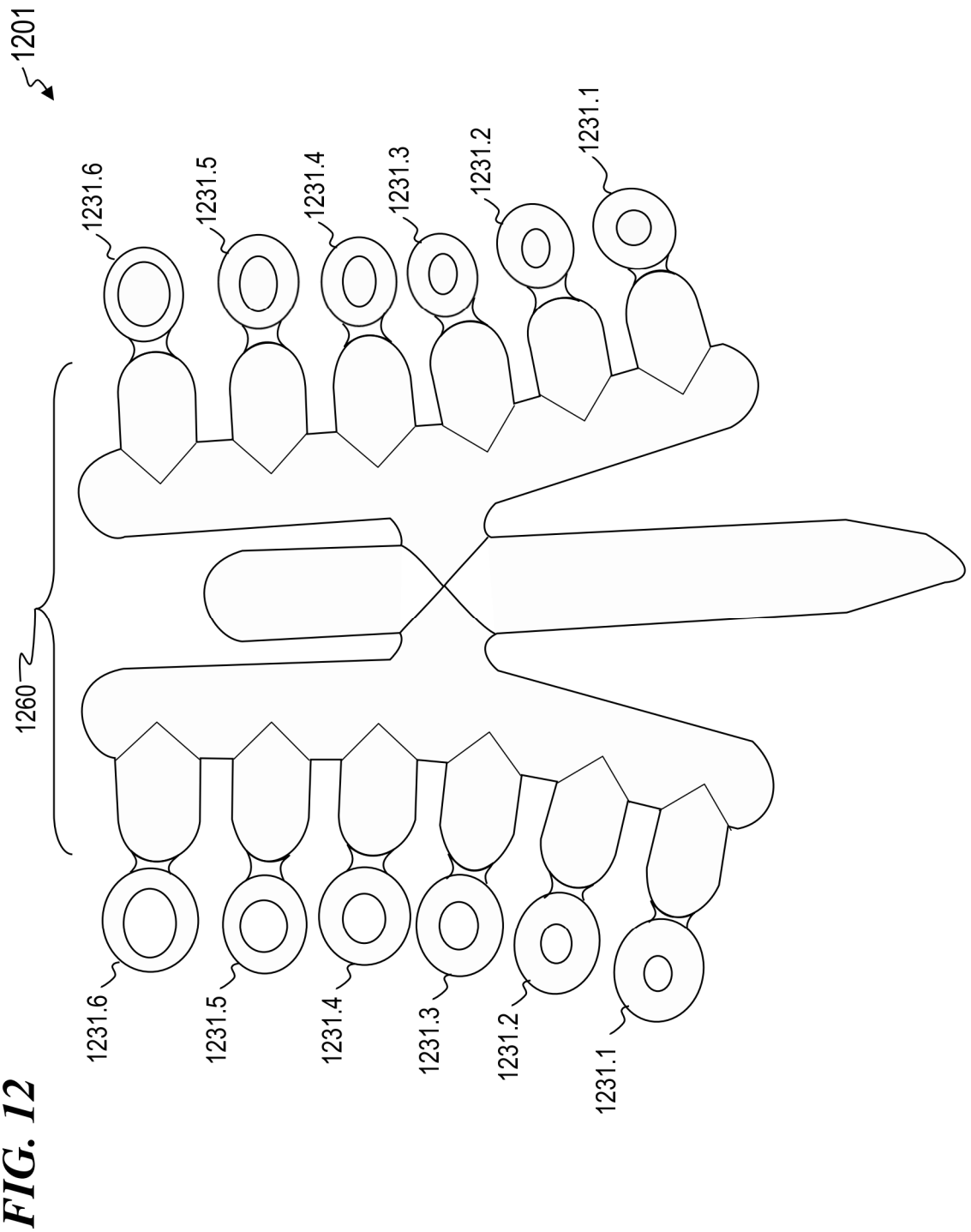
1201
1231.6
1231.5
1231.4
1231.3
1231.2
1231.1
1260
1231.6
1231.5
1231.4
1231.3
1231.2
1231.1

FIG. 12

APPARATUS AND METHOD FOR TUNED-FREQUENCY-SPECTRUM EARPIECE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 18/371,400, filed Sep. 21, 2023 by David M. Chenal and titled "Tuned-frequency-spectrum earpiece" (which issued Jul. 23, 2024 as U.S. Pat. No. 12,047,732), which claims priority benefit, under 35 U.S.C. § 119(e), of U.S. Provisional Patent Application 63/409,408, filed Sep. 23, 2022 by David M. Chenal and titled "Tuned-frequency-spectrum earpiece," each of which is incorporated herein by reference in its entirety.

This application is related to:

- PCT Patent Application No. PCT/US2020/066494, filed Dec. 21, 2020 by JMJ Holdings, LLC, titled "Apparatus and method for an earpiece-foam shaping/sizing tool and container" (published as WO 2021/133747);
- PCT Patent Application No. PCT/US2022/014768, filed Feb. 1, 2022 by JMJ Holdings, LLC, titled "Apparatus and method for an earpiece device" (published as WO 2022/169769);
- PCT Patent Application No. PCT/US2022/025793, filed Apr. 21, 2022 by JMJ Holdings, LLC, titled "Apparatus and method for an earpiece" (published as WO 2022/226213);
- U.S. Design patent application Ser. No. 29/780,178, filed Apr. 22, 2021 by JMJ Holdings, LLC, titled "Earpiece apparatus" (which issued as U.S. Pat. D952,831 on May 24, 2022);
- U.S. Design patent application Ser. No. 29/769,169, filed Feb. 3, 2021 by JMJ Holdings, LLC, titled "Earpiece device assembly" (which issued as U.S. Pat. D964,547 on Sep. 20, 2022);
- U.S. patent application Ser. No. 17/785,799 filed Jun. 15, 2022 by JMJ Holdings, LLC, titled "Earpiece-foam sizing apparatus and method" (which issued as U.S. Pat. No. 11,826,231 on Nov. 28, 2023); and
- U.S. patent application Ser. No. 15/130,417, filed Apr. 15, 2016 by JMJ Holdings, LLC, titled "Sound attenuation" (which issued as U.S. Pat. No. 9,603,746 on Mar. 28, 2017); each of which is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

The present invention relates to devices and methods for earpieces, and in particular to a system and method for ear protectors configured to selectively tune the audible-frequency spectrum of audio passed to the eardrum of the user to improve speech recognition while substantially reducing the intensity of impulse sounds, such as from gunshots and explosions.

BACKGROUND OF THE INVENTION

U.S. Pat. No. 2,881,759 by Robert W. Hocks et al., issued on Apr. 14, 1959 with the title "Ear protector", and is incorporated herein by reference. U.S. Pat. No. 2,881,759 describes an improved ear protector or plug for controlling communication between the ear drum and the outside of the ear.

U.S. Pat. No. 7,236,605 by Robert J. Oliveira et al. issued on Jun. 26, 2007 with the title "User disposable sleeve for use within the ear canal", and is incorporated herein by reference. U.S. Pat. No. 7,236,605 describes user disposable sleeves for use with sound controlling structures having a non-constant radial profile that can include an inner portion adapted to releasably attach to the sound controlling structure and an outer portion adapted to fit within a user's ear canal. The user disposable sleeve can include holding means configured to releasably secure the sleeve to the elongate sound controlling structure and fitment means configured to conform to an inner surface of an ear. The fitment means can be fixedly disposed over the holding means.

U.S. Pat. No. 7,743,771 by Robert N. Falco issued on Jun. 29, 2010 with the title "Earplug with articulating stem and locking features", and is incorporated herein by reference. U.S. Pat. No. 7,743,771 describes a hearing protection device that includes a stem, a protrusion formed on the stem, an articulation point formed on the stem, and a sound attenuating element including a cavity, where the protrusion is disposed in locking engagement within the cavity to releasably attach the stem to the sound attenuating element, and where the stem is configured to at least partially articulate about the articulation point.

U.S. Pat. No. 8,161,975 by Crest Turdijian issued on Apr. 24, 2012 with the title "Dual mode impulse noise protecting earplug (D-182)", and is incorporated herein by reference. U.S. Pat. No. 8,161,975 describes a two piece dual mode carplug including an integrally molded elongated member having a nose end and an open rear end and a channel extending through. An integrally molded insert member is formed with a base portion and a rod portion and with the rod portion seated within the open rear end of the elongated member and includes an attenuation filter integrally molded as part of the rod portion and includes first and second openings located on each side of a chamber and with the size and length of the openings together with the chamber providing attenuation of impulse noise. The insert member also includes the base portion integrally molded to have a third opening larger than the first and second openings in the rod portion and with the first, second and third openings together forming a passageway through the insert member to the channel extending through the elongated member.

U.S. Pat. No. 8,327,973 by William Parish et al. issued on Dec. 11, 2012 with the title "Foam compositions with enhanced sound attenuation", and is incorporated herein by reference. U.S. Pat. No. 8,327,973 describes foam compositions with enhanced sound attenuation characteristics for use in earpieces, for example, user-disposable foam members such as foam tips for sound control devices including sound transmission devices and earplugs in which a relationship between the size of the pores and the volume of the cells of the polymeric may be controlled.

U.S. Pat. No. 8,596,279 by Robert N. Falco issued on Dec. 3, 2013 with the title "Offset stem for earplug and earplug formed therewith", and is incorporated herein by reference. U.S. Pat. No. 8,596,279 describes a stem for an earplug and an earplug incorporating the stem where the stem includes an attachment portion configured to receive and retain a sound attenuating element, the attachment portion extending substantially along an attachment axis, and a handle portion extending from the attachment portion substantially along a handle axis, where at least part of the handle axis is non-collinear with respect to the attachment axis.

U.S. Pat. No. 8,960,366 by Justin C. Peskar et al. issued on Feb. 24, 2015 with the title "Foam cushion for headphones", and is incorporated herein by reference. U.S. Pat. No. 8,960,366 describes a composite foam cushion for a

sound control device. The cushion includes a core formed of a polymeric foam material and a polymeric coating overlying at least a portion of the core of polymeric foam material. The polymeric coating includes an outer coating layer and an inner polymeric coating layer bonded to the core of polymeric foam material. The inner coating layer may provide the cushion with strength, while providing a high degree of flexibility and suppleness to closely conform around contours and obstructions. The outer coating layer may provide the cushion with enhanced abrasion resistance and/or chemical resistance while having an aesthetically pleasing feel and appearance.

U.S. Pat. No. 9,092,965 by Christopher Thomas Lyons et al. issued on Jul. 28, 2015 with the title "System and method of detecting sleep disorders", and is incorporated herein by reference. U.S. Pat. No. 9,092,965 describes an apparatus for detecting sleep disorders, such as obstructive sleep apnea, includes a housing insertable into an ear canal of a subject. A sensor disposed within the housing measures a position of the subject's head relative to an axis of gravity. A transducer is responsive to the sensor and is capable of creating a stimulus detectable by the subject under certain conditions. In various embodiments, a controller receives signals corresponding to a pitch angle and a roll angle of the subject's head measured by the sensor, determines if the pitch and roll angles correspond to a sleep apnea inducing position, and causes the transducer to generate a stimulus upon determining that the subject's head is in the sleep apnea inducing position more than a predetermined threshold number of times. Various parameters of the stimulus may be modified with successive stimulus generation until a non-sleep apnea inducing position is detected.

U.S. Pat. No. 9,603,746 by David M. Chenal issued on Mar. 28, 2017 with the title "Sound attenuation", and is incorporated herein by reference. U.S. Pat. No. 9,603,746 describes a sound attenuation system that can include a first end that can include a shaft and a flange, the flange can be coupled to the shaft, and a second end that can include a filter stem and a cap. The filter stem can have a hole. The cap can have a first position in which the cap occludes the hole and can have a second position in which the cap is clear of the hole.

U.S. Pat. No. 10,440,459 by Richard C. Smith et al. issued on Oct. 8, 2019 with the title "Ergonomic earpiece", and is incorporated herein by reference. U.S. Pat. No. 10,440,459 describes a cable assembly for electronic devices such as cellular telephones and music devices. The cable assembly can comprise either one or two earpieces, each of which is configured to be received into the concha of a user's ear. The earpiece(s) can be configured so as to be held in place by at least one anatomical structure of the concha. A speaker can be in acoustic communication with each earpiece. A cable can be configured to communicate a signal representative of sound from the electronic device to each earpiece. A microphone can be permanently attached or removably attachable to the cable to facilitate use with a cellular telephone. The cable assembly can facilitate hands free operation of a cellular telephone and can facilitate listening to a music device. Other implementations and related methods are also disclosed.

SUMMARY OF THE INVENTION

In some embodiments, the present invention provides a tuned-frequency-spectrum earpiece for selectively tuning audio frequencies that enter an inner ear of a user wearing the earpiece, the earpiece including a base having an emitter end and a receiver end, wherein the base includes a channel that passes through an entirety of the base; a sound-attenuation plug, wherein the sound-attenuation plug is configured to couple to the base such that the sound-attenuation plug surrounds at least a portion of the channel of the base; a first filter device configured to insert into the channel of the base and configured to selectively reject undesired frequencies of the audio frequencies that enter the earpiece; and a frequency-spectrum-shaping sound-collection horn operatively coupled to the receiver end of the base and configured to selectively increase a relative amount of desired frequencies of the audio frequencies that enter the inner ear of the user via the first filter device. As used herein, "selectively tuning" by the earpiece means selectively enhancing certain frequencies of the audio spectrum (i.e., increasing the audio volume or sound intensity of those portions of the audio spectrum delivered to the eardrum of the human user) and/or selectively rejecting other certain frequencies of the audio spectrum (i.e., decreasing the audio volume or sound intensity of those other portions of the audio spectrum delivered to the eardrum of the human user and/or decreasing the impulse energy of audio delivered to the eardrum, e.g., from gunshots).

In some embodiments, the earpiece selectively tunes the frequency-spectrum response and impulse response of audio passed to the eardrum of the user to improve speech recognition while substantially reducing the intensity of impulse sounds, such as from gunshots and explosions.

In some embodiments, a plurality of sound-collection horns are coupled to each deliver sound into the base of the tuned-frequency-spectrum earpiece.

BRIEF DESCRIPTION OF THE FIGURES

FIG. **1**A is a first side-view diagram of a tuned-frequency-spectrum earpiece **101**, according to some embodiments of the present invention.

FIG. **1**B is a cross-section view of tuned-frequency-spectrum earpiece **101**, according to some embodiments of the present invention.

FIG. **1**C is a cross-section view of tuned-frequency-spectrum earpiece **101** (labeled in FIG. **1**C as **101**'), according to some embodiments of the present invention.

FIG. **1**D is a second side-view diagram of tuned-frequency-spectrum earpiece **101**, according to some embodiments of the present invention.

FIG. **1**E is a first end-view diagram of tuned-frequency-spectrum earpiece **101**, according to some embodiments of the present invention.

FIG. **1**F is a second end-view diagram of tuned-frequency-spectrum earpiece **101**, according to some embodiments of the present invention.

FIG. **1**G is a first perspective-view diagram of tuned-frequency-spectrum earpiece **101**, according to some embodiments of the present invention.

FIG. **1**H is a second perspective-view diagram of tuned-frequency-spectrum earpiece **101**, according to some embodiments of the present invention.

FIG. **2**A is a side-view diagram of a tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention.

FIG. **2**B is a cross-section view of tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention.

FIG. **2**C is a top-view diagram of tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention.

FIG. **2**D is a bottom-view diagram of tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention.

FIG. **2**E is a first end-view diagram of tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention.

FIG. **2**F is a second end-view diagram of tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention.

FIG. **2**G is a first perspective-view diagram of tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention.

FIG. **2**H is a second perspective-view diagram of tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention.

FIG. **3**A is a side-view diagram of a tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention.

FIG. **3**B is a cross-section view of tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention.

FIG. **3**C is a top-view diagram of tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention.

FIG. **3**D is a bottom-view diagram of tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention.

FIG. **3**E is a first end-view diagram of tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention.

FIG. **3**F is a second end-view diagram of tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention.

FIG. **3**G is a first perspective-view diagram of tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention.

FIG. **3**H is a second perspective-view diagram of tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention.

FIG. **4**A a first side-view diagram of a tuned-frequency-spectrum earpiece **401**, according to some embodiments of the present invention.

FIG. **4**B is a cross-section view of tuned-frequency-spectrum earpiece **401**, according to some embodiments of the present invention.

FIG. **4**C is a second side-view diagram of tuned-frequency-spectrum earpiece **401**, according to some embodiments of the present invention.

FIG. **4**D is a first end-view diagram of tuned-frequency-spectrum earpiece **401**, according to some embodiments of the present invention.

FIG. **4**E is a second end-view diagram of tuned-frequency-spectrum earpiece **401**, according to some embodiments of the present invention.

FIG. **4**F is a first perspective-view diagram of tuned-frequency-spectrum earpiece **401**, according to some embodiments of the present invention.

FIG. **4**G is a second perspective-view diagram of tuned-frequency-spectrum earpiece **401**, according to some embodiments of the present invention.

FIG. **5**A is a side-view diagram of a tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention.

FIG. **5**B is a cross-section view of tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention.

FIG. **5**C is a top-view diagram of tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention.

FIG. **5**D is a bottom-view diagram of tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention.

FIG. **5**E is a first end-view diagram of tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention.

FIG. **5**F is a second end-view diagram of tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention.

FIG. **5**G is a first perspective-view diagram of tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention.

FIG. **5**H is a second perspective-view diagram of tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention.

FIG. **6**A is a side-view diagram of a tuned-frequency-spectrum earpiece **601**, according to some embodiments of the present invention.

FIG. **6**B is a cross-section view of tuned-frequency-spectrum earpiece **601**, according to some embodiments of the present invention.

FIG. **6**C is a first end-view diagram of tuned-frequency-spectrum earpiece **601**, according to some embodiments of the present invention.

FIG. **6**D is a second end-view diagram of tuned-frequency-spectrum earpiece **601**, according to some embodiments of the present invention.

FIG. **6**E is a first perspective-view diagram of tuned-frequency-spectrum earpiece **601**, according to some embodiments of the present invention.

FIG. **6**F is a second perspective-view diagram of tuned-frequency-spectrum earpiece **601**, according to some embodiments of the present invention.

FIG. **7**A is a top-view diagram of a tuned-frequency-spectrum earpiece **701**, according to some embodiments of the present invention.

FIG. **7**B is a cross-section view of tuned-frequency-spectrum earpiece **701**, according to some embodiments of the present invention, as viewed along cross-section line **7**B in FIG. **7**A.

FIG. **7**C is a first end-view diagram of tuned-frequency-spectrum earpiece **701**, according to some embodiments of the present invention.

FIG. **7**D is a second end-view diagram of tuned-frequency-spectrum earpiece **701**, according to some embodiments of the present invention.

FIG. **7**E is a first perspective-view diagram of tuned-frequency-spectrum earpiece **701**, according to some embodiments of the present invention.

FIG. **7**F is a second perspective-view diagram of tuned-frequency-spectrum earpiece **701**, according to some embodiments of the present invention.

FIG. **8**A is a first side-view diagram of a tuned-frequency-spectrum earpiece **801**, according to some embodiments of the present invention.

FIG. **8**B is a cross-section view of tuned-frequency-spectrum earpiece **801**, according to some embodiments of the present invention, as viewed along cross-section line **8**B in FIG. **8**D.

FIG. **8**C is a second side-view diagram of tuned-frequency-spectrum earpiece **801**, according to some embodiments of the present invention.

FIG. **8**D is a first end-view diagram of tuned-frequency-spectrum earpiece **801**, according to some embodiments of the present invention.

FIG. **8**E is a second end-view diagram of tuned-frequency-spectrum earpiece **801**, according to some embodiments of the present invention.

FIG. **8**F is a first perspective-view diagram of tuned-frequency-spectrum earpiece **801**, according to some embodiments of the present invention.

FIG. **8**G is a second perspective-view diagram of tuned-frequency-spectrum earpiece **801**, according to some embodiments of the present invention.

FIG. **8**H is a schematic diagram of a tuned-frequency-spectrum system **802**, according to some embodiments of the present invention.

FIG. **9**A is a side-view diagram of a tuned-frequency-spectrum earpiece **901**, according to some embodiments of the present invention.

FIG. **9**B is a cross-section view of tuned-frequency-spectrum earpiece **901**, according to some embodiments of the present invention.

FIG. **9**C is a first end-view diagram of tuned-frequency-spectrum earpiece **901**, according to some embodiments of the present invention.

FIG. **9**D is a second end-view diagram of tuned-frequency-spectrum earpiece **901**, according to some embodiments of the present invention.

FIG. **9**E is a first perspective-view diagram of tuned-frequency-spectrum earpiece **901**, according to some embodiments of the present invention.

FIG. **9**F is a second perspective-view diagram of tuned-frequency-spectrum earpiece **901**, according to some embodiments of the present invention.

FIG. **9**G is a schematic diagram of a tuned-frequency-spectrum system **902**, according to some embodiments of the present invention.

FIG. **10**A is a side-view diagram of a tuned-frequency-spectrum earpiece **1001**, according to some embodiments of the present invention.

FIG. **10**B is a cross-section view of tuned-frequency-spectrum earpiece **1001**, according to some embodiments of the present invention.

FIG. **10**C is a first end-view diagram of tuned-frequency-spectrum earpiece **1001**, according to some embodiments of the present invention.

FIG. **10**D is a second end-view diagram of tuned-frequency-spectrum earpiece **1001**, according to some embodiments of the present invention.

FIG. **10**E is a first perspective-view diagram of tuned-frequency-spectrum earpiece **1001**, according to some embodiments of the present invention.

FIG. **10**F is a second perspective-view diagram of tuned-frequency-spectrum earpiece **1001**, according to some embodiments of the present invention.

FIG. **10**G is a schematic diagram of a tuned-frequency-spectrum system **1002**, according to some embodiments of the present invention.

FIG. **11** is a side-view photograph of a tuned-frequency-spectrum earpiece **1101**, according to some embodiments of the present invention.

FIG. **12** is an end-view photograph of a filter-device tree **1201**, according to some embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Although the following detailed description contains many specifics for the purpose of illustration, a person of ordinary skill in the art will appreciate that many variations and alterations to the following details are within the scope of the invention. Specific examples are used to illustrate particular embodiments; however, the invention described in the claims is not intended to be limited to only these examples, but rather includes the full scope of the attached claims. Accordingly, the following preferred embodiments of the invention are set forth without any loss of generality to, and without imposing limitations upon the claimed invention. Further, in the following detailed description of the preferred embodiments, reference is made to the accompanying drawings that form a part hereof, and in which are shown by way of illustration specific embodiments in which the invention may be practiced. It is understood that other embodiments may be utilized and structural changes may be made without departing from the scope of the present invention.

It is specifically contemplated that the present invention includes embodiments having combinations and subcombinations of the various embodiments and features that are individually described herein (i.e., rather than listing every combinatorial of the elements, this specification includes descriptions of representative embodiments and contemplates embodiments that include some of the features from one embodiment combined with some of the features of another embodiment, including embodiments that include some of the features from one embodiment combined with some of the features of embodiments described in the patents and application publications incorporated by reference in the present application). Further, some embodiments include fewer than all the components described as part of any one of the embodiments described herein.

The leading digit(s) of reference numbers appearing in the Figures generally corresponds to the Figure number in which that component is first introduced, such that the same reference number is used throughout to refer to an identical component which appears in multiple Figures Signals and connections may be referred to by the same reference number or label, and the actual meaning will be clear from its use in the context of the description.

Certain marks referenced herein may be common-law or registered trademarks of third parties affiliated or unaffiliated with the applicant or the assignee. Use of these marks is for providing an enabling disclosure by way of example and shall not be construed to limit the scope of the claimed subject matter to material associated with such marks.

FIG. **1**A is a first side-view diagram of a tuned-frequency-spectrum earpiece **101**, according to some embodiments of the present invention. In some embodiments, earpiece **101** includes a sound-attenuating element (also called a "plug") **110** (in some embodiments, a foam sound-attenuating element **110**), a pliable, sound-attenuating base **120**, a filter system **130** (not visible in FIG. **1**A; see FIG. **1**B), and a frequency-selective sound collector **140** (also referred to herein as a horn or funnel or frequency collector). In some embodiments, earpiece **101** is similar to earpiece **1701** of FIG. **17**A in PCT application publication WO 2022/226213 (incorporated by reference above), except that earpiece **101** further includes components **130** and **140** in order to provide the tuned-frequency-spectrum functionality of the present invention. As used herein, "audio frequencies" refer to frequencies of sound detectable by a mammal such as a human. In some embodiments, filter system **130** functions as the audio-frequency equivalent of an electronic band-pass filter (e.g., one that exhibits first-order, second-order or higher-order low-pass filtering to block high frequency components of sound impulses (such as from explosions or

gunfire) combined with selective first-order, second-order or higher-order high-pass filtering that blocks low-frequency rumble such as from a military tank or industrial air compressors) that selectively passes frequencies within a certain range (such as frequencies needed to understand human speech) and rejects frequencies outside that range. In some such embodiments, for example, filter system **130** rejects selected low audio frequencies (e.g., audio frequencies associated with engine rumbling, low bass at a rock concert, etc.) and rejects selected high audio frequencies (e.g., frequencies associated with loud, sudden-impact or impulse noises such as an explosion from a gun or bomb), while passing most other audio frequencies, and in particular speech frequencies, for some embodiments. In some embodiments, filter system **130** reduces the amplitude of audio frequencies associated with loud, sudden-impact (impulse) noises by absorbing the abrupt change in air pressure caused by the sudden-impact noises.

In some embodiments, horn **140** increases the amounts of desired audio frequencies (e.g., relatively higher-audio-frequency audio associated with a speaking or singing voice and/or music) that reach filter system **130**. In some such embodiments, horn **140** combines with system **130** and earpiece **101** as a whole to provide the tuned-frequency-spectrum functionality of earpiece **101**. In some embodiments, the tune-frequency-spectrum functionality of earpiece **101** allows the user of earpiece **101** to block out unwanted sounds and provide protection for the user's ear while still hearing desired sounds. Accordingly, in some embodiments, earpiece **101** is used in environments that have unwanted loud or low-frequency background noise and/or loud, sudden-impact noises, but also have higher frequency talking/singing/music that is desired to be heard (e.g., at a rock concert, a football stadium, inside a tank or other large, noisy vehicle, etc.). In some embodiments, the desired audio frequencies that are amplified by horn **140** include lower audio frequencies (like frequencies down to 20 Hz), which, in some embodiments, are used to provide therapeutic or healing characteristics.

FIG. **1**B is a cross-section view of tuned-frequency-spectrum earpiece **101**, according to some embodiments of the present invention. Some components shown in the cross-section view of FIG. **1**B (and some components in the cross-section views of FIGS. **1**C, **2**B, **3**B, **4**B, **5**B, **6**B, **7**B, **8**B, **9**B, and **10**B) have overlap with each other at the boundaries between the components (see, for example, the overlap between the boundaries of sound-attenuating element **110** and stem **129** of base **120**). The component overlap shown in the cross-section views is due to the fact that certain pliable components (e.g., the sound-attenuating element **110**, the frequency-selective sound collector **140**, the first filter device **131**, and the second filter device **133**) are shown in their "as-molded" or "as-made" sizes in the cross-section views rather than in their modified sizes that occur when the earpieces are actually assembled. For example, when sound-attenuating element **110** is placed over stem **129** of base **120**, the interior channel of sound-attenuating element **110** is expanded (is temporarily stretched) from the size shown in FIG. **1**B to a larger size (not shown) that allows the base to be inserted through the interior channel of sound-attenuating element **110** and then reduces in size (shrinks towards its smaller diameter) to fit snugly against the outside wall of the central stem **129** of base **120**. In some embodiments, one or more of each frequency-selective sound collector (each also optionally called a sound-collection horn or funnel) described herein (such as frequency-selective sound collector **140**) is also, or is primarily, a direction-selective sound collector **140** that is pointed and/or oriented to increase the amount of sound and/or certain selected frequencies of the audio spectrum of sound from certain selected direction(s) while reducing the amounts and/or other certain selected frequencies of sound from other directions. In some other embodiments, one or more of each sound collector (each also optionally called a sound-collection horn or funnel) described herein (such as frequency-selective sound collector **140**) is primarily a direction-selective sound collector that is pointed and/or oriented to increase the amount of sound from certain selected direction(s) while reducing the amount of sound from other directions. This can help the user in a loud concert selectively collect relatively more sound from the person's side (e.g., from neighboring concert fans) in order to have conversations with those next to the user while collecting relatively less of the heavily amplified sound from the concert stage. Other environments that could benefit from similar selective directionality for sound reception could be football games or gun ranges or military/artillery battlefields.

In some embodiments, base **120** includes a channel **121** that passes through base **120** (including stem **129**). In some embodiments, base **120** includes a plug-stop **122** having a flat proximal surface **126** and a tapered section **127**. In some embodiments, earpiece **101** is assembled by stretching and forcing sound-attenuating element **110** over the end of pliable distal flange **125** and into position around stem **129**, wherein top surface **111** of sound-attenuating element **110** is compressed against flat interior surface of flange **123**, and bottom flat surface **112** of sound-attenuating element **110** is compressed against flat proximal surface **126** of plug-stop **122**. In some embodiments, sound-attenuating element **110** keeps the stem **129** of base **120** from buckling, and also absorbs and attenuates sound that otherwise is somewhat conducted through the length of base **120**. The numerous material discontinuities and spacings between base **120** and sound-attenuating element **110** also further help to attenuate sound. In some embodiments, sound-attenuating element **110** is made of a visco-clastic foam (also called memory form) that, once temporarily compressed slowly restores (e.g., over a period of about 5 seconds to about 30 seconds) toward a default fully expanded shape or toward a shape that conforms gently to the shape of the user's ear canal.

In some embodiments, distal flange **125** is attached to the distal end of tapered section **127** at a flexible joint region **128**, and therefore distal flange **125** may easily bend such that one side of the inner surface of distal flange **125** is much nearer to, or touching, tapered section **127** or nearer to, or touching, sound-attenuating element **110** in the assembled earpiece **101**. In some embodiments, the external lateral surface of tapered section **127** is shaped like the frustrum of a cone. In some embodiments, tapered section **127** is shaped to vary its stiffness from a more-stiff stiffness value at stop **126** to a less-stiff stiffness value at flexible joint region **128**, in order to reduce a tendency of tapered portion **127** to collapse or bend sideways along its length, yet still allow easier bending of the distal flange **125** relative to tapered portion **127** at bending location **128** at the distal end of tapered portion **127** to allow a variable angle (as shown in FIG. **1**C) of the pliable distal flange **125** relative to the internal-to-the-ear axis of stem **129**.

In some embodiments, filter system **130** includes a first filter device **131** and a second filter device **133**. In some embodiments (not shown), filter system **130** includes only first filter device **131**. In some embodiments (not shown), filter system **130** includes only second filter device **133**. In

some embodiments, first filter device **131** is a Hocks Noise Filter™ such as provided by Hocks Hearing Healthcare Products (www.hocksproducts.com/hocks_noise_filter). In some embodiments, first filter device **131** is similar to the body portion **10** of FIG. **1** in U.S. Pat. No. 2,881,759 (incorporated by reference above), except that the shape of first filter device **131** is made to fit inside channel **121** of base **120** instead of fitting the ear of a user directly. In some embodiments, first filter device **131** includes a channel **132** that passes through first filter device **131** (in other embodiments (not shown), first filter device **131** does not include a channel). In some embodiments, channel **132** includes two portions, a first portion with a first larger diameter, and a second portion with a second smaller diameter. In some embodiments, the narrowness of channel **132** of first filter device **131** limits the amount of air that can get into and past first filter device **131**, which therefore reduces the magnitude of incoming pulses of sound. In some embodiments, first filter device **131** is configured to eliminate or reduce high frequencies associated with loud, sudden impact noises. In some embodiments, first filter device **131** is made from a polypropylene; in some embodiments, first filter device **131** is made from a foam; in some embodiments, first filter device **131** is made from any other suitable material for absorbing selected audio frequencies and/or reducing the amplitude of incoming audio frequencies. In some embodiments, second filter device **133** is configured to reduce resonance in earpiece **101** caused by incoming audio frequencies. In some embodiments, second filter device **133** is made from, or includes, cotton. In some embodiments, second filter device **133** is made from, or includes, a visco-clastic memory foam such as described for sound-attenuating element **110**. In some embodiments, second filter device **133** is made from, or includes, urethane. In some embodiments, second filter device **133** is made from, or includes, urethane foam. In some embodiments, second filter device **133** is made from, or includes, any suitable polymer foam having open cells and/or closed cells (e.g., in some embodiments, second filter device **133** includes an open-cell or closed-cell polyurethane foam). In some embodiments, second filter device **133** is made from any other suitable material capable of reducing resonance in earpiece **101**. In some embodiments, first filter device **131** and/or second filter device **133** is integrated with base **120** such that base **120** and filter system **130** are made as a single, fully integrated component (e.g., in some embodiments, base **120** and first filter device **131** are made from a single mold that forms first filter device **131** within channel **121** of base **120** as a single piece).

In some embodiments (not shown), second filter device **133** includes a channel or opening there through (in some such embodiments, the channel improves the ability of second filter device **133** to allow changes in air pressure to pass through second filter device **133** such as encountered when flying in a commercial or military aircraft). In some embodiments, second filter device **133** is separated from first filter device **131** by an air gap **134** having a length **135** and a cross-sectional area equal to the cross section of channel **121**. In some embodiments, the configuration of first filter device **131**, air gap **134**, and second filter device **133** forms the audio-frequency equivalent of an electronic two-stage low-pass filter that absorbs high frequencies and passes at least some low frequencies. In some embodiments (not shown), the sequential order of first filter device **131** and second filter device **133** is reversed such that second filter device **133** is closer to horn **140** than first filter device **131**, but in such embodiments, air gap **134** remains between second filter device **133** and first filter device **131**.

In some embodiments, the shape and/or dimensions of frequency-selective sound collector **140** are varied to selectively increase the amount of desired audio frequencies that enter earpiece **101**. For example, in some embodiments, the length of frequency-selective sound collector **140** is modified (compare, for example, frequency-selective sound collector **140** to frequency-selective sound collector **440** of FIG. **4**A); in some embodiments, the circumference of the cone at the input end **141** of frequency-selective sound collector **140** is modified (compare, for example, frequency-selective sound collector **140** to frequency-selective sound collector **540** of FIG. **5**A); in some embodiments, the angle of input end **141** relative to the longitudinal axis of channel **121** (and/or relative to the longitudinal axis of horn **140** itself) is modified. In some embodiments, as shown in FIG. **1**B, a plane surface of input end **141** is at a 90-degree angle relative to the longitudinal axis of channel **121**, while in other embodiments, the plane surface of input end **141** is at a different angle relative to the longitudinal axis of channel **121** such as 135 degrees, 145 degrees, 155 degrees, 165 degrees, or the like (see, for example, FIGS. **7**A-**7**F). In some embodiments, frequency-selective sound collector **140** is made from a cured plastisol (e.g., a PVC). In some embodiments, frequency-selective sound collector **140** is injection molded and is made from a suitable plastic polymer. In some embodiments, frequency-selective sound collector **140** is made from any other suitable material. In some embodiments, the distal end (left-hand portion in FIG. **1**B) of frequency-selective sound collector **140** stretches over the proximal end (right-hand portion) of base **120** and/or the proximal end of base **120** is compressed to insert into the distal end of frequency-selective sound collector **140**, to provide a snug fit.

FIG. **1**C is a cross-section view of tuned-frequency-spectrum earpiece **101** (labeled in FIG. **1**C as **101**'), according to some embodiments of the present invention. As shown in FIG. **1**C, earpiece **101** is labeled as **101**' because distal flange **125** is also shown with dashed-line alternative bent position **125**' that includes pliable sound-attenuating base **120**, sound-attenuating element **110**, filter system **130**, and frequency-selective sound collector **140**. FIG. **1**C shows sound-attenuating pliable distal flange in its default position labeled **125**, and in dashed-line outline of a bent position, labeled **125**'. Bent position **125**' (i.e., the angle of cup **125**) is determined by the individual shape of the ear canal of the user wearing earpiece.

FIG. **1**D is a second side-view diagram of tuned-frequency-spectrum earpiece **101**, according to some embodiments of the present invention.

FIG. **1**E is a first end-view diagram of tuned-frequency-spectrum earpiece **101**, according to some embodiments of the present invention. In some embodiments, the first end-view diagram of FIG. **1**E shows the view if facing the end of horn **140**.

FIG. **1**F is a second end-view diagram of tuned-frequency-spectrum earpiece **101**, according to some embodiments of the present invention. In some embodiments, the second end-view diagram of FIG. **1**F shows the view if facing the end of distal flange **125** of base **120**.

FIG. **1**G is a first perspective-view diagram of tuned-frequency-spectrum earpiece **101**, according to some embodiments of the present invention.

FIG. **1**H is a second perspective-view diagram of tuned-frequency-spectrum earpiece **101**, according to some embodiments of the present invention.

FIG. **2**A is a side-view diagram of a tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention. In some embodiments, earpiece **201** is substantially similar to earpiece **101**, except that base **220** and its bendable end cup **225** replaces base **120** and its bendable end cup **125** (filter system **130** is not visible in FIG. **2**A; see FIG. **2**B).

FIG. **2**B is a cross-section view of tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention. In some embodiments, the central axis of base **220** toward the receiver end of base **220** (i.e., the proximal end of base **220** (the right-hand end in FIG. **2**B) that is coupled to frequency-selective sound collector **140**), is bent (molded) at an angle relative to the central axis of the remainder of base **220** in order that earpiece **201** fits into the ear canal of the user more comfortably while still having the frequency-selective sound collector **140** extend straight out from, or at some other desired orientation relative to, the side of the head of the user.

FIG. **2**C is a top-view diagram of tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention.

FIG. **2**D is a bottom-view diagram of tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention.

FIG. **2**E is a first end-view diagram of tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention. In some embodiments, the first end-view diagram of FIG. **2**E shows the view if facing earpiece **201** from the end that includes horn **140**.

FIG. **2**F is a second end-view diagram of tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention. In some embodiments, the second end-view diagram of FIG. **2**F shows the view if facing the end of distal flange **225** of base **220**.

FIG. **2**G is a first perspective-view diagram of tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention.

FIG. **2**H is a second perspective-view diagram of tuned-frequency-spectrum earpiece **201**, according to some embodiments of the present invention.

FIG. **3**A is a side-view diagram of a tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention. In some embodiments, earpiece **301** is substantially similar to earpiece **201** of FIGS. **2**A-**2**B except that base **220** is replaced with base **320** and sound-attenuating element **110** of FIG. **2**B is removed. In some embodiments, base **320** includes a flange system **325** made of a plurality of (e.g., in some embodiments, a series of three) different-sized cup shapes located at the distal (emitter) end of base **320** (in some embodiments, flange system **325** replaces the single, distal flange **225** of FIG. **2**B). In some embodiments, each individual cup of flange system **325** includes a convex outer surface and a concave back-side or inner surface, and flange system **325** is made of a polyvinyl chloride (PVC), polymer foam, or any other suitable material.

FIG. **3**B is a cross-section view of tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention.

FIG. **3**C is a top-view diagram of tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention.

FIG. **3**D is a bottom-view diagram of tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention.

FIG. **3**E is a first end-view diagram of tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention. In some embodiments, the first end-view diagram of FIG. **3**E shows the view if facing earpiece **301** from the end that includes horn **140**.

FIG. **3**F is a second end-view diagram of tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention. In some embodiments, the second end-view diagram of FIG. **3**F shows the view if facing the end of flange system **325** of base **320**.

FIG. **3**G is a first perspective-view diagram of tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention.

FIG. **3**H is a second perspective-view diagram of tuned-frequency-spectrum earpiece **301**, according to some embodiments of the present invention.

FIG. **4**A is a first side-view diagram of a tuned-frequency-spectrum earpiece **401**, according to some embodiments of the present invention. In some embodiments, earpiece **401** is substantially similar to earpiece **101** of FIG. **1**A, except that horn **140** of FIG. **1**A is replaced with horn **440**. In some embodiments, horn **440** is shorter or longer in length and/or smaller or larger in diameter and/or has a different conical, paraboloid, elliptical paraboloid, or other shape configured to tune a frequency-spectrum and/or amplitude of passed audio, rather than conical horn **140**.

FIG. **4**B is a cross-section view of tuned-frequency-spectrum earpiece **401**, according to some embodiments of the present invention.

FIG. **4**C is a second side-view diagram of tuned-frequency-spectrum earpiece **401**, according to some embodiments of the present invention.

FIG. **4**D is a first end-view diagram of tuned-frequency-spectrum earpiece **401**, according to some embodiments of the present invention. In some embodiments, the first end-view diagram of FIG. **4**D shows the view if facing the end of horn **440**.

FIG. **4**E is a second end-view diagram of tuned-frequency-spectrum earpiece **401**, according to some embodiments of the present invention. In some embodiments, the second end-view diagram of FIG. **4**E shows the view if facing the end of distal flange **125** of base **120**.

FIG. **4**F is a first perspective-view diagram of tuned-frequency-spectrum earpiece **401**, according to some embodiments of the present invention.

FIG. **4**G is a second perspective-view diagram of tuned-frequency-spectrum earpiece **401**, according to some embodiments of the present invention.

FIG. **5**A is a side-view diagram of a tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention. In some embodiments, earpiece **501** is substantially similar to earpiece **101** of FIG. **1**A, except that horn **140** is replaced with horn **540**. In some embodiments, horn **540** has a larger diameter and/or a longer length than horn **140**.

FIG. **5**B is a cross-section view of tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention.

FIG. **5**C is a top-view diagram of tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention.

FIG. **5**D is a bottom-view diagram of tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention.

FIG. **5**E is a first end-view diagram of tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention. In some embodiments, the first end-

view diagram of FIG. **5**E shows the view if facing earpiece **501** from the end that includes horn **540**.

FIG. **5**F is a second end-view diagram of tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention. In some embodiments, the second end-view diagram of FIG. **5**F shows the view if facing the end of distal flange **225** of base **220**.

FIG. **5**G is a first perspective-view diagram of tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention.

FIG. **5**H is a second perspective-view diagram of tuned-frequency-spectrum earpiece **501**, according to some embodiments of the present invention.

FIG. **6**A is a side-view diagram of a tuned-frequency-spectrum earpiece **601**, according to some embodiments of the present invention. In some embodiments, earpiece **601** is substantially similar to earpiece **101** of FIG. **1**A, except that an elbow extension **650** is added between base **120** and horn **140**.

FIG. **6**B is a cross-section view of tuned-frequency-spectrum earpiece **601**, according to some embodiments of the present invention. In some embodiments, elbow extension **650** is injection molded and is made from a material that includes a suitable plastic polymer. In some embodiments, elbow extension **650** is made from a material that includes a cured plastisol (e.g., a PVC). In some embodiments, elbow extension **650** includes a channel **651** that passes through elbow extension **650**. In some embodiments, frequency horn **140** couples to a first end of elbow extension **650** (in some such embodiments, the first end of elbow extension **650** is inserted into horn **140**) and base **120** is inserted into a second end of elbow extension **650** (in some such embodiments, channel **651** includes a first diameter and a second diameter where the first diameter is larger than the second diameter and base **120** is inserted into the larger first diameter of channel **651**). In some embodiments, elbow extension **650** allows the horn **140** to be directed out of the ear at a direction more suitable to receiving the desired audio frequencies.

FIG. **6**C is a first end-view diagram of tuned-frequency-spectrum earpiece **601**, according to some embodiments of the present invention. In some embodiments, the first end-view diagram of FIG. **6**C shows the view if facing earpiece **601** from the end that includes horn **140**.

FIG. **6**D is a second end-view diagram of tuned-frequency-spectrum earpiece **601**, according to some embodiments of the present invention. In some embodiments, the second end-view diagram of FIG. **6**D shows the view if facing the end of distal flange **125** of base **120**.

FIG. **6**E is a first perspective-view diagram of tuned-frequency-spectrum earpiece **601**, according to some embodiments of the present invention.

FIG. **6**F is a second perspective-view diagram of tuned-frequency-spectrum earpiece **601**, according to some embodiments of the present invention.

FIG. **7**A is a top-view diagram of a tuned-frequency-spectrum earpiece **701**, according to some embodiments of the present invention. In some embodiments, earpiece **701** is substantially similar to earpiece **101** except that horn **140** is replaced with horn **740**. In some embodiments, the input end **741** of horn **740** is at a non-90-degree angle (e.g., 45 degrees) relative to the longitudinal axis of horn **740**.

FIG. **7**B is a cross-section view of tuned-frequency-spectrum earpiece **701**, according to some embodiments of the present invention, as viewed along cross-section line **7**B in FIG. **7**A.

FIG. **7**C is a first end-view diagram of tuned-frequency-spectrum earpiece **701**, according to some embodiments of the present invention. In some embodiments, the first end-view diagram of FIG. **7**C shows the view if facing the end of horn **740**.

FIG. **7**D is a second end-view diagram of tuned-frequency-spectrum earpiece **701**, according to some embodiments of the present invention. In some embodiments, the second end-view diagram of FIG. **7**D shows the view if facing the end of distal flange **125** of base **120**.

FIG. **7**E is a first perspective-view diagram of tuned-frequency-spectrum earpiece **701**, according to some embodiments of the present invention.

FIG. **7**F is a second perspective-view diagram of tuned-frequency-spectrum earpiece **701**, according to some embodiments of the present invention.

FIG. **8**A is a first side-view diagram of a tuned-frequency-spectrum earpiece **801**, according to some embodiments of the present invention. In some embodiments, earpiece **801** is substantially similar to earpiece **101** of FIG. **1**A except that earpiece **801** further includes a split connector **860**, two elbow connectors **850**, and two horns (e.g., in some embodiments, horn **140** and horn **540**). In some other embodiments (not shown), a plurality of horns at a plurality of different orientations or angles are provided, such as three or more horns, pointed or oriented to selectively collect relatively more sound from certain directions and relatively less sound from other directions. In some embodiments, split connector **860** includes a first end and a second end, wherein the second end includes a first receiver portion **861** and a second receiver portion **862**. In some embodiments, the receiver end of base **120** is inserted into the first end of split connector **860**, each respective receiver portion **861** and **862** is inserted into a first end of a respective elbow connector **850**, and the second ends of each respective elbow connector **850** are inserted into a respective horn. In some embodiments, earpiece **801** allows audio frequencies to be received into horn **140** as horn **140** faces forward from the user **99** while audio frequencies are also received into horn **540** as horn **540** faces backward from user **99** (see FIG. **8**H). In some embodiments, split connector **860** and elbow connectors **850** are made from any suitable plastic polymer, cured plastisol, or the like. In some embodiments, connector **860** and elbow connectors **850** are injection molded.

FIG. **8**B is a cross-section view of tuned-frequency-spectrum earpiece **801**, according to some embodiments of the present invention, as viewed along cross-section line **8**B in FIG. **8**D.

FIG. **8**C is a second side-view diagram of tuned-frequency-spectrum earpiece **801**, according to some embodiments of the present invention.

FIG. **8**D is a first end-view diagram of tuned-frequency-spectrum earpiece **801**, according to some embodiments of the present invention. In some embodiments, the first end-view diagram of FIG. **8**D shows the view if facing earpiece **801** from the end that includes horn **140** and horn **540**.

FIG. **8**E is a second end-view diagram of tuned-frequency-spectrum earpiece **801**, according to some embodiments of the present invention. In some embodiments, the second end-view diagram of FIG. **8**E shows the view if facing the end of distal flange **125** of base **120**.

FIG. **8**F is a first perspective-view diagram of tuned-frequency-spectrum earpiece **801**, according to some embodiments of the present invention.

FIG. **8**G is a second perspective-view diagram of tuned-frequency-spectrum earpiece **801**, according to some embodiments of the present invention.

FIG. **8**H is a schematic diagram of a tuned-frequency-spectrum system **802**, according to some embodiments of

the present invention. In some embodiments, earpiece **801** is inserted into the ear of user **99** such that horn **140** faces forward from user **99** and horn **540** faces backward from user **99**. In some embodiments, earpiece **801** is inserted into the ear of user **99** such that horn **140** and horn **540** face any other suitable directions.

FIG. **9**A is a side-view diagram of a tuned-frequency-spectrum earpiece **901**, according to some embodiments of the present invention. In some embodiments, earpiece **901** is substantially similar to earpiece **801** of FIG. **8**A except that earpiece **901** further includes an elbow connector **950** and an extension tube **951**. In some embodiments, the receiver end of base **120** is inserted into a first end of split connector **860**, first receiver portion **861** of split connector **860** is inserted into a first end of elbow connector **950**, second receiver portion **862** of split connector **860** is inserted into horn **140**, the second end of elbow connector **950** is inserted into a first end of extension tube **951**, and horn **540** is coupled to a second end of extension tube **951**. In some embodiments, earpiece **901** allows audio frequencies to be received into horn **140** as horn **140** faces outward from the user **99** while audio frequencies are also received into horn **540** as horn **540** faces forward from user **99** (see FIG. **9**G). In some embodiments, elbow connector **950** and extension tube **951** are made from any suitable plastic polymer, cured plastisol, or the like. In some embodiments, elbow connector **950** and extension tube **951** are injection molded.

FIG. **9**B is a cross-section view of tuned-frequency-spectrum earpiece **901**, according to some embodiments of the present invention.

FIG. **9**C is a first end-view diagram of tuned-frequency-spectrum earpiece **901**, according to some embodiments of the present invention. In some embodiments, the first end-view diagram of FIG. **9**C shows the view if facing earpiece **901** from the end that includes horn **140** and horn **540**.

FIG. **9**D is a second end-view diagram of tuned-frequency-spectrum earpiece **901**, according to some embodiments of the present invention. In some embodiments, the second end-view diagram of FIG. **9**D shows the view if facing the end of distal flange **125** of base **120**.

FIG. **9**E is a first perspective-view diagram of tuned-frequency-spectrum earpiece **901**, according to some embodiments of the present invention.

FIG. **9**F is a second perspective-view diagram of tuned-frequency-spectrum earpiece **901**, according to some embodiments of the present invention.

FIG. **9**G is a schematic diagram of a tuned-frequency-spectrum system **902**, according to some embodiments of the present invention. In some embodiments, earpiece **901** is inserted into the ear of user **99** such that horn **140** faces outward from user **99** and horn **540** faces forward from user **99** and is positioned above the left ear of user **99** for this embodiment. In some embodiments, earpiece **901** is inserted into the ear of user **99** such that horn **140** and horn **540** face any other suitable directions.

FIG. **10**A is a side-view diagram of a tuned-frequency-spectrum earpiece **1001**, according to some embodiments of the present invention. In some embodiments, earpiece **1001** is substantially similar to earpiece **101** of FIG. **1**A except that earpiece **1001** further includes a three-way connector **1060**, two elbow connectors **1050**, two extension tubes **1051**, and three horns (e.g., in some embodiments, horn **140**, horn **540**, and a third horn **1040**). In some embodiments, horn **1040** has a larger diameter than both horn **140** and horn **540**. In some embodiments, three-way connector **1060** includes a first end coupled to base **120** and a second end that includes a first receiver portion, a second receiver portion, and a third receiver portion. In some embodiments, the receiver end of base **120** is inserted into the first end of three-way connector **1060**, each of the first and second receiver portions of three-way connector **1060** is inserted into a respective elbow connector **1050**, the third receiver portion of three-way connector **1060** is inserted into horn **140**, each of the second ends of each elbow connector **1050** is inserted into a first end of a respective extension tube **1051**, horn **540** is coupled to a second end of a first extension tube **1051**, and horn **1040** is coupled to a second end of a second extension tube **1052**. In some embodiments, earpiece **1001** allows audio frequencies to be received into horn **140** as it faces outward from user **99** while audio frequencies are also received into horn **540** as it faces forward from user **99** on a first side of user **99** and audio frequencies are received into horn **1040** as it faces forward from user **99** on a second side of user **99** (see FIG. **10**G). In some embodiments, elbow connectors **1050** and extension tubes **1051** and **1052** are made from any suitable plastic polymer, cured plastisol, or the like. In some embodiments, elbow connectors **1050** and extension tubes **1051** are injection molded.

FIG. **10**B is a cross-section view of tuned-frequency-spectrum earpiece **1001**, according to some embodiments of the present invention.

FIG. **10**C is a first end-view diagram of tuned-frequency-spectrum earpiece **1001**, according to some embodiments of the present invention. In some embodiments, the first end-view diagram of FIG. **10**C shows the view if facing earpiece **1001** from the end that includes horn **140**, horn **540**, and horn **1040**.

FIG. **10**D is a second end-view diagram of tuned-frequency-spectrum earpiece **1001**, according to some embodiments of the present invention. In some embodiments, the second end-view diagram of FIG. **10**D shows the view if facing the end of distal flange **125** of base **120**.

FIG. **10**E is a first perspective-view diagram of tuned-frequency-spectrum earpiece **1001**, according to some embodiments of the present invention.

FIG. **10**F is a second perspective-view diagram of tuned-frequency-spectrum earpiece **1001**, according to some embodiments of the present invention.

FIG. **10**G is a schematic diagram of a tuned-frequency-spectrum system **1002**, according to some embodiments of the present invention. In some embodiments, earpiece **1001** is inserted into the ear of user **99** such that horn **140** faces outward from user **99**, horn **540** faces forward from user **99** on a first side of user **99** and is positioned above the left ear of user **99** for this embodiment, and horn **1040** faces forward from user **99** on a second side of user **99** and is positioned above the right ear of user **99** for this embodiment. In some embodiments, earpiece **1001** is inserted into the ear of user **99** such that horn **140**, horn **540**, and horn **1040** face any other suitable combinations of directions.

FIG. **11** is a side-view photograph of a tuned-frequency-spectrum earpiece **1101**, according to some embodiments of the present invention. In some embodiments, earpiece **1101** includes a base **1120** (substantially similar to base **320** of FIG. **3**A except having a longer bent portion than base **320**), a flange **1125** (substantially similar to flange **325** of FIG. **3**A), an ear-attachment device **1150**, filter system **130** (not shown) contained within the channel of base **1120**, and frequency-selective sound collector **140**. In some embodiments, ear-attachment device **1150** is coupled around the outside of base **1120** in a location between flange **1125** and frequency-selective sound collector **140**. In some embodiments, ear-attachment device **1150** is made of any suitable plastic polymer or other suitable material and is configured

to fit snugly in the outer ear of the user while flange **1125** is placed into the ear canal of the user such that earpiece **1101** is held in place on the user.

FIG. **12** is an end-view photograph of a filter-device tree **1201**, according to some embodiments of the present invention. In some embodiments, tree **1201** includes a plurality of injection-molded filter devices **1231**.**1**, **1231**.**2**, **1231**.**3**, **1231**.**4**, **1231**.**5**, and **1231**.**6**, each having two copies, and all attached to an injection-mold scaffolding **1260**. In some embodiments, the channel diameter within each individual filter device gets larger starting with the smallest-diameter channel in filter devices **1231**.**1**, and ending with the largest-diameter channel in filter devices **1231**.**6**. In some embodiments, tree **1201** is made from a polypropylene, polyethylene, or any other suitable material. In some embodiments, an individual filter device removed from tree **1201** is used as the first filter device **131** of FIG. **1**B (in some such embodiments, an individual filter device is removed by twisting the device off of scaffolding **1260**).

In some embodiments, the present invention provides a tuned-frequency-spectrum earpiece for selectively tuning audio frequencies that enter an inner ear of a user wearing the earpiece, the earpiece including: a base having an emitter end and a receiver end, wherein the base includes a channel that passes through an entirety of the base; a sound-attenuation plug, wherein the sound-attenuation plug is configured to couple to the base such that the sound-attenuation plug surrounds at least a portion of the channel of the base; a first filter device configured to insert into the channel of the base and configured to selectively reject undesired frequencies of the audio frequencies that enter the earpiece; and a frequency-selective sound collector operatively coupled to the receiver end of the base and configured to selectively increase an amount of desired frequencies of the audio frequencies that enter the first filter device.

In some embodiments of the earpiece, the first filter device is further configured to reduce an amplitude of the audio frequencies that enter the earpiece. In some embodiments, the first filter device includes a channel that passes through an entirety of the first filter device. In some embodiments, the first filter device is made from a material that includes a polypropylene. In some embodiments, the earpiece further includes a second filter device configured to insert into the channel of the base and configured to reduce resonance in the earpiece, wherein the second filter device is located closer to the emitter end of the base than the first filter device, and wherein an air gap is located between the first filter device and the second filter device. In some embodiments, the second filter device is made from a material that includes urethane.

In some embodiments of the earpiece, the frequency-selective sound collector includes a funnel shape. In some embodiments, the base includes: a first flange at the emitter end of the base, wherein the first flange has a cup shape having a convex external surface at the emitter end of the base and an outer perimeter, wherein the cup shape is configured to engage the ear canal to create a seal in the ear canal, wherein the first flange has a concave inner surface toward the receiver end of the base, and a stop located within the cup shape of the first flange, wherein the sound-attenuation plug is configured to couple to the base such that the distal end of the sound-attenuation plug is adjacent to the stop and at least a portion of the sound-attenuation plug is within the outer perimeter of the cup shape of the first flange. In some embodiments, the receiver end of the base has a first longitudinal axis, the emitter end of the base has a second longitudinal axis, and the first longitudinal axis is at a first angle relative to the second longitudinal axis.

In some embodiments of the earpiece, the frequency-selective sound collector includes a conical funnel shape. In some embodiments, the first filter device is integrated with the base such that the base and the first filter device form a single-piece component. In some embodiments, the frequency-spectrum-shaping sound-collection horn includes an input end and a longitudinal axis, wherein a plane surface of the input end of the sound-collection horn is at a ninety-degree angle relative to the longitudinal axis of the sound-collection horn (in other embodiments, the plane surface of the input end of the sound-collection horn is at a non-90-degree angle (e.g., 45 degrees, 135 degrees, and the like) relative to the longitudinal axis of the sound-collection horn in order to more precisely aim the input end of the sound-collection horn in a desired direction). In some embodiments, the earpiece further includes an elbow connector having a first end and a second end, wherein the first end of the elbow connector is coupled to the receiver end of the base, and wherein the second end of the elbow connector is coupled to the frequency-spectrum-shaping sound-collection horn such that the elbow connector is located between the base and the sound-collection horn.

In some embodiments, the present invention provides a tuned-frequency-spectrum earpiece for selectively tuning audio frequencies that enter an inner ear of a user wearing the earpiece, the earpiece including: a base having an emitter end and a receiver end, wherein the base includes: a channel that passes through an entirety of the base, and a plurality of flanges arranged in a series at the emitter end of the base including a first flange and a second flange, wherein each of the plurality of flanges has a cup shape having a convex external surface toward the emitter end of the base and a concave inner surface toward the receiver end of the base, wherein the first flange has a first cup diameter, wherein the second flange has a second cup diameter, and wherein the first cup diameter is smaller than the second cup diameter; the earpiece further including a first filter device configured to insert into the channel of the base and configured to selectively reject undesired frequencies of the audio frequencies that enter the earpiece; the earpiece further including a frequency-selective sound collector operatively coupled to the receiver end of the base and configured to selectively increase an amount of desired frequencies of the audio frequencies that enter the first filter device. In some embodiments, the earpiece further includes an ear-attachment piece operatively coupled around the base in a location between the plurality of flanges and the frequency-selective sound collector, wherein the ear-attachment piece is configured to fit snugly within the outer ear of a user of the earpiece. In some embodiments, the frequency-selective sound collector includes one or more horn-shaped pieces, made of polymer, and having one or more internal passageways extending from relatively larger-diameter sound-entry port(s) to one or more relatively smaller-diameter sound-exit port(s) coupled to the first filter device. In some embodiments, the frequency-selective sound collector includes a plurality of horn-shaped sound-collection ports each pointed in one of a plurality of different directions to selectively receive relatively more sound energy from those plurality of different directions and relatively less sound energy from other directions.

In some embodiments, the present invention provides a method for selectively tuning audio frequencies that enter an inner ear of a user, the method including providing a base having an emitter end and a receiver end, wherein the base

includes a channel that passes through an entirety of the base; providing a sound-attenuation plug; coupling the sound-attenuation plug to the base such that the sound-attenuation plug surrounds at least a portion of the channel of the base; providing a first filter device; inserting the first filter device into the channel of the base; selectively rejecting, via the first filter device, undesired frequencies of the audio frequencies that enter the earpiece; providing a frequency-selective sound collector; coupling the frequency-selective sound collector to the receiver end of the base; and selectively increasing, via the frequency-selective sound collector, an amount of desired frequencies of the audio frequencies that enter the first filter device.

It is to be understood that the above description is intended to be illustrative, and not restrictive. Although numerous characteristics and advantages of various embodiments as described herein have been set forth in the foregoing description, together with details of the structure and function of various embodiments, many other embodiments and changes to details will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention should be, therefore, determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. In the appended claims, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein," respectively. Moreover, the terms "first," "second," and "third," etc., are used merely as labels, and are not intended to impose numerical requirements on their objects.

What is claimed is:

1. A tuned-frequency-spectrum earpiece for selectively tuning audio frequencies that enter an inner ear of a user wearing the earpiece, the earpiece comprising:

a base having an emitter end and a receiver end, and a stem portion located between the emitter end and the receiver end, wherein the base includes a channel that passes through an entirety of the base;

a sound-attenuation plug, wherein the sound-attenuation plug surrounds at least a portion of the stem portion of the base; and

a first frequency-spectrum-shaping sound-collection horn operatively coupled to the receiver end of the base and configured to selectively increase sound intensities of desired frequencies relative to sound intensities of other frequencies of the audio that enters the earpiece.

2. The tuned-frequency-spectrum earpiece of claim **1**, wherein the base is pliable and includes:

a bendable first flange at the emitter end of the base, wherein the first flange has a cup shape having a convex external surface at the emitter end of the base and an outer perimeter, wherein the cup shape is configured to engage the ear canal to create a seal in the ear canal, wherein the first flange has a concave inner surface toward the receiver end of the base, and

a plug-stop feature located within the cup shape of the first flange, wherein the sound-attenuation plug is configured to couple to the base such that a distal end of the sound-attenuation plug is adjacent to the plug-stop feature and at least a portion of the sound-attenuation plug is within the outer perimeter of the cup shape of the first flange and is spaced apart from the first flange.

3. The tuned-frequency-spectrum earpiece of claim **1**, further comprising:

a first filter device located within the channel of the base and configured to selectively reduce undesired frequencies of audio that enters the earpiece, wherein the first filter device includes a channel that passes through an entirety of the first filter device.

4. The tuned-frequency-spectrum earpiece of claim **1**, further comprising:

a first filter device located within the channel of the base and configured to selectively reduce undesired frequencies of audio that enters the earpiece, wherein the first filter device is made from a material that includes a polypropylene.

5. The tuned-frequency-spectrum earpiece of claim **4**, further comprising:

a second filter device located in the channel of the base and configured to reduce resonance in the earpiece, wherein the second filter device is located closer to the emitter end of the base than the first filter device, and wherein an air gap is located between the first filter device and the second filter device.

6. The tuned-frequency-spectrum earpiece of claim **5**, wherein the second filter device is made from a material that includes urethane.

7. The tuned-frequency-spectrum earpiece of claim **5**, wherein the second filter device includes cotton.

8. The tuned-frequency-spectrum earpiece of claim **1**, further comprising:

a first filter device located within the channel of the base and configured to selectively reduce undesired frequencies of audio that enters the earpiece, wherein the first filter device is further configured to reduce an amplitude of the audio frequencies that enter the earpiece.

9. The tuned-frequency-spectrum earpiece of claim **1**, wherein the receiver end of the base has a first longitudinal axis, wherein the emitter end of the base has a second longitudinal axis, and wherein the first longitudinal axis is at a first non-zero angle relative to the second longitudinal axis.

10. The tuned-frequency-spectrum earpiece of claim **1**, wherein the first frequency-spectrum-shaping sound-collection horn includes a conical funnel shape.

11. The tuned-frequency-spectrum earpiece of claim **1**, further comprising:

a first filter device located within the channel of the base and configured to selectively reduce undesired frequencies of audio that enters the earpiece, wherein the first filter device is integrated with the base such that the base and the first filter device form a single-piece component.

12. The tuned-frequency-spectrum earpiece of claim **1**, wherein the first frequency-spectrum-shaping sound-collection horn includes an input end and a longitudinal axis, and wherein a plane surface defined by a distal edge of the input end of the first sound-collection horn is at a ninety-degree angle relative to the longitudinal axis of the first sound-collection horn.

13. The tuned-frequency-spectrum earpiece of claim **1**, further comprising:

an elbow connector having a first end and a second end, wherein the first end of the elbow connector is coupled to the receiver end of the base, and wherein the second end of the elbow connector is coupled to the first frequency-spectrum-shaping sound-collection horn such that the elbow connector is located between the base and the first sound-collection horn.

14. The tuned-frequency-spectrum earpiece of claim **1**, further comprising:

a split connector, wherein the split connector includes a first end coupled to the receiver end of the base, and a second end having a first receiver portion and a second receiver portion;

a plurality of elbow connectors including a first elbow connector and a second elbow connector, wherein each of the plurality of elbow connectors includes a first end and a second end;

a second frequency-spectrum-shaping sound-collection horn, wherein the first end of the first elbow connector is coupled to the first receiver portion of the split connector, and the second end of the first elbow connector is coupled to the first frequency-spectrum-shaping sound-collection horn, wherein the first end of the second elbow connector is coupled to the second receiver portion of the split connector, and the second end of the second elbow connector is coupled to the second frequency-spectrum-shaping sound-collection horn, wherein the first sound-collection horn faces a first direction, and wherein the second sound-collection horn faces a second direction, opposite the first direction.

15. The tuned-frequency-spectrum earpiece of claim **1**, further comprising:

a split connector, wherein the split connector includes a first end coupled to the receiver end of the base, and a second end having a first receiver portion and a second receiver portion;

an elbow connector having a first end and a second end, wherein the first end of the elbow connector is coupled to the first receiver portion of the split connector;

an extension tube having a first end and a second end, wherein the first end of the extension tube is coupled to the second end of the elbow connector;

a second frequency-spectrum-shaping sound-collection horn, wherein the second sound-collection horn is coupled to the second end of the extension tube, and wherein the first sound-collection horn is coupled to the second receiver portion of the split connector.

16. The tuned-frequency-spectrum earpiece of claim **1**, further comprising:

a three-way connector, wherein the split connector includes a first end coupled to the receiver end of the base, and a second end having a first receiver portion, a second receiver portion, and a third receiver portion;

a plurality of elbow connectors including a first elbow connector and a second elbow connector, wherein each of the plurality of elbow connectors includes a first end and a second end;

a plurality of extension tubes including a first extension tube and a second extension tube, wherein each of the plurality of extension tubes includes a first end and a second end;

a second frequency-spectrum-shaping sound-collection horn; and

a third frequency-spectrum-shaping sound-collection horn, wherein the first end of the first elbow connector is coupled to the first receiver portion of the three-way connector, and the second end of the first elbow connector is coupled to the first end of the first extension tube, wherein the first end of the second elbow connector is coupled to the second receiver portion of the three-way connector, and the second end of the second elbow connector is coupled to the first end of the second extension tube, wherein the first sound-collection horn is coupled to the third receiver portion of the three-way connector, wherein the second sound-collection horn is coupled to the second end of the first extension tube, and wherein the third sound-collection horn is coupled to the second end of the second extension tube.

17. A tuned-frequency-spectrum earpiece for selectively tuning audio frequencies that enter an inner ear of a user wearing the earpiece, the earpiece comprising:

a base having an emitter end and a receiver end, wherein the base includes:

a channel that passes through an entirety of the base, and

a plurality of flanges arranged in a series at the emitter end of the base including a first flange and a second flange, wherein each of the plurality of flanges has a cup shape having a convex external surface toward the emitter end of the base and a concave inner surface toward the receiver end of the base, wherein the first flange has a first cup diameter, wherein the second flange has a second cup diameter, and wherein the first cup diameter is smaller than the second cup diameter; and

a frequency-selective sound collector operatively coupled to the receiver end of the base and configured to selectively increase sound intensities of desired frequencies relative to sound intensities of other frequencies of audio that enters the earpiece.

18. The tuned-frequency-spectrum earpiece of claim **17**, further comprising:

an ear-attachment piece operatively coupled around the base in a location between the plurality of flanges and the frequency-selective sound collector, wherein the ear-attachment piece is configured to fit within an outer ear of the user.

19. A method for selectively tuning audio frequencies that enter an inner ear of a user, the method comprising:

providing a base having an emitter end and a receiver end, wherein the base includes a channel that passes through an entirety of the base;

providing a sound-attenuation plug;

coupling the sound-attenuation plug to the base such that the sound-attenuation plug surrounds at least a portion of the channel of the base;

providing a frequency-selective sound collector;

coupling the frequency-selective sound collector to the receiver end of the base; and

selectively increasing, via the frequency-selective sound collector, sound intensities of selected desired frequencies, relative to sound intensities of other frequencies, of those audio frequencies that are passed to the frequency-selective sound collector.

20. The method of claim **19**, further comprising:

providing a first filter device;

inserting the first filter device into the channel of the base;

selectively reducing, via the first filter device, undesired frequencies of audio that enters the channel of the base;

providing a second filter device;

inserting the second filter device into the channel of the base such that the second filter device is located closer to the emitter end of the base than the first filter device, and such that an air gap is located between the first filter device and the second filter device; and

reducing resonance in the channel of the earpiece via the second filter device.

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