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(54) **FRESH AIR PORT MECHANISM FOR FACEPIECE USED ON SELF-CONTAINED OPEN-CIRCUIT COMPRESSED AIR BREATHING APPARATUS**

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MÉCANISME D'ENTRÉE D'AIR FRAIS POUR MASQUE FACIAL UTILISÉ SUR UN APPAREIL
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Description

BACKGROUND

[0001] Traditionally, a self-contained breathing apparatus (or SCBA) may use a demand valve to control the air flow from one or more cylinders into a mask for the user to breathe. A demand valve may be controlled by the pressure from the breathing of a user, allowing air flow when a user breathes in and stopping air flow when a user breathes out. In some instances, a user may wish to breathe ambient air when able, such as when the user is in a waiting area or has exited a hazardous environment, in order to preserve the air stored in the cylinders of the SCBA. However, it may be difficult or time intensive to disconnect the demand valve or remove the mask of the SCBA. Applicants have found that the use of an intermediate device may provide the user with the ability to temporarily disconnect and/or deactivate the demand valve, while wearing the mask. Applicants have developed a fresh-air port apparatus operable to allow a user to alternate between the demand valve and ambient air. International Patent Publication WO 2011/136674 describes disengaging air tanks and allowing ambient air by push, twist and pull of the whole casing and demand valve away from the mask. European Patent Application EP 0760700 describes an adjuster for a closable ambient air intake aperture with a release switch. The actuating member is formed directly by the connecting piece for the automatic lung machine and can be actuated by a simple pressure from the front on the automatic pulmonary system, while a subsequent pull is switched back to the automatic unit. United States Patent Publication US 7322350 describes a combined high-pressure and medium-pressure air line with a pivotable coupling to an air manifold block and a pressure reducer.

SUMMARY

[0002] Aspects of the disclosure may include embodiments of a self-contained breathing apparatus comprising: one or more air cylinders; a pressure reducer; a mask having an exhalation with the demand valve; a combined pressure gauge and warning whistle; and a fresh-air port assembly coupled to the demand valve such that the fresh-air port assembly is positioned between the demand valve and the mask, wherein the fresh-air port assembly is operable to rotate and open and close one or more port to ambient air. The fresh-air port assembly comprises: a cam knob operable to house one or more driving balls; a cam collar comprising at least one pathway operable to accept and guide the driving balls; an adapter operable to attach the fresh-air port assembly to the mask; and a spring positioned between the cam collar and the adapter operable to bias the cam collar away from the adapter. In some embodiments, the cam knob comprises a first protrusion operable to interact with the exhalation valve to hold the exhalation valve open when

the one or more port is open to ambient air. In some embodiments, the cam knob comprises a second protrusion operable to indicate the position of the cam assembly to the user of the apparatus, wherein the second protrusion is in the line-of-sight of the user when the port is open to ambient air. In some embodiments, the at least one pathway of the cam collar comprises: a first section operable to provide control feel resistance when initiating the turning operation; a second section operable to move the cam collar in a linear motion perpendicular to the face of the mask; a third section operable to lock the cam collar in an open position; and a forth section operable to allow assembly of the cam assembly. In some embodiments, the fresh-air port assembly further comprises a front cover attached to the cam collar. The demand valve attaches to the fresh-air port assembly via the demand valve adapter. In some embodiments, the apparatus may further comprise a mask cover assembly operable to cover at least a portion of the mask and exhalation valve.

[0003] The invention includes a rotating assembly for use with a respirator comprising a mask and a demand valve, the assembly comprising: one or more driving balls; a cam knob operable to house the one or more driving balls; a cam collar coupled to the cam knob comprising at least one pathway on the exterior surface of the collar operable to receive the driving balls; an adapter operable to attach the cam assembly to the mask of the respirator; and a spring positioned between the cam collar and the adapter operable to bias the cam collar away from the adapter, wherein: the rotating assembly is coupled to the mask such that the assembly is positioned between the demand valve and the mask, and the rotating assembly is operable to open and close one or more port to ambient air. In some embodiments, the cam knob comprises a first protrusion operable to interact with the exhalation valve to hold the exhalation valve open. In some embodiments, the cam knob comprises a second protrusion operable to indicate the position of the cam assembly to the user of the apparatus, wherein the second protrusion is in the line-of-sight of the user when the port is open to ambient air. In some embodiments, the cam knob rotates with respect to the mask and the cam collar moves linearly perpendicular to the face of the mask. In some embodiments, the at least one pathway of the cam collar comprises: a first section operable to provide control feel resistance when initiating the turning operation; a second section operable to move the cam collar in a linear motion perpendicular to the face of the mask; a third section operable to lock the cam collar in an open position; and a forth section operable to allow assembly of the cam assembly. In some embodiments, the cam collar comprises two matching pathways. In some embodiments, the assembly may further comprise a front cover attached to the cam collar with screws. In some embodiments, the adapter interacts with a push rod of the demand valve to activate or deactivate the demand valve. In some embodiments, the port to ambient air opens between the demand valve and the adapter,

while the demand valve remains coupled to the rotating assembly.

[0004] Additional aspects of the invention include a method according to claims 12 - 14, of retrofitting or upgrading a self-contained breathing apparatus having a mask and a demand valve.

[0005] These and other features will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] For a more complete understanding of the present disclosure, reference is now made to the following brief description, taken in connection with the accompanying drawings and detailed description, wherein like reference numerals represent like parts.

FIG. 1 is an illustration of an exemplary embodiment of a self-contained breathing apparatus system;
 FIGS. 2A-2B illustrate an exemplary embodiment of a demand valve;
 FIGS. 3A-3B illustrate an exemplary embodiment of a fresh-air port assembly coupled to a mask and demand valve of a self-contained breathing apparatus;
 FIG. 4 is an exploded view of an exemplary embodiment of a fresh-air port assembly;
 FIGS. 5A-5D illustrate detailed views of an embodiment of a cam collar;
 FIG. 6 illustrates an embodiment of a pathway of the cam collar;
 FIGS. 7A-7E illustrate detailed views of an embodiment of a cam knob;
 FIGS. 8A-8D illustrate detailed views of an embodiment of a demand valve adapter;
 FIGS. 9A-9B illustrate detailed views of an embodiment of a front cover comprising screws;
 FIGS. 10A-10C illustrate detailed views of an embodiment of an exhalation valve assembly;
 FIGS. 11A-11D illustrate detailed views of an embodiment of a mask cover assembly;
 FIGS. 12A-12D illustrate detailed views of an embodiment of a demand valve;
 FIGS. 13A-13B illustrate an exemplary embodiment of a fresh-air port assembly when the fresh-air port is closed;
 FIGS. 14A-14B illustrate an exemplary embodiment of a fresh-air port assembly when the fresh-air port is being opened; and
 FIGS. 15A-15B illustrate an exemplary embodiment of a fresh-air port assembly when the fresh-air port is open.

DETAILED DESCRIPTION

[0007] Generally, Applicants have found that incorporation of a fresh-air port assembly into the mask of a self-

contained breathing apparatus (SCBA) may be beneficial to enabling the user to breathe ambient air when purified air is not required. For example, a user may be in a waiting area and may wish to conserve the air in the cylinders of the SCBA, so they may wish to temporarily switch to ambient air. A fresh-air port assembly positioned between the demand valve and mask of an SCBA may be operable to disconnect and/or disable the demand valve to allow ambient air into the mask, as well as to control the exhalation valve of the mask so that a user may easily breathe ambient air. This may also allow a user to quickly switch to purified air when necessary. The fresh-air port assembly comprises a cam knob operable to rotate with respect to the mask, a cam collar operable to move linearly perpendicular to the face of the mask, and a demand valve adapter operable to attach the assembly to the mask and/or the demand valve.

[0008] FIG. 1 illustrates a SCBA system 100 comprising a mask 102, a demand valve 104 operable to be connected to the mask 102, one or more air cylinders 110, a medium-pressure hose 106 providing fluid communication between the air cylinder(s) 110 and the mask 102 via the demand valve 104 (which may also be known as a second stage reducer), and a pressure reducer 124, operable to reduce the pressure of the air from the cylinders 110, providing fluid communication between the air cylinders 110 and the medium-pressure hose 106. In some embodiments, the cylinders 110 may comprise high-pressure air at approximately 310 bar (4500 psi), for example. The pressure reducer 124 may reduce the high-pressure air from the cylinders 110 to medium-pressure air of approximately 6,9 bar (100psi), for example. In some embodiments, the demand valve 104 may be operable to reduce the medium-pressure air to approximately atmospheric pressure before delivering the air into the mask 102.

[0009] Additionally, the SCBA system 100 may comprise a harness comprising shoulder straps 108, a belt strap 112, and/or a cylinder strap 122. In some embodiments, the SCBA may also comprise a pressure gauge 118 and whistle 119, wherein the pressure gauge 118 and whistle 119 may be in fluid communication with the air cylinder(s) 110 via a high-pressure hose 120. In some embodiments, the high-pressure hose 120 may be coupled to the cylinders 110 via the pressure reducer 124. For example, in some embodiments the pressure reducer 124 may comprise a high-pressure pathway, for the high-pressure hose 120 to provide high-pressure air to the high-pressure gauge 118, a first medium-pressure pathway for the medium-pressure hose 106, and a second medium-pressure pathway (to provide medium-pressure air to the whistle). Thus, the pressure reducer 124 of FIG. 1 may be operable to reduce the high-pressure air of the air cylinder(s) 110 to medium pressure air, and to transmit (via coupling of the appropriate hoses) high pressure air to the pressure gauge 118, medium pressure to the demand valve 104, and medium pressure air to the whistle 119. Typically, the high-pressure hose 120 comprises a

high-pressure pathway and a medium-pressure pathway, and couples to the pressure reducer 124 so that both high-pressure air and medium-pressure air may be transmitted to the combined high-pressure gauge 118 and whistle 119. In FIG. 1, the pressure reducer 124 has only one high-pressure pathway/port (for attachment of the high-pressure hose 120). In some embodiments, the pressure gauge 118 and whistle 119 may be operable to monitor the pressure of the air in the cylinders 110 as well as alert a user of the SCBA if the pressure drops below a pre-set or defined limit.

[0010] Turning now to FIGS. 2A-2B, an exemplary embodiment of the mask 102 and the demand valve 104 is shown. The mask 102 may comprise an exhalation valve 202. The demand valve 104 may be operable to control air flow 206 into the mask 102, wherein the air may flow into the mask from the medium-pressure hose 106 through the demand valve 104 and out of the mask through the exhalation valve 202. In FIG. 2A, a user may be breathing in, causing the demand valve 104 to open and allow air flow 206 into the mask 102. In FIG. 2B, a user may be breathing out, causing the demand valve 104 to close and the exhalation valve 202 to open and allow air flow 206 out of the mask 102. In some embodiments, both the demand valve 104 and the exhalation valve 202 may be controlled by springs. In the embodiment shown in FIGS. 2A-2B, the demand valve 104 may be attached to the mask 102 via threads 208 on the mask 102 and threads 210 on the demand valve 104. In some embodiments, the demand valve 104 may couple to the medium-pressure hose 106 at a connector 204.

[0011] Turning now to FIGS. 3A-3B, an exemplary embodiment of the mask 102 and demand valve 104 is shown, wherein the assembly further comprises a fresh-air port assembly 300 coupled to both the mask 102 and the demand valve 104. The fresh-air port assembly 300 is positioned between the mask 102 and the demand valve 104. The fresh-air port is operable to rotate in the direction shown by arrow 302, wherein FIG. 3A illustrates the fresh-air port assembly 300 in a first position, and FIG. 3B illustrates the fresh-air port assembly 300 in a second position. In some embodiments, the fresh-air port assembly 300 may be considered "closed" in the first position and "open" in the second position. As described further herein, the open and closed positions of the fresh-air port assembly 300 control engagement of one or more air passages through the assembly 300, wherein the air passages provide air from the cylinders 110 of the SCBA and/or ambient air.

[0012] Turning now to FIG. 4, an exploded view of the fresh-air port assembly 300, mask 102 and demand valve 104 is shown. Although, in some embodiments, the assembly 300 may comprise the specific components described herein, different components may also be used to accomplish similar functionality. The fresh-air port assembly 300 comprises a cam collar 402, a cam knob 404, driving balls 405, a load spring 410, a demand valve adapter 412, and front cover 414. The cam collar 402

comprises pathways 406 operable to receive the driving balls 405. The cam knob 404 is operable to fit over the cam collar 402, wherein the cam knob 404 may comprise indentions 407 operable to hold the driving balls 405. In some embodiments, the demand valve adapter 412 may be operable to fit through the cam collar 402 and cam knob 404. In some embodiments, the demand valve adapter 412 may be operable to attach to the mask 102, wherein the demand valve adapter 412 may comprise threads 411 operable to fit with threads 208 of the mask 102. The assembly 300 comprises a load spring 410 that fits between the cam collar 402 and the demand valve adapter 412, wherein the load spring 410 biases the cam collar 402 away from the demand valve adapter 412. In some embodiments, the front cover 414 may attach to the cam collar 402 with screws 416 and may be operable to hold the demand valve adapter 412 and spring 410 in place.

[0013] In some embodiments, the mask 102 may attach to a mask cover assembly 430, which may comprise an exhalation valve cover 432 and a nozzle cover 434. Additionally, the exhalation valve 202 may be coupled to a hold clip 436. In some embodiments, the demand valve 104 may be operable to attach to the demand valve adapter 412.

[0014] Turning now to FIGS. 5A-5D, the cam collar 402 is shown in detail. The cam collar comprises at least one pathway 406, wherein the embodiment shown in FIGS. 5A-5D comprises two pathways 406. In some embodiments, the cam collar 402 may comprise a lip 502 around the circumference of the cam collar 402 and protruding into the center of the cam collar 402 operable to contact the load spring 410. Additionally, the cam collar 402 may comprise one or more openings 504 operable to receive screws 416 and hold the front cover 414 in place against the cam collar 402. In some embodiments, the pathways 406 may be located on the outer surface of the cam collar 402, and they may be located on opposite sides of the cam collar 406. In some embodiments, the pathways 406 may be matching. In other embodiments, the cam collar 402 may comprise any number of pathways 406 wherein the pathways 406 may each be operable to receive and direct a driving ball 405.

[0015] Turning now to FIG. 6, outer surface of the cam collar 402 is shown as a rectangle comprising the two pathways 406. FIG. 6 is a special view of the exterior surface of the cam collar 402 that has been cut and flattened out, such that the far left and far right sides of the rectangle shown would be connected. The pathways 406 may comprise four sections, a first section 601, a second section 602, a third section 603, and a fourth section 604. In some embodiments, when the driving ball 405 is in the first section 601 of the pathway, the fresh-air port assembly may be considered closed. The shape of the first section 601 is designed to demand the user to positively control and turn the cam knob 404. When the driving ball 405 is in the second section 602 of the pathway 406, a user may be opening the fresh-air port assembly 300. In

some embodiments, the second section 602 may be angled such that, if a user releases, or loses their hold on, the assembly 300 while the driving ball 405 is in the second section 602, the assembly 300 may be biased closed, or back to the first section 601, by the load spring 410. The user must deliberately turn the cam knob 404 past the second section 602 into the third section 603 to open, and must deliberately turn the cam knob 404 back past the third section 603 into the second section 602 to close. When the driving ball 405 is in the third section 603, the assembly 300 may be locked in an open position, or biased open, by the load spring 410. In some embodiments, the third section 603 may be angled such that, if a user releases, or loses their hold on, the assembly 300 while the driving ball 405 is in the third section 602, or if the assembly 300 is bumped or moved, the assembly 300 may be biased open, or back to the third section 603, by the load spring 410. The fourth section 604 may only be used when assembling the fresh-air port assembly 300. In some embodiments, the first section may be operable to provide control feel resistance when initiating the turning operation; the second section may be operable to move the cam collar in a linear motion perpendicular to the face of the mask; the third section may be operable to lock the cam collar in an open position; and the forth section may be operable to allow assembly of the cam assembly.

[0016] Turning now to FIGS. 7A-7E, the cam knob 404 is shown in detail. The cam knob 404 may comprise indentions 702 on the interior surface operable to receive the driving balls 405. The driving balls 405 may interact with the pathways 406 of the cam collar 402 and may follow the pathways 406 if the cam knob 404 is turned in either a clockwise or counter-clockwise direction. Additionally, the cam knob 404 may comprise an indicator 704, wherein the indicator 704 may align with the line of sight of a user whenever the assembly 300 is turned to the second (or open) position. This may allow a user to notice if the fresh-air port assembly is open or closed before entering a hazardous environment, for example. The indicator 704 may also be considered a protrusion from the cam knob 404. In some embodiments, the indicator 704 may comprise a color, particularly a bright or noticeable color. In some embodiments, the indicator 704 may comprise further indication, such as a light, for example. Also, the cam knob 404 may comprise a protrusion 706 operable to engage with at least a portion of the exhalation valve 202, wherein when the cam knob is in the second (open) position, the exhalation valve 202 may be held open by the protrusion 706. In some embodiments, the protrusion 706 may slope away from the side of the cam knob 404, so that it may slidably engage with the exhalation valve 202. In some embodiments, the protrusion 706 and the indicator 704 may be aligned on opposite sides of the cam knob 404, such that when the indicator 204 is in the line of sight of a user, the protrusion 706 is holding the exhalation valve 202 open. The cam knob 404 may also comprise a lip 710 about the circum-

ference of the cam knob 404 and protruding in toward the center of the cam knob 404, operable to contact the cam collar 402. Additionally, the cam knob 404 may comprise ridges 708 on the outer surface, wherein the ridges 708 may allow for gripping to assist turning of the cam knob 404.

[0017] Turning now to FIGS. 8A-8D, the demand valve adapter 412 is shown in detail. The demand valve adapter 412 may comprise threads 411 operable to connect the demand valve adapter 412 to the mask 102. In some embodiments, the demand valve adapter 412 may comprise a first sealing ring 802, wherein the sealing ring 802 may be operable to seal against a portion of the demand valve 104. The sealing ring 802 may be operable to create an air-tight seal between the demand valve 104 and the demand valve adapter 412. In some embodiments, the demand valve adapter 412 may comprise a second sealing ring 804 operable to seal with at least a portion of the mask 102. The second sealing ring 804 may be operable to create an air-tight seal between the mask 102 and the demand valve adapter 412.

[0018] Turning now to FIGS. 9A-9B, the front cover 414 is shown in detail. The front cover 414 may comprise openings 902 operable to receive screws 416. The screws 416 may attach the front cover 414 to the cam collar 402. In some embodiments, the front cover 414 may comprise any number of openings 902 and screws 416, wherein in the embodiment shown in FIGS. 9A-9B, the front cover 414 may comprise 6 openings 902 equally spaced around the circumference of the front cover 414.

[0019] Turning now to FIGS. 10A-10C, the exhalation valve 202 is shown in detail. The exhalation valve 202 may be coupled to a hold clip 436, wherein the hold clip 436 may be attached to one or more rods 1006. In some embodiments, the exhalation valve 202 may comprise a membrane 1004 operable to seal the exhalation valve 202 closed against at least a portion of the mask 102. In some embodiments, the rods 1006 may be attached to a pin 1010. Additionally, the rods 1006 may be coupled to the membrane 1004, such that if the rods 1006 are moved, the membrane 1004 is also moved. In some embodiments, the exhalation valve 202 may comprise a spring 1002 operable to bias the membrane 1004 against the mask 102. In other words, the spring 1002 may be operable to bias the exhalation valve 202 closed. In some embodiments, the hold clip 436 and/or rods 1006 may be operable to interact with the protrusion 706 of the cam knob 404. In some embodiments, the protrusion 706 of the cam knob 404 may be operable to move the hold clip 436, and therefore the rods 1006, in a lateral direction. In other words, when the cam knob 404 is in the second (open) position, the protrusion 706 may be holding the exhalation valve 202 open, such that if the fresh-air port assembly 300 is open, the exhalation valve 202 is also held open. In the embodiment shown in FIG. 10B, the membrane 1004 may be in a first position, held against the mask 102 by the spring 1002, and the exhalation valve 202 may be considered closed. In the embodiment

shown in FIG. 10A, the membrane 1004 may be in a second position, pulled away from the mask 102 by the hold clip 436 and/or rods 1006, and the exhalation valve 202 may be considered open. In some embodiments, the membrane 1004 may move a distance 1008 between the first and second positions.

[0020] Turning now to FIGS. 11A-11D, the mask cover assembly 430 is shown in detail. In some embodiments, the mask cover assembly 430 may comprise an exhalation valve cover 432 and a nozzle cover 434. In some embodiments, the nozzle cover 434 may fit over at least a portion of the mask 102. The nozzle cover 434 may comprise vents 1102 to allow air flow from the exhalation valve 202. In some embodiments, the exhalation valve cover 432 may cover at least a portion of the exhalation valve 202. In some embodiments, the exhalation valve cover 432 may fit against, or snap to, the nozzle cover 434. In some embodiments, the rods 1006 of the exhalation valve 202 may fit through the vents 1102 of the nozzle cover 434, wherein the hold clip 436, coupled to the rods 1006, may be located on the exterior of the nozzle cover 434, while the exhalation valve 202 may be covered by the nozzle cover 434. In some embodiments, the hold clip 436 may be covered by the exhalation valve cover 432.

[0021] Turning now to FIGS. 12A-12D, the demand valve 104 is shown in detail. The demand valve 104 may comprise a push rod 1202, wherein the push rod 1202 may be a trigger operable to open up and/or close down the demand valve 104. For example, when the push rod 1202 is pushed down, as shown in FIG. 12D, the demand valve 104 may be activated or opened, such as when the demand valve 104 is attached to the mask 102 and/or the demand valve adapter 412. Additionally, when the push rod 1202 is extended, as shown in FIG. 12C, the demand valve 104 may be deactivated or closed, such as when the demand valve 104 is removed from the mask 102 and/or the demand valve adapter 412. In some embodiments, the push rod 1202 may be spring loaded, such that the push rod 1202 is biased to an extended position, shown in FIG. 12C. In some embodiments, the demand valve 104 may comprise a portion 1204, wherein the portion 1204 of the demand valve 104 may be operable to seal with the demand valve adapter 412.

[0022] Turning now to FIGS. 13A-13B, the fresh-air port assembly 300 is shown assembled and coupled to the demand valve 104 and mask 102, wherein the assembly 300 may be positioned between the demand valve 104 and the mask 102. In the embodiment shown in FIGS. 13A-13B, the assembly 300 may be in a first (or closed) position. The driving ball 405 may be in the first section 601 of the pathway 406 on the cam collar 402. The assembly 300 may be considered closed when the demand valve 104 is positioned against a sealing ring 802 located within the demand valve adapter 412. As shown in FIG. 5B, at least a portion of the demand valve 104 may be positioned against the demand valve adapter 412, wherein the sealing ring 802 may be in contact with

the portion 1204 of the demand valve 104. In the embodiment shown in FIGS. 5A-5B, the air flow 206 may flow through the demand valve 104, through the demand valve adapter 412, and into the mask 102 when a user is breathing in, and then out through the exhalation valve 202 when a user is breathing out (similar to FIGS. 2A-2B). In the embodiment shown in FIGS. 13A-13B, the demand valve 104 may be activated, wherein the push rod 1202 may be pushed down by the demand valve adapter 412.

[0023] Turning now to FIGS. 14A-14B, the fresh-air port assembly 300 is shown, wherein the driving ball 405 may be in the second section 602 of the pathway 406. The cam knob 404 may be turned, moving the driving ball(s) 405 into the second section 602. As shown in FIG. 14B, cam collar 402 may be pushed against the load spring 410 by the movement of the driving ball(s) 405, pushing the demand valve 104 outward (or away from the mask 102). This may release the seal between the sealing ring 802 and the portion 1204 of the demand valve 104. In some embodiments, a port 1402 may be opened between the portion 1204 of the demand valve 104 and the demand valve adapter 412. Additionally, as the demand valve 104 is pushed away from the mask 102 (and therefore the demand valve adapter 412), the push rod 1202 may begin to extend, deactivating the demand valve 104. Additionally, as the cam knob 404 is turned, the protrusion 706 may be moving the hold clip 436 outward, or away from the mask 102, causing the exhalation valve 202 to be opened. In some embodiments, the position of the fresh-air port assembly 300 shown in FIGS. 14A-14B may be considered a transition stage between closing and opening the assembly 300. In this transition stage, if the user were to stop turning the cam knob 404, the load spring 410 may be operable to push the cam collar 402 and driving ball(s) 405 back to the first (closed) position. This may serve as a safety mechanism to prevent from opening the fresh air port 1402 accidentally, since it may be dangerous in a contaminated environment.

[0024] Turning now to FIGS. 15A-15B, the fresh-air port assembly 300 is shown in an open position. The cam knob 404 may be turned further, causing the driving ball(s) 405 to enter the third section 603 of the pathway(s) 406 on the cam collar 402. As shown in FIG. 15B, the cam collar 402 may be further pushed against the load spring 410, pushing the demand valve 104 outward (or away from the mask 102). The port 1402 may be further opened as the demand valve 104 is pushed away from the demand valve adapter 412. In some embodiments, the port 1402 may extend around the circumference of the demand valve adapter 412, wherein a portion of the circumference may be blocked by the push rod 1202. In other words, the space created between the portion 1204 of the demand valve 104 and the demand valve adapter 412 may extend around the circumference of both the portion 1204 and the demand valve adapter 412. Additionally, the demand valve 104 may comprise ports or

spaces 1504 to allow air flow through at least a portion of the demand valve 104. In some embodiments, the exhalation valve 202 may also be held open by the protrusion 706 interacting with the hold clip 436. In the embodiment shown, air flow 206 may flow through the port 1402 around the demand valve adapter 412 as well as through the exhalation valve 202. In some embodiments, the direction of the air flow may be directed into the mask through the fresh-air port assembly 300 and out of the mask through the exhalation valve 202. As shown in FIGS. 15A-15B, the push rod 1202 of the demand valve 104 may be extended, deactivating the demand valve 104.

[0025] Some embodiments of the disclosure may include methods of using the fresh-air port assembly 300 described above. In some embodiments, a user may wish to deactivate the demand valve 104 and breathe atmospheric air while wearing a mask 102, such as on a SCBA 100. The method may comprise rotating a cam knob 404 of the fresh-air port assembly 300 from a first position to a second position, causing the demand valve 104 to be deactivated and opening one or more ports 1402 through the fresh-air port assembly 300, allowing atmospheric air into the mask 102. In some embodiments, rotating the cam knob 404 may also open the exhalation valve 202 of the mask 102, allow a user to breathe out of the mask 102 without the pressure gradient typically required to open the exhalation valve 202. The method may further comprise rotating the cam knob 404 in the opposite direction from the second position to the first position, causing the demand valve 104 to be activated and closing the one or more ports 1402 through the fresh-air port assembly 300. In some embodiments, rotating the cam knob 404 back to the first position may release the exhalation valve 202, wherein the exhalation valve 202 may then operate based on the pressure in the mask 102 from a user's breathing.

[0026] The invention includes methods of retrofitting a fresh-air port assembly to an SCBA 100. The method may comprise removing the demand valve 104 from the mask 102 of the SCBA 100, attaching the fresh-air port assembly 300 to the mask 102, and attaching the demand valve 104 to the fresh-air port assembly 300. In some embodiments, the fresh-air port assembly 300 may attach to the mask 102 via the demand valve adapter 412. In some embodiments, the fresh-air port assembly 300 may attach to the demand valve via the cam collar 402 and/or front cover 414 of the fresh-air port assembly 300.

[0027] The figures discussed above provide examples of various exemplary devices, systems, and techniques and ways to make and use such devices. These illustrations are merely exemplary.

Claims

1. A self-contained breathing apparatus (100) comprising:

one or more air cylinders (110);
 a pressure reducer (124);
 a mask (102) having an exhalation valve (202);
 a demand valve (104) operable to attach to the mask (102), wherein the exhalation valve and the demand valve are configured such that a user inhales air through the demand valve (104) and exhales air through the exhalation valve (202);
 a medium-pressure hose (106), extending from the pressure reducer (124) to the demand valve (104), wherein the pressure reducer (124) is in fluid communication with the demand valve (104);
 a combined pressure gauge (118) and warning whistle (119); and
 a fresh-air port assembly (300) coupled to the mask (102) and the demand valve (104) such that the fresh-air port assembly (300) is positioned between the demand valve (104) and the mask (102), wherein the fresh-air port assembly (300) is operable to rotate with respect to the mask (102) and the demand valve (104) in order to open and close one or more ports (1402) to ambient air,

wherein the fresh-air port assembly (300) comprises:

a cam knob (404) operable to house one or more driving balls (405);
 a cam collar (402) comprising at least one pathway (406) operable to accept and guide the driving balls (405), wherein the cam knob (404) is rotatable with respect to the cam collar (402) in order to move the one or more driving balls (405) through the at least one pathway (406).

2. The apparatus (100) of claim 1, wherein the fresh-air port assembly further comprises:
 - an adapter (412) operable to attach the fresh-air port assembly (300) to the mask (102); and
 - a spring (410) positioned between the cam collar (402) and the adapter (412) operable to bias the cam collar (402) away from the adapter (412).
3. The apparatus (100) of claim 2, wherein the cam knob (404) comprises a first protrusion (706) operable to interact with the exhalation valve (202) to hold the exhalation valve (202) open when the port (1402) is open to ambient air.
4. The apparatus (100) of claim 3, wherein the cam knob (404) further comprises a second protrusion (704) operable to indicate the position of the cam assembly (300) to the user of the apparatus (100), wherein the second protrusion (704) is in the line-of-sight of the user when the port (1402) is open to

ambient air.

5. The apparatus (100) of claim 2, wherein the at least one pathway (406) of the cam collar (402) comprises:

a first section (601) operable to provide control feel resistance when initiating the turning operation;
a second section (602) operable to move the cam collar (402) in a linear motion perpendicular to the face of the mask (102);
a third section (603) operable to lock the cam collar (402) in an open position; and
a fourth section (604) operable to allow assembly of the fresh-air port assembly (300).

6. The apparatus of claim 2, wherein the fresh-air port assembly (300) further comprises a front cover (414) attached to the cam collar (402), and wherein the demand valve (104) attaches to the fresh-air port assembly (300) via a demand valve adapter (412).

7. A rotating assembly (300) for use with a respirator (100) comprising a mask (102) and a demand valve (104), the assembly (300) comprising:

one or more driving balls (405);
a cam knob (404) operable to house the one or more driving balls (405);
a cam collar (402) coupled to the cam knob (404) comprising at least one pathway (406) on the exterior surface of the collar (402) operable to receive the driving balls (405);
an adapter (412) operable to attach the rotating assembly (300) to the mask (102) of the respirator (100); and
a spring (410) positioned between the cam collar (402) and the adapter (412) operable to bias the cam collar (402) away from the adapter (412),

wherein:

the rotating assembly (300) is coupled to the mask (102) such that the assembly (300) is positioned between the demand valve (104) and the mask (102), and
the rotating assembly (300) is operable to open and close one or more ports (1402) to ambient air.

8. The assembly (300) of claim 7, wherein the cam knob (404) comprises a first protrusion (706) operable to interact with an exhalation valve (202) of the mask (102) to hold the exhalation valve (202) open.

9. The assembly (300) of claim 8, wherein the cam knob (404) comprises a second protrusion (704) operable to indicate the position of the rotating assembly (300)

to the user, wherein the second protrusion (704) is in the line-of-sight of the user when the port (1402) is open to ambient air.

10. The assembly (300) of claim 7, wherein the cam knob (404) rotates with respect to the mask (102) and the cam collar (402) moves linearly perpendicular to the face of the mask (102).

11. The assembly (300) of claim 7, wherein the at least one pathway (406) of the cam collar (402) comprises:

a first section (601) operable to provide control feel resistance when initiating the turning operation;
a second section (602) operable to move the cam collar (402) in a linear motion perpendicular to the face of the mask;
a third section (603) operable to lock the cam collar (402) in an open position; and
a fourth section (604) operable to allow assembly of the rotating assembly (300).

12. The assembly (300) of claim 7, wherein the adapter (412) interacts with a push rod (1202) of the demand valve (104) to activate or deactivate the demand valve (104), and wherein the port (1402) to ambient air opens between the demand valve (104) and the adapter (412), while the demand valve (104) remains coupled to the rotating assembly (300).

13. A method of retrofitting or upgrading a self-contained breathing apparatus (100) having a mask (102) and a demand valve (104), the method comprising:

providing a fresh-air port assembly (300);
attaching the fresh-air port assembly (300) to the mask (102); and
attaching the demand valve (104) to the fresh-air port assembly (300);

wherein the fresh-air port assembly (300) is operable to rotate with respect to the mask (102) and the demand valve (104) in order to open and close one or more ports (1402) to ambient air, and wherein the fresh-air port assembly (300) comprises:

a cam knob (404) operable to house one or more driving balls (405); and
a cam collar (402) comprising at least one pathway (406) operable to accept and guide the driving balls (405), wherein the cam knob (404) is rotatable with respect to the cam collar (402) in order to move the one or more driving balls (405) through the at least one pathway (406).

14. The method of claim 13, wherein attaching the fresh-air port assembly (300) to the mask comprises at-

taching an adapter (412) of the assembly (300) to the mask (102) via threads.

15. The method of claim 13, wherein attaching the demand valve (104) to the fresh-air port assembly (300) comprises attaching the demand valve (104) to the cam collar (402) of the assembly (300).

Patentansprüche

1. Umgebungsluftunabhängiges Atemgerät (100), umfassend:

einen oder mehrere Luftzylinder (110);
einen Druckminderer (124);
eine Maske (102) mit einem Ausatemventil (202);
ein Bedarfsventil (104), das funktionsfähig mit der Maske (102) verbunden ist, wobei das Ausatemventil und das Bedarfsventil so gestaltet sind, dass ein Anwender durch das Bedarfsventil (104) Luft einatmet und durch das Ausatemventil (202) Luft ausatmet;
einen Mitteldruckschlauch (106), der von dem Druckminderer (124) zu dem Bedarfsventil (104) verläuft, wobei der Druckminderer (124) in Fluidverbindung mit dem Bedarfsventil (104) steht;
einen kombinierten Druckmesser (118) und eine Warnpfeife (119); und
eine Frischluftöffnungsbaugruppe (300), die an die Maske (102) und das Bedarfsventil (104) gekoppelt ist, so dass die Frischluftöffnungsbaugruppe (300) zwischen dem Bedarfsventil (104) und der Maske (102) angeordnet ist, wobei die Frischluftöffnungsbaugruppe (300) zur Drehung relativ zu der Maske (102) und dem Bedarfsventil (104) funktionsfähig ist, um eine oder mehrere Öffnungen (1402) zu der Umgebungsluft zu öffnen und zu schließen,

wobei die Frischluftöffnungsbaugruppe (300) umfasst:

einen Nockenknopf (404), der funktionsfähig ist, eine oder mehrere Führungskugeln (405) aufzunehmen;
einen Nockenkranz (402), der wenigstens eine Bahn (406) umfasst, die funktionsfähig ist, die Führungskugeln (405) aufzunehmen und zu führen, wobei der Nockenknopf (404) relativ zu dem Nockenkranz (402) drehbar ist, um die eine oder mehreren Führungskugeln (405) durch die wenigstens eine Bahn (406) zu bewegen.

2. Gerät (100) gemäß Anspruch 1, wobei die Frischluftöffnungsbaugruppe ferner umfasst:

einen Adapter (412), der funktionsfähig ist, die Frischluftöffnungsbaugruppe (300) an der Maske (102) zu befestigen; und
eine Feder (410), die zwischen dem Nockenkranz (402) und dem Adapter (412) angeordnet ist und funktionsfähig ist, den Nockenkranz (402) von dem Adapter (412) weg vorzuspannen.

3. Gerät (100) gemäß Anspruch 2, wobei der Nockenknopf (404) einen ersten Vorsprung (706) umfasst, der funktionsfähig ist, mit dem Ausatemventil (202) zu wechselwirken, um das Ausatemventil (202) offen zu halten, wenn die Öffnung (1402) zu der Umgebungsluft offen ist.

4. Gerät (100) gemäß Anspruch 3, wobei der Nockenknopf (404) ferner einen zweiten Vorsprung (704) umfasst, der funktionsfähig ist, dem Anwender des Geräts (100) die Stellung der Nockenbaugruppe (300) anzuzeigen, wobei der zweite Vorsprung (704) in der Sichtlinie des Anwenders liegt, wenn die Öffnung (1402) zu der Umgebungsluft offen ist.

5. Gerät (100) gemäß Anspruch 2, wobei die wenigstens eine Bahn (406) des Nockenkranzes (402) umfasst:

einen ersten Abschnitt (601), der funktionsfähig ist, Steuergefühl-Widerstand bereitzustellen, wenn die Drehbewegung begonnen wird;
einen zweiten Abschnitt (602), der funktionsfähig ist, den Nockenkranz (402) in einer linearen Bewegung senkrecht zu der Vorderseite der Maske (102) zu bewegen;
einen dritten Abschnitt (603), der funktionsfähig ist, den Nockenkranz (402) in einer offenen Stellung zu verriegeln; und
einen vierten Abschnitt (604), der funktionsfähig ist, das Zusammenbauen der Frischluftöffnungsbaugruppe (300) zu ermöglichen.

6. Gerät gemäß Anspruch 2, wobei die Frischluftöffnungsbaugruppe (300) ferner eine Vorderabdeckung (414) umfasst, die mit dem Nockenkranz (402) verbunden ist, und wobei das Bedarfsventil (104) mithilfe eines Bedarfsventiladapters (412) an der Frischluftöffnungsbaugruppe (300) befestigbar ist.

7. Drehbaugruppe (300) für die Verwendung mit einem Atemschutzgerät (100), das eine Maske (102) und ein Bedarfsventil (104) umfasst, wobei die Baugruppe (300) umfasst:

eine oder mehrere Führungskugeln (405);
einen Nockenknopf (404), der funktionsfähig ist, die eine oder mehreren Führungskugeln (405) aufzunehmen;

einen Nockenkranz (402), der an den Nockenknopf (404) gekoppelt ist und wenigstens eine Bahn (406) an der Außenoberfläche des Kranzes (402) umfasst, die funktionsfähig ist, die Führungskugeln (405) aufzunehmen;

einen Adapter (412), der funktionsfähig ist, die Drehbaugruppe (300) an der Maske (102) des Atemschutzgeräts (100) zu befestigen; und

eine Feder (410), die zwischen dem Nockenkranz (402) und dem Adapter (412) angeordnet ist und funktionsfähig ist, den Nockenkranz (402) von dem Adapter (412) weg vorzuspannen,

wobei:

die Drehbaugruppe (300) an die Maske (102) gekoppelt ist, so dass die Baugruppe (300) zwischen dem Bedarfsventil (104) und der Maske (102) angeordnet ist, und

die Drehbaugruppe (300) funktionsfähig ist, eine oder mehrere Öffnungen (1402) zu der Umgebungsluft zu öffnen und zu schließen.

8. Baugruppe (300) gemäß Anspruch 7, wobei der Nockenknopf (404) einen ersten Vorsprung (706) umfasst, der funktionsfähig ist, mit einem Ausatemventil (202) der Maske (102) zu wechselwirken, um das Ausatemventil (202) offen zu halten.

9. Baugruppe (300) gemäß Anspruch 8, wobei der Nockenknopf (404) einen zweiten Vorsprung (704) umfasst, der funktionsfähig ist, dem Anwender die Stellung der Drehbaugruppe (300) anzuzeigen, wobei der zweite Vorsprung (704) in der Sichtlinie des Anwenders liegt, wenn die Öffnung (1402) zu der Umgebungsluft offen ist.

10. Baugruppe (300) gemäß Anspruch 7, wobei sich der Nockenknopf (404) relativ zu der Maske (102) dreht und sich der Nockenkranz (402) linear senkrecht zu der Vorderseite der Maske (102) bewegt.

11. Baugruppe (300) gemäß Anspruch 7, wobei die wenigstens eine Bahn (406) des Nockenkranzes (402) umfasst:

einen ersten Abschnitt (601), der funktionsfähig ist, Steuergefühl-Widerstand bereitzustellen, wenn die Drehbewegung begonnen wird;

einen zweiten Abschnitt (602), der funktionsfähig ist, den Nockenkranz (402) in einer linearen Bewegung senkrecht zu der Vorderseite der Maske zu bewegen;

einen dritten Abschnitt (603), der funktionsfähig ist, den Nockenkranz (402) in einer offenen Stellung zu verriegeln; und

einen vierten Abschnitt (604), der funktionsfähig

ist, das Zusammenbauen der Drehbaugruppe (300) zu ermöglichen.

12. Baugruppe (300) gemäß Anspruch 7, wobei der Adapter (412) mit einem Druckstab (1202) des Bedarfsventils (104) wechselwirkt, um das Bedarfsventil (104) zu aktivieren oder deaktivieren, und wobei sich die Öffnung (1402) zu der Umgebungsluft zwischen dem Bedarfsventil (104) und dem Adapter (412) öffnet, während das Bedarfsventil (104) an die Drehbaugruppe (300) gekoppelt bleibt.

13. Verfahren zum Nachrüsten oder Aufrüsten eines umgebungsluftunabhängigen Atemgeräts (100), das eine Maske (102) und ein Bedarfsventil (104) aufweist, wobei das Verfahren umfasst:

Bereitstellen einer Frischluftöffnungsbaugruppe (300);

Befestigen der Frischluftöffnungsbaugruppe (300) an der Maske (102); und

Befestigen des Bedarfsventils (104) an der Frischluftöffnungsbaugruppe (300);

wobei die Frischluftöffnungsbaugruppe (300) funktionsfähig ist, sich relativ zu der Maske (102) und dem Bedarfsventil (104) zu drehen, um eine oder mehrere Öffnungen (1402) zu der Umgebungsluft zu öffnen und zu schließen, und wobei die Frischluftöffnungsbaugruppe (300) umfasst:

einen Nockenknopf (404), der funktionsfähig ist, eine oder mehrere Führungskugeln (405) aufzunehmen; und

einen Nockenkranz (402), der wenigstens eine Bahn (406) umfasst, die funktionsfähig ist, die Führungskugeln (405) aufzunehmen und zu führen, wobei der Nockenknopf (404) relativ zu dem Nockenkranz (402) drehbar ist, um die eine oder mehreren Führungskugeln (405) durch die wenigstens eine Bahn (406) zu bewegen.

14. Verfahren gemäß Anspruch 13, wobei das Befestigen der Frischluftöffnungsbaugruppe (300) an der Maske Befestigen eines Adapters (412) der Baugruppe (300) an der Maske (102) über Gewinde umfasst.

15. Verfahren gemäß Anspruch 13, wobei das Befestigen des Bedarfsventils (104) an der Frischluftöffnungsbaugruppe (300) Befestigen des Bedarfsventils (104) an dem Nockenkranz (402) der Baugruppe (300) umfasst.

Revendications

1. Appareil respiratoire autonome (100) comprenant:

un ou plusieurs cylindres à air (110);
 un réducteur de pression (124);
 un masque (102) ayant une soupape d'expiration (202);
 une soupape à la demande (104) pouvant être actionnée pour se fixer au masque (102), la soupape d'expiration et la soupape à la demande étant configurées de telle sorte qu'un utilisateur inhale de l'air à travers la soupape à la demande (104) et exhale de l'air à travers la soupape d'expiration (202);
 un tuyau à moyenne pression (106), s'étendant du réducteur de pression (124) jusqu'à la soupape à la demande (104), le réducteur de pression (124) étant en communication fluïdique avec la soupape à la demande (104);
 un manomètre combiné (118) et un sifflet d'avertissement (119); et
 un ensemble orifice d'air frais (300) couplé au masque (102) et à la soupape à la demande (104) de telle sorte que l'ensemble orifice d'air frais (300) est positionné entre la soupape à la demande (104) et le masque (102), l'ensemble orifice d'air frais (300) pouvant tourner par rapport au masque (102) et à la soupape à la demande (104) afin d'ouvrir et de fermer un ou plusieurs orifices (1402) à l'air ambiant, l'ensemble orifice d'air frais (300) comprend:

un bouton à came (404) pouvant être actionné pour loger une ou plusieurs billes d'entraînement (405);
 un collier à came (402) comprenant au moins une voie (406) pouvant être actionnée pour accepter et guider les billes d'entraînement (405), dans lequel le bouton à came (404) peut tourner par rapport au collier à came (402) afin de déplacer la ou les billes d'entraînement (405) à travers l'au moins une voie (406).

2. Appareil (100) selon la revendication 1, dans lequel l'ensemble orifice d'air frais comprend en outre:

un adaptateur (412) pouvant être actionné pour fixer l'ensemble orifice d'air frais (300) au masque (102); et
 un ressort (410) positionné entre le collier à came (402) et l'adaptateur (412) pouvant être actionné pour polariser le collier à came (402) à l'écart de l'adaptateur (412).

3. Appareil (100) selon la revendication 2, dans lequel le bouton à came (404) comprend une première

saillie (706) pouvant être actionnée pour interagir avec la soupape d'expiration (202) pour maintenir la soupape d'expiration (202) ouverte lorsque l'orifice (1402) est ouvert à l'air ambiant.

4. Appareil (100) selon la revendication 3, dans lequel le bouton à came (404) comprend en outre une seconde saillie (704) pouvant être actionnée pour indiquer la position de l'ensemble à came (300) à l'utilisateur de l'appareil (100), dans lequel la seconde saillie (704) se trouve dans la ligne de visée de l'utilisateur lorsque l'orifice (1402) est ouvert à l'air ambiant.

5. Appareil (100) selon la revendication 2, dans lequel l'au moins une voie (406) du collier à came (402) comprend:

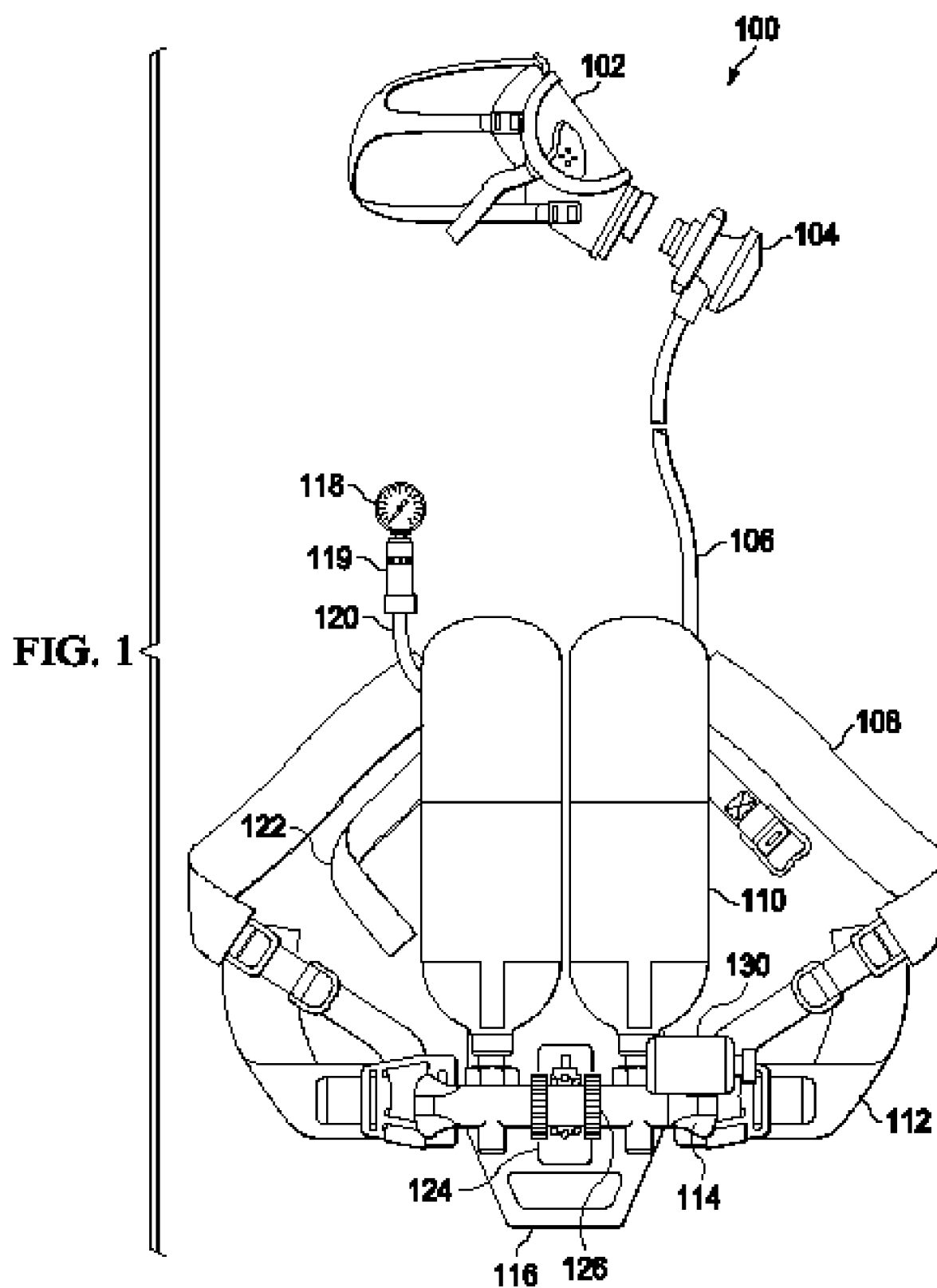
une première section (601) pouvant être actionnée pour fournir une résistance à la sensation de contrôle lors du déclenchement de l'opération de rotation;
 une deuxième section (602) pouvant être actionnée pour déplacer le collier à came (402) dans un mouvement linéaire perpendiculaire à la face du masque (102);
 une troisième section (603) pouvant être actionnée pour verrouiller le collier à came (402) dans une position ouverte; et
 une quatrième section (604) pouvant être actionnée pour permettre l'assemblage de l'ensemble orifice d'air frais (300).

6. Appareil selon la revendication 2, dans lequel l'ensemble orifice d'air frais (300) comprend en outre un couvercle avant (414) fixé au collier à came (402), et dans lequel la soupape à la demande (104) est fixée à l'ensemble orifice d'air frais (300) par l'intermédiaire d'un adaptateur de soupape à la demande (412).

7. Ensemble rotatif (300) destiné à être utilisé avec un appareil respiratoire (100) comprenant un masque (102) et une soupape à la demande (104), l'ensemble (300) comprenant:

une ou plusieurs billes d'entraînement (405);
 un bouton à came (404) pouvant être actionné pour loger la ou les billes d'entraînement (405);
 un collier à came (402) couplé au bouton à came (404) comprenant au moins une voie (406) sur la surface extérieure du collier (402) pouvant être actionnée pour recevoir les billes d'entraînement (405);
 un adaptateur (412) pouvant être actionné pour fixer l'ensemble rotatif (300) au masque (102) de l'appareil respiratoire (100); et
 un ressort (410) positionné entre le collier à ca-

- me (402) et l'adaptateur (412) pouvant être actionné pour polariser le collier à came (402) à l'écart de l'adaptateur (412),
l'ensemble rotatif (300) étant couplé au masque (102) de telle sorte que l'ensemble (300) est positionné entre la soupape à la demande (104) et le masque (102), et
l'ensemble rotatif (300) pouvant être actionné pour ouvrir et fermer un ou plusieurs orifices (1402) à l'air ambiant.
8. Ensemble (300) selon la revendication 7, dans lequel le bouton à came (404) comprend une première saillie (706) pouvant être actionnée pour interagir avec une soupape d'expiration (202) du masque (102) pour maintenir ouverte la soupape d'expiration (202).
9. Ensemble (300) selon la revendication 8, dans lequel le bouton à came (404) comprend une seconde saillie (704) pouvant être actionnée pour indiquer la position de l'ensemble rotatif (300) à l'utilisateur, dans lequel la seconde saillie (704) se trouve dans la ligne de visée de l'utilisateur lorsque l'orifice (1402) est ouvert à l'air ambiant.
10. Ensemble (300) selon la revendication 7, dans lequel le bouton à came (404) tourne par rapport au masque (102) et le collier à came (402) se déplace linéairement perpendiculairement à la face du masque (102) .
11. Ensemble (300) selon la revendication 7, dans lequel l'au moins une voie (406) du collier à came (402) comprend:
une première section (601) pouvant être actionnée pour fournir une résistance à la sensation de contrôle lors du déclenchement de l'opération de rotation;
une deuxième section (602) pouvant être actionnée pour déplacer le collier à came (402) dans un mouvement linéaire perpendiculaire à la face du masque;
une troisième section (603) pouvant être actionnée pour verrouiller le collier à came (402) dans une position ouverte; et
une quatrième section (604) pouvant être actionnée pour permettre l'assemblage de l'ensemble rotatif (300) .
12. Ensemble (300) selon la revendication 7, dans lequel l'adaptateur (412) interagit avec une tige de poussée (1202) de la soupape à la demande (104) pour activer ou désactiver la soupape à la demande (104), et dans lequel l'orifice (1402) à l'air ambiant s'ouvre entre la soupape à la demande (104) et l'adaptateur (412), tandis que la soupape à la demande (104)
- reste couplée à l'ensemble rotatif (300).
13. Procédé de modification ou de mise à niveau d'un appareil respiratoire autonome (100) comportant un masque (102) et une soupape à la demande (104), le procédé consistant à:
fournir un ensemble orifice d'air frais (300);
fixer l'ensemble orifice d'air frais (300) au masque (102); et
fixer la soupape à la demande (104) à l'ensemble orifice d'air frais (300);
l'ensemble orifice d'air frais (300) pouvant tourner par rapport au masque (102) et à la soupape à la demande (104) afin d'ouvrir et de fermer un ou plusieurs orifices (1402) à l'air ambiant, et dans lequel l'ensemble orifice d'air frais (300) comprend:
un bouton à came (404) pouvant être actionné pour loger une ou plusieurs billes d'entraînement (405); et
un collier à came (402) comprenant au moins une voie (406) pouvant être actionnée pour accepter et guider les billes d'entraînement (405), dans lequel le bouton à came (404) peut tourner par rapport au collier à came (402) afin de déplacer la ou les billes d'entraînement (405) à travers l'au moins une voie (406) .
14. Procédé selon la revendication 13, dans lequel la fixation de l'ensemble orifice d'air frais (300) au masque comprend la fixation d'un adaptateur (412) de l'ensemble (300) au masque (102) par l'intermédiaire de filetages.
15. Procédé selon la revendication 13, dans lequel la fixation de la soupape à la demande (104) à l'ensemble orifice d'air frais (300) comprend la fixation de la soupape à la demande (104) au collier à came (402) de l'ensemble (300).



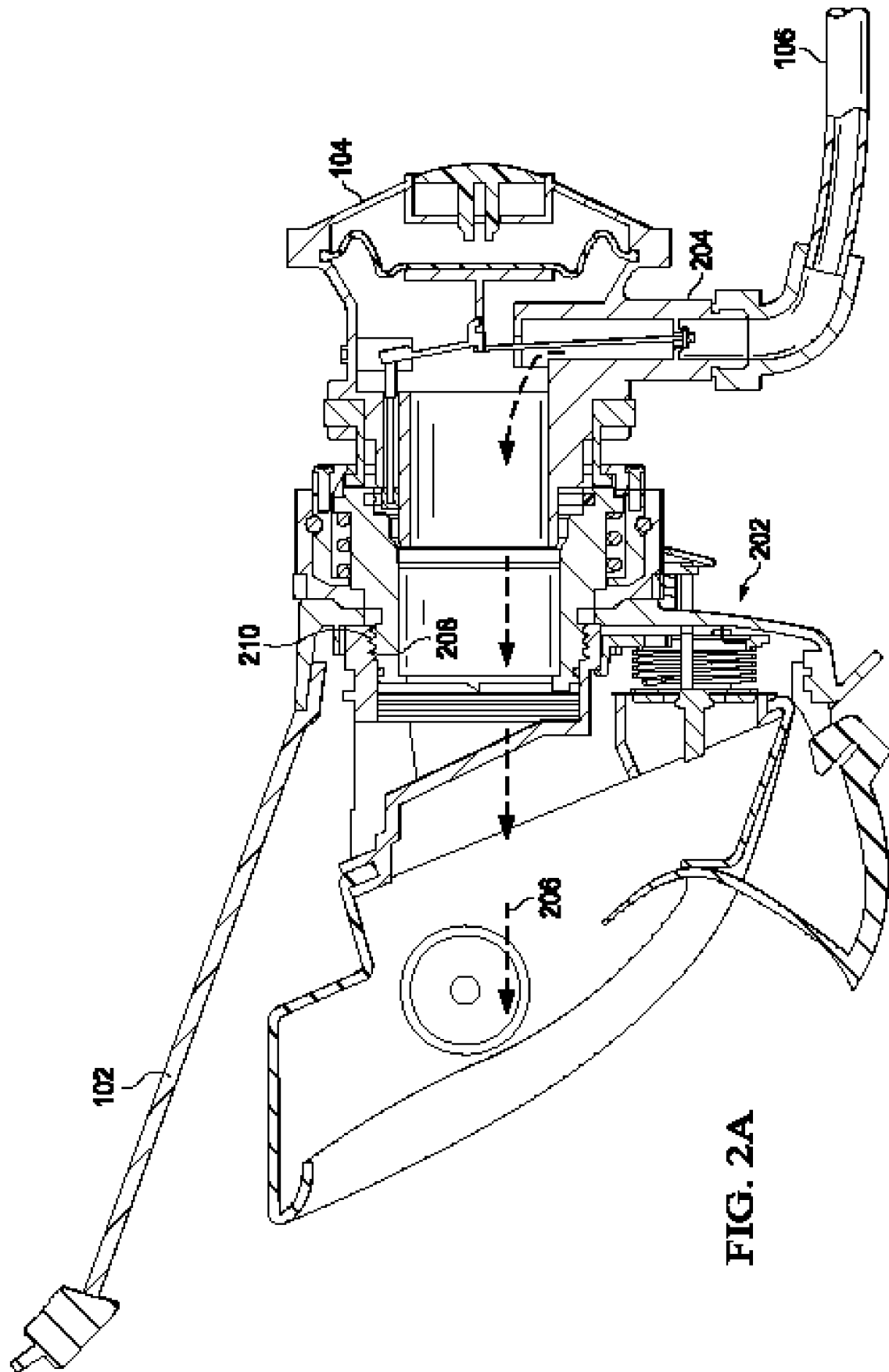
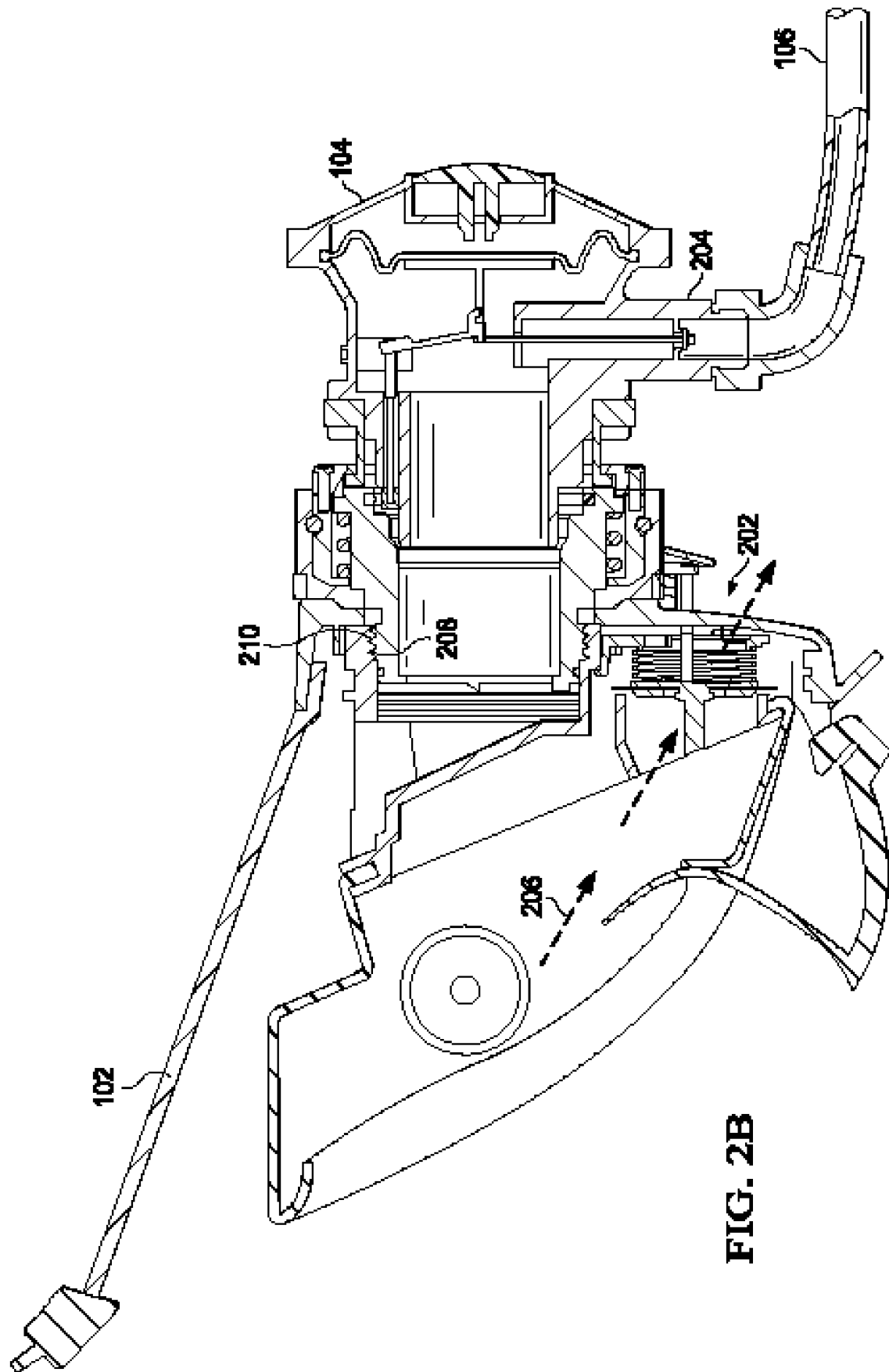


FIG. 2A



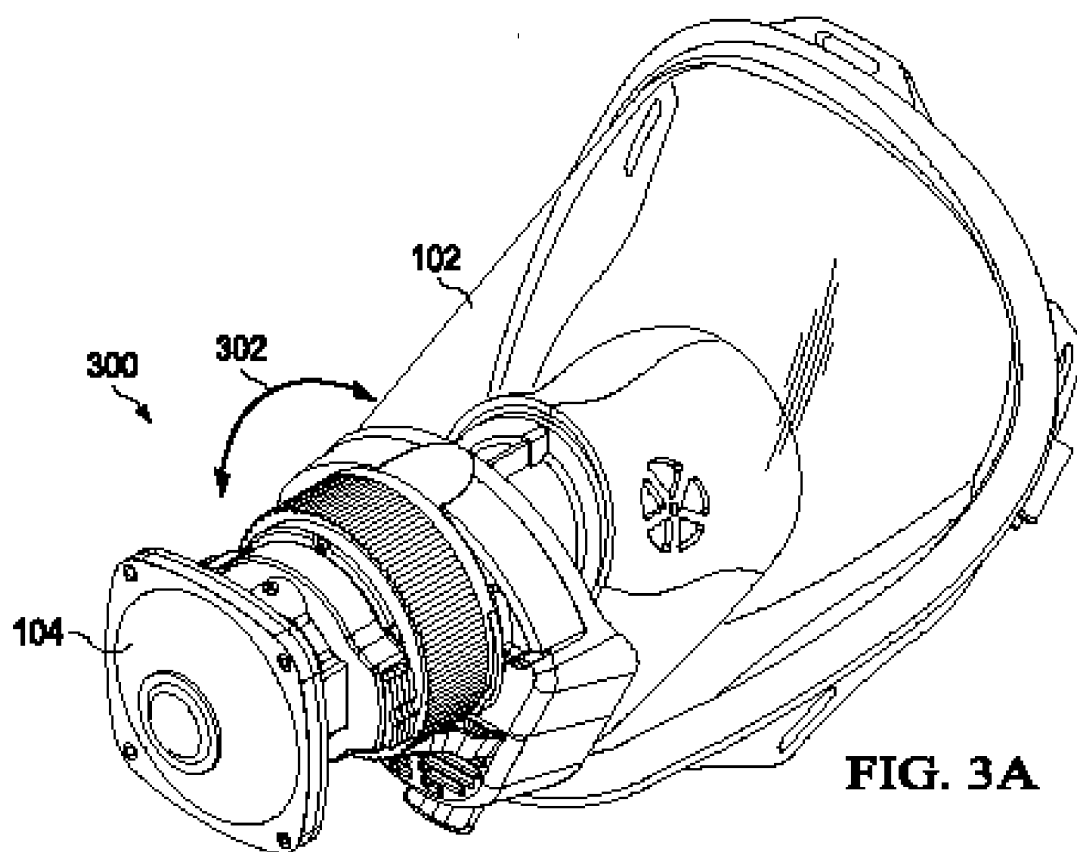


FIG. 3A

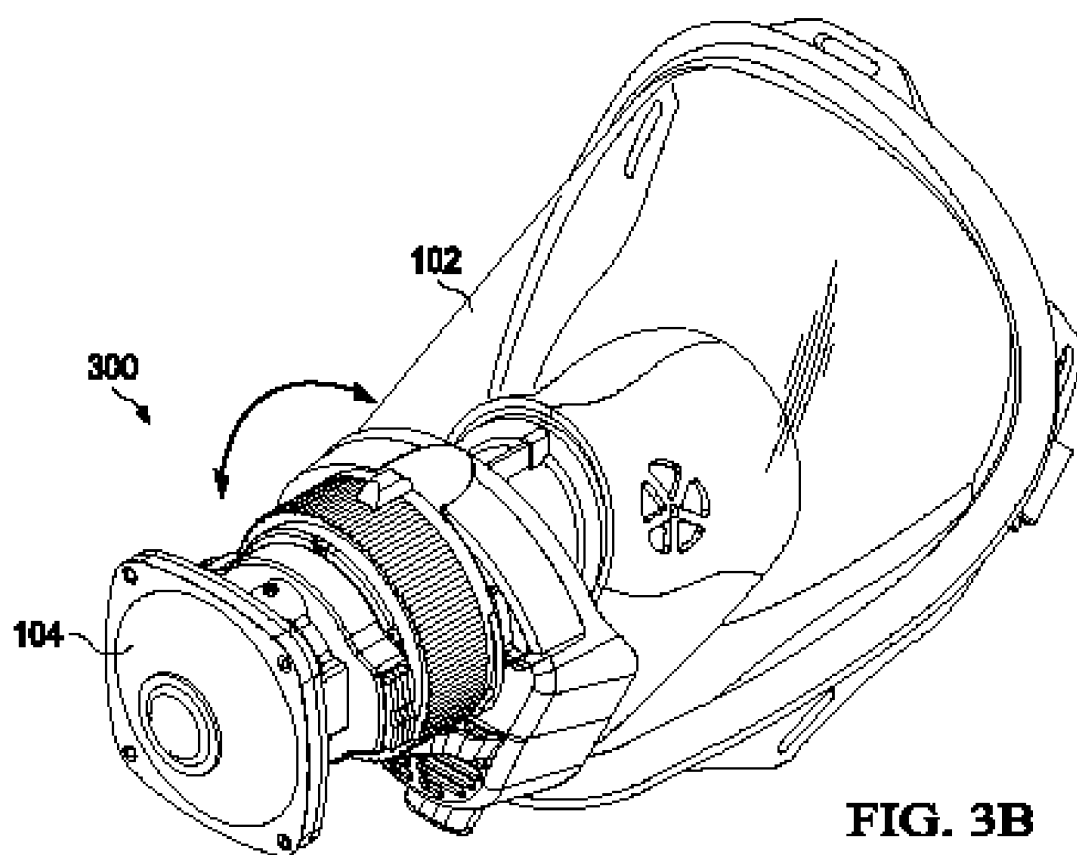


FIG. 3B

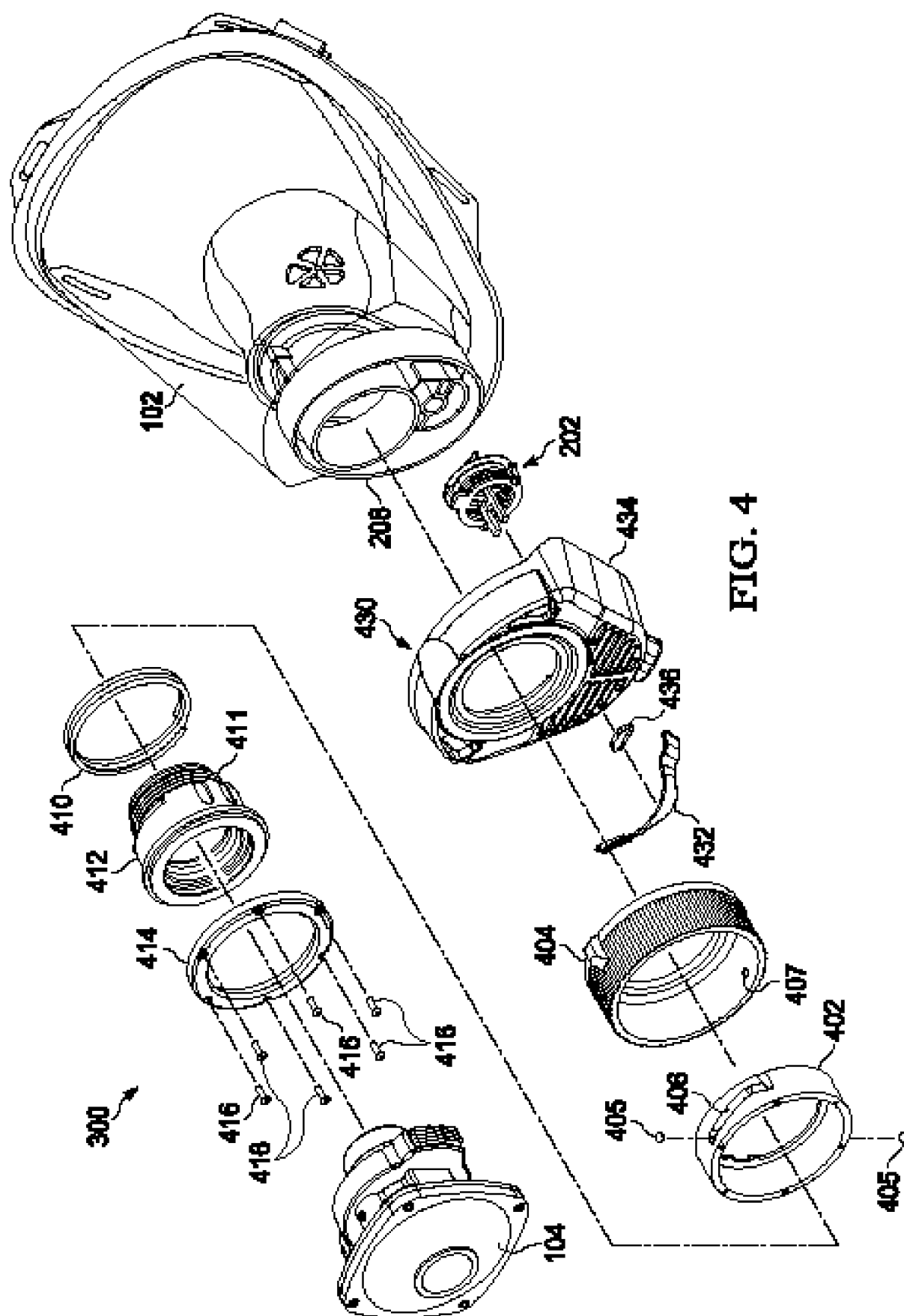
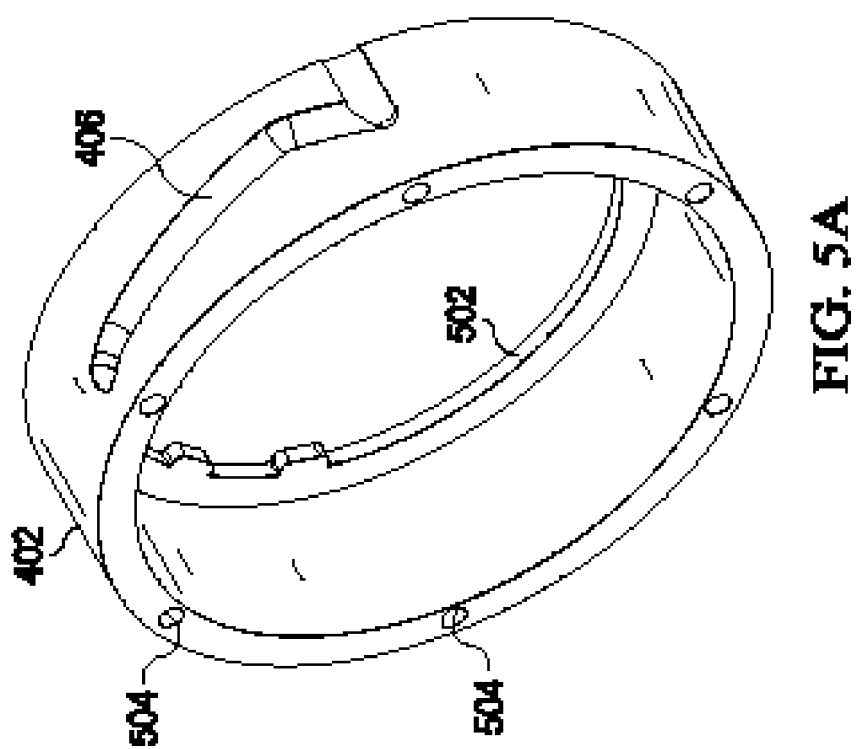
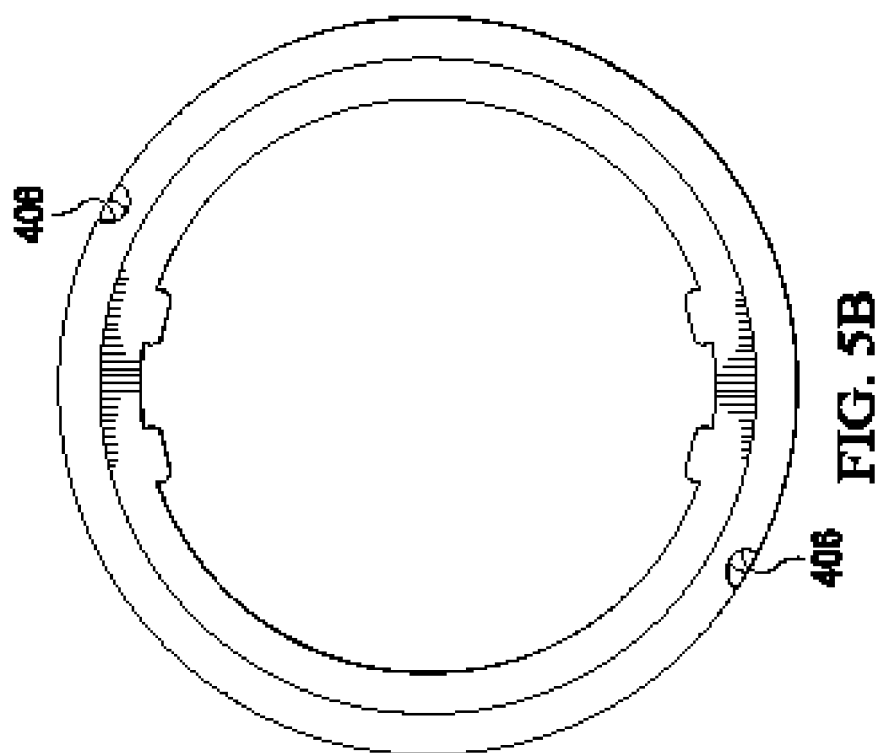


FIG. 4



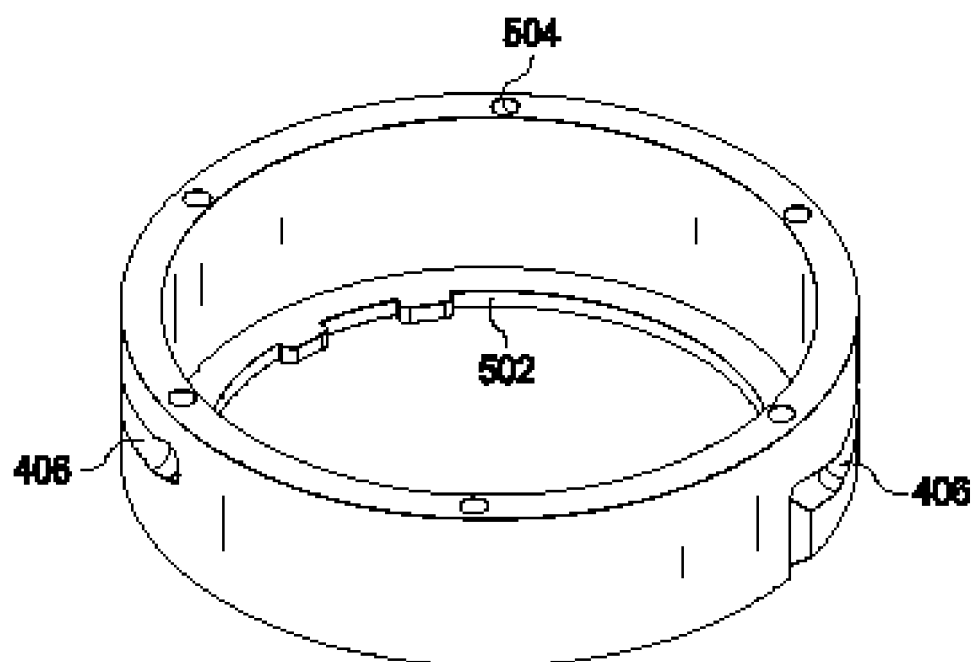


FIG. 5C

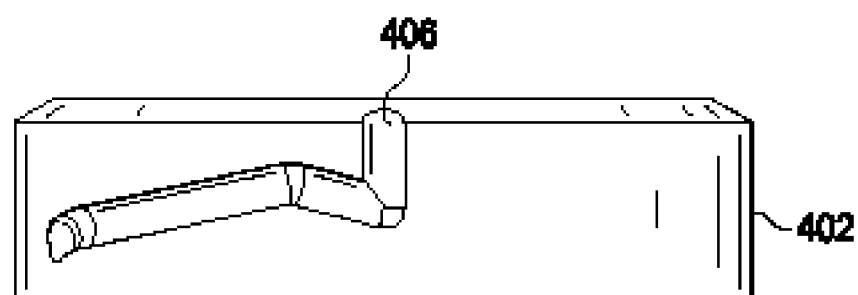


FIG. 5D

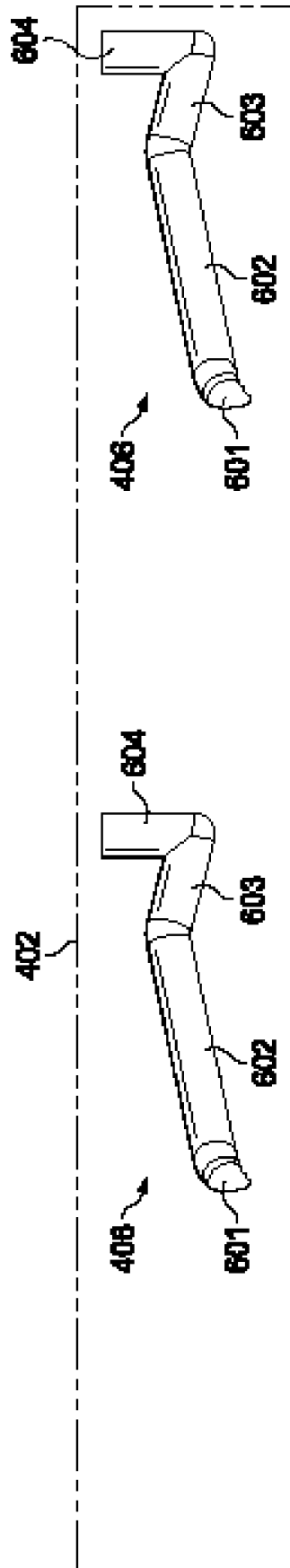


FIG. 6

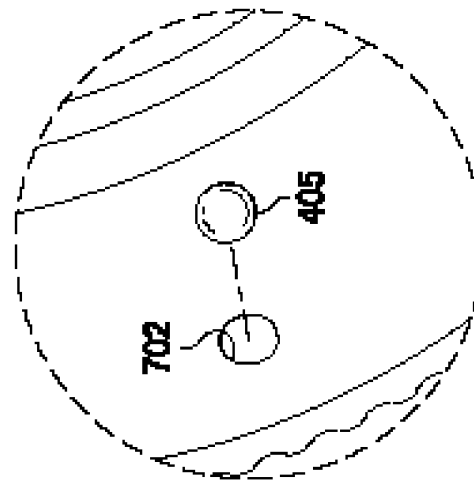


FIG. 7E

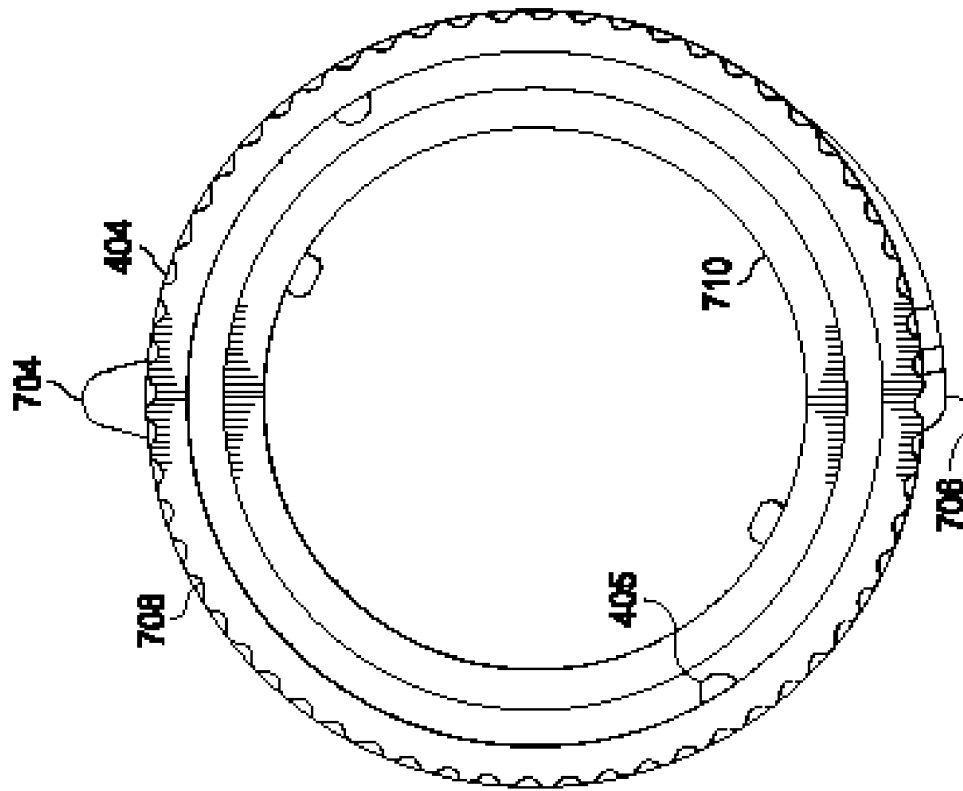


FIG. 7B

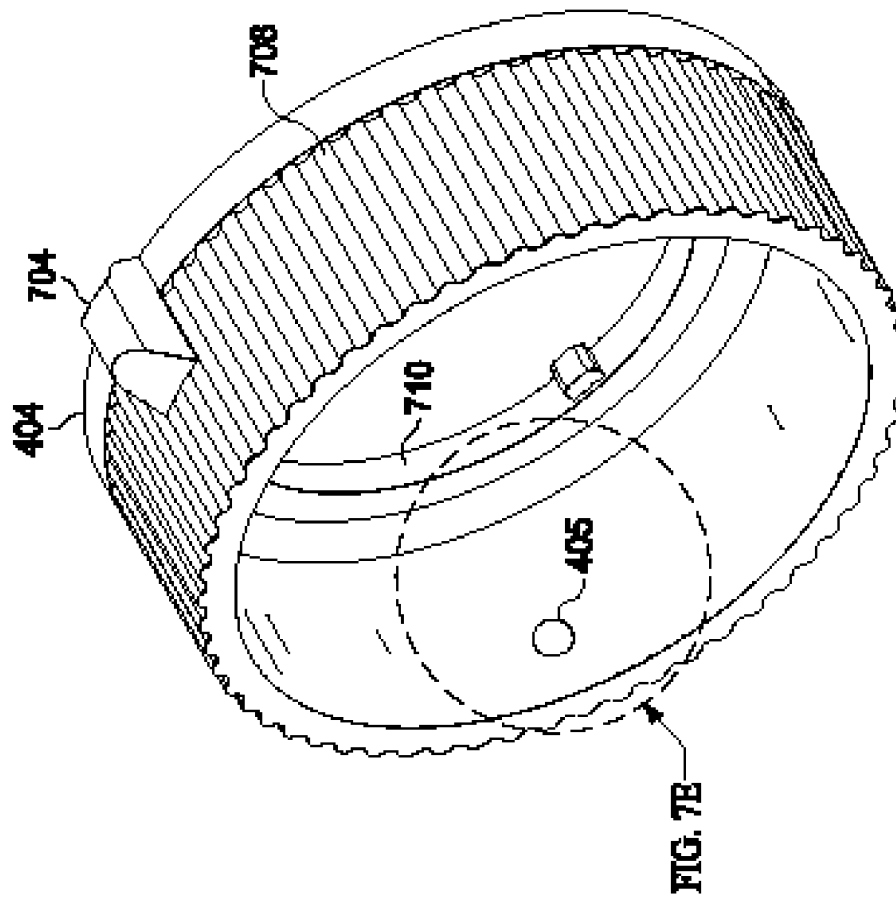


FIG. 7A

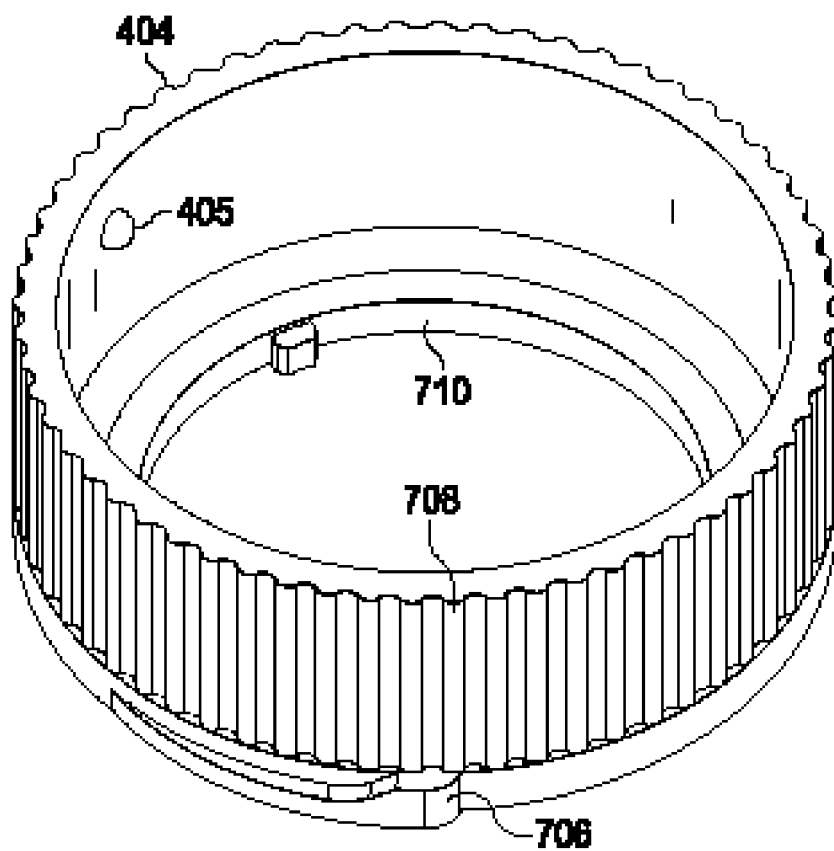


FIG. 7C

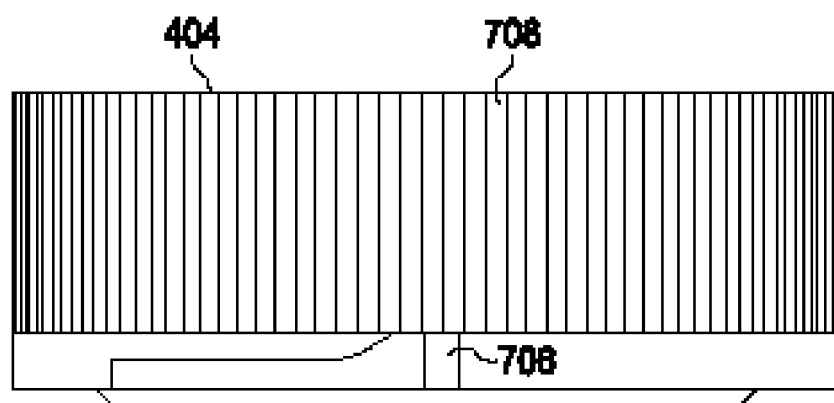


FIG. 7D

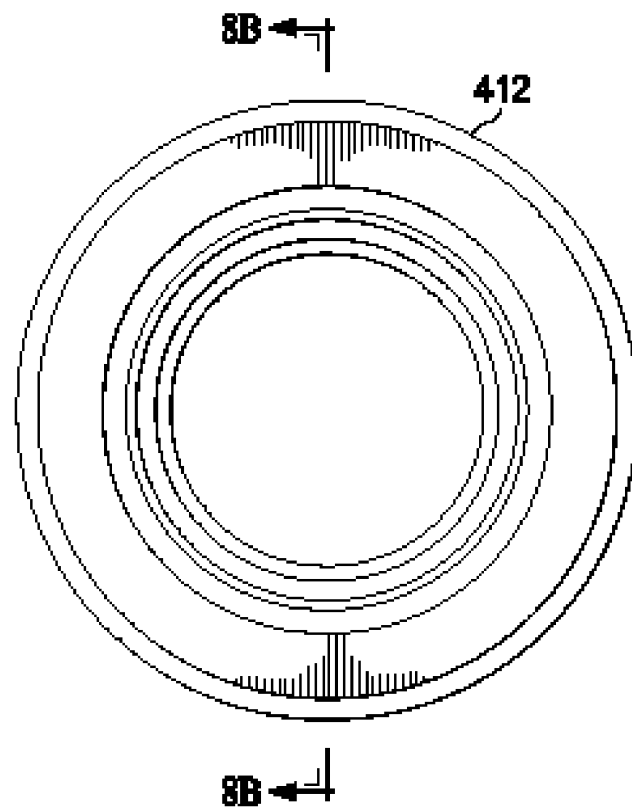


FIG. 8A

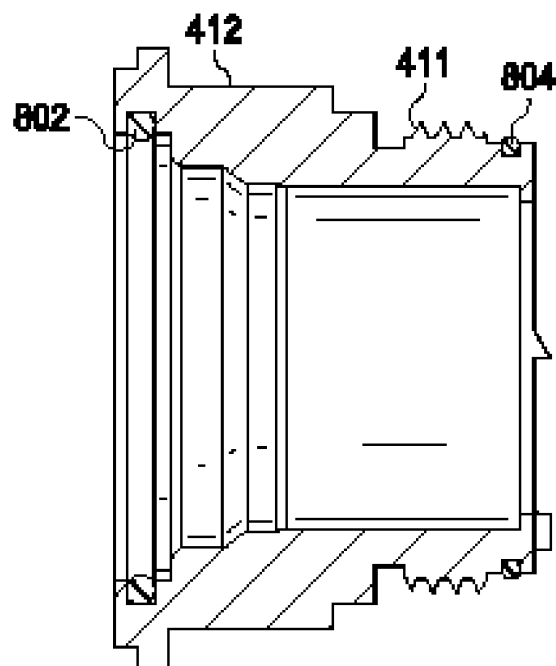


FIG. 8B

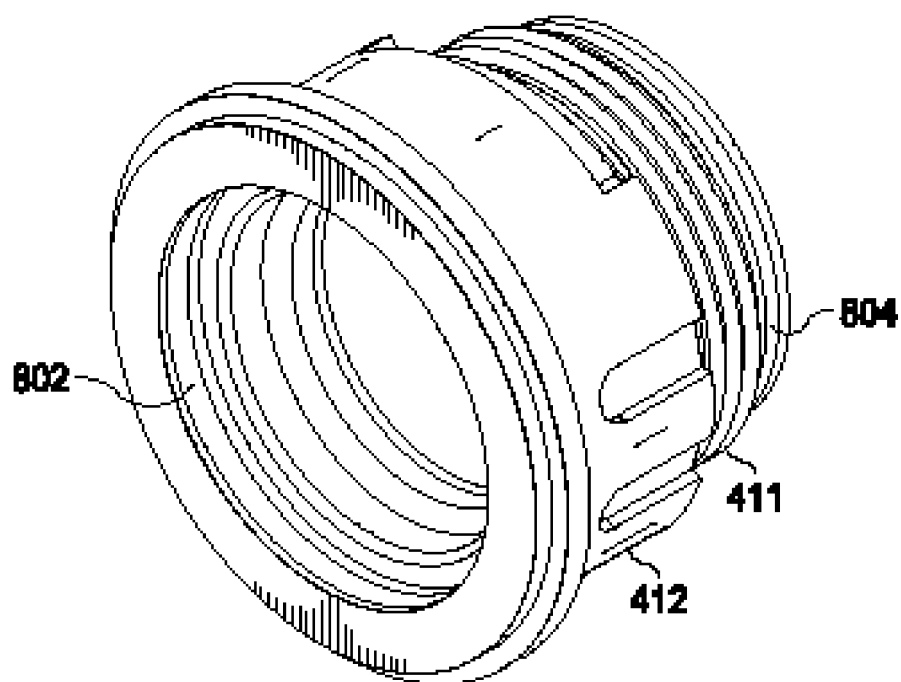


FIG. 8C

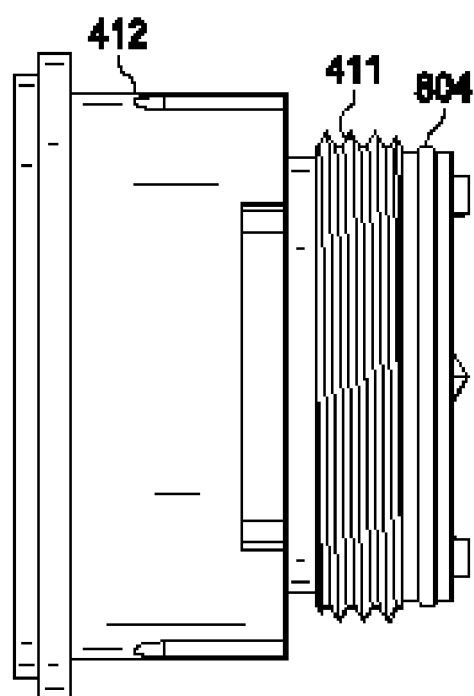


FIG. 8D



FIG. 9B

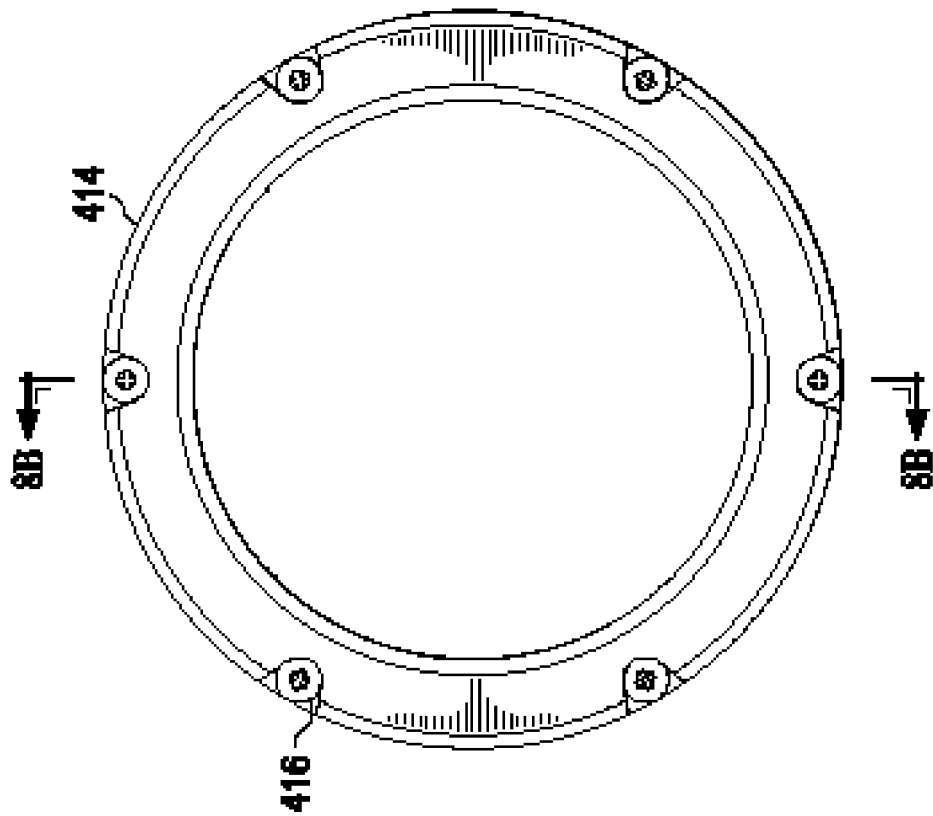


FIG. 9A

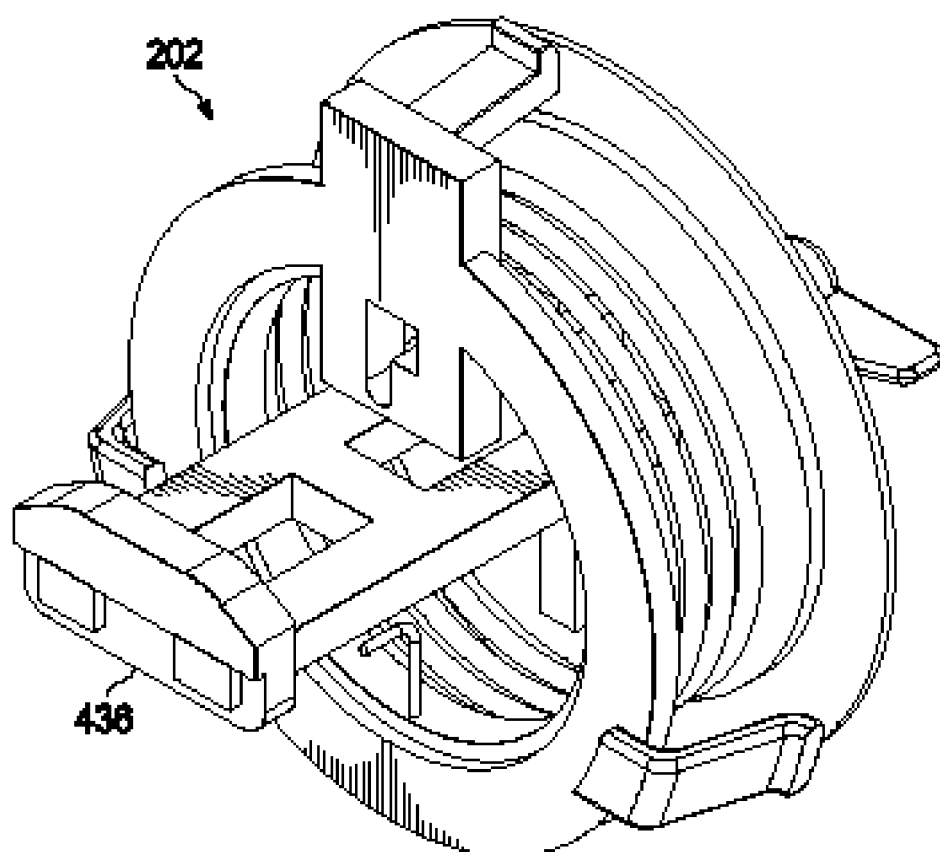


FIG. 10A

FIG. 10B

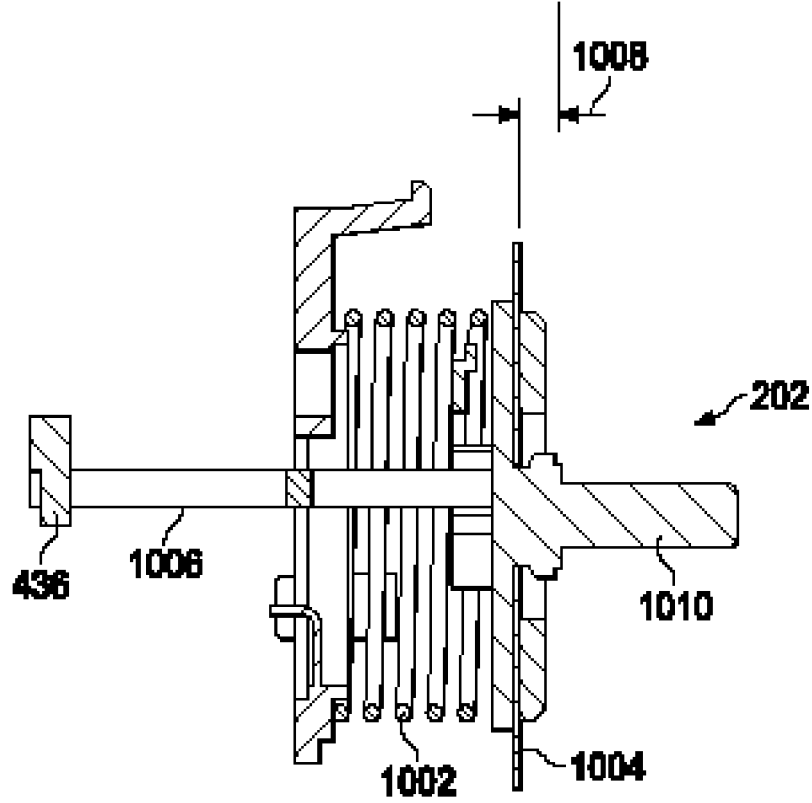
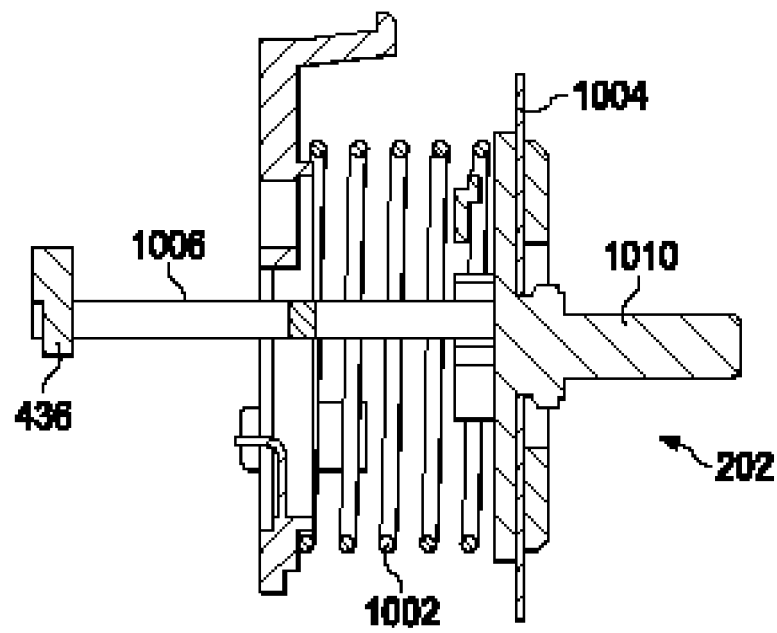


FIG. 10C

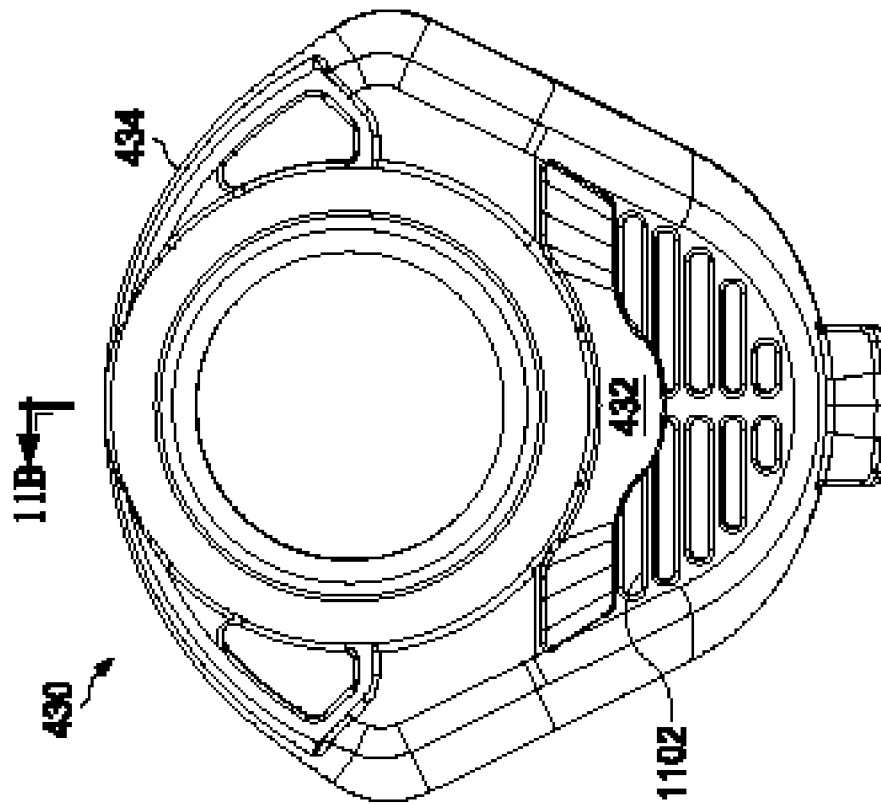


FIG. 11A

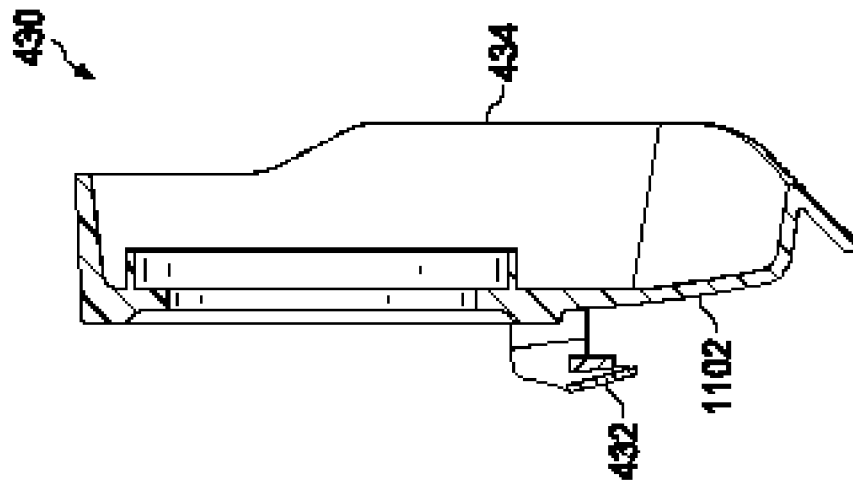


FIG. 11B

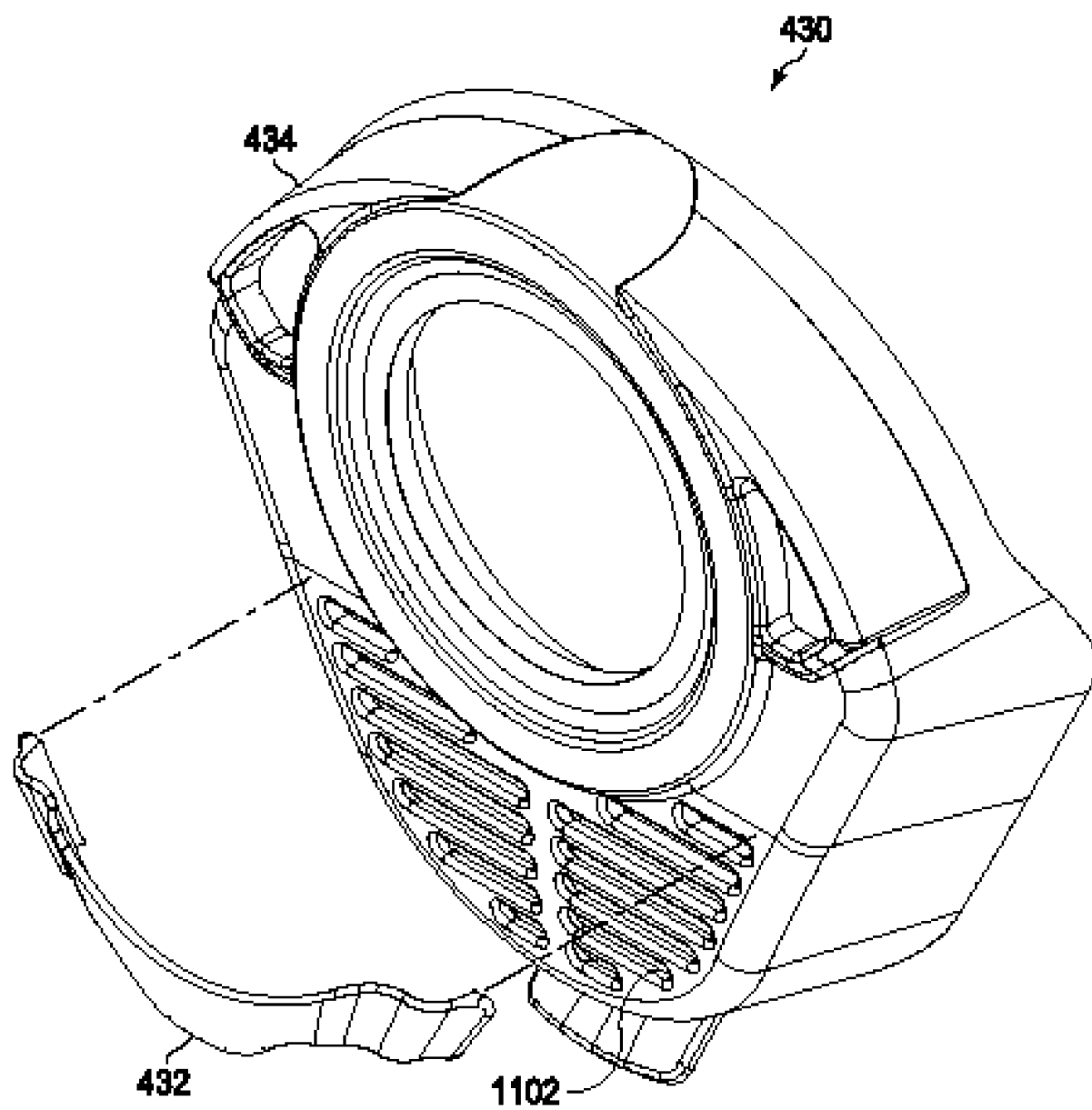


FIG. 11C

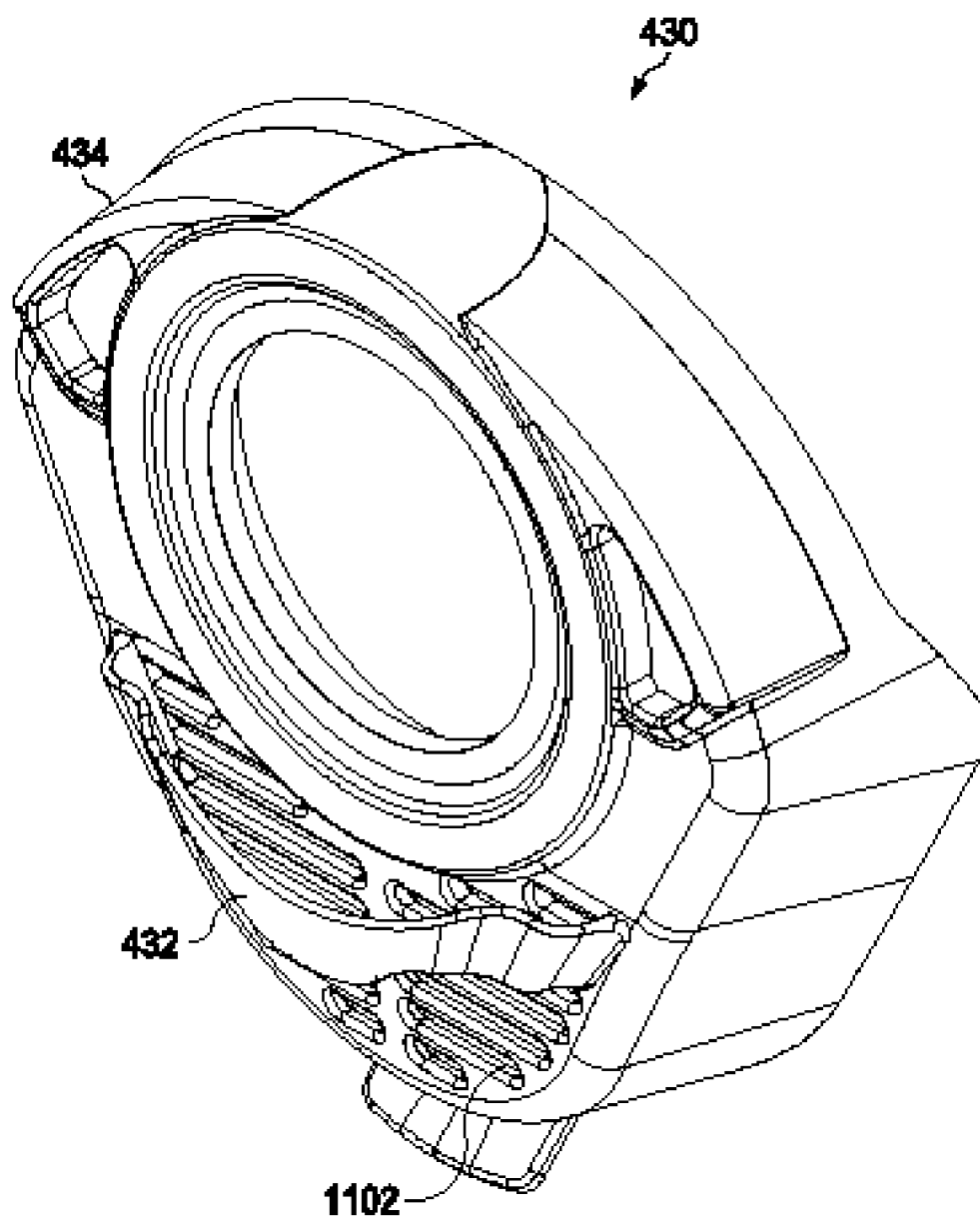


FIG. 11D

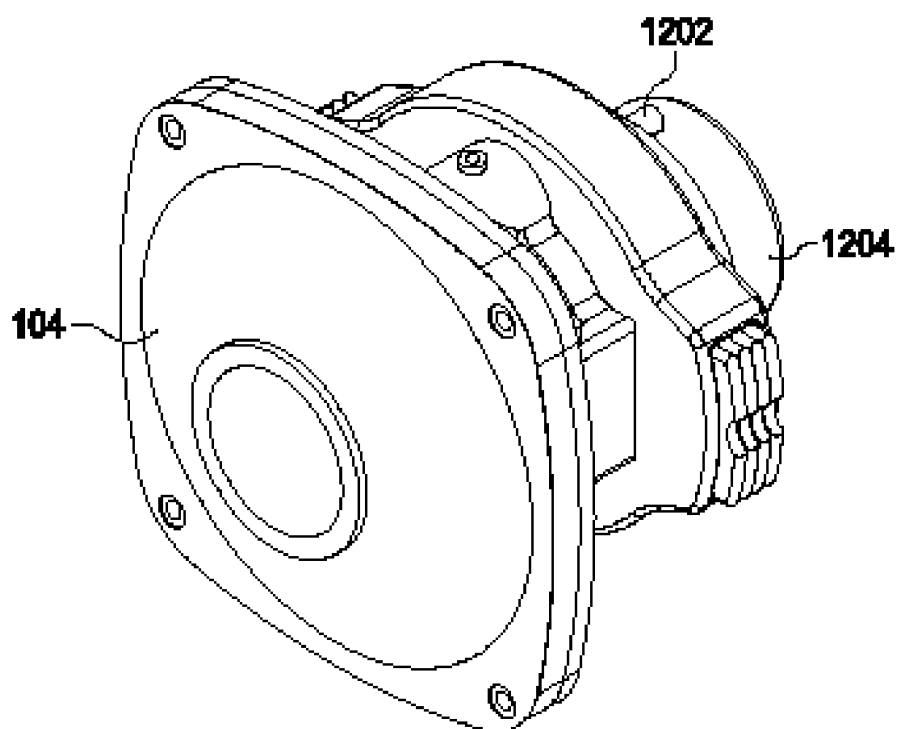


FIG. 12A

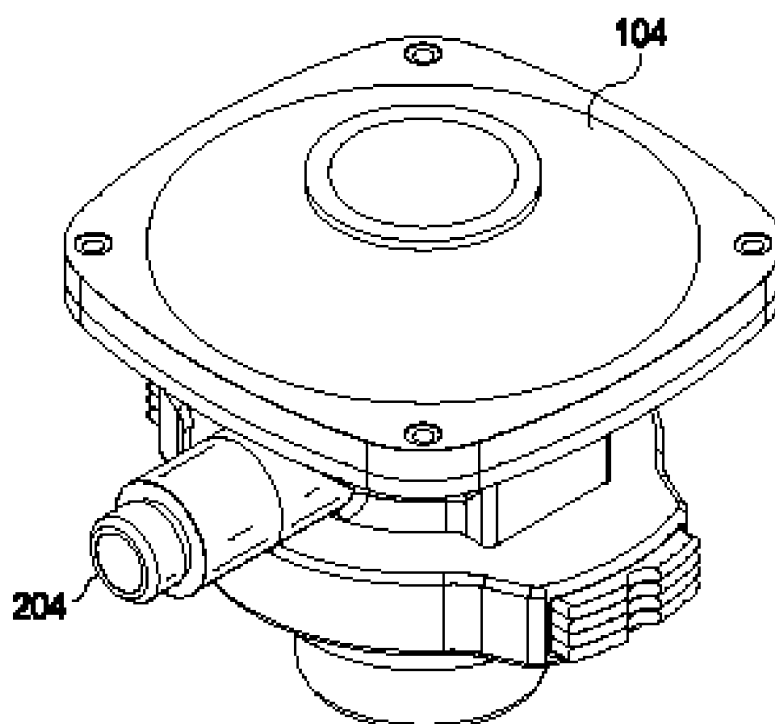


FIG. 12B

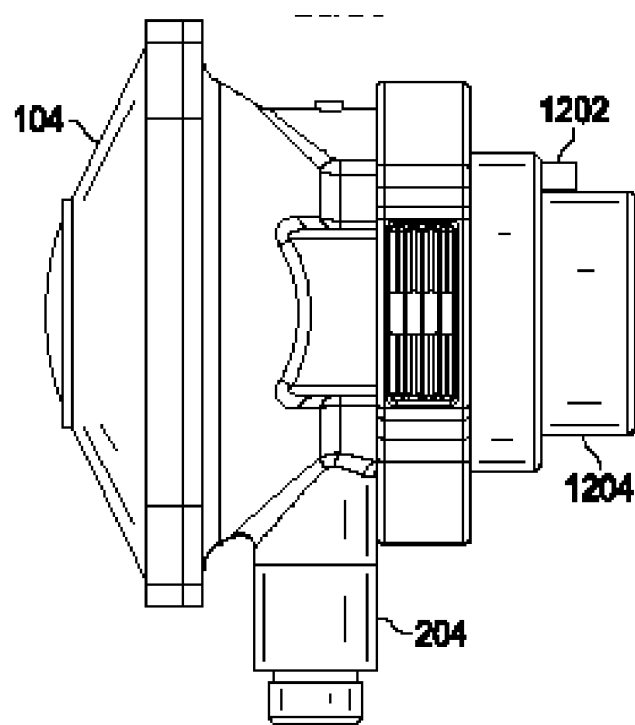


FIG. 12C

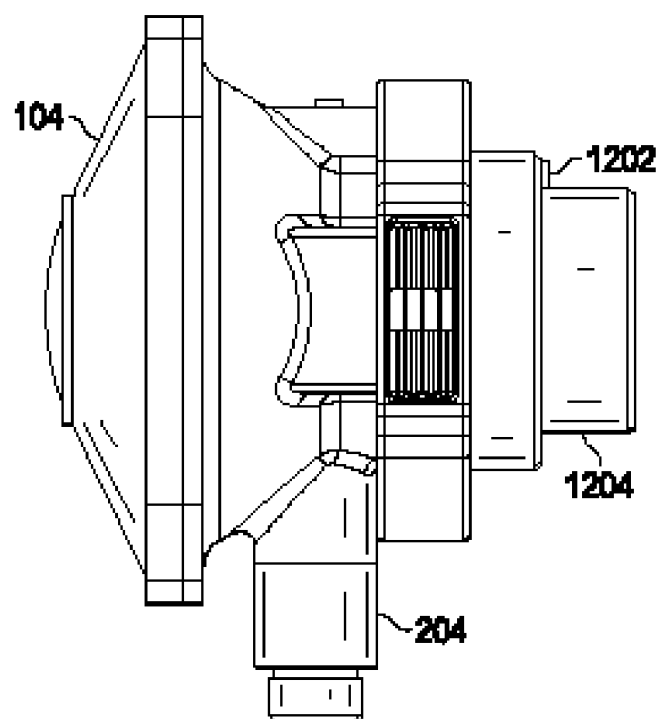
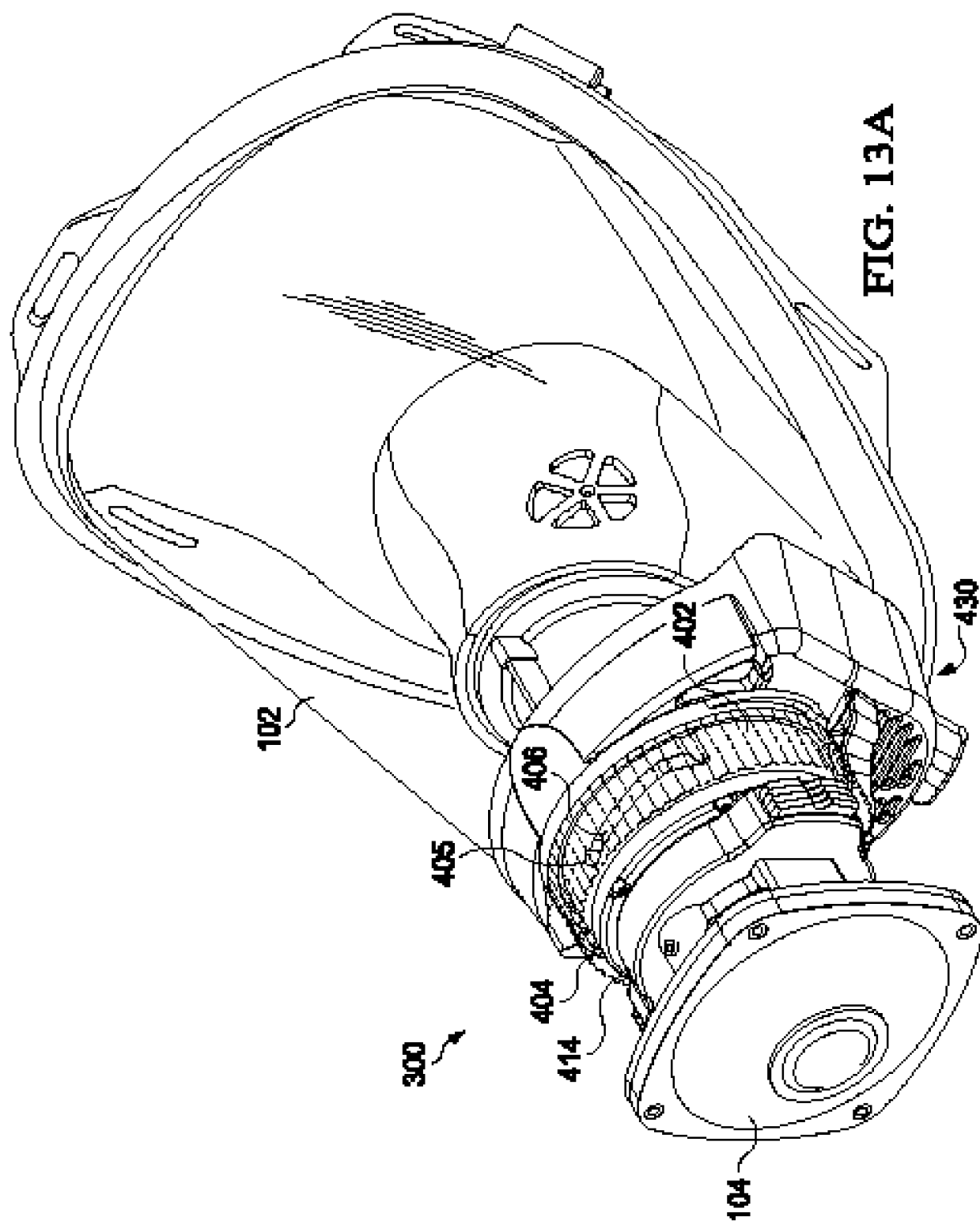


FIG. 12D



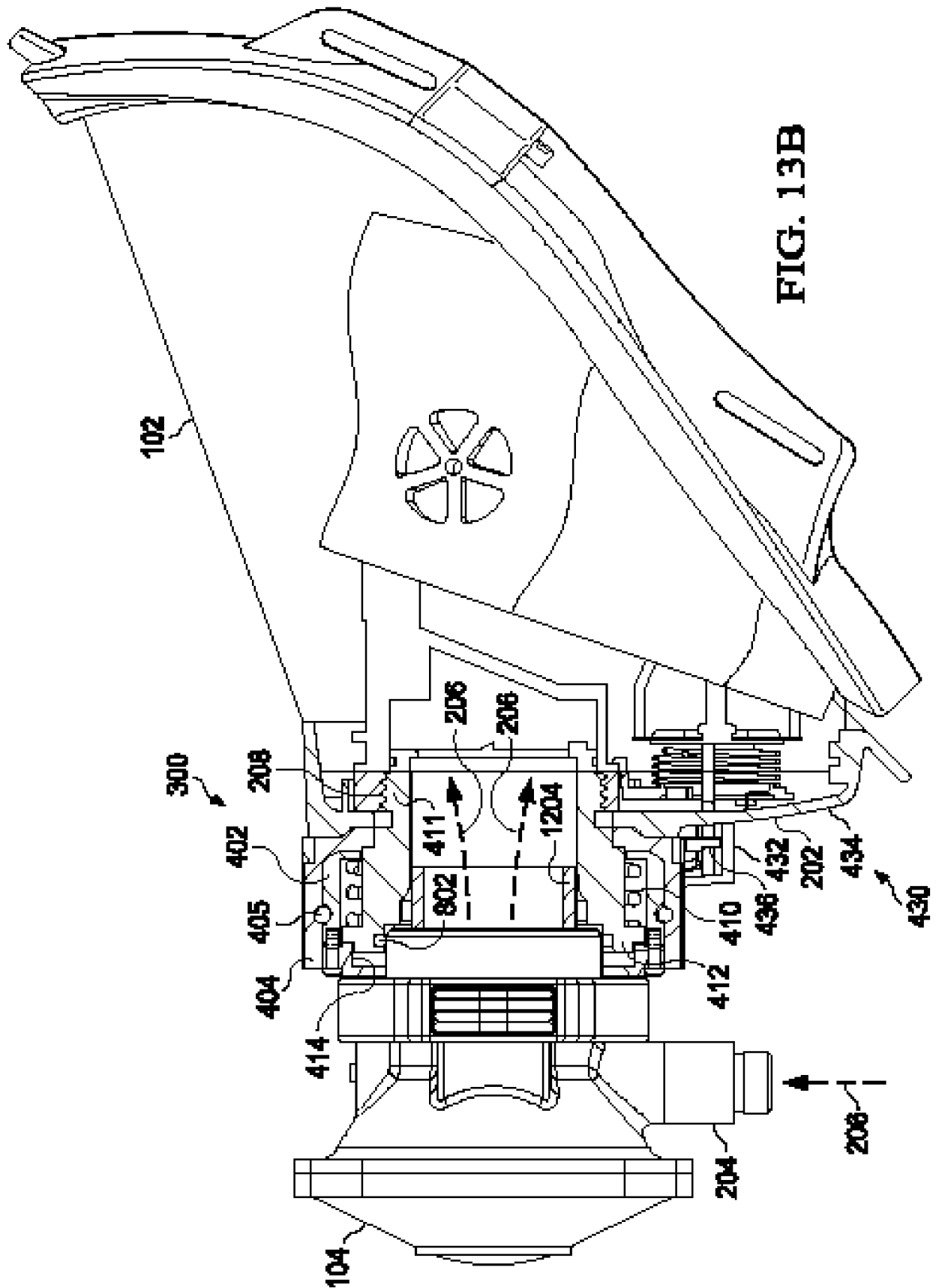
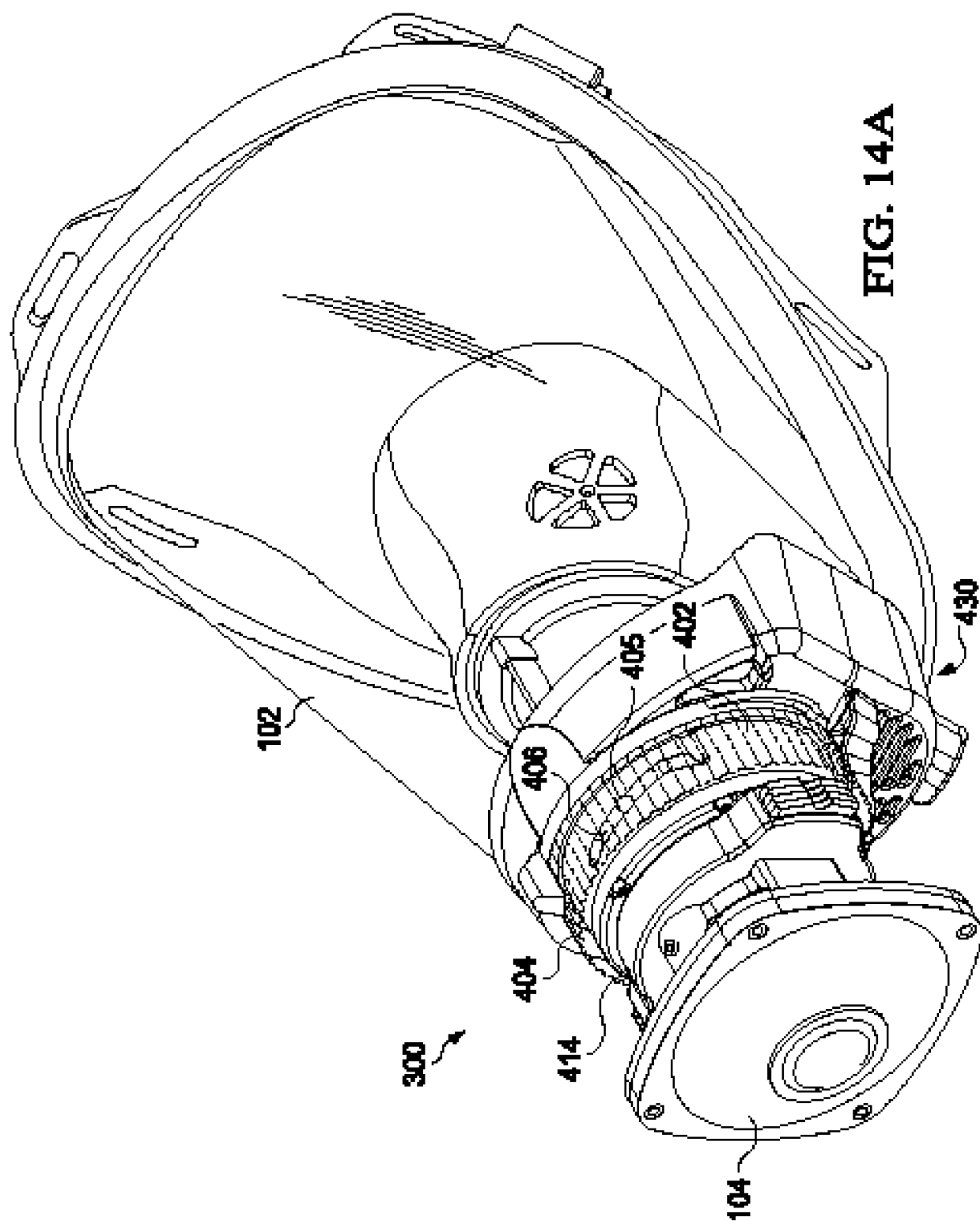


FIG. 13B



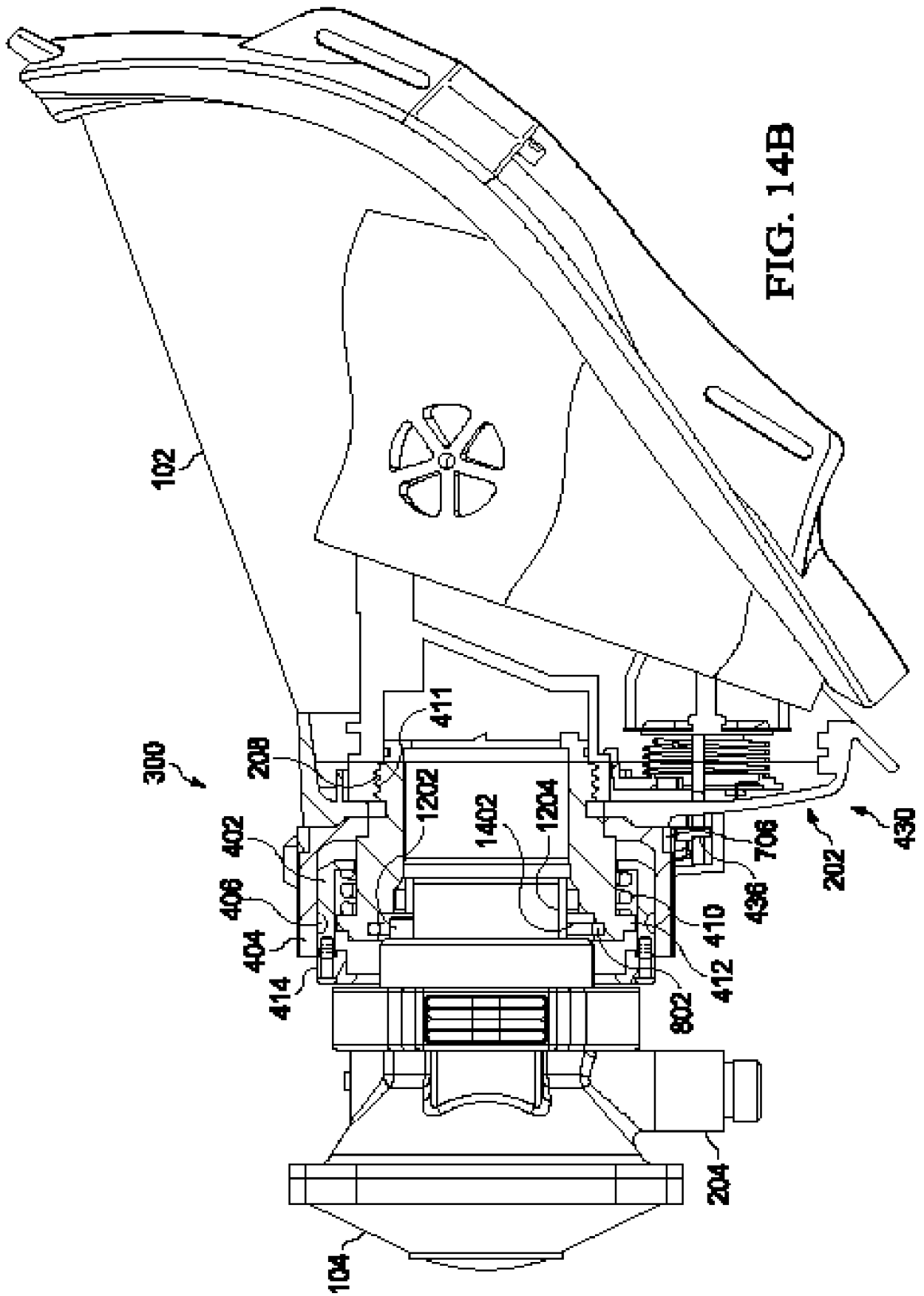
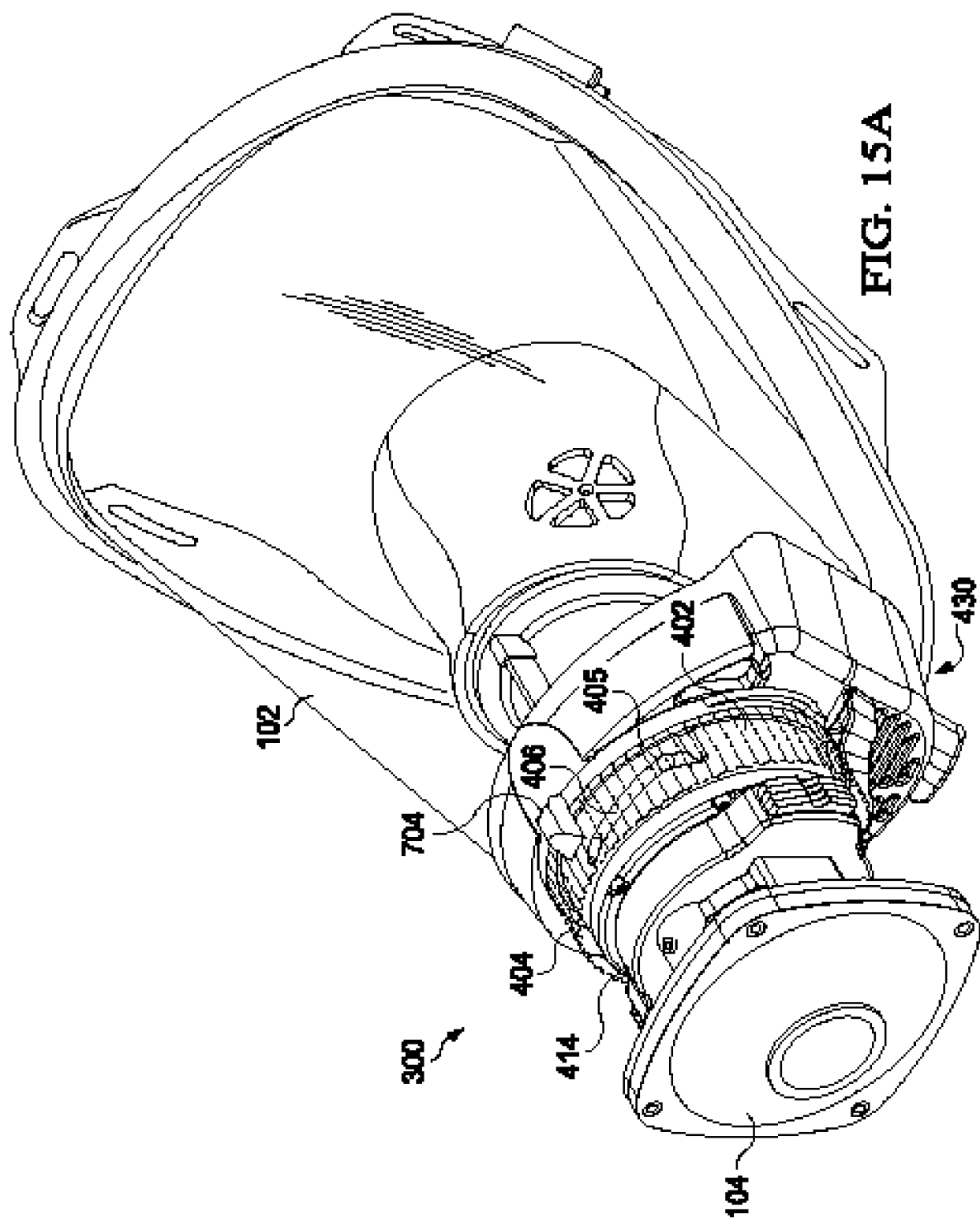
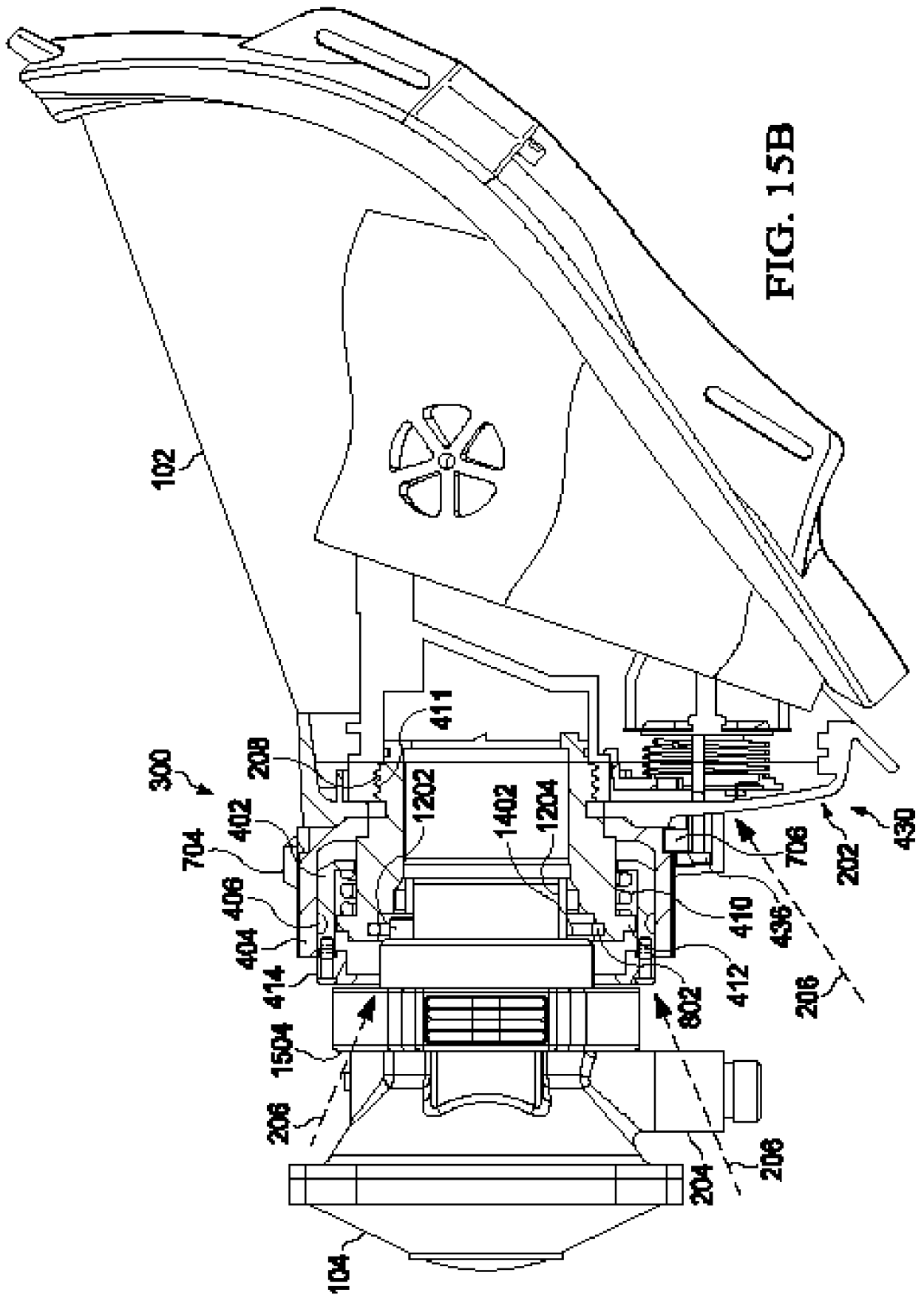


FIG. 14B





REFERENCES CITED IN THE DESCRIPTION

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