(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 706 234 A1

(12) # EUROPEAN PATENT APPLICATION

(43) Date of publication:
12.03.2014 Bulletin 2014/11

(51) Int Cl.:
F04B 39/00 *(2006.01)* ***F04B 39/12*** *(2006.01)*
F04B 41/02 *(2006.01)*

(21) Application number: **13183932.6**

(22) Date of filing: **11.09.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **11.09.2012 US 201213609331**
11.09.2012 US 201213609343

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(54) **Air ducting shroud for cooling an air compressor pump and motor**

(57) A compressor assembly having a sound reduction shroud and a sound level of 75 dBA or less when in a compressing state. The sound reduction shroud can be a cylinder head shroud, a pump cylinder shroud, or a pump assembly shroud. The sound reduction shroud can optionally cover one or more of a compressor pump assembly, a cylinder head and a compressed gas outlet line. A compressor assembly having a sound reduction conduit and a sound level of 75 dBA or less when in a compressing state. The sound reduction conduit provides a cooling air channel directing cooling air to cool one or more portions of the compressor assembly and can direct exhaust cooling air to an exhaust port. A method for compressing a gas at a sound level of 75 dBA or less when the compressor is in a compressing state using a sound reduction shroud or a sound reduction conduit.

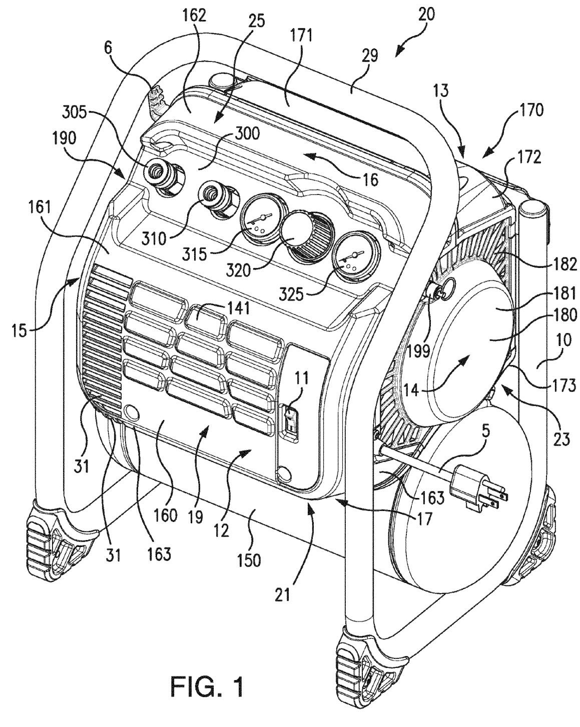

FIG. 1

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Description

[0001] The invention relates to a compressor for air, gas or gas mixtures.

[0002] Compressors are widely used in numerous applications. Existing compressors can generate a high noise output during operation. This noise can be annoying to users and can be distracting to those in the environment of compressor operation. Non-limiting examples of compressors which generate unacceptable levels of noise output include reciprocating, rotary screw and rotary centrifugal types. Compressors which are mobile or portable and not enclosed in a cabinet or compressor room can be unacceptably noisy. However, entirely encasing a compressor, for example in a cabinet or compressor room, is expensive, prevents mobility of the compressor and is often inconvenient or not feasible. Additionally, such encasement can create heat exchange and ventilation problems. There is a strong and urgent need for a quieter compressor technology.

[0003] When a power source for a compressor is electric, gas or diesel, unacceptably high levels of unwanted heat and exhaust gases can be produced. Additionally, existing compressors can be inefficient in cooling a compressor pump and motor. Existing compressors can use multiple fans, *e.g.* a compressor can have one fan associated with a motor and a different fan associated with a pump. The use of multiple fans adds cost manufacturing difficulty, noise and unacceptable complexity to existing compressors. Current compressors can also have improper cooling gas flow paths which can choke cooling gas flows to the compressor and its components. Thus, there is a strong and urgent need for a more efficient cooling design for compressors.

[0004] In one aspect of the invention there is a compressor assembly, comprising: a fan; pump assembly; a motor; a sound reduction shroud and / or a sound reduction conduit; and a sound level having a value of 75 dBA or less when the compressor assembly is in a compressing state.

[0005] Preferably the sound reduction shroud is a cylinder head shroud and the cylinder head shroud covers at least a portion of a cylinder head. Preferably the cylinder head shroud covers at least a portion of a cylinder head and at least a portion of a compressed gas outlet line. Preferably the cylinder head shroud can have a shroud coverage angle which is equal to or less than 45º. Preferably the sound reduction shroud is a pump cylinder shroud or a pump assembly shroud. Preferably wherein the pump cylinder shroud covers at least a portion of a cylinder head, at least a portion of a pump cylinder and / or at least a portion of a compressed gas outlet line. Preferably the pump cylinder shroud can have a shroud coverage angle which is in a range of 33º to 75º. Preferably the pump assembly shroud covers at least a portion of a cylinder head, at least a portion of a pump cylinder, at least a portion of the eccentric drive and / or at least a portion of a compressed gas outlet line. Preferably the pump assembly shroud can have a shroud coverage angle which is in a range of 45º to 90º.Preferably the pump assembly shroud, at least in part, provides a fillable space between the pump assembly shroud and a compressor housing into which a sound absorbing material can be placed, said fillable space filled at least in part with the sound absorbing material. Preferably the sound reduction conduit covers at least in part each of the eccentric drive, the pump assembly and the compressed gas outlet line. Preferably the sound reduction conduit provides a cooling air flow path which receives cooling air from the fan and which exhausts cooling air effluent in the direction of an exit port. Preferably the sound reduction conduit provides a cooling air channel which receives a cooling air from the fan and directs the cooling air to the motor, a cylinder head and a compressed gas outlet line.

[0006] In an embodiment, the compressor assembly disclosed herein can have a motor air duct having a blocking partition disposed along an inner surface thereof, the blocking partition configured to direct cooling air flow within the motor air duct, a conduit in flow communication with the motor air duct; and a motor cavity configured to accept a compressor assembly motor.

[0007] The air ducting shroud can have a plurality of blocking partitions. The air ducting shroud can have a blocking partition which is a front blocking partition that prevents a cooling air flow along a front portion of a pump assembly component. The air ducting shroud can have blocking partition which is a rear blocking partition that prevents a cooling air flow along a rear portion of a pump assembly component. The air ducting shroud can have three or more blocking partitions. The air ducting shroud can have four or more blocking partitions.

[0008] The air ducting shroud can have a ratio of the area of the internal cross-sectional area of the air ducting shroud to the conduit feed port and can have a value in a range of 2:1 to 50:1. The air ducting shroud according to claim 1 can have a ratio of the area of the internal cross-sectional area of the air ducting shroud to the conduit feed port can have a value greater than 11:1.

[0009] A compressor assembly can have a fan, a pump assembly, a motor and a sound reduction shroud. The compressor can have a sound level of 75 dBA or less when the compressor is in a compressing state. In an embodiment, the sound reduction shroud can be a cylinder head shroud which can cover at least a portion of a cylinder head. In another embodiment, the cylinder head shroud can cover at least a portion of the cylinder head and at least a portion of a compressed gas outlet line. The cylinder head shroud can have a shroud coverage angle of 0º to 45º, or equal to or less than 45º.

[0010] In an embodiment, the sound reduction shroud can be a pump cylinder shroud which can cover at least a portion of the cylinder head and at least a portion of a pump cylinder. In another embodiment, the pump cylinder shroud can cover at least a portion of the cylinder head, at least a portion of the pump cylinder and at least a portion of the compressed gas outlet line. The pump cylinder shroud can have a shroud coverage angle which is in a range of 33º to 75º.

[0011] In an embodiment, the sound reduction shroud can be a pump assembly shroud which can cover at least a portion of the cylinder head and at least a portion of the pump cylinder and at least a portion of the eccentric drive. In another embodiment, the pump assembly shroud can cover at least a portion of the cylinder head and at least a portion of the pump cylinder and at least a portion of the eccentric drive and at least a portion of the compressed gas outlet line. The pump assembly shroud can have a shroud coverage angle which is in a range of 45º to 90º, or greater than 90º.

[0012] In an embodiment, the pump assembly shroud can at least in part provide a fillable space between the pump assembly shroud and a compressor housing into which a sound absorbing material can be placed. The fillable space can be filled at least in part with the sound absorbing material.

[0013] In an embodiment, a compressor assembly can have the fan, the pump assembly and a sound reduction conduit. The sound reduction conduit can cover at least in part each of the eccentric drive, the pump assembly and the compressed gas outlet line. In another embodiment, the sound reduction conduit can provide a cooling air flow path which can receive cooling air from the fan and which can exhaust cooling air effluent in the direction of an exit port. In yet another embodiment, the sound reduction conduit can provide a cooling air channel which can receive a cooling air from the fan and can direct the cooling air to the motor, the cylinder head and the compressed gas outlet line.

[0014] In an embodiment, a method for compressing a gas can have the steps of: providing a compressor assembly having a motor, a pump assembly, a cylinder head and a compressed gas outlet line; providing a sound reduction shroud which covers at least a portion of the cylinder head; using the sound reduction shroud to direct toward an exhaust port at least a portion of a cooling air which flow across the cylinder head. In an embodiment, the method for compressing a gas can have the step of using the sound reduction shroud to direct at least a portion of a cooling air which flows across the motor in a direction toward an exhaust port.

[0015] The present invention in its several aspects and embodiments solves the problems discussed above and significantly advances the technology of compressors. The present invention can become more fully understood from the detailed description and the accompanying drawings, wherein:

FIG. 1 is a perspective view of a compressor assembly;

FIG. 2 is a front view of internal components of the compressor assembly;

FIG. 3 is a front sectional view of the motor and fan assembly;

FIG. 4 is a pump-side view of components of the pump assembly;

FIG. 5 is a fan-side perspective of the compressor assembly;

FIG. 6 is a rear perspective of the compressor assembly;

FIG. 7 is a rear view of internal components of the compressor assembly;

FIG. 7A is a rear view of an embodiment of a sound reduction shroud;

FIG. 8 is a rear sectional view of the compressor assembly;

FIG. 8A is a rear sectional view of the compressor assembly having the sound reduction shroud;

FIG. 9 is a top view of components of the pump assembly;

FIG. 10 is a top sectional view of the pump assembly;

FIG. 11 is an exploded view of the air ducting shroud;

FIG. 12 is a rear view of a valve plate assembly;

FIG. 13 is a cross-sectional view of the valve plate assembly;

FIG. 14 is a front view of the valve plate assembly;

FIG. 15A is a perspective view of sound control chambers of the compressor assembly;

FIG. 15B is a perspective view of sound control chambers having optional sound absorbers;

FIG. 16A is a perspective view of sound control chambers with an air ducting shroud;

FIG. 16B is a perspective view of sound control chambers having optional sound absorbers;

FIG. 17 is a first table of embodiments of compressor assembly ranges of performance characteristics;

FIG. 18 is a second table of embodiments of compressor assembly ranges of performance characteristics;

FIG. 19 is a first table of example performance characteristics for an example compressor assembly;

FIG. 20 is a second table of example performance characteristics for an example compressor assembly;

FIG. 21 is a table containing a third example of performance characteristics of an example compressor assembly;

FIG. 22 is a perspective view of the outer top side of an upper air ducting shroud;

FIG. 23 is a perspective view of the inner motor side of the upper air ducting shroud;

FIG. 24 is a fan-side view of the upper air ducting shroud;

FIG. 25 is a view of the outer top side of an upper air ducting shroud;

FIG. 26 is a view of the inner motor side of the upper air ducting shroud;

FIG. 27 is a pump-side view of the upper air ducting shroud;

FIG. 28 is a perspective view of the inner motor side of a lower air ducting shroud;

FIG. 29 is a perspective view of the outer bottom side of a lower air ducting shroud;

FIG. 30 is a fan-side view of the lower air ducting shroud;

FIG. 31 is a view of the outer bottom side of a lower air ducting shroud;

FIG. 32 is a view of the inner motor side of a lower air ducting shroud;

FIG. 33 is a pump-side view of the lower air ducting shroud;

FIG. 34 is a sectional view of the inner motor side of a rear section of an air ducting shroud with angled partitions;

FIG. 35 is a perspective view of the inner motor side of a lower section of an air ducting shroud with angled partitions;

FIG. 36 is a perspective of a fan-side view of the air ducting shroud; and

FIG. 37 is a perspective of a pump-side view of the air ducting shroud.

FIG. 38A is a top view of a cylinder head shroud;

FIG. 38B is a top view of a pump cylinder shroud;

FIG. 38C is a top view of a pump assembly shroud;

FIG. 38D is a top view of a pump assembly shroud encased in a sound absorbing material;

FIG. 39 is an exploded view of the air ducting shroud having the cylinder head shroud;

FIG. 40A is a perspective of a pump-side view of the cylinder head shroud;

FIG. 40B is a perspective of a pump-side view of the pump cylinder shroud;

FIG. 40C is a perspective of a pump-side view of the pump assembly shroud;

FIG. 41 is a pump end view of the sound reduction shroud having a fan shape;

FIG. 42 is a sectional top view of components of the pump assembly showing a sound reduction conduit;

FIG. 43 is a fan-side view of a sound reduction conduit;

FIG. 44 is a sectional view of the motor and cooling air flow paths having a sound reduction conduit.

[0016] Herein, like references numbers in one figure refer to like reference numbers in another figure.

[0017] The invention relates to a compressor assembly which can compress air, or gas, or gas mixtures, and which has a low noise output, effective cooling means and high heat transfer. The inventive compressor assembly achieves efficient cooling of the compressor assembly **20** (FIG. 1) and/or pump assembly **25** (FIG. 2) and/or the components thereof (FIGS. 3 and 4). In an embodiment, the compressor can compress air. In another embodiment, the compressor can compress one or more gases, inert gases, or mixed gas compositions. The disclosure herein regarding compression of air is also applicable to the use of the disclosed apparatus in its many embodiments and aspects in a broad variety of services and can be used to compress a broad variety of gases and gas mixtures.

[0018] FIG. 1 is a perspective view of a compressor assembly **20** shown according to the invention. In an embodiment, the compressor assembly **20** can compress air, or can compress one or more gases, or gas mixtures. In an embodiment, the compressor assembly **20** is also referred to hearing herein as "a gas compressor assembly" or "an air compressor assembly".

[0019] The compressor assembly **20** can optionally be portable. The compressor assembly **20** can optionally have a handle **29,** which optionally can be a portion of frame **10.**

[0020] In an embodiment, the compressor assembly **20** can have a value of weight between 15 lbs and 100 lbs. In an embodiment, the compressor assembly **20** can be portable and can have a value of weight between 15 lbs and 50 lbs. In an embodiment, the compressor assembly **20** can have a value of weight between 25 lbs and 40 lbs. In an embodiment, the compressor assembly **20** can have a value of weight of, *e.g.* 38 lbs, or 29 lbs, or 27 lbs, or 25 lbs, or 20 lbs, or less. In an embodiment, frame **10** can have a value of weight of 10 lbs or less. In an embodiment, frame **10** can weigh 5 lbs, or less, *e.g.* 4 lbs, or 3 lbs, of 2 lbs, or less.

[0021] In an embodiment, the compressor assembly **20** can have a front side **12** ("front"), a rear side **13** ("rear"), a fan side **14** ("fan-side"), a pump side **15** ("pump-side"), a top side **16** ("top") and a bottom side **17** ("bottom").

[0022] The compressor assembly **20** can have a housing **21** which can have ends and portions which are referenced herein by orientation consistently with the descriptions set forth above. In an embodiment, the housing **21** can have a front housing **160,** a rear housing **170,** a fan-side housing **180** and a pump-side housing **190.** The front housing **160** can have a front housing portion **161,** a top front housing portion **162** and a bottom front housing potion **163.** The rear housing **170** can have a rear housing portion **171,** a top rear housing portion **172** and a bottom rear housing portion **173.** The fan-side housing **180** can have a fan cover **181** and a plurality of intake ports **182.** The compressor assembly can be cooled by air flow provided by a fan **200** (FIG. 3), *e.g.* cooling air stream **2000** (FIG. 3).

[0023] In an embodiment, the housing **21** can be compact and can be moulded. The housing **21** can have a construction at least in part of plastic, or polypropylene, acrylonitrile butadiene styrene (ABS), metal, steel, stamped steel, fibreglass, thermoset plastic, cured resin, carbon fibber, or other material. The frame **10** can be made of metal, steel, aluminium, carbon fibber, plastic or fibreglass.

[0024] Power can be supplied to the motor of the compressor assembly through a power cord **5** extending through the fan-side housing **180.** In an embodiment, the compressor assembly **20** can comprise one or more of a cord holder member, *e.g.* first cord wrap **6** and second cord wrap **7** (FIG. 2).

[0025] In an embodiment, power switch **11** can be used to change the operating state of the compressor assembly **20** at least from an "on" to an "off" state, and *vice versa.* In an "on" state, the compressor can be in a compressing state (also herein as a "pumping state") in which it is compressing air, or a gas, or a plurality of gases, or a gas mixture.

[0026] In an embodiment, other operating modes can be engaged by power switch **11** or a compressor control system, *e.g.* a standby mode, or a power save mode. In an embodiment, the front housing **160** can have a dashboard **300** which provides an operator-accessible location for connections, gauges and valves which can be connected to a manifold **303** (FIG. 7). In an embodiment, the dashboard **300** can provide an operator access in non-limiting example to a first quick connection **305,** a second quick connection **310,** a regulated pressure gauge **315,** a pressure regulator **320** and a tank pressure gauge **325.** In an embodiment, a compressed gas outlet line, hose or other device to receive compressed gas can be connected the first quick connection **305** and/or second quick connection **310.** In an embodiment, as shown in FIG. 1, the frame can be configured to provide an amount of protection to the dashboard **300** from the impact of objects from at least the pump-side, fan-side and top directions.

[0027] In an embodiment, the pressure regulator **320** employs a pressure regulating valve. The pressure regulator **320** can be used to adjust the pressure regulating valve **26** (FIG. 7). The pressure regulating valve **26** can be set to establish a desired output pressure. In an embodiment, excess air pressure can be can vented to atmosphere through the pressure regulating valve **26** and/or pressure relief valve **199** (FIG. 1). In an embodiment, pressure relief valve **199** can be a spring loaded safety valve. In an embodiment, the air compressor assembly **20** can be designed to provide an unregulated compressed air output.

[0028] In an embodiment, the pump assembly **25** and the compressed gas tank **150** can be connected to frame **10.** The pump assembly **25,** housing **21** and compressed gas tank **150** can be connected to the frame **10** by a plurality of screws and/or one or a plurality of welds and/or a plurality of connectors and/or fasteners.

[0029] The plurality of intake ports **182** can be formed in the housing **21** adjacent the housing inlet end **23** and a plurality of exhaust ports **31** can be formed in the housing **21.** In an embodiment, the plurality of the exhaust ports **31** can be placed in housing **21** in the front housing portion **161.** Optionally, the exhaust ports **31** can be located adjacent to the pump end of housing **21** and/or the pump assembly **25** and/or the pump cylinder **60** and/or cylinder head **61** (FIG. 2) of the pump assembly **25.** In an embodiment, the exhaust ports **31** can be provided in a portion of the front housing portion **161** and in a portion of the bottom front housing portion **163.**

[0030] The total cross-sectional open area of the intake ports **182** (the sum of the cross-sectional areas of the individual intake ports **182)** can be a value in a range of from 3.0 in^2 to 100 in^2. In an embodiment, the total cross-sectional open area of the intake ports **182** can be a value in a range of from 6.0 in^2 to 38.81 in^2. In an embodiment, the total cross-sectional open area of the intake ports **182** can be a value in a range of from 9.8 in^2 to 25.87 in^2. In an embodiment, the total cross-sectional open area of the intake ports **182** can be 12.936 in^2.

[0031] In an embodiment, the cooling gas employed to cool compressor assembly 20 and its components can be air (also known herein as "cooling air"). The cooling air can be taken in from the environment in which the compressor assembly **20** is placed. The cooling air can be ambient from the natural environment, or air which has been conditioned or treated. The definition of "air" herein is intended to be very broad. The term "air" includes breathable air, ambient air, treated air, conditioned air, clean room air, cooled air, heated air, non-flammable oxygen containing gas, filtered air, purified air, contaminated air, air with particulates solids or water, air from bone dry (*i.e.* 0.00 humidity) air to air which is supersaturated with water, as well as any other type of air present in an environment in which a gas (*e.g.* air) compressor can be used. It is intended that cooling gases which are not air are encompassed by this disclosure. For non-limiting example, a cooling gas can be nitrogen, can comprise a gas mixture, can comprise nitrogen, can comprise oxygen (in a safe concentration), can comprise carbon dioxide, can comprise one inert gas or a plurality of inert gases, or comprise a mixture of gases.

[0032] In an embodiment, cooling air can be exhausted from compressor assembly **20** through a plurality of exhaust ports **31.** The total cross-sectional open area of the exhaust ports **31** (the sum of the cross-sectional areas of the individual exhaust ports **31)** can be a value in a range of from 3.0 in^2 to 100 in^2. In an embodiment, the total cross-sectional open area of the exhaust ports can be a value in a range of from 3.0 in^2 to 77.62 in^2. In an embodiment, the total cross-sectional open area of the exhaust ports can be a value in a range of from 4.0 in^2 to 38.81 in^2. In an embodiment, the total cross-sectional open area of the exhaust ports can be a value in a range of from 4.91 in^2 to 25.87 in^2. In an embodiment, the total cross-sectional open area of the exhaust ports can be 7.238 in^2.

[0033] Numeric values and ranges herein, unless otherwise stated, also are intended to have associated with them a tolerance and to account for variances of design and manufacturing, and/or operational and performance fluctuations. Thus, a number disclosed herein is intended to disclose values "about" that number. For example, a value X is also intended to be understood as "about X". Likewise, a range of Y-Z is also intended to be understood as within a range of from "about Y-about Z". Unless otherwise stated, significant digits disclosed for a number are not intended to make the number an exact limiting value. Variance and tolerance, as well as operational or performance fluctuations, are an expected aspect of mechanical design and the numbers disclosed herein are intended to be construed to allow for such factors (in non-limiting *e.g.*, ± 10 percent of a given value). This disclosure is to be broadly construed. Likewise, the claims are to be broadly construed in their recitations of numbers and ranges.

[0034] The compressed gas tank **150** can operate at a value of pressure in a range of at least from ambient pressure, *e.g.* 14.7 psig to 3000 psig ("psig" is the unit lbf/in^2 gauge), or greater. In an embodiment, compressed gas tank **150** can operate at 200 psig. In an embodiment, compressed gas tank **150** can operate at 150 psig.

[0035] In an embodiment, the compressor has a pressure regulated on/off switch which can stop the pump when a set pressure is obtained. In an embodiment, the pump is activated when the pressure of the compressed gas tank **150** falls to 70 percent of the set operating pressure, *e.g.* to activate at 140 psig with an operating set pressure of 200 psig (140 psig = 0.70*200 psig). In an embodiment, the pump is activated when the pressure of the compressed gas tank **150** falls to 80 percent of the set operating pressure, *e.g.* to activate at 160 psig with an operating set pressure of 200 psig (160 psig = 0.80*200 psig). Activation of the pump can occur at a value of pressure in a wide range of set operating pressure, *e.g.* 25 percent to 99.5 percent of set operating pressure. Set operating pressure can also be a value in a wide range of pressure, *e.g.* a value in a range of from 25 psig to 3000 psig. An embodiment of set pressure can be 50 psig, 75 psig, 100 psig, 150 psig, 200 psig, 250 psig, 300 psig, 500 psig, 1000 psig, 2000 psig, 3000 psig, or greater than or less than, or a value in between these example numbers.

[0036] The compressor assembly **20** disclosed herein in its various embodiments achieves a reduction in the noise created by the vibration of the air tank while the air compressor is running, in its compressing state (pumping state) *e.g.* to a value in a range of from 60-75 dBA, or less, as measured by ISO3744-1995. Noise values discussed herein are compliant with ISO3744-1995. ISO3744-1995 is the standard for noise data and results for noise data, or sound data, provided in this application. Herein "noise" and "sound" are used synonymously.

[0037] The pump assembly **25** can be mounted to an air tank and can be covered with a housing **21.** A plurality of optional decorative shapes **141** can be formed on the front housing portion **161.** The plurality of optional decorative shapes **141** can also be sound absorbing and/or vibration dampening shapes. The plurality of optional decorative shapes **141** can optionally be used with, or contain at least in part, a sound absorbing material.

[0038] FIG. 2 is a front view of internal components of the compressor assembly.

[0039] The compressor assembly **20** can include a pump assembly **25.** In an embodiment, pump assembly **25** which can compress a gas, air or gas mixture. In an embodiment in which the pump assembly **25** compresses air, it is also referred to herein as air compressor **25,** or compressor **25.** In an embodiment, the pump assembly **25** can be powered by a motor **33** (*e.g.* FIG. 3).

[0040] FIG. 2 illustrates the compressor assembly **20** with a portion of the housing **21** removed and showing the pump assembly **25.** In an embodiment, the fan-side housing **180** can have a fan cover **181** and a plurality of intake ports **182.** The cooling gas, for example air, can be fed through an air inlet space **184** which feeds air into the fan **200** (*e.g.* FIG. 3). In an embodiment, the fan **200** can be housed proximate to an air intake port **186** of an air ducting shroud **485.**

[0041] Air ducting shroud **485** can have a shroud inlet scoop **484.** As illustrated in FIG. 2, air ducting shroud **485** is shown encasing the fan **200** and the motor **33** (FIG. 3). In an embodiment, the shroud inlet scoop **484** can encase the fan **200,** or at least a portion of the fan and at least a portion of motor **33.** In this embodiment, an air inlet space **184** which feeds air into the fan **200** is shown. The air ducting shroud **485** can encase the fan **200** and the motor **33,** or at least a portion of these components.

[0042] FIG. 2 is an intake muffler **900** which can receive feed air for compression (also herein as "feed air **990"**; *e.g.* FIG. 8) *via* the intake muffler feed line **898.** The feed air **990** can pass through the intake muffler **900** and be fed to the cylinder head **61** *via* the muffler outlet line **902.** The feed air **990** can be compressed in pump cylinder **60** by piston **63.** The piston can be provided with a seal which can function, such as slide, in the cylinder without liquid lubrication. The cylinder head **61** can be shaped to define an inlet chamber **81** (*e.g.* FIG. 9) and an outlet chamber **82** (*e.g.* FIG. 8) for a compressed gas, such as air (also known herein as "compressed air **999"** or "compressed gas **999"**; *e.g.* FIG. 10). In an embodiment, the pump cylinder **60** can be used as at least a portion of an inlet chamber **81.** A gasket can form an air tight seal between the cylinder head **61** and the valve plate assembly **62** to prevent a leakage of a high pressure gas, such as compressed air **999,** from the outlet chamber **82.** Compressed air **999** can exit the cylinder head **61** *via* a compressed gas outlet port **782** and can pass through a compressed gas outlet line **145** to enter the compressed gas tank **150.**

[0043] As shown in FIG. 2, the pump assembly **25** can have a pump cylinder **60,** a cylinder head **61,** a valve plate assembly **62** mounted between the pump cylinder **60** and the cylinder head **61,** and a piston **63** which is reciprocated in the pump cylinder **60** by an eccentric drive **64** (*e.g.* FIG. 9). The eccentric drive **64** can include a sprocket **49** which can drive a drive belt **65** which can drive a pulley **66.** A bearing **67** can be eccentrically secured to the pulley **66** by a screw, or a rod bolt **57,** and a connecting rod **69.** Preferably, the sprocket **49** and the pulley **66** can be spaced around their perimeters and the drive belt **65** can be a timing belt. The pulley **66** can be mounted about pulley centreline **887** and linked to a sprocket **49** by the drive belt **65** (FIG. 3) which can be configured on an axis which is represent herein as a shaft centreline **886** supported by a bracket and by a bearing **47** (FIG. 3). A bearing can allow the pulley **66** to be rotated about an axis **887** (FIG. 10) when the motor rotates the sprocket **49.** As the pulley **66** rotates about the axis **887** (FIG. 10), the bearing **67** (FIG. 2) and an attached end of the connecting rod **69** are moved around a circular path.

[0044] The piston **63** can be formed as an integral part of the connecting rod **69.** A compression seal can be attached to the piston **63** by a retaining ring and a screw. In an embodiment, the compression seal can be a sliding compression seal.

[0045] A cooling gas stream, such as cooling air stream **2000** (FIG. 3), can be drawn through intake ports **182** to feed fan **200.** The cooling air stream **2000** can be divided into a number of different cooling air stream flows which can pass through portions of the compressor assembly and exit separately, or collectively as an exhaust air steam through the plurality of exhaust ports **31.** Additionally, the cooling gas, *e.g.* cooling air stream **2000,** can be drawn through the plurality of intake ports **182** and directed to cool the internal components of the compressor assembly **20** in a predetermined sequence to optimize the efficiency and operating life of the compressor assembly **20.** The cooling air can be heated by heat transfer from compressor assembly **20** and/or the components thereof, such as pump assembly **25** (FIG. 3). The heated air can be exhausted through the plurality of exhaust ports **31.**

[0046] In an embodiment, one fan can be used to cool both the pump and motor. A design using a single fan to provide cooling to both the pump and motor can require less air flow than a design using two or more fans, *e.g.* using one or more fans to cool the pump, and also using one or more fans to cool the motor. Using a single fan to provide cooling to both the pump and motor can reduce power requirements and also reduces noise production as compared to designs using a plurality of fans to cool the pump and the motor, or which use a plurality of fans to cool the pump assembly **25,** or the compressor assembly **20.**

[0047] In an embodiment, the fan blade **205** (*e.g.* FIG. 3) establishes a forced flow of cooling air through the internal housing, such as the air ducting shroud **485.** The cooling air flow through the air ducting shroud can be a volumetric flow rate having a value of between 25 CFM to 400 CFM. The cooling air flow through the air ducting shroud can be a volumetric flow rate having a value of between 45 CFM to 125 CFM.

[0048] In an embodiment, the outlet pressure of cooling air from the fan can be in a range of from 1 psig to 50 psig. In an embodiment, the fan 200 can be a low flow fan with which generates an outlet pressure having a value in a range of from 1 in of water to 10 psi. In an embodiment, the fan 200 can be a low flow fan with which generates an outlet pressure having a value in a range of from 2 in of water to 5 psi.

[0049] In an embodiment, the air ducting shroud **485** can flow 100 CFM of cooling air with a pressure drop of from 0.0002 psi to 50 psi along the length of the air ducting shroud. In an embodiment, the air ducting shroud **485** can flow 75 CFM of cooling air with a pressure drop of 0.028 psi along its length as measured from the entrance to fan **200** through the exit from conduit **253** (FIG. 7).

[0050] In an embodiment, the air ducting shroud **485** can flow 75 CFM of cooling air with a pressure drop of 0.1 psi along its length as measured from the outlet of fan **200** through the exit from conduit **253.** In an embodiment, the air ducting shroud **485** can flow 100 CFM of cooling air with a pressure drop of 1.5 psi along its length as measured from the outlet of fan **200** through the exit from conduit **253.** In an embodiment, the air ducting shroud **485** can flow 150 CFM of cooling air with a pressure drop of 5.0 psi along its length as measured from the outlet of fan **200** through the exit from conduit **253.**

[0051] In an embodiment, the air ducting shroud **485** can flow 75 CFM of cooling air with a pressure drop in a range of from 1.0 psi to 30 psi across as measured from the outlet of fan **200** across the motor **33.**

[0052] Depending upon the compressed gas output, the design rating of the motor **33** and the operating voltage, in an embodiment, the motor **33** can operate at a value of rotation (motor speed) between 5,000 rpm and 20,000 rpm. In an embodiment, the motor **33** can operate at a value in a range of between 7,500 rpm and 12,000 rpm. In further embodiments, the motor **33** can operate at *e.g.*: 11,252 rpm; or 11,000 rpm; or 10,000 rpm; or 9,000 rpm; or 6,000 rpm; or 5,000 rpm. The pulley **66** and the sprocket **49** can be sized to achieve reduced pump speeds (also herein as "reciprocation rates" or "piston speed") at which the piston **63** is reciprocated. For example, if the sprocket **49** can have a diameter of 1 in and the pulley **66** can have a diameter of 4 in, then a motor **33** speed of 14,000 rpm can achieve a reciprocation rate, or a piston speed, of 3,500 strokes per minute. In an embodiment, if the sprocket **49** can have a diameter of 1.053 in and the pulley **66** can have a diameter of 5.151 in, then a motor **33** speed of 11,252 rpm can achieve a reciprocation rate, or a piston speed (pump speed), of 2,300 strokes per minute.

[0053] FIG. 3 is a front sectional view of the motor and fan assembly.

[0054] FIG. 3 illustrates the fan **200** and motor **33** covered by air ducting shroud **485.** The fan **200** is shown proximate to a shroud inlet scoop **484.**

[0055] The motor can have a stator **37** with an upper pole **38** around which upper stator coil **40** is wound and/or configured. The motor can have a stator **37** with a lower pole **39** around which lower stator coil **41** is wound and/or configured. A shaft **43** can be supported adjacent a first shaft end **44** by a bearing **45** and is supported adjacent to a second shaft end **46** by a bearing **47.** A plurality of fan blades **205** can be secured to the fan **200** which can be secured to the first shaft end **44.** When power is applied to the motor **33,** the shaft **43** rotates at a high speed to in turn drive the sprocket **49** (FIG. 2), the drive belt **65**

(FIG. 4), the pulley **66** (FIG. 4) and the fan blade **200.** In an embodiment, the motor can be a non-synchronous universal motor. In an embodiment, the motor can be a synchronous motor used.

[0056] The compressor assembly **20** can be designed to accommodate a variety of types of motor **33.** The motors **33** can come from different manufacturers and can have horsepower ratings of a value in a wide range from small to very high. In an embodiment, a motor **33** can be purchased from the existing market of commercial motors. For example, although the housing **21** is compact, In an embodiment, it can accommodate a universal motor, or other motor type, rated, for example, at 1/2 horsepower, at 3/4 horsepower or 1 horsepower by scaling and/or designing the air ducting shroud **485** to accommodate motors in a range from small to very large.

[0057] FIG. 3 and FIG. 4 illustrate the compression system for the compressor which is also referred to herein as the pump assembly **25.** The pump assembly **25** can have a pump **59,** a pulley **66,** drive belt **65** and driving mechanism driven by motor **33.** The connecting rod **69** can connect to a piston **63** (*e.g.* FIG. 10) which can move inside of the pump cylinder **60.**

[0058] In one embodiment, the pump **59** such as "gas pump" or "air pump" can have a piston **63,** a pump cylinder **60,** in which a piston **63** reciprocates and a cylinder rod **69** (FIG. 2) which can optionally be oil-less and which can be driven to compress a gas, *e.g.* air. The pump **59** can be driven by a high speed universal motor, *e.g.* motor **33** (FIG. 3), or other type of motor.

[0059] FIG. 4 is a pump-side view of components of the pump assembly **25.** The "pump assembly **25"** can have the components which are attached to the motor and/or which serve to compress a gas; which in non-limiting example can comprise the fan, the motor **33,** the pump cylinder **60** and piston **63** (and its driving parts), the valve plate assembly **62,** the cylinder head **61** and the outlet of the cylinder head **782.** Herein, the feed air system **905** system (FIG. 7) is referred to separately from the pump assembly **25.**

[0060] FIG. 4 illustrates that pulley **66** is driven by the motor **33** using drive belt **65.**

[0061] FIG. 4 (*also see* FIG. 10) illustrates an offset **880** which has a value of distance which represents one half (½) of the stroke distance. The offset **880** can have a value between 0.25 in and 6 in, or larger. In an embodiment, the offset **880** can have a value between 0.75 in and 3 in. In an embodiment, the offset **880** can have a value between 1.0 in and 2 in, *e.g.* 1.25 in. In an embodiment, the offset **880** can have a value of about 0.796 in. In an embodiment, the offset **880** can have a value of about 0.5 in. In an embodiment, the offset **880** can have a value of about 1.5 in.

[0062] A stroke having a value in a range of from 0.50 in and 12 in, or larger can be used. A stroke having a value in a range of from 1.5 in and 6 in can be used. A stroke having a value in a range of from 2 in and 4 in can be used. A stroke of 2.5 in can be used. In an embodiment, the stroke can be calculated to equal two (2) times the offset, for example an offset **880** of 0.796 produces a stroke of 2(0.796) = 1.592 in. In another example, an offset **880** of 2.25 produces a stroke of 2(2.25) = 4.5 in. In yet another example, an offset **880** of 0.5 produces a stroke of 2(0.5) = 1.0 in.

[0063] The compressed air passes through valve plate assembly **62** and into the cylinder head **61** having a plurality of cooling fins **89.** The compressed gas, is discharged from the cylinder head **61** through the outlet line **145** which feeds compressed gas to the compressed gas tank **150.**

[0064] FIG. 4 also identifies the pump-side of upper motor path **268** which can provide cooling air to upper stator coil **40** and lower motor path **278** which can provide cooling to lower stator coil **41.**

[0065] FIG. 5 illustrates tank seal **600** providing a seal between the housing **21** and compressed gas tank **150** viewed from fan-side **14.** FIG. 5 is a fan-side perspective of the compressor assembly **20.** FIG. 5 illustrates a fan-side housing **180** having a fan cover **181** with intake ports **182.** FIG. 5 also shows a fan-side view of the compressed gas tank **150.** Tank seal **600** is illustrated sealing the housing **21** to the compressed gas tank **150.** Tank seal **600** can be a one piece member or can have a plurality of segments which form tank seal **600.**

[0066] FIG. 6 is a rear-side perspective of the compressor assembly **20.** FIG. 6 illustrates a tank seal **600** sealing the housing **21** to the compressed gas tank **150.**

[0067] FIG. 7 is a rear view of internal components of the compressor assembly. In this sectional view, in which the rear housing **170** is not shown, the fan-side housing **180** has a fan cover **181** and intake ports **182.** The fan-side housing **180** is configured to feed air to air ducting shroud **485.** Air ducting shroud **485** has shroud inlet scoop **484** and conduit **253** which can feed a cooling gas, such as air, to the cylinder head **61** and pump cylinder **60.**

[0068] FIG. 7 also provides a view of the feed air system **905.** The feed air system **905** can feed a feed air **990** through a feed air port **952** for compression in the pump cylinder **60** of pump assembly **25.** The feed air port **952** can optionally receive a clean air feed from an inertia filter **949** (FIG. 8). The clean air feed can pass through the feed air port **952** to flow through an air intake hose **953** and an intake muffler feed line **898** to the intake muffler **900.** The clean air can flow from the intake muffler **900** through muffler outlet line **902** and cylinder head hose **903** to feed pump cylinder head **61.** Noise can be generated by the compressor pump, such as when the piston forces air in and out of the valves of valve plate assembly **62.** The intake side of the pump can provide a path for the noise to escape from the compressor which intake muffler **900** can serve to muffle.

[0069] The filter distance **1952** between an inlet centreline **1950** of the feed air port **952** and a scoop inlet **1954** of shroud inlet scoop **484** can vary widely and have a value in a range of from 0.5 in to 24 in, or even greater for larger compressor assemblies. The filter distance

1952 between inlet centreline **1950** and inlet cross-section of shroud inlet scoop **484** identified as scoop inlet **1954** can be *e.g.* 0.5 in, or 1.0 in, or 1.5 in, or 2.0 in, or 2.5 in, or 3.0 in, or 4.0 in, or 5.0 in or 6.0 in, or greater. In an embodiment, the filter distance **1952** between inlet centreline **1950** and inlet cross-section of shroud inlet scoop **484** identified as scoop inlet **1954** can be 1.859 in. In an embodiment, the inertia filter can have multiple inlet ports which can be located at different locations of the air ducting shroud **485.** In an embodiment, the inertial filter is separate from the air ducting shroud and its feed is derived from one or more inlet ports.

[0070] FIG. 7 illustrates that compressed air can exit the cylinder head **61** via the compressed gas outlet port **782** and pass through the compressed gas outlet line **145** to enter the compressed gas tank **150.** FIG. 7 also shows a rear-side view of manifold **303.**

[0071] FIG. 8 is a rear sectional view of the compressor assembly **20.** FIG. 8 illustrates the fan cover **181** having a plurality of intake ports **182.** A portion of the fan cover **181** can be extended toward the shroud inlet scoop **484,** *e.g.* the rim **187.** In this embodiment, the fan cover **181** has a rim **187** which can eliminate a visible line of sight to the air inlet space **184** from outside of the housing **21.** In an embodiment, the rim **187** can cover or overlap an air space **188.** FIG. 8 illustrates an inertia filter **949** having an inertia filter chamber **950** and air intake path **922.**

[0072] In an embodiment, the rim **187** can extend past the air inlet space **184** and overlaps at least a portion of the shroud inlet scoop **484.** In an embodiment, the rim **187** does not extend past and does not overlap a portion of the shroud inlet scoop **484** and the air inlet space **184** can have a width between the rim **187** and a portion of the shroud inlet scoop **484** having a value of distance in a range of from 0.1 in to 2 in, *e.g.* 0.25 in, or 0.5 in. In an embodiment, the air ducting shroud **485** and/or the shroud inlet scoop **484** can be used to block line of sight to the fan **200** and the pump assembly **25** in conjunction with or instead of the rim **187.**

[0073] The inertia filter **949** can provide advantages over the use of a filter media which can become plugged with dirt and/or particles and which can require replacement to prevent degrading of compressor performance. Additionally, filter media, even when it is new, creates a pressure drop and can reduce compressor performance.

[0074] Air must make a substantial change in direction from the flow of cooling air to become compressed gas feed air to enter and pass through the feed air port **952** to enter the air intake path **922** from the inertia filter chamber **950** of the inertia filter **949.** Any dust and other particles dispersed in the flow of cooling air have sufficient inertia that they tend to continue moving with the cooling air rather than change direction and enter the air intake path **922.**

[0075] In an embodiment the compressor assembly **20** can have one or more sound reduction shrouds and/or sound reduction conduits. In an embodiment, the compressor assembly **20** can have a sound reduction shroud **800** (FIGS. 38A, 38B, 38C, 39, 40A, 40B, 40C and 41) which can direct cooling air flow passing across the cylinder head **61** to the exhaust ports **31.** In an embodiment, the compressor assembly **20** can have a sound reduction conduit **875** (FIGS. 42, 43 and 44) which can direct cooling air flow to cool the motor **33,** the pump assembly **25** and the compressed gas outlet line **145,** to the exhaust ports **31.**

[0076] FIG. 7A is a rear view of an embodiment of the sound reduction shroud **800.** The sound reduction shroud **800** can extend over the cylinder head **61** and past the compressed gas outlet line **145.** In an embodiment, the sound reduction shroud **800** can extend into the top housing portions **(162, 172)** and into the bottom housing portions **(163, 173)** to cover the compressed gas outlet line **145.** The sound reduction shroud **800** can direct the cooling air exhaust from the cylinder head **61** and compressor assembly **20** toward and/or through the exhaust ports **31.**

[0077] FIG. 8 also shows a section of a dampening ring **700.** The dampening ring **700** can optionally have a cushion member **750,** as well as optionally a first hook **710** and a second hook **720.**

[0078] FIG. 8A is a rear sectional view of the compressor assembly **20** having the sound reduction shroud **800.** The sound reduction shroud **800** can be shaped to extend along the top and bottom sides of the cylinder head **61** as well as to extend around a portion of the compressed gas outlet line **145.**

[0079] FIG. 9 is a top view of the components of the pump assembly **25.**

[0080] Pump assembly **25** can have a motor **33** which can drive the shaft **43** which causes a sprocket **49** to drive a drive belt **65** to rotate a pulley **66.** The pulley **66** can be connected to and can drive the connecting rod **69** which has a piston **63** (FIG. 2) at an end. The piston **63** can compress a gas in the pump cylinder **60** pumping the compressed gas through the valve plate assembly **62** into the cylinder head **61** and then out through a compressed gas outlet port **782** through an outlet line **145** and into the compressed gas tank **150.**

[0081] FIG. 9 also shows a pump **91.** Herein, pump **91** collectively refers to a combination of parts including the cylinder head **61,** the pump cylinder **60,** the piston **63** and the connecting rod having the piston **63,** as well as the components of these parts.

[0082] FIG. 10 is a top sectional view of the pump assembly **25.** FIG. 10 also shows a shaft centreline **886,** as well as pulley centreline **887** and a rod bolt centreline **889** of a rod bolt **57.** FIG. 10 illustrates an offset **880** which can be a dimension having a value in the range of 0.5 in to 12 in, or greater. In an embodiment, the stroke can be 1.592 in, from an offset **880** of 0.796 in. FIG. 10 also shows air inlet chamber **81.**

[0083] FIG. 11 is an exploded view of the air ducting shroud **485.** In an embodiment, the air ducting shroud **485** can have an upper ducting shroud **481** and a lower ducting shroud **482.** In the example of FIG. 11, the upper ducting shroud **481** and the lower ducting shroud **482**

can be fit together to shroud the fan **200** and the motor **33** and can create air ducts for cooling pump assembly **25** and/or the compressor assembly **20.** In an embodiment, the air ducting shroud **485** can also be a motor cover for motor **33.** The upper air ducting shroud **481** and the lower air ducting shroud **482** can be connected by a broad variety of means which can include snaps and/or screws.

[0084] FIG. 12 is a rear-side view of a valve plate assembly. A valve plate assembly **62** is shown in detail in FIGS. 12, 13 and 14.

[0085] The valve plate assembly **62** of the pump assembly **25** can include air intake and air exhaust valves. The valves can be of a reed, flapper, one-way or other type. A restrictor can be attached to the valve plate adjacent the intake valve. Deflection of the exhaust valve can be restricted by the shape of the cylinder head which can minimize valve impact vibrations and corresponding valve stress.

[0086] The valve plate assembly **62** has a plurality of intake ports **103** (five shown) which can be closed by the intake valves **96** (FIG. 14) which can extend from fingers **105** (FIG. 13). In an embodiment, the intake valves **96** can be of the reed or "flapper" type and are formed, for example, from a thin sheet of resilient stainless steel. Radial fingers 113 (FIG. 12) can radiate from a valve finger hub 114 to connect the plurality of valve members **104** of intake valves **96** and to function as return springs. A rivet **107** secures the hub **106** (*e.g.* FIG. 13) to the centre of the valve plate **95.** An intake valve restrictor **108** can be clamped between the rivet **107** and the hub **106.** The surface **109** terminates at an edge **110** (FIGS. 13 and 14). When air is drawn into the pump cylinder **60** during an intake stroke of the piston **63,** the radial fingers 113 can bend and the plurality of valve members **104** separate from the valve plate assembly **62** to allow air to flow through the intake ports **103.**

[0087] FIG. 13 is a cross-sectional view of the valve plate assembly and FIG. 14 is a front-side view of the valve plate assembly. The valve plate assembly **62** includes a valve plate **95** which can be generally flat and which can mount a plurality of intake valves **96** (FIG. 14) and a plurality of outlet valves **97** (FIG. 12). In an embodiment, the valve plate assembly **62** (FIGS. 10 and 12) can be clamped to a bracket by screws which can pass through the cylinder head **61** (*e.g.* FIG. 2), the gasket and a plurality of through holes **99** in the valve plate assembly **62** and engage a bracket. A valve member **112** of the outlet valve **97** can cover an exhaust port **111.** A cylinder flange and a gas tight seal can be used in closing the cylinder head assembly. In an embodiment, a flange and seal can be on a cylinder side (herein front-side) of a valve plate assembly **62** and a gasket can be between the valve plate assembly **62** and the cylinder head 61.

[0088] FIG. 14 illustrates the front side of the valve plate assembly **62** which can have a plurality of exhaust ports **111** (three shown) which are normally closed by the outlet valves **97.** A plurality of a separate circular valve member **112** can be connected through radial fingers 113 (FIG. 12) which can be made of a resilient material to a valve finger hub **114.** The valve finger hub **114** can be secured to the rear side of the valve plate assembly **62** by the rivet **107.** Optionally, the cylinder head **61** can have a head rib **118** (FIG. 13) which can project over and can be spaced a distance from the valve members **112** to restrict movement of the exhaust valve members **112** and to lessen and control valve impact vibrations and corresponding valve stress.

[0089] FIG. 15A is a perspective view of a plurality of sound control chambers of an embodiment of the compressor assembly **20.** FIG. 15A illustrates an embodiment having four (4) sound control chambers. The number of sound control chambers can vary widely in a range of from one to a large number, *e.g.* 25, or greater. In a non-limiting example, in an embodiment, a compressor assembly **20** can have a fan sound control chamber **550** (also herein as "fan chamber **550"),** a pump sound control chamber **491** (also herein as "pump chamber **491** "), an exhaust sound control chamber **555** (also herein as "exhaust chamber **555"),** and an upper sound control chamber **480** (also herein as "upper chamber **480").**

[0090] FIG. 15B is a perspective view of sound control chambers having optional sound absorbers. The optional sound absorbers can be used to line the inner surface of housing **21,** as well as both sides of partitions which are within the housing **21** of the compressor assembly **20.**

[0091] FIG. 16A is a perspective view of sound control chambers with an air ducting shroud **485.** FIG. 16A illustrates the placement of air ducting shroud **485** in coordination with, for example, the fan chamber **550,** the pump sound control chamber **491,** the exhaust sound control chamber **555,** and the upper sound control chamber **480.**

[0092] FIG. 16B is a perspective view of sound control chambers having optional sound absorbers. The optional sound absorbers can be used to line the inner surface of housing **21,** as well as both sides of partitions which are within the housing **21** of compressor assembly **20.**

[0093] FIG. 17 is a first table of embodiments of compressor assembly range of performance characteristics. The compressor assembly **20** can have values of performance characteristics as recited in FIG. 17 which are within the ranges set forth in FIG. 17.

[0094] FIG. 18 is a second table of embodiments of ranges of performance characteristics for the compressor assembly **20.** The compressor assembly **20** can have values of performance characteristics as recited in FIG. 18 which are within the ranges set forth in FIG. 18.

[0095] The compressor assembly **20** achieves efficient heat transfer. The heat transfer rate can have a value in a range of from 25 BTU/min to 1000 BTU/min. The heat transfer rate can have a value in a range of from 90 BTU/min to 500 BTU/min. In an embodiment, the compressor assembly **20** can exhibit a heat transfer rate of 200 BTU/min. The heat transfer rate can have a value in a range of from 50 BTU/min to 150 BTU/min. In an embodiment, the compressor assembly **20** can exhibit a heat transfer rate of 135 BTU/min. In an embodiment, the compressor assembly **20** exhibited a heat transfer rate of 84.1 BTU/min.

[0096] The heat transfer rate of a compressor assembly **20** can have a value in a range of 60 BTU/min to 110 BTU/min. In an embodiment of the compressor assembly **20,** the heat transfer rate can have a value in a range of 66.2 BTU/min to 110 BTU/min; or 60 BTU/min to 200 BTU/min.

[0097] The compressor assembly **20** can have noise emissions reduced by, for example, slower fan and/or slower motor speeds, use of a check valve muffler, use of tank vibration dampeners, use of tank sound dampeners, use of a tank dampening ring, use of tank vibration absorbers to dampen noise to and/or from the tank walls which can reduce noise. In an embodiment, a two stage intake muffler can be used on the pump. A housing having reduced or minimized openings can reduce noise from the compressor assembly. As disclosed herein, the elimination of line of sight to the fan and other components as attempted to be viewed from outside of the compressor assembly **20** can reduce noise generated by the compressor assembly. Additionally, routing cooling air through ducts, using foam lined paths and/or routing cooling air through tortuous paths can reduce noise generation by the compressor assembly **20.**

[0098] Additionally, noise can be reduced from the compressor assembly **20** and its sound level lowered by one or more of the following, employing slower motor speeds, using a check valve muffler and/or using a material to provide noise dampening of the housing **21** and its partitions and/or the compressed air tank **150** heads and shell. Other noise dampening features can include one or more of the following and be used with or apart from those listed above, using a two-stage intake muffler in the feed to a feed air port **952,** elimination of line of sight to the fan and/or other noise generating parts of the compressor assembly **20,** a quiet fan design and/or routing cooling air routed through a tortuous path which can optionally be lined with a sound absorbing material, such as a foam. Optionally, fan **200** can be a fan which is separate from the shaft 43 and can be driven by a power source which is not shaft **43.**

[0099] In an example, an embodiment of compressor assembly **20** achieved a decibel reduction of 7.5 dBA. In this example, noise output when compared to a pancake compressor assembly was reduced from about 78.5 dBA to about 71 dBA.

Example 1.

[0100] FIG. 19 is a first table of example performance characteristics for an example embodiment. FIG. 19 contains combinations of performance characteristics exhibited by an embodiment of compressor assembly **20.**

Example 2.

[0101] FIG. 20 is a second table of example performance characteristics for an example embodiment. FIG. 20 contains combinations of further performance characteristics exhibited by an embodiment of compressor assembly **20.**

Example 3.

[0102] FIG. 21 is a table containing a third example of performance characteristics of an example compressor assembly **20.** In the Example of FIG. 21, a compressor assembly **20** having an air ducting shroud **485,** a dampening ring **700,** an intake muffler **900,** four sound control chambers, a fan cover, four foam sound absorbers and a tank seal **600** exhibited the performance values set forth in FIG. 21.

[0103] The air ducting shroud **485** can be configured to segment cooling air flow, such as, for example, air flow, into streams to produce a plurality of duct air flow streams which can cool the compressor assembly **20,** as well as for example the pump assembly **25** and parts thereof, *e.g.* pump **91** and motor **33.**

[0104] In an embodiment, the air ducting shroud **485** can forms ducting that directs cooling air flow from the fan **200** across the pump and motor **33.**

[0105] FIGS. 22-37 illustrate the air ducting shroud **485** for dividing the cooling air flow into three gas flows (also herein as "segments"). In an embodiment, the cooling air flow is divided into a first cooling air flow (also herein as "segment 1 "), a second cooling air flow (also herein as "segment 2") and a third cooling air flow (also herein as "segment 3").

[0106] FIG. 22 is a perspective view of the outer top side of an upper air ducting shroud. The upper air ducting shroud **481** can have an upper motor and pump cover **475** and can optionally have an upper brush pocket **211.** The upper air ducting shroud **481** also has an upper portion of the conduit **253** and air feed port **952.**

[0107] FIG. 23 is a perspective view of the inner motor side of the upper air ducting shroud **481** which has the upper motor and pump cover **475,** as well as the conduit **253** and the air feed port **952.** The motor side view of an upper brush pocket **211** is also illustrated. In an embodiment, the upper brush pocket **211** can be integrally moulded in the upper motor and pump cover and can protrude outwardly away from an outer surface thereof, leaving a hollow cavity on the inner surface of the cover. The upper brush pocket serves the purpose of providing cooling air flow to the brush as well as reducing noise emitted from the pump assembly and improving heat transfer from the pump assembly **25** by encasing the brush. FIG. 23 further illustrates an upper portion of a front blocking partition **115,** an upper portion of a rear blocking partition **116,** an upper portion of a front stabilizing partition **212** and an upper portion of a rear stabilizing partition **213.**

[0108] The upper portion of a front blocking partition **115,** the upper portion of a rear blocking partition **116,** the front stabilizing partition **212** rear stabilizing partition **213,** and the rear stabilizing partition **213** protrude inwardly from the inner surface of the upper motor and pump cover **475** toward a centre thereof. The lower portions of these partitions also protrude inwardly from the inner surface of the upper motor and pump cover **475** toward a centre thereof (FIG. 28)

[0109] Front stabilizing partition **212** and rear stabilizing partition **213** can be used to prevent a back flow of air along the motor from the pump-side of the pump assembly, as well as to provide additional mechanical stability to the mounting to the motor.

[0110] FIG. 24 is a fan-side view of the upper air ducting shroud **481.**

[0111] FIG. 24 illustrates an upper portion of a the front blocking partition **115** and an upper portion of the rear blocking partition **116** which can be fit around an upper portion of the motor **33** to prevent air flow along the front and rear sides of the motor 33. FIG. 24 also illustrates an upper portion of a shroud inlet scoop **484.**

[0112] The following dimensions of air ducting shroud are shown in FIGS. 24-36. The dimensions are example dimensions for which an air ducting shroud 485 can be designed to achieve noise reduction in a compressor assembly. The dimension provided below are intended to provide examples and ranges which will accommodate a variety of motors, fans and pumps. Further, the dimension are intended to provide examples and ranges which will achieve efficient heat transfer rates from the pump assembly **25** and parts thereof. Additionally, the dimensions below provide examples and ranges which will achieve effective and quieter air flow paths to the pump assembly **25** and parts thereof. The air ducting shroud disclosed herein is scalable and can be used in a compressor assembly of any size and having a broad variety of pump assembly designs and parts.

[0113] The air ducting shroud **485** has a shroud width **3000** which can have a dimension of 6.5 in, and optionally can be in a range of from 3.25 in to 9.75 in as measured form the front most point of the outer diameter of shroud inlet scoop **484** to the rearmost point of conduit **253.** The air ducting shroud **485** has a shroud ID **3100** which can have a dimension of 3.8 in; and optionally can be in a range of from 1.9 in to 5.7 in. The air ducting shroud **485** has a motor cavity width **3090** which can have a dimension of 3.0 in; and optionally can be in a range of from 0.5 in to 12 in. The air ducting shroud **485** has a rear blocking partition width **3070** which can have a dimension of 0.44 in; and optionally can be in a range of from 0.1 in to 1.2 in. The air ducting shroud **485** has a front blocking partition width **3080** which can have a dimension of 0.44 in; and optionally can be in a range of from 0.1 in to 1.2 in. The air ducting shroud **485** has an upper conduit height **3040** which can have a dimension of 1.5 in; and optionally can be in a range of from 0.75 in to 2.25 in. The air ducting shroud **485** has a feed air port projection **3050** which can have a dimension of 0.4 in; and optionally can be in a range of from 0.2 in to 0.6 in. The air ducting shroud **485** has a scoop OD **3020** which can have a dimension of 4.659 in; and optionally can be in a range of from 2.33 in to 6.9885 in. The air ducting shroud **485** has an upper scoop width **3030** which can have a dimension of 2.3 in; and optionally can be in a range of from 1.15 in to 3.45 in. The air ducting shroud **485** has an upper duct width **3010** which can have a dimension of 2.37 in; and optionally can be in a range of from 1.19 in to 3.555 in. The air ducting shroud **485** has a brush pocket projection **3060** which can have a dimension of 0.07 in; and optionally can be in a range of from 0.04 in to 0.105 in.

[0114] FIG. 25 is a top view of the outer top side of an upper air ducting shroud **481.**

[0115] The air ducting shroud **485** has a conduit length **3250** which can have a dimension of 5.3 in; and optionally can be in a range of from 2.65 in to 7.95 in. The air ducting shroud **485** has a conduit inlet width **3260** which can have a dimension of 1.6 in; and optionally can be in a range of from 0.8 in to 2.4 in. The air ducting shroud **485** has a feed air port conduit position **3270** which can have a dimension of 0.9 in; and optionally can be in a range of from 0.45 in to 1.35 in. The air ducting shroud **485** has a feed air port distance **3280** which can have a dimension of 1.9 in; and optionally can be in a range of from 0.95 in to 2.85 in. The air ducting shroud **485** has a scoop lip **3300** which can have a dimension of 0.3 in; and optionally can be in a range of from 0.15 in to 0.45 in. The air ducting shroud **485** has a brush pocket rear distance **3310** which can have a dimension of 0.6 in; and optionally can be in a range of from 0.3 in to 0.9 in. The air ducting shroud **485** has a brush pocket width **3320** which can have a dimension of 1.1 in; and optionally can be in a range of from 0.55 in to 1.65 in. The air ducting shroud **485** has a brush pocket front distance **3330** which can have a dimension of 2.4 in; and optionally can be in a range of from 1.2 in to 3.6 in. The air ducting shroud **485** has a scoop lip **3333** which can have a dimension of 0.3 in; and optionally can be in a range of from 0.15 in to 0.45 in. The air ducting shroud **485** has a brush pocket front distance **3240** which can have a dimension of 0.5 in; and optionally can be in a range of from 0.25 in to 0.75 in. The air ducting shroud **485** has a scoop length **3245** which can have a dimension of 0.6 in; and optionally can be in a range of from 0.3 in to 0.9 in. The air ducting shroud **485** has a first motor cavity length **3230** which can have a dimension of 3.1 in; and optionally can be in a range of from 1.55 in to 4.65 in. The air ducting shroud **485** has a second motor cavity length **3220** which can have a dimension of 4.7 in; and optionally can be in a range of from 2.35 in to 7.05 in. The air ducting shroud **485** has an air ducting shroud length **3210** which can have a dimension of 6.2 in; and optionally can be in a range of from 3.1 in to 9.3 in. The air ducting shroud **485** has a conduit extension **3222** which can have a dimension of 1 in; and optionally can be in a range of from 0.5 in to 1.5 in. The air ducting shroud **485** has a conduit exit width **3200** which can have a dimension of 6.22 in; and optionally can be in a range of from 1.1 in to 24 in. The air ducting shroud **485** has an air ducting shroud width **3290** which can have a dimension of 2.2 in; and optionally can be in a range of from 1.1 in to 3.3 in.

[0116] FIG. 26 is a view of the inner motor side of the upper air ducting shroud **481.**

[0117] The air ducting shroud **485** has a first conduit width **3510** which can have a dimension of 0.6 in; and optionally can be in a range of from 0.3 in to 0.9 in. The air ducting shroud **485** has a second conduit width **3520** which can have a dimension of 0.8 in; and optionally can be in a range of from 0.4 in to 1.2 in. The air ducting shroud **485** has a first blocking partition distance **3450** which can have a dimension of 3.5 in; and optionally can be in a range of from 1.75 in to 5.25 in. The air ducting shroud **485** has a first blocking partition thickness **3460** which can have a dimension of 0.1 in; and optionally can be in a range of from 0.05 in to 0.15 in. The air ducting shroud **485** has a second blocking partition distance **3470** which can have a dimension of 0.9 in; and optionally can be in a range of from 0.45 in to 1.35 in. The air ducting shroud **485** has a second blocking partition thickness **3480** which can have a dimension of 0.1 in; and optionally can be in a range of from 0.05 in to 0.15 in. The air ducting shroud **485** has an end port length **3490** which can have a dimension of 0.5 in; and optionally can be in a range of from 0.25 in to 0.75 in. The air ducting shroud **485** has a conduit entrance height **3620** (Fig. 36) which can have a dimension of 1 in; and optionally can be in a range of from 0.5 in to 12 in, or greater.

[0118] FIG. 27 is a pump-side view of the upper air ducting shroud showing an upper portion of a front stabilizing partition **212** and an upper portion of a rear stabilizing partition **213.**

[0119] FIG. 28 is a perspective view of the inner motor side of a lower air ducting shroud **482** having the lower motor and pump cover **476,** as well as the conduit **253.** Fig. 28 illustrates portal distance **3650** defined by the largest minor axis chord of the feed port to conduit **253,** which in an example can have a length of 1.4 in, or a value in a range of from 0.5 in to 24 in, or greater.

[0120] FIG. 28 illustrates the motor side view of lower brush pocket **214** of the lower motor and pump cover **476.** The lower motor and pump cover **476** can also have a lower portion of a front blocking partition **115** and a lower portion of a rear blocking partition **116.** A lower portion of a front stabilizing partition **212** and a lower portion of a rear stabilizing partition **213.** As discussed above, the front stabilizing partition **212** and the rear stabilizing partition **213** can be used to prevent a back flow of air along the motor from the pump-side of the pump assembly, as well as to provide additional mechanical stability when mounting to the motor.

[0121] FIG. 28 shows how the cooling gas flow which does not flow through conduit **253** flows though a motor conduit. In an embodiment, the flow can be directed by the use of one or more blocking partitions, such as a front blocking partition **115** and a rear blocking partition **116,** or other flow directing member.

[0122] FIG. 29 is a perspective view of the outer bottom side of a lower air ducting shroud **482** illustrating a lower air ducting shroud **482** having a lower motor and pump cover **476.** A lower brush pocket **214** and a lower portion of conduit **253** are also shown.

[0123] FIG. 30 is a fan-side view of the lower air ducting shroud **482.**

[0124] FIG. 30 illustrates a lower portion of a front blocking partition **115** and a lower portion of a rear blocking partition **116** which can be fit around a lower portion of the motor **33** to prevent air flow along the front and rear sides of the motor **33.** FIG. 30 also illustrates a lower portion of a shroud inlet scoop **484.**

[0125] FIG. 31 is a view of the outer bottom side of a lower air ducting shroud.

[0126] FIG. 32 is a view of the inner motor side of a lower air ducting shroud.

[0127] FIG. 33 is a pump-side view of the lower air ducting shroud.

[0128] FIG. 34 is a sectional view of the inner motor side of a rear section of an air ducting shroud with angled partitions.

[0129] FIG. 35 is a perspective view of the inner motor side of a lower section of an air ducting shroud with angled partitions.

[0130] FIG. 36 is a perspective of a fan-side view of the air ducting shroud.

[0131] In an embodiment, an internal cross-sectional area of the air ducting shroud **3995** can have a value in a range of from 5 in^2 to 144 in^2. In an embodiment, an internal cross-sectional area of the air ducting shroud **3995** can be 12 in^2. In an embodiment, the internal cross-sectional area of the scoop **3997** can be 17 in^2. FIG. 36 also illustrates a conduit feed port **3999** from which the conduit **253** draws feed air. FIG. 36 also illustrates a motor cavity **4001** into which a compressor assembly motor can be placed.

[0132] In an embodiment, the cross-sectional area of a conduit feed port **3999** can have a value in a range of from 1.0 in^2 to 5000 in^2, or larger. In further embodiments, the area of a conduit feed port **3999** can be 2.20 in^2; or 1.6 in^2; or 36 in^2.

[0133] The ratio of the area of the internal cross-sectional area of the air ducting shroud **3995** to the conduit feed port **3999** can have a range of 2:1 to 50:1. In further embodiments, the ratio of the area of the internal cross-sectional area of the air ducting shroud **3995** to the conduit feed port **3999** can be 11:1; or 7.57:1; or 4:1; or 3.5:1; or 3:1. The ratio of the area of the internal cross-sectional area of the air ducting shroud **3995** to the conduit feed port **3999** can contribute to the balance of cooling air which flows to the various parts of the pump assembly **25.** For example, the balance between how much cooling air flow cools the motor **33** and how much cooling air flow passes through conduit **253** to the cylinder head **61** area.

[0134] FIG. 37 is a perspective of a pump-side view of the air ducting shroud. In addition to other elements disclosed herein, FIG. 37 identifies a conduit support rib **3690** extending between the a portion of an outer diameter surface of air ducting shroud **485** and a portion of the conduit **253.**

[0135] In an embodiment, a first cooling stream can flow across the bottom field winding and a second cooling air flow can flow across the top field winding and the head and cylinder area.

[0136] In an embodiment, the first cooling stream can flow across a first portion of the motor field windings, the second cooling stream can flow across a second portion of the motor field windings, and the third cooling stream can flow across the head and cylinder area.

[0137] In an embodiment, one fan can be used to cool both the pump and motor.

[0138] A design using a single fan to provide cooling to both the pump and motor can require less air flow than a design using one or more fans to cool the pump and one or more fans to cool the motor. Using a single fan to provide cooling to both the pump and motor reduces power requirements and also reduces noise production as compared to designs using one or more fans to cool the pump and one or more fans to cool the motor.

[0139] In an embodiment, the gas compressor uses pathways to direct the flow of cooling air to cool portions of the pump assembly **25.** Cooling the pump **91** and motor **33** allows each to operate with improved efficiency and have a longer performance life.

[0140] Each of the embodiments shown in FIGS. 38A, 38B and 38C is a variation of the sound reduction shroud **800.** Each of the cylinder head shroud **810** (FIG. 38A), the pump cylinder shroud **820** (FIG. 38B) and the pump assembly shroud **830** (FIG. 38C) provide a significant reduction in sound emitted from the compressor assembly **20.** The sound reduction shroud **800** can have a broad variety of forms and shapes which can direct cooling air and reduce the sound emitted by the compressor assembly **20.** The controlled and aerodynamic redirection toward the exhaust ports **31** of the cooling air which passes across various components of the pump assembly **25** and the compressed gas outlet line **145** reduces the sound emitted from the compressor assembly **20.** Additionally, each of the various embodiments of the sound reduction shroud **800** buffer, dampen, redirect and control the turbulence and buffeting of the cooling air caused by the operation of the pump assembly and fan, as well as the impact of the cooling air against the pump-side housing **190,** or other barrier to cooling air flow. Further, each of the various embodiments of the sound reduction shroud **800** can provide an additional sound barrier within the housing **21** to dampen sound emitted from the housing **21.** Optionally, the sound reduction shroud **800** can be made of a hard and/or a sound absorbing material.

[0141] FIG. 38A is a top view of the cylinder head shroud **810.** The cylinder head shroud **810** can be a sound reduction shroud which can be formed to cover at least a portion of the cylinder head **61.** As shown in FIG. 38A, the cylinder head shroud **810** can optionally cover at least a portion of the compressed gas outlet line **145.** The cylinder head shroud **810** can redirect cooling gas which flows across the cylinder head **61** to flow across the compressed gas outlet line **145** and to exit the housing **21** through the exhaust ports **31.** FIG. 38A can have a shroud coverage angle **818** which can be equal to or less than 45º, such as 15º to 45º, for example 20º, and which can be sufficient to facilitate a transition and redirection of the cooling flow from across the cylinder head toward the exhaust ports **31.**

[0142] In an embodiment, the cylinder head shroud **810** (FIGS. 38A and 40A) can reduce compressor assembly sound output by at least 0.5 dBA to 1.0 dBA

[0143] FIG. 38B is a top view of the pump cylinder shroud **820.** The pump cylinder shroud **820** can be a sound reduction shroud which can be formed to cover the cylinder head **61** and at least a portion of the pump cylinder **60.** As shown in FIG. 38B, the pump cylinder shroud **820** can optionally cover at least a portion of the compressed gas outlet line **145.** The pump cylinder shroud **820** can redirect cooling gas which flows across the cylinder head **61** and the pump cylinder **60** to flow across the compressed gas outlet line **145** and to exit the housing **21** through the exhaust ports **31.** Optionally, the pump cylinder shroud **820** can also redirect cooling which passes across the upper motor path **268** and/or the lower motor path 278.

[0144] FIG. 38B can have a shroud coverage angle **818** in a range of 33º to 75º, such as of 45º, and which is sufficient to facilitate a transition and redirection of the cooling flow across the cylinder head **61** and from the pump cylinder **60** toward the exhaust ports **31.**

[0145] In an embodiment, the pump cylinder shroud **820** (FIG. 38B and 40B) can reduce compressor assembly sound output by at least 0.5 to 1.0 dBA.

[0146] FIG. 38C is a top view of components of the pump assembly showing a pump assembly shroud **830.** The pump assembly shroud **830** can be a sound reduction shroud formed to cover the pump assembly **25.** In an embodiment, the pump assembly shroud **830** can cover the cylinder head **61,** the pump **91** and the compressed gas outlet line **145.** In an embodiment, the pump assembly shroud **830** can cover the eccentric drive **64.** The pump assembly shroud **830** can redirect cooling gas which flows across the cylinder head **61,** the pump assembly **25** and the compressed gas outlet line **145** to exit the housing **21** through the exhaust ports **31.** As shown in FIG. 38C, the pump assembly shroud **830** can redirect the cooling air across the eccentric drive as well as containing and controlling cooling air and the cooling air turbulence caused by the operation of the pump assembly.

[0147] FIG. 38C can have a shroud coverage angle **818** in a range of 45º to 90º, or greater 133º, such as 85º, or 90º, or 115º, and which can be sufficient to facilitate a transition and redirection of the cooling flow across the pump assembly **25** toward the exhaust ports **31.**

[0148] In an embodiment, the pump assembly shroud **830** (FIGS. 38C and 40C) can reduce compressor assembly sound output by at least 0.5 to 1.0 dBA.

[0149] FIG. 38D is a top view of the pump assembly shroud **830** surround by a sound absorbing material **850.** As shown in FIG. 38D, the sound reduction shroud **800,** such as the pump assembly shroud **830** which can cover the pump assembly, can support a sound absorbing material **850** which can fill in part or wholly the open space within the housing **21.** The sound absorbing material can be any material compatible with the operating temperatures and conditions of the compressor assembly **20.** In a non-limiting example, the sound absorbing material **850** can be one or more of the following: a plastic, a polymer, a rubber, a foam, a cured resin, an acoustical foam, a sound panel or material thereof, a cellulosic material, a cardboard, a paper, a wood, a metal, a fibreglass, a porous material, a plaster, a ceramic, a fibrous material, a honeycombed material, a matrixed material, a loose packing, a formed packing, a thermoset plastic and an insulation.

[0150] In an embodiment, a formed or shaped acoustical foam can be inserted or introduced to fill in part, or wholly, open areas between the housing **21** and the pump assembly shroud **830** as well as between the housing **21** and the motor cover **(475, 476).** In an embodiment, surrounding the pump assembly shroud **830** and the motor cover **(475, 476)** with sound absorbing material **850** can reduce compressor assembly sound output by at least 0.5 dBA to 5.0 dBA, such as 1 dBA, 2 dBA or 3dBA.

[0151] FIG. 39 is an exploded view of the air ducting shroud having the cylinder head shroud **810.** As shown in FIG. 39, the cylinder head shroud **810** can be of two or more parts which can be formed to enclose at least a portion of the cylinder head **61** and optionally at least a portion of the compressed gas outlet line **145.** Other embodiments of the sound reduction shroud **800,** such as the pump cylinder shroud **820** and/or the pump assembly shroud **830** can be similarly configured to encompass their respective portions of the pump assembly **25.**

[0152] This disclosure is not limited regarding the dimensions which can be used in the embodiments of the sound reduction shroud **800** (FIGS. 40A, 40B, 40C and 41) and the sound reduction conduit **875** (FIGS. 42, 43 and 44). This disclosure is to be broadly construed regarding the dimensions of the sound reduction shroud **800** and the sound reduction conduit **875.**

[0153] For example, the cylinder head shroud **810** can have a ratio of a head width **812** to a scoop height **814** of 1:1, or of 1 to greater than one. The scoop height **814** which is greater than the head width **812** reduces exhaust cooling air velocity and sound after cooling the cylinder head **61.** For example, the ratio of the head width **812** to a scoop height **814** can vary over a wide range, such as 1:1.25, or 1:1.5, or 1:2, or 1:2.5, or 1:3; or 1:4, or 1:5, or 1:10. The ratio of the head width **812** to a scoop length **813** can also vary over a wide range which can improve flow regime characteristics of the exhaust cooling air and reduce sound. For example, the ratio of the head width **812** to the scoop length **813,** can be in the range of 1 to less than one, or to 1:5, or 1 to greater than 5. In other examples, the ratio of the head width **812** to the scoop length **813** can be 1:0.5, or 1:0.75, 1:1, or 1:1.5, or 1:2, or 1:2.5, or 1:3, or 1:4, or 1:5, or 1:6, or 1:10.

[0154] In an embodiment, the scoop height **814** can be greater than or less than a first scoop depth 815 in and/or a second scoop depth **816.** The first scoop depth **815** in and the second scoop depth **816** can have lengths which are the same or different. In an embodiment, the first scoop depth **815** and the second scoop depth **816** can be the same and can be less than the scoop height **814.** The ratio of the scoop height **814** to the first scoop depth **815** to the second scoop depth **816,** can range for example from 1:0.25:0.25 to 1:5:5, such as 1:0.25:0.25; 1:0.5: 0.5, or 1:0.75:0.75, or 1:1:1, or 1:1.5:1.5, or 1:2:2, or 1: 3:3, or 1:4:4, or 1:5:5.

[0155] The shroud length **811** can be any value necessary to accommodate the dimension(s) of the shroud and/or the equipment which the shroud covers.

[0156] FIG. 40A is a perspective of a pump-side view of the cylinder head shroud **810.** As shown in FIG. 40A, the cylinder head shroud **810** can be formed to cover at least a portion of the cylinder head **61** and at least a portion of the compressed gas outlet line **145.** The embodiment of FIG. 40A can have a scoop **819** which can have a fan shape and which can accommodate at least a portion of the compressed gas outlet line **145.**

[0157] The embodiment of FIG. 40A can have a shroud coverage angle **818** which can be equal to or less than 45º, such as 15º to 45º, for example 20º, and which can be sufficient to facilitate a transition and redirection of **the** cooling flow across the cylinder head toward the exhaust ports **31.** The first scoop depth **815** a second scoop depth **816** can cover at least a portion of the of the compressed gas outlet line **145.**

[0158] FIG. 40B is a perspective of a pump-side view of the pump cylinder shroud **820.** As shown in FIG. 40B, the pump cylinder shroud **820** can be formed to cover the cylinder head **61** and at least a portion of the pump cylinder. The embodiment of FIG. 40 can have a scoop **819** which can have a fan shape.

[0159] The embodiment of FIG. 40B can have a shroud coverage angle **818** in a range of 33º to 75º, such as of 45º, and which can be sufficient to facilitate a transition and redirection of the cooling flow across the cylinder head **61** and from the pump cylinder **60** toward the exhaust ports **31.** The first scoop depth **815** a second scoop depth **816** can cover at least a portion of the of the compressed gas outlet line **145,** as well as at least a portion of the cylinder head **61.**

[0160] FIG. 40C is a perspective of a pump-side view of the pump assembly shroud **830.** As shown in FIG. 40C, the pump assembly shroud **830** can be formed to cover the pump assembly **25** and also the compressed gas outlet line **145.** The embodiment of FIG. 40 can have a scoop **819** which can have a fan shape.

[0161] The embodiment of FIG. 40C can have a shroud coverage angle **818** in a range of 45º to 90º, or greater 133º, such as 85º, or 90º, or 115 º, sufficient to facilitate a transition and redirection of the cooling flow across the pump assembly 25 toward the exhaust ports **31.** The first scoop depth **815** and the second scoop depth **816** can cover at least a portion of the compressed gas outlet line **145** and pump assembly, including the eccentric drive **64.**

[0162] FIG. 41 is a pump end view of the outside of the sound reduction shroud **800** having a fan shape. The embodiment of FIG. 41 is a pump end view of the sound reduction shroud **800** which can have a scoop **819** which can have a fan shape.

[0163] FIG. 42 is a top sectional view of components of the pump assembly showing a sound reduction conduit **875.** In an embodiment, the sound reduction conduit **875** can be a channel which can direct the cooling air from the plurality of intake ports **182** to the exhaust ports **31.**

[0164] The shroud length **821** and the scoop length **822** can have any values necessary to accommodate the dimension(s) of the shroud and/or the equipment which the conduit covers. Additionally, the sound reduction conduit **875** can have an eccentric drive cover **876** with an eccentric drive accommodation **823** which can have a pulley offset **824** and a drive offset **825.**

[0165] FIG. 43 is a fan-side view of the intake-side of the fan having a sound reduction conduit **875.** The eccentric drive cover **876** is shown covering the pump assembly **25.**

[0166] In the embodiment depicted in FIGS. 42, 43 and 44, the sound reduction conduit **875** can reduce compressor assembly sound output by at least 0.5 dBA to 2.0 dBA.

[0167] FIG. 44 is a sectional view of the motor and cooling air flow paths having a sound reduction conduit **875.** FIG. 44 shows the sound reduction conduit channelling cooling air from a variety of sources, such as the feed pump stream **254,** the upper motor stream **270,** the lower motor stream **280** and/or the motor gap **240,** to the exhaust ports **31.**

[0168] In an embodiment, the sound reduction conduit **875** can be a generally tubular channel and open on an inlet end **878** and an exhaust end **978.**

[0169] In an embodiment, the sound reduction conduit **875** can be a generally closed channel which controls air flow along the cooling path for the motor **33,** cylinder head **61,** pump assembly **25** and the compressed gas outlet line **145.** The sound reduction conduit **875** can smooth out air flow, reduce turbulence and significantly reduce sound caused by turbulent and/or other air flow. Additionally, the sound reduction conduit **875** can provide a hard and/or a sound absorbing barrier against sound and which can be in part or wholly within the housing **21.** In an embodiment, open space(s) between the outside surface of the sound reduction conduit **875** and the inside of the housing **21** can be packed in part or wholly with the sound absorbing material **850.**

[0170] In the conduit embodiment of FIG. 44, the sound reduction conduit **875** in conjunction with the use of a sound absorbing material **850** filling in part, or wholly, the fillable space or spaces between the sound reduction conduit **875** and the housing **21** can reduce compressor assembly sound output by at least 0.5 to 5.0 dBA, such as 1 dBA, 2 dBA or 3 dBA.

[0171] The scope of this disclosure is to be broadly construed. It is intended that this disclosure disclose equivalents, means, systems and methods to achieve the devices, designs, operations, control systems, controls, activities, mechanical actions, fluid dynamics and results disclosed herein. For each mechanical element or mechanism disclosed, it is intended that this disclosure also encompasses within the scope of its disclosure and teaches equivalents, means, systems and methods for practicing the many aspects, mechanisms and devices disclosed herein. Additionally, this disclosure regards a compressor and its many aspects, features and elements. Such an apparatus can be dynamic in its use and operation. This disclosure is intended to encompass the equivalents, means, systems and methods of the use of the compressor assembly and its many aspects consistent with the description and spirit of the apparatus, means, methods, functions and operations disclosed herein. The claims of this application are likewise to be broadly construed.

[0172] The description of the inventions herein in their many embodiments is merely exemplary in nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the invention and the disclosure herein. Such variations are not to be regarded as a departure from the spirit and scope of the invention.

[0173] It will be appreciated that various modifications and changes can be made to the above described embodiments of a compressor assembly as disclosed herein without departing from the scope of the following claims.

Claims

1. A compressor assembly, comprising:

    a fan;
    a pump assembly;
    a motor;
    a sound reduction shroud and / or a sound reduction conduit; and
    a sound level having a value of 75 dBA or less when the compressor assembly is in a compressing state.

2. The compressor assembly according to claim 1, wherein the sound reduction shroud is a cylinder head shroud and the cylinder head shroud covers at least a portion of a cylinder head.

3. The compressor assembly according to claim 2,

wherein the cylinder head shroud covers at least a portion of a cylinder head and at least a portion of a compressed gas outlet line.

4. The compressor assembly according to claim 3, wherein the cylinder head shroud can have a shroud coverage angle which is equal to or less than 45º.

5. The compressor assembly according to any of claims 1 to 4, wherein the sound reduction shroud is a pump cylinder shroud or a pump assembly shroud.

6. The compressor assembly according to claim 5, wherein the pump cylinder shroud covers at least a portion of a cylinder head, at least a portion of a pump cylinder and / or at least a portion of a compressed gas outlet line.

7. The compressor assembly according to claims 5 or 6, wherein the pump cylinder shroud can have a shroud coverage angle which is in a range of 33º to 75º.

8. The compressor assembly according to claims 5 to 7, wherein the pump assembly shroud covers at least a portion of a cylinder head, at least a portion of a pump cylinder, at least a portion of the eccentric drive and / or at least a portion of a compressed gas outlet line.

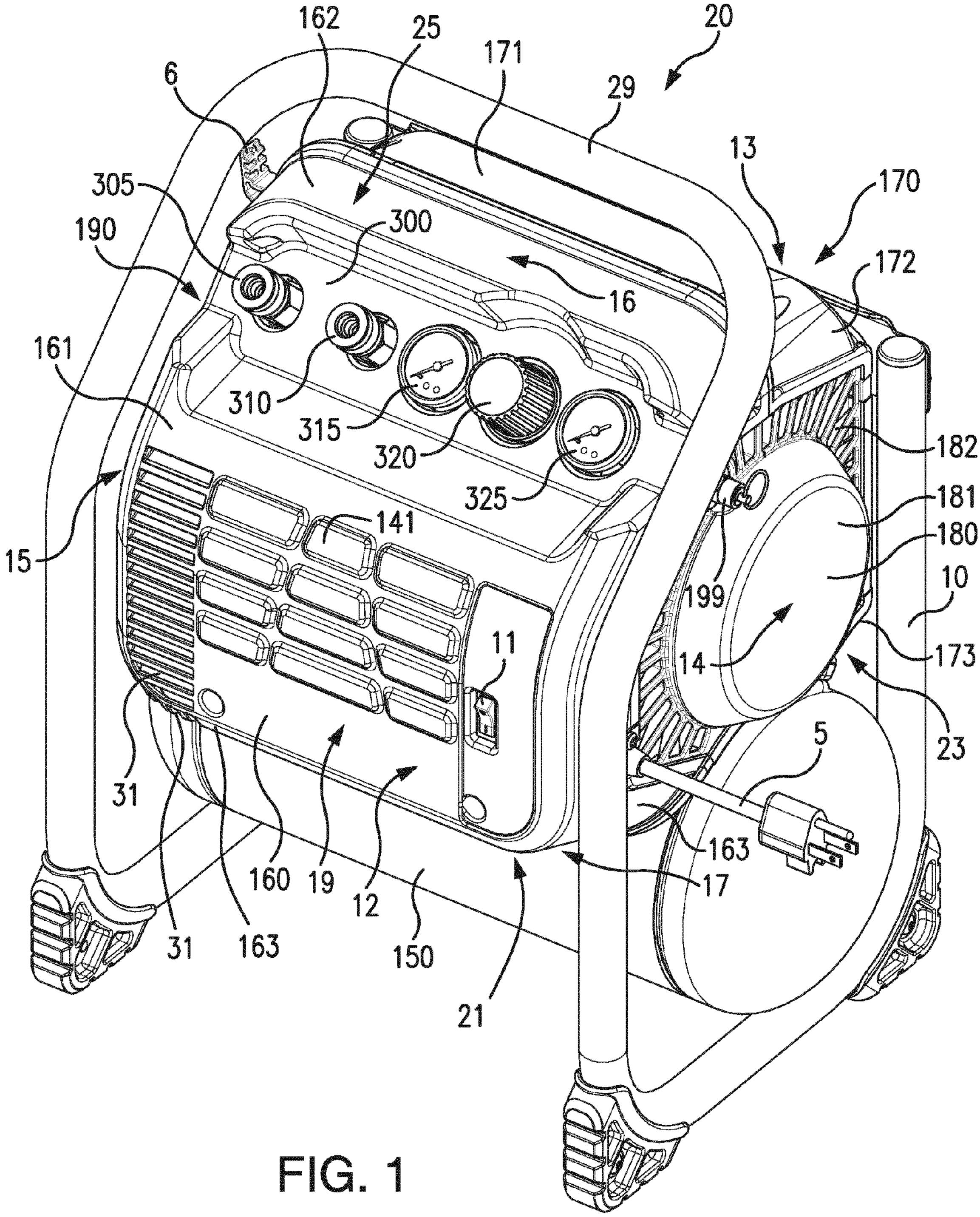
9. The compressor assembly according to claims 5 to 8, wherein the pump assembly shroud can have a shroud coverage angle which is in a range of 45º to 90º.

10. The compressor assembly according to claims 5 to 9, wherein the pump assembly shroud, at least in part, provides a fillable space between the pump assembly shroud and a compressor housing into which a sound absorbing material can be placed, said fillable space filled at least in part with the sound absorbing material.

11. The compressor assembly according to claims 1 to 10, wherein the sound reduction conduit covers at least in part each of the eccentric drive, the pump assembly and the compressed gas outlet line.

12. The compressor assembly according to claims 1 to 11 wherein the sound reduction conduit provides a cooling air flow path which receives cooling air from the fan and which exhausts cooling air effluent in the direction of an exit port.

13. The compressor assembly according to claims 1 to 12, wherein the sound reduction conduit provides a cooling air channel which receives a cooling air from the fan and directs the cooling air to the motor, a cylinder head and a compressed gas outlet line.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305
300
190
172
16
161
310
315
320
182
325
181
141
180
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199
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14
173
23
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31
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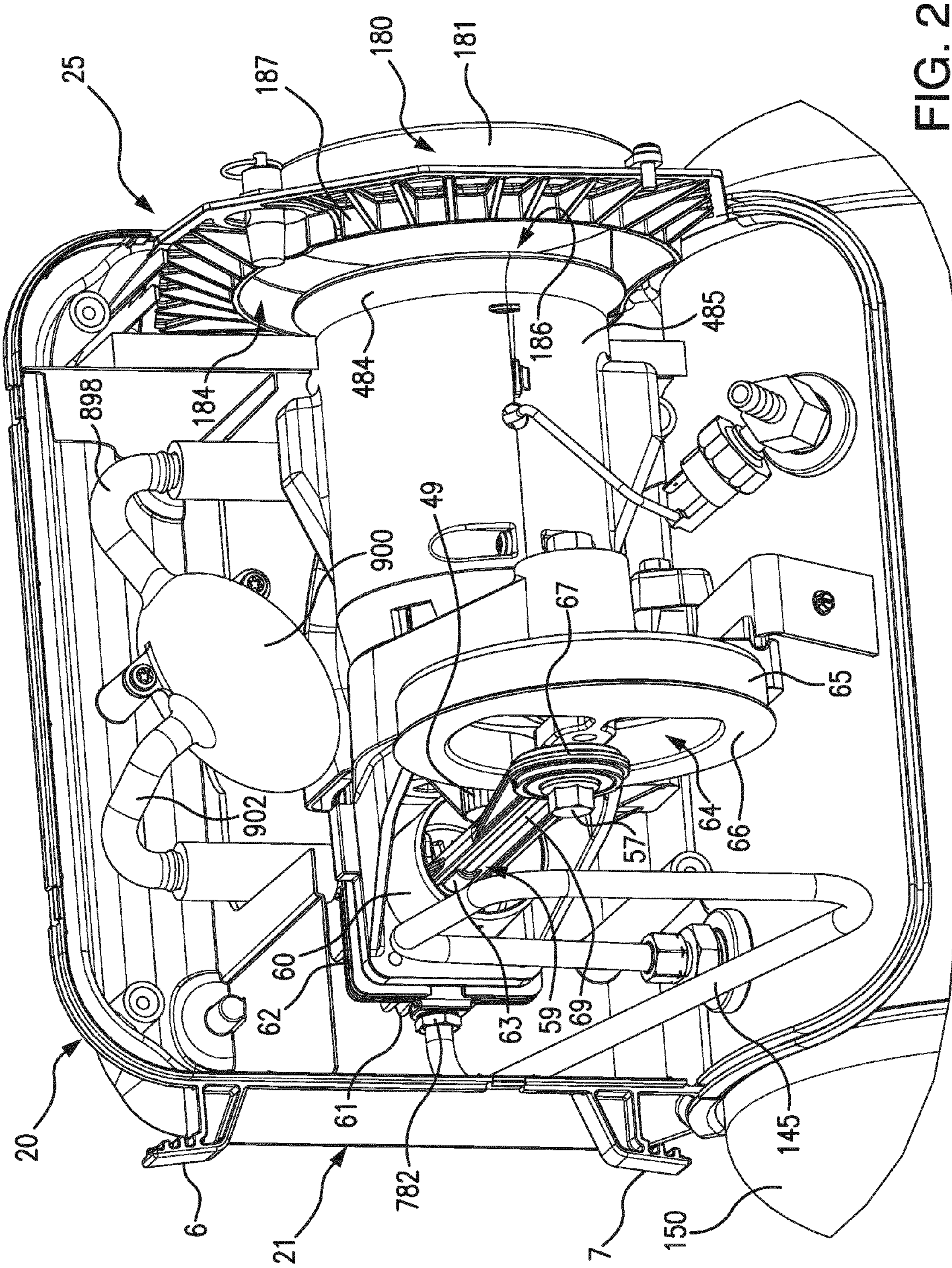
31
160
19
12
17
163
150
21

FIG. 1


25
187
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485
898
49
900
67
65
902
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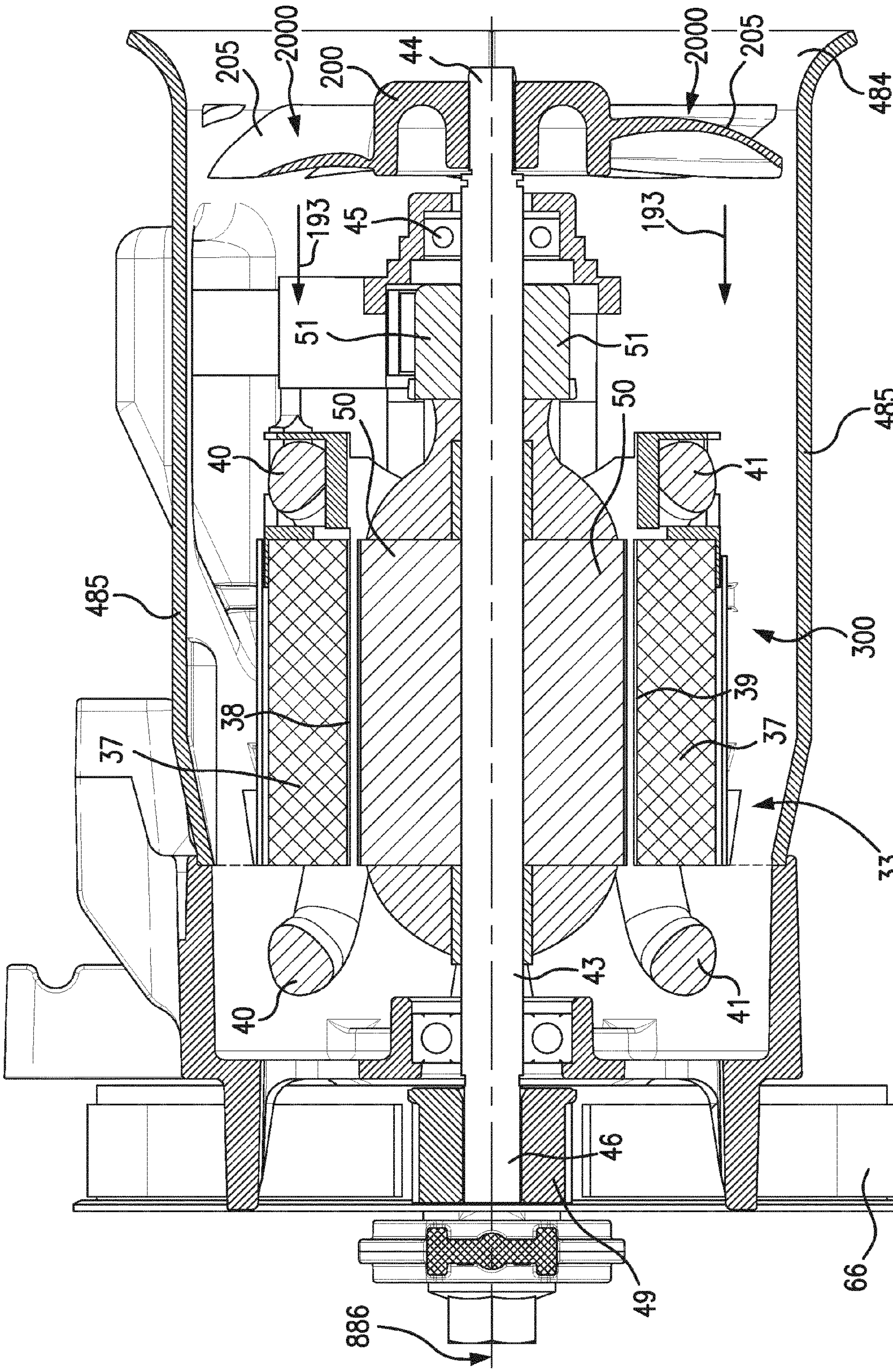
63
59
69
61
782
145
20
6
21
7
150

FIG. 2


2000
205
200
44
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193
51
51
50
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40
41
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300
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39
37
37
33
40
43
41
46
66
49
886

FIG. 3

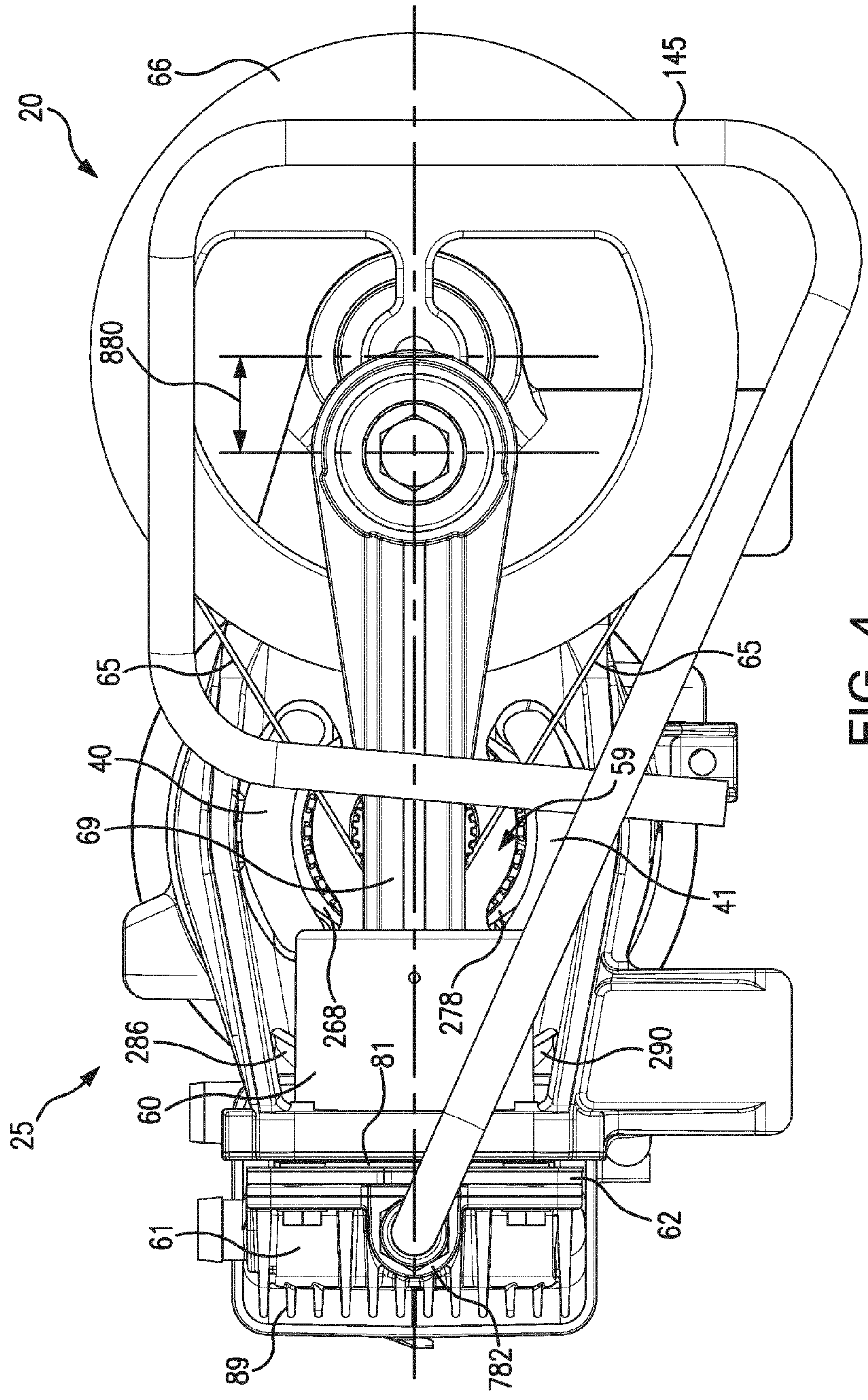


FIG. 4

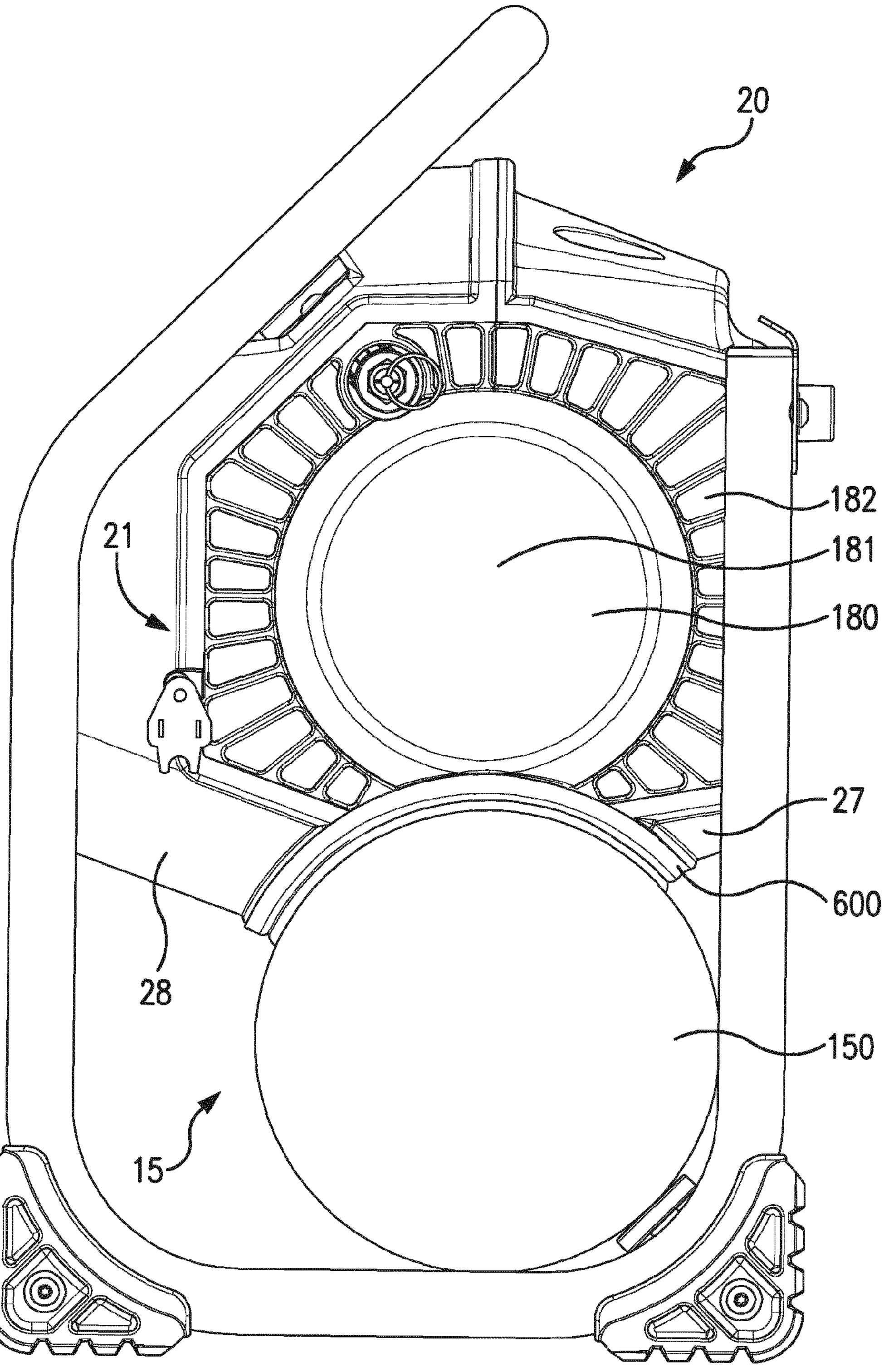


FIG. 5

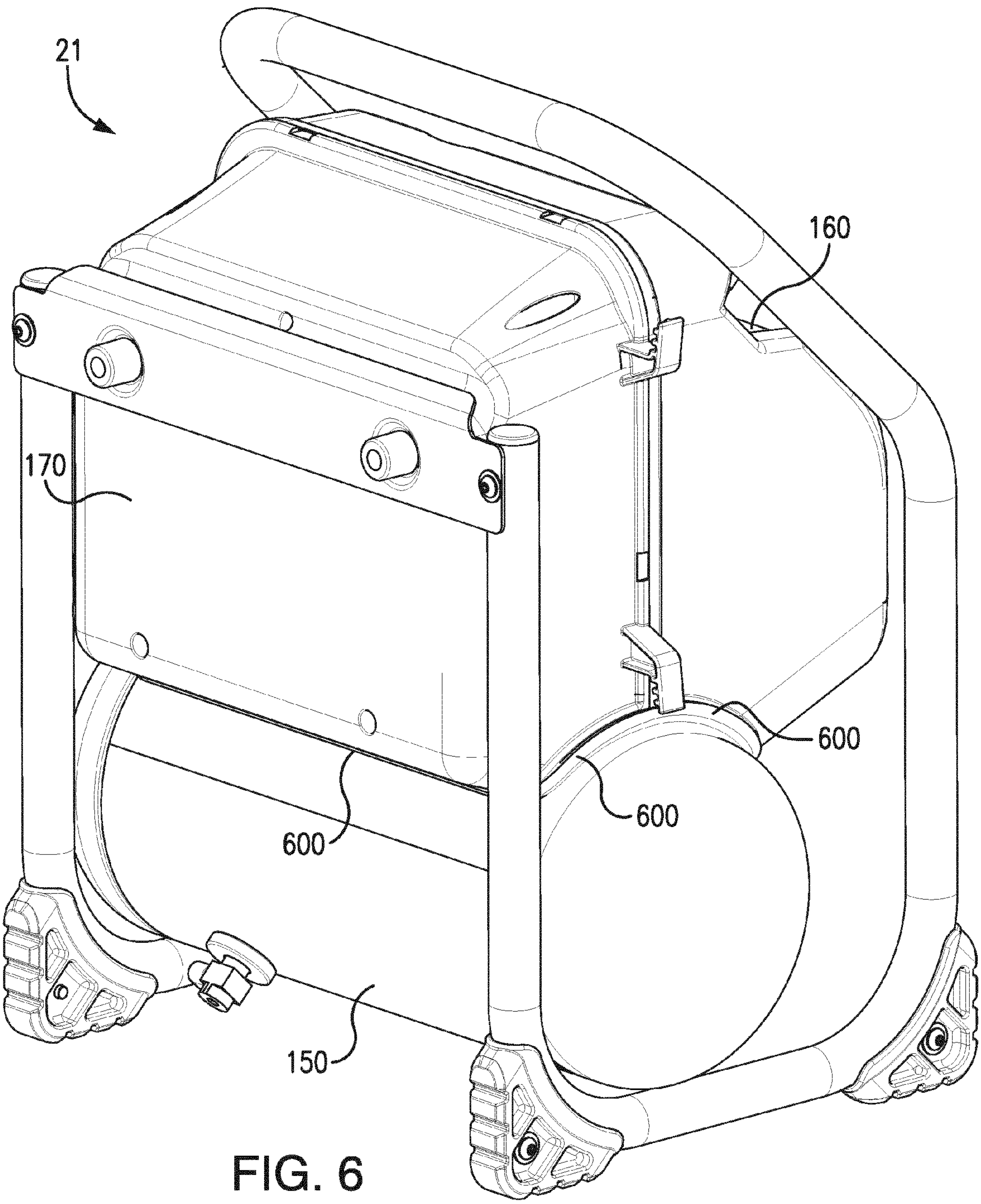


FIG. 6

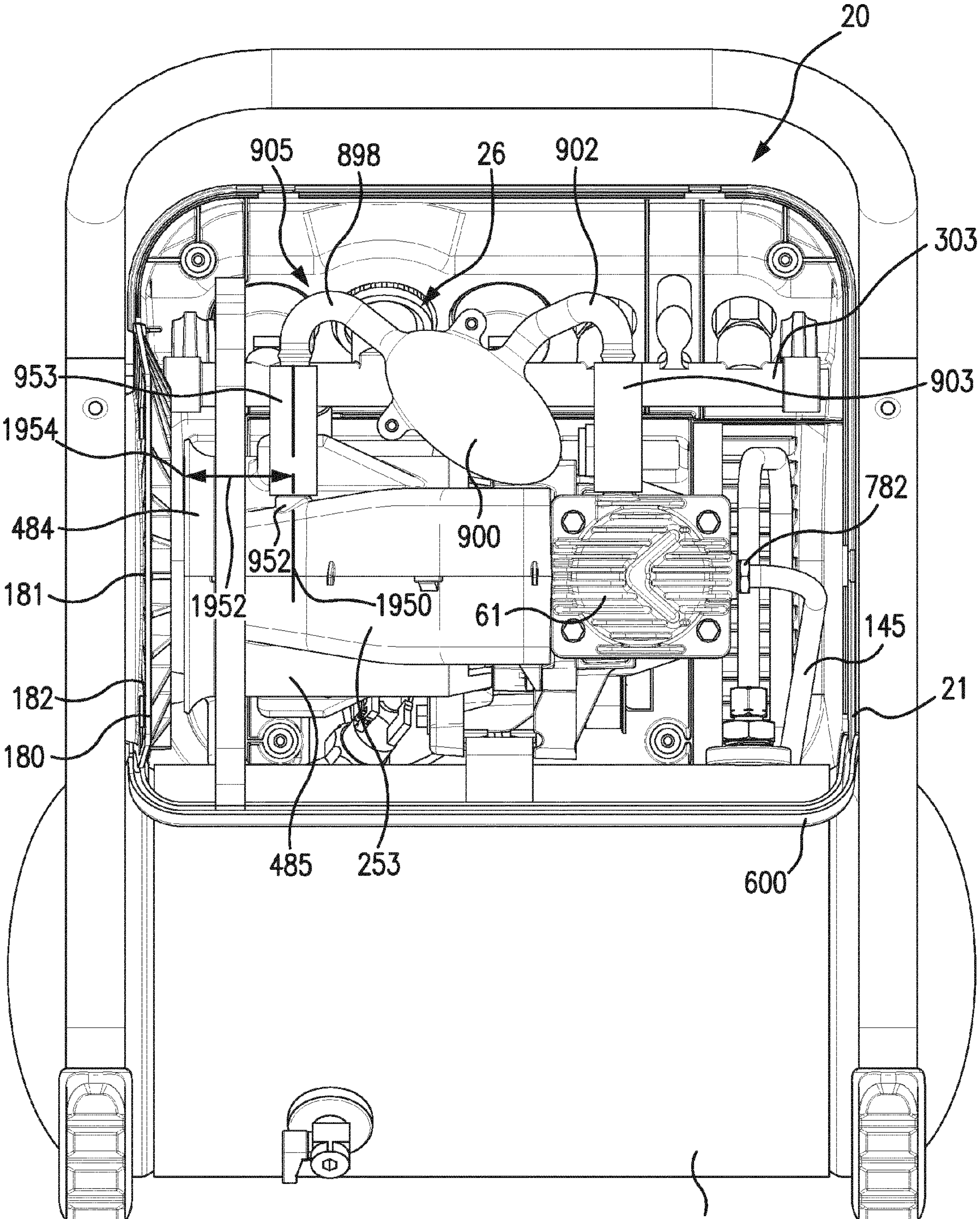
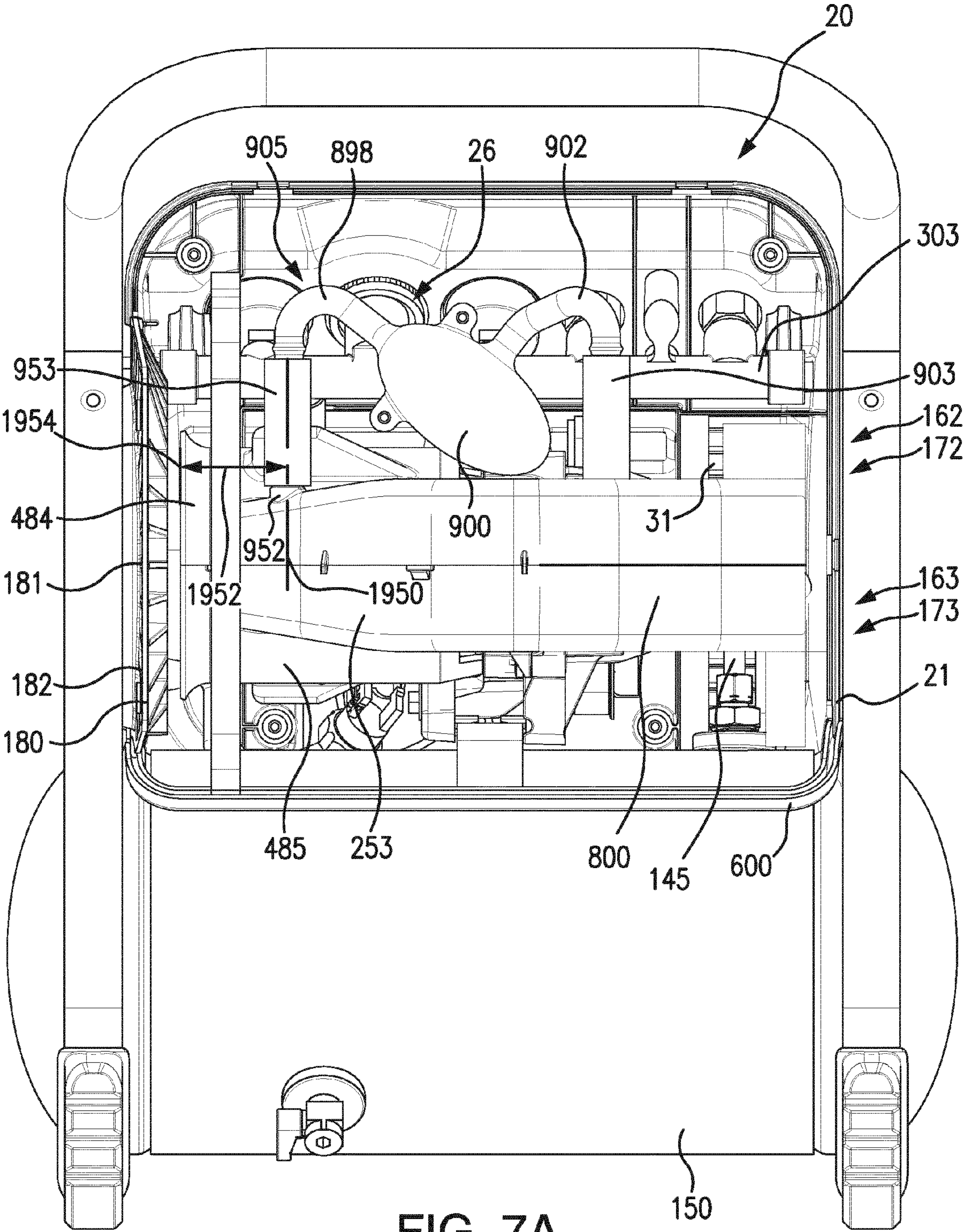

20
905
898
26
902
303
953
903
1954
782
484
900
952
181
1952
1950
61
145
182
21
180
485
253
600
150

FIG. 7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903
1954
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182
21
180
485
253
800
145
600
150

FIG. 7A

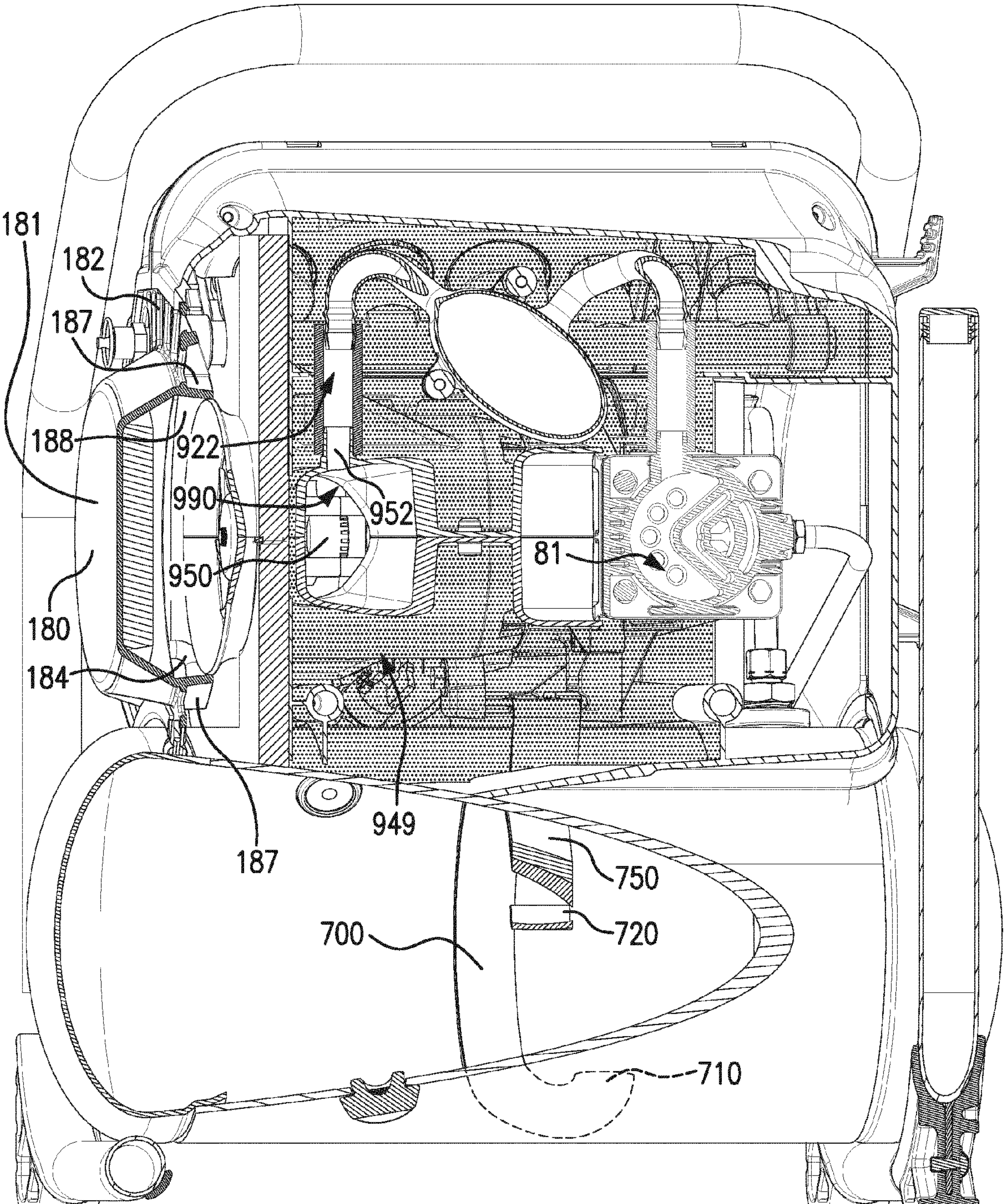

181
182
187
188
922
990
952
950
81
180
184
187
949
750
720
700
710

FIG. 8

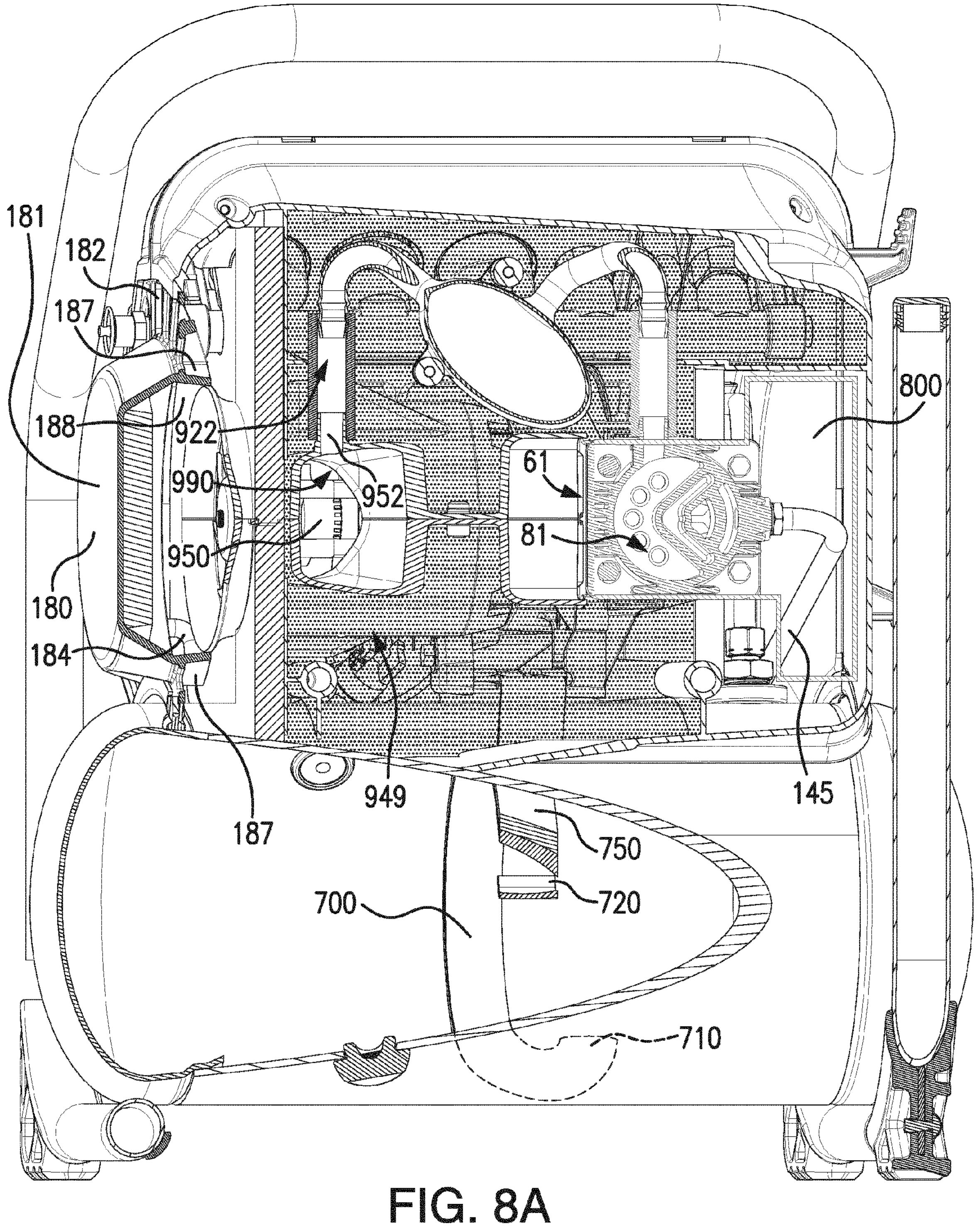

181
182
187
188
922
990
952
950
180
184
187
949
61
81
800
145
750
720
700
710

FIG. 8A

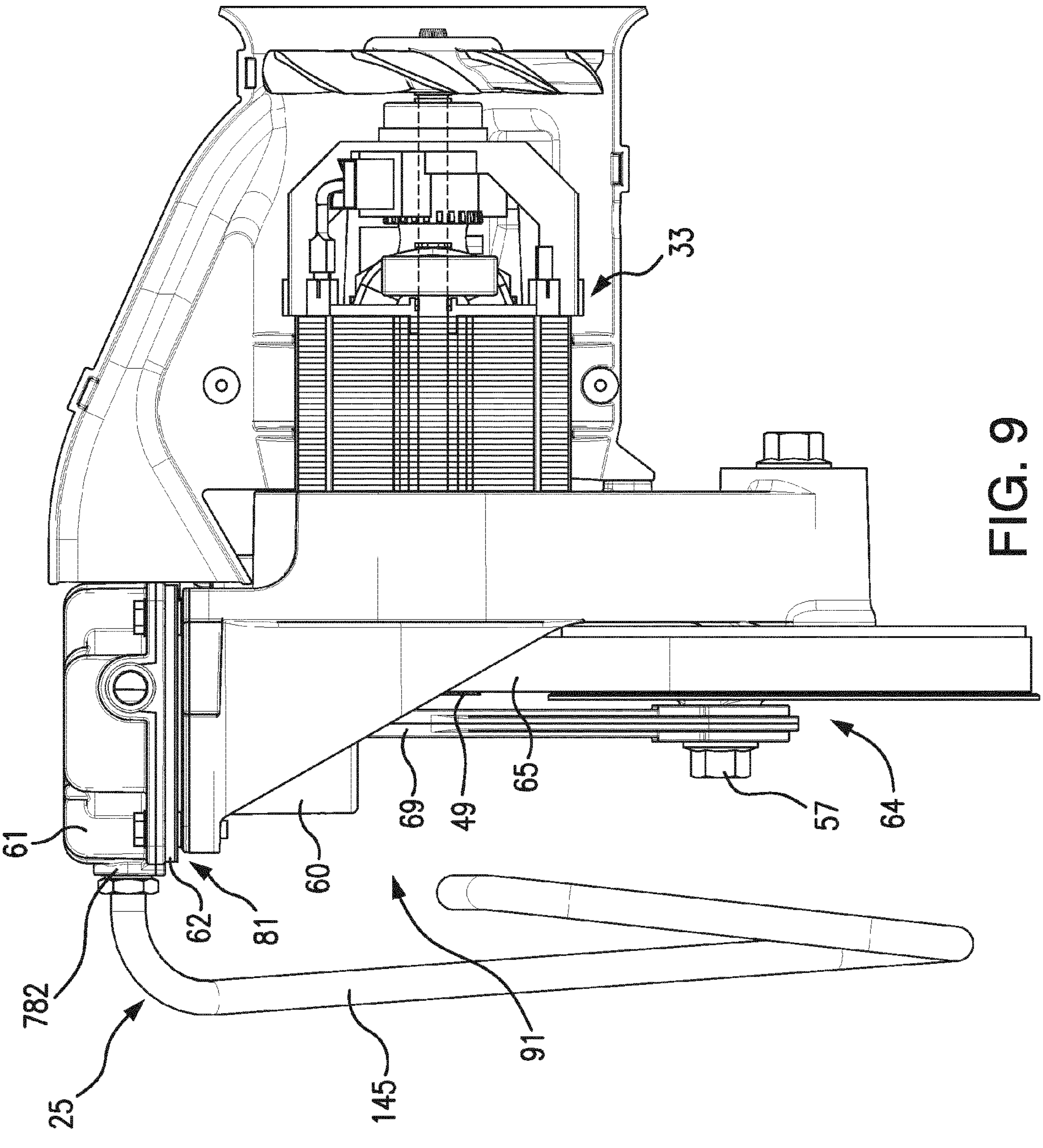


FIG. 9

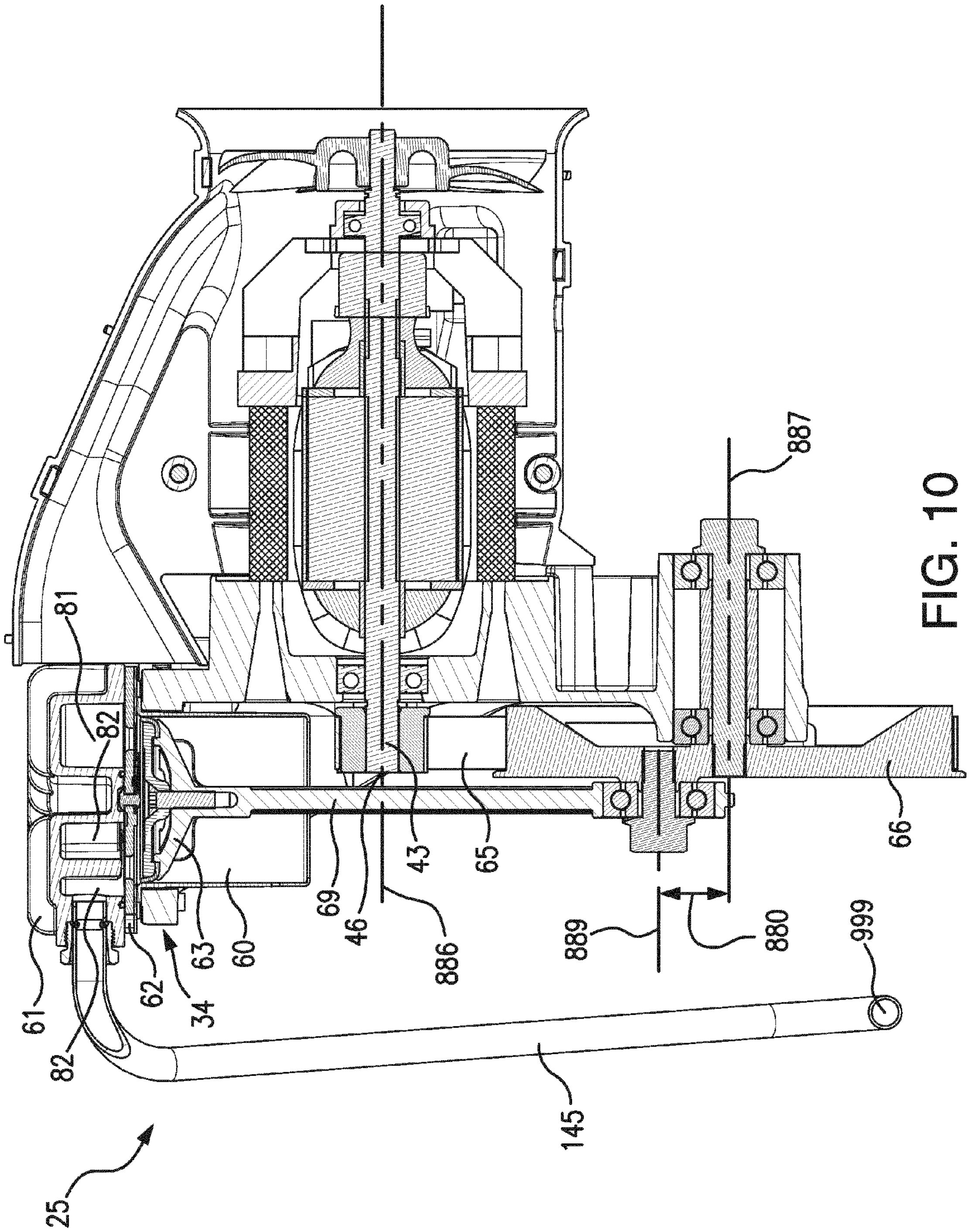


FIG. 10

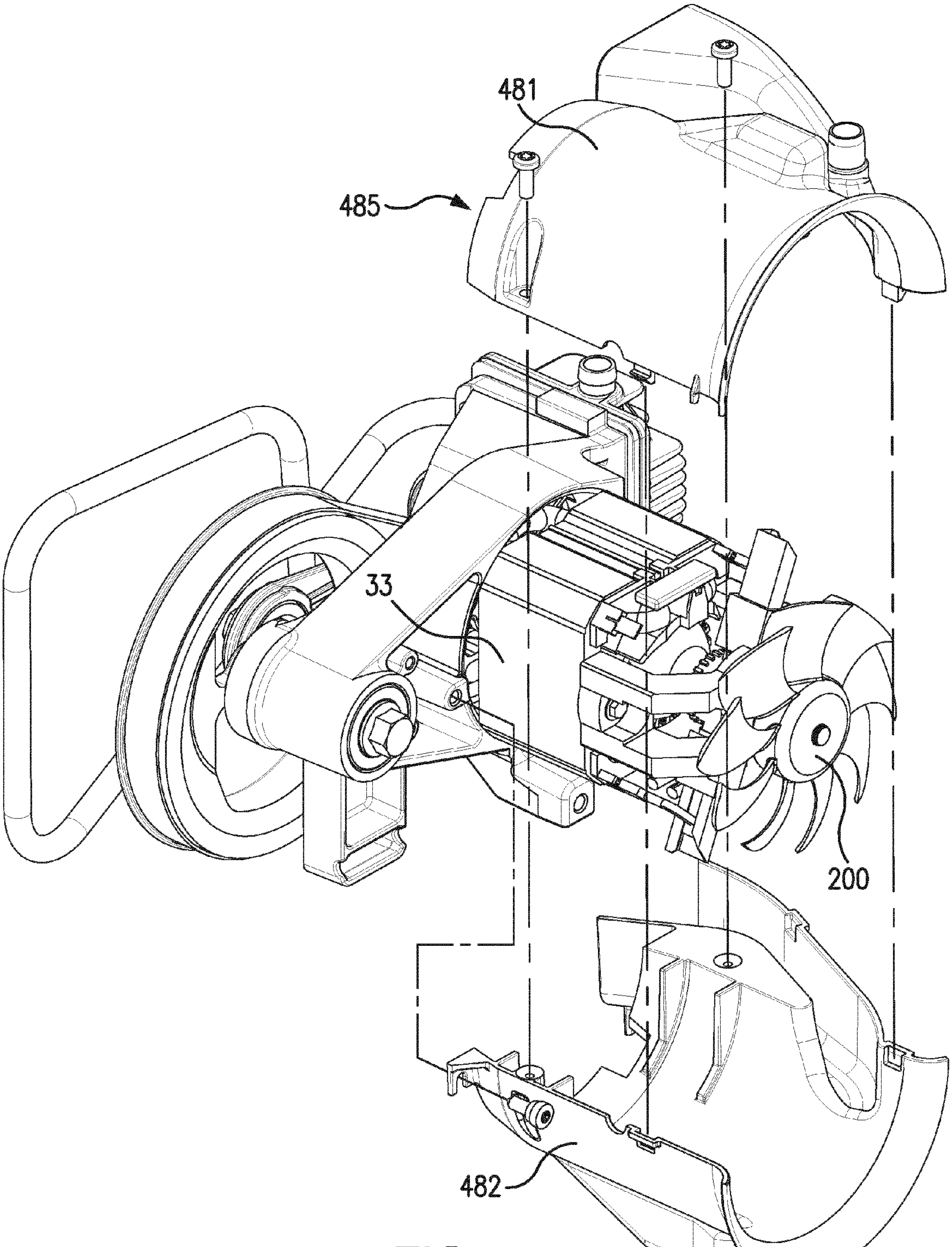
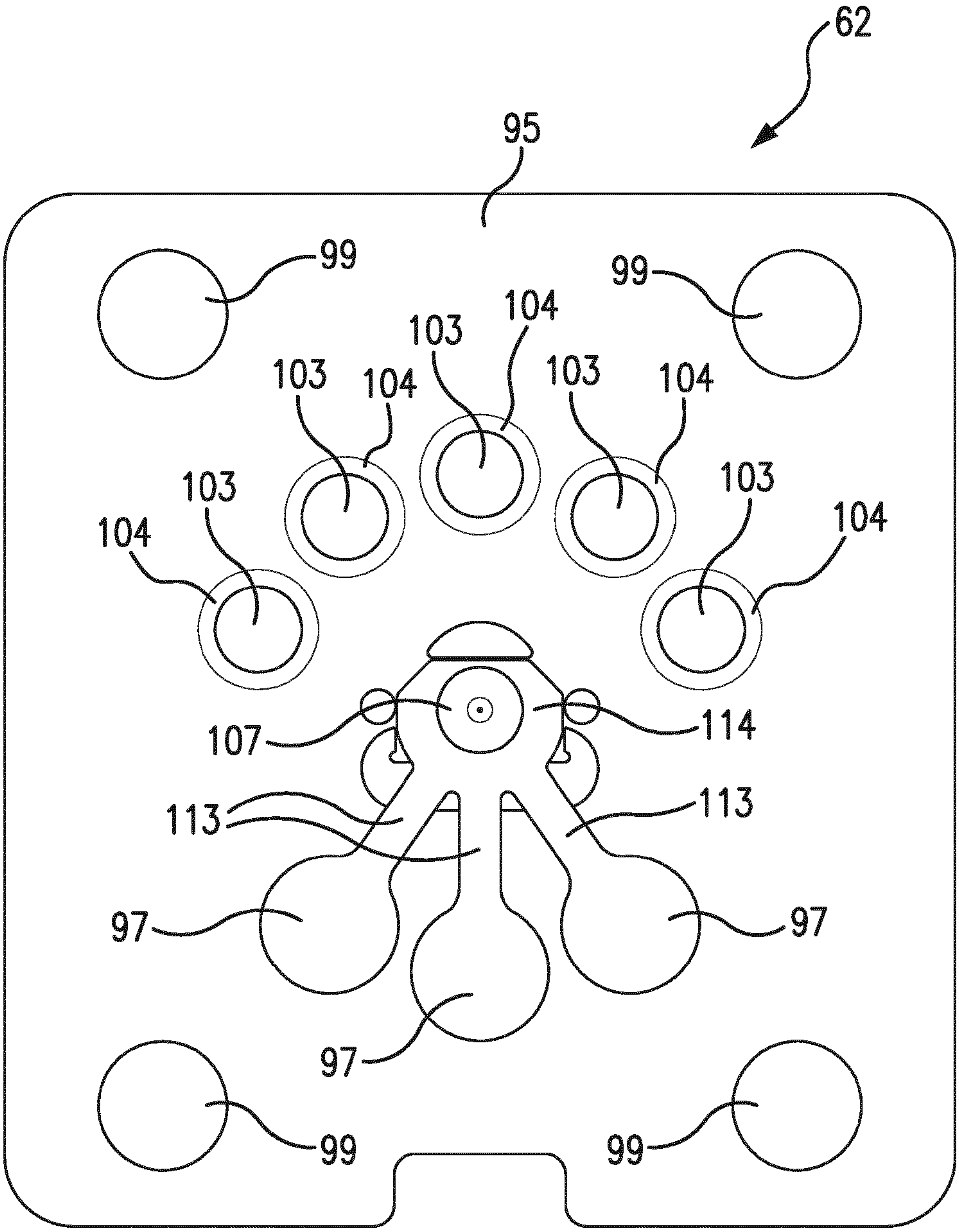


FIG. 11


62
95
99
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103
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103
104
107
114
113
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97
97
97
99
99

FIG. 12

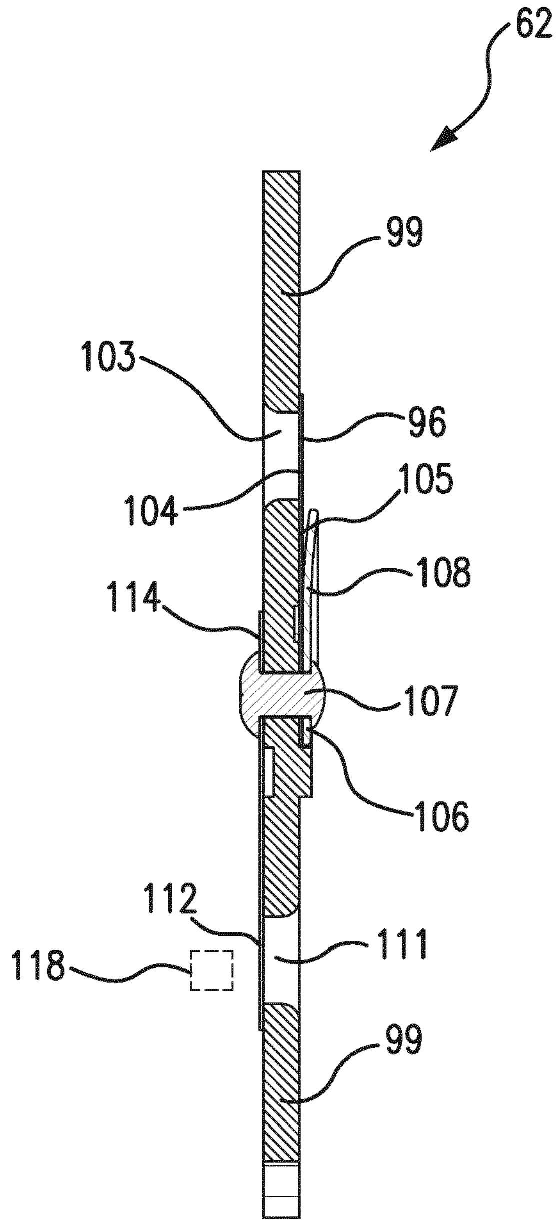
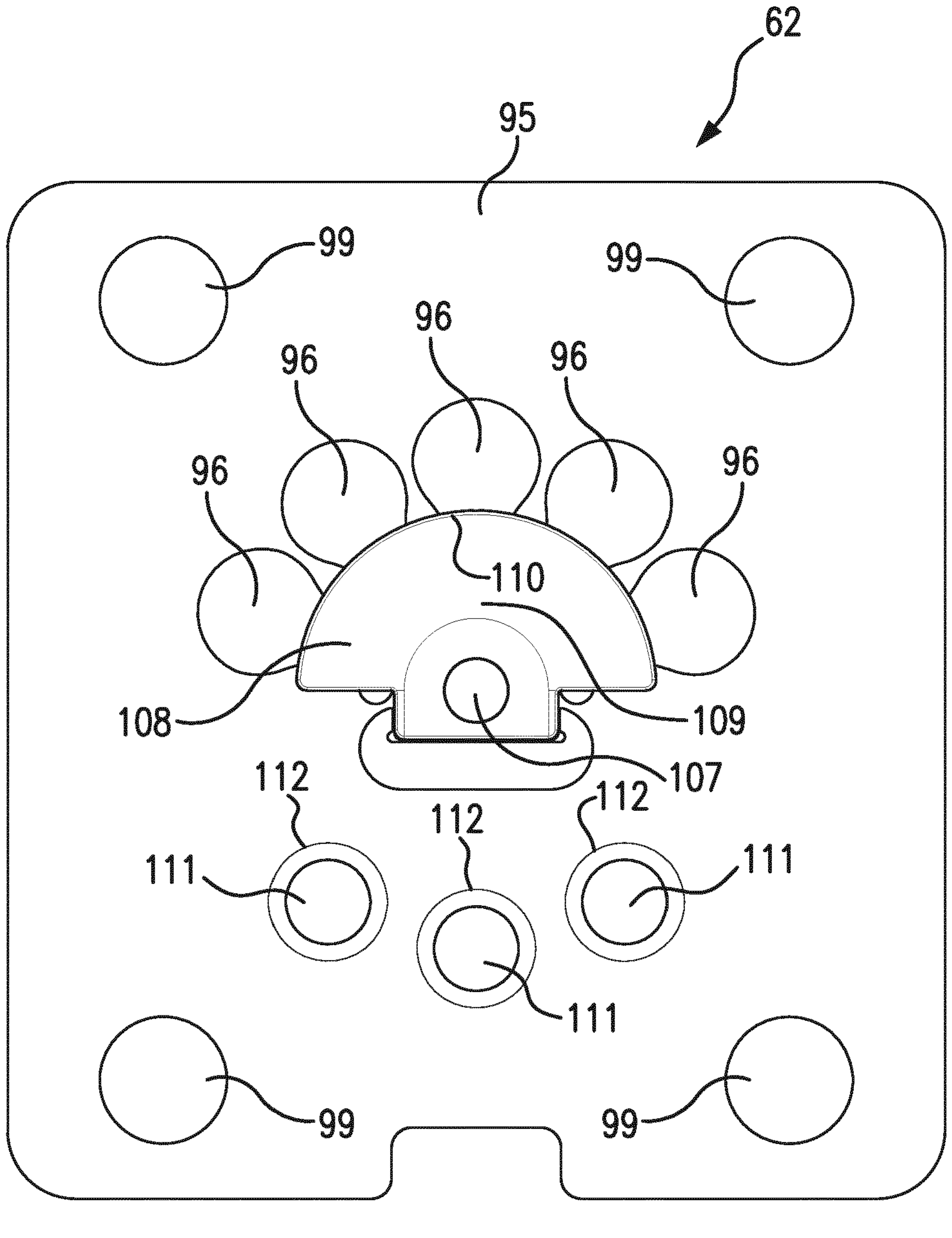


FIG. 13


62
95
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111
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111
99
99

FIG. 14

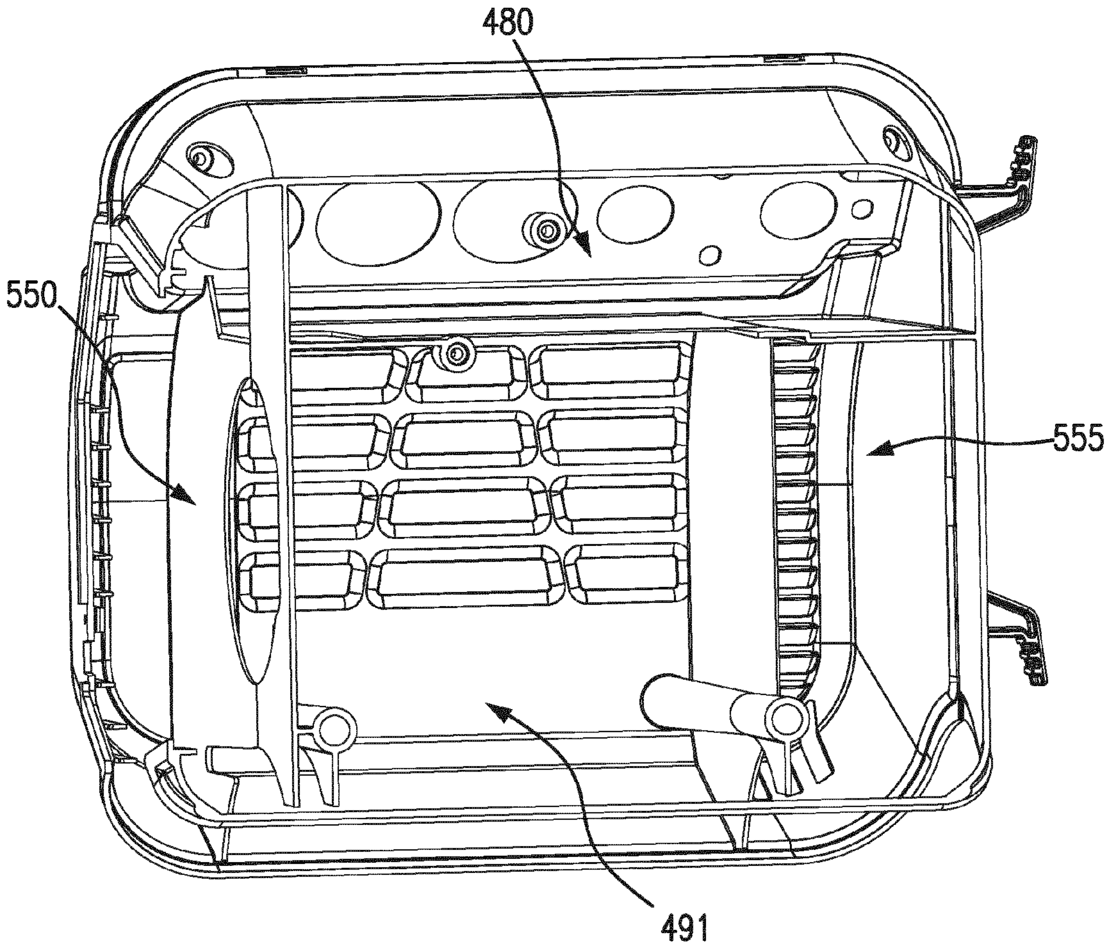


FIG. 15A

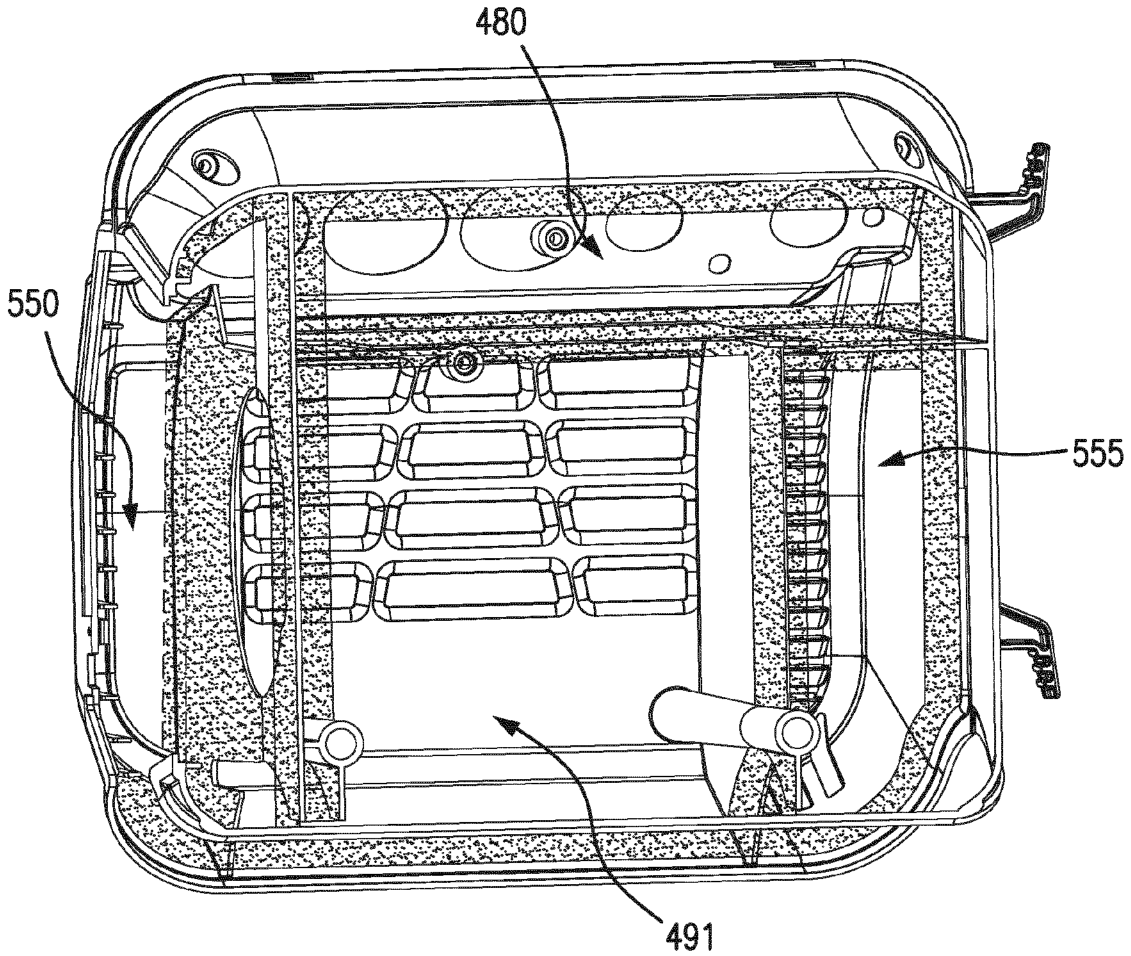


FIG. 15B

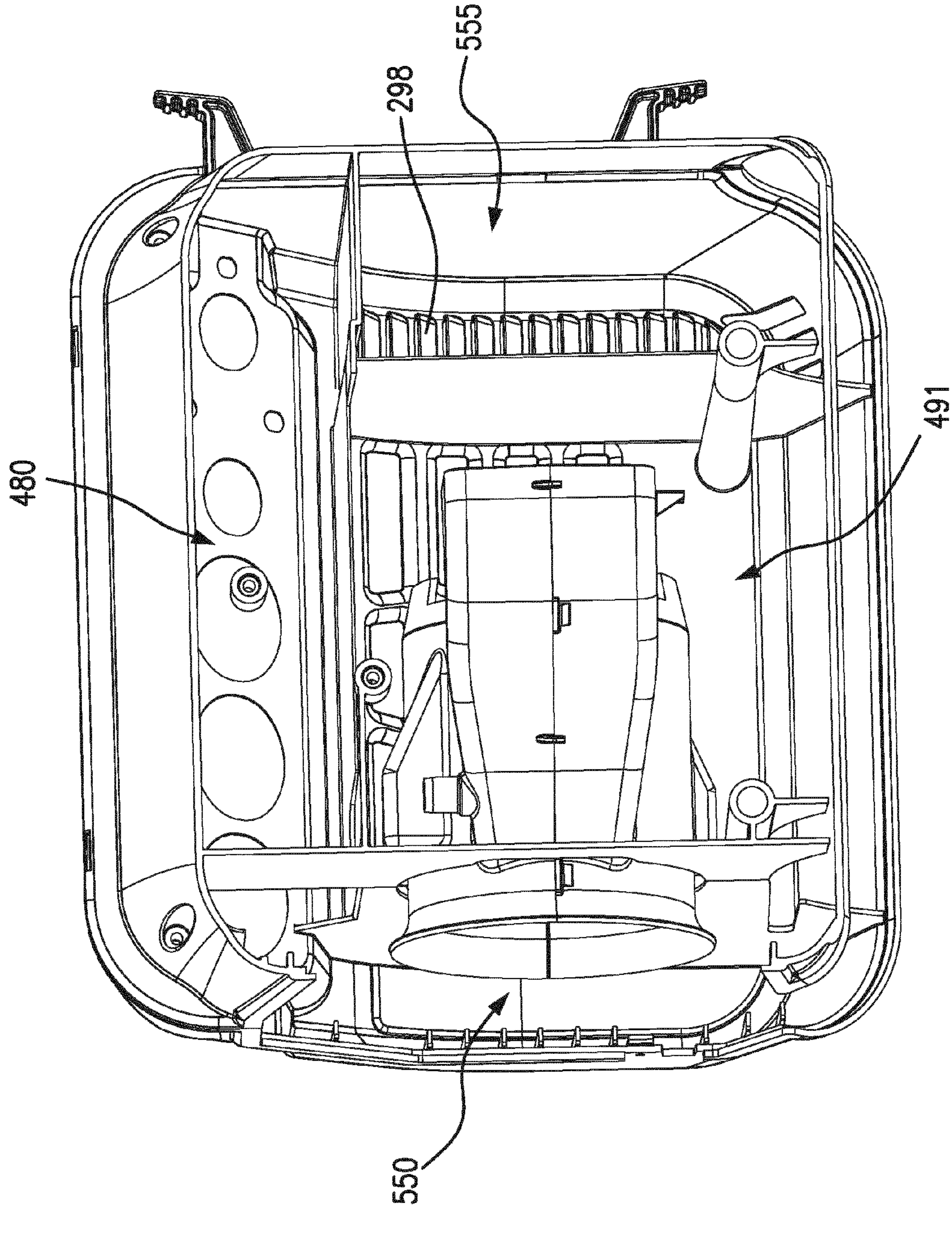


FIG. 16A

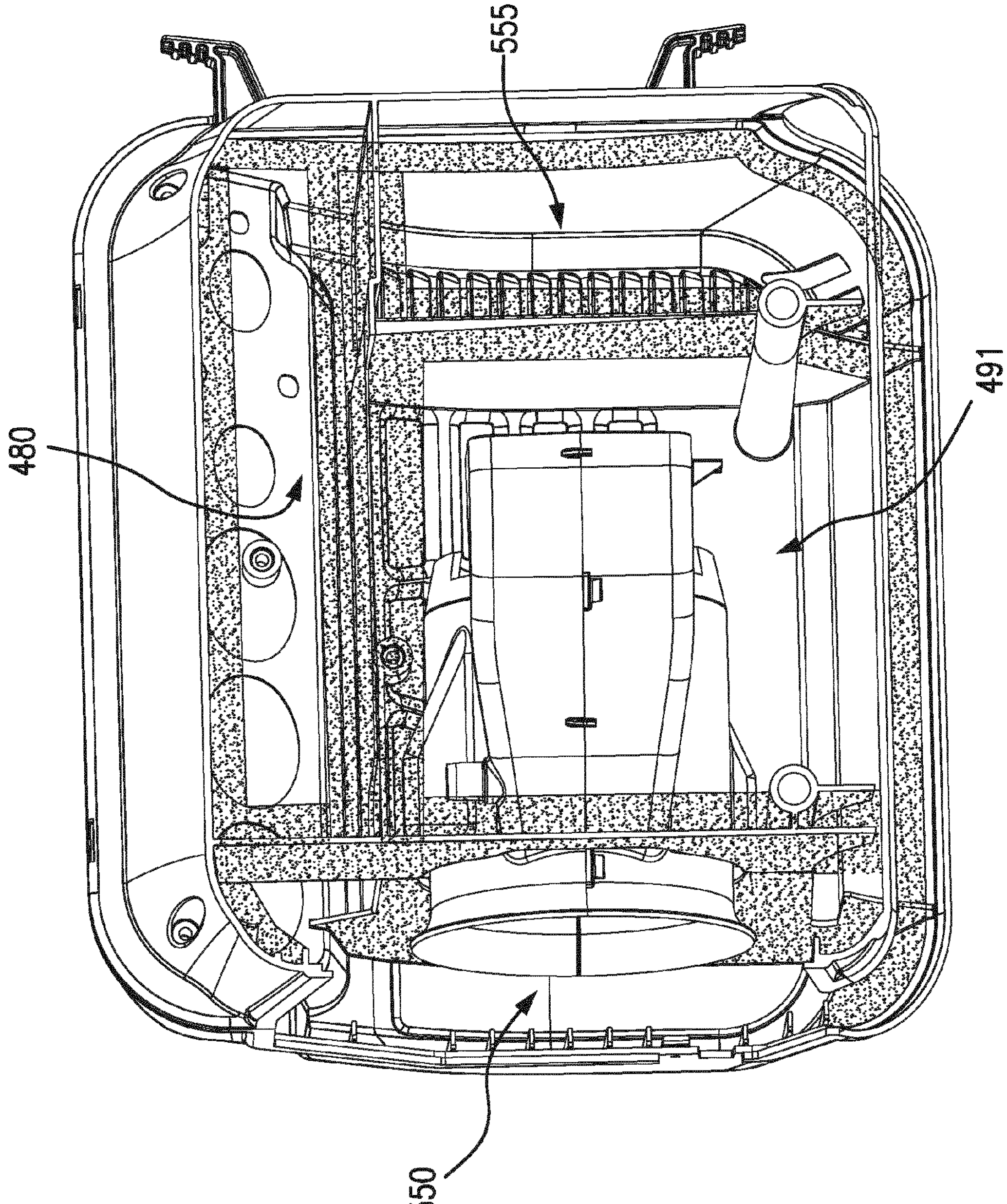


FIG. 16B

Sound Level	Pump Air Delivery	Maximum Pressure	Heat Transfer Rate	Cooling Fan Flowrate	Pump Speed	Cylinder Bore	Stroke	Swept Volume	Volumetric Efficiency	Input Power	Motor Efficiency
(dBA)	(SCFM@90 psig)	(psig)	BTU/min	(CFM)	(rpm)	(inches)	(inches)	inches^3	(% at 150 psig)	(Watts)	(%)
65 – 75	2.4 - 3.5										
65 – 75		150 - 250									
65 – 75			60 - 200								
65 – 75				50 - 100							
65 – 75	2.4 - 3.5	150 - 250	60 - 200								
65 – 75	2.4 - 3.5	150 - 250		50 - 100							
65 – 75	2.4 - 3.5	150 - 250			1500 - 3000	1.5 - 2.25	1.3 - 2				
65 – 75	2.4 - 3.5	150 - 250						2.3 - 8	33 - 50		
65 – 75	2.4 - 3.5	150 - 250								1000-1800	45 - 65

FIG. 17

Sound Level	Pump Air Delivery	Maximum Pressure	Heat Transfer Rate	Cooling Fan Flowrate	Pump Speed	Cylinder Bore	Stroke	Swept Volume	Volumetric Efficiency	Input Power	Motor Efficiency
(dBA)	(SCFM@90 psig)	(psig)	BTU/min	(CFM)	(rpm)	(inches)	(inches)	inches^3	(% at 150 psig)	(Watts)	(%)
65 – 75					1500 - 3000						
65 – 75						1.5 - 2.25					
65 – 75							1.3 - 2				
65 – 75								2.3 - 8			
65 – 75									33 - 50		
65 – 75										1000-1800	
65 – 75	2.4 - 3.5	150 - 250	60 - 200	50 - 100							45 - 65
65 – 75					1500 - 3000	1.5 - 2.25					
65 – 75	2.4 - 3.5	150 - 250	60 - 200	50 - 100	1500 - 3000	1.5 - 2.25	1.3 - 2				
65 – 75	2.4 - 3.5	150 - 250	60 - 200	50 - 100	1500 - 3000	1.5 - 2.25	1.3 - 2	2.3 - 8	33 - 50	1000-1800	45 - 65

FIG. 18

Sound Level	Pump Air Delivery	Maximum Pressure	Heat Transfer Rate	Cooling Fan Flowrate	Pump Speed	Cylinder Bore	Stroke	Swept Volume	Volumetric Efficiency	Input Power	Motor Efficiency
(dBA)	(SCFM@90 psig)	(psig)	BTU/min	(CFM)	(rpm)	(inches)	(inches)	inches^3	(% at 150 psig)	(Watts)	(%)
70.5	2.9			71.5							
70.5	2.9				2300	1.875	1.592				
70.5	2.9							4.4	41		
70.5	2.9									1446	56.5
70.5	2.9	200	84.1								
70.5	2.9	200		71.5							
70.5	2.9	200			2300	1.875	1.592				
70.5	2.9	200						4.4	41		
70.5	2.9	200								1446	56.5
70.5	2.9		84.1								
70.5	2.9			71.5							
70.5	2.9				2300						
70.5	2.9									1446	
70.5		200	84.1								
70.5		200		71.5							
70.5		200			2300						
70.5		200								1446	
70.5			84.1	71.5							
70.5			84.1		2300						
70.5										1446	

FIG. 19

Sound Level	Pump Air Delivery	Maximum Pressure	Heat Transfer Rate	Cooling Fan Flowrate	Pump Speed	Cylinder Bore	Stroke	Swept Volume	Volumetric Efficiency	Input Power	Motor Efficiency
(dBA)	(SCFM@90 psig)	(psig)	BTU/min	(CFM)	(rpm)	(inches)	(inches)	inches^3	(% at 150 psig)	(Watts)	(%)
70.5	2.9	200	84.1	71.5							
70.5	2.9	200	84.1		2300						
70.5	2.9	200	84.1	71.5	2300						
70.5	2.9	200	84.1			1.875					
70.5	2.9	200	84.1				1.592				
70.5	2.9	200	84.1	71.5	2300						
70.5	2.9	200	84.1	71.5	2300	1.875					
70.5	2.9	200	84.1	71.5	2300		1.592				
70.5	2.9	200	84.1	71.5	2300	1.875	1.592				
70.5	2.9	200	84.1					4.4			
70.5	2.9	200	84.1						41		
70.5	2.9	200	84.1	71.5	2300	1.875	1.592	4.4			
70.5	2.9	200	84.1	71.5	2300	1.875	1.592	4.4	41		
70.5	2.9	200	84.1							1446	
70.5	2.9	200	84.1								56.5
70.5	2.9	200	84.1	71.5	2300	1.875	1.592	4.4	41	1446	
70.5	2.9	200	84.1	71.5	2300	1.875	1.592	4.4	41	1446	56.5

FIG. 20

	Compressor Assembly Performance Data
Motor Speed (RPM)	11200
Pump Speed (RPM)	2300
Voltage	120
Air Flow (SCFM) @ 90 psi	2.9
Current Draw @ 90 psi (amps)	11.8
Volumetric Efficiency @ 90 psi	49.6%
Motor Torque (lb-in) @ 90 psi	6.01
Motor Efficiency @ 90 psi	56.3%
Air Flow (SCFM) @ 150 psi	2.4
Current Draw @ 150 psi (amps)	12.05
Volumetric Efficiency @ 150 psi	41.0%
Motor Torque (lb-in) @ 150 psi	6.16
Motor Efficiency @ 150 psi	56.5%
Air Flow (SCFM) @ 200 psi	2.15
Current Draw @ 200 psi (amps)	11.88
Volumetric Efficiency @ 200 psi	36.7%
Motor Torque (lb-in) @ 200 psi	6.06
Motor Efficiency @ 200 psi	56.4%
Cylinder Bore (inches)	1.875
Cylinder Stroke (inches)	1.592
Cylinder Swept Volume (cubic inches)	4.40
Sound Level (dBA)	70.5
Heat Transfer Rate (BTU/min)	84.1

FIG. 21

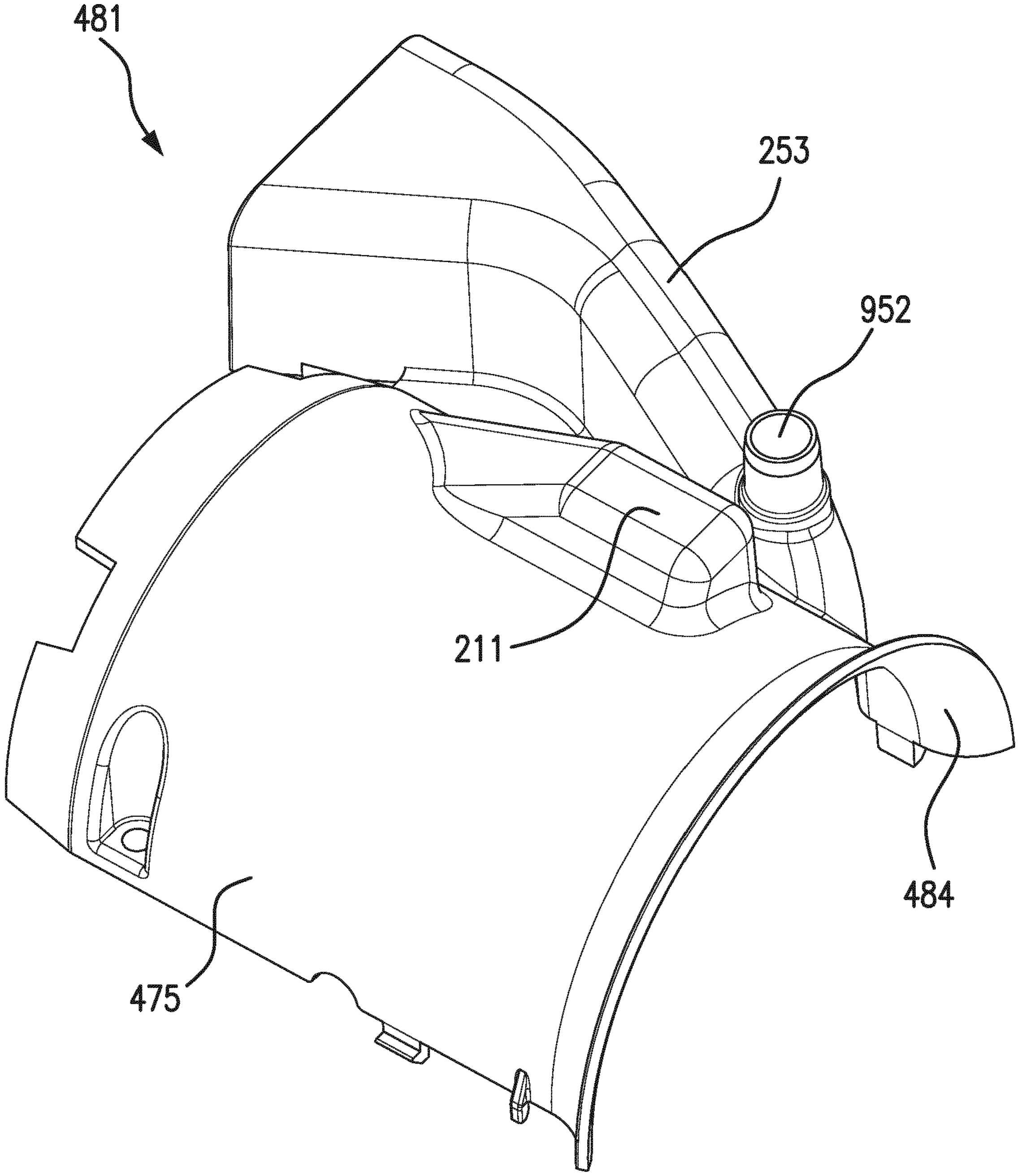


FIG. 22

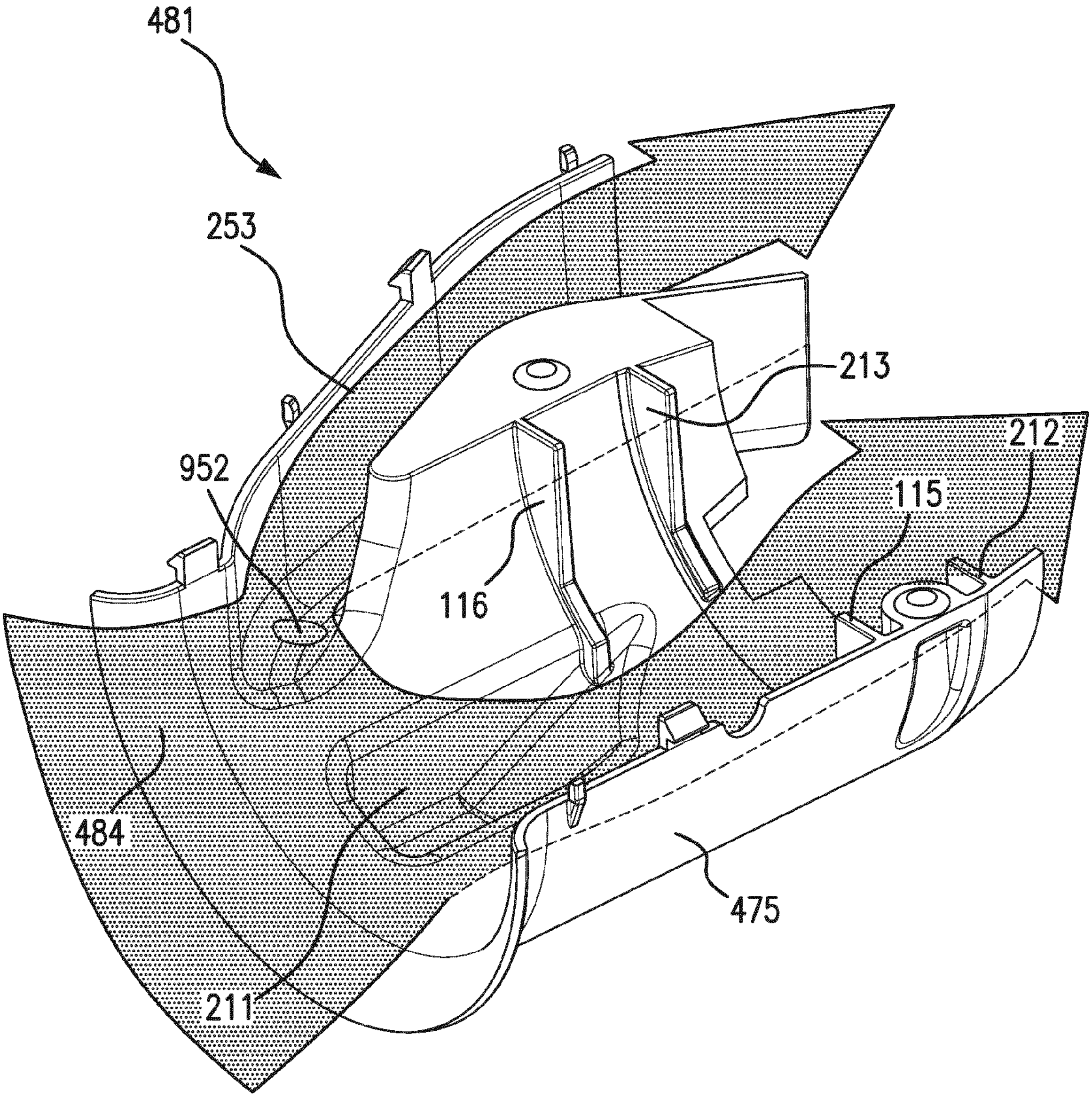


FIG. 23

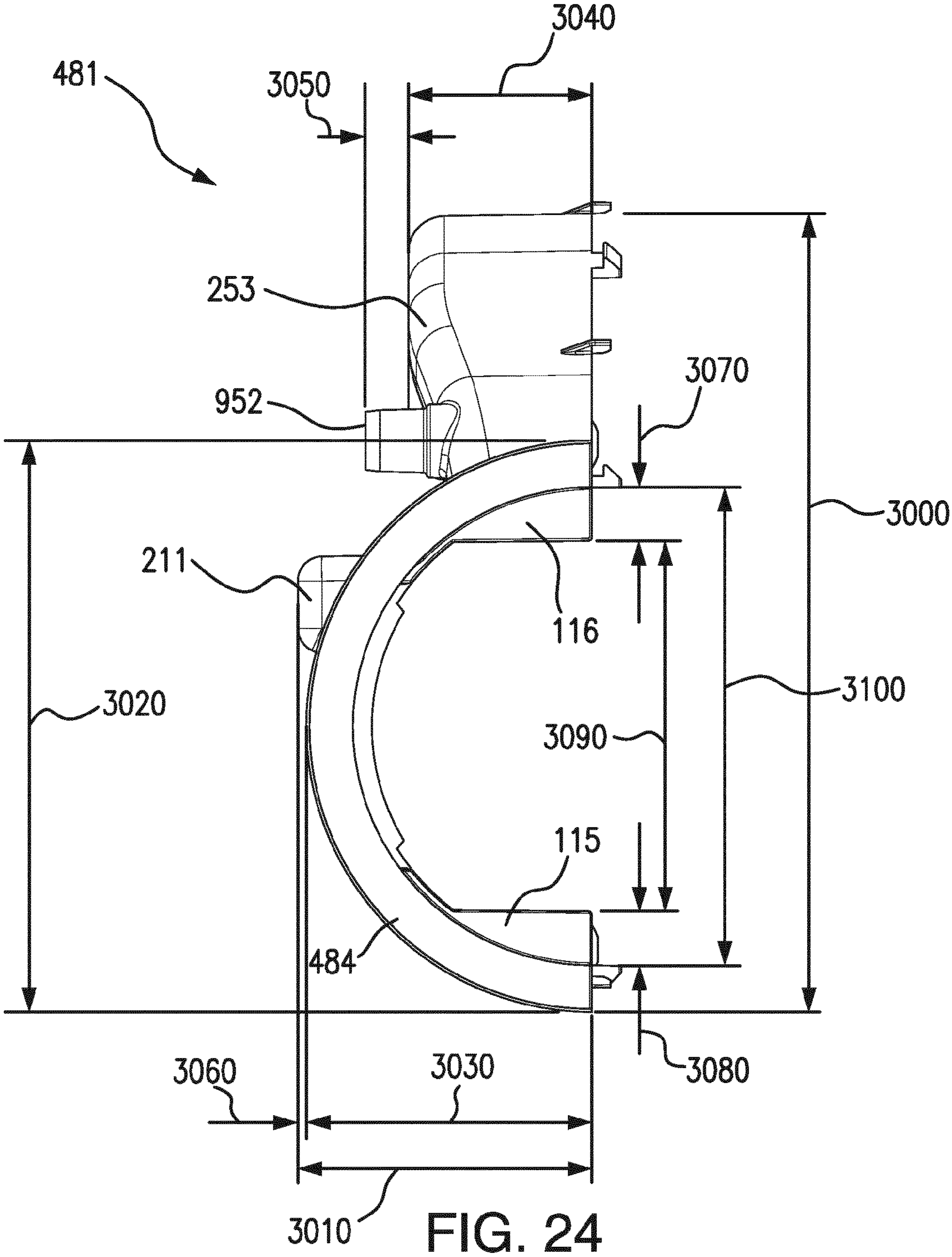

481
3040
3050
253
952
3070
3000
211
116
3020
3100
3090
115
484
3080
3060
3030
3010

FIG. 24

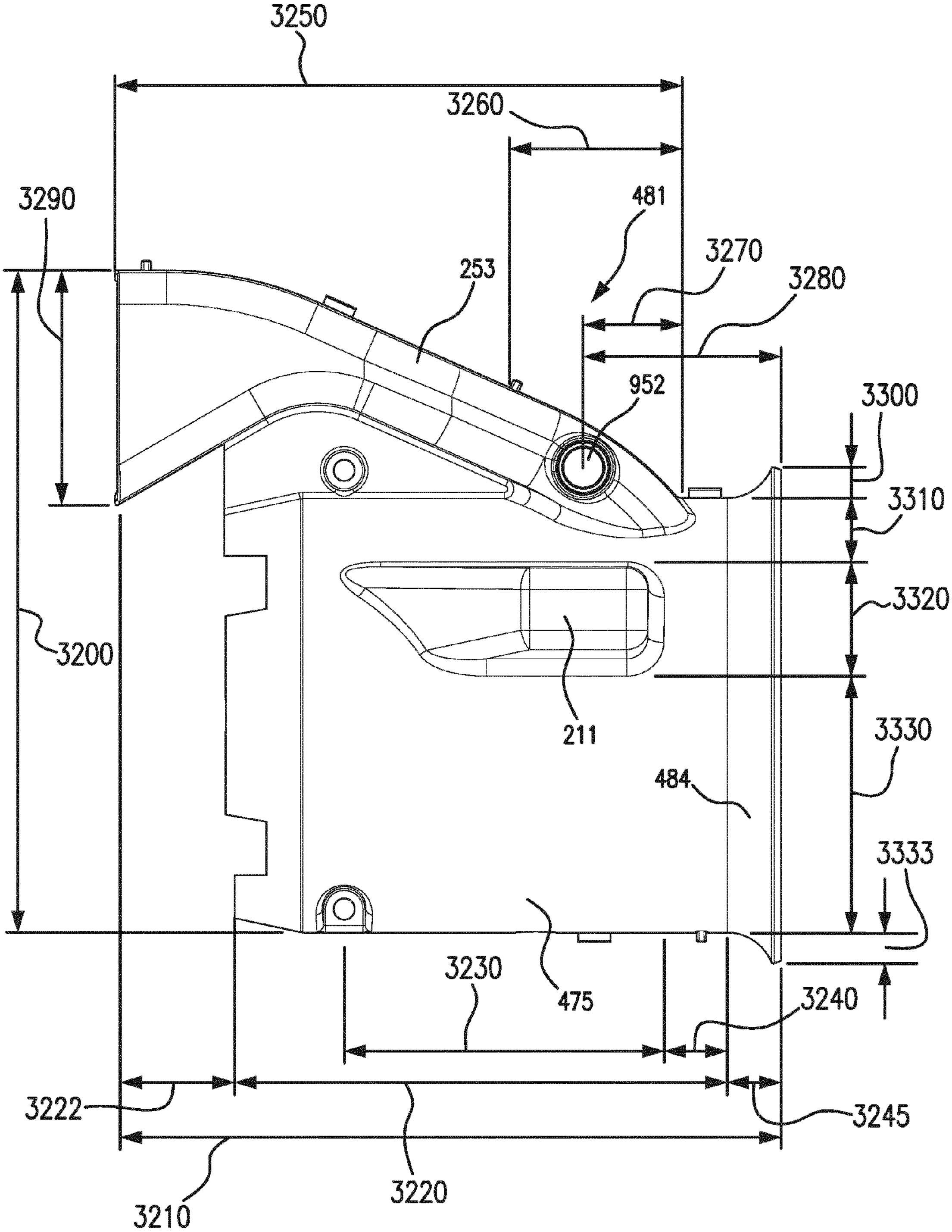

3250
3260
3290
481
3270
253
3280
952
3300
3310
3320
3200
211
3330
484
3333
3230
475
3240
3222
3245
3220
3210

FIG. 25

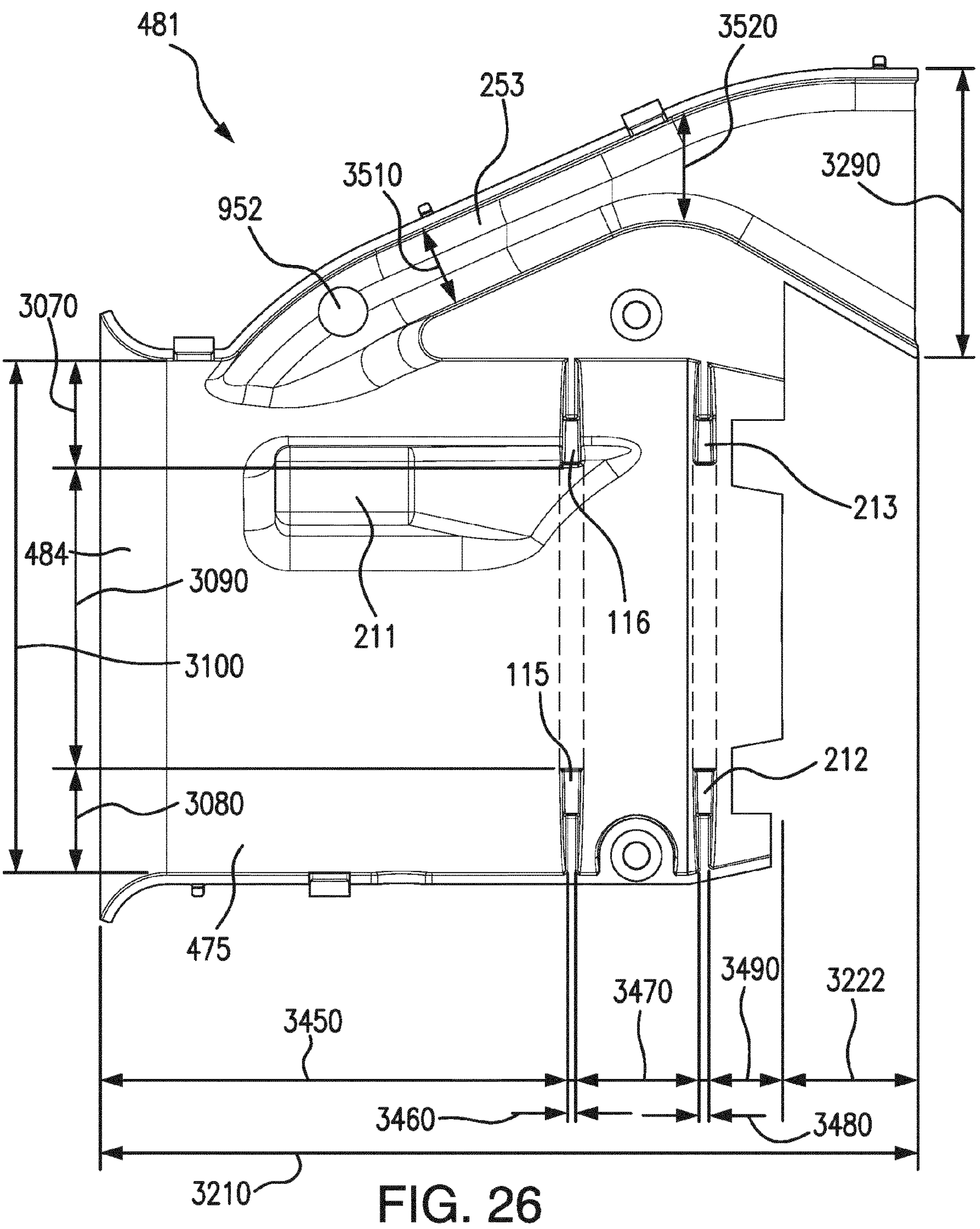

481
3520
253
3290
3510
952
3070
213
484
3090
211
116
3100
115
212
3080
475
3490
3222
3470
3450
3460
3480
3210

FIG. 26

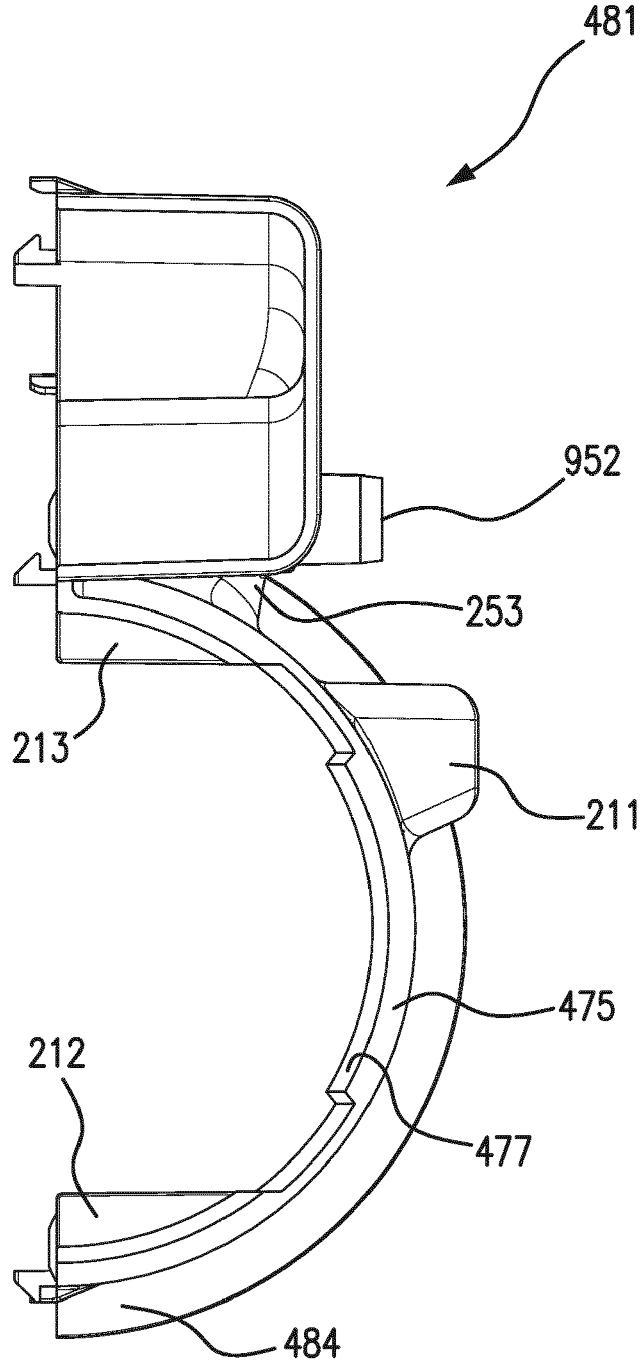


FIG. 27

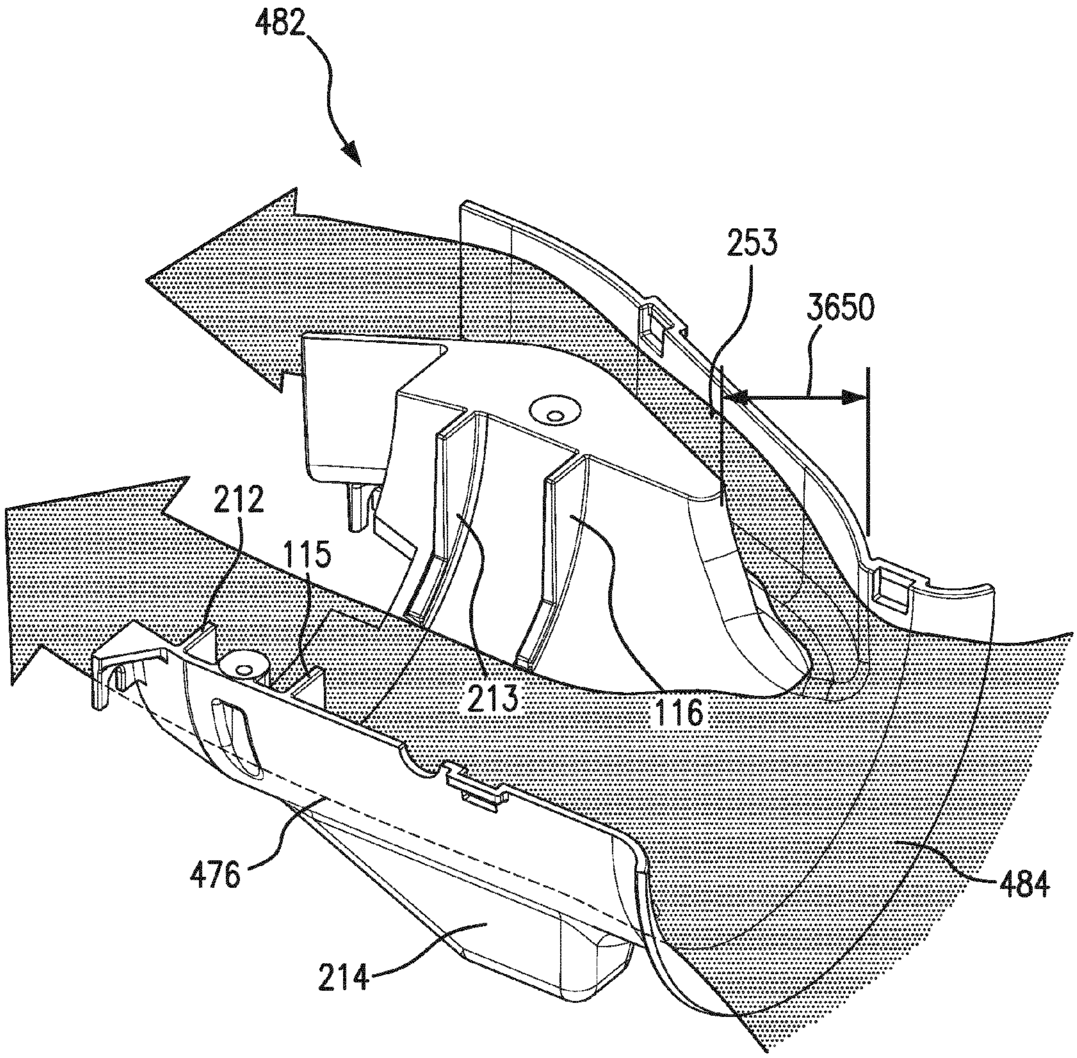


FIG. 28

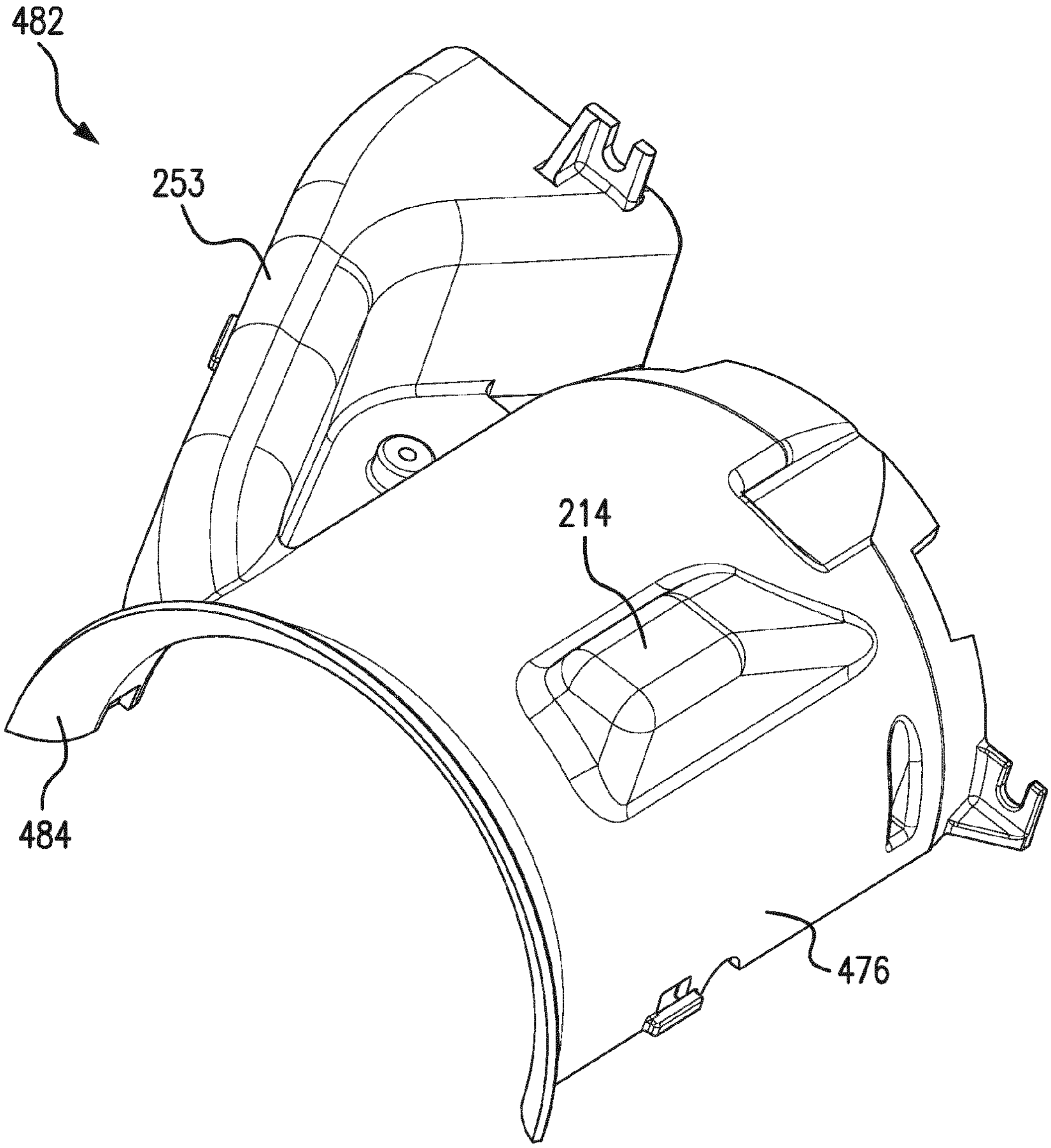


FIG. 29

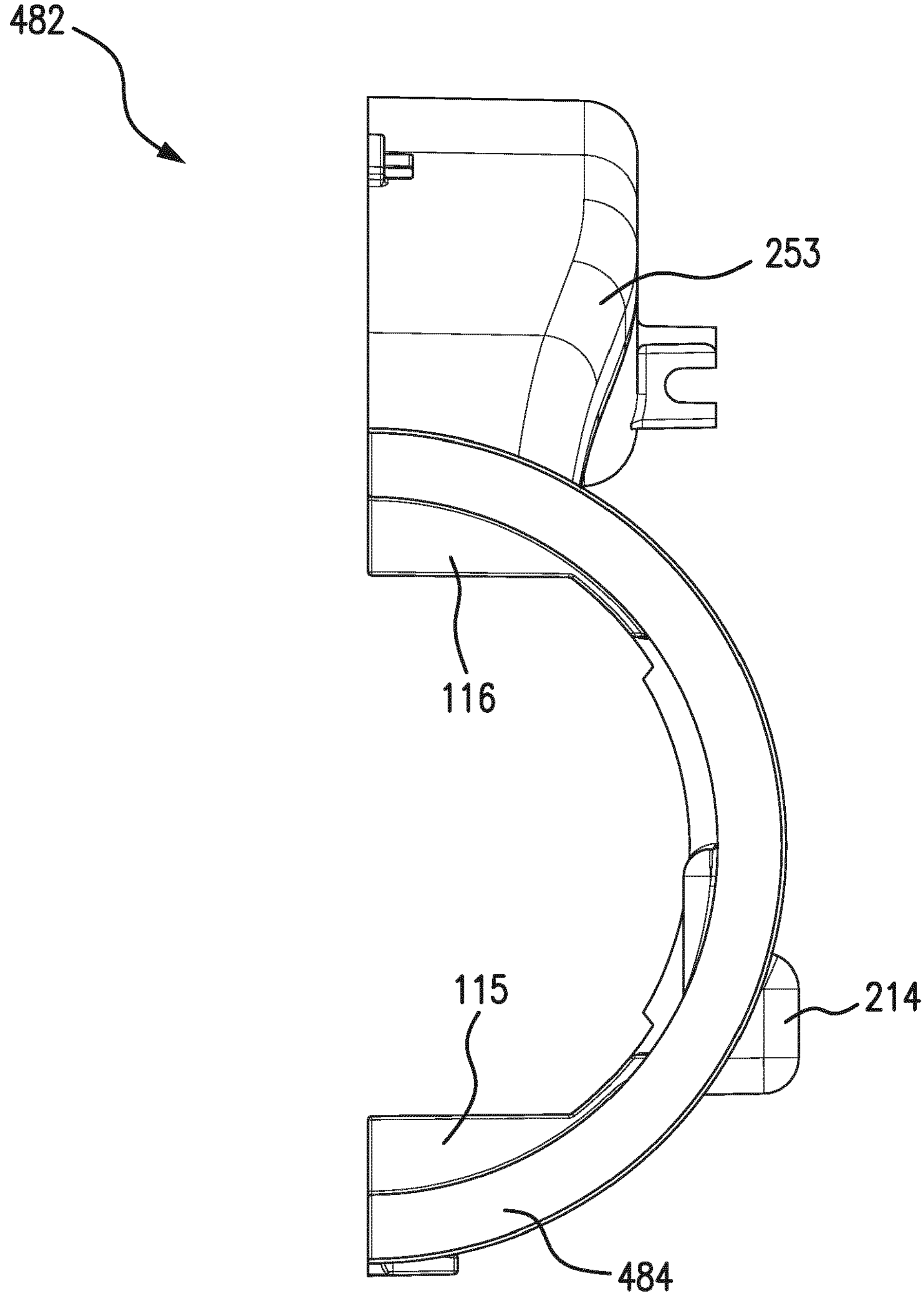


FIG. 30

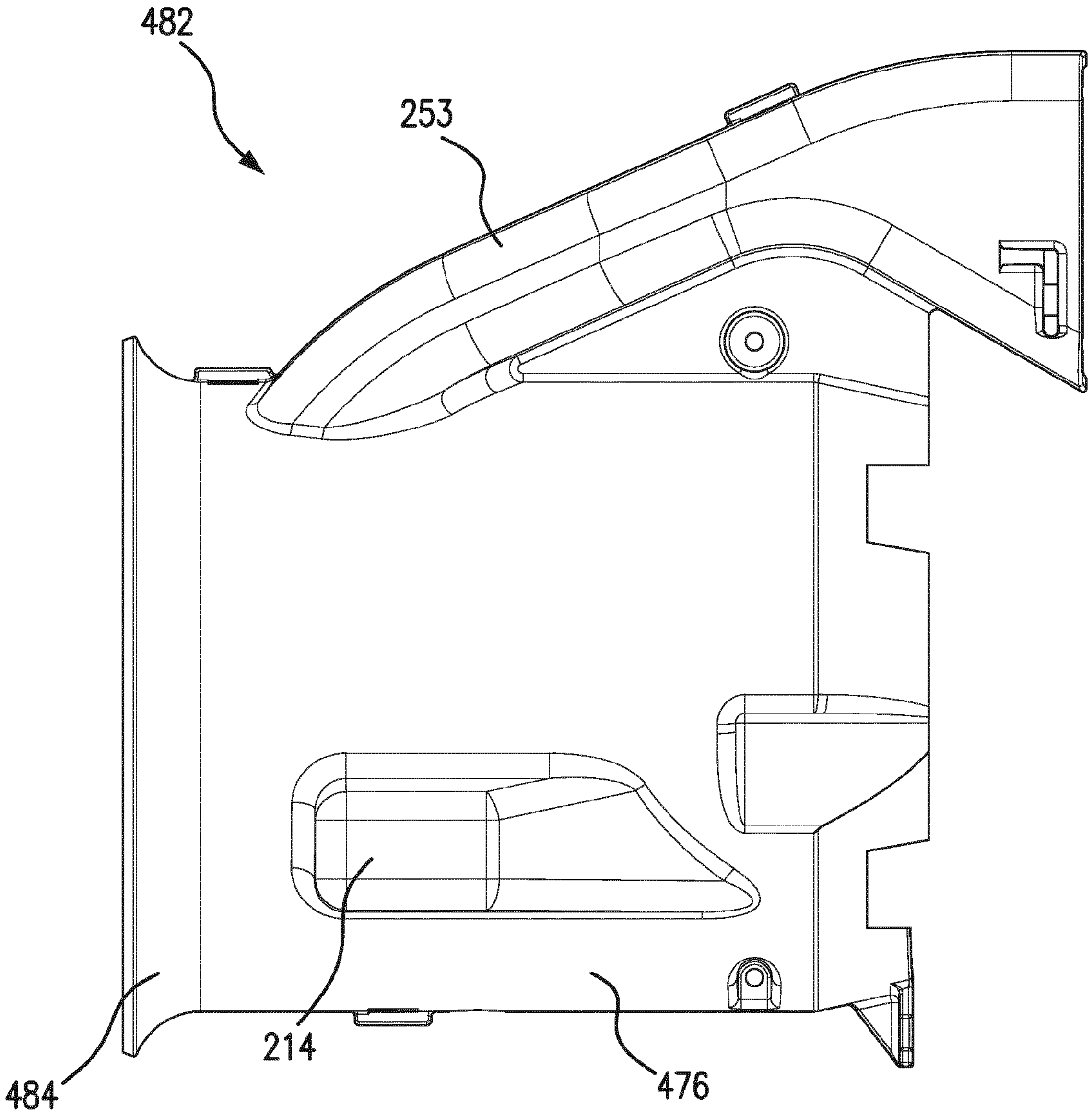


FIG. 31

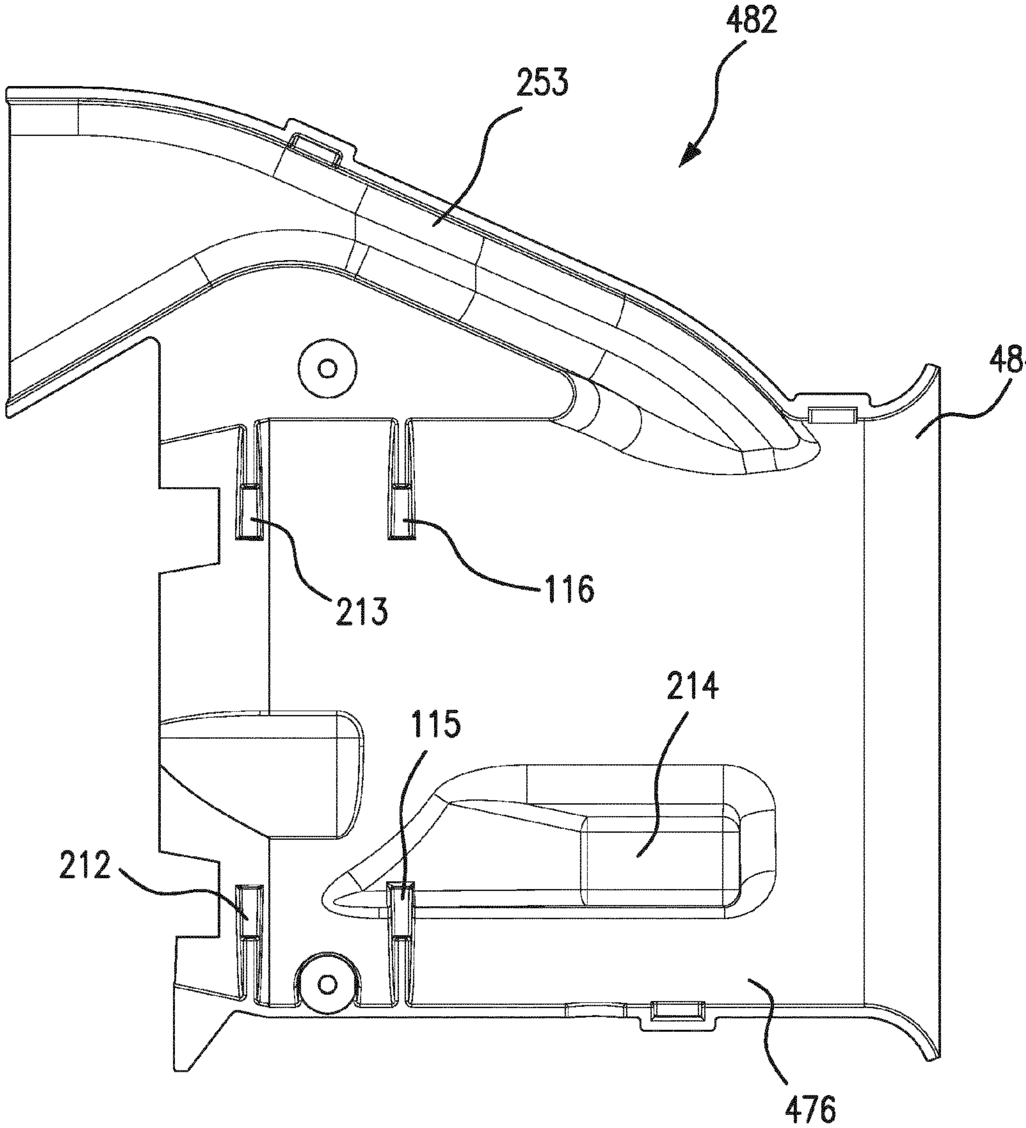


FIG. 32

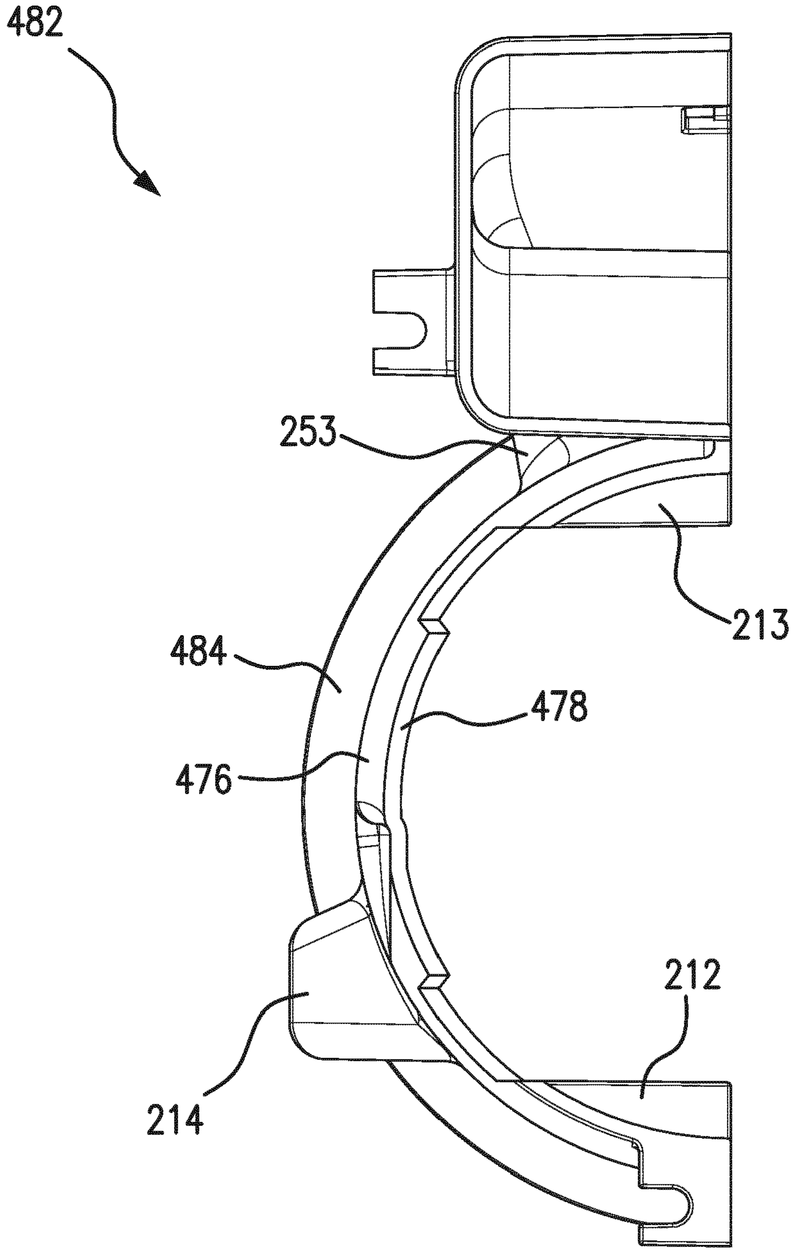


FIG. 33

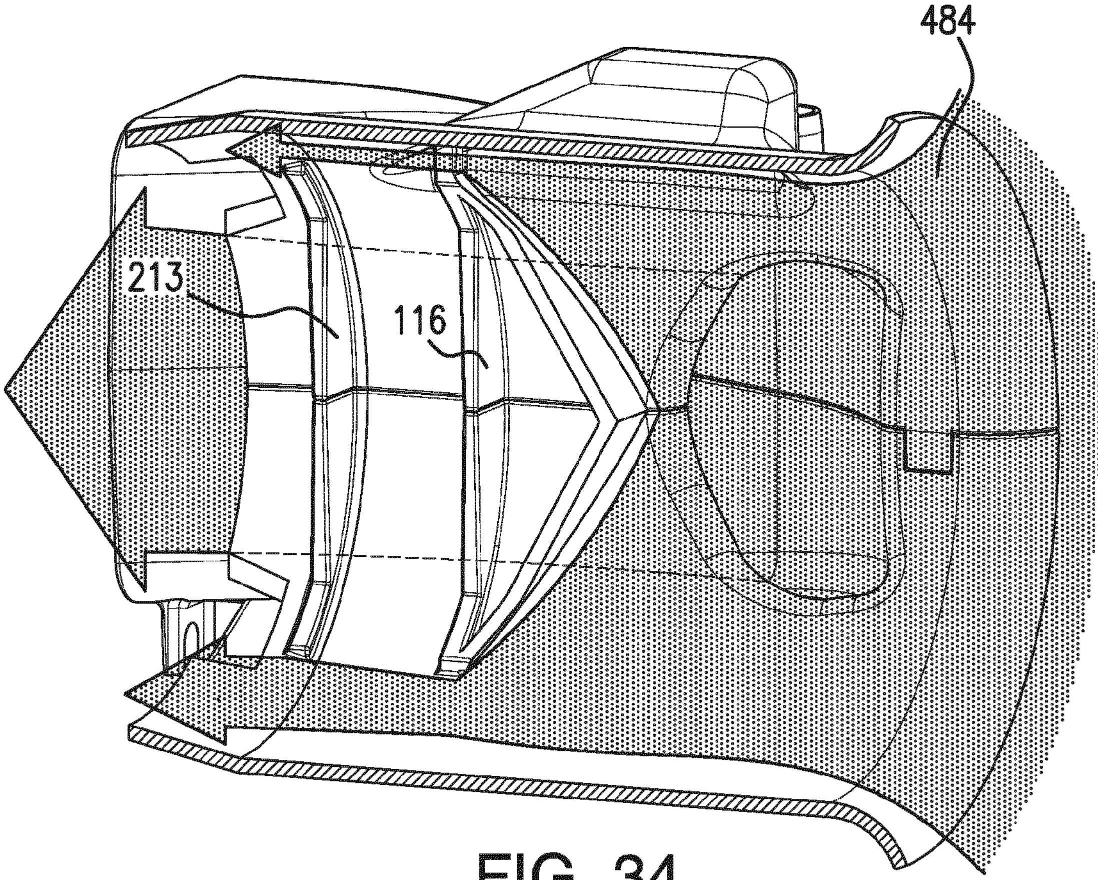


FIG. 34

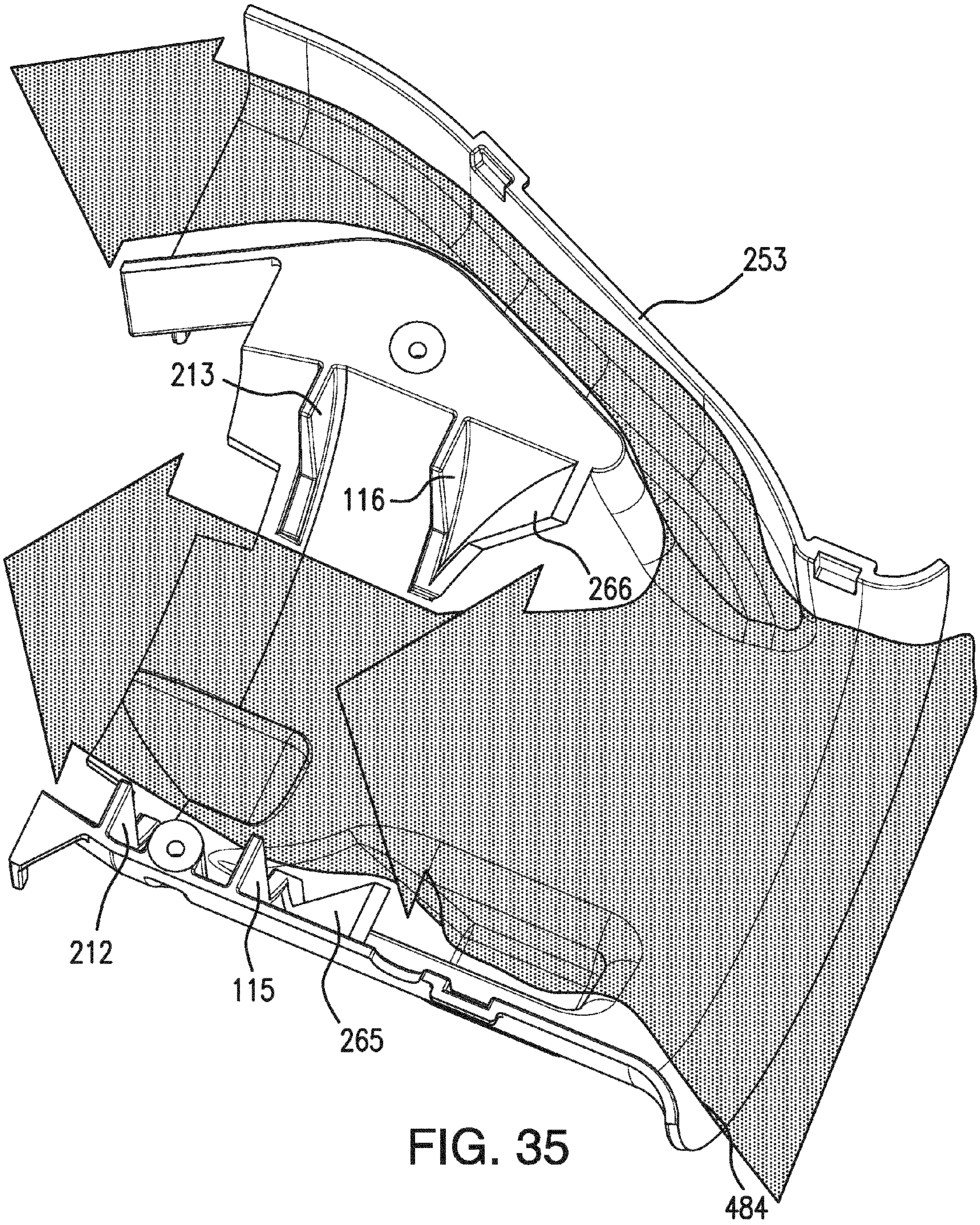


FIG. 35

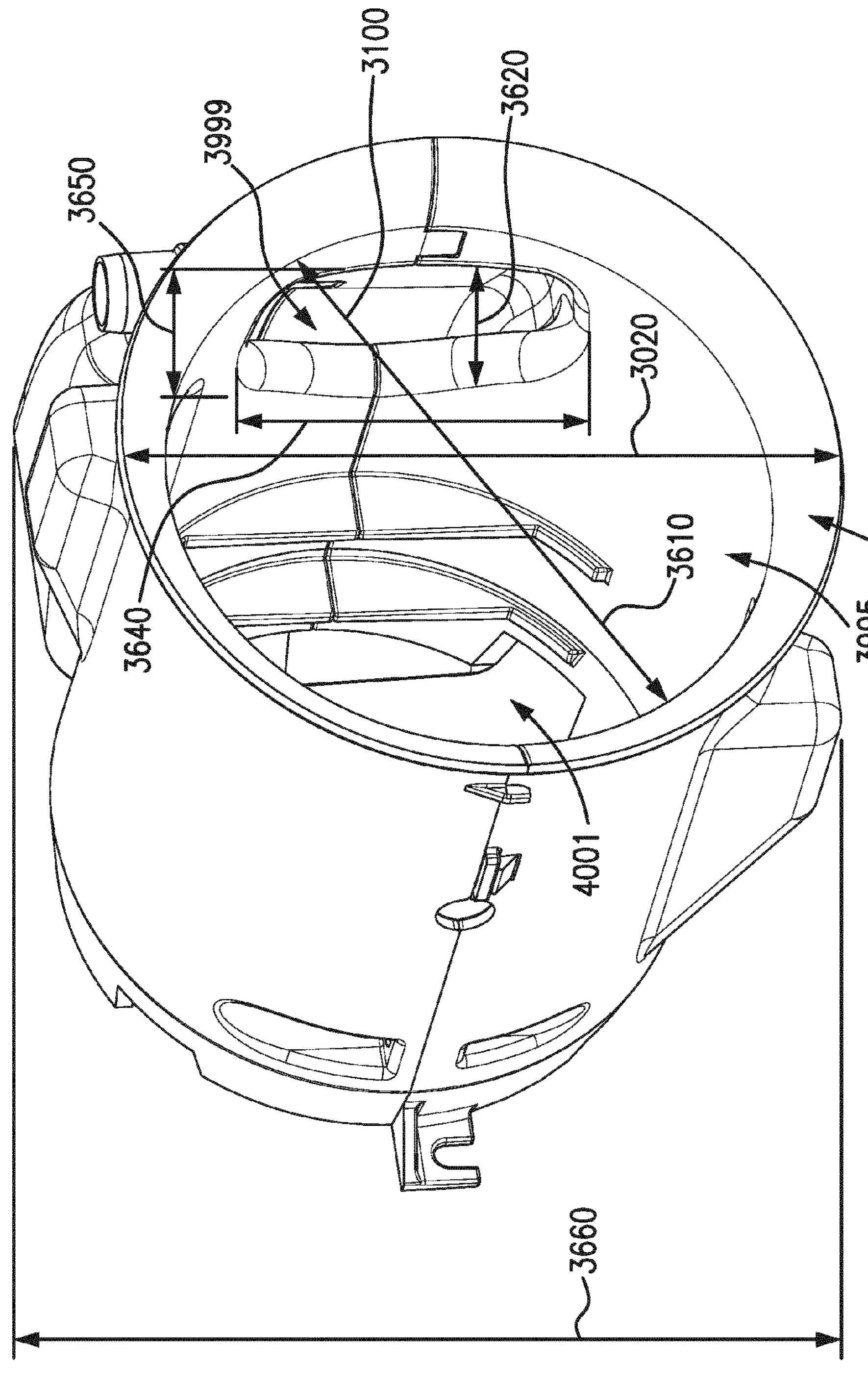


FIG. 36

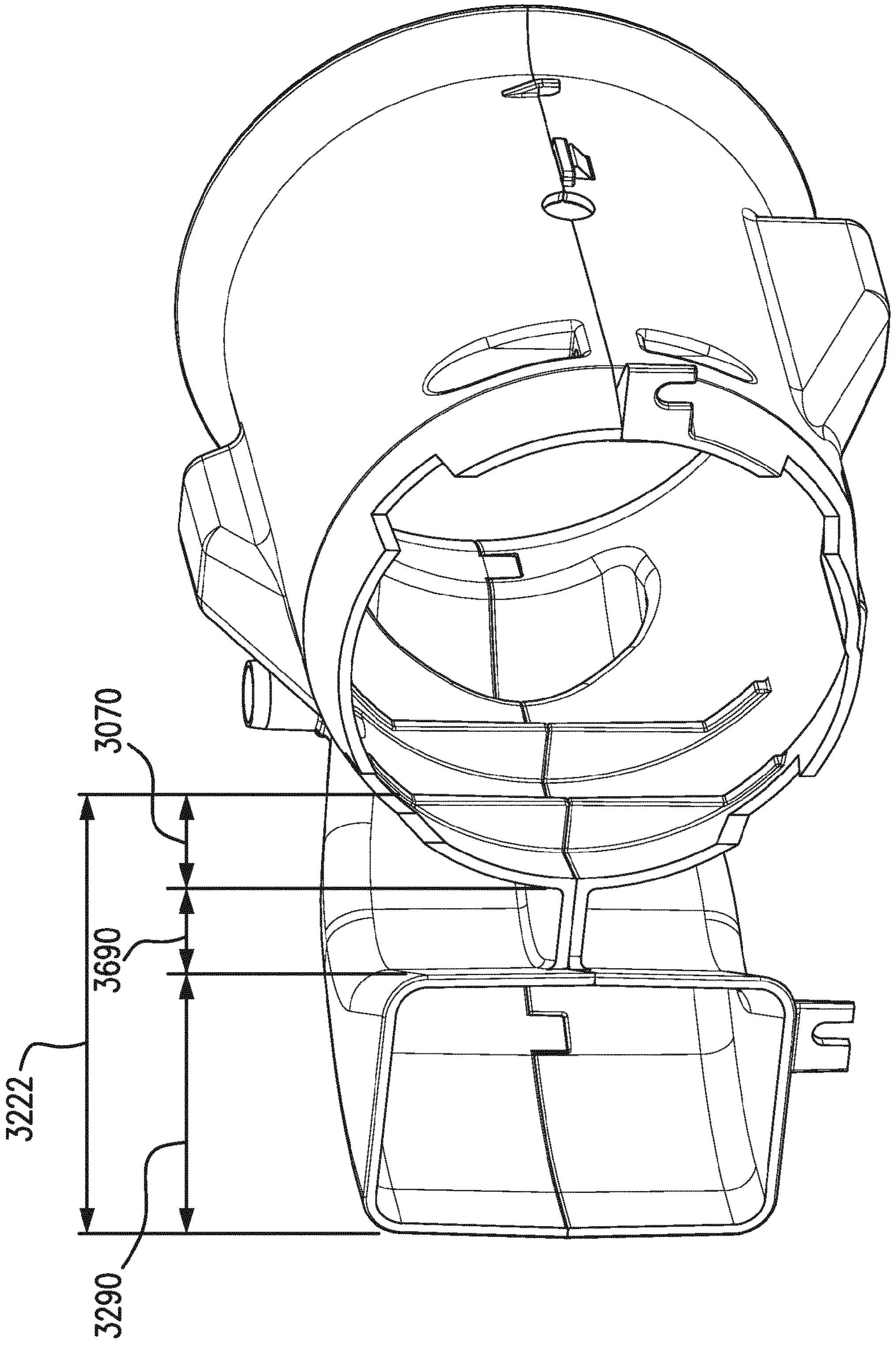


FIG. 37

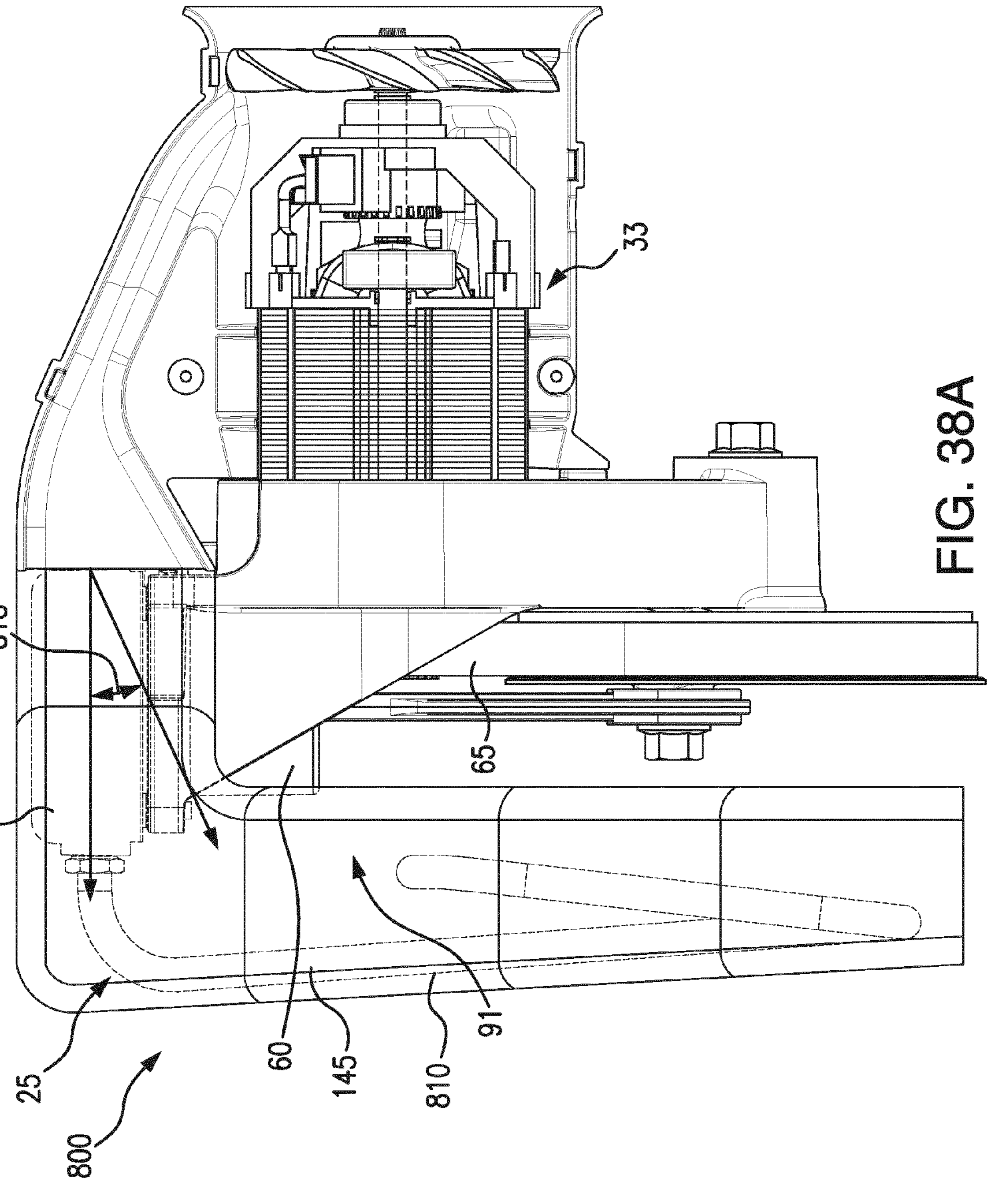


FIG. 38A

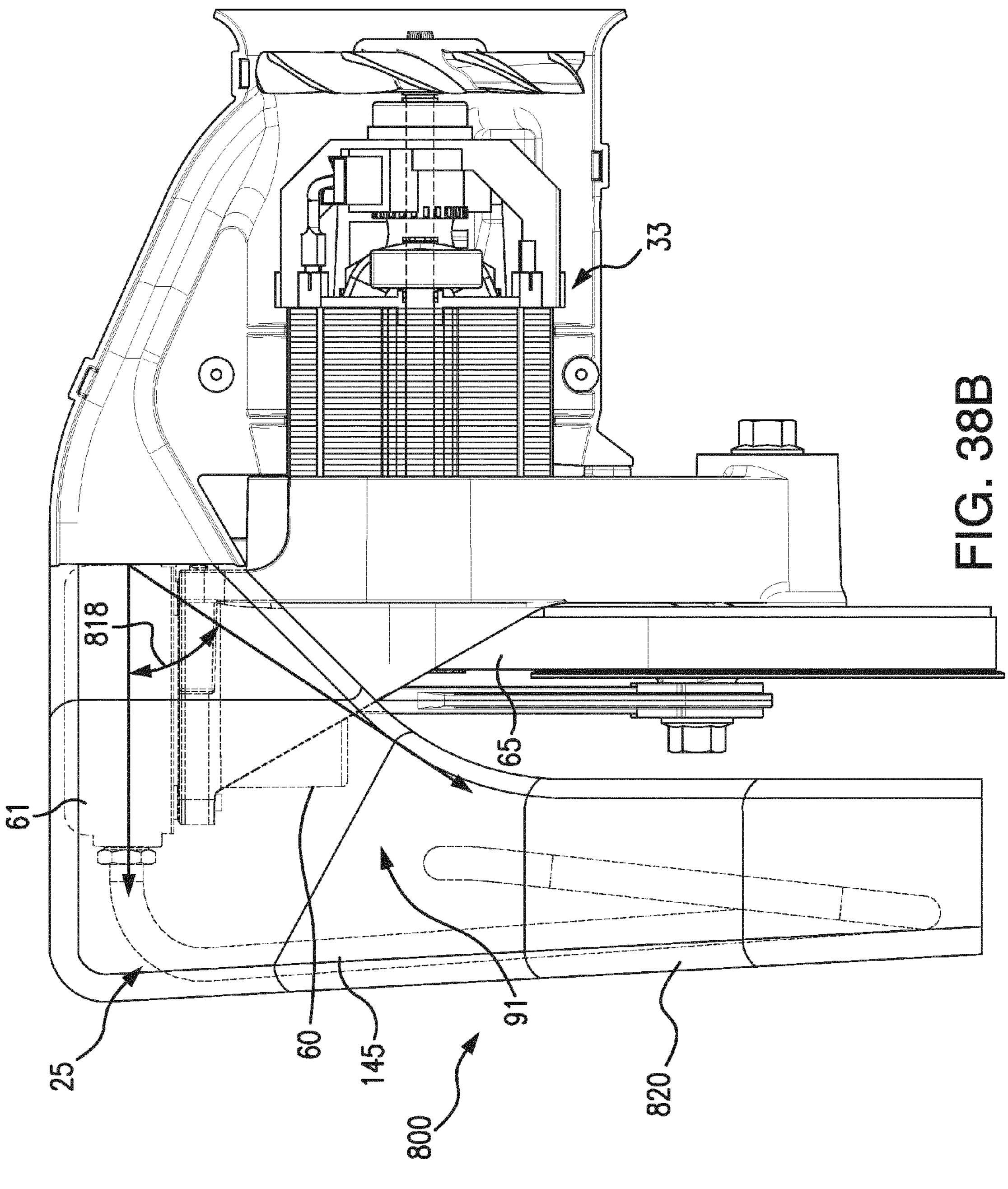


FIG. 38B

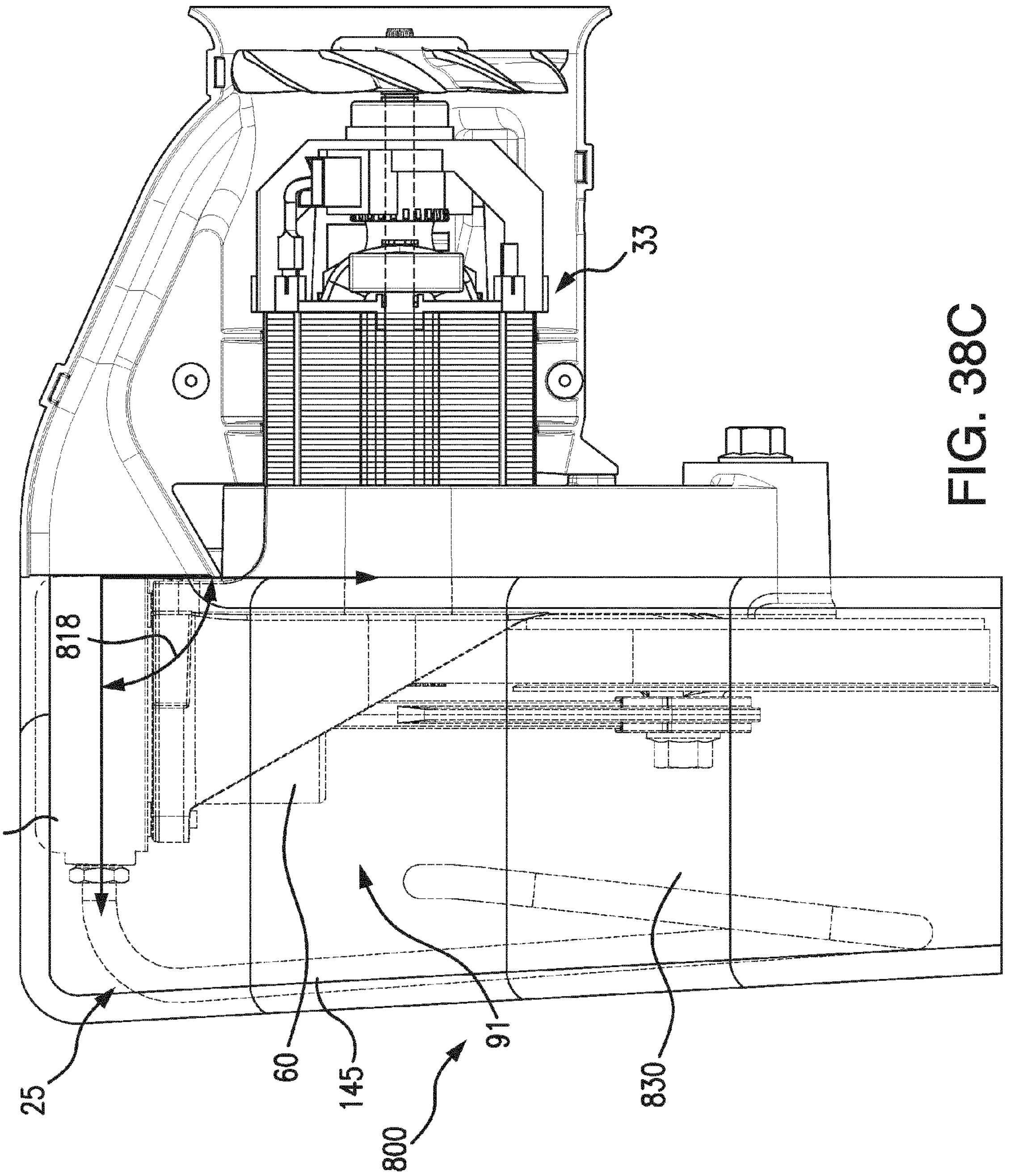


FIG. 38C

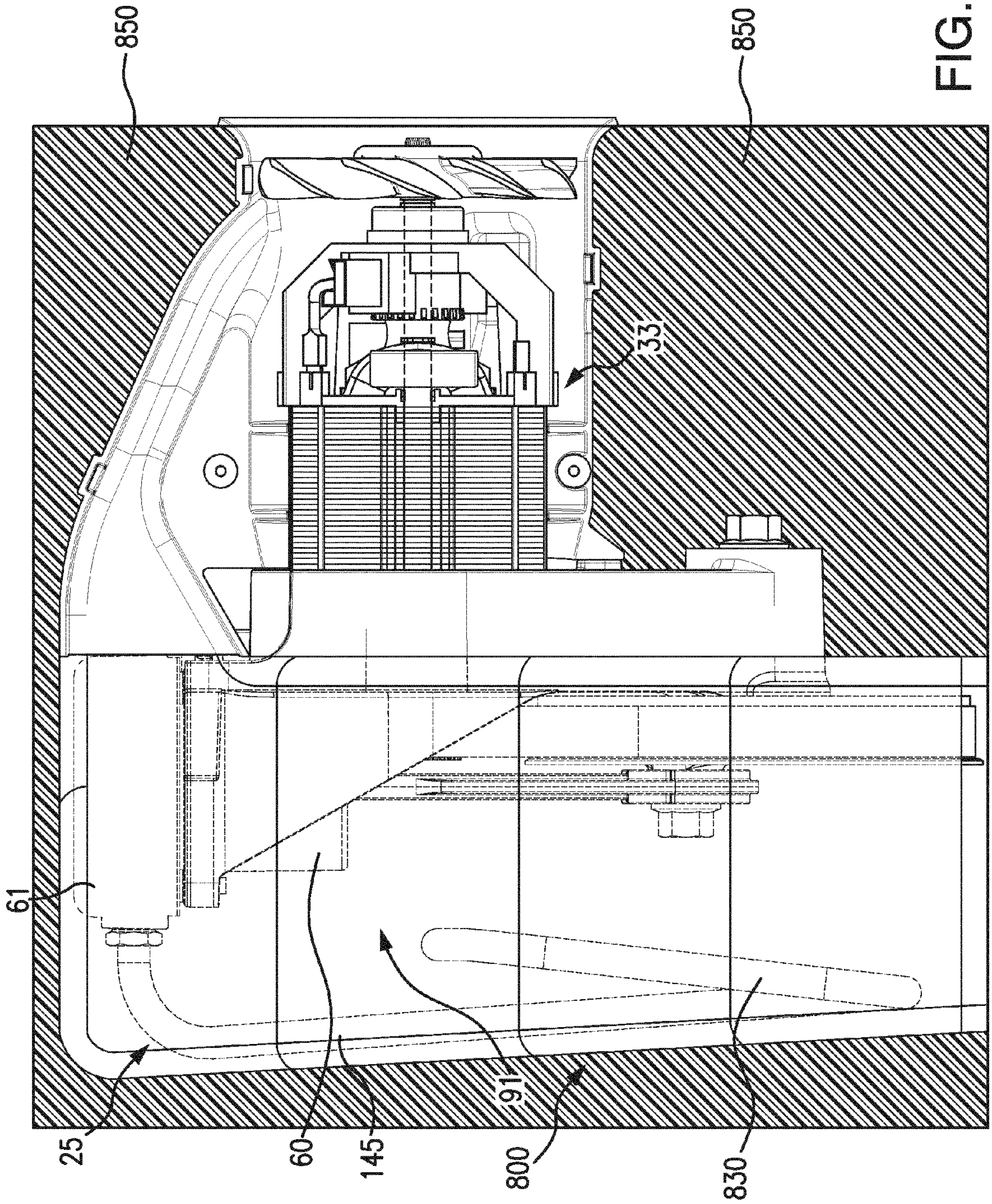


FIG. 38D

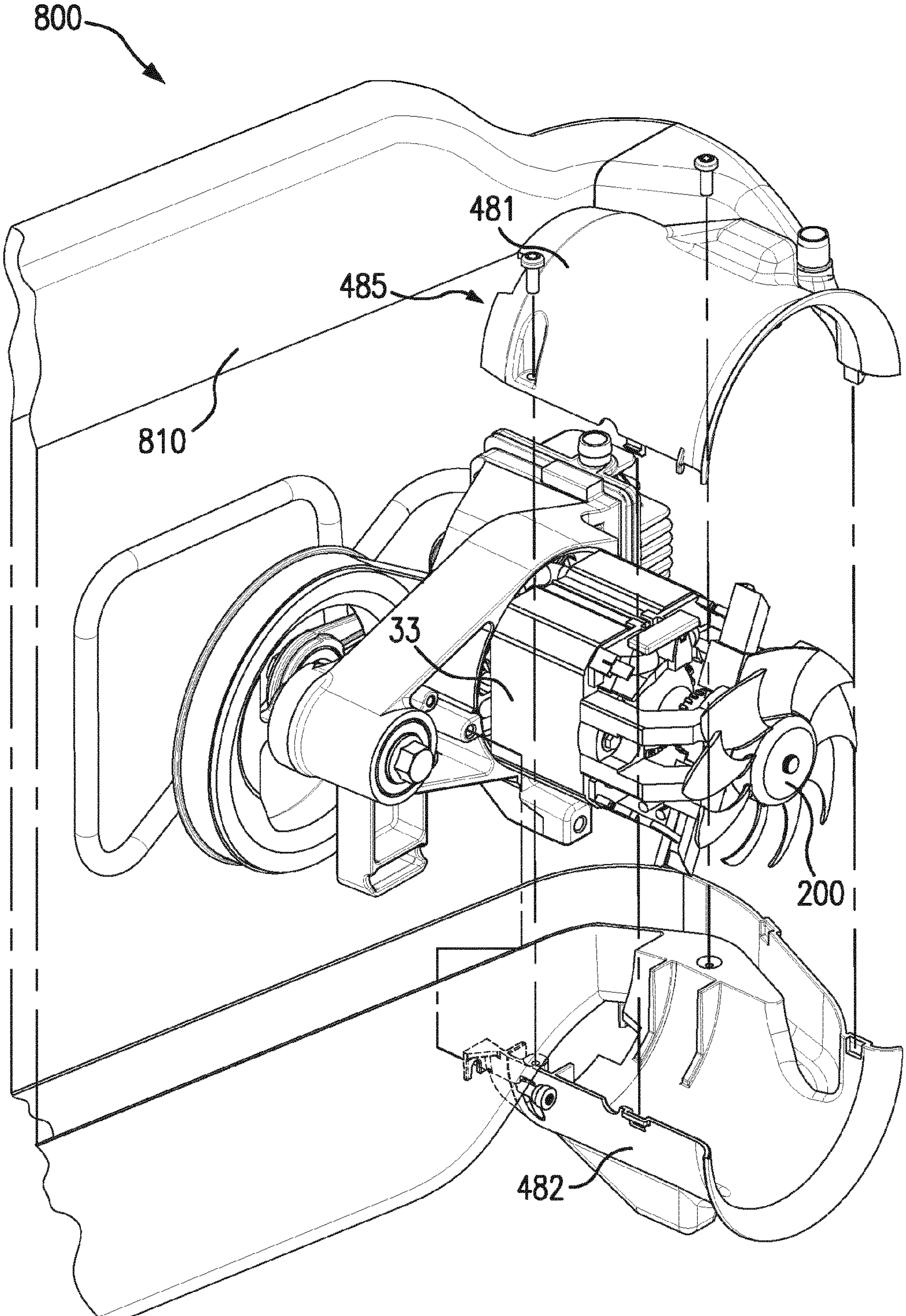


FIG. 39

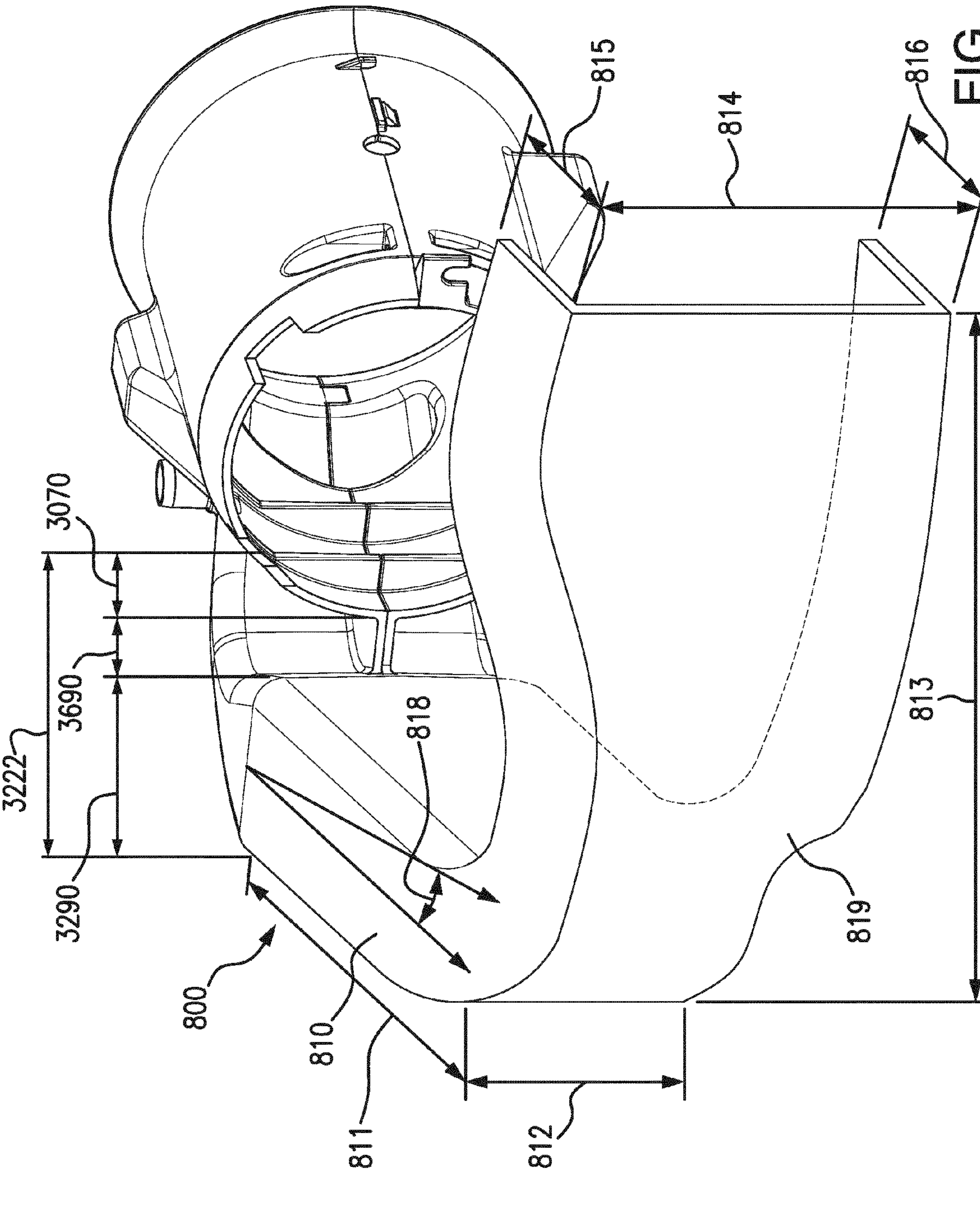


FIG. 40A

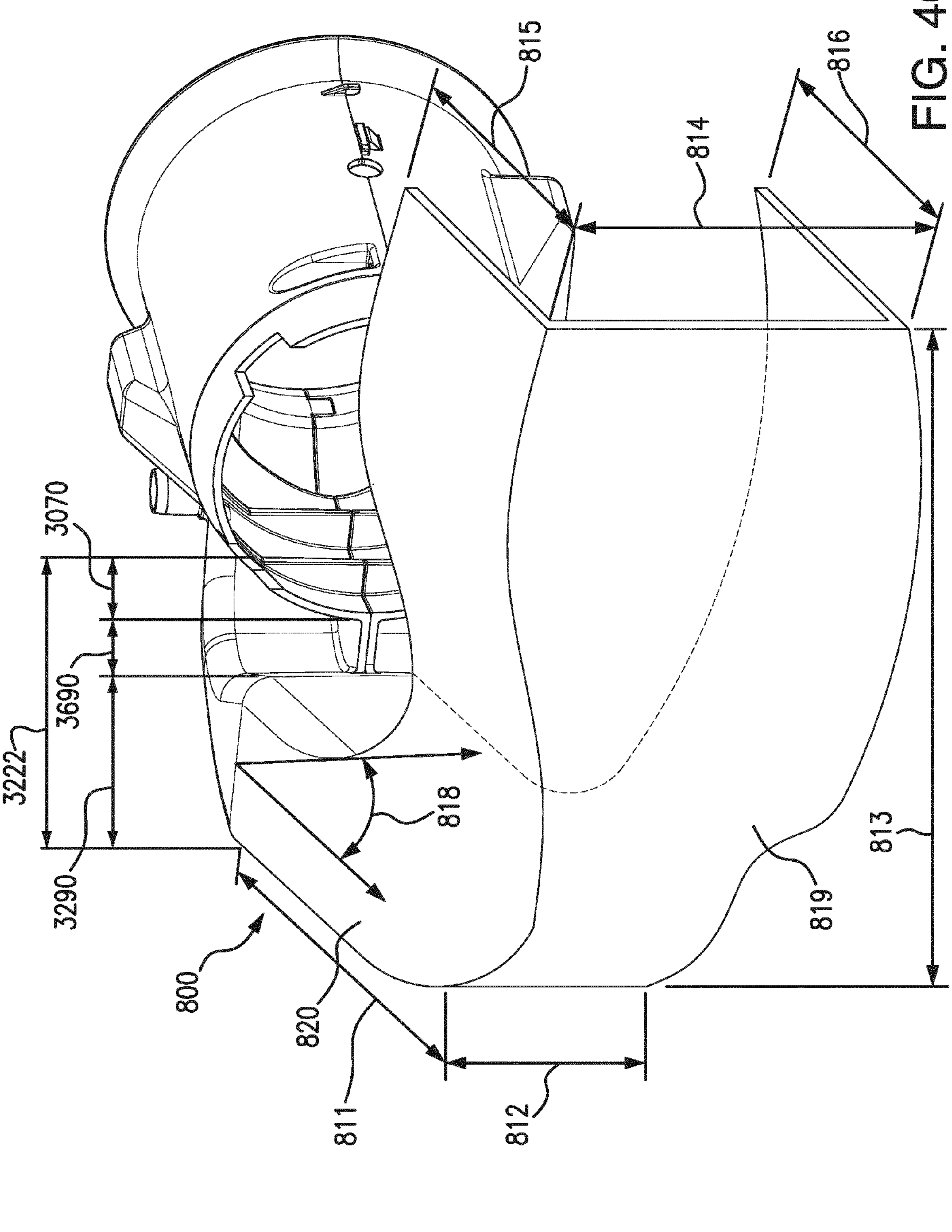


FIG. 40B

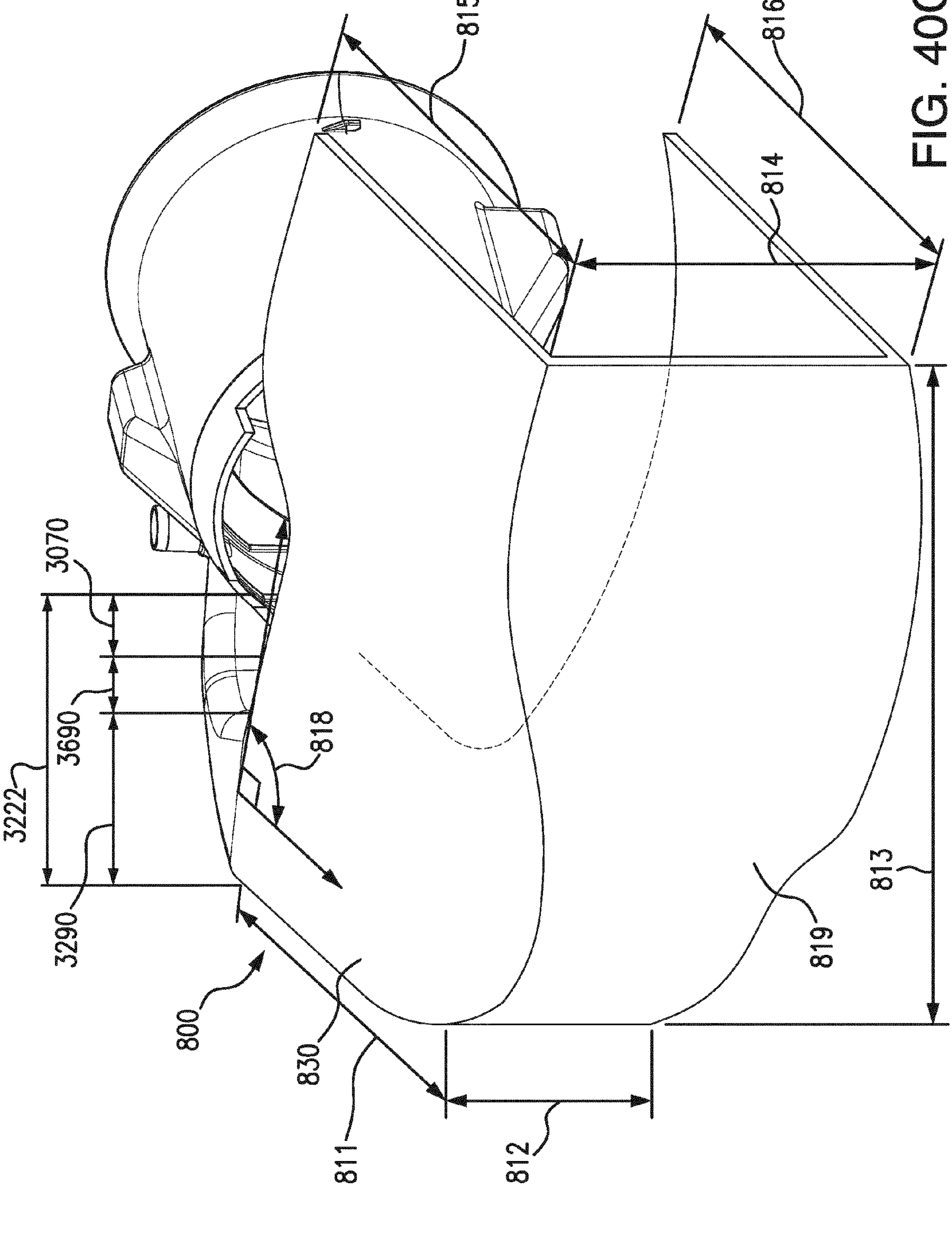


FIG. 40C

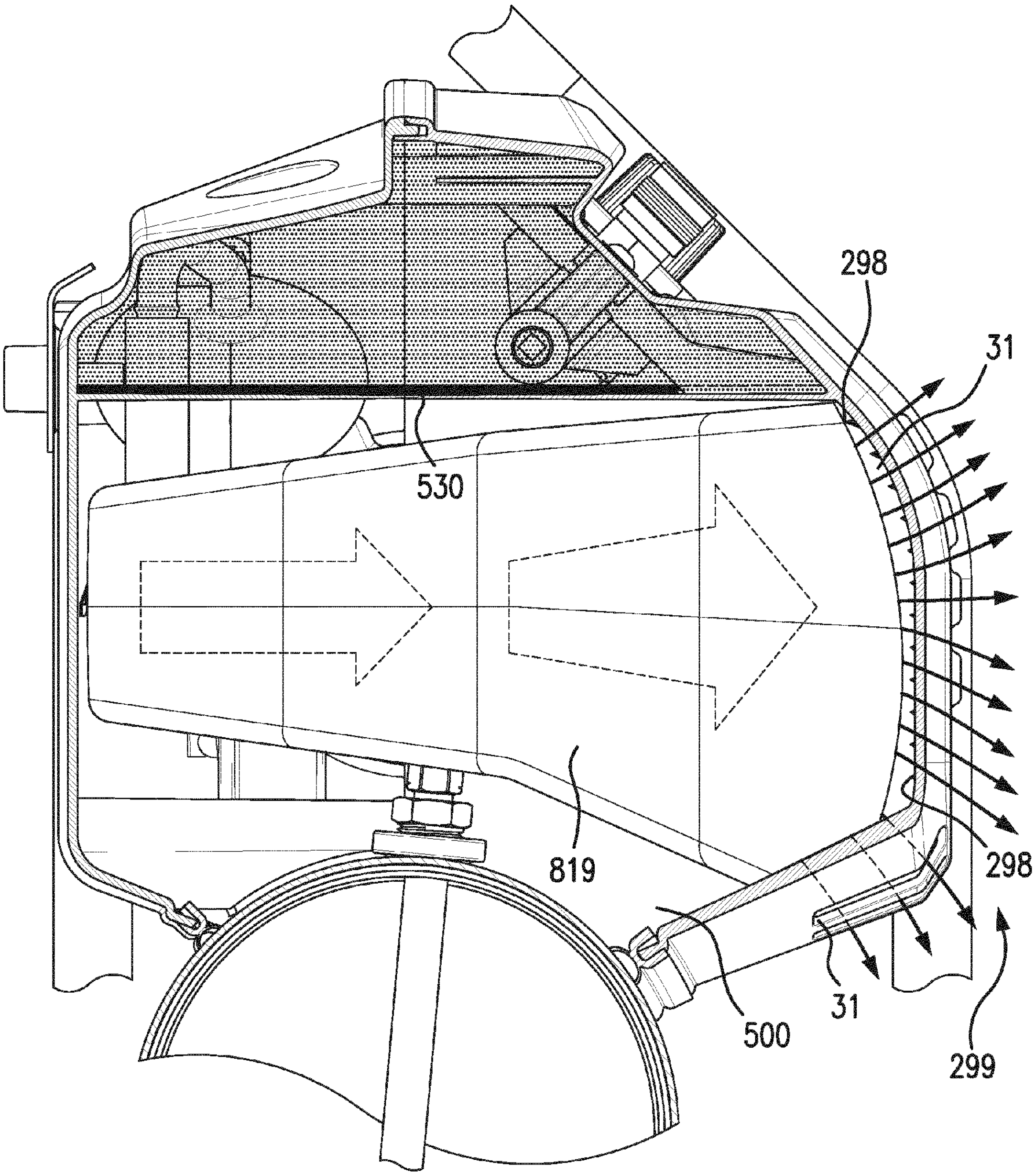
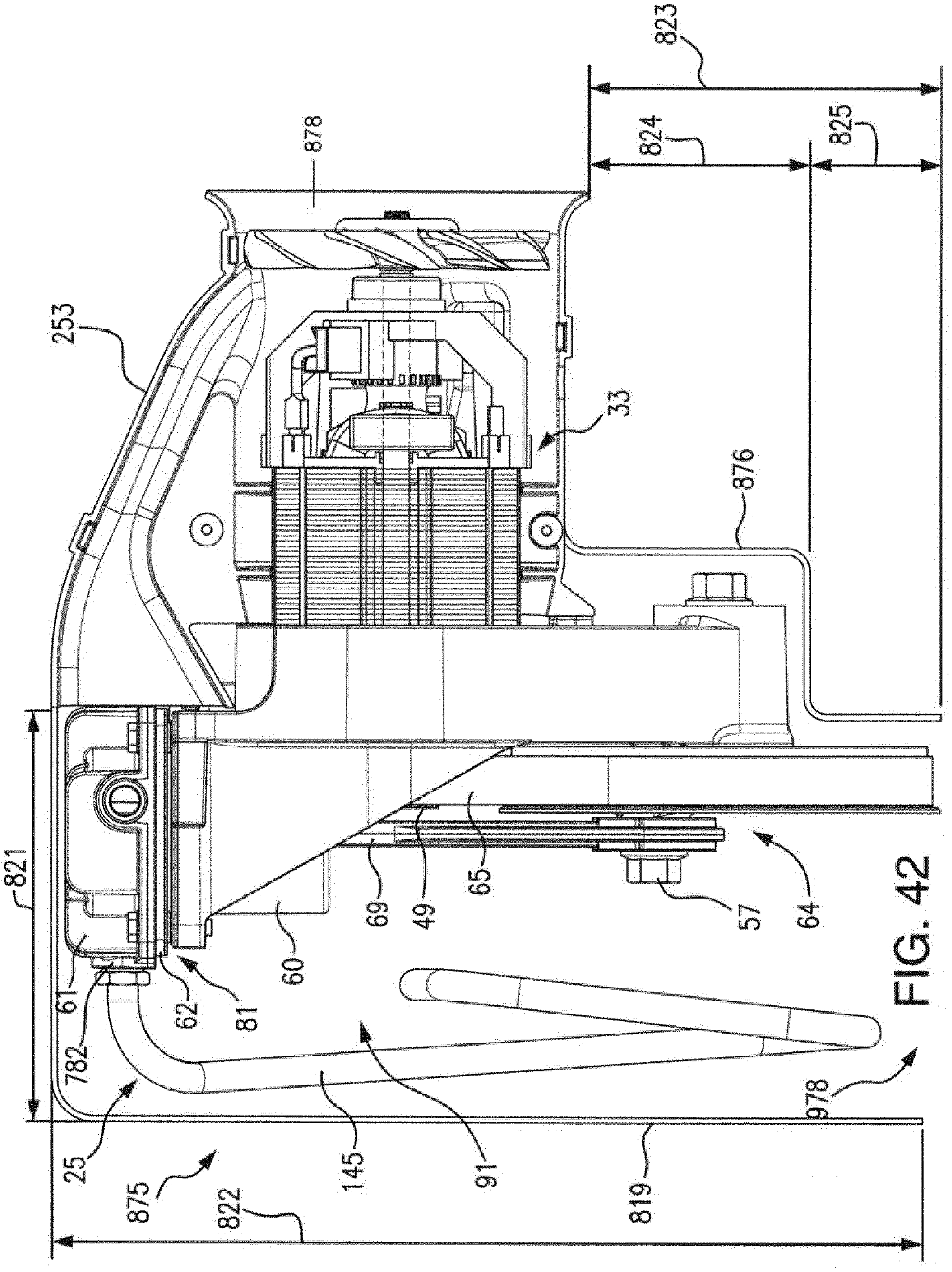


FIG. 41


823
824
825
878
253
33
876
821
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782
62
81
60
69
49
65
57
64
25
875
145
91
978
819
822

FIG. 42

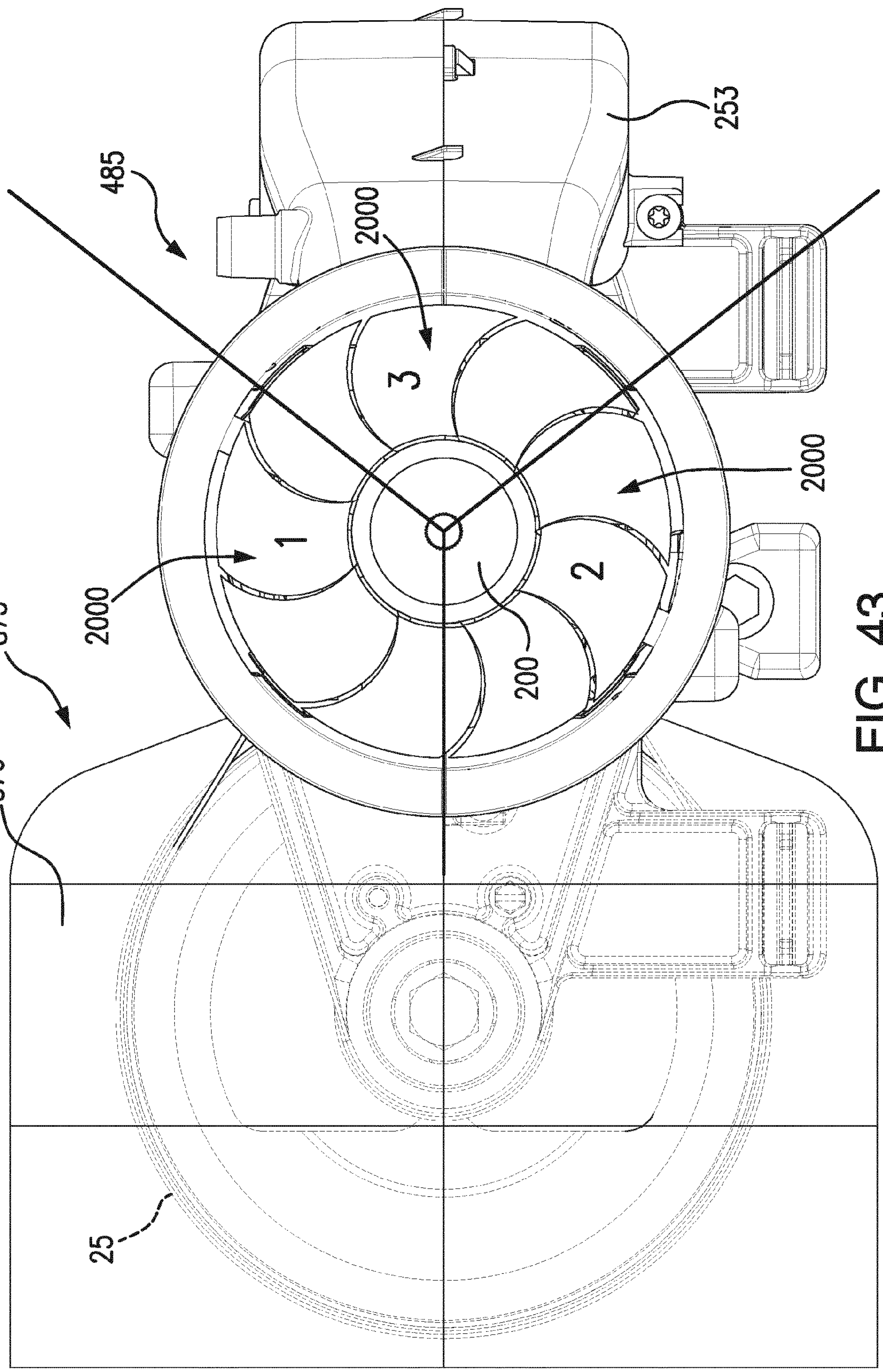

FIG. 43

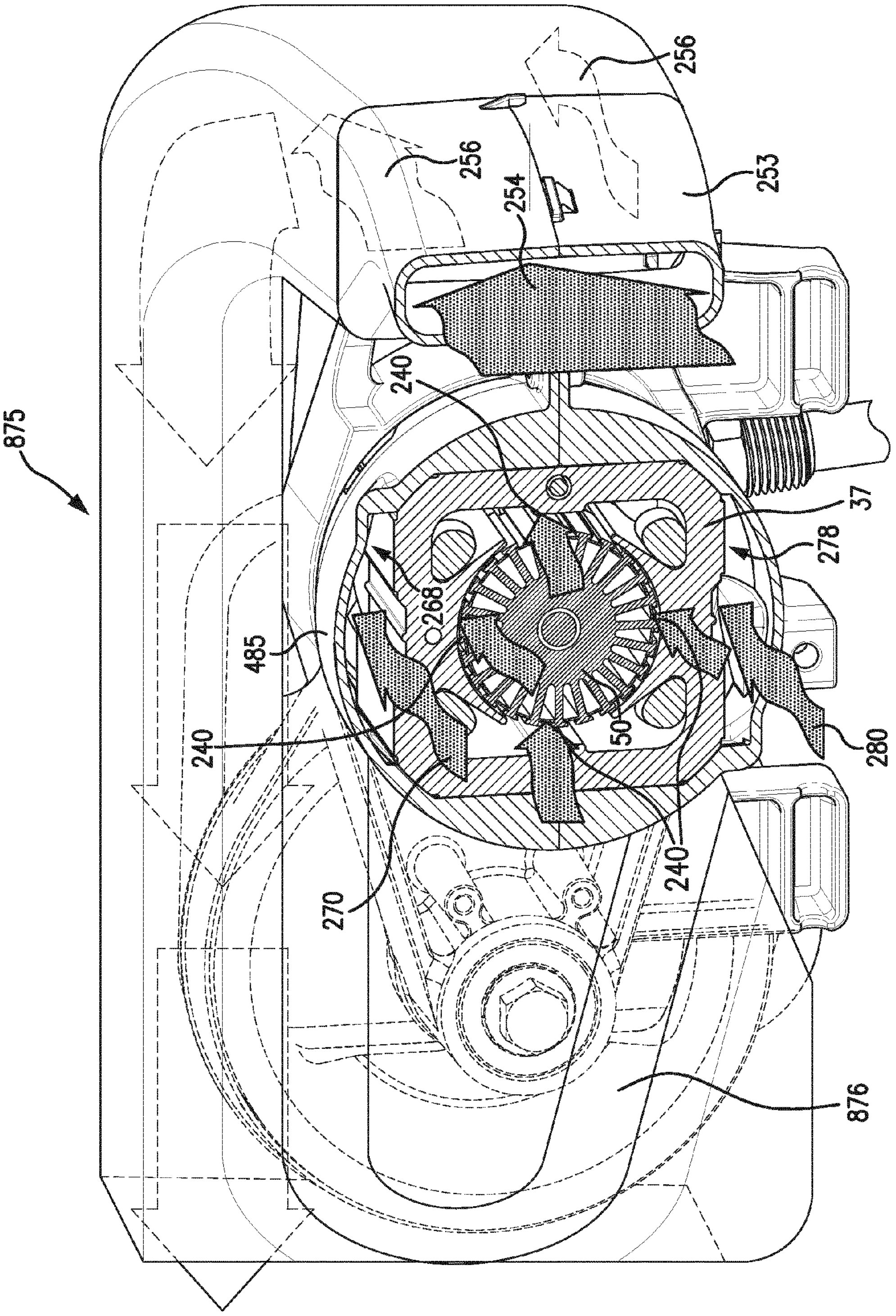

FIG. 44

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EUROPEAN SEARCH REPORT

Application Number
EP 13 18 3932

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The present search report has been drawn up for all claims

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Place of search	Date of completion of the search	Examiner
Munich	21 November 2013	Fistas, Nikolaos

CATEGORY OF CITED DOCUMENTS

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21-11-2013

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