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(72) Inventor; and

(71) Applicant: VADIPOUR, Morteza [US/US]; 6300 Owensmouth Ave #E203, Woodland Hills, California 91367 (US).

(74) Agent: BONDERER, D. Austin; 1851 Chantilly Ln, Fullerton, California 92833 (US).

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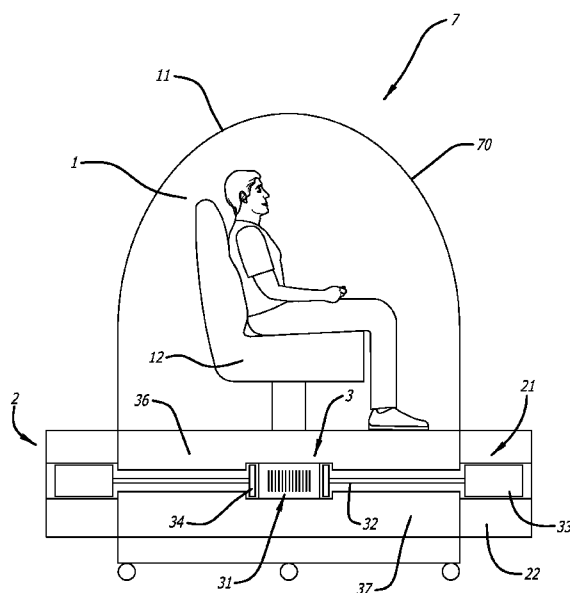


FIG. 1

(57) Abstract: A peripheral propulsion system having a propulsion unit (3), an upper section (36), and a lower section (37). The propulsion unit (3) has a motor (31), a motor engagement section (34), an extension (32) coupled to the motor engagement section (34), and two or more blades (33) coupled to the extension (32). The extension (32) is located between the upper section (36) and the lower section (37). The output section (22) is located about at least a portion of the lower section (37), and the two or more blades (33) are located outside a periphery of the vehicle (7). When the motor (31) is running, the two or more blades (33) are capable of drawing fluid from about the periphery of the vehicle (7) and through the output section (22).

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- *as to the identity of the inventor (Rule 4.17(i))*
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## PROPULSION SYSTEMS AND VEHICLES USING THE SAME

## FIELD

[0001] The subject matter herein generally relates to a propulsion system.

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## BRIEF DESCRIPTION OF THE DRAWINGS

[0002] Implementations of the present technology will now be described, by way of example only, with reference to the attached figures, wherein:

[0003] FIG. 1 shows an embodiment of a Vertical Take Off and Landing vehicle (VTOL)

10 using an embodiment of the Peripheral Propulsion System (PPS).

[0004] FIG. 2A shows an embodiment of a motor.

[0005] FIG. 2B shows an embodiment of a motor.

[0006] FIG. 2C shows an embodiment of a VTOL using an embodiment of the PPS.

[0007] FIG. 3A shows an embodiment of the output section.

15 [0008] FIG. 3B Shows an embodiment of the output section comprising output section vanes.

[0009] FIG. 3C shows an embodiment of the output vanes in an embodiment of the output section.

[0010] FIG. 3D shows an embodiment of the propulsion unit.

20 [0011] FIG. 3E shows an embodiment of the propulsion unit.

[0012] FIG. 4A shows an embodiment of the PPS.

[0013] FIG. 4B shows a representation of an embodiment of the PPS with an embodiment of the intake vanes and an embodiment of the output vanes.

[0014] FIG. 5 shows an embodiment of the throttles and vectoring elements.

[0015] FIG. 6A shows an embodiment of an intake cover.

5 [0016] FIG. 6B shows an embodiment of intake grille vanes.

[0017] FIG. 7A shows an embodiment of a VTOL with an embodiment of a PPS.

[0018] FIG. 7B shows an embodiment of a VTOL with an embodiment of a PPS.

[0019] FIG. 8A shows an embodiment of an aircraft with an embodiment of a PPS.

[0020] FIG. 8B shows an embodiment of an aircraft with an embodiment of a PPS.

10 [0021] FIG. 8C shows an embodiment of an aircraft with embodiments of PPS.

[0022] FIG. 8D shows an embodiment of a submarine with an embodiment of a PPS.

[0023] FIG. 8E shows an embodiment of a watercraft with an embodiment of a PPS.

[0024] FIG. 8F shows an embodiment of an enclosed transport system with an embodiment of a PPS.

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## DETAILED DESCRIPTION

[0025] It will be appreciated that for simplicity and clarity of illustration, where appropriate, reference numerals have been repeated among the different figures to indicate corresponding or analogous elements. In addition, numerous specific details are set forth in order  
20 to provide a thorough understanding of the embodiments described herein. However, it will be understood by those of ordinary skill in the art that the embodiments described herein can be practiced without these specific details. In other instances, methods, procedures, and components

have not been described in detail so as not to obscure the related relevant feature being described. The drawings are not necessarily to scale and the proportions of certain parts may be exaggerated to better illustrate details and features. The description is not to be considered as limiting the scope of the embodiments described herein. It should be noted that references to “an  
5 embodiment,” “one embodiment,” or “some embodiments” in this disclosure are not necessarily to the same embodiment, and such references mean at least one.

[0026] Several definitions that apply throughout this disclosure will now be presented.

[0027] The term “coupled” is defined as connected, whether integral with, directly  
10 attached, or indirectly attached through intervening components, and is not necessarily limited to physical connections. The connection can be such that the objects are permanently connected or releasably connected. The term “electrically coupled” is defined as being in structural electrical contact, whether directly or indirectly through intervening components, to allow the flow of electrons between the respective elements. The term “outside” refers to a region that is beyond the outermost confines of a physical object. The term “inside” indicates that at least a portion of  
15 a region is partially contained within a boundary formed by the object. The term “substantially” is defined to be essentially conforming to the particular dimension, shape or other word that substantially modifies, such that the component need not be exact. For example, substantially cylindrical means that the object resembles a cylinder, but can have one or more deviations from a true cylinder. The term “about” in relation to quantitative measurements (unless otherwise  
20 stated) includes, but is not limited to, the disclosed measure and measurements about the disclosed measure in terms of its disclosed degree. For example, “about 90” would at least include 80-100, whereas “about 90.0” would at least include 89.0-91.0. The term “comprising”

means “including, but not necessarily limited to”; it specifically indicates open-ended inclusion or membership in a so-described combination, group, series, and the like.

[0028] The present disclosure is described primarily in relation to a vehicle **7** that is a VTOL **70**; however, as indicated, the PPS **2** can be used in any appropriate environment. As shown, it is contemplated for use with other vehicles **7** such as aircraft **71**, watercraft **73**, submarine **72**, and an enclosed transport vehicle **74**, e.g., vactrain and hyperloop.

[0029] FIG. 1 illustrates an embodiment of the VTOL **70**. The VTOL **70** comprises a personnel section **1** and a PPS **2**.

[0030] In some embodiments, the personnel section **1** comprises one or more of the following: a cover **11**, a chair **12**, and flight controls (not shown). In some embodiments, a personnel section **1** is housed in a separate module coupled to and electrically coupled to the PPS **2**. Cockpit noise isolation can be achieved, in part due to the location of the PPS **2**, compared to traditional helicopters, where propellers are overhead, and the engine is next to the passenger. Passive noise reduction techniques such as double-paned glasses and active noise cancellation can also be used. In some embodiments, the personnel section **1** floor could be made of sound-absorbing material to reduce noise during lift-off and landing. The VTOL **70**, with its minimalistic footprint, would be ideal to land in smaller places such as yards, parking lots, flat roofs, etc.

[0031] In some embodiments, the PPS **2** comprises an intake section **21**, an output section **22**, and a propulsion unit **3**. In some embodiments, the propulsion unit **3** comprises a motor **31** and a propulsion member. In some embodiments, the propulsion member comprises an extension **32** and blades **33**. In some embodiments, the propulsion member comprises a motor engagement

section **34** that has a length greater than the extension **32** to increase the engagement of the motor **31** while still decreasing the weight of the extension **32**. In some embodiments, the motor **31** comprises a stator of an electric motor, and the motor engagement section **34** acts as, or is, the external rotor of an electric motor. The blades **33** are configured to draw in and push out fluid  
5 into and out of the PPS **2**. In some embodiments, the propulsion unit **3** comprises an upper section **36** and a lower section **37**. In some embodiments, the motor **31** and the propulsion member are located between the upper section **36** and the lower section **37**. In some embodiments, the personnel section **1** is coupled to the upper section **36**. In some embodiments, the upper section **36** is at least partially coupled to lower section **37** by the intake section **21**  
10 and/or the output section **22**. In some embodiments, the upper section **36** and/or the lower section **37** have outer walls that are substantially or fully solid such that fluid flow primarily or fully flows through the openings at the top and bottom thereof.

[0032] In some embodiments, the blades **33** rotate about or outside the periphery of the personnel section **1**. It is believed that having the PPS **2** below and the blades **33** and fluid flow  
15 outside the periphery enhances aerodynamic and/or rideability effects because the active air thrust is out along the periphery.

[0033] In some embodiments, the motor **31** is coupled to or an integral part of the lower section **37** and acts to support or partially support the upper section **36**. In some embodiments, the motor **31** comprises an electric motor, an internal combustion motor, or a combination  
20 thereof.

[0034] FIG. 2A illustrates an embodiment of the motor **31** and the motor engagement section **34**. In some embodiments, there is an air gap **314** between the motor **31** and the motor

engagement section **34**. In some embodiments, the air gap **314** is consistent about the motor **31**. In some embodiments, the motor engagement section **34** rotates about the motor **31**. In some embodiments, there is a bearing **35** located between one or both (upper and lower bearing), the motor engagement section **34** and the upper section **36**, and the motor engagement section **34** and the lower section **37**. In some embodiments, the one or more of the bearings **35** comprises balls **351**.

[0035] The diameter **315** of the motor engagement section **34** can be set to achieve optimum performance. In some embodiments, too small a diameter would have difficulty supporting the weight of the upper section **36** and the personnel section **1** during the flight, while too large a diameter would create impractically ultra-fast spinning ball bearings, causing severe friction loss and destruction. Currently, there is no ball-bearing technology to operate on the periphery of the propulsion unit **3**, at the required speeds, in the weight and the size suitable for a VTOL **70** able to carry a passenger. In contrast, in some embodiments of the current design, by using the extension **32**, the bearing **35** can reduce its required speed and lessen friction. In some embodiments, the diameter **315** of the motor engagement section **34** is about 50 cm and in some embodiments the diameter **315** is less than 50 cm. In some embodiments, the balls **351** can be roll-bearings, which, in some embodiments, can provide better lift handling.

[0036] In some embodiments, the motor **31** comprises stator of an electric motor, and the motor engagement section **34** is the external rotor of the electric motor. In some embodiments, the balls **351** are located on both ends of the motor engagement section **34**, and the air gap **314** is well-defined and constant to create the required stator-rotor separation. The direct engagement of the balls **351** with the motor engagement section **34** and when the motor engagement section **34**

is the external rotor of the electric motor can allow for efficiencies that allow for better power consumption. Designs of the prior art may use traditional ball bearings to secure the rotor to a motor shaft and use thrust bearings to couple the shaft to the body. In some embodiments, given that there is no need for traditional ball bearings, the weight and/or friction is reduced, resulting in greater efficiency.

[0037] FIG. 2B illustrates an embodiment of the motor **31** and the motor engagement section **34**. In some embodiments, the motor engagement section **34** defines one or more ball grooves **341**. In some embodiments, the ball grooves **341** comprise of an upper ball groove **3410** and the lower ball groove **3411**. In some embodiments, the upper section **36** defines an upper section groove **361** and the balls **351** at least partially reside inside the spaces defined by the upper ball groove **3410** and the upper section groove **361**. In some embodiments, the lower section **37** defines a lower section groove **371** and the balls **351** at least partially reside inside the spaces defined by the lower ball groove **3411** and the lower section groove **371**. The bearings **35** allow for low friction movement between motor engagement section **34** and the upper section **36** and/or the lower section **37**. Also in some embodiments, the motor engagement section **34**, and the extension **32**, the blades **33**, or a combination thereof can be integral.

[0038] FIG. 2C illustrates an embodiment of the PPS **2** comprising a motor **31** located in the lower section **37**. In some embodiments, the motor engagement section **34** extends from the motor **31**, is coupled to or integral with the extension **32**, and the extension **32** is coupled to or integral with the blades **33**. In some embodiments, the motor **31** is a stator and the motor engagement section **34** is a rotor. While it is shown in FIG. 1B that the motor **31** is located in the lower section **37**, it is to be understood that the orientation can be flipped such that the motor **31**

is located in the upper section **36** and the motor engagement section **34** extends down from the motor **31**.

[0039] FIG. 3A illustrates an embodiment of the output section **22**. In some embodiments, the output section **22** acts to provide for the reduction of torque or torque-free operation of the propulsion unit **3**. In some embodiments, the output section **22** comprises a flow guide **24**. In some embodiments, the flow guide **24** comprises one or more output vanes **241**. In some embodiments, the output vanes **241** define internally curved surfaces that absorb the rotational momentum of the exiting air created by blades **33** and directs the fluid straight out of the output section **22**. This effectively cancels the exiting fluid torque and produces a uniform outward thrust. In some embodiments, the angle, curvature, thickness of the blades **33**, or a combination thereof can be changed. In some embodiments, the output vanes **241** extend the majority of the, if not the entire, length of the flow guide **24**.

[0040] In some embodiments, the output section **22** comprises three or more output throttles **25**. In some embodiments, the one or more of the throttle vanes **242** comprise output vane vectoring elements **2410**, or also called throttle vane vectoring elements. In some embodiments, the output vanes **241** comprise throttle vanes **242** that have an output throttle **25** controlling the flow of fluid therebetween. In some embodiments, the output vanes **241** comprise an output vane vectoring elements **2410** configured to at least partially direct fluid flow out the output section **22**.

[0041] In some embodiments, the extension **32** comprises a spoke configuration comprising two or more arms extending from the motor engagement section **34** with a blade **33** on the end. The motor engagement section **34** will rotate, which will cause the blades **33** to move

and force fluid into the output section **22** and through the output vanes **241**, output throttles **25**, and/or the throttle vanes **242**. In some embodiments, output throttles **25** extend, horizontally, in and out from the lower section **37** to adjust air flow. In some embodiments, the output throttles **25** are located below the throttle vanes **242** and/or are configured to extend in and out from the lower section **37**.

[0042] In some embodiments, due to the peripheral structure of the PPS **2**, the blade angle **332** of the blades **33** can stay constant and does not change radially, so the resultant downward flow is vortex-free and uniform, allowing better torque cancellation. In some embodiments, the blades **33** are able to rotate according to need, and one or all the vanes, as a set or individually, are able to rotate in order to increase torque cancelation. Further, the output vanes **241** need to be of sufficient length to be effective and provide a smooth downward fluid flow transition. In some embodiments, the curvature and/or the combination of the length and the curvature of the output vanes **241** are arranged such that no fluid could travel straight through the output section **22** without altering its path. In some embodiments, one would not be able to see straight through the output section **22** due to the shape and location of the output vanes **241**.

[0043] FIG. 3B illustrates an embodiment of the output section **22** comprising output section vectoring elements **221**. It is to be understood, that the output section vectoring elements **221** may line up with the output vanes **241** or be offset therefrom. The number and location of the output section vectoring elements **221** is not limited. In use the output section vectoring elements **221** can work independently, all together, or in different groups. In some embodiments, output throttle **25** resides in a different vane than output section vectoring element **221**. Output vane vectoring element **2410** achieves the same task as output vane vectoring element **2410**. In

some embodiments, there will be both output section vectoring elements **221** and output vane vectoring elements **2410**, and in some embodiments, the output section vectoring elements **221** and the output vane vectoring elements **2410** can be aligned with the same output vane **241**. In some embodiments, there are output section vectoring elements **221**, output vane vectoring elements **2410**, intake vane vectoring elements, blade vectoring elements **331**, or a combination thereof.

[0044] FIG. 3C illustrates an embodiment of the output vanes **241** define a trailing distance **2411**. In some embodiments, the trailing distance **2411** is defined by the distance between the trailing input edge **2413** and the trailing output edge **2414** of an output vane **241**. In some embodiments, the trailing distance is greater than or equal to the distance between the trailing input edge **2413** and the leading input edge **2415** of an adjacent output vane **241**. In some embodiments, the trailing distance **2411** and the location of the leading input edge **2415** of an adjacent output vane **241** are situated such that there is no way for fluid to flow straight through the output section **22**. The fluid will have to alter its course to some degree as it flows through the output vanes **241**. There is a trailing edge tangent **24140** that is the tangent of the trailing output edge **2414**, and in some embodiments, the trailing edge tangent **24140** is set to, or about, 90 degrees in relation to the output plane. There is also a trailing input edge tangent **24130** that is the tangent of the trailing input edge **2413**, and in some embodiments, the trailing input edge tangent **24130** is set to, or about, 45 degrees in relation to the intake plane. In some embodiments, the output vanes **241** defines a shape where the output vane **241** near the entry is thicker than it is at the output. In some embodiments, the output vanes **241** are substantially a curved tear-drop shape. In some embodiments, the total height of the output vane **241** is, or

about, two times the effective length **2416** of the output vanes **241**. In some embodiments, the ability of the output throttle **25** to limit flow between the throttle vanes **242** can be set as desired. As can be seen in FIG. 3B, in some embodiments, the output throttle **25**, when extended, only covers a portion of the entry. In some embodiments, the output throttle **25** covers a majority, if  
5 not all of the entry when fully extended (e.g., anything between 50% to 100%).

[0045] As indicated below, in some embodiments the intake vanes **231** are a reflection, or substantially a reflection of, the output vanes **241**. In some embodiments, the intake vanes **231** comprise an intake trailing input edge and an intake trailing output edge. The intake trailing input edge defines an intake trailing input edge tangent, and the intake trailing output edge defines an  
10 intake trailing output edge tangent. Each intake vane **231** defines an effective length. In some embodiments the intake trailing input edge tangent is about 90 degrees, the intake trailing output edge tangent is about 45 degrees, or a combination thereof. In some embodiments, each intake vane **231** comprises a leading input edge; and a distance between trailing input edge and the leading input edge of an adjacent output vane is less than or equal to the effective length.

15 [0046] FIG. 3D illustrates a representation of an embodiment of the propulsion unit **3**. In some embodiments, the blades **33** are set at a blade angle **332** in relation to extension **32**. In some embodiments, the blades **33** will encounter the substantially linear fluid flow at the blade angle **332**. In some embodiments, the blade angle **332** is set to 45 degrees, and the blades **33** will encounter the substantially linear fluid flow at a 45-degree angle. In some embodiments, the  
20 blades **33** are planar; in other embodiments, the blades **33** have a non-planar shape. In some embodiments, the blades **33** are all the same shape; however, in other embodiments, all blades **33** do not have the same shape.

[0047] FIG. 3E illustrates an embodiment of the propulsion unit **3**. In some embodiments, the extension **32** comprises a disk that extends from the motor engagement section **34** to the blades **33**. In some embodiments, the one or more blades **33** comprise one or more blade vectoring elements **331** that can change the angle of the leading edge or the trailing edge of the blade **33**.

[0048] One of the benefits of electrical motors is the low-end torque they can exert, while one of the drawbacks of those same electrical motors is the energy required for high-end speed. Thus, one advantage of the extension **32** and the blades **33**, located a distance away from the motor **31**, allows the propulsion unit **3** to utilize the advantages of a motor **31** that is electric. The distance away from the motor **31** will increase the speed of the blades **33** in relation to the motor **31**, and it will increase the torque required to move the motor engagement section **34**. Thus, it uses the extension **32** as a means to employ the torque as a means to increase speed. The extension **32** exploits the ability of an electric motor to exert a large amount of torque at lower speeds. Also, as stated above, the location of the bearing **35**, being so close to the center, allows for slower rotation of the balls **351**.

[0049] FIG. 4A illustrates an embodiment of the PPS **2** comprising an intake section **21** and an output section **22** that are coupled together. In some embodiments, the intake section **21** and the output section **22** share parts, are integral, separate from each other, coupled together and/or electrically coupled. In some embodiments, the intake section **21** comprises intake vanes **231**. In some embodiments, the intake vanes **231** are very similar to the output vanes **241**. In some embodiments, the intake vanes **231** are situated such that there is no way for fluid to flow straight through the intake section **21**. The fluid will have to alter its course to some degree as it

flows through the intake vanes **231**. There is an intake input edge tangent, and in some embodiments, the intake input edge tangent is set to, or about, 90 degrees relative to the exit plane. There is also an intake trailing edge tangent, and in some embodiments, the intake trailing edge tangent is set to, or about, 45 degrees relative to the intake plane. In some embodiments, the intake vanes **231** define a shape where the intake vane **231** near the entry is thicker than at the output. In some embodiments, the intake vanes **231** define a substantially curved tear-drop shape cross-section.

[0050] In some embodiments, the intake vanes **231** and the output vanes **241** are a reflection of each other, as if they were flipped 180 degrees. In some embodiments, as can be seen, when the fluid exits the intake vanes **231**, the fluid is directed in a direction, at least partially, that the blades **33** rotate. Further, the output vanes **241** are angled in a direction, at least partially, opposite to the blades **33** rotate. It is believed that the shape and angle of the output vanes **241** and or the intake vanes **231** will help reduce or cancel the torque created by the rotation of the blades **33**.

[0051] In some embodiments, as the propulsion unit **3** operates, fluid is drawn in through the intake section **21** and out the output section **22** by the blades **33**. In some embodiments, the fluid will be drawn through the intake vanes **231**, out the output vanes **241**, or both. In some embodiments, the fluid will be directed from a perpendicular flow, entering the intake section **21**, to a relative angled flow, exiting the intake section **21**; an angled flow, entering the output section **22**, to a perpendicular flow, exiting the output section **22**; or both as shown in FIG. 4B.

[0052] In some embodiments, the intake vanes **231**, the output vanes **241**, the blades **33**, or a combination thereof, are able to rotate to the desired angle.

[0053] Some embodiments comprise an enhanced torque cancellation. As shown in Fig.

4A, the intake section **21** and the output section **22**, through the intake vanes **231** and output

vanes **241**, which act to straighten both intake and exit fluid flow. While output vanes **241** cancel

exiting air circulation, intake vanes **231** prevent incoming air circulation. In combination or

5 separately, the intake section **21** and the output section **22** act to reduce or cancel the total air

torque and can produce a uniform outward thrust. The use of the intake vanes **231** and output

vanes **241** can help achieve true torque cancellation. The use of the intake vanes **231**, as opposed

to just the use of the output vanes **241**, may increase the torque cancellation. Stronger incoming

air circulation can occur if only the output vanes **241** are used, reducing the torque cancellation

10 of the PPS **2**. In some embodiments, the intake vanes **231** and output vanes **241**, while in a

different orientation, are of the differing or same size and/or shape. In some embodiments, one or

more of the intake vanes **231**, one or more of the output vanes **241**, or a combination thereof are

of a differing shape or size from the other intake vanes **231** and/or output vanes **241**. In some

embodiments, additional set, or sets, of vanes are located in the intake section **21**, output section

15 **22**, or a combination thereof.

[0054] It is believed that the proper cancelation of torque of the PPS **2** would improve

efficiency considerably. It is well-known that about 30% of power is lost in the booms of

traditional helicopters. Similar losses are expected in modern multi-copter, although their

opposing rotating propellers cancel each other's torque. However, power loss occurs in the

20 opposing airflow rotations.

[0055] A further benefit of torque cancellation is less acoustic noise. Energy loss in

circulating air contributes much to audible noise, so the non-circulating fluid flow in this would

generate less noise. In some embodiments, the PPS **2** will comprise sound-absorbing materials designed to absorb and dissipate sound power at the frequencies of generated noise. Furthermore, the intake section **21**, the output section **22**, the intake cover **210**, or a combination thereof, reduce lateral noise emissions.

5 [0056] In some embodiments of the VTOL **70**, the loudest noise is generated during lift-off and landing, and the torque cancelation and/or the sound-absorbing materials will reduce the peak noise level in the vicinity of the VTOL's **70** takeoff and landing sites. These noise reduction benefits can be significant for acoustic comfort, and regulatory requirements that VTOL **70** should not generate more than certain noise levels in residential areas. These materials  
10 can also be used in different embodiments, parts, and locations of the PPS **2**.

[0057] Some embodiments of the PPS **2** use dual peripheral anti-rotating propulsion units  
**3**.

[0058] In some embodiments, the PPS **2** comprises a mechanism such as a swash plate used in traditional helicopters to enable propeller pitch control to vary lift force.

15 [0059] In some embodiments of the VTOL **70**, a payload module is mounted to the PPS **2**. In some embodiments where the payload is located below the PPS **2** and sized such that the payload module has a smaller diameter than the extension **32**, the payload will not block the fluid flow from the PPS **2**.

[0060] In some embodiments, the VTOL **70** comprises a parachute. In some embodiments,  
20 the parachute is coupled to the personnel section **1**. In some embodiments, the personnel section **1** is detachable from the remainder of the VTOL **70**, reducing weight and allowing for more support from a parachute if deployed. One advantage that the VTOL **70** has, by having the PPS **2**

located below the personnel section **1**, the parachute is free from possible interference by the propulsion unit **3**. In other designs, a deployed parachute may interact with propellers above the personnel compartment.

[0061] FIG. 5 illustrates an embodiment comprising four output throttles **25**. The output

5 throttles **25** work in conjunction to limit the fluid flow out of the output section **22** in certain areas to allow for directional control. In some embodiments, there are three output throttles **25**; in some, there are four or more.

[0062] In some embodiments, the propulsion control or assistance thereof is done by the output throttles **25**. In some embodiments, the output throttles **25** will control the direction or

10 assist in directing the vehicle (e.g., VTOL **70**, aircraft **71**, submarine **72**, watercraft **73**). The three or more output throttles **25** allow for two-dimensional directional control and stabilization.

In some embodiments, the output vane vectoring elements **2410**, are only coupled to one or more the throttle vanes **242**, which can provide further control of direction, rotation, and/or torque cancellation. Having control in an x-y axis allows full two-dimensional operation. In some

15 embodiments, output throttles **25**, or the outputs thereof, are positioned at the periphery of the PPS **2**, and away from its center of gravity. In some embodiments, the output throttles **25**, and their positioning can provide the ability to maintain stability during lift-up, flight, and landing of the VTOL **70**. It is understood that one or more of the output vanes **241** can comprise output

vane vectoring elements **2410**. It is understood that all the vectoring elements (e.g., output vane

20 vectoring elements **2410**, blade vectoring elements **331**, etc.) can act in unison, in different groups, or independently.

[0063] FIG. 6A illustrates an embodiment of an intake cover **210**. In some embodiments, the intake cover **210** will be located above the intake section **21**. In some embodiments, the intake cover **210** comprises an intake cover grille **2101**. In some embodiments, the intake cover grille **2101** will prevent items of varying sizes from entering the intake section **21**, and the

5 effective opening sizes can be varied as desired. In some embodiments, the intake cover **2010** comprises intake grille vanes **2102**. In some embodiments, the intake grille vanes **2102** are configured to straighten the fluid flow entering the intake section **21**. In some embodiments, the tear-drop shape will reduce fluid flow resistance and reduce turbulent flow generation by the fluid flowing through the intake grille vanes **2102**, reducing noise and/or increasing efficacy. In  
10 some embodiments, the intake grille vanes **2102** define a tear-drop shape cross-section. In some embodiments, the intake grille vanes **2102** will straighten the fluid flow while preventing items of a certain size from entering the intake section **21**. In some embodiments, the PPS **2** comprises two intake covers **210** located on either side of the PPS **2**. In some embodiments, the intake grille vanes **2102** can rotate to any desired angle.

15 [0064] FIG. 7A illustrates an embodiment of the VTOL **70** in use. After initial lift-up and levitation in the air, the whole VTOL **70** could tilt forward to allow horizontal forward flight. This way, air thrust would support the weight of the VTOL **70** and provide the forward propulsion force.

[0065] FIG. 7B illustrates an embodiment of the VTOL **70** in use and having a chair **12**  
20 that will allow the user to remain vertical or substantially vertical during flight. In some embodiments, the user will be able to fix the chair **12** or allow for gyroscopic movement and maintain position in relation to the horizon. This could give a better travel experience and a

better view of the surroundings. Any front display or console could also follow the passenger's gyroscopic movement as well. In some embodiments, the amount of movement can be limited to allow for user feedback as to the flight of the VTOL 70.

[0066] FIG. 8A, 8B, and 8C illustrate one or more PPS 2 used to propel an aircraft 71. The PPS 2 can be located about the center of the aircraft 71, between the wing and the tail, and/or on the tail. In some embodiments, the PPS 2 is tapered. In some embodiments, the PPS 2 can be tapered to better allow for takeoff and landing. In some embodiments, the PPS 2 would divide the cabin into two sections.

[0067] FIG. 8D illustrates a submarine 72 comprising a PPS 2.

[0068] FIG. 8E illustrates a watercraft 73 comprising a PPS 2.

[0069] FIG. 8F illustrates an enclosed transport vehicle 74 comprising a PPS 2. In some embodiments, the enclosed transport vehicle 74 is a vactrain. In some embodiments, wheels, rails, or a magnetic levitation/drive could be used. The movement could be bidirectional, and only the direction of rotation of the motor 31 needs to be reversed and/or the angle of the blades 33. In some embodiments, the blades 33, the intake vanes 231, the output vanes 241, the intake grille vanes 2102, or a combination thereof can also be rotated as desired and/or for a reverse operation. In some embodiments, the PPS 2 comprises two intake covers 210 located on both sides of the PPS 2.

[0070] In some embodiments, the VLOT 70 is a remote vehicle, comprises a camera, a self-guidance system, a package delivery system, or a combination thereof. It is understood that in some embodiments, the VTOL 70 is a remote delivery vehicle configured to transport packages from one location to another.

[0071] The embodiments shown and described above are only examples. Even though numerous characteristics and advantages of the present technology have been set forth in the foregoing description, together with details of the structure and function of the present disclosure, the disclosure is illustrative only, and changes may be made in the detail, including in  
5 matters of shape, size and arrangement of the parts within the principles of the present disclosure up to, and including, the full extent established by the broad general meaning of the terms used in the claims.

[0072] It should also be noted that elements of embodiments may be described in reference to the description of a particular embodiment; however, it is disclosed that elements of disclosed  
10 embodiments can be switched with corresponding elements of embodiments with the same name and/or number of other disclosed embodiments.

[0073] Depending on the embodiment, certain steps of methods described may be removed, others may be added, and the sequence of steps may be altered. It is also to be understood that the description and the claims drawn to a method may include some indication in  
15 reference to certain steps. However, the indication used is only to be viewed for identification purposes and not as a suggestion as to an order for the steps.

## CLAIMS

What is claimed is:

1. An apparatus comprising:

a vehicle; and

a peripheral propulsion system coupled to the vehicle, wherein the peripheral propulsion system comprises:

a propulsion unit, wherein the propulsion unit comprises:

a motor;

a motor engagement section;

an extension coupled to the motor engagement section; and

two or more blades coupled to the extension;

an upper section and a lower section, wherein the extension is located between the upper section and the lower section; and

an output section located about at least a portion of the lower section;

wherein the two or more blades are located outside a periphery of the vehicle; and when the motor is running, the two or more blades are capable of drawing fluid from about the periphery of the vehicle and through the output section.

2. The apparatus of claim 1, wherein the propulsion unit further comprises an intake section located about at least a portion of the upper section; and the two or more blades are capable of drawing fluid from about the periphery of the vehicle, into the intake section, and out the output section.

3. The apparatus of claim 2, wherein the peripheral propulsion system is configured to direct fluid to substantially perpendicular flow after entering the intake section, to a relative angled flow as exiting the intake section; and an angled flow after entering the output section to perpendicular flow as exiting the output section.
4. The apparatus of claim 3, wherein the relative angled flow as exiting the intake section is angled in a direction of the one or more blades rotation.
5. The apparatus of claim 2, wherein the intake section comprises intake vanes.
6. The apparatus of claim 5, wherein each intake vane comprises an intake trailing input edge and an intake trailing output edge; the intake trailing input edge defines an intake trailing input edge tangent, and the intake trailing output edge defines an intake trailing output edge tangent; and each intake vane defines an effective length.
7. The apparatus of claim 6, wherein the intake trailing input edge tangent is about 90 degrees, the intake trailing output edge tangent is about 45 degrees, or a combination thereof.
8. The apparatus of claim 6, wherein each intake vane further comprises a leading input edge; and a distance between trailing input edge and the leading input edge of an adjacent output vane is less than or equal to the effective length.
9. The apparatus of claim 1, wherein the output section comprises output vanes.
10. The apparatus of claim 9, wherein the propulsion unit further comprises an intake section that comprises intake vanes, the intake vanes and the output vanes, and the intake vanes are a reflection of the output vanes.
11. The apparatus of claim 9, wherein one or more of the output vanes comprises an output vane vectoring element.

12. The apparatus of claim 9, wherein one or more of the output vanes comprise an output vane vectoring element located on a leading edge of the output vane, a trailing edge of the output vane, or a combination thereof.

13. The apparatus of claim 9, wherein each output vane comprises a trailing input edge and a trailing output edge; the trailing input edge defines a trailing input edge tangent and the trailing output edge defines a trailing output edge tangent; and each output vane defines an effective length.

14. The apparatus of claim 13, wherein the trailing input edge tangent is about 45 degrees, the trailing output edge tangent is about 90 degrees, or a combination thereof.

15. The apparatus of claim 13, wherein each vane further comprises a leading input edge; and a distance between trailing input edge and the leading input edge of an adjacent output vane is less than or equal to the effective length.

16. The apparatus of claim 1, wherein the output section comprises three or more output throttles; and each output throttle is configured to selectively limit fluid flow between two throttle vanes.

17. The apparatus of claim 16, wherein at least one of the two throttle vanes comprises a throttle vane vectoring element.

18. The apparatus of claim 16, wherein each output throttle is capable of restricting about one hundred percent of fluid flow between the two throttle vanes.

19. The apparatus of claim 1, wherein the output section comprises three or more throttling vane vectoring elements.

20. The apparatus of claim 1, wherein the extension comprises a disk, and the two or more blades are coupled to the periphery of the disk.
21. The apparatus of claim 1, wherein the extension comprises two or more spokes, and each spoke has at least one of the two or more blades coupled to an end thereof.
22. The apparatus of claim 1, wherein the motor is a stator of an electric motor, and the motor engagement section is its external rotor.
23. The apparatus of claim 22, wherein the motor engagement section and the motor define a air gap.
24. The apparatus of claim 1, wherein the motor engagement section is integral with the extension.
25. The apparatus of claim 1, the motor is located between the upper section and the lower section.
26. The apparatus of claim 1, further comprising an upper bearing located between the upper section and the motor engagement section, and a lower bearing located between the lower section and the motor engagement section.
27. The apparatus of claim 26, wherein the upper bearing bears some or all of the weight of the upper section.
28. The apparatus of claim 26, wherein the upper bearing and the lower bearing comprises of balls.
29. The apparatus of claim 28, the motor engagement section defines an upper ball groove and a lower ball groove, the upper section defines an upper section groove, the lower section defines a

lower section groove; and the balls reside within a space created between the upper ball groove and the upper section groove and the lower ball groove and the lower section groove.

30. The apparatus of claim 1, wherein the motor is located in the upper section or the lower section, the motor engagement section extends from the motor.

31. The apparatus of claim 1, wherein one or more of the two or more blades comprise blade vectoring elements.

32. The apparatus of claim 1, wherein the output section comprises output section vectoring elements.

33. The apparatus of claim 1, wherein the vehicle is selected from a group consisting of a vertical takeoff and landing vehicle, a fixed-winged aircraft, a watercraft, a submersible watercraft, and a vactrain.

34. The apparatus of claim 1, wherein the two or more blades, the extension, and the motor engagement section are integral.

35. The apparatus of claim 1, wherein the motor is an electric motor.

36. An apparatus comprising:

a vehicle; and

a peripheral propulsion system coupled to the vehicle, wherein the peripheral propulsion system comprises:

a propulsion unit, wherein the propulsion unit comprises:

a motor;

a motor engagement section;

an extension coupled to the motor engagement section; and

two or more blades coupled to the extension; and

an upper section and a lower section, wherein the extension is located between the upper section and the lower section;

wherein the extension is sized such that the two or more blades are located outside a periphery of the vehicle.

37. The apparatus of claim 36, wherein the propulsion unit further comprises an output section located about at least a portion of the lower section, and an intake section located about at least a portion of the upper section; and the two or more blades are capable of drawing fluid from about the periphery of the vehicle, into the intake section, and out the output section.

38. The apparatus of claim 37, wherein the peripheral propulsion system is configured to direct fluid to substantially perpendicular flow after entering the intake section, to a relative angled flow as exiting the intake section; and an angled flow after entering the output section to perpendicular flow as exiting the output section.

39. The apparatus of claim 38, wherein the relative angled flow as exiting the intake section is angled in a direction of the one or more blades rotation.

40. The apparatus of claim 37, wherein the intake section comprises intake vanes.

41. The apparatus of claim 40, wherein each intake vane comprises an intake trailing input edge and an intake trailing output edge; the intake trailing input edge defines an intake trailing input edge tangent, and the intake trailing output edge defines an intake trailing output edge tangent; and each intake vane defines an effective length.

42. The apparatus of claim 41, wherein the intake trailing input edge tangent is about 90 degrees, the intake trailing output edge tangent is about 45 degrees, or a combination thereof.

43. The apparatus of claim 41, wherein each vane further comprises a leading input edge; and a distance between trailing input edge and the leading input edge of an adjacent output vane is less than or equal to the effective length.

44. The apparatus of claim 36, wherein the propulsion unit further comprises an output section located about at least a portion of the lower section, and the output section comprises output vanes.

45. The apparatus of claim 44, wherein the propulsion unit further comprises an intake section that comprises intake vanes, the intake vanes and the output vanes, and the intake vanes are a reflection of the output vanes.

46. The apparatus of claim 44, wherein one or more of the output vanes comprises an output vane vectoring element.

47. The apparatus of claim 44, wherein one or more of the output vanes comprise an output vane vectoring element located on a leading edge of the output vane, a trailing edge of the output vane, or a combination thereof.

48. The apparatus of claim 44, wherein each output vane comprises a trailing input edge and a trailing output edge; the trailing input edge defines a trailing input edge tangent and the trailing output edge defines a trailing output edge tangent; and each output vane defines an effective length.

49. The apparatus of claim 48, wherein the trailing input edge tangent is about 45 degrees, the trailing output edge tangent is about 90 degrees, or a combination thereof.

50. The apparatus of claim 48, wherein each vane further comprises a leading input edge; and a distance between trailing input edge and the leading input edge of an adjacent output vane is less than or equal to the effective length.

51. The apparatus of claim 36, wherein the propulsion unit further comprises an output section located about at least a portion of the lower section, and the output section comprises three or more output throttles; and each output throttle is configured to selectively limit fluid flow between two throttle vanes.

52. The apparatus of claim 51, wherein at least one of the two throttle vanes comprises a throttle vane vectoring element.

53. The apparatus of claim 51, wherein each output throttle is capable of restricting about one hundred percent of fluid flow between the two throttle vanes.

54. The apparatus of claim 36, wherein the propulsion unit further comprises an output section located about at least a portion of the lower section, and the output section comprises three or more throttling vane vectoring elements.

55. The apparatus of claim 36, wherein the extension comprises a disk, and the two or more blades are coupled to the periphery of the disk.

56. The apparatus of claim 36, wherein the extension comprises two or more spokes, and each spoke has at least one of the two or more blades coupled to an end thereof.

57. The apparatus of claim 36, wherein the motor is a stator of an electric motor, and the motor engagement section is its external rotor.

58. The apparatus of claim 57, wherein the motor engagement section and the motor define a air gap.

59. The apparatus of claim 36, wherein the motor engagement section is integral with the extension.

60. The apparatus of claim 36, the motor is located between the upper section and the lower section.

61. The apparatus of claim 36, further comprising an upper bearing located between the upper section and the motor engagement section, and a lower bearing located between the lower section and the motor engagement section.

62. The apparatus of claim 61, wherein the upper bearing bears some or all of the weight of the upper section.

63. The apparatus of claim 61, wherein the upper bearing and the lower bearing comprises of balls.

64. The apparatus of claim 63, the motor engagement section defines an upper ball groove and a lower ball groove, the upper section defines an upper section groove, the lower section defines a lower section groove; and the balls reside within a space created between the upper ball groove and the upper section groove and the lower ball groove and the lower section groove.

65. The apparatus of claim 36, wherein the motor is located in the upper section or the lower section, the motor engagement section extends from the motor.

66. The apparatus of claim 36, wherein one or more of the two or more blades comprise blade vectoring elements.

67. The apparatus of claim 36, wherein the propulsion unit further comprises an output section located about at least a portion of the lower section, and the output section comprises output section vectoring elements.

68. The apparatus of claim 36, wherein the vehicle is selected from a group consisting of a vertical takeoff and landing vehicle, a fixed-winged aircraft, a watercraft, a submersible watercraft, and a vactrain.

69. The apparatus of claim 36, wherein the two or more blades, the extension, and the motor engagement section are integral.

70. The apparatus of claim 36, wherein the motor is an electric motor.

71. An apparatus comprising:

- a vehicle; and

- a peripheral propulsion system coupled to the vehicle, wherein the peripheral propulsion system comprises:

- a propulsion unit, wherein the propulsion unit comprises:

- a motor;

- a motor engagement section;

- an extension coupled to the motor engagement section; and

- two or more blades coupled to the extension; and

- an upper section and a lower section, wherein the extension is located between the upper section and the lower section;

- wherein the two or more blades are capable of drawing fluid from about a periphery of the vehicle and pushing fluid out about the periphery of the vehicle.

72. The apparatus of claim 71, wherein the propulsion unit further comprises an output section located about at least a portion of the lower section, and an intake section located about at least a

portion of the upper section; and the two or more blades are capable of drawing fluid from about the periphery of the vehicle, into the intake section, and out the output section.

73. The apparatus of claim 72, wherein the propulsion unit is configured to direct fluid to substantially perpendicular flow after entering the intake section, to a relative angled flow as exiting the intake section; and an angled flow after entering the output section to perpendicular flow as exiting the output section.

74. The apparatus of claim 73, wherein the relative angled flow as exiting the intake section is angled in a direction of the one or more blades rotation.

75. The apparatus of claim 72, wherein the intake section comprises intake vanes.

76. The apparatus of claim 75, wherein each intake vane comprises an intake trailing input edge and an intake trailing output edge; the intake trailing input edge defines an intake trailing input edge tangent, and the intake trailing output edge defines an intake trailing output edge tangent; and each intake vane defines an effective length.

77. The apparatus of claim 76, wherein the intake trailing input edge tangent is about 90 degrees, the intake trailing output edge tangent is about 45 degrees, or a combination thereof.

78. The apparatus of claim 76, wherein each vane further comprises a leading input edge; and a distance between trailing input edge and the leading input edge of an adjacent output vane is less than or equal to the effective length.

79. The apparatus of claim 71, wherein the propulsion unit further comprises an output section located about at least a portion of the lower section, and the output section comprises output vanes.

80. The apparatus of claim 79, wherein the propulsion unit further comprises an intake section that comprises intake vanes, the intake vanes and the output vanes, and the intake vanes are a reflection of the output vanes.

81. The apparatus of claim 79, wherein one or more of the output vanes comprises an output vane vectoring element.

82. The apparatus of claim 79, wherein one or more of the output vanes comprise an output vane vectoring element located on a leading edge of the output vane, a trailing edge of the output vane, or a combination thereof.

83. The apparatus of claim 79, wherein each output vane comprises a trailing input edge and a trailing output edge; the trailing input edge defines a trailing input edge tangent and the trailing output edge defines an trailing output edge tangent; and each output vane defines an effective length.

84. The apparatus of claim 83, wherein the trailing input edge tangent is about 45 degrees, the trailing output edge tangent is about 90 degrees, or a combination thereof.

85. The apparatus of claim 83, wherein each vane further comprises a leading input edge; and a distance between trailing input edge and the leading input edge of an adjacent output vane is less than or equal to the effective length.

86. The apparatus of claim 71, wherein the propulsion unit further comprises an output section located about at least a portion of the lower section, and the output section comprises three or more output throttles; and each output throttle is configured to selectively limit fluid flow between two throttle vanes.

87. The apparatus of claim 86, wherein at least one of the two throttle vanes comprises a throttle vane vectoring element.

88. The apparatus of claim 86, wherein each output throttle is capable of restricting about one hundred percent of fluid flow between the two throttle vanes.

89. The apparatus of claim 71, wherein the propulsion unit further comprises an output section located about at least a portion of the lower section, and the output section comprises three or more throttling vane vectoring elements.

90. The apparatus of claim 71, wherein the extension comprises a disk, and the two or more blades are coupled to the periphery of the disk.

91. The apparatus of claim 71, wherein the extension comprises two or more spokes, and each spoke has at least one of the two or more blades coupled to an end thereof.

92. The apparatus of claim 71, wherein the motor is a stator of an electric motor, and the motor engagement section is its external rotor.

93. The apparatus of claim 92, wherein the motor engagement section and the motor define a air gap.

94. The apparatus of claim 71, wherein the motor engagement section is integral with the extension.

95. The apparatus of claim 71, the motor is located between the upper section and the lower section.

96. The apparatus of claim 71, further comprising an upper bearing located between the upper section and the motor engagement section, and a lower bearing located between the lower section and the motor engagement section.

97. The apparatus of claim 96, wherein the upper bearing bears some or all of the weight of the upper section.

98. The apparatus of claim 96, wherein the upper bearing and the lower bearing comprises of balls.

99. The apparatus of claim 98, the motor engagement section defines an upper ball groove and a lower ball groove, the upper section defines an upper section groove, the lower section defines a lower section groove; and the balls reside within a space created between the upper ball groove and the upper section groove and the lower ball groove and the lower section groove.

100. The apparatus of claim 71, wherein the motor is located in the upper section or the lower section, the motor engagement section extends from the motor.

101. The apparatus of claim 71, wherein one or more of the two or more blades comprise blade vectoring elements.

102. The apparatus of claim 71, wherein the propulsion unit further comprises an output section located about at least a portion of the lower section, and the output section comprises output section vectoring elements.

103. The apparatus of claim 71, wherein the vehicle is selected from a group consisting of a vertical takeoff and landing vehicle, a fixed-winged aircraft, a watercraft, a submersible watercraft, and a vactrain.

104. The apparatus of claim 71, wherein the two or more blades, the extension, and the motor engagement section are integral.

105. The apparatus of claim 71, wherein the motor is an electric motor.

106. The apparatus of claim 1, further comprising a parachute attached above the propulsion unit.

107. The apparatus of claim 1, further comprising a parachute attached to the vehicle.

108. The apparatus of claim 36, further comprising a parachute attached above the propulsion unit.

109. The apparatus of claim 36, further comprising a parachute attached to the vehicle.

110. The apparatus of claim 71, further comprising a parachute attached above the propulsion unit.

111. The apparatus of claim 71, further comprising a parachute attached to the vehicle.

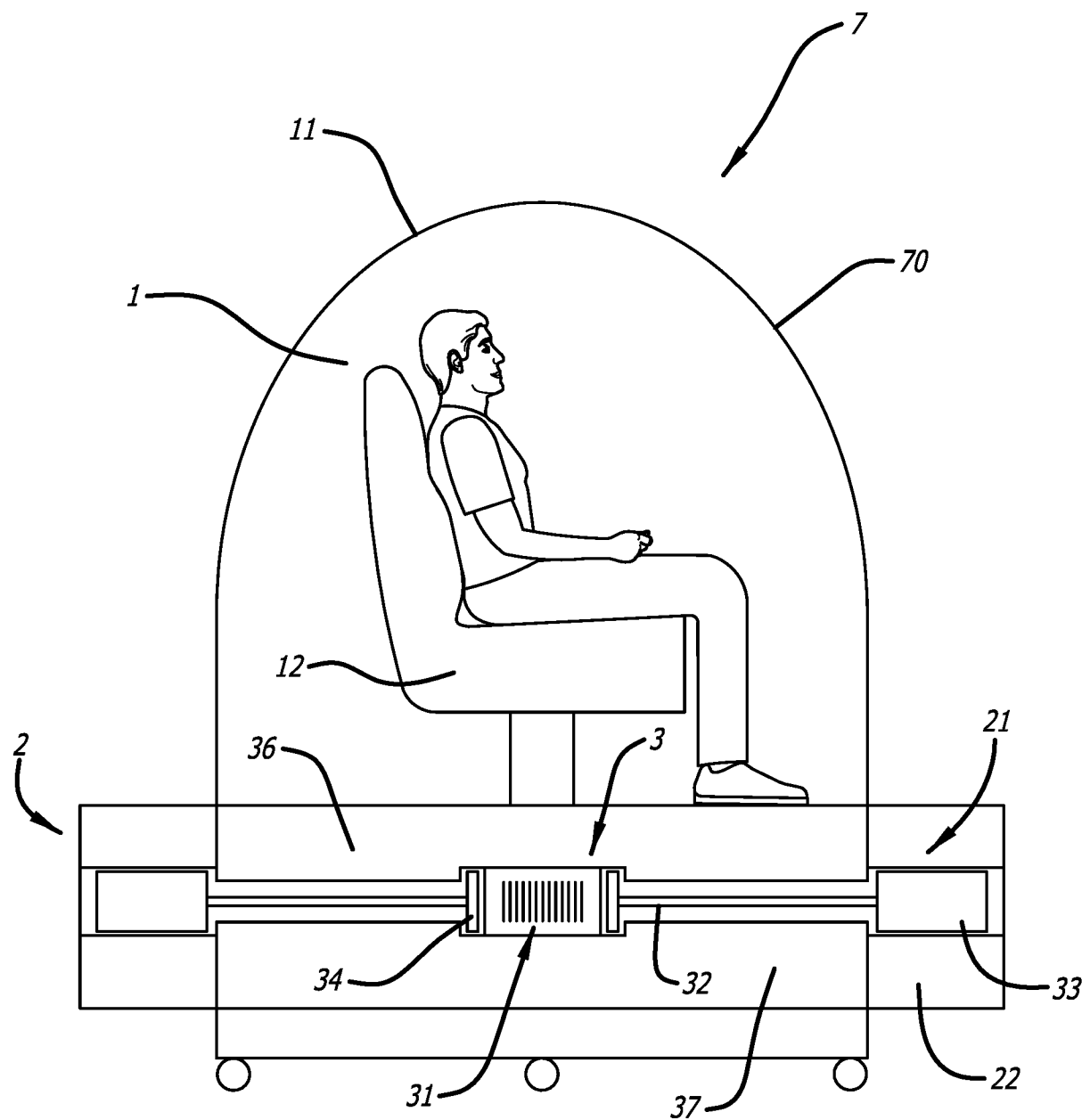


FIG. 1

**FIG. 2A**

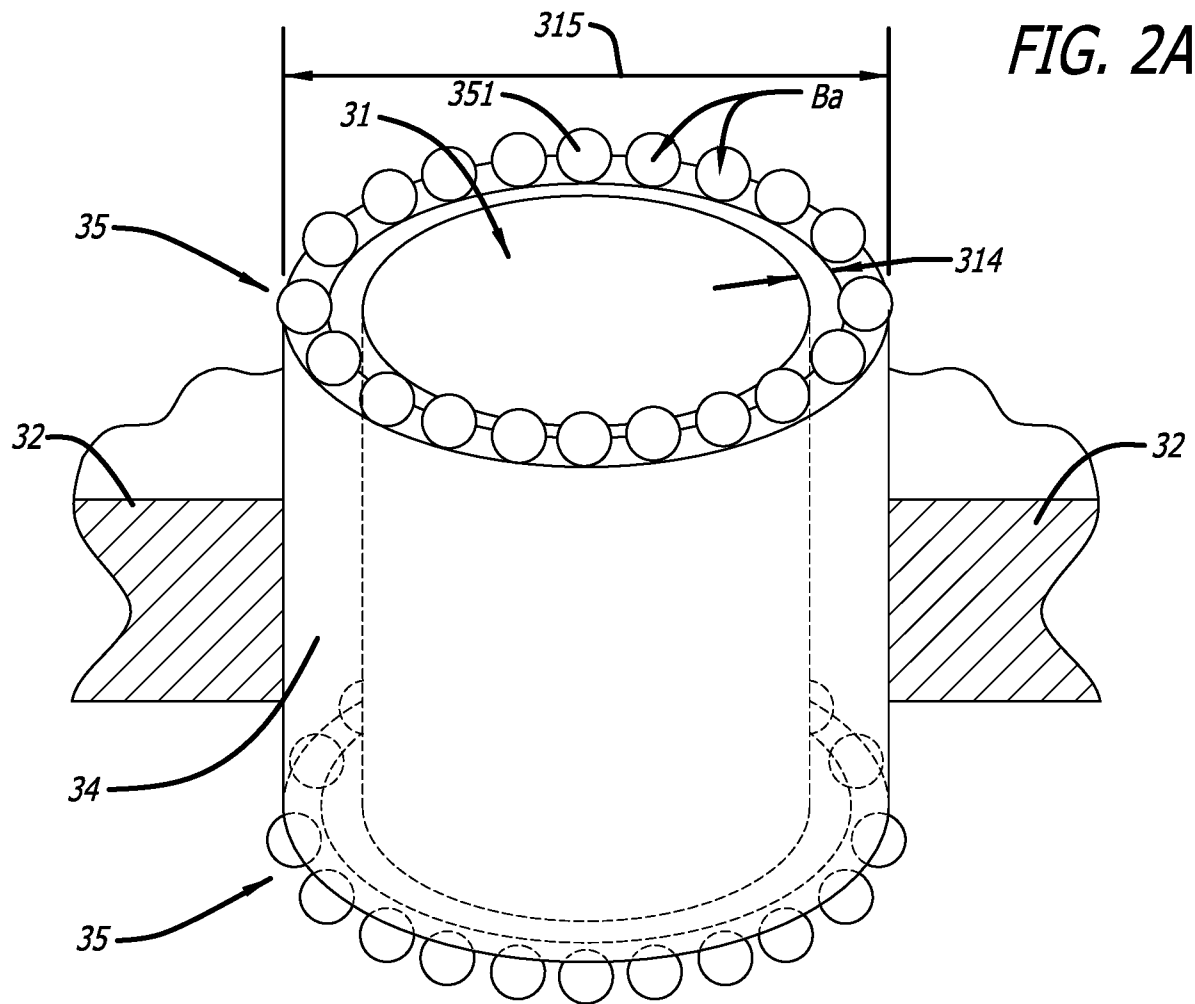
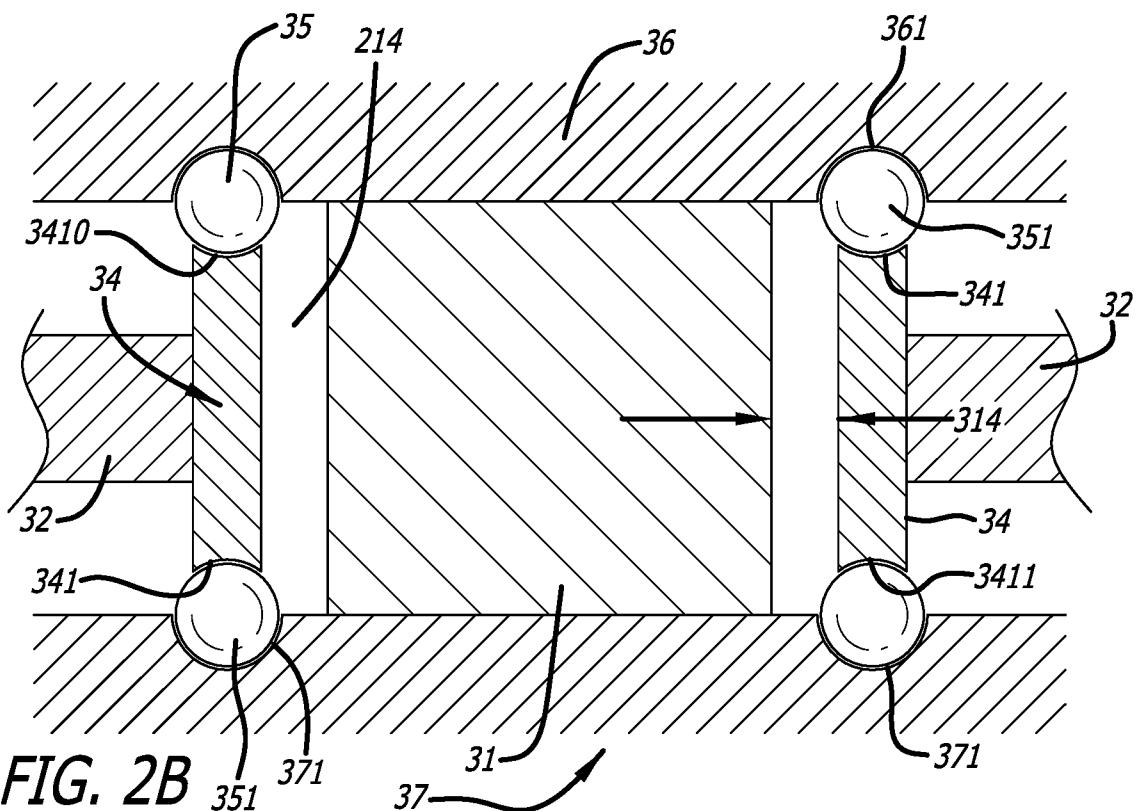
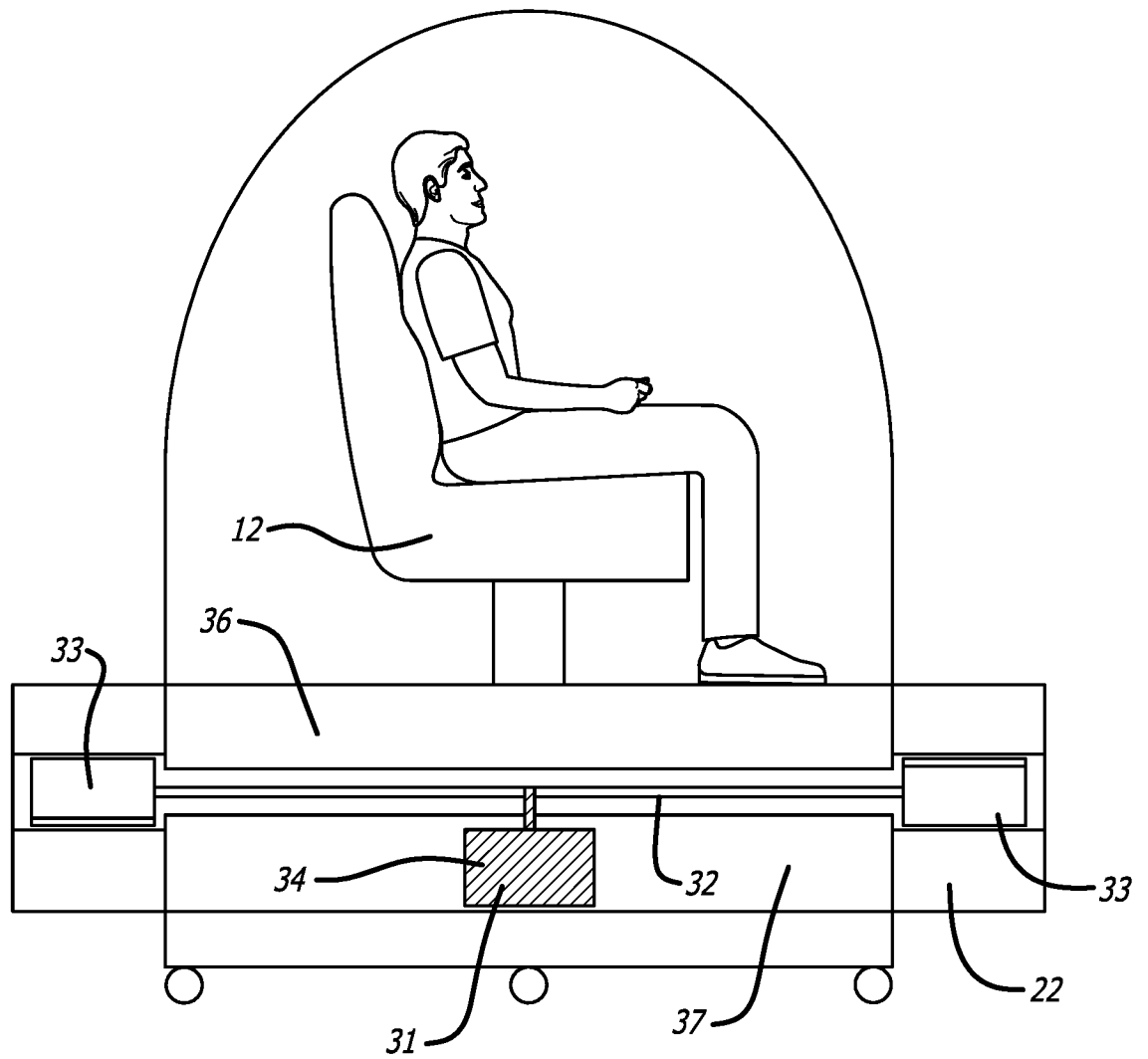


**FIG. 2B**



*FIG. 2C*

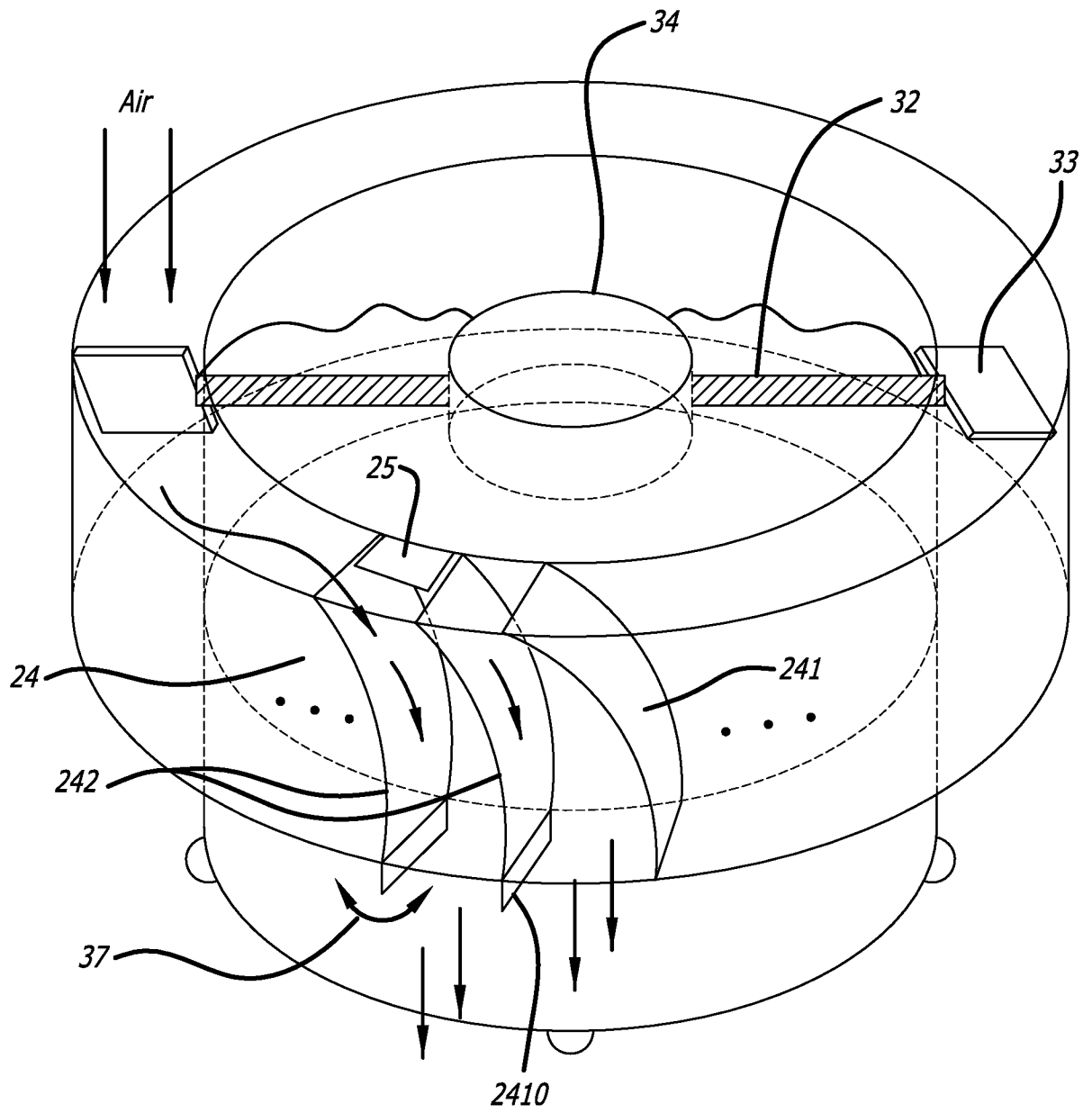


FIG. 3A

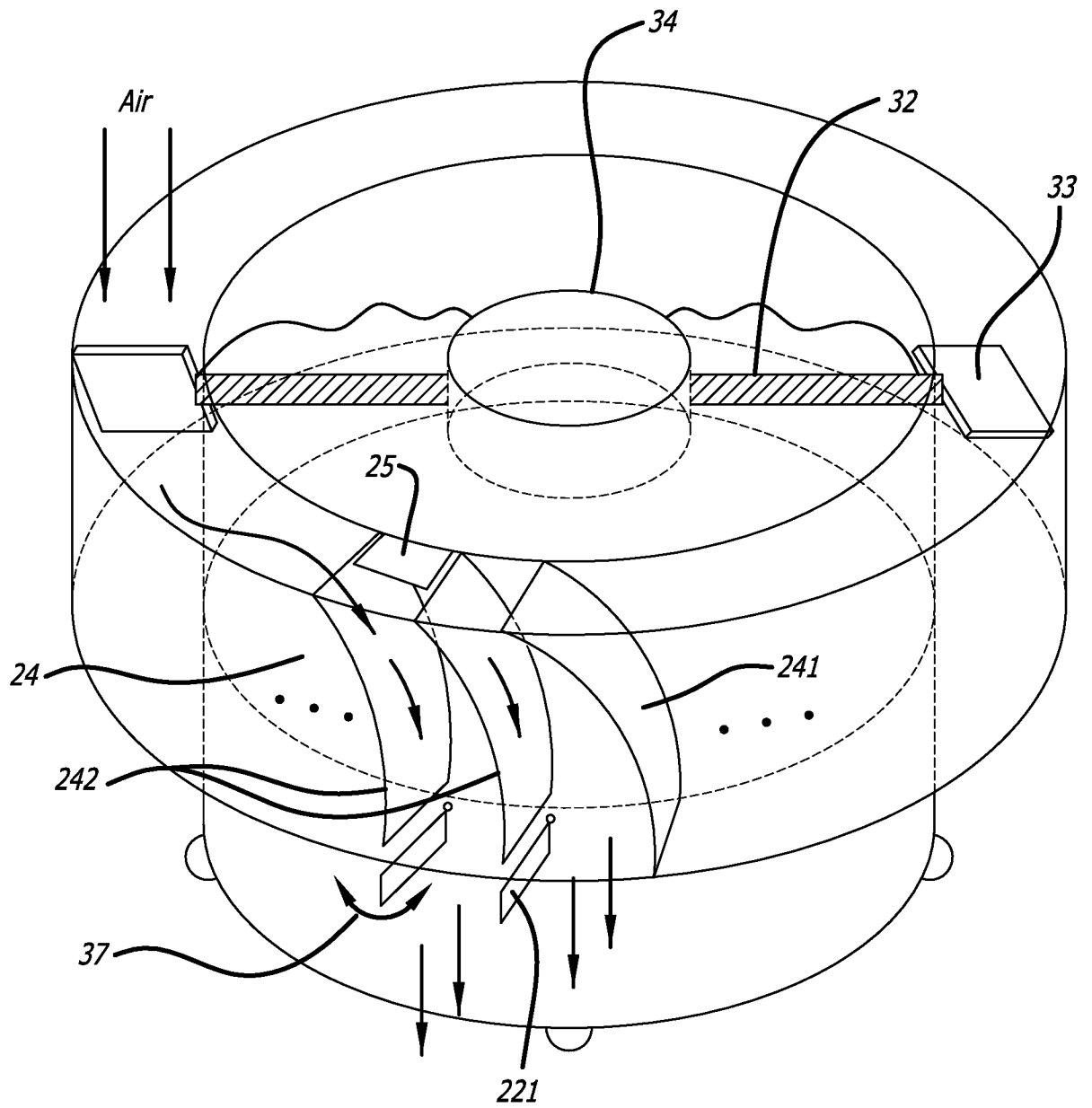


FIG. 3B

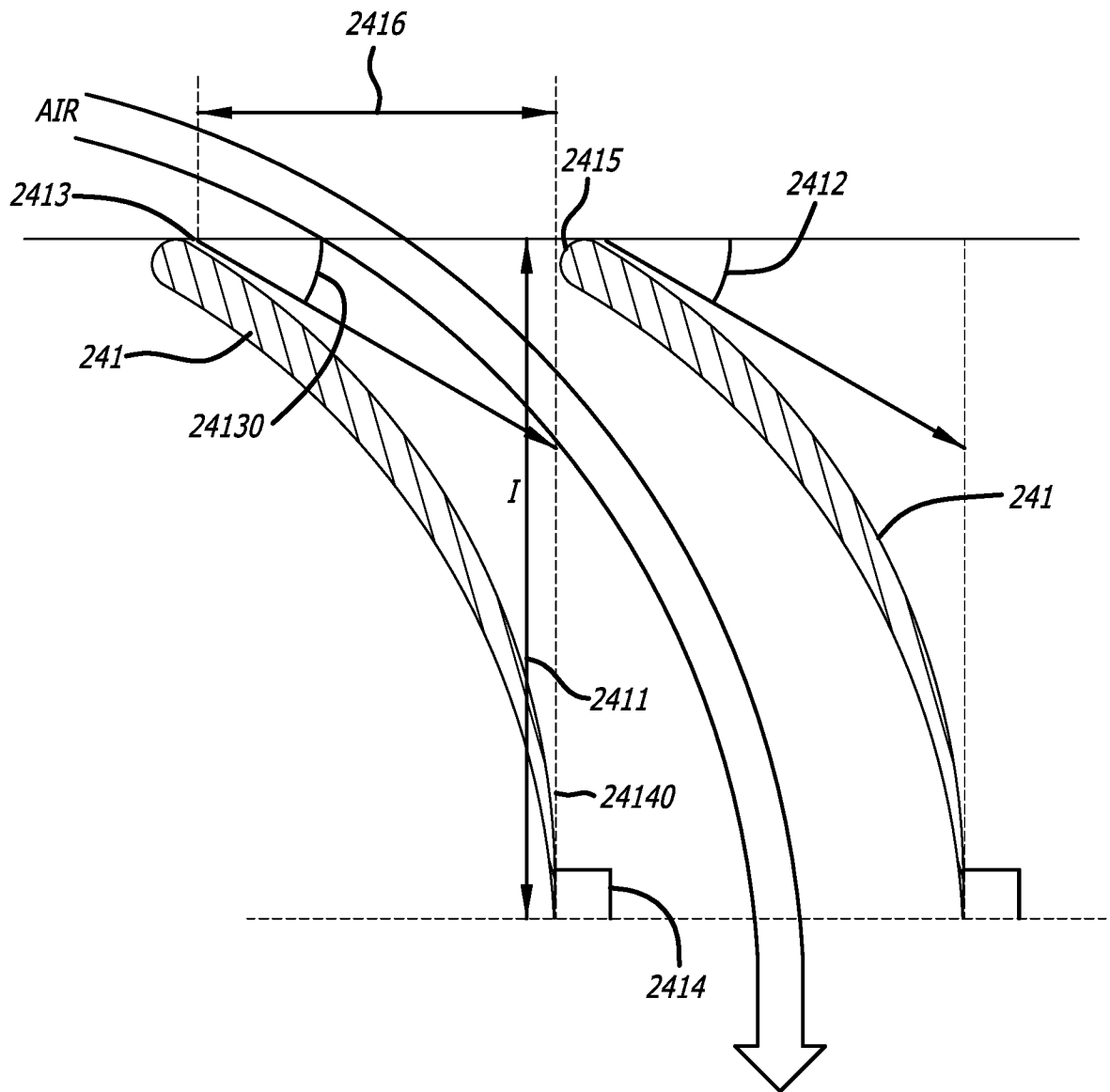
**FIG. 3C**

**FIG. 3D**

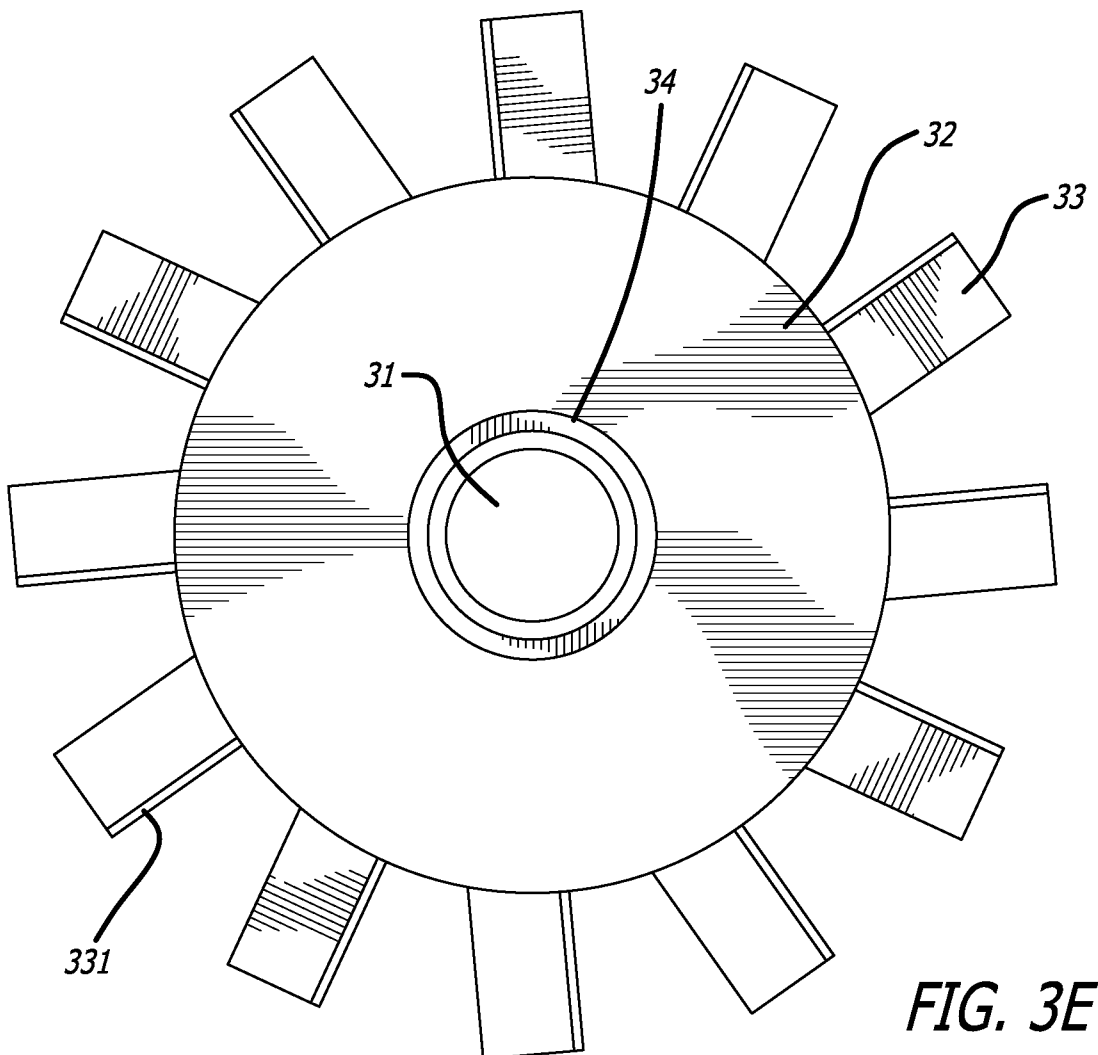
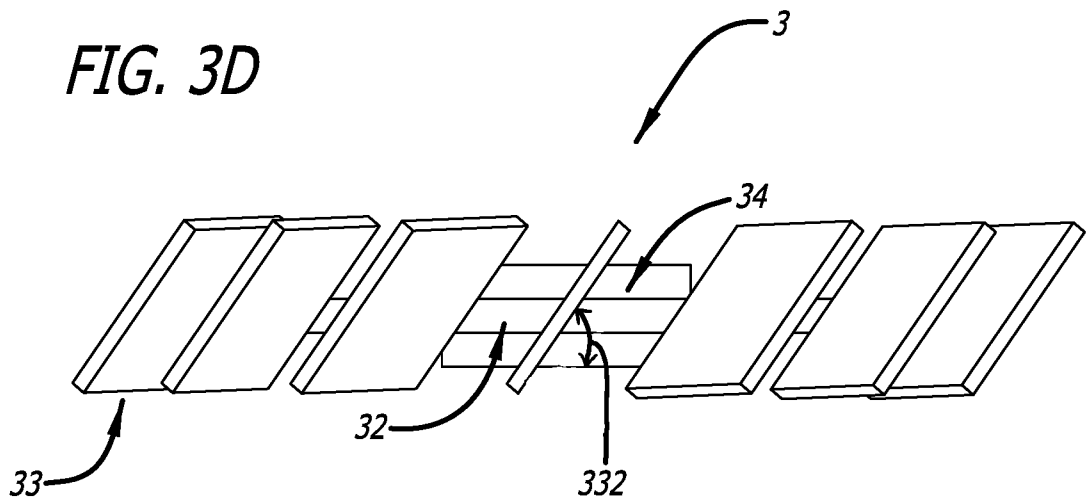


**FIG. 4A**

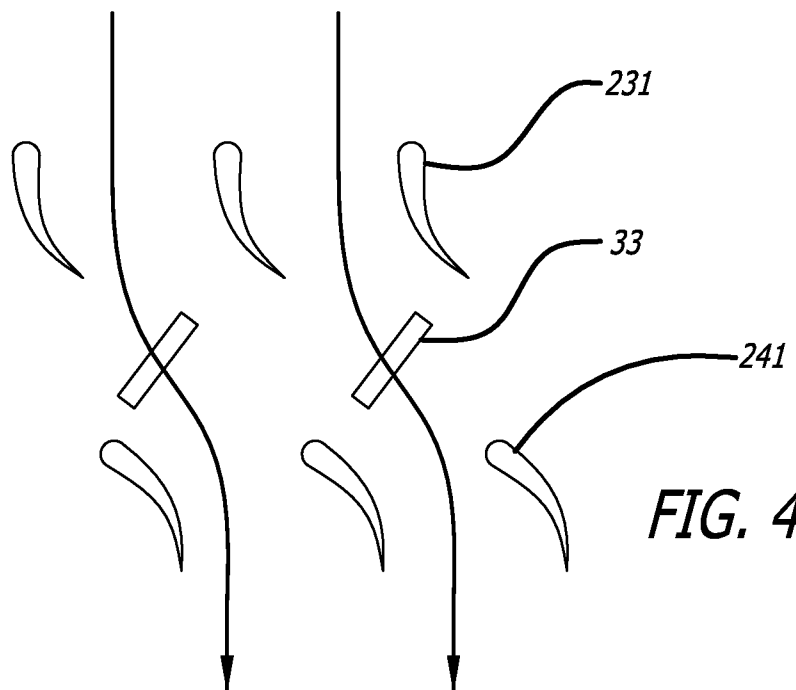
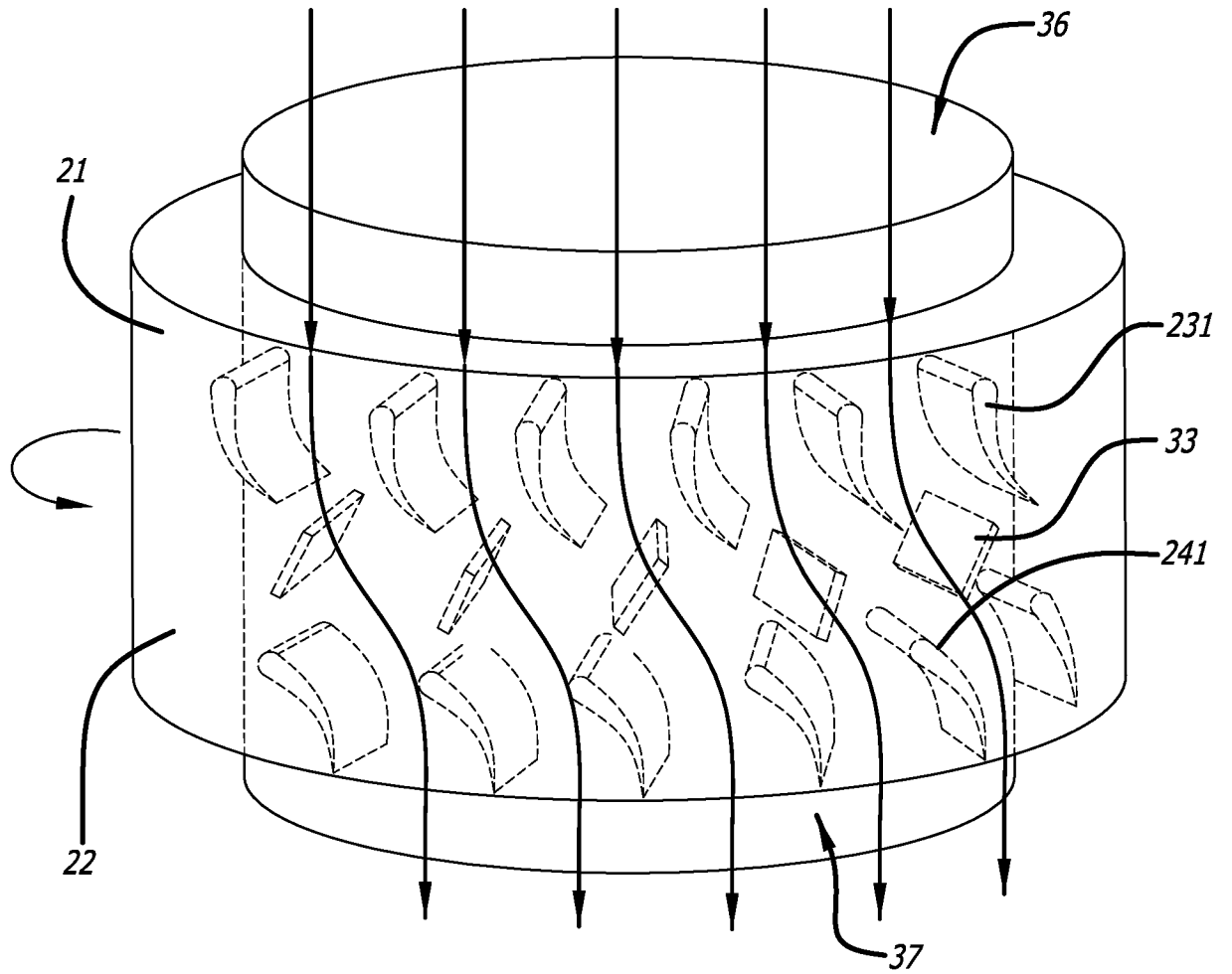


**FIG. 4B**

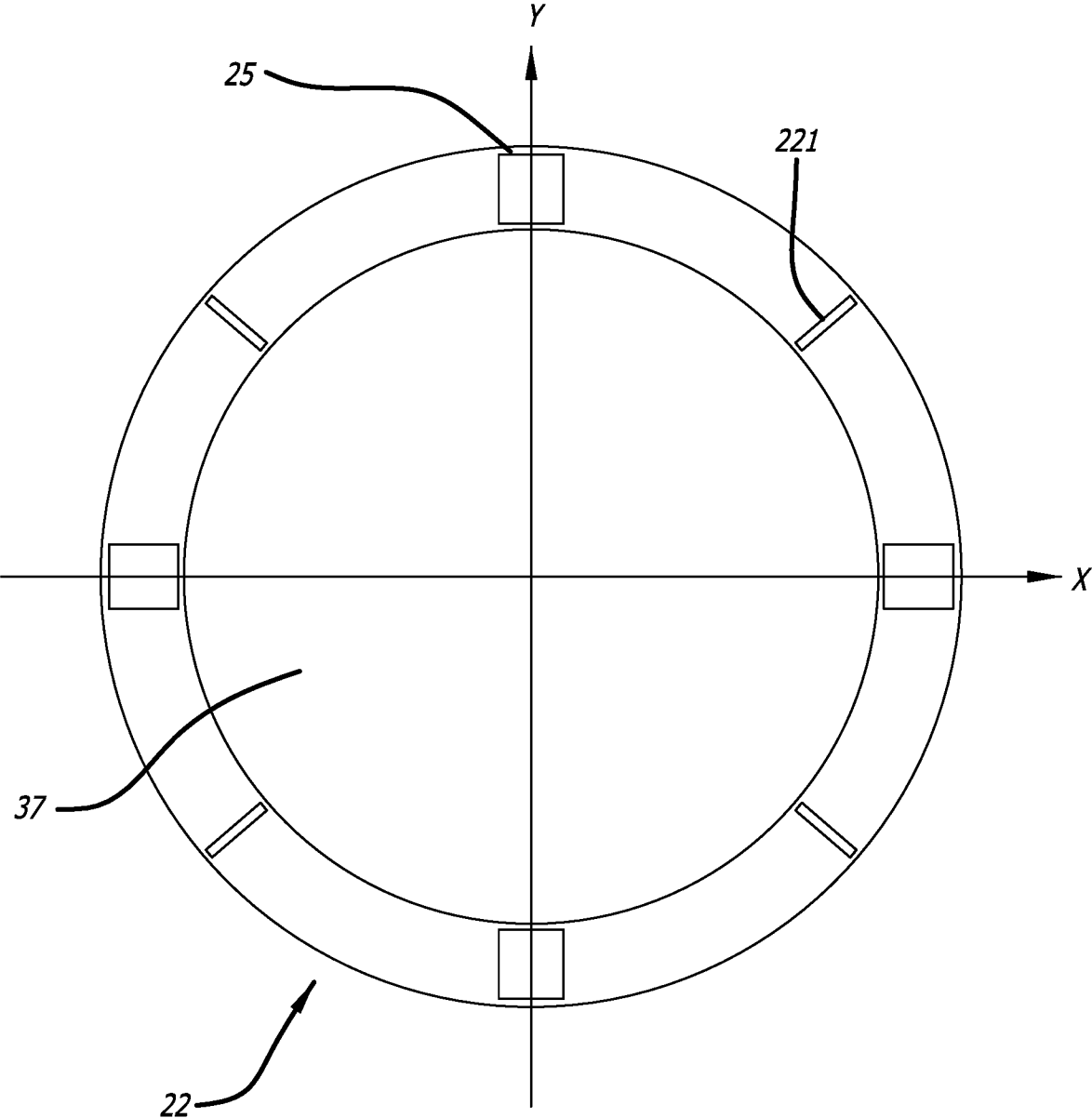


FIG. 5

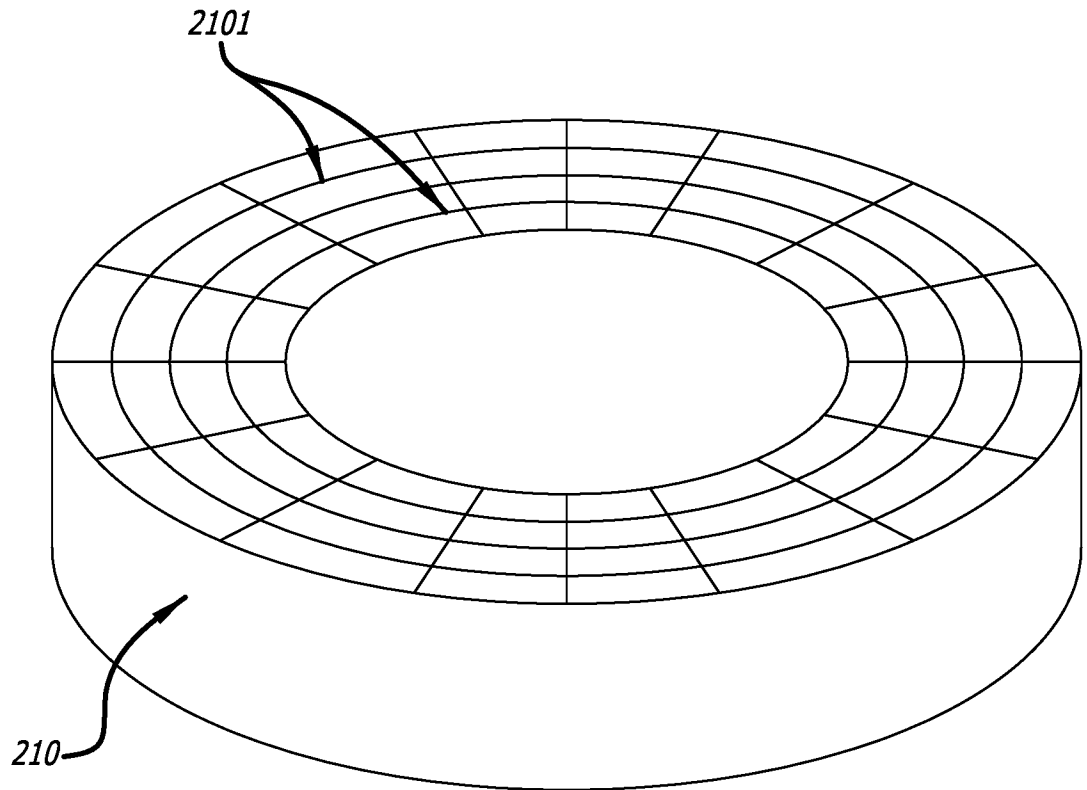
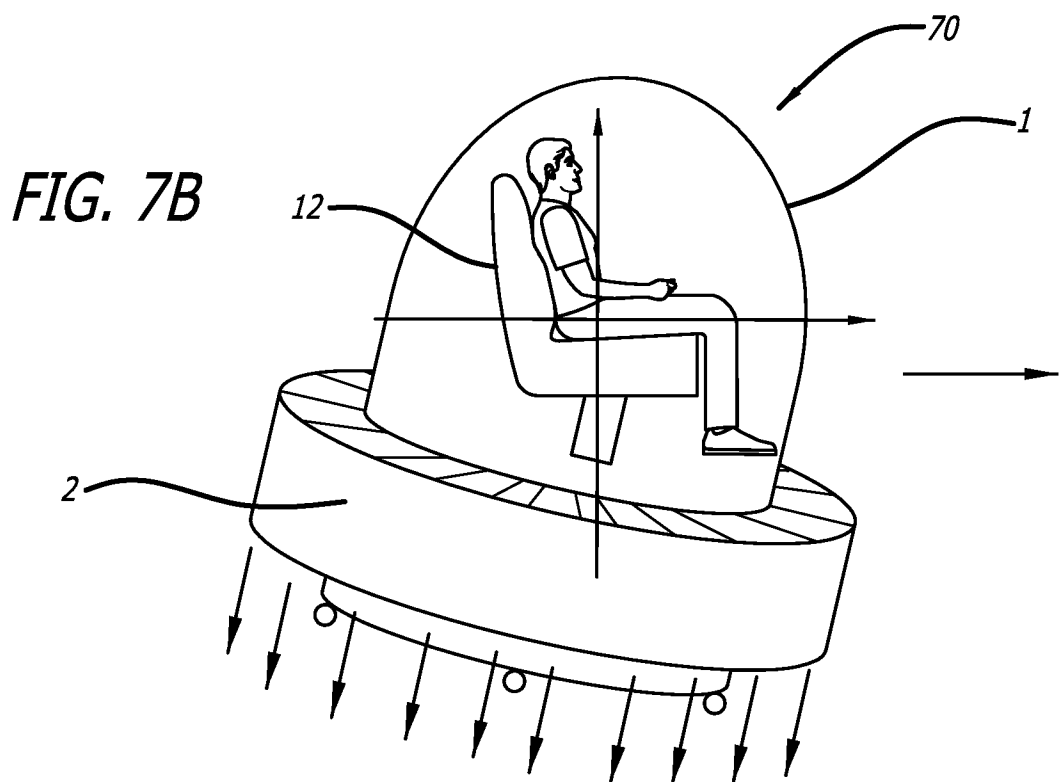
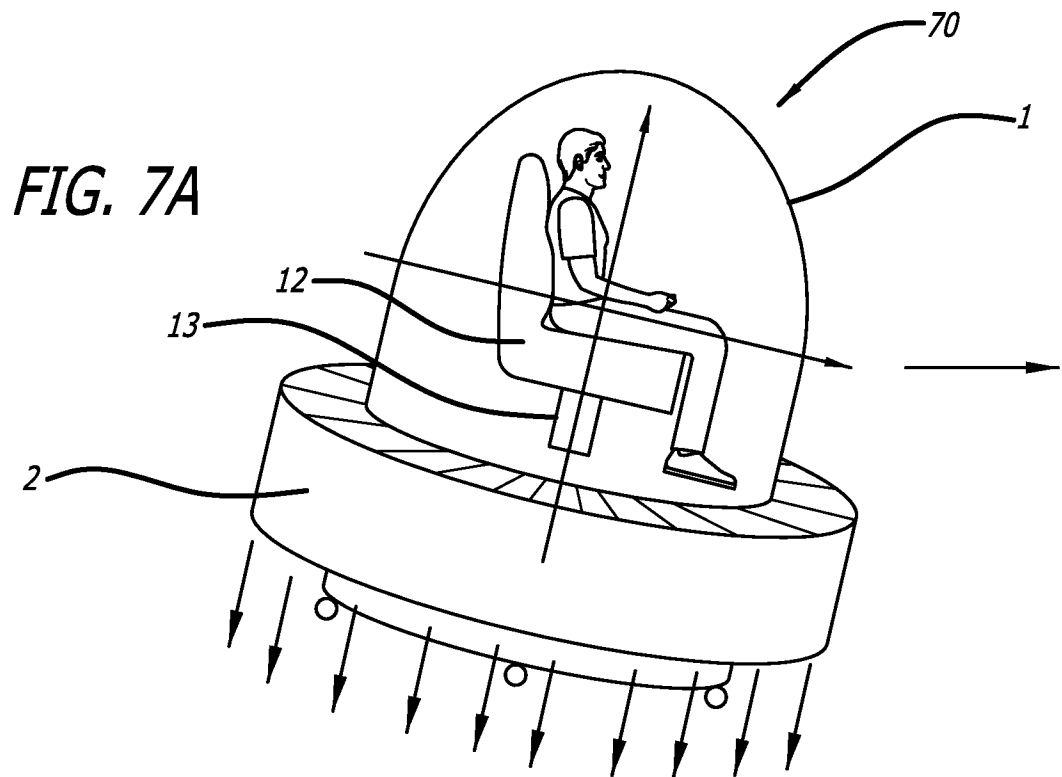
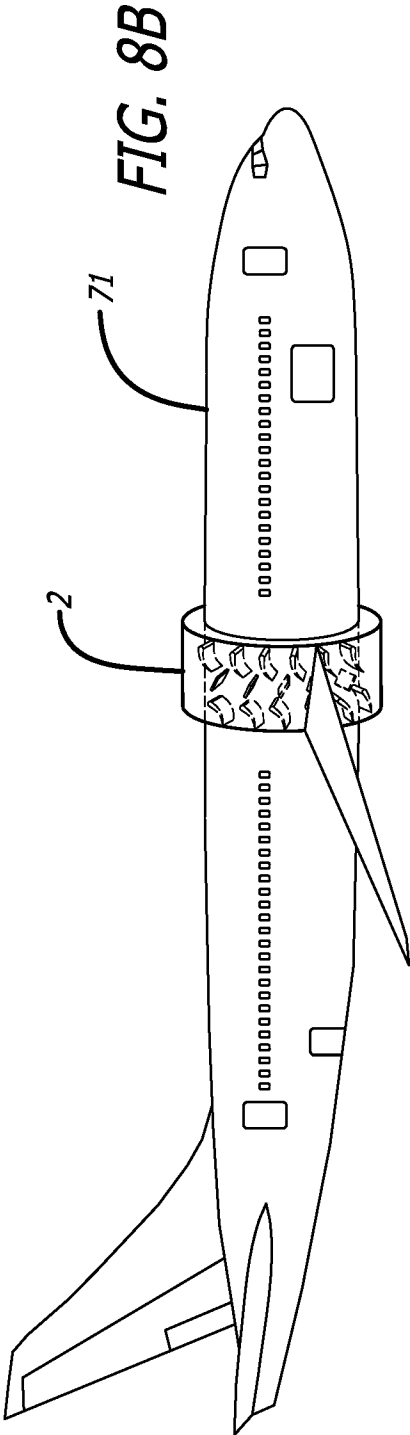
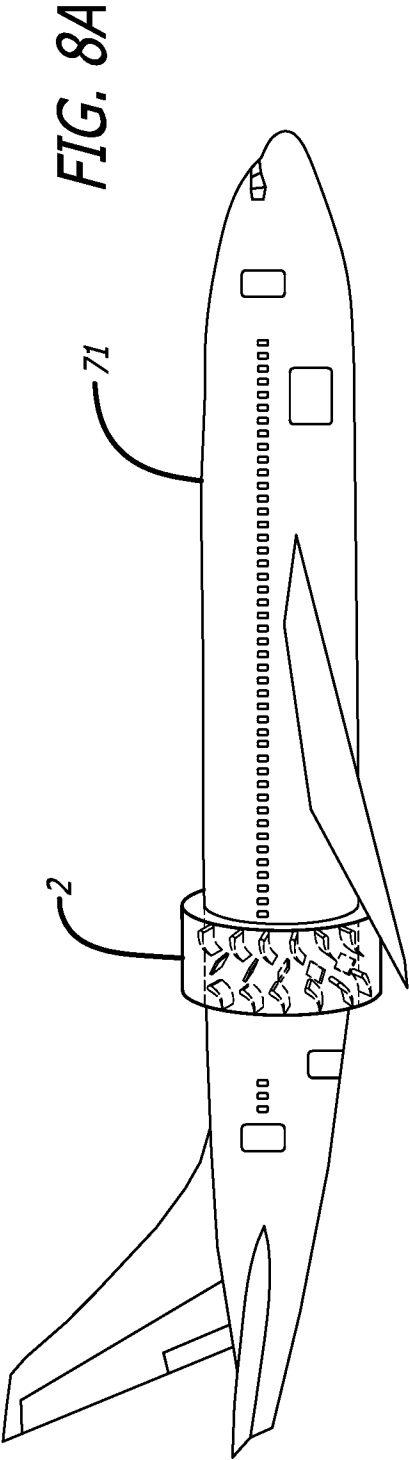


**FIG. 6A**



**FIG. 6B**





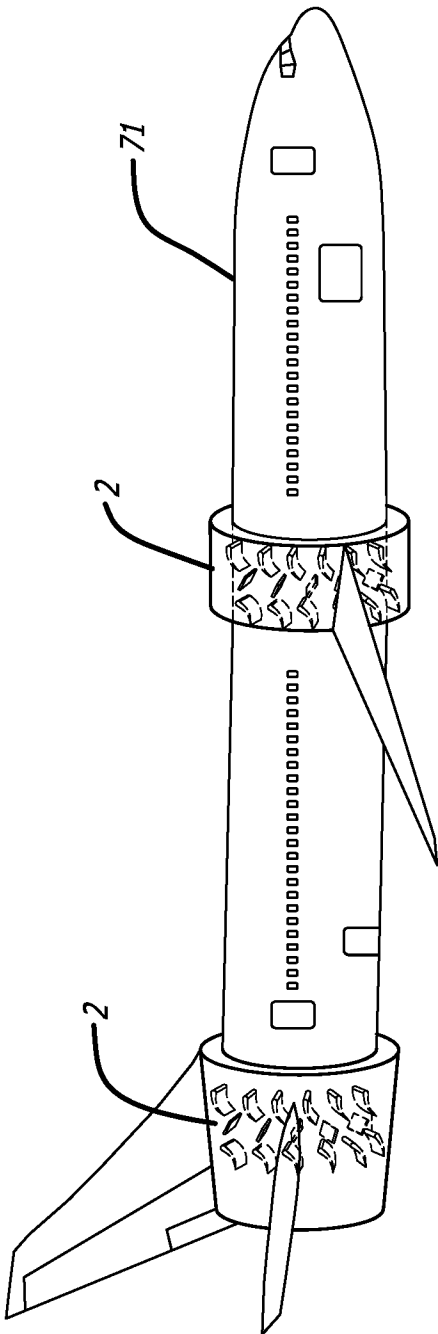


FIG. 8C

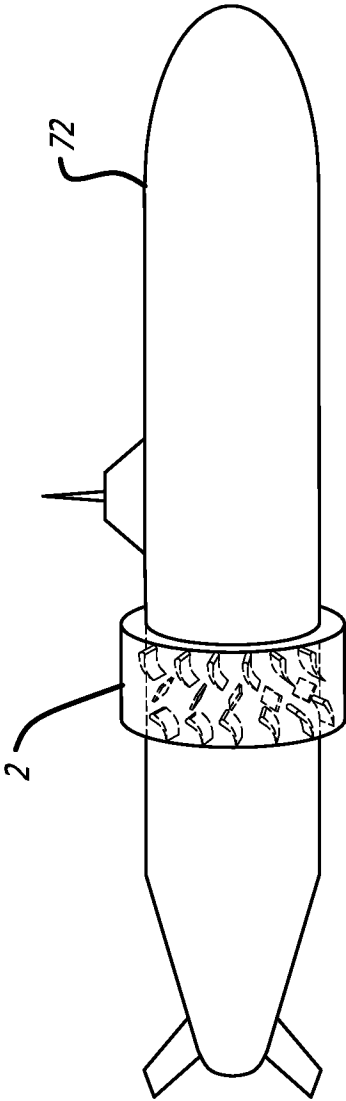
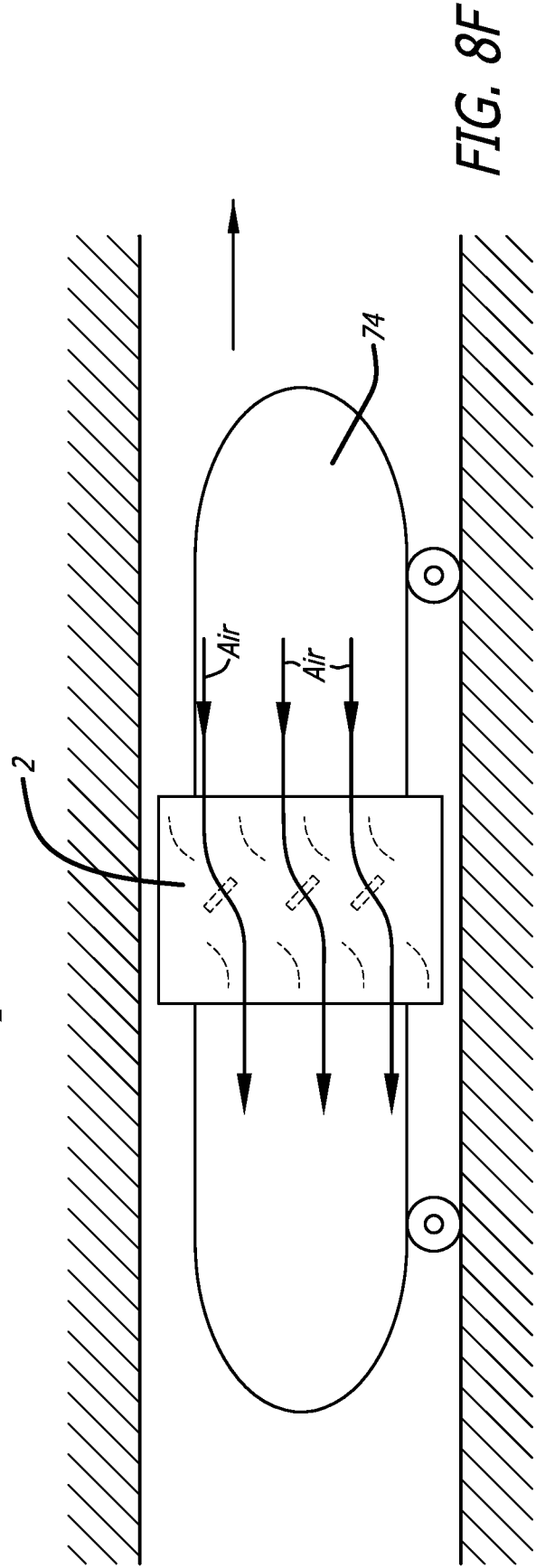
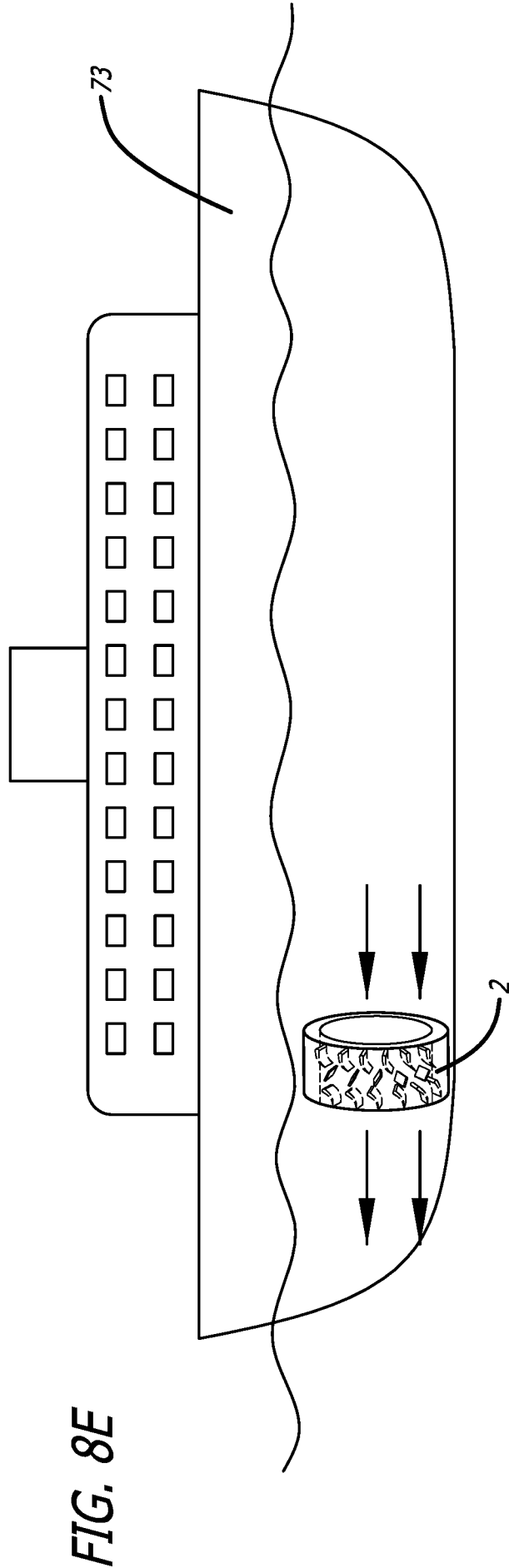


FIG. 8D



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 22/48468

## A. CLASSIFICATION OF SUBJECT MATTER

IPC - INV. B64C 27/20

ADD. B64C 27/00, B64C 11/30, B64C 11/46, B64C 27/26 (2023.01)

CPC - INV. B64C 27/20

ADD. B64C 27/32, B64C 29/00, B64C 29/0025, B64C 3/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History document

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                            | Relevant to claim No.                                          |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| X         | US 2,777,649 A (WILLIAMS) 15 January 1957 (15.01.1957), entire document                                                                       | 1-21, 24-25, 30-34, 36-56, 59-60, 65-69, 71-91, 94-95, 100-104 |
| Y         |                                                                                                                                               |                                                                |
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☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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Date of the actual completion of the international search

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Mail Stop PCT, Attn: ISA/US, Commissioner for Patents  
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-8300

Authorized officer

Kari Rodriguez

Telephone No. PCT Helpdesk: 571-272-4300