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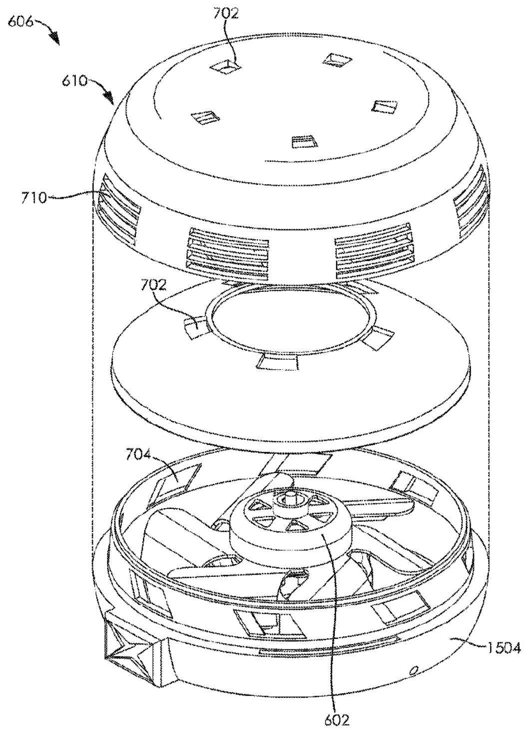

(57) Abrégé/Abstract:
Embodiments of the present invention are generally related to acoustic white noise machines. In particular, embodiments of the present invention are directed to an acoustic white noise machine that comprises a fan blade designed to shear airflow against a sharp edge in order to create broadband turbulent noise. Embodiments of the present invention may further include an adjustable enclosure that may be manipulated via the rotation or other movement of an outer shell to alter the amount of air being sheared by the fan blade, thereby changing the frequencies which resonate in the adjustable enclosure.

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(57) Abstract: Embodiments of the present invention are generally related to acoustic white noise machines. In particular, embodiments of the present invention are directed to an acoustic white noise machine that comprises a fan blade designed to shear airflow against a sharp edge in order to create broadband turbulent noise. Embodiments of the present invention may further include an adjustable enclosure that may be manipulated via the rotation or other movement of an outer shell to alter the amount of air being sheared by the fan blade, thereby changing the frequencies which resonate in the adjustable enclosure.

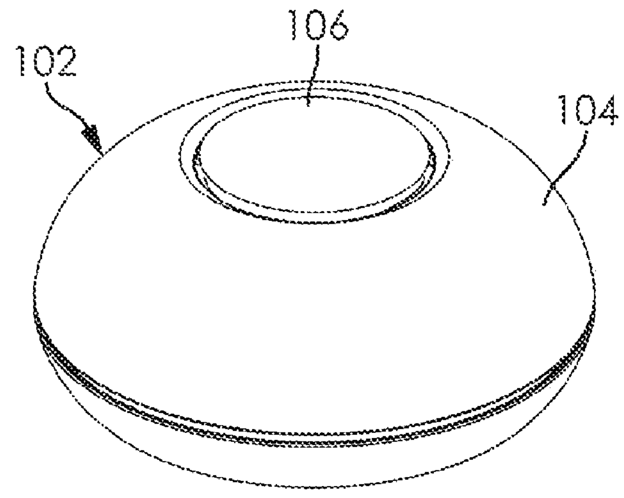

FIG. 1

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MACHINE AND METHOD FOR ACOUSTIC WHITE NOISE GENERATION

FIELD OF INVENTION

[0001] The present invention is related generally to a method and machine for generating acoustic white noise. More specifically, the present invention provides a compact acoustic white noise generation mechanism which is convenient to control and can be calibrated to a specified sound level.

BACKGROUND

[0002] Currently available white noise machines can be categorized into one of two categories: digital or acoustic. Digital white noise machines typically employ an audio speaker system to produce sound. On the other hand, acoustic white noise machines typically produce sound by using a fan blade system to generate noise.

[0003] The design of currently available acoustic white noise machines has not changed substantially for over fifty years and suffers from a variety of drawbacks. First, due to its reliance on moving sound porting closer and further away from a sheared airflow edge, the established design is limited to only controlling the volume exuded from the device without enabling the user to control the actual broadband turbulent noise created. This is because the current design does not provide for controlling the amount of air flow sheared which remains constant. Consequently this drawback significantly limits the variability in sound that can be produced by the device.

[0004] Further, the existing design depends on increasing airflow speed to increase volume. However, increased airflow speed also necessarily entails the increase of blade passing frequency and other undesirable phenomena which detrimentally impact sound quality. Therefore, this shortcoming also limits the potential volume range of the device. Added to the limited volume range are the ineffective overlapping methods of controlling the levels of the noise volume produced by the device. The prevailing design employs a combination of adjustable top vent holes and an outer rotating disk each operating independently to adjust the tone generated by the device. This arrangement results in a number of overlapping settings that are unnecessarily complicated and ineffective for accurately obtaining the desired tone.

[0005] Another drawback of the design on the market today is the significant air outflow produced by the device. Considering that the purpose and operating principle of the system is converting the kinetic energy of the air being driven by the fan into sound energy, having excess air outflow is indicative of wasted energy. However, the substantial cold air outflow is not simply a latent inefficiency of the design but is also a highly undesirable feature. This flaw may be especially detrimental if the device is used near cribs, which incidentally also highlights another widely noted drawback. In particular, as one of the most frequent uses of white noise machines is soothing infants to sleep, aside from cold air, safe volume limits also become an oft-cited and significant concern. As these units often remain on up to 8-12 hours per night, safe volume limits should be based on the prolonged continuous duration of device operation. The white noise machines currently available to consumers do not provide users with the means of ensuring safe operating volume during usage.

[0006] Finally, there is also a lack of any white noise machines configured to be controlled remotely without necessitating physical interaction with the device, as well as a lack of such machines which provide dim illumination to serve as night-lights during night time operation. For the foregoing reasons, there is a need for an acoustic white noise machine which is efficient and safe to use in a variety of settings and whose volume and tone can be accurately controlled. These and other features and advantages of the present invention will be explained and will become obvious to one skilled in the art through the summary of the invention that follows.

SUMMARY

[0007] The present invention is directed to a method of use and an apparatus that meets the abovementioned needs and addresses the faults noted above. Accordingly it is an object of the present invention to provide a compact, energy efficient, conveniently adjustable, and safe acoustic white noise machine which comprises a calibration feature as well as a lighting component. Embodiments of the present invention are generally related to acoustic white noise machines. In particular, embodiments of the present invention are directed to an acoustic white noise machine that comprises a fan blade designed to shear airflow against a sharp edge in order to create broadband turbulent noise. Embodiments of the present invention may further include an adjustable enclosure that may be manipulated via the rotation or other movement of an outer shell to alter the amount of air being sheared by the fan blade, thereby changing the frequencies which resonate in the adjustable enclosure.

[0008] In order to provide a user with precise means of regulating the tone and volume of the turbulent white noise created by the machine, embodiments of the present invention comprise a plurality of overlapping openings in the main body and exterior portions thereof which, via movement relative to each other, allow for the precise adjustment of the airflow between the interior and exterior of the machine. Further customization of user interaction with embodiments of the present invention is provided by the wireless communication means and control means on a remote mobile computing device configured to control the functions of the machine. Notably, because embodiments of the invention are intended to use in areas such as nurseries or children's bedrooms, a safe volume calibration feature is provided to either automatically or manually adjust the volume of the white noise generated by the machine to a safe level.

[0009] The foregoing summary of the present invention with the preferred embodiments should not be construed to limit the scope of the invention. It should be understood and obvious to one skilled in the art that the embodiments of the invention thus described may be further modified without departing from the spirit and scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] These and other features, aspects, functions, and advantages of the present invention will become better understood with regard to the following description, appended claims, and accompanying drawings where:

[0011] Fig. 1 is a side view of an acoustic white noise machine, in accordance with an embodiment of the present invention;

[0012] Fig. 2 is a top view of an acoustic white noise machine, in accordance with an embodiment of the present invention;

[0013] Fig. 3 is a bottom view of an acoustic white noise machine, in accordance with an embodiment of the present invention;

[0014] Fig. 4 is a top view of an acoustic white noise machine, in accordance with an embodiment of the present invention;

[0015] Figs. 5A-5B illustrate a graphical user interface (GUI) on a mobile computing device, for use with an acoustic white noise machine, in accordance with an embodiment of the present invention;

[0016] Figs. 6A-6B are side and cutaway views of a fan blade and interior components utilized in an acoustic white noise machine, in accordance with an embodiment of the present invention;

[0017] Figs. 7-7A are detailed schematics of an acoustic white noise machine, in accordance with an embodiment of the present invention;

[0018] Fig. 8 is an exploded view of an acoustic white noise machine, in accordance with an embodiment of the present invention;

[0019] Figs. 9A-9C comprise multiple views of a fan blade for use in an acoustic white noise machine, in accordance with an embodiment of the present invention;

[0020] Fig. 10 comprises multiple views of an enclosure for use in an acoustic white noise machine, in accordance with an embodiment of the present invention;

[0021] Fig. 11A-11B comprise multiple views of an enclosure for use in an acoustic white noise machine, in accordance with an embodiment of the present invention;

[0022] Fig. 12 is a perspective interior view of an acoustic white noise machine, in accordance with an embodiment of the present invention;

[0023] Figs. 13A-13C comprise views of an acoustic white noise machine, in accordance with an embodiment of the present invention;

[0024] Figs. 14A-14D comprise views of a fan blade for use in an acoustic white noise machine, in accordance with an embodiment of the present invention;

[0025] Figs. 15A-15C comprise views of an enclosure for use in an acoustic white noise machine, in accordance with an embodiment of the present invention;

[0026] Fig. 16 is a cutaway view of the interior of an enclosure of an acoustic white noise machine in accordance with an embodiment of the present invention;

[0027] Fig. 17 is a cutaway view of a portion of an enclosure of and an outer shell of an acoustic white noise machine in accordance with an embodiment of the present invention;

[0028] Figs. 18A-18F are cutaway, perspective, and cross-sectional views of embodiments of an acoustic white noise machine of the present invention displaying embodiments of the impeller fan and its displacement within an embodiment of the present acoustic white noise machine invention;

[0029] Figs. 19A-19D are cross-sectional and exploded views displaying the internal components of an acoustic white noise machine in accordance with an embodiment of the present invention; and

[0030] Figs. 20A-20D are views of a control interface of a mobile device configured to control the operation of an acoustic white noise machine in accordance with an embodiment of the present invention.

DETAILED SPECIFICATION

[0031] In the Summary above, in the Detailed Specification, the Claims below, and in the accompanying drawings, reference is made to particular features including method steps of the invention. It is to be understood that the disclosure of the invention in this specification includes all possible combinations of such particular features. For example, where a particular feature is disclosed in the context of a claim, that feature can also be used to the extent possible, in combination with and/or in the context of other particular aspects and embodiments of the invention and in the invention generally.

[0032] The term “comprises” and grammatical equivalents thereof are used herein to mean that other components, ingredients, steps, etc. are optionally present. For example, an article “comprising” (or “which comprises”) components A, B, and C can consist of (i.e. contain only) components A, B, and C or can contain not only components A, B, and C but also one or more other components.

[0033] Where reference is made herein to a method comprising two or more defined steps, the defined steps can be carried out in any order or simultaneously (except where the context excludes that possibility), and the method can include one or more other steps which are carried out before any of the defined steps, between two of the defined steps, or after all the defined steps (except where the context exclude that possibility).

[0034] The term “at least” followed by a number is used here into the note the start of a range beginning with that number (which may be a range having an upper limit or no upper limit, depending on the variable being defined). For example, “at least one” means one or more than one. The term “at most” followed by a number is used here into the note the end of a range ending with that number (which may be a range having 1 or 0 as its lower limit, or a range having no lower limit, depending upon the variable being defined). For example “at most 4” means four or less than 4, and “at most 40%” means 40% or less than 40%. When, in the specification, a range is given as “(a first number) to (a second number)” or “(a first number) – (a second number),” this means a range whose lower limit is the first number and whose upper limit is the second number. For example, 25 to 100 mm means a range whose lower limit is 25 mm, and whose upper limit is 100 mm.

[0035] Embodiments of the present invention are generally related to acoustic white noise machines. In particular, embodiments of the present invention are directed to an acoustic white noise machine that comprises a fan blade designed to shear airflow against a sharp edge in order to create broadband turbulent noise. Embodiments of the present invention may further include an adjustable enclosure that may be manipulated via the rotation or other movement of an outer shell to alter the amount of air being sheared by the fan blade, thereby changing the frequencies which resonate in the adjustable enclosure.

[0036] According to an embodiment of the present invention, an acoustic white noise machine is provided that utilizes a specialized fan blade to shear airflow against a sharp edge, which then creates broadband turbulent noise. The broadband turbulent noise is then filtered through a tunable acoustic enclosure. In a preferred embodiment, the tunable acoustic enclosure may be adjusted through rotation of an outer shell of the enclosure. Rotation of the outer shell opens and closes one or more vent holes in the enclosure, which varies the amount of air flow through enclosure, thereby changing the amount of air being sheared by the fan blade. This change in the amount of air being sheared by the fan blade changes frequencies of the broadband turbulent noise.

[0037] Turning to Figs. 1-4, an acoustic white noise machine, in accordance with an embodiment of the present invention, is shown. In a preferred embodiment of the present invention, the acoustic white noise machine comprises an enclosure **102** with at least one rotatable outer shell section **104**. In the figures shown, the rotatable outer shell is located on an upper portion **1514** of the enclosure. Rotation of this rotatable outer shell works to adjust the tone of the broadband turbulent noise generated by the acoustic white noise machine.

[0038] According to an embodiment of the present invention, an acoustic white noise machine may further comprise an interactive element **106** for turning on and off power provided to the acoustic white noise machine. In a preferred embodiment, as shown in Fig.1, the interactive element **106** for turning on and off power may be a push button. In other embodiments, the interactive element **106** for turning on and off power may include, but are not limited to, buttons, dials, knobs, touch sensitive components (e.g., capacitive touch sensor), communication means allowing for connection (e.g., BLUETOOTH, WIFI) to the acoustic white noise machine via a computing device **502** (e.g., tablet PC, smartphone), or any combination thereof. One of ordinary skill in the art would appreciate that there are numerous types of interactive elements for turning on and off power that could be utilized with embodiments of the present invention, and embodiments of the present invention are contemplated for use with any such elements.

[0039] According to an embodiment of the present invention, an acoustic white noise machine may further comprise an adjustable volume component. In a preferred embodiment, as shown in Fig. 2, the adjustable volume component could be a precision volume dial **108**, allowing for a user to vary the volume of the device by turning the dial. In other embodiments, the adjustable volume component may include, but are not limited to, dials, knobs, touch sensitive components, switches, levers, or communications means for allowing connection to the acoustic white noise machine via a computing device, or any combination thereof. One of ordinary skill in the art would appreciate that there are numerous types of adjustable volume components that could be utilized with embodiments of the present invention, and embodiments of the present invention are contemplated for use with any such components.

[0040] According to an embodiment of the present invention, an acoustic white noise machine may further comprise a power cord storage area. In a preferred embodiment, as shown in Fig.3, the power cord storage area **302** may be comprised of a cavity formed in a lower region of the enclosure. In other embodiments, the power cord **304** storage area could be formed in other regions of the enclosure **102**. One of ordinary skill in the art would appreciate that there are numerous acceptable regions where the power cord storage area could be formed, and embodiments of the present invention are contemplated for use with any appropriate power cord storage area.

[0041] According to an embodiment of the present invention, an acoustic white noise machine may further comprise a lighting element. In a preferred embodiment, as shown in Fig.4, the lighting element **402** may be a nightlight formed from one or more light emitting diodes (LED) or other illumination source, situated beneath or around an exterior depression of a precision volume dial **108**. In other embodiments, the lighting element **402** could be located in other areas on the enclosure **102**, such as on a side of the enclosure, on a lower region **1504** of the enclosure or any combination thereof. Further, certain embodiments may include more than one lighting element in one or more locations on the enclosure. One of ordinary skill in the art would appreciate that there are numerous acceptable regions where the lighting element could be located as well as numerous types of lighting elements that could be utilized, and embodiments of the present invention are contemplated for use with any appropriate lighting element and location for said lighting element(s).

[0042] According to an embodiment of the present invention, an acoustic white noise machine may be configured to communicate with a remote computing device **502**, such as a tablet PC, desktop PC, smartphone or other computing device. In a preferred embodiment, the acoustic white noise machine may comprise a communications module that allows for communication with a remote computing device **502** via a Bluetooth, WIFI or other wireless communications protocol. In other embodiments, a wired connection could be utilized (e.g., USB). One of ordinary skill in the art would appreciate that there are numerous types of communications modules that could be utilized with embodiments of the present invention, and embodiments of the present invention are contemplated for use with any appropriate type of communications module.

[0043] In conjunction with the communications module, embodiments of the acoustic white noise machine may communicate with a remote computing device **502** in order to allow control/calibration of the acoustic white noise machine by the remote computing device. For instance, in a preferred embodiment, an application on a tablet PC or smartphone **502** may connect to the acoustic noise machine in order to provide various functions, including, but not limited to, turning the machine on/off **504**, setting a timer or schedule **508** for the acoustic white noise machine, altering the volume **506**, calibrating **510** for use in a setting where particular noise levels are desired (e.g., nursery), turning on/off of the lighting element **512**, or any combination thereof. One of ordinary skill in the art would appreciate that there are numerous functions that could be provided via connection to the machine via the communications module, and embodiments of the present invention are contemplated for use with any appropriate type of functionality.

[0044] According to an embodiment of the present invention, an acoustic white noise machine may utilize a connection with a remote computing device **502** in order to calibrate volume levels of the machine for particular applications. For instance, for use in a nursery, where volume levels should not exceed certain thresholds in order to ensure no harm is done to the sensitive hearing of an infant, the acoustic white noise module may utilize a connection with the remote computing device **502** to calculate decibel levels at the location of the crib (e.g., via microphone integrated into a smartphone/tablet PC) and adjust the volume level of the machine accordingly to appropriate levels. The adjustment could be done automatically by the acoustic white noise machine based on the detected decibel levels. In other embodiments, the adjustment could be processed on the remote computing device **502** and effected on the machine via editing of the volume levels.

[0045] According to an embodiment of the present invention, an acoustic white noise machine utilizes a specialized fan **602** blade design that is configured to maximize potential frequencies while concurrently maximizing the potential to provide a compact enclosure **102**. In preferred embodiments, as shown in Figs. 6A-6B, the fan blade **604** is designed to wrap around a motor **608** that drives the fan blade **604**. By reaching down and around the motor **608**, the fan blade **604** provides a compact design while maximizing the volume of air above the fan blades **604**. This increase in the volume of air above the fan blade **604** is important as it determines which frequencies will resonate in the enclosure **606**.

[0046] Turning now to Figs. 7-8, multiple cross-sectional views of a preferred embodiment of an acoustic white noise machine are shown. Figs. 7-8 show multiple features of the enclosure **606** and interior components and how they interact and work together to generate acoustic white noise. In particular, Figs. 7-8 illustrate an enclosure **606** with top intake ports **702**, exit vents **704**, motor **608**, motor insulation **706**, fan blade **604**, adjustment ring **710** and rubber feet **1502**.

[0047] According to an embodiment of the present invention, the top intake ports **702** are formed in a top portion **610** of the enclosure **606** to allow for the inflow of air to the fan **602**. Figs. 10-11 also show the top intake ports **702** in the enclosure **606** and how adjustment of the intake ports **702** may be accomplished in certain embodiments through a rotatable or otherwise adjustable top section **610** of the enclosure **606**. By adjusting the amount or number of open intake ports **702**, or the amount by which each of them is respectively opened, airflow is changed through the enclosure **606**, thereby assisting in the change of frequencies of broadband white noise generated by the machine.

[0048] According to an embodiment of the present invention, the exit vents **704** are optimized for pitch control and acoustic resonance and reduce external air disturbances. In preferred embodiments, exit vents **704** are comprised of one or more of a false step **712**, a trailing edge **714** and a leading edge **716**. The false step **712** helps air directly impact the trailing edge **714** and works with the trailing **714** edge to generate a soft pitch. The leading edge **716** generates a throaty pitch. Edge thickness is calibrated for optimal sound generation. Further, in a preferred embodiment, the edges of the exit vents **704** are angled in a way that mirrors the fan blade **604** angle so that propelled air collides with the exit edges all at once.

[0049] According to an embodiment of the present invention, the adjustment ring **710** is configured to allow the adjustment of an enclosure portion **610** in relation to the exit vents **704** and changes the focus of circulated air between the leading edge(s) **716** and the trailing edge(s) **714** in order to change the pitch of the white noise generated.

[0050] According to an embodiment of the present invention, the motor **608** is configured to drive the fan blade **604**. In a preferred embodiment of the present invention, the motor **608** may be an efficient DC brushless motor. In other embodiments, the motor may **608** be selected from any type of motor capable of driving the fan blade **604** inside the enclosure **606**. One of ordinary skill in the art would appreciate that there are numerous types of motors **608** that could be utilized with embodiments of the present invention, and embodiments of the present invention are contemplated for use with any type of motor.

[0051] According to an embodiment of the present invention, the motor insulation **706** is configured to minimize noise and vibrations caused by the motor **608**. In a preferred embodiment, the motor insulation **706** is provided by way of an insulated motor housing **702** around the motor **608** itself. In other embodiments, insulation may be applied to the outside of the motor in order to provide the desired effects. Insulation **706** may be selected from any type of insulation that would be suitable for direct or indirect contact with the motor **608** or for use as housing for the motor. One of ordinary skill in the art would appreciate that there are numerous types of motor insulations that could be utilized with embodiments of the present invention, and embodiments of the present invention are contemplated for use with any type of motor insulation.

[0052] According to an embodiment of the present invention, one or more rubber feet **1502** may be utilized to eliminate surface vibration. In other embodiments, the feet **1502** may be made of other substances capable of reducing surface friction, including, but not limited to, silicone. One of ordinary skill in the art would appreciate that there are numerous materials that could be used for the feet **1502**, and embodiments of the present invention are contemplated for use with any appropriate materials.

[0053] Turning now to Fig. 9, several versions of a fan **602** are shown, in accordance with various embodiments of the present invention. A first fan blade **910** is shown (left) that has been optimized for improved air flow while retaining its compact form. A second fan blade **912** (center) is shown with slits **913** added to each blade arm **911** in order to increase turbulence and improve sound generation over the first fan blade **910**. A third fan blade **914** is shown (right) that shows a fan blade with outwardly bent tips **916** so shaped in order to spread airflow pulse past the exit vents **704** over a greater time duration, thereby lowering blade passing frequency intensity. One of ordinary skill in the art would appreciate that certain embodiments of the present invention may utilize fan blades incorporating elements from any of these exemplary embodiments.

[0054] Turning now to Fig. 12, an exemplary embodiment of the interior of the enclosure is shown. An inner design of the enclosure comprises two offset cylinders **1200, 1201**. A first edge **714** of the offset cylinder **1200** is used to force the airflow to move along the outer cylinder **1200** wall. The airflow moving along the outer cylinder **1200** wall is then driven directly into the downstream edge **716** of the inner cylinder **1201**.

[0055] Figs. 13A-13C, 14A-14D and 15A-15C show exemplary embodiments of a preferred embodiment of the present invention and options thereto. Figs. 13A-13C show the upper portion **610** of the enclosure **606**. Figs. 14A-14D show various embodiments of exemplary fan blades **911, 914** for use inside the enclosure **606**. Figs. 15A-15C show various views of an exemplary embodiment of a lower portion **1504** of the enclosure.

[0056] Turning now to Figs. 16-17, a portion of the interior of the housing **1600** of an exemplary embodiment of the present invention is shown. In particular, the openings **1602** created by rotationally offset concentric components **1200, 1201** of the housing **1600** are depicted. In particular, Fig. 16 illustrates how a partial overlap of the orifices **1604** of the outer concentric component **1200** and the orifices **1606** of the inner concentric component **1201** combine to create holes **1602** in the wall **1500** of the housing. It further shows, for each opening **1602**, the detailed construction of an upstream edge **716** and a downstream edge **714.** There is a recessed lip **1612** created along the downstream edge **714** to allow airflow to line up with the upstream edge **716**. Fig. 17 likewise depicts an inner portion of the housing **1600** of an embodiment of the present invention but also shows a cutaway of an outer shell **1702** of the embodiment. In accordance with this embodiment the outer shell contains multiple holes **1704** and is configured to rotate around the housing **1600**. As the shell **1702** is rotated, solid portions **1706** thereof may cover the openings **1602** formed by the partially overlapping orifices **1604, 1606** of the abovementioned concentric components **1200, 1201** thereby changing the length and depth of the opening. Consequently, as the dimensions of the opening are changed, so do the sound pressure levels and acoustic frequencies produced by the embodiment of the invention.

[0057] Yet another preferred embodiment of the invention is depicted in Figs. 18A-18C which depict an impeller type rotor **1802** mounted on the motor **608** as well as a number of cavities **1602** within the wall **1500** of the housing **1600**. While the central portion **1804** of the rotor **1802** is likewise domed partially around the motor **608** as in the fans of the embodiments described above, this embodiment comprises a combination of the disc shaped protrusion **1806** and the planar blade **1808** design. The disk shaped protrusion **1806** being positioned in the plane of the rotor's **1802** rotation and the planar blades **1808** being perpendicular to both the plane and the axis of rotation cooperate to make the air moved within the housing **1600** directly strike the upstream edge **716** of the opening **1602**. This embodiment of the invention which comprises the combination eight cavities **1602** in the housing **1600** and five blades **1808** on the rotor **1802** results in a unique operational combination which greatly reduces and nearly eliminates the blade passing frequency produced when invention is being used. Figs.18D-18F show, external, exploded, and cross-sectional views of a similar embodiment of the present invention. Following the top cover **1810**, fabric wrap **1812**, combined housing **1600** and shell **1702**, and rotor **1802** displayed in Fig. 18E are combined to result in the assembled embodiment depicted in Fig. 18D and 18F. Further, in Fig. 18E, one can see how the rotor **1802** is mounted on the motor **608** positioned on the axis of the bottom portion **1504** of the housing.

[0058] An exemplary embodiment of the control means discussed above as well as of a first circuit board **1902** and second circuit board **1904** are shown in Figs. 19A-19C. The control means **106** of the embodiment depicted comprise a touchpad with touch-sensitive areas corresponding to volume **1912**, light **1914**, and power **1916** controls respectively which through an electrical connection to one or both of the first circuit board **1902** and second circuit board **1904** enable a user of the embodiment to control its operation and adjust its operational settings. Furthermore, a more detailed view of the shell **1702** and housing **1600** of an embodiment of the present invention is available in Fig. 19D. The plurality of openings **1920** going through the top and the middle portions housing **1600** of the embodiment are visible as are the openings **1930** in the top and bottom portions of the outer shell **1702**. The rotation of the outer shell **1702** around the housing **1600** of this embodiment simultaneously changes the overlap of the shell openings **1930** and housing openings **1920** respectively and consequently alters the dimensions of the combined opening **1602**. This results in a convenient and precise ability to adjust the tone and volume of the noise produced by the embodiment of the invention.

[0059] These arrangements of components allow for the unique method of operation and customization of an acoustic white noise generating machine. For example, a user of a preferred embodiment of the invention can adjust the size of more than one opening in the machine simultaneously. This action can alter the amount of airflow sheared by the openings and the frequencies of sound which resonate within the machine. Taking advantage of the compact assembly of the housing and conveniently rotatable components of the embodiment of the present invention, a user's rotation of a rotatable component simultaneously adjusts the size of both the holes through which air enters the device and the holes through which it exits the device. In an embodiment of the present invention the intake ports **702** on the top portion **1504** and the openings in the housing **1600** of an embodiment of the invention are coupled with the openings in an outer element of the embodiment in such a manner that a displacement altering the position or dimensions of an intake port results in a corresponding adjustment of an opening. Therefore, the opening and closing of at least one of the cavities displaced circumferentially around the housing is coupled with the opening and closing of the intake ports allowing the user to adjust them simultaneously to control the volume and tone of the noise produced by the device.. Furthermore, the incorporation of the wireless communication means and a remote computing device **502** enables ability user to calibrate the sound level of a white noise machine. By measuring the sound level of the machine with a remote portable computing device **502**; and adjusting the sound level of the machine either through manual controls **106** or via said remote computing device **502** until the sound level measurement reaches a predetermined value a user can ensure that the device is operating at safe volume levels. Consequently, the aforementioned wireless communication also allows a user to operate a white noise machine by wirelessly connecting the machine to communicate with a remote computing device **502** and then physically interacting with digital representations of control means **2002, 2004, 2006, 2008, 2010** (described below) produced by the remote computing device to perform an action selected from the following: turning the machine on/off, setting a timer or, altering the volume, calibrating to a predetermined noise level, turning a lighting element of the machine on/off, or any combination thereof.

Exemplary Embodiments

[0060] Accordingly, a preferred embodiment of the present invention comprises an oblate housing **1600** comprising a top portion **1514** and a bottom portion **1504**, with each of top portion **1514** and bottom portion **1504** having an inner surface and an outer surface, wherein said top portion **1514** and said bottom portion **1504** are configured to securely engage each other via an attachment means **1202** displaced along a rim of at least one of said top portion **1514** and said bottom portion **1504** to form a cavity defined by respective inner surfaces **1900** of said top portion **1514** and bottom **1504** portion; said housing further comprising a curved wall **1500**, said wall **1500** comprising a cylindrical frame **1201** displaced concentrically within a cylindrical band **1200**, said wall **1500** further comprising a plurality of openings **1602**, wherein a rotational displacement of the band **1200** relative to the frame **1201** determines the dimensions of each of said openings **1602**; a motor enclosure **1820** displaced within said housing **1600**, said motor enclosure comprising a motor **608** secured therein, and said motor enclosure **1820** further configured with means to isolate noise and vibration **1822**; a fan **602** mounted on said motor **608**, said fan **602** comprising a concave central dome **1804** and further comprising a plurality of blades **604**, wherein said central dome **1804** is shaped to partially wrap-around said motor enclosure **1820** and each of said blades **604** comprise a first end **630** integrally fused to said central dome **1804** and further comprise a tip **640**; a substantially rigid shell configured to envelop said housing, wherein said shell **1702** is rotatably connected to said housing **1600** to adjust the length and depth of said openings **1602**; a power source **304** and a circuit board **1902** electrically connected to each other, said power source **304** and said circuit board **1902** electrically connected to said motor **608** to regulate the operation of said fan **602**; and a physical control means **106** disposed on said top portion **1514** adapted to effectuate manual regulation of the operation of said fan **602**. In this embodiment, the frame **1201** and the band **1200** each respectively comprise a plurality of corresponding orifices **1604, 1606** configured to permit the passage of air between the interior and exterior of said housing **1600**, while the openings **1602** of said wall **1500** are formed by a rotational displacement of said band **1200** relative to said frame **1201** offsetting each corresponding orifice **1604, 1606** with respect to one another to create an upstream edge **716** and a downstream edge **714** for each opening **1602**, and wherein each of said openings **1602** comprise a recessed lip **1612** formed along the length of the downstream edge **714**. The top portion of said housing **1600** comprises a plurality of vents and the motor enclosure **1820** is preferentially disposed concentrically along a central vertical axis of said bottom portion **1504** of said oblate housing **1600** and therein the motor **608** comprises a rotatable mounting means **650** on which said fan **602** is mounted. Each of the blades **604** in this embodiment radially projects from said concave central dome **1804** and each of said blades **604** is shaped concavely with a concavity corresponding in direction to a curvature of said top portion **1514** of said housing **1600**. Optionally, embodiments of the invention may also have each of said blades **604** modified in any for the following manners independently or in combination with each other: having one or more slits **913** of various configurations and an outwardly bent tip **916**. The preferred embodiment's shell **1702** may comprise at least the same number of openings **1704** as said frame **1201** permitting the passage of air through said shell **1702** and the embodiment may further comprise a wireless communication means electrically connected to a circuit board with the wireless communication means configured to be communicatively coupled to a computing device **502** enabling the operation of said fan **602** to be controlled via said computing device **502**. Embodiments of the invention may also comprise at least one foot pad **1502** attached to said bottom portion **1504** of said housing **1600**, said at least one foot pad **1502** creating a vibrationally dampening cushion between said housing **1600** and a surface on which said housing **1600** is placed, and they may further comprise a permeable elastic covering **1812** surrounding an outer surface of said shell **1702** to disperse airflow.

[0061] Another preferred embodiment of the invention comprises a concave enclosure **102** having an inner surface **1900** and an outer surface, said enclosure **102** comprising an upper portion **1514** and a lower portion **1504** affixed to each other along a cross-sectional perimeter of said enclosure **102**; said enclosure further comprising a ceiling and a cylindrical wall **1500**, wherein said wall **1500** comprises an outer cylinder **1200** comprising an inner surface and an outer surface and further comprises an inner cylinder **1201** positioned concentrically with said outer cylinder **1200** and in immediate contact with said inner surface of said outer cylinder **1200**, where each of said ceiling and said wall **1500** further respectively comprise a plurality of openings **1602**, wherein a rotational displacement of said cylinders **1200, 1201** relative to each other alters the size of more than one of said openings **1602**; a vibrationally dampened drive module **1822** connected to said lower portion **1504** of said enclosure **102**, said drive module **1822** comprising a motor **608** and configured with means to isolate motor noise; a rotor **1802** rotatably attached to said drive module **1822**, said rotor **1802** comprising a curved central frame **1804** and further comprising a plurality of blades **1808**, wherein said central frame **1804** curves partially around said drive module **1822** and each of said blades **1804** is integrally fused to said central frame **1804**; an exterior shell **1702** configured to encase said enclosure **102** along a perimeter of said enclosure **102**, wherein said shell **1702** is rotatably engaged with said enclosure **102** so that a rotation of said shell around said enclosure modifies the dimensions of said openings **1602**; a power source **304** and a circuit board **1904** electrically connected to each other, said power source **304** and said circuit board **1904** electrically connected to said motor **608** to regulate the operation of said rotor **1802**; and a physical control means **106** disposed on said upper portion **1514** adapted to effectuate manual regulation of operational settings of the device. The rotor of this embodiment comprises a disc shaped protrusion **1806** integrally fused to both of said central frame **1804** and said plurality of blades **1808**, wherein said protrusion **1806** is coplanar with its plane of rotation and extends perpendicularly from a central vertical axis of said lower portion **1504** of said enclosure **102**, and wherein each of said blades **1808** extend perpendicularly to said frame **1804** and said protrusion **1806**. The preferred embodiment of the invention also comprise a light emitting means **402** electrically connected to said circuit board **1904** and further comprising at least one foot pad **1502** attached to said lower portion **1504** of said enclosure **102**, said at least one foot pad **1502** creating a vibrationally dampening cushion between said enclosure **102** and a surface on which said enclosure **102** is placed. A porous flexible outer wrap **1812** envelops an exterior surface of said shell to disperse airflow and limit the draft of air exuding from the device, and a power cord storage compartment **302** is provided to house the power source **304** connection.

[0062] Figs. 20A-20D show different operational states of a GUI of a mobile computing device **502** configured to wirelessly control the operation of the components of a white noise machine in accordance with an embodiment of the present invention. The GUI interface provides virtual representations of controls to adjust the volume **2002**, to turn the machine on/off **2004**, and to turn a light emitting element of the embodiment on/off **2006**. Turning to Fig. 20B, controls for setting a timer **2008** for the operation of the embodiment of the invention are shown. Controls for initiating a sound level calibration **2010** and the sound level measurement indicator **2012** are depicted in Figs. 20C and 20D respectively. Since the controls displayed in the GUI are virtual representations of physical controls, this embodiment of the invention provides a convenient way of remotely controlling and adjusting the operation of the white noise machine via a mobile computing device that is wirelessly connected to a wireless communication module of the circuit board. One of ordinary skill in the art should understand that there are various ways that the control means can be virtually represented via a remote or mobile computing device and that the embodiments of the present invention are contemplate to operate with any combination thereof.

[0063] Any element in a claim that does not explicitly state “means for” performing a specified function, or “step for” performing a specific function, is not to be interpreted as a “means” or “step” clause as specified in 35 U.S.C § 112, ¶ 6. In particular, the use of “step of” in the claims herein is not intended to invoke the provisions of 35 U.S.C § 112, ¶ 6.

[0064] While multiple embodiments are disclosed, still other embodiments of the present invention will become apparent to those skilled in the art from this detailed description. The invention is capable of myriad modifications in various obvious aspects, all without departing from the spirit and scope of the present invention. Accordingly, the drawings and descriptions are to be regarded as illustrative in nature and not restrictive.

CLAIMS

What is claimed is:

1. A machine for generating acoustic white noise comprising:

an oblate housing comprising a top portion and a bottom portion each of which have an inner surface and an outer surface, wherein said top portion and said bottom portion are configured to securely engage each other via an attachment means displaced along a rim of at least one of said top portion and said bottom portion to form a cavity defined by said inner surface of said top portion and bottom portion;

said housing further comprising a curved wall, said wall comprising a cylindrical frame displaced concentrically within a cylindrical band, said wall further comprising a plurality of openings, wherein a rotational displacement of said band relative to said frame determines the dimensions of each of said openings;

a motor enclosure displaced within said housing, said motor enclosure comprising a motor secured therein, and said motor enclosure further configured with a means to isolate noise and vibration;

a fan mounted on said motor, said fan comprising a concave central dome and further comprising a plurality of blades, wherein said central dome is shaped to partially wrap around said motor enclosure and each of said blades comprise a first end integrally fused to said central frame and a second end forming a blade tip;

a substantially rigid shell configured to envelop said housing, wherein said shell is rotatably connected to said housing to adjust the length and depth of said openings;

a power source and a circuit board electrically connected to each other, said power source and said circuit board electrically connected to said motor to regulate the operation of said fan; and

a physical control means disposed on said top portion adapted to effectuate manual regulation of the operation of said fan.

2. The machine of claim 1 wherein each of said frame and said band comprise a plurality of corresponding orifices configured to permit the passage of air between the interior and exterior of said housing.

3. The machine of claim 2 wherein said openings of said wall are formed by a rotational displacement of said band relative to said frame offsetting each corresponding orifice with respect to one another to create an upstream edge and a downstream edge for each opening, and wherein each of said openings comprise a recessed lip formed along the length of said downstream edge.

4. The machine of claim 1 wherein said top portion of said housing comprises a plurality of vents.

5. The machine of claim 1 wherein said motor enclosure is disposed concentrically along a central vertical axis of said bottom portion of said oblate housing and wherein said motor comprises a rotatable mounting means on which said fan is mounted.

6. The machine of claim 1 wherein each of said blades radially projects from said concave central dome.

7. The machine of claim 1 wherein each of said blades is shaped concavely with a concavity corresponding in direction to a curvature of said top portion of said housing.

8. The machine of claim 1 wherein each of said blades comprises a modification selected from the group of at least one slit, an outwardly bent tip, and combinations thereof.

9. The machine of claim 1 wherein said shell comprises at least the same number of openings as said frame permitting the passage of air through said shell.

10. The machine of claim 1 further comprising a wireless communication means electrically connected to said circuit board, said wireless communication means configured to be

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communicatively coupled to a computing device enabling the operation of said fan to be controlled via said computing device.

11. The machine of claim 1 further comprising at least one foot pad attached to said bottom portion of said housing, said at least one foot pad creating a vibrationally dampening cushion between said housing and a surface on which said housing is placed.

12. The machine of claim 1 further comprising a permeable elastic covering surrounding an outer surface of said shell to disperse airflow.

Date Reçue/Date Received 2022-11-28

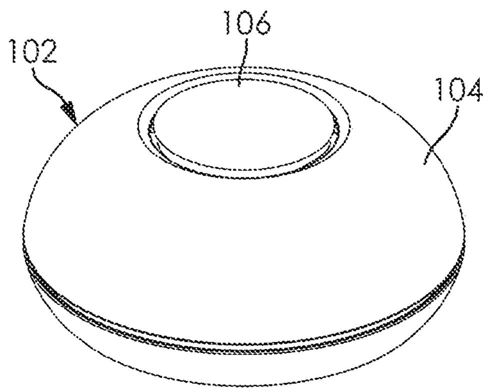

FIG. 1

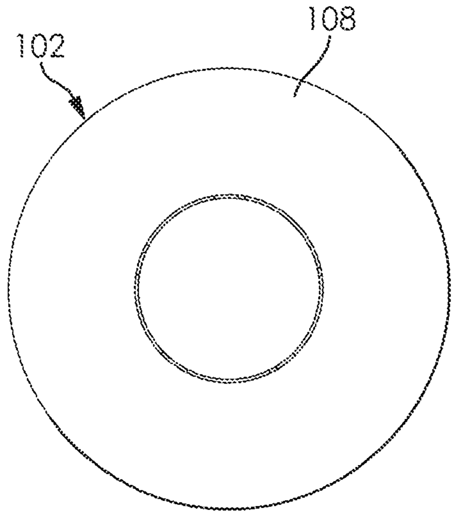

FIG. 2

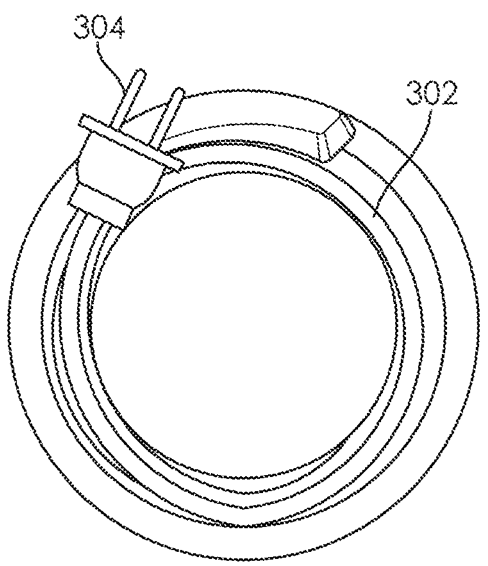

FIG. 3

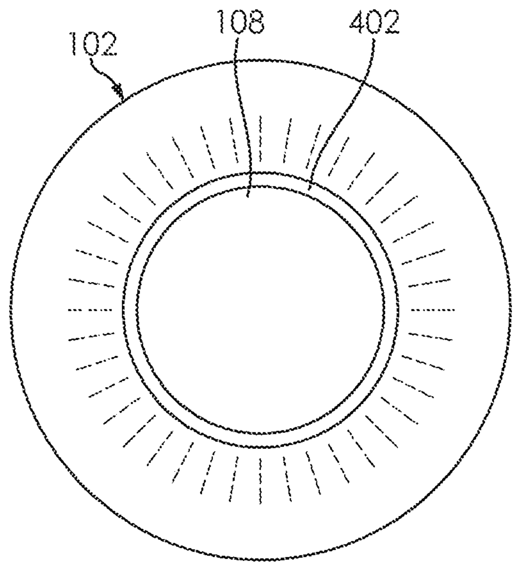

FIG. 4

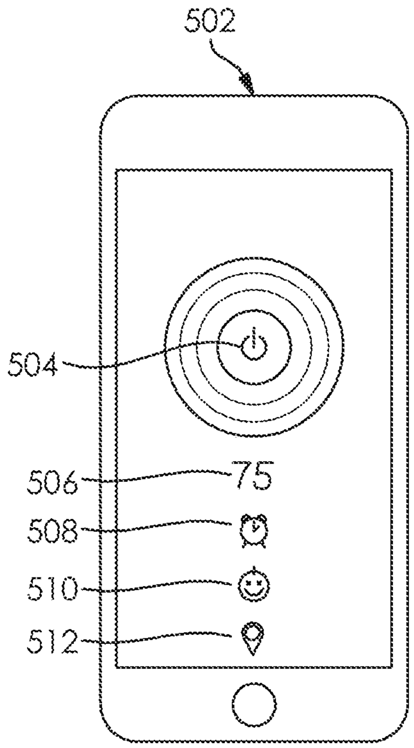

FIG. 5A

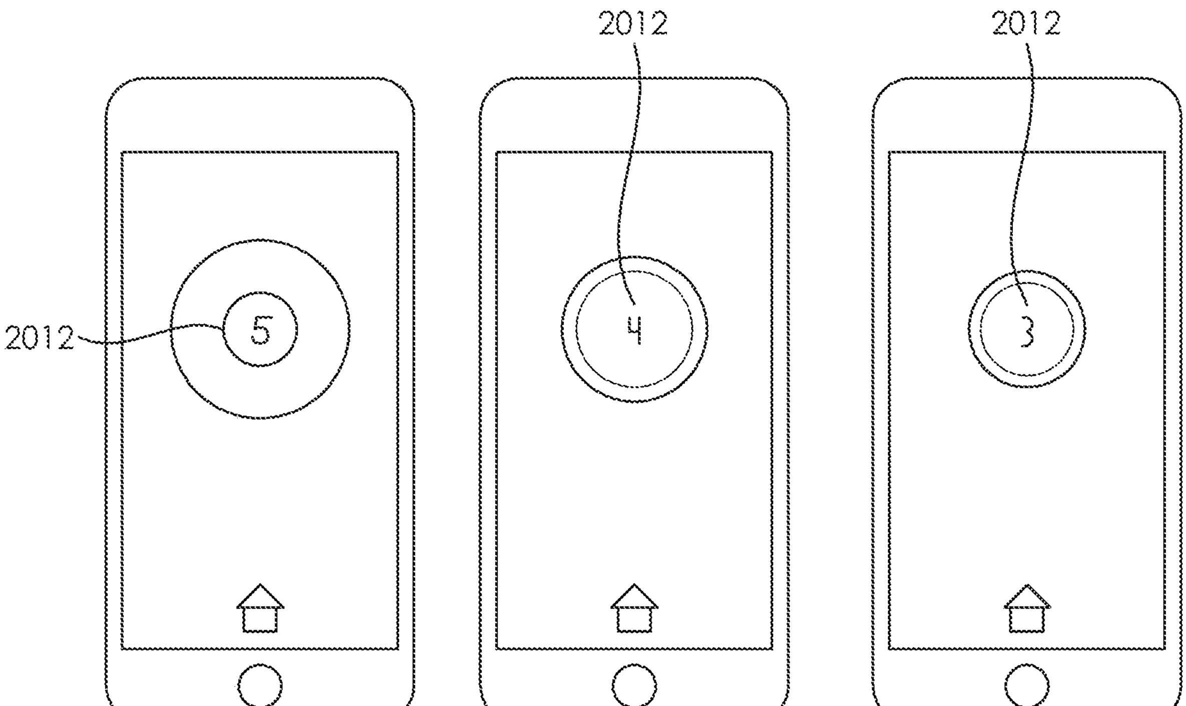

FIG. 5B

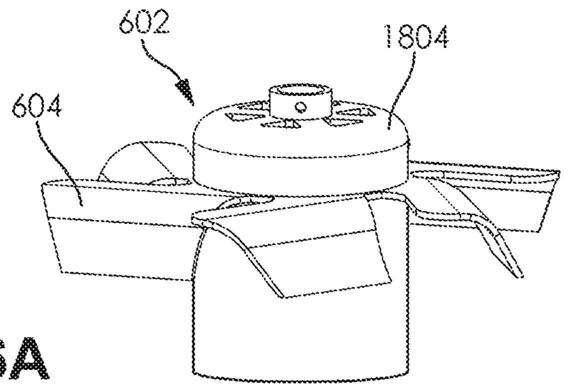

FIG. 6A

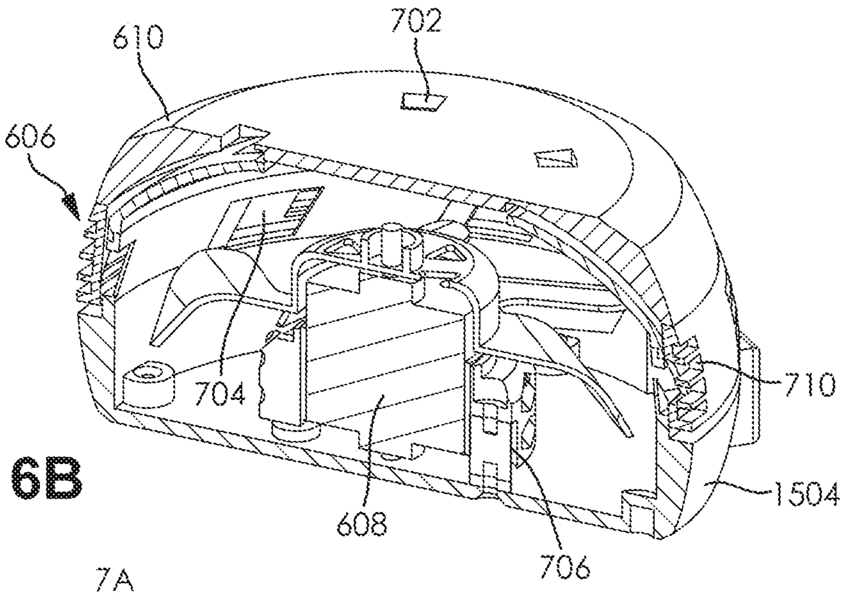

FIG. 6B

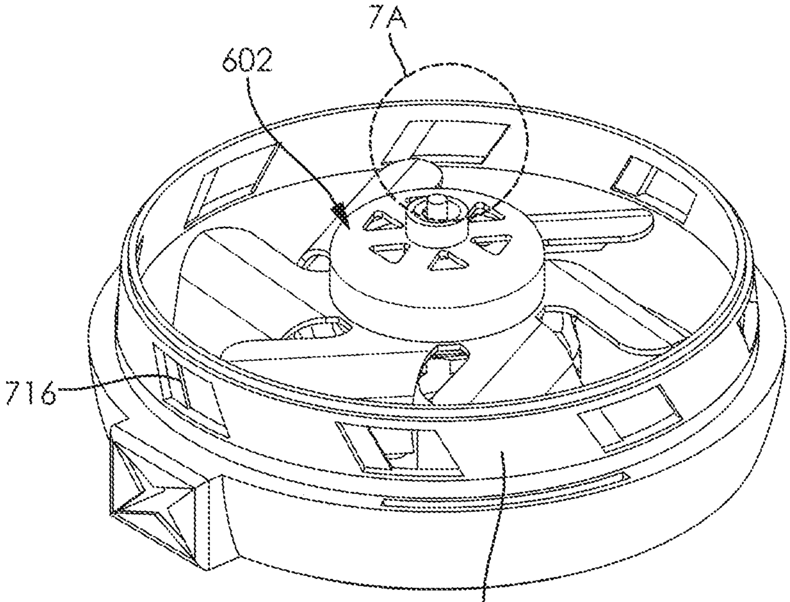

FIG. 7

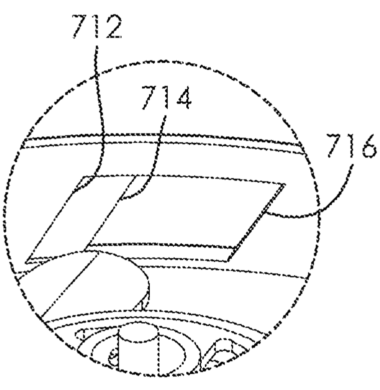

FIG. 7A

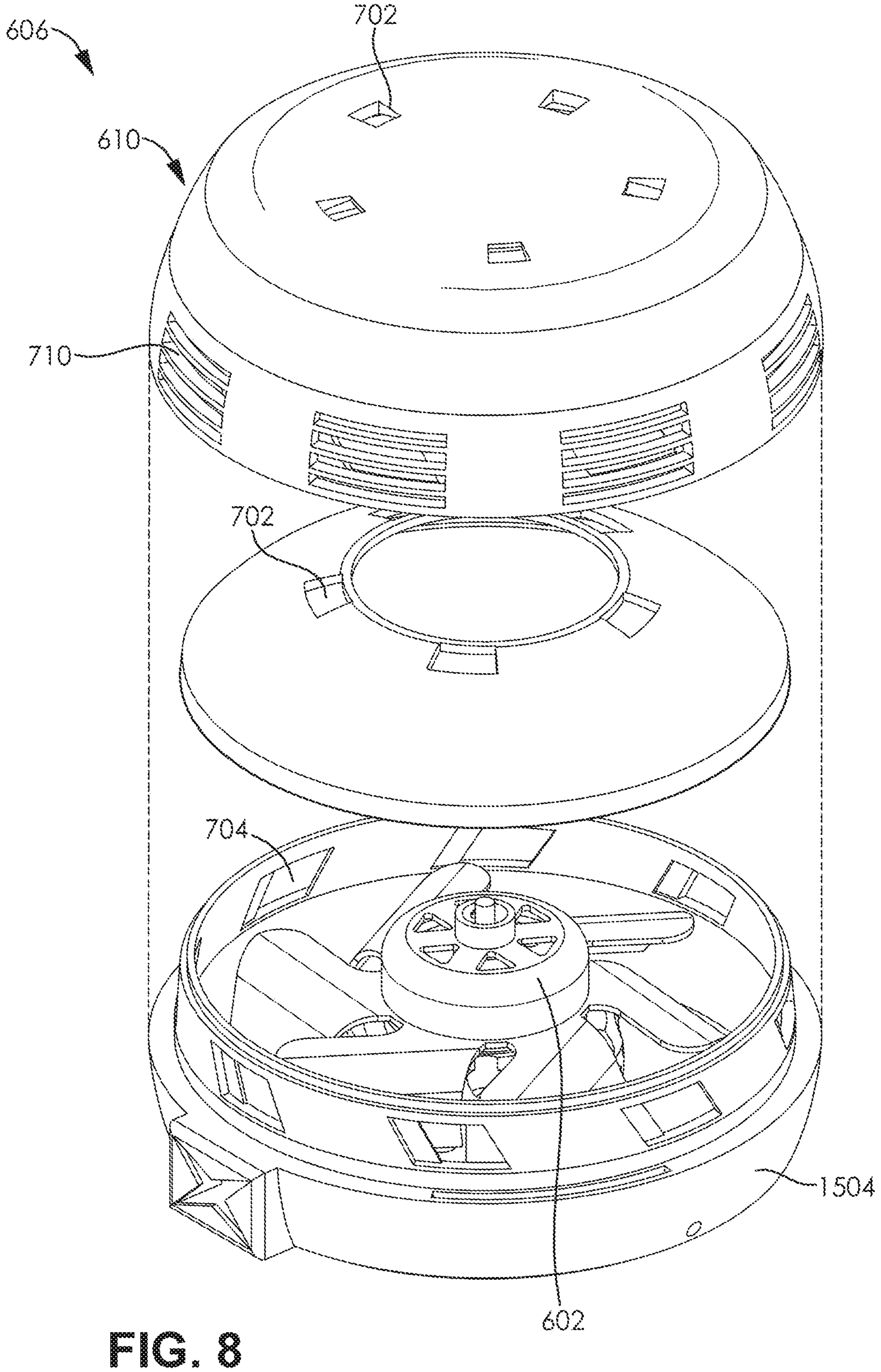

FIG. 8

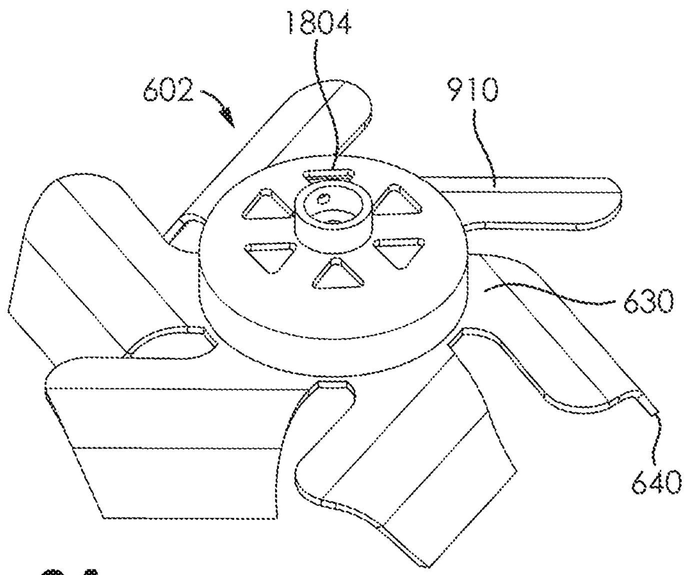

FIG. 9A

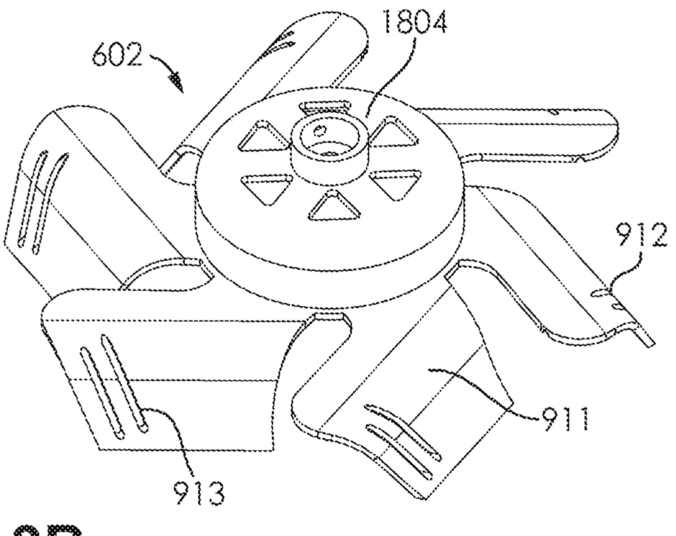

FIG. 9B

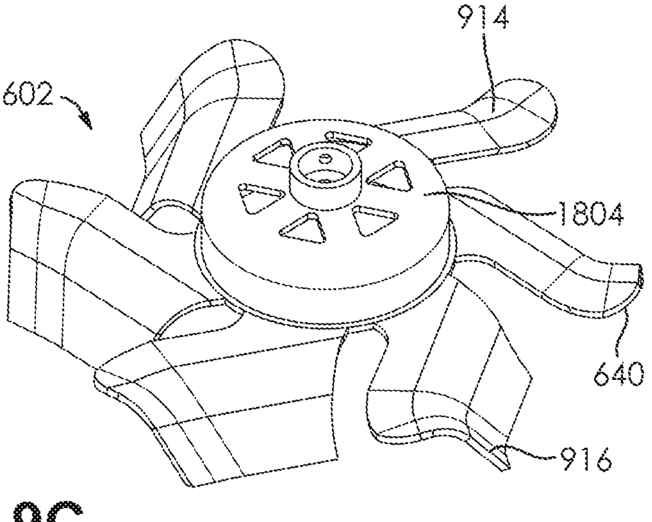

FIG. 9C

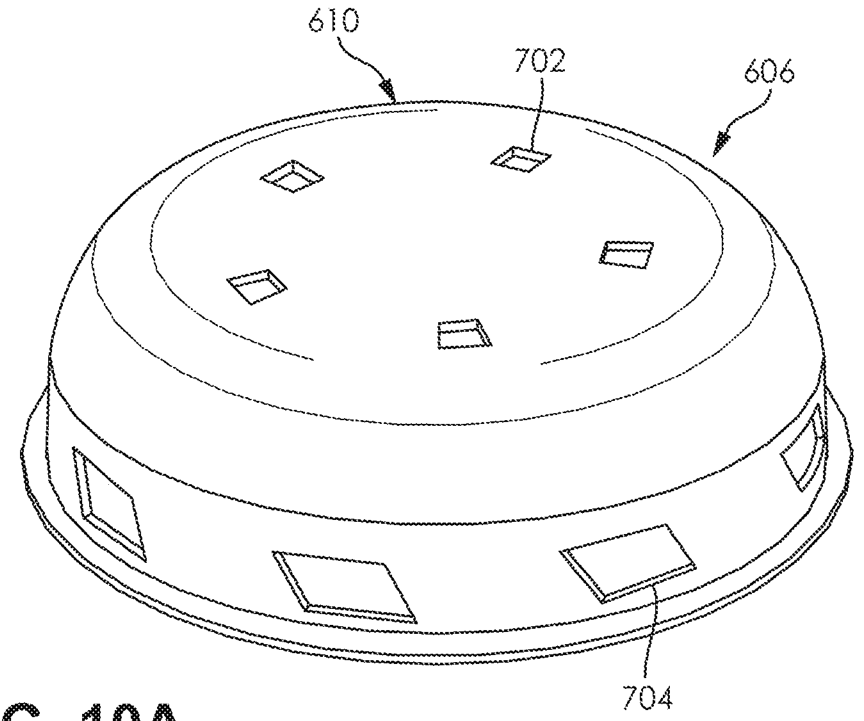

FIG. 10A

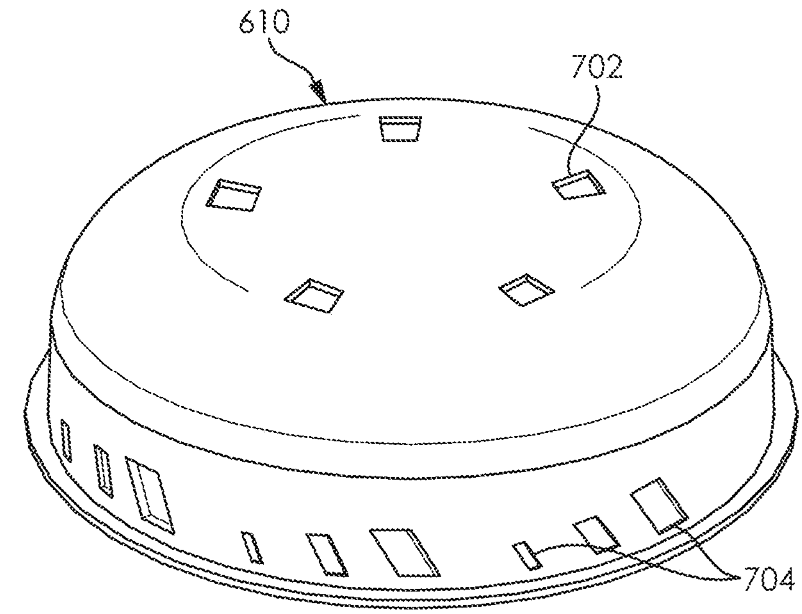

FIG. 10B

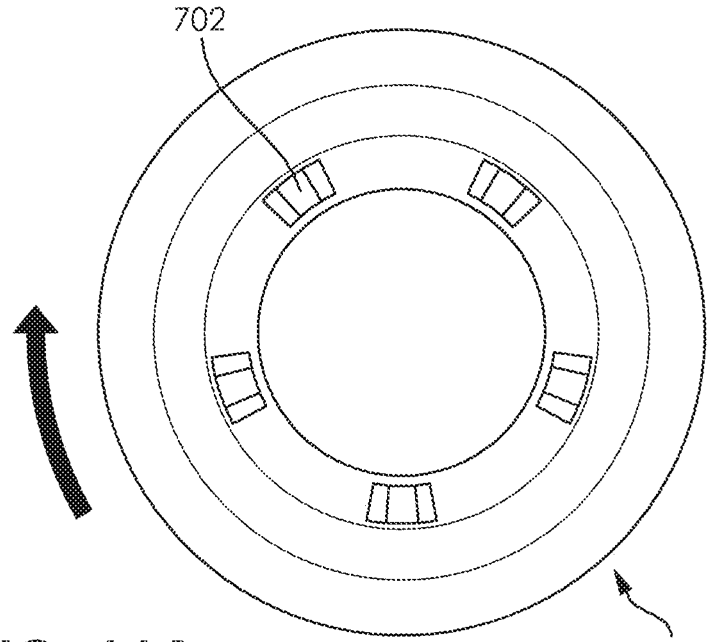

FIG. 11A

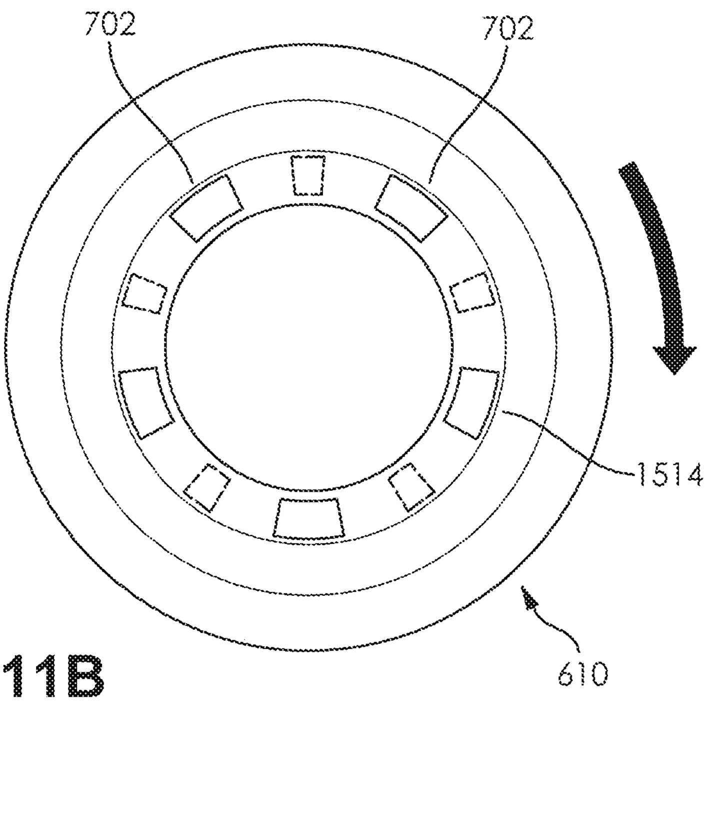

FIG. 11B

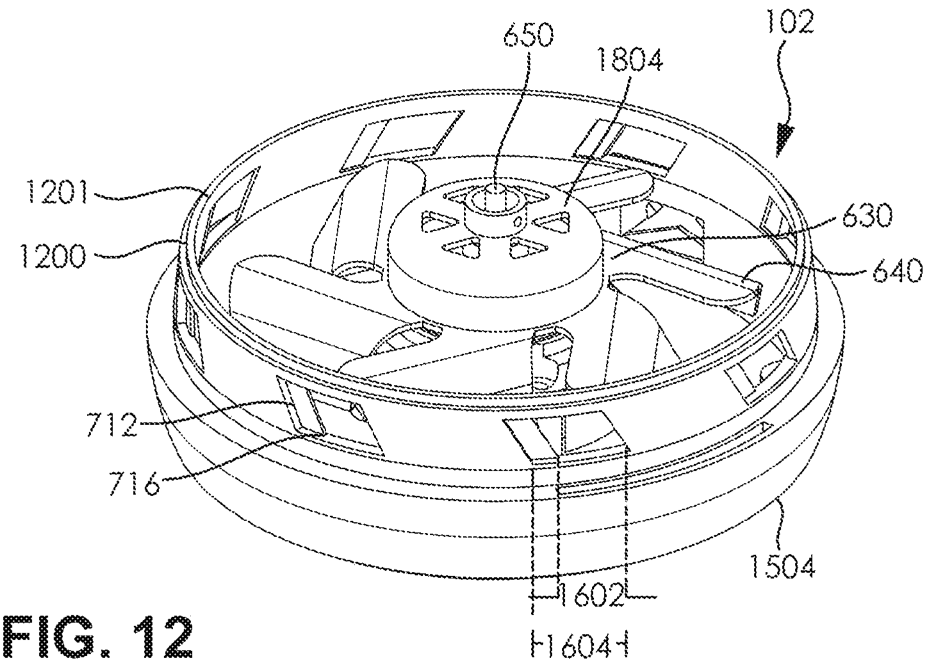

FIG. 12

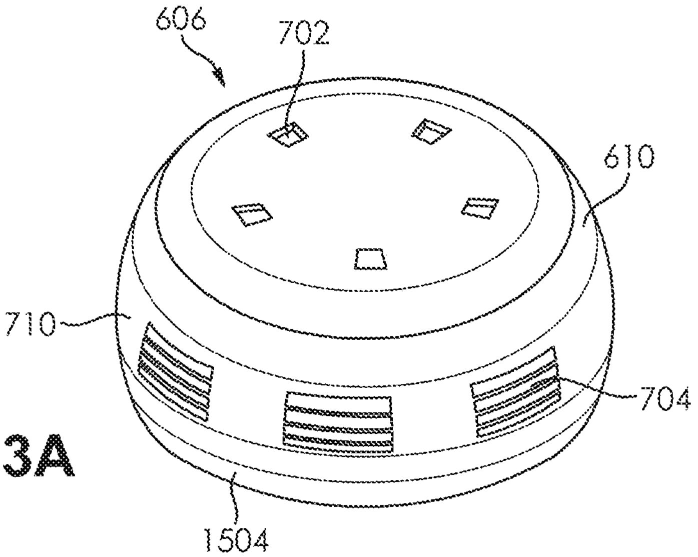

FIG. 13A

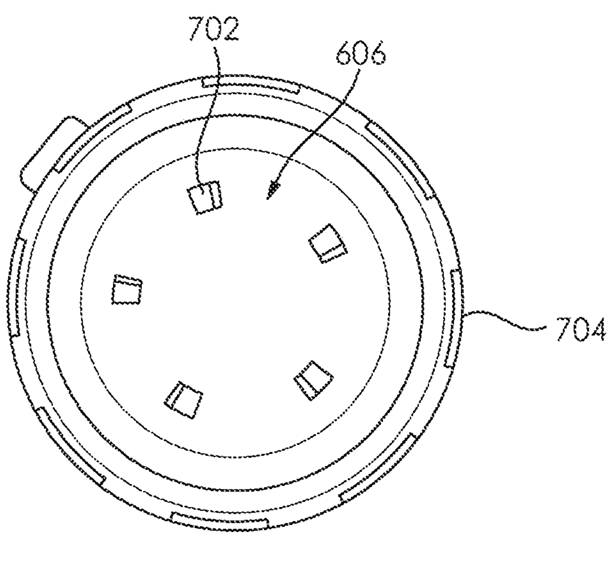

FIG. 13B

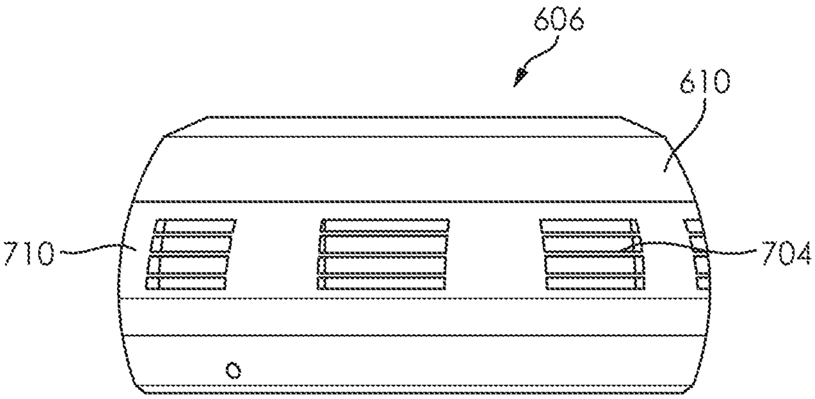

FIG. 13C

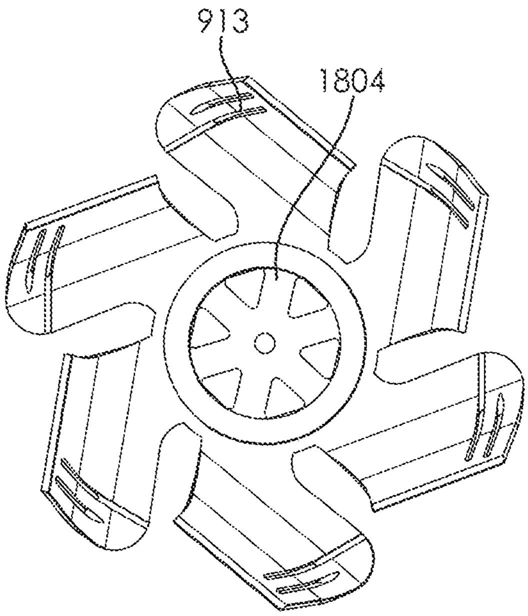

FIG. 14A

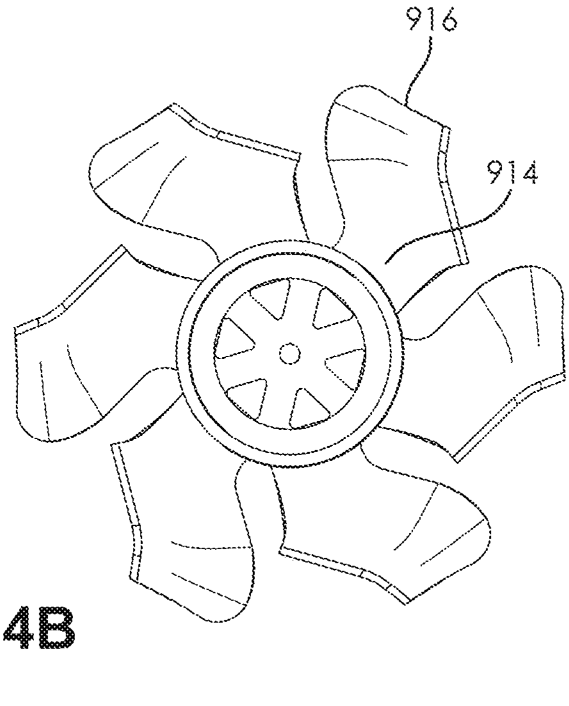

FIG. 14B

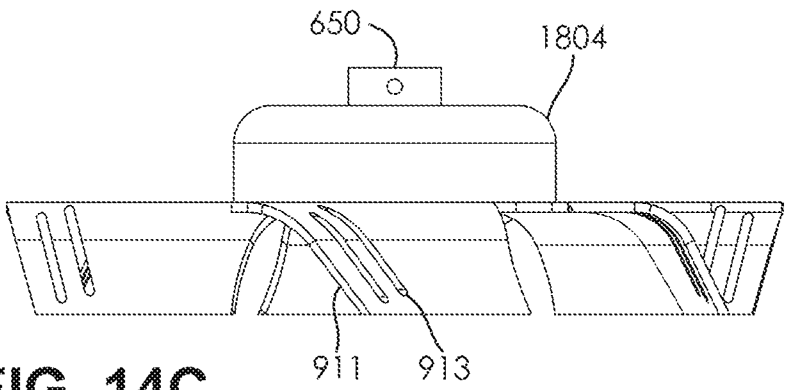

FIG. 14C

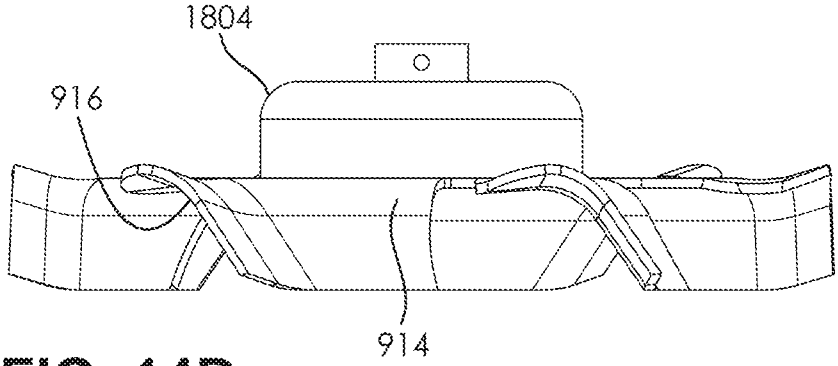

FIG. 14D

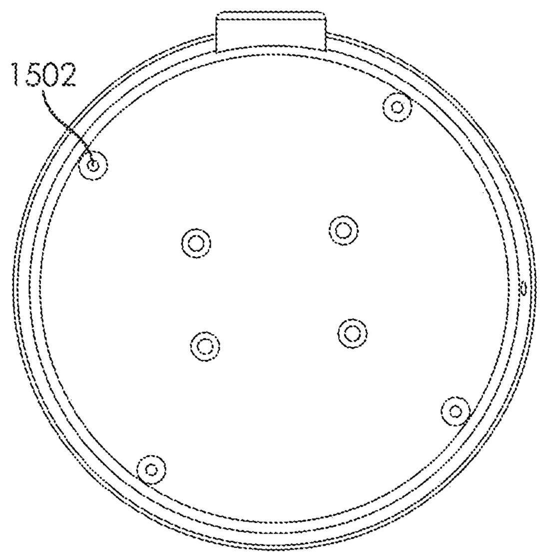

FIG. 15A

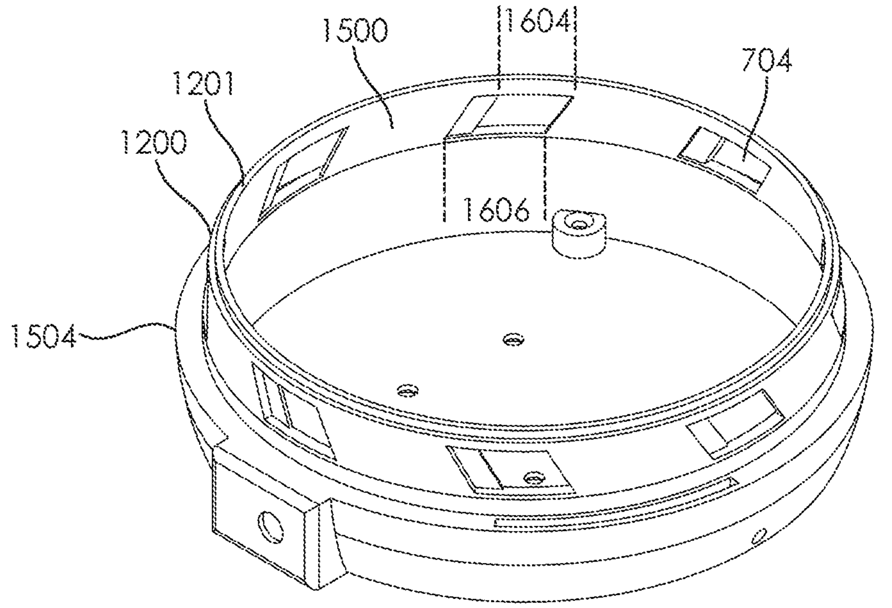

FIG. 15B

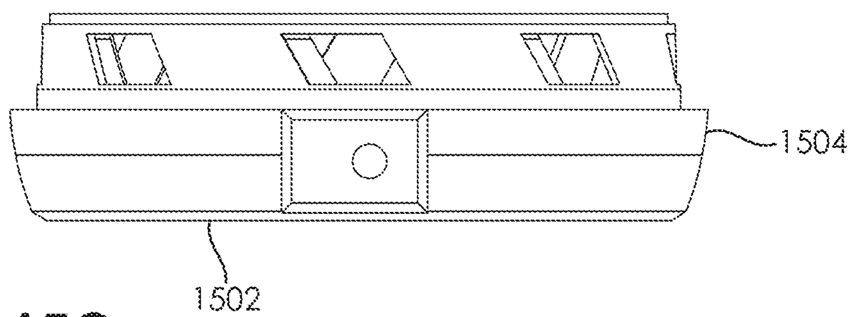

FIG. 15C

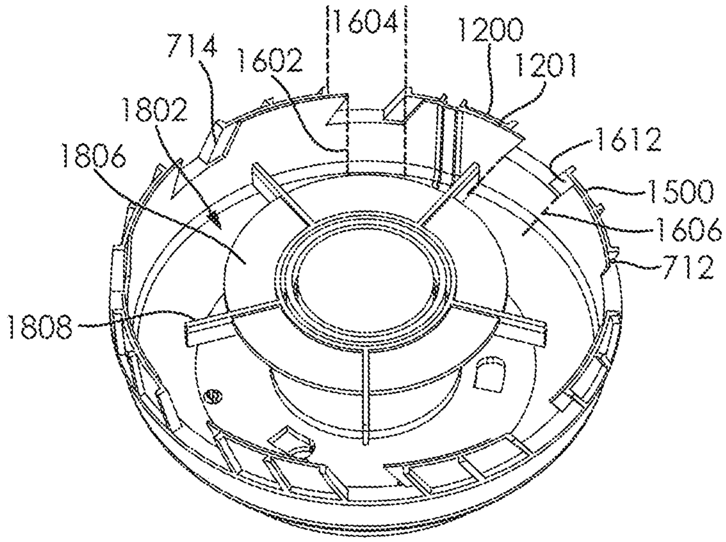

FIG. 16

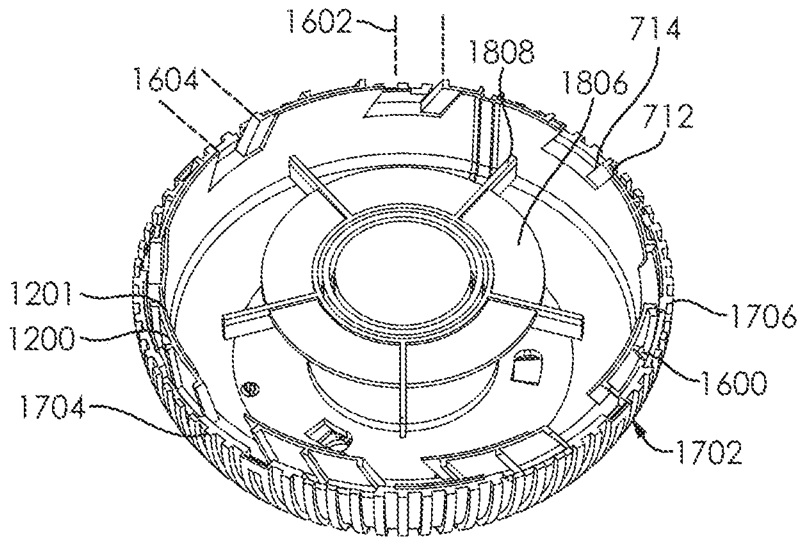

FIG. 17

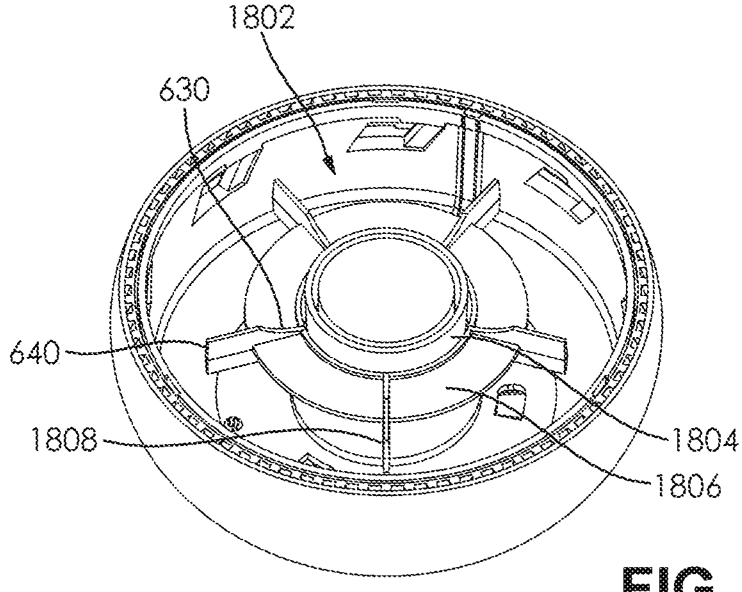

FIG. 18A

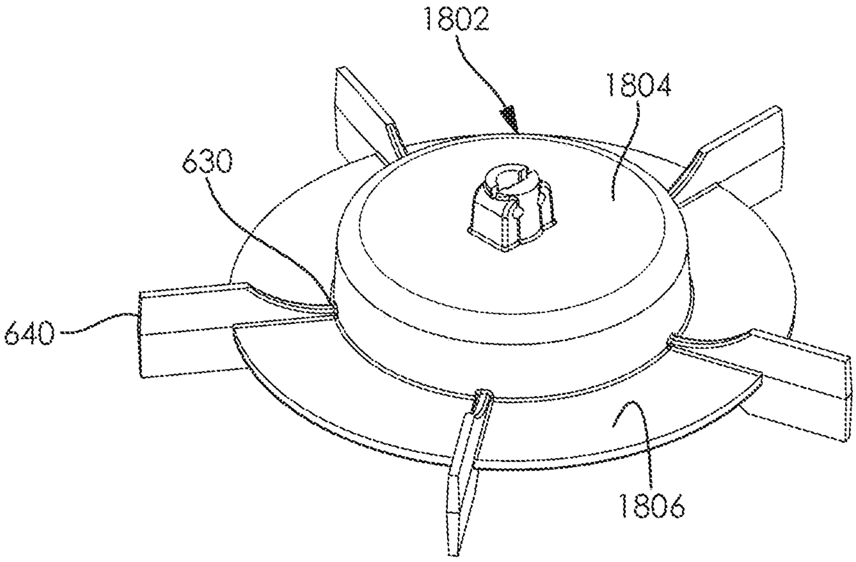

FIG. 18B

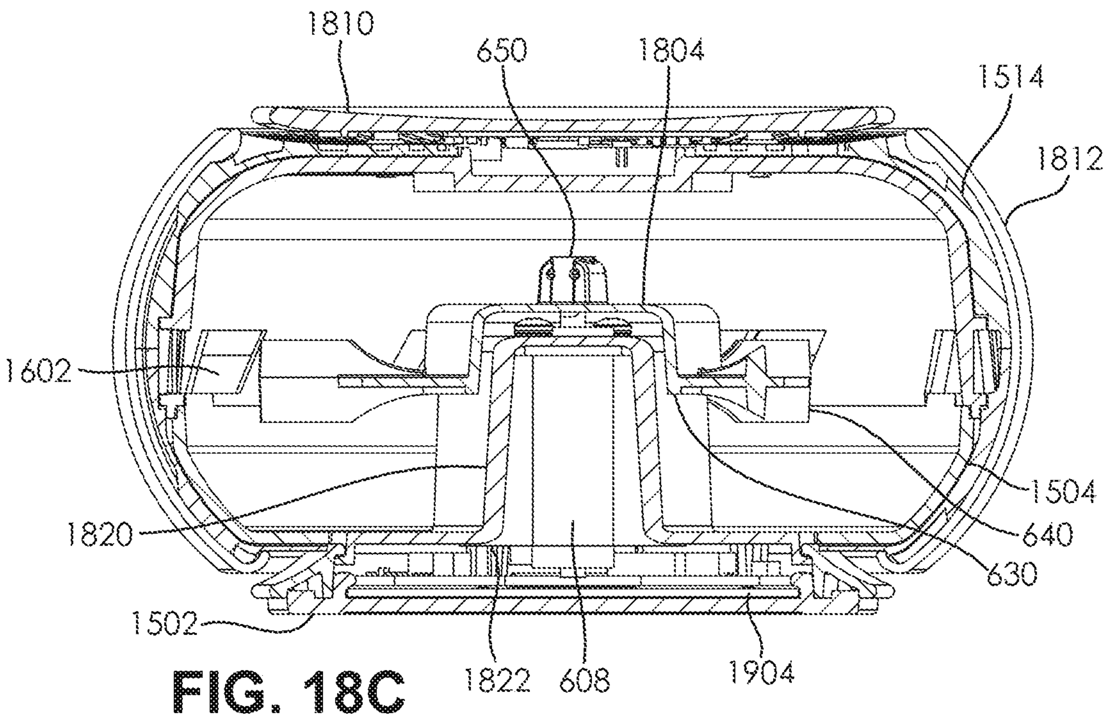

FIG. 18C

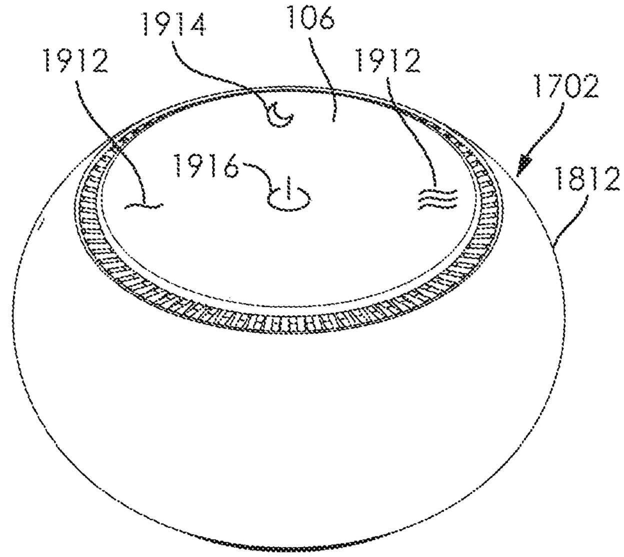

FIG. 18D

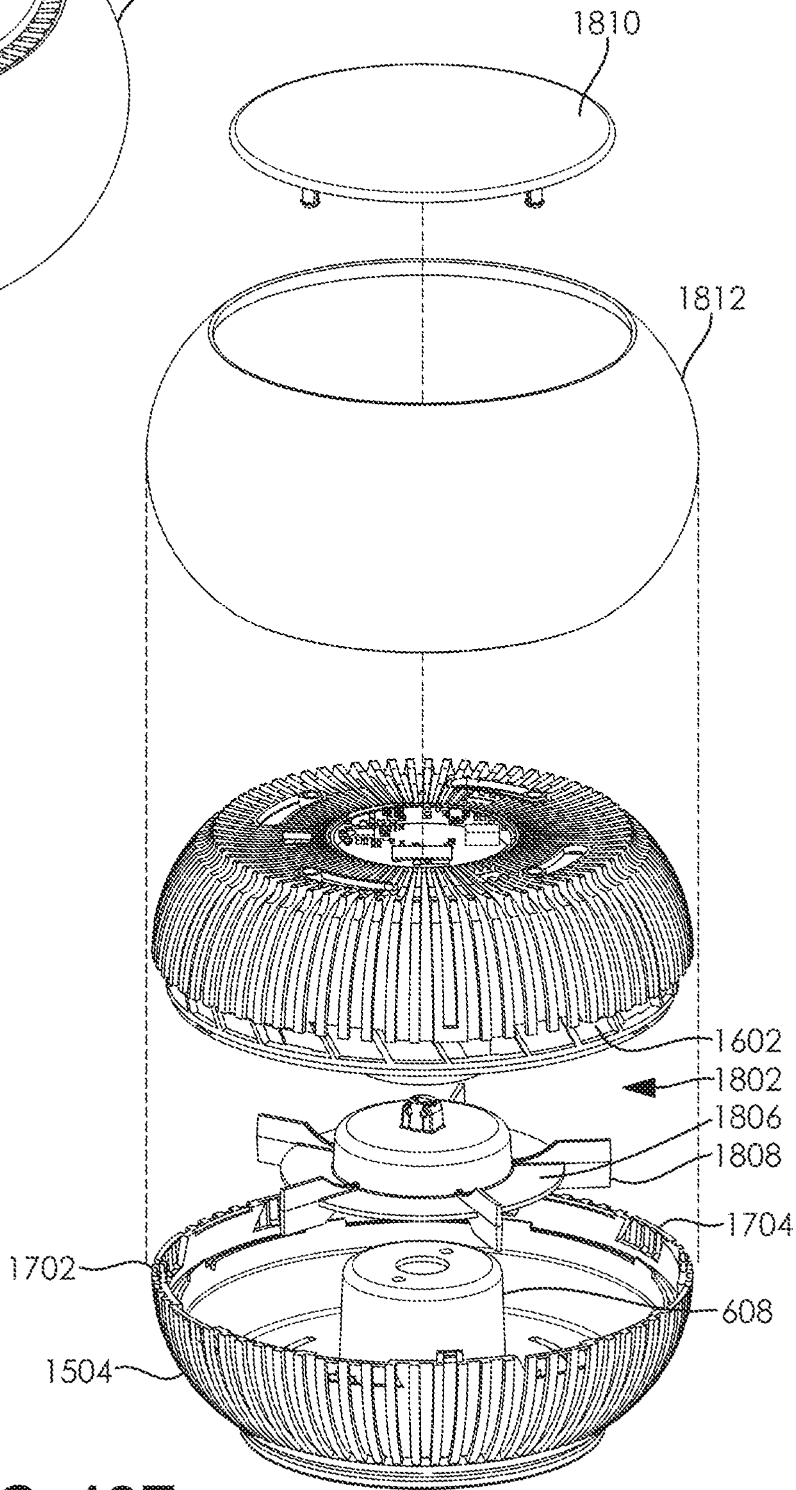

FIG. 18E

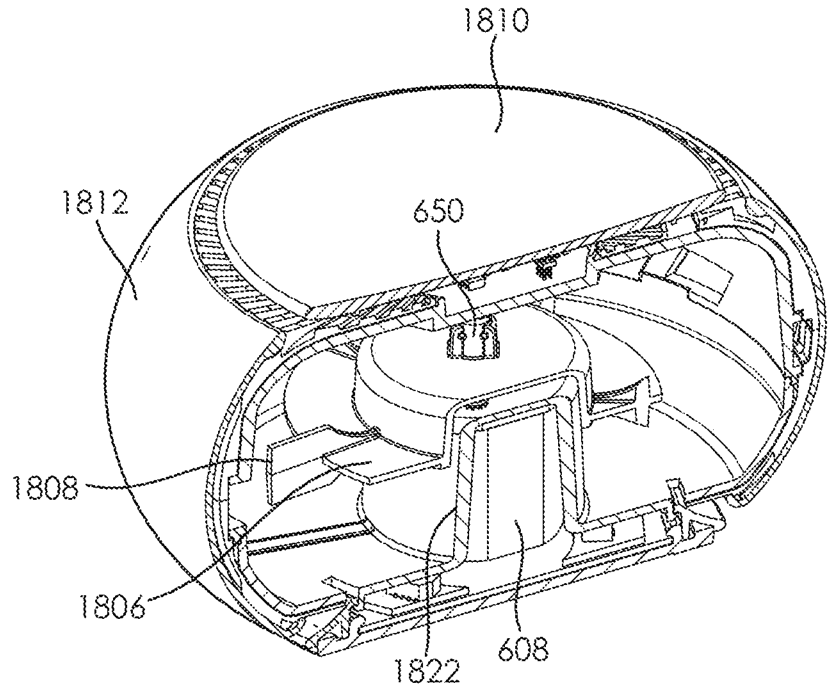

FIG. 18F

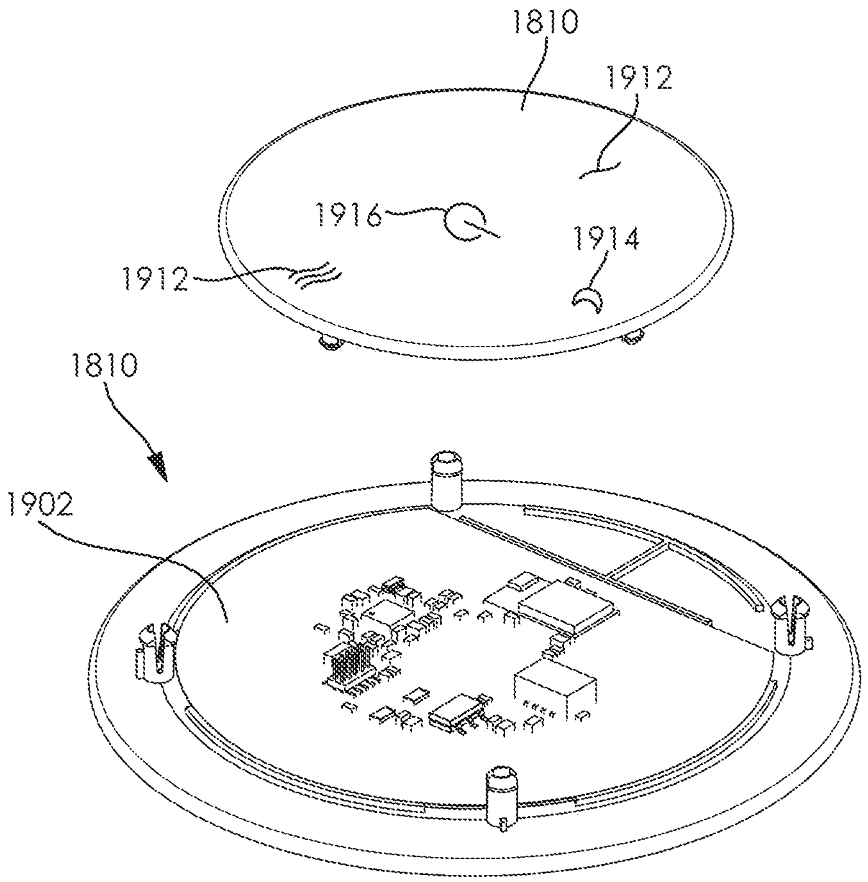

FIG. 19A

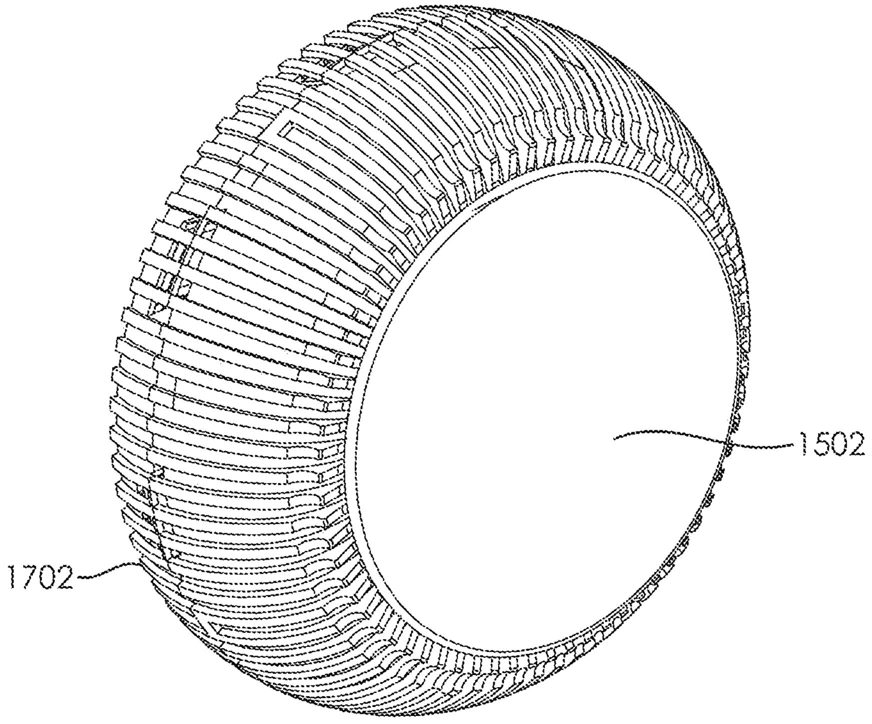

FIG. 19B

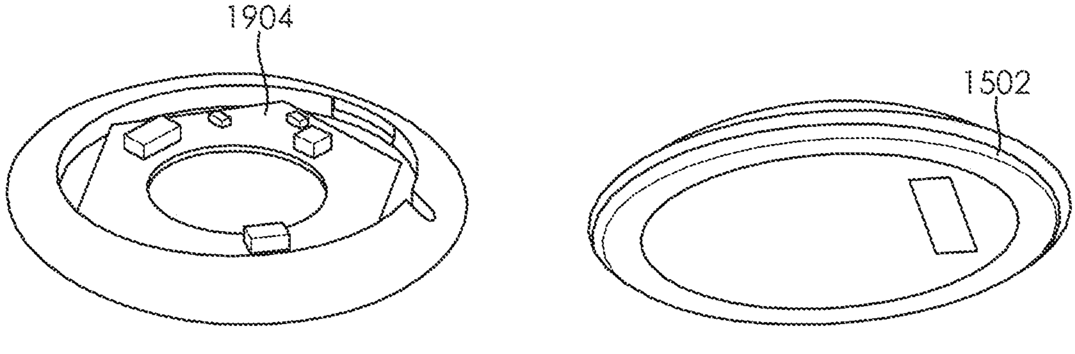

FIG. 19C

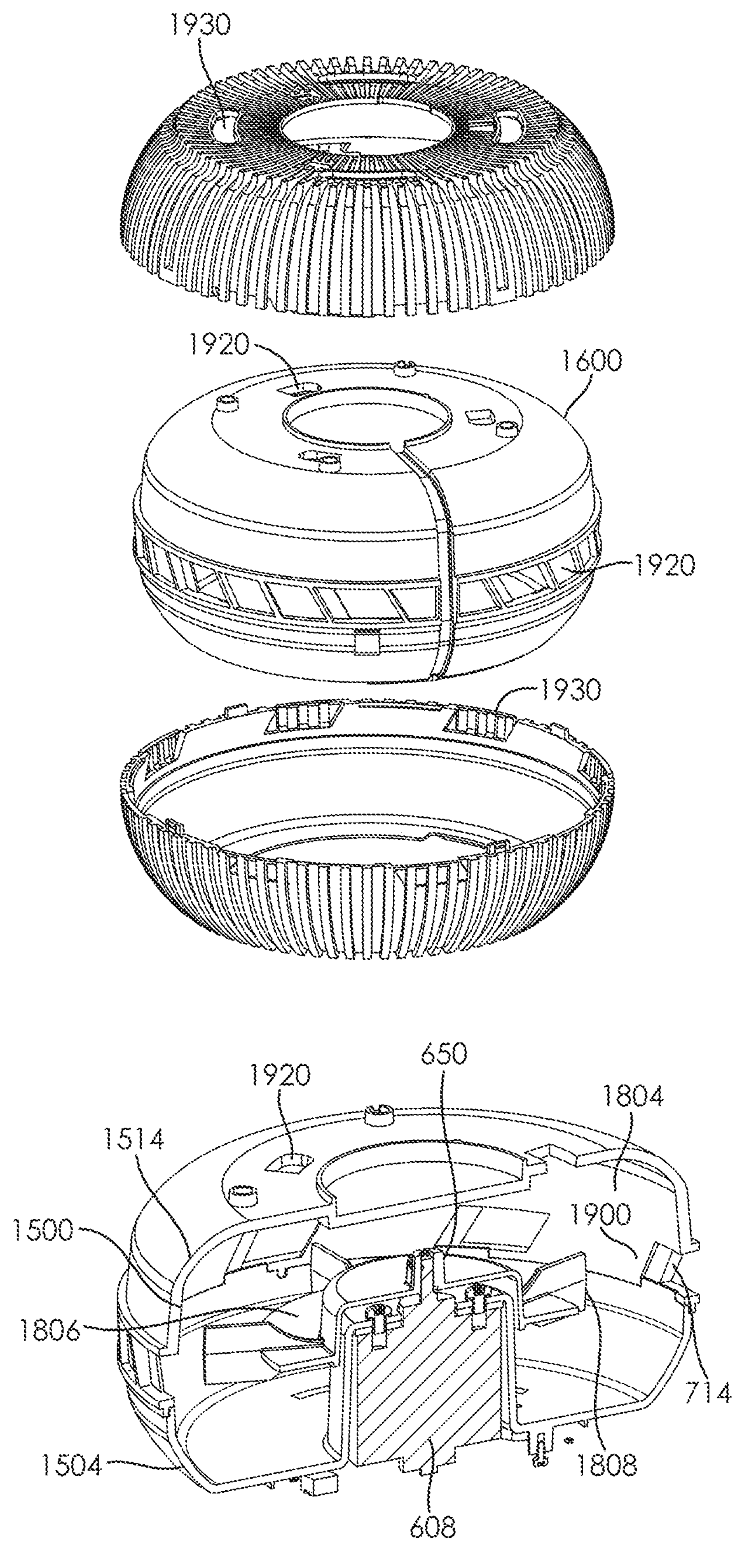
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FIG. 19D

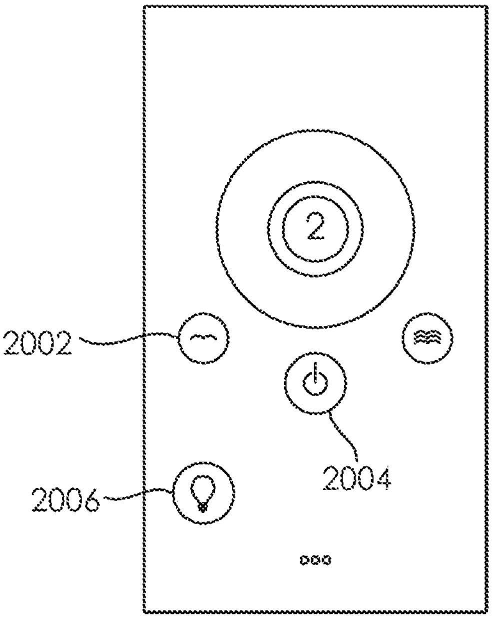


FIG. 20A

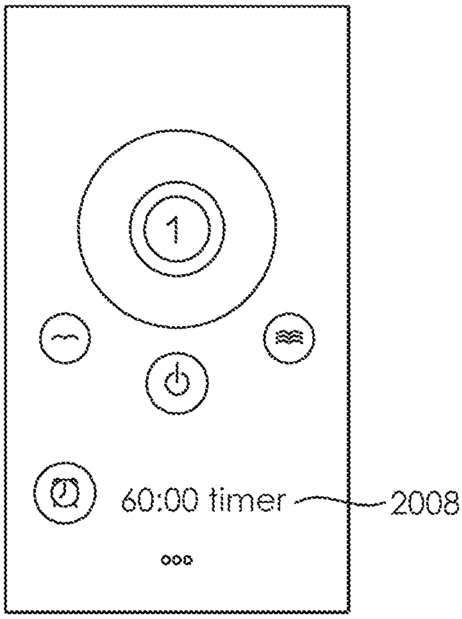


FIG. 20B

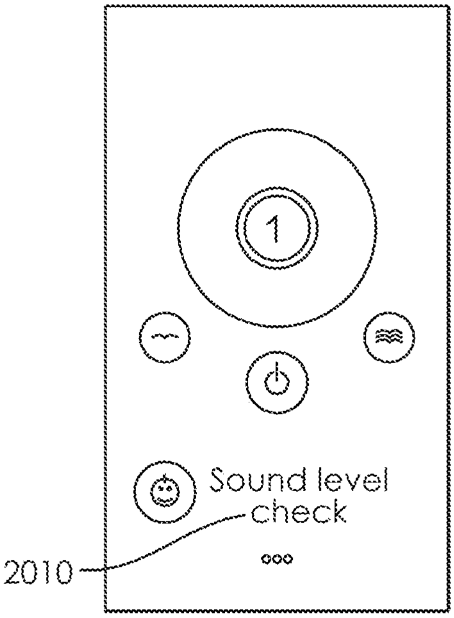


FIG. 20C

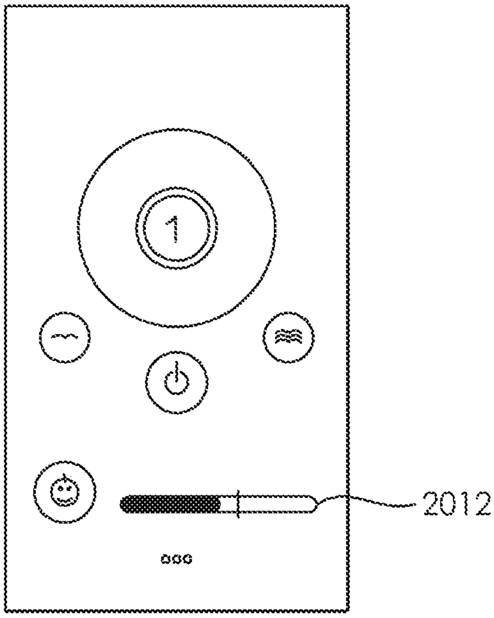
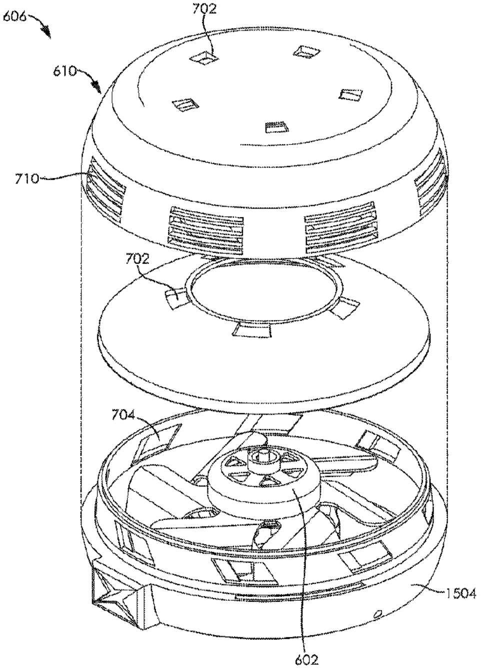


FIG. 20D



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