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(54) **VACUUM CLEANER WITH AIR AGITATION ASSISTENCE**

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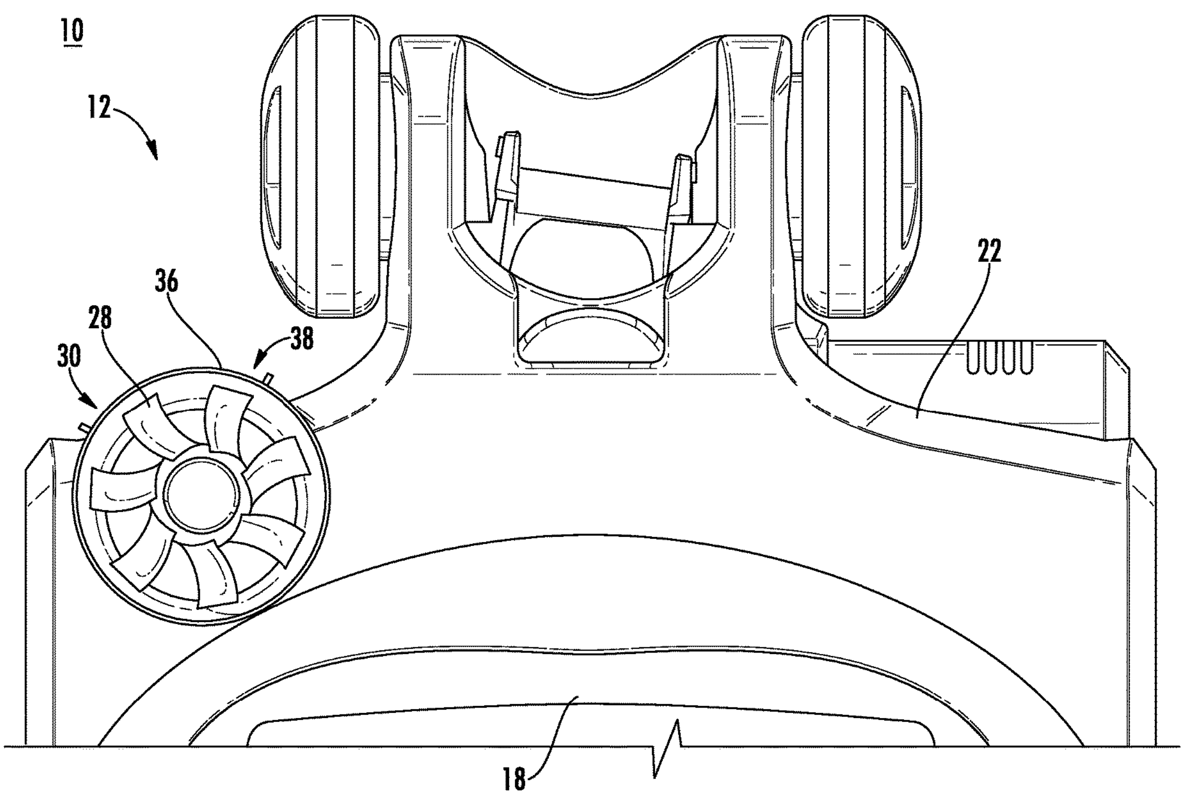
A47L 9/04 (2006.01)

(52) **U.S. Cl.**

CPC ***A47L 9/08*** (2013.01); ***A47L 9/0477*** (2013.01); ***A47L 5/30*** (2013.01)

(57) **ABSTRACT**

A surface cleaning apparatus includes an upper portion having a handle and a suction motor and a surface cleaning head pivotably connected to the upper portion. The surface cleaning head includes a vacuum inlet fluidly coupled to the suction motor and an air-agitation blower assembly. The air-agitation blower assembly includes at least one air-agitation blower and at least one discharge nozzle. The least one air-agitation blower is configured to generate a pressurize air flow and includes an air pump and an air-agitation motor drivingly connected to the air pump, the air-agitation motor being independent from the suction motor. The at least one discharge nozzle is fluidly coupled to the air pump and configured to discharge the pressurized air flow to form an air-blast agitation flow.



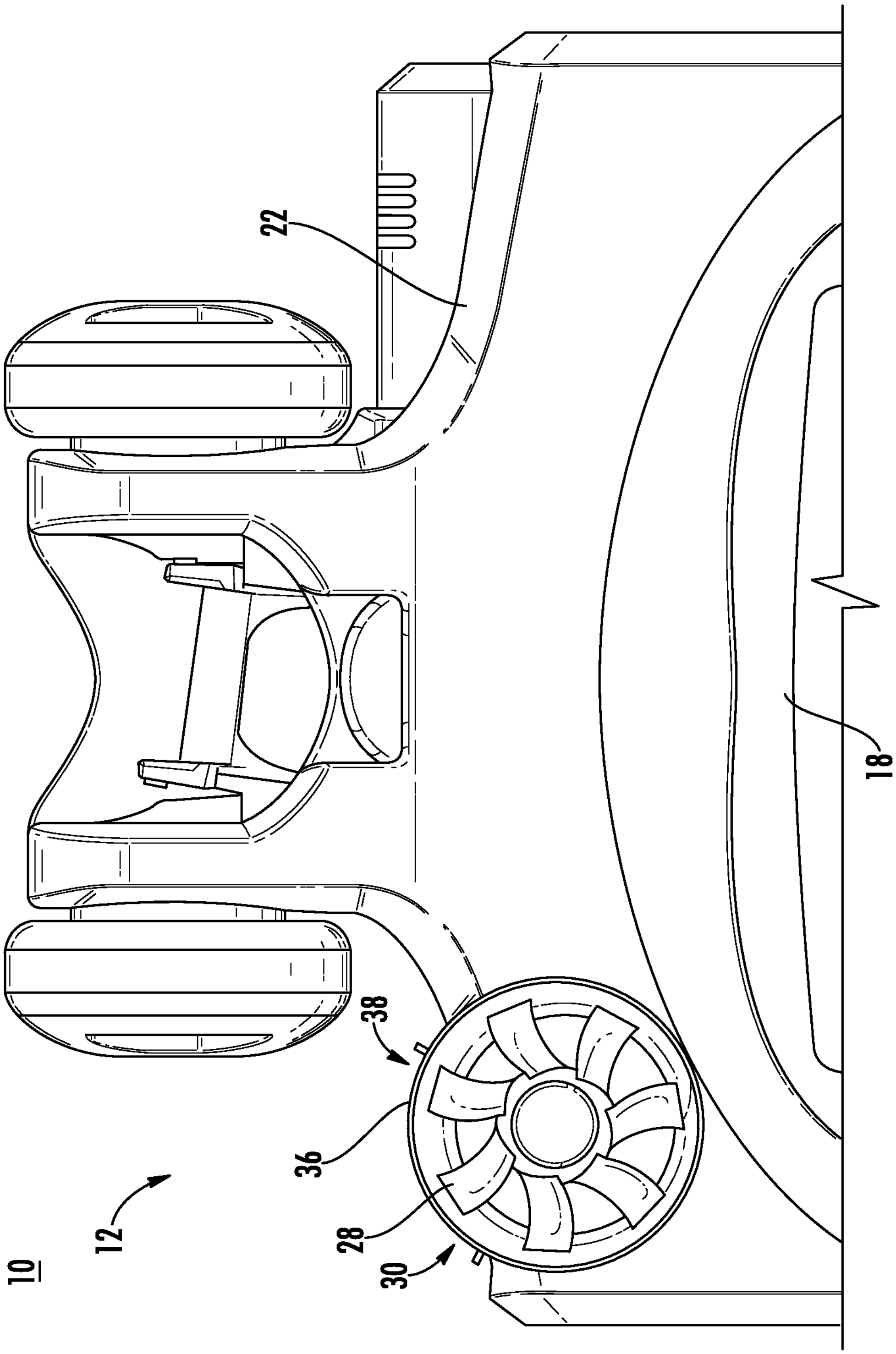


FIG. 1

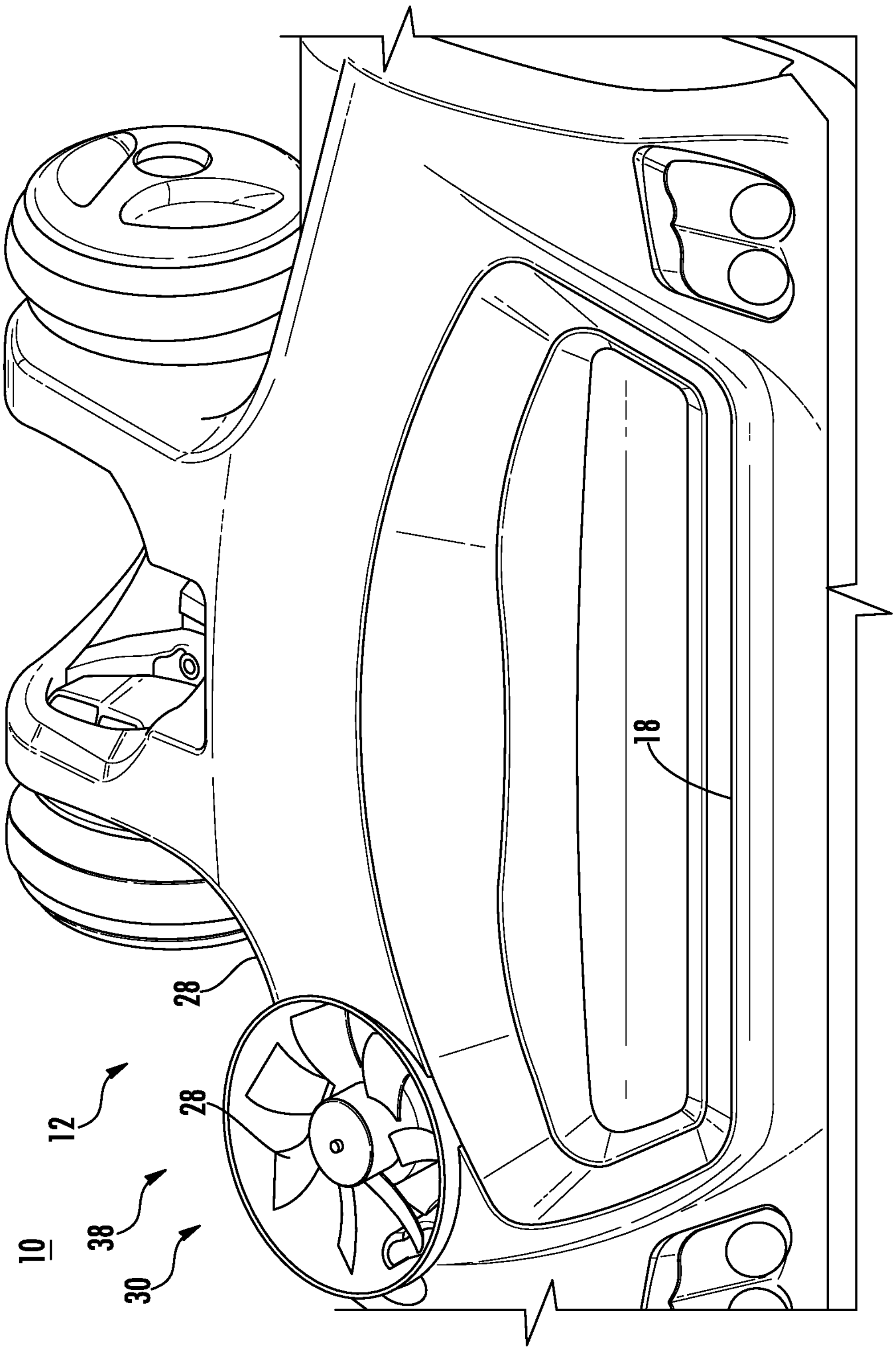


FIG. 2

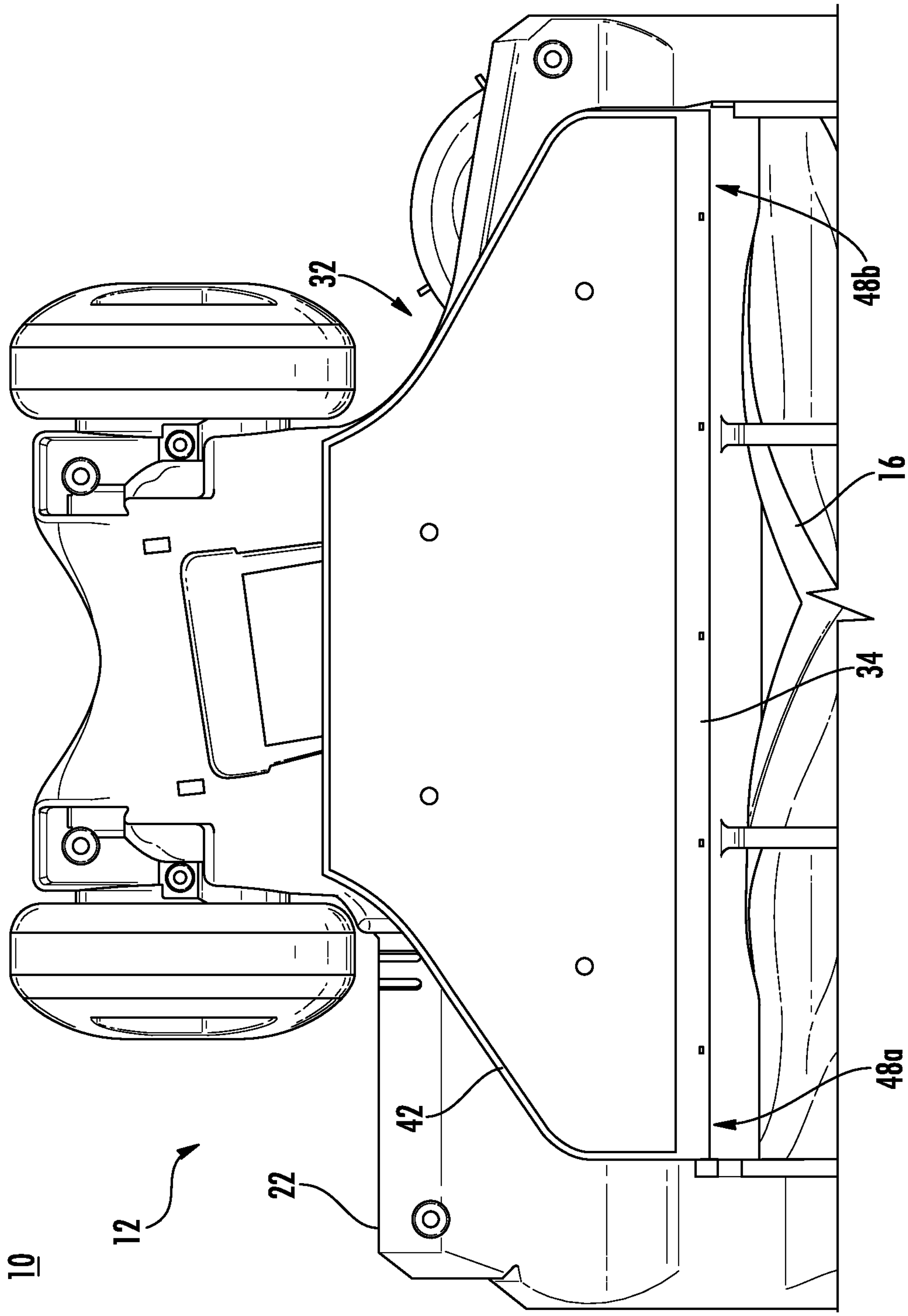


FIG. 3

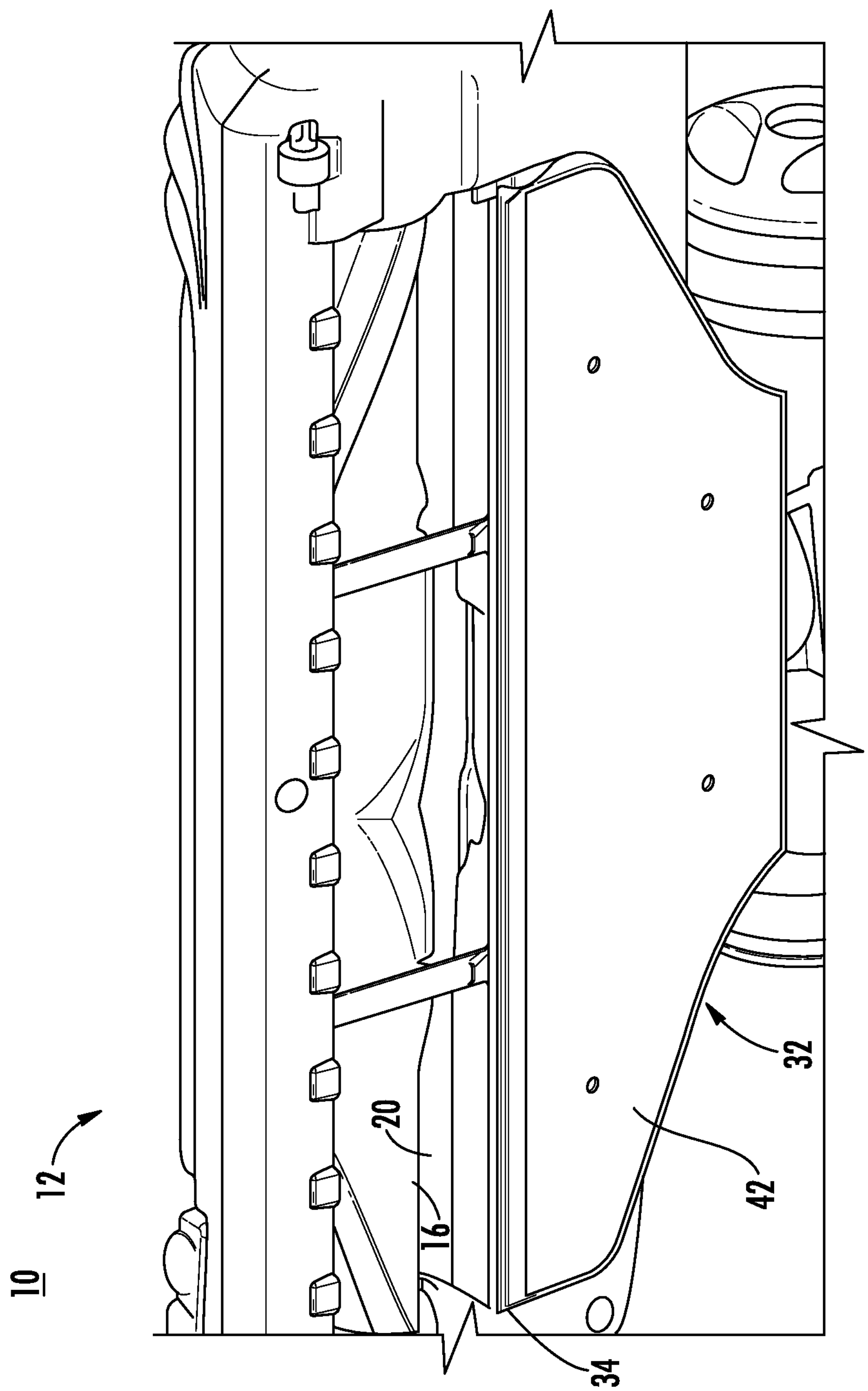


FIG. 4

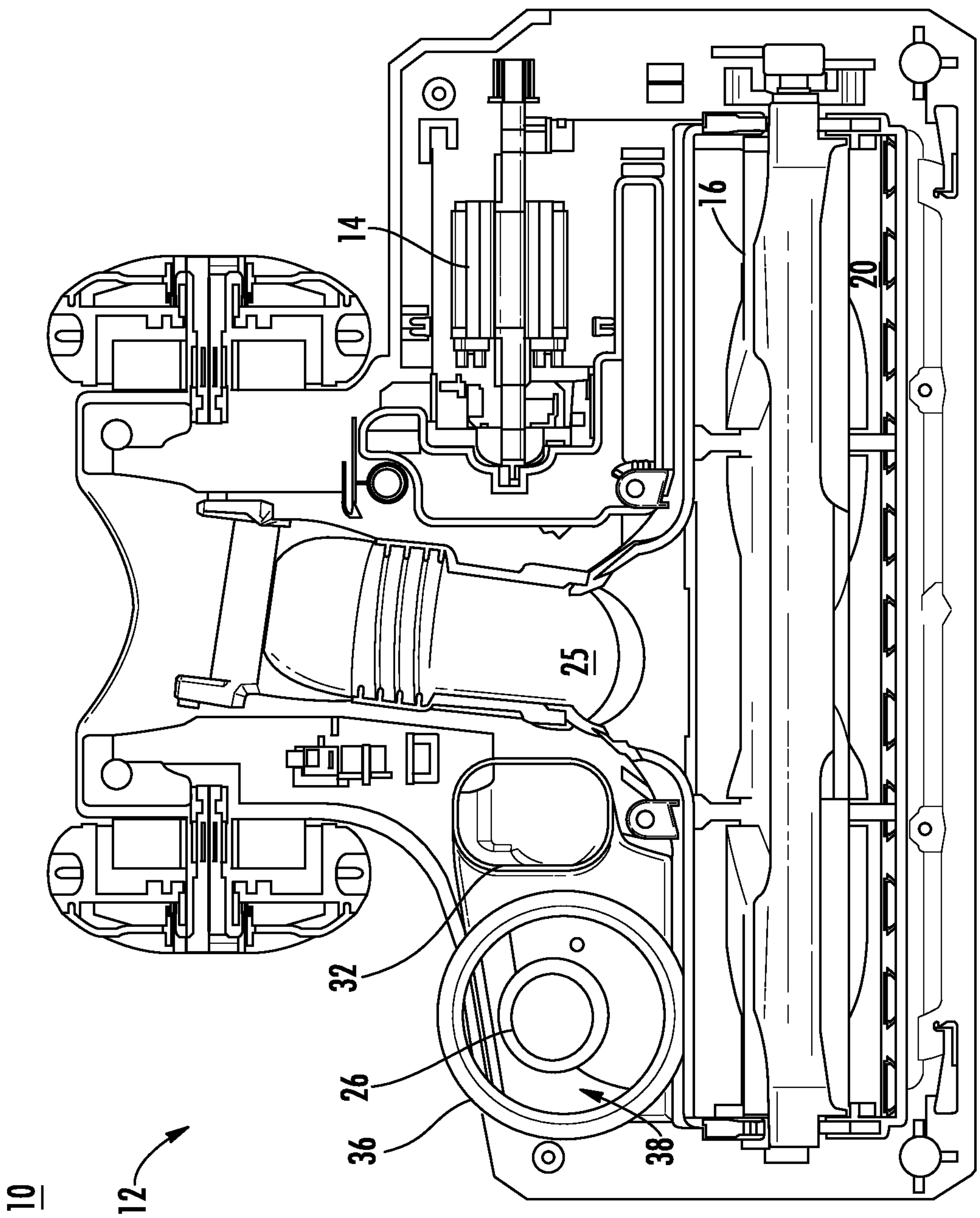


FIG. 5

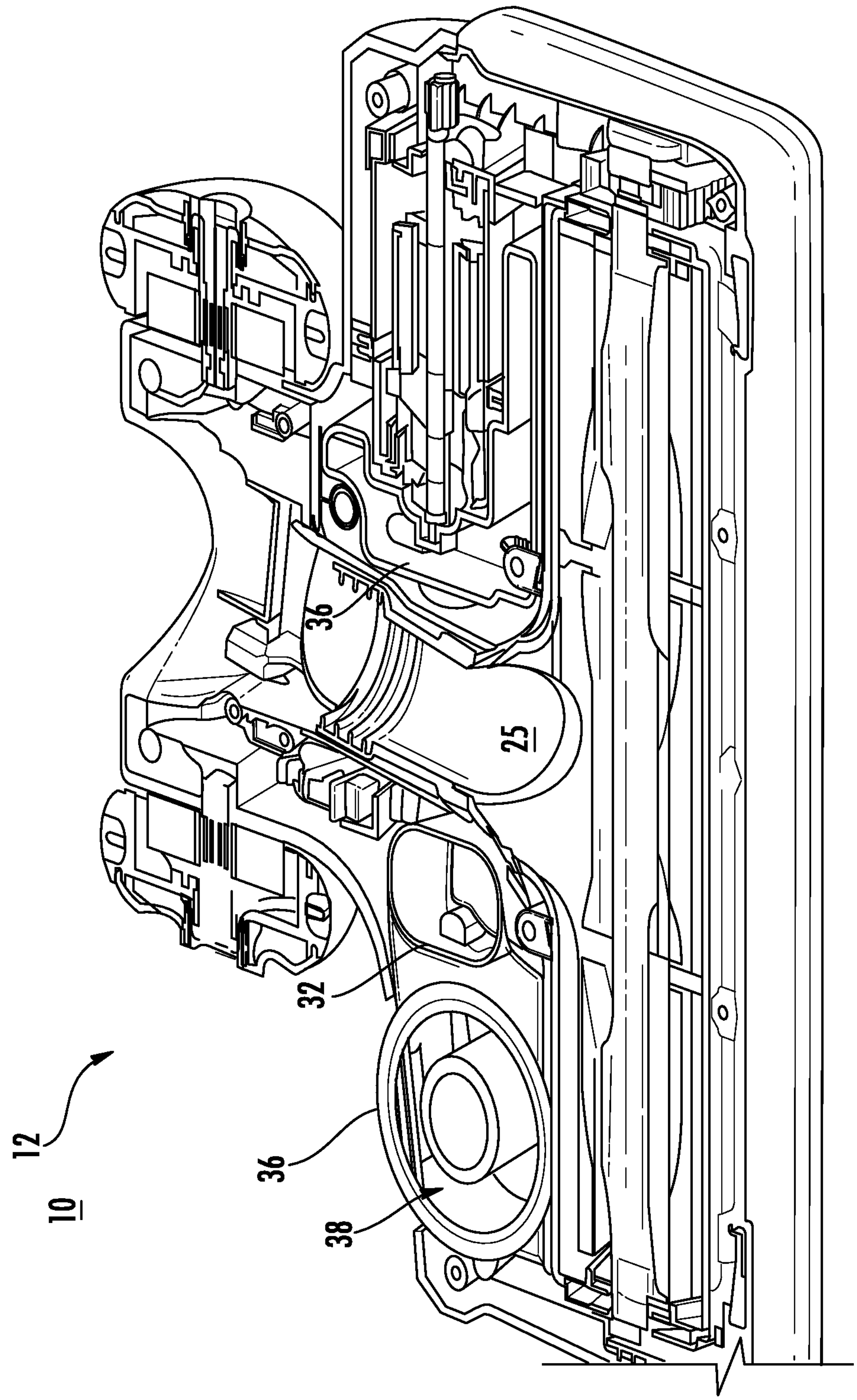


FIG. 6

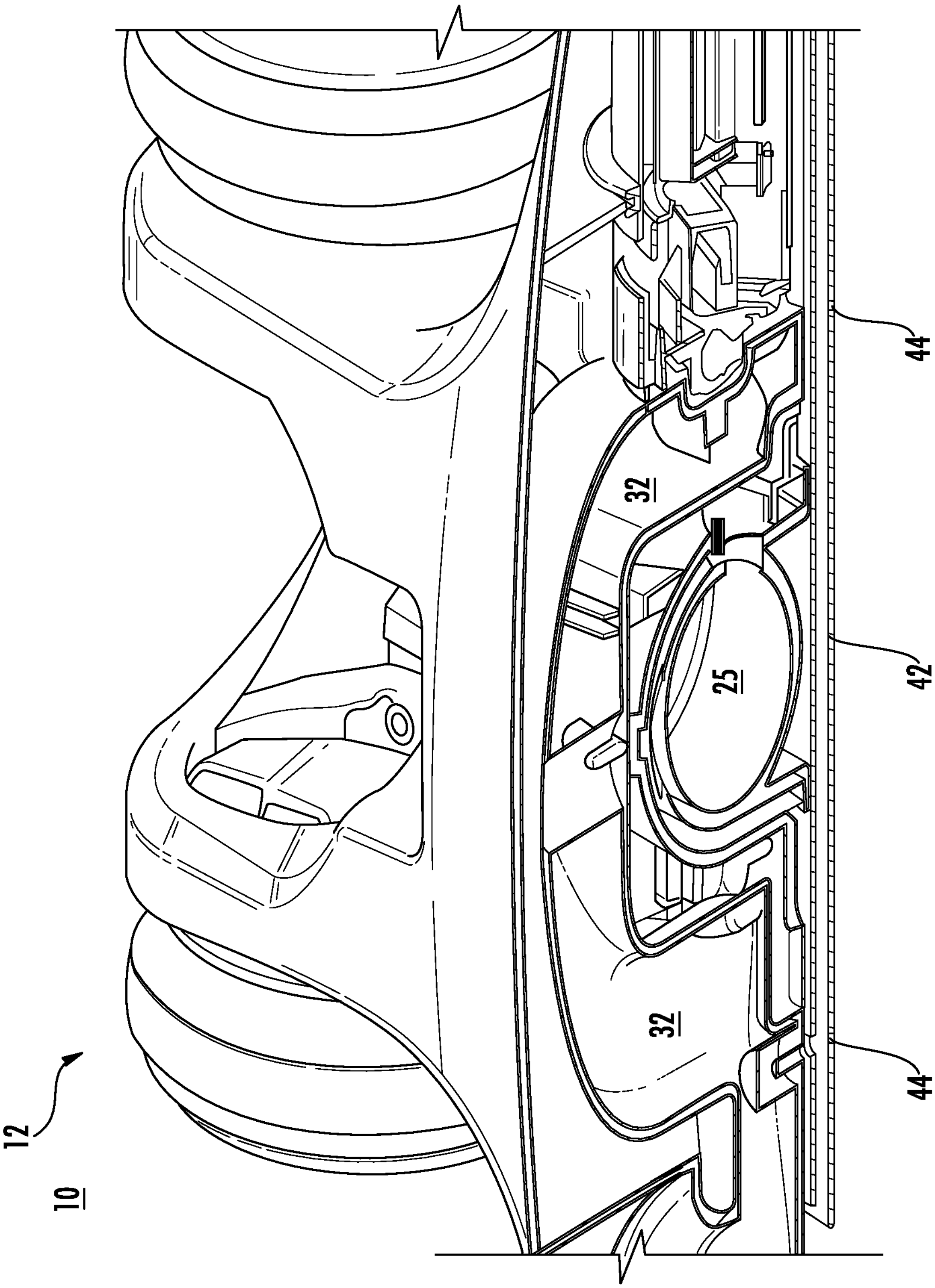


FIG. 7

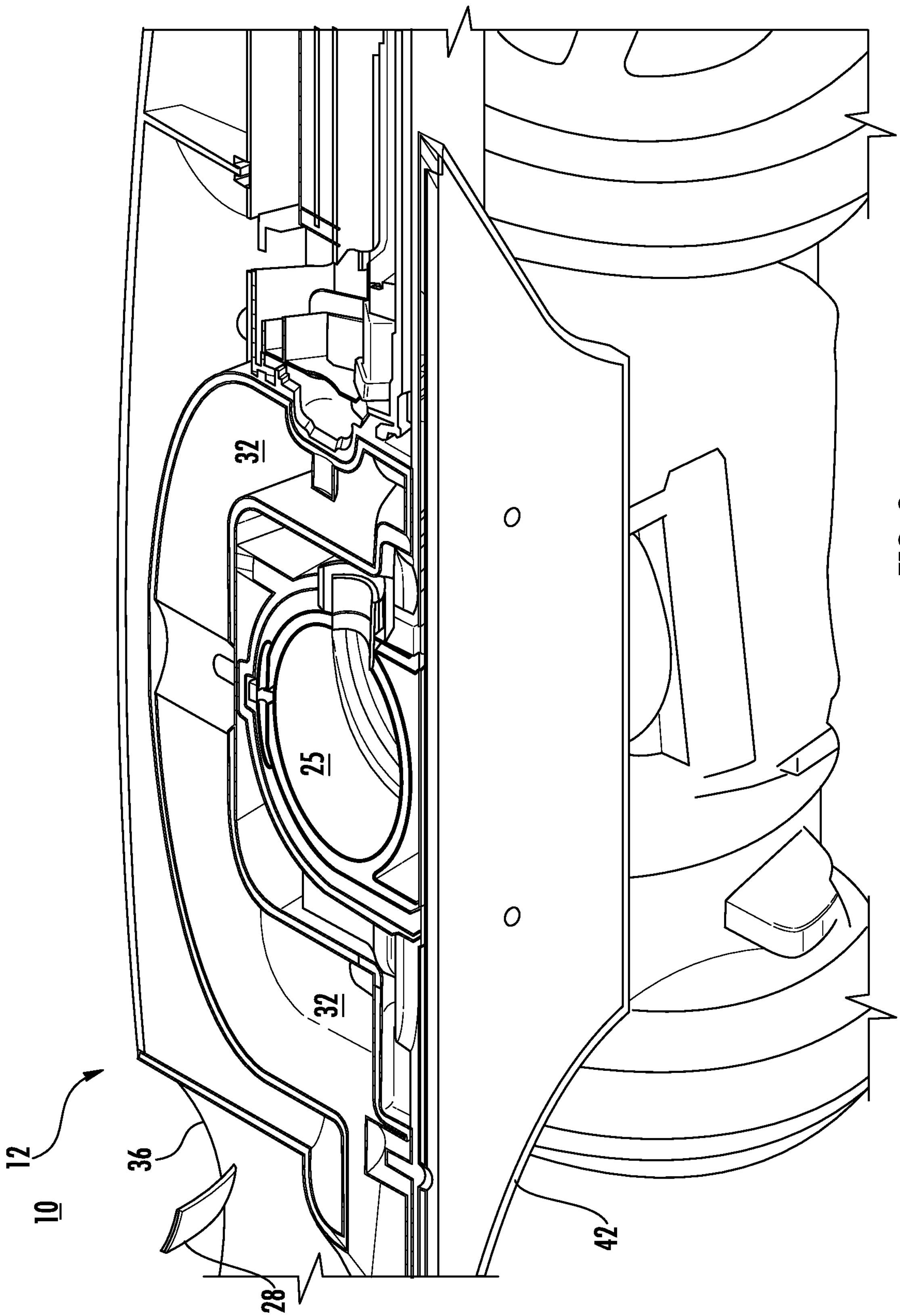


FIG. 8

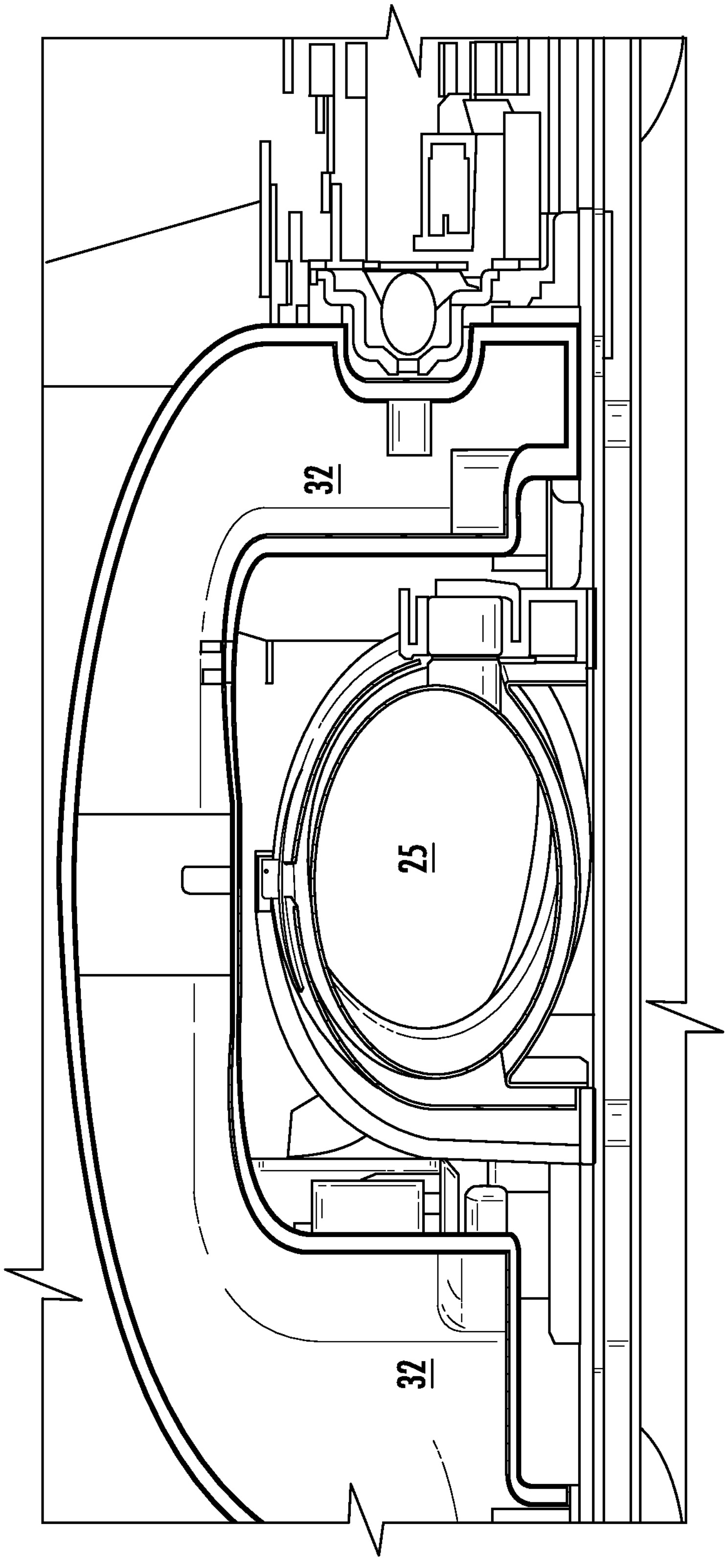


FIG. 9

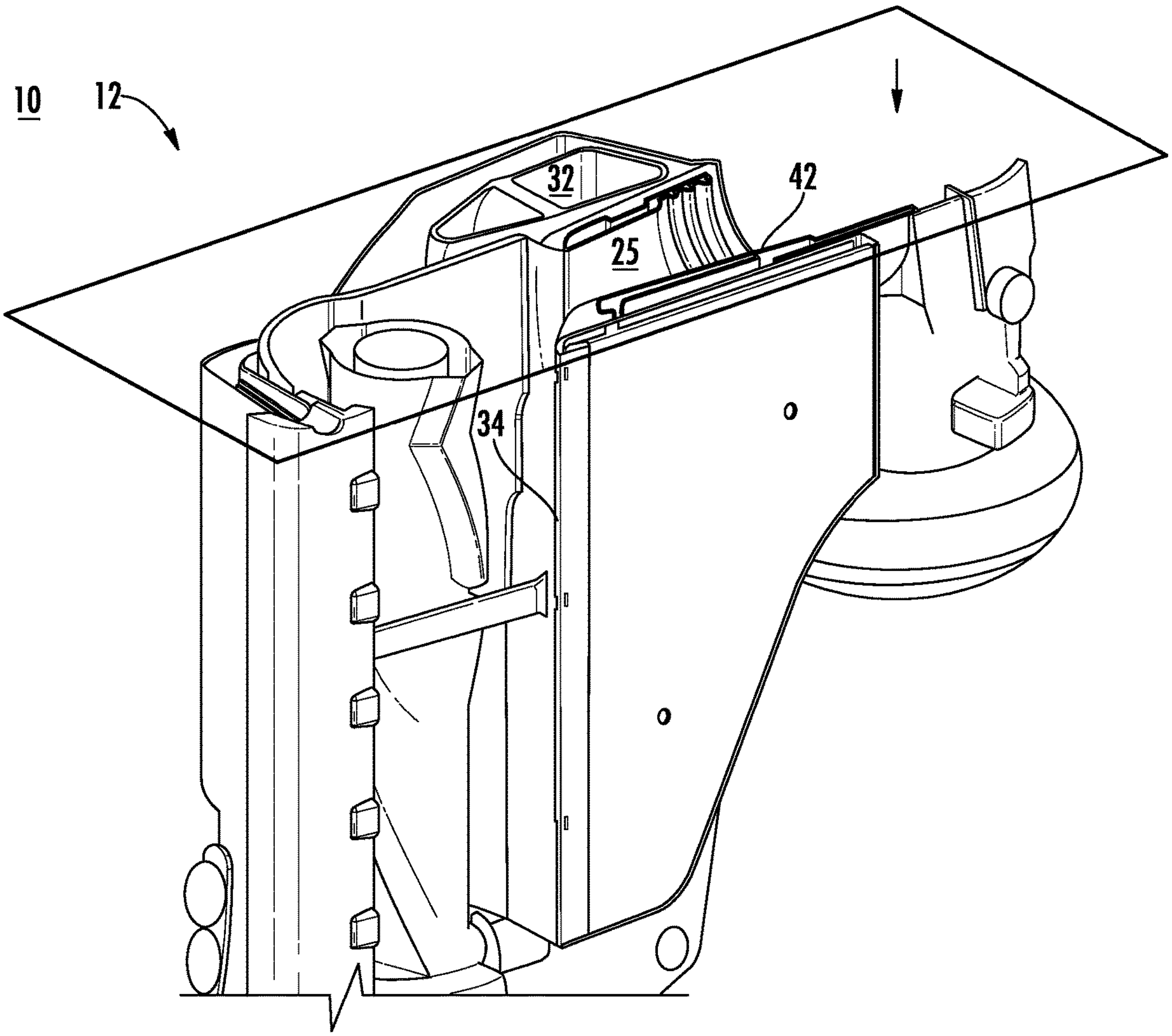


FIG. 10

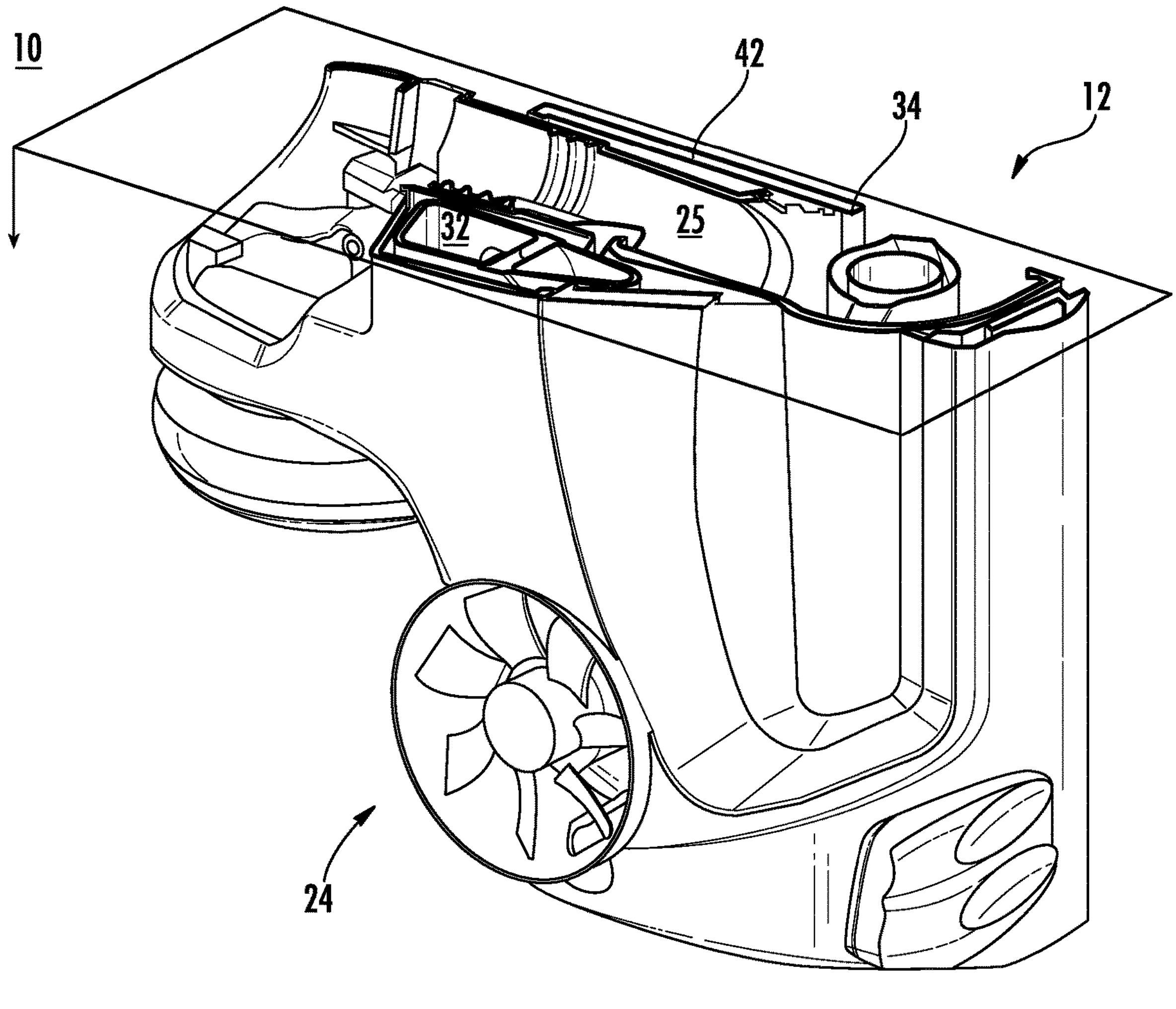


FIG. 11

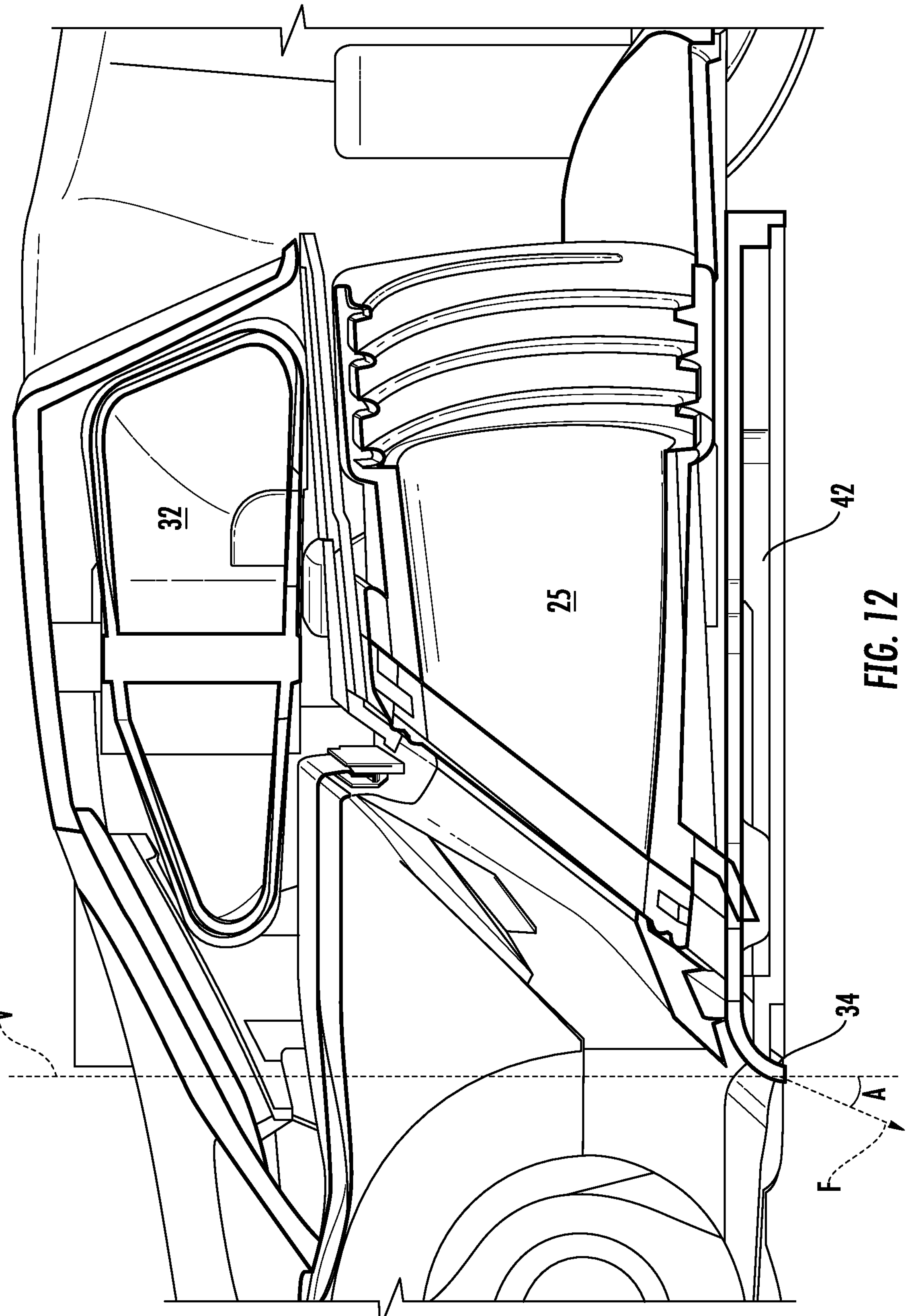


FIG. 12

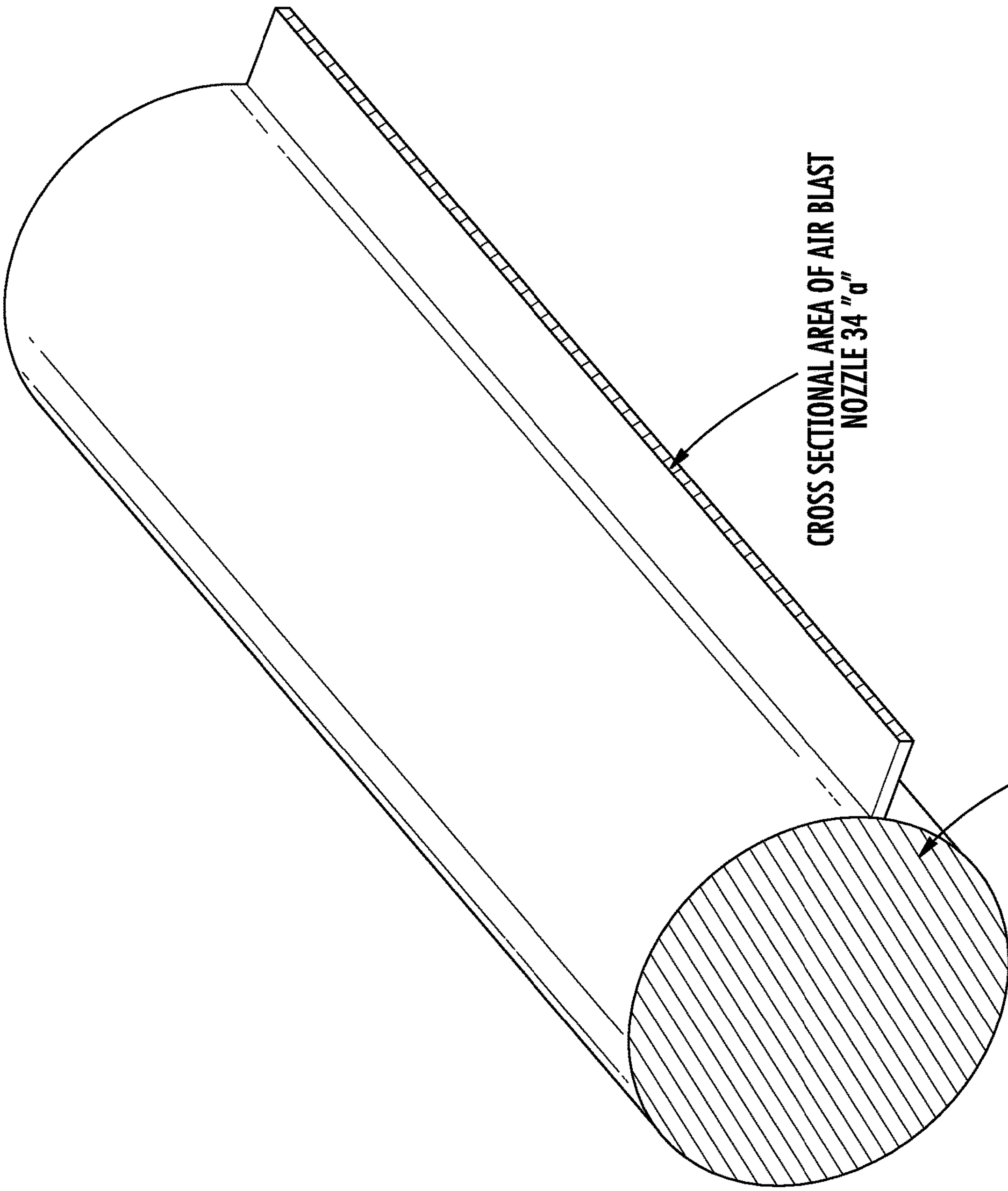

CROSS SECTIONAL AREA OF AIR BLAST NOZZLE 34 "a"
CROSS SECTIONAL AREA OF PLENUM CHAMBER 42 "A"

FIG. 13

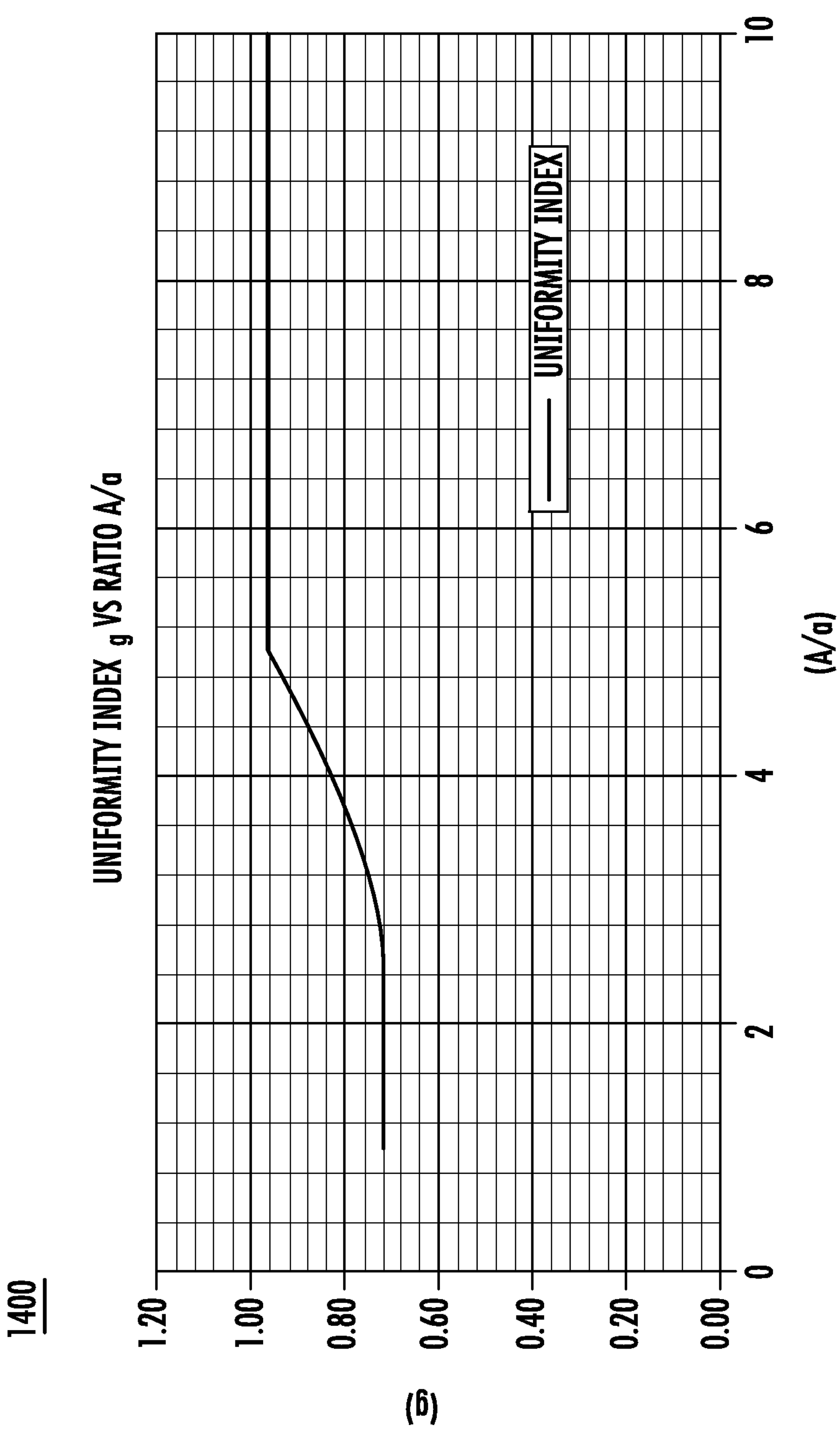

1400
UNIFORMITY INDEX g VS RATIO A/a
(g)
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0
2
4
6
8
10
(A/a)
UNIFORMITY INDEX

FIG. 14

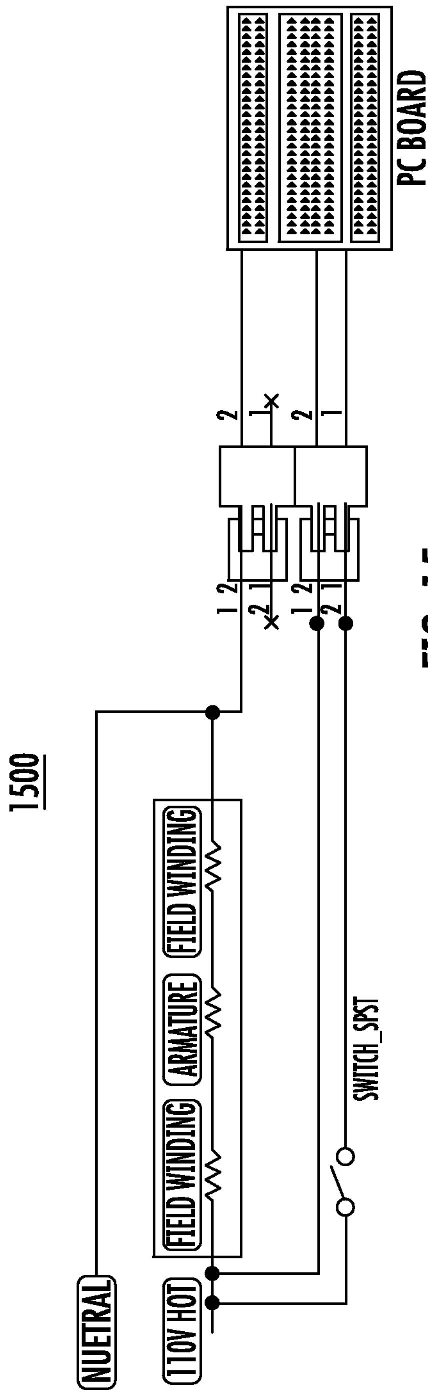

1500
PC BOARD
FIELD WINDING
ARMATURE
FIELD WINDING
SWITCH_SPST
NUETRAL
110V HOT

FIG. 15

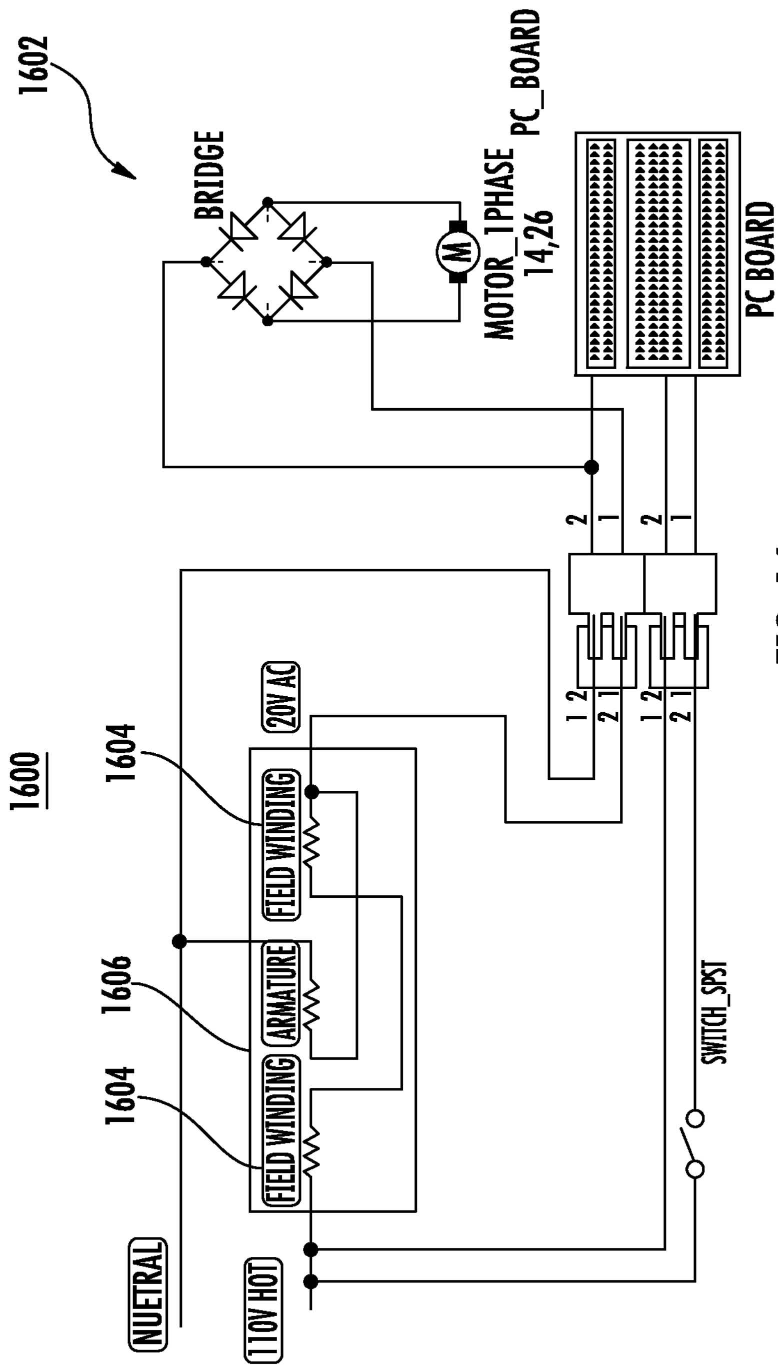

1602
BRIDGE
MOTOR_1PHASE
14,26
PC_BOARD
PC BOARD
1600
1604
1606
1604
FIELD WINDING
ARMATURE
FIELD WINDING
20V AC
SWITCH_SPST
NUETRAL
110V HOT

FIG. 16

VACUUM CLEANER WITH AIR AGITATION ASSISTENCE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a 371 of international Application No. PCT/US17/56484 filed Oct. 13, 2017, which claims the benefit of U.S. Provisional Patent Application Ser. No. 62/408,147 filed Oct. 14, 2016, both of which are fully incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to vacuum cleaners and more particularly, to a surface cleaning head for a vacuum cleaner including air agitation.

BACKGROUND INFORMATION

[0003] A vacuum cleaner creates a partial vacuum to suck up dust, dirt, and/or particles (hereinafter collectively referred to as debris) from the surface to be cleaned. Some vacuum cleaners also utilize air-agitation in which a pressurized air stream discharged from the vacuum cleaner to dislodge debris. Existing air-agitation vacuum cleaners generally include a single air pump and a single motor which performs both the functional of creating an air agitation (e.g., the pressurized airflow) and vacuum flow to dislodge and suck up debris from the surface to be cleaned. While the existing systems are generally effective, they suffer from several problems. For example, the use of a single motor and single air pump requires complex ducting. In particular, a portion of the air flow from the single motor and single air pump may need to be directed to provide the air-agitation pressure/flow and another portion of the air flow may need to be redirected to provide the vacuum source. As may be appreciated, the primary consideration of the vacuum system is generally the efficient creation of the vacuum source, and this may lead to a situation were a long and/or complex ducting is necessary in order to provide the desired air-agitation pressure/flow to the air-agitation discharge. This long and/or complex ducting may increase the cost of the vacuum, increase the weight, and/or increase the size of the vacuum head, thereby making it unsuitable for some cleaning applications (e.g., but not limited to, cleaning under a couch or the like).

[0004] Additionally, the use of a single motor and single air pump to provide both the air-agitation flow as well as the vacuum flow may limit the flexibility and efficiency of the vacuum system. In particular, if the air-agitation pressure/flow is too high, then debris may be blown away from the vacuum inlet, thus reducing the efficiency of the system. On the other hand, if the air-agitation pressure/flow is too low, then debris may not be blow towards the vacuum inlet, again thereby reducing the efficiency of the system. As may be further appreciated, the amount of the air-agitation pressure/flow may depend on the surface and/or the type of debris being cleaned. As such, a single air-agitation pressure/flow may work as efficiently as possible for all cleaning circumstances. The use of a single motor and single air pump to provide both the air-agitation flow as well as the vacuum flow may require the ratio of the air-agitation pressure/flow to the vacuum flow to be static (e.g., fixed). Alternatively, while it may be possible to adjust the ratio of the air-agitation pressure/flow to the vacuum flow, such a design may generally require the inclusion (among other components) of air-flow regulatory valve and control mechanism. The air-flow regulatory valve and control mechanism further increase the cost, complexity, expensive, and size of the vacuum system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] These and other features and advantages will be better understood by reading the following detailed description, taken together with the drawings wherein:

[0006] FIG. **1** generally illustrates a top view of a surface cleaning head, consistent with embodiments of the present disclosure;

[0007] FIG. **2** generally illustrates another top view of a surface cleaning head, consistent with embodiments of the present disclosure;

[0008] FIG. **3** generally illustrates a bottom view of a surface cleaning head, consistent with embodiments of the present disclosure;

[0009] FIG. **4** generally illustrates another bottom view of a surface cleaning head, consistent with embodiments of the present disclosure;

[0010] FIG. **5** generally illustrates a top, cross-sectional view of a surface cleaning head, consistent with embodiments of the present disclosure;

[0011] FIG. **6** generally illustrates another top, cross-sectional view of a surface cleaning head, consistent with embodiments of the present disclosure;

[0012] FIG. **7** generally illustrates a front cross-sectional view of a surface cleaning head, consistent with embodiments of the present disclosure;

[0013] FIG. **8** generally illustrates another front cross-sectional view of a surface cleaning head, consistent with embodiments of the present disclosure;

[0014] FIG. **9** generally illustrates a further front cross-sectional view of a surface cleaning head, consistent with embodiments of the present disclosure;

[0015] FIG. **10** generally illustrates a side cross-sectional view of a surface cleaning head, consistent with embodiments of the present disclosure;

[0016] FIG. **11** generally illustrates another side cross-sectional view of a surface cleaning head, consistent with embodiments of the present disclosure;

[0017] FIG. **12** generally illustrates a further side cross-sectional view of a surface cleaning head, consistent with embodiments of the present disclosure;

[0018] FIG. **13** generally illustrates a cross-sectional area of a plenum and an air blast nozzle, consistent with embodiments of the present disclosure;

[0019] FIG. **14** generally illustrates results of a simulation of a uniformity index g versus a ratio A/a of cross-sectional areas of the plenum to the nozzle, consistent with embodiments of the present disclosure;

[0020] FIG. **15** generally illustrates one embodiment of a circuit diagram for providing power to the suction motor and the agitator drive motors and/or air-agitation motors, consistent with embodiments of the present disclosure; and

[0021] FIG. **16** generally illustrates another embodiment of a circuit diagram for providing power to the suction motor and the agitator drive motors and/or air-agitation motors, consistent with embodiments of the present disclosure.

DETAILED DESCRIPTION

[0022] A surface cleaning apparatus, consistent with embodiments of the present disclosure, provides a lower profile surface cleaning head by moving at least the suction motor out of the surface cleaning head. The suction motor may be located in an upper portion (e.g., in a wand) pivotably coupled to the surface cleaning head and fluidly connected to a cyclone assembly located in the surface cleaning head. The cyclone assembly may include first and second opposing cyclones with a smaller diameters (e.g., as compared to a single cyclone used in existing "all in the head" vacuums) to provide a lower profile with substantially the same or better performance.

[0023] Referring to FIGS. **1-4**, top and bottom views of a surface cleaning apparatus **10**, consistent with one embodiment, is generally illustrated. The surface cleaning apparatus **10** includes a surface cleaning head **12** which may be coupled to (e.g., pivotably coupled) an upper portion (not shown for clarity). The upper portion includes a handle, and optionally one or more suction motors configured to generate a vacuum source (e.g., an airflow having a pressure at less than atmospheric pressure). The upper portion may also include a pre-motor filter upstream of the suction motor and/or a post-motor filter downstream of the suction motor and/or one or more debris containment cavities/bags for filtering and/or storing debris sucked up by the surface cleaning apparatus **10**. It should be appreciated, however, that the surface cleaning head **12** may optionally include one or more suction motors in place of, or in addition to, any suction motors in the upper portion. The suction motor may be an AD and/or DC powered motor. The surface cleaning apparatus **10** may include a battery to provide for cordless operation or may include a power cord for connecting to an external power source. Additionally, it should be appreciated that the surface cleaning head **12** may optionally include one or more filters and/or debris containment cavities/bags in place of, or in addition to, any filters and/or debris containment cavities/bags in the upper portion.

[0024] With reference to FIGS. **1-6**, the surface cleaning head **12** may optionally further includes a rotational drive motor **14** (best shown in FIGS. **5** and **6**) drivingly connected to a driven rotating/agitator member **16**. The rotating/agitator member **16** may include, for example, a rotating brush roll or the like. The surface cleaning head **12** may further include an external cover **18** (best shown in FIGS. **1** and **2**) covering an agitator chamber **20** (best shown in FIGS. **5** and **6**) including the rotating/agitator member **16**, which may be removable from the agitator chamber. One example of a surface cleaning head with an openable agitator chamber and a removable rotatable agitator is described in greater detail in U.S. Patent Application Publication No. 2016/0220080 (Ser. No. 14/739,915), now U.S. Pat. No. 9,456,723 issued Oct. 4, 2016, which is incorporated herein by reference.

[0025] The surface cleaning head **12** includes a frame/body/enclosure **22** and includes one or more an air-agitation blower assemblies **24**. The air-agitation blower assembly **24** is configured to provide a positive pressure air flow (e.g., an air-blast agitation flow) to move (e.g., dislodge) debris. According to one embodiment, the air-agitation blower assembly **24** may be configured to direct the air-blast agitation flow to cause debris to be generally directed towards the rotating/agitator member **16** and/or the vacuum inlet **25** of the surface cleaning head **12**.

[0026] The air-agitation blower assembly **24** includes one or more air-agitation blowers **30** and one or more nozzles and/or discharge outlets **34** (FIGS. **3-4**) configured to form the air-blast agitation flow. The air-agitation blower **30** may include one or more air-agitation motors **26** (FIG. **5**) drivingly connected to one or more air pumps **28** (such as, but not limited to, one or more fan blades or the like, FIGS. **1-2**) configured to create a positive pressure air flow. As described herein, the positive pressure air flow may flow through one or more air conduits, ducts, or the like **32**, and ultimately to one or more nozzles and/or discharge outlets **34** (FIGS. **3-4**). It should be appreciated that the air-agitation blower **30** (e.g., the air-agitation motors **26** and air pumps **28**) may be separate from the suction motors for creating the vacuum source. Additionally, the one or more air conduits, ducts, or the like **32** and one or more air-blast nozzles and/or discharge outlets **34** may also be separate from the suction motors/conduits for creating the vacuum source. While the air-agitation blower **30** is illustrated as part of the surface cleaning head **12**, it should be appreciated that one or more parts of the air-agitation blower **30** may be located in the upper portion of the surface cleaning apparatus **10**.

[0027] In the illustrated embodiment, the surface cleaning head **12** includes a single air-blast discharge outlets/nozzle **34** that is behind the rotating/agitator member **16** and/or vacuum inlet **25**. It should be appreciated, however, that the surface cleaning head **12** may include one or more air-blast discharge outlets/nozzles **34** behind the rotating/agitator member **16** and/or vacuum inlet **25** and/or one or more air-blast discharge outlets/nozzles **34** in front of the rotating/agitator member **16** and/or vacuum inlet **25**. As used herein, the terms "behind" and "in front of" are intended to refer to positions relative to the user while holding the upper portion (e.g., handle). As such, the term "behind" is intended to refer to a position between the user and the rotating/agitator member **16** and/or vacuum inlet **25**, while the term "in front of" is intended to refer to a position in front both the user and the rotating/agitator member **16** and/or vacuum inlet **25**.

[0028] With reference to FIGS. **3-4** and **12**, the air-blast discharge outlets/nozzle **34** may be configured to direct the air-blast agitation flow at an angle of 0 to 45 degrees from the vertical axis. For example, the air-blast discharge outlets/nozzle **34** may Marlborough, Mass. be configured to direct the air-blast agitation flow F at an angle A (best seen in FIG. **12**) of 5 to 30 degrees from the vertical axis V. According to another embodiment, the air-blast discharge outlets/nozzle **34** may be configured to direct the air-blast agitation flow F at an angle A of 10-20 degrees or 17-20 degrees. It may be appreciated that smaller angles A may be used if one or more squeegees (not shown) is provided. The squeegee may extend downward (either fully or partially) towards the cleaning surface and may be provided behind and/or in front of the air-blast discharge outlets/nozzle **34**. The squeegee may be generally configured to direct the air-blast agitation flow towards the rotating/agitator member **16** and/or vacuum inlet **25**, e.g., by generally restricting the air flow in the direction opposite of the rotating/agitator member **16** and/or vacuum inlet **25**.

[0029] Turning back to FIGS. **1-2**, the air-agitation blower **30** may include a housing **36** defining an air inlet opening **38** through which the air pump **28** may draw air. The air inlet opening **38** may include a cover, grate, or the like configured to generally prevent objects (other than air) from being sucked into the air pump **28**. With reference to FIGS. **5-12**, the air pump **28** may be fluidly coupled through one or more air conduits, ducts, or the like **32** to one or more air-blast nozzles and/or discharge outlets **34** as discussed. For example, the air pump **28** may cause pressurized air (e.g., air above atmospheric pressure) to flow into the air duct(s) **32** to allow the pressurized air to flow from the air pump **28** to one or more plenums **42** and/or air-blast discharge outlets/nozzles **34**. The air duct(s) **32** may allow the pressurized air from the air pump **28** to flow into one or more plenums **42** and/or air-blast discharge outlets/nozzles **34** while generally minimizing flow restrictions, reducing the overall height of the surface cleaning head **12**, and/or more evenly distributing the pressurized air flow to the one or more plenums **42** and/or air-blast discharge outlets/nozzles **34**, while also avoiding other components of the surface cleaning head **12** such as, but not limited to, the vacuum inlet/ducting **25**, rotational drive motor **14**, and/or rotating/agitator member **16**.

[0030] As discussed above, the air duct **32** may optionally be fluidly coupled to one or more plenums **42**. One or more plenums **42** may be fluidly coupled to one or more air-blast discharge outlets/nozzles **34**. The plenums **42** may be configured to distribute the air flow to the one or more air-blast discharge outlets/nozzles **34**. For example, in an embodiment in which a single air-blast discharge outlets/nozzle **34** is used, it may be desirable to evenly distribute the pressurized air flow across the air-blast discharge outlets/nozzle **34**. As may be appreciated, space available in the surface cleaning head **12** to include an air path for the air-blast discharge outlets/nozzle **34** design is very limited. The plenum **42** may allow for an even distribution of pressurized air to be achieved within the confined space available, preferably without using regular air ducts or hoses. To achieve even distribution of pressurized air to the air-blast discharge outlets/nozzle **34**, the plenum chamber **42** is used. The plenum chamber **42** may be a pressurized housing containing fluid at positive pressure. The function of the plenum **42** is generally to equalize pressure of the air flow across the inlet and/or outlet of the air-blast discharge outlets/nozzle **34** such that the air-blast discharge outlets/nozzle **34** discharges air generally evenly. The plenum chamber **42** may also provide acoustic benefits by reducing unwanted/undesirable noises.

[0031] In designing a plenum chamber **42**, it is generally necessary to understand specific constraints for the application. For a surface cleaning head **12**, one constraint is space. A good distribution is preferably achieved within a confined space. A non-dimensional parameter (A/a) is considered; this is the ratio of cross-sectional area of the plenum chamber "A" (FIG. **13**) to the cross sectional area of fluid outlet 'a' (FIG. **13**). If the plenum chamber **42** area is big enough to act as a reservoir, then the effects of pressure in the plenum chamber **42** will be approximately uniform and thus results in an approximately even distribution of air from the air-blast discharge outlets/nozzle **34**. In this way, air distribution can be approximately uniform across the air-blast discharge outlets/nozzle **34** independent of shape, size, and location of the inlet(s) to the plenum chamber **42**.

[0032] Applicants have performed a set of simulations **1400** to find preferred 'A/a' ratios to achieve the desired flow distribution from the air-blast discharge outlets/nozzle **34**, the results of which are generally illustrated in FIG. **14**. As may be seen, a parameter is used to quantify the flow distribution called the "uniformity index of velocity (g)." The uniformity index (g) represents how a specified variable (in this case, velocity) varies over a surface; a value of 1 indicates the highest uniformity. Applicants have unexpected determined that a ratio "A/a" of 4 or greater achieves a desired uniformity index of velocity (g) of approximately 0.8 or greater. In particular, Applicants have unexpected determined that a ratio "A/a" of 5 or greater achieves a desired uniformity index of velocity (g) of approximately 1.0.

[0033] The plenum chamber **42** may also optionally include one or more baffles **44** (see, e.g., FIG. **7**). The bafflers **44** may also help break up and/or distribute the pressurized air flow across the air-blast discharge outlets/nozzle **34**. For example, the baffles **44** may include dividers extending at least partially between an upper and/or lower surface of the plenum chamber **42**. Depending on the location, size, and orientation of the baffles **44**, pressurized air may be directed in one or more directions, thereby allowing the air flow to be generally balanced.

[0034] It should be appreciated that it may be desirable to create a generally even air-blast agitation flow across all of the air-blast discharge outlets/nozzle(s) **34**, in some instances it may be desirable to have an uneven distribution. For example, it may be desirable to increase the air flow in regions further away from the vacuum inlet **25**, such as the lateral edges **48***a*, **48***b* (e.g., as seen in FIG. **3**) of the surface cleaning head **12**. In particular, it may be desirable to increase the air flow in these regions **48***a*, **48***b* in order to help move the debris towards the vacuum inlet **25** and/or generally prevent the debris from escaping beyond the surface cleaning head **12**. The desired air-blast agitation flow distribution may be achieved by adjusting one or more of the plenums **42**, baffles **42**, and/or air-blast discharge outlets/nozzles **34**.

[0035] Turning now to FIG. **15**, one embodiment of a circuit diagram **1500** for an AC powered suction motor is generally illustrated. As can be seen, there are three pins going from the wand to the nozzle in the vacuum. One is 110 v AC, one is neutral, and the third is used for controlling the functions, such as agitator drive motors **14** (e.g., for a brush bar or the like) and/or air-agitation motors **26** (e.g., for the air-agitation blower **30**). In this instance, the both the suction motor and the rotational drive motor **14** and/or air-agitation motors **26** are all AC powered motors.

[0036] According to one embodiment, the agitator drive motors **14** and/or air-agitation motors **26** may be DC motors, while the suction motors may be AC motors. Using a DC motor for the air-agitation motor **26** may be desirable because it may be smaller, lighter, and/or cheaper than AC motors in typical air-agitation applications, while using an AC motor for the suction motor may be desirable in an application in which the surface cleaning apparatus **10** is powered by an AC source.

[0037] Turning now to FIG. **16**, one embodiment of a circuit diagram **1600** for an AC powered suction motor and DC powered agitator drive motors **14** and/or air-agitation motors **26** without the use of a separate transformer is generally illustrated. In particular, the step-down voltage rectifier circuitry **1600** includes a rectifier **1602** that converts AC to DC. The circuit **1600** also takes advantage of the windings **1604** of the AC suction motor **1606** to step down the voltage from the AC line voltage (e.g., 110 v) to a desired voltage for the DC motor (e.g., 20 v AC). This stepped down voltage (e.g., 20 v AC) is supplied to the rectifier **1602** that converts the stepped down voltage (e.g., 20 v AC) to the desired DC signal (e.g., 20 v DC). The windings **1604** of the AC suction motor **1606** may be arranged in any order necessary to achieve the desired stepped down voltage. The rectifier **1602** may include any AC to DC rectifier. For example, a non-exhaustive list of rectifiers **1602** may include single-phase rectifiers (e.g., but not limited to, half-wave rectifiers, full-wave rectifiers) three-phase rectifiers (e.g., three-phase-half-wave rectifiers, three-phase-full-wave rectifiers, three-phase-bridge rectifiers, and twelve-pulse bridges), and/or voltage-multiplying bridges. Optionally, one or more filters (e.g., but not limited to, one or more capacitors or the like, not shown) may be added to smooth out and produce a steadier DC current. The rectifier **1602** may be located in the surface cleaning head **12**, though it could also be located in the upper portion.

[0038] As may be appreciated, three pins may go from the wand to the nozzle in the vacuum. One is 110 v AC, one is neutral, and the third is the stepped-down DC (e.g., 20 v AC) that will power the DC powered agitator drive motors **14** and/or air-agitation motors **26**. In carpet mode, for example, the rotating/agitator member **16** (e.g., brush bar) may be on, and the air-agitation blower **30** may be off. In hard floor mode (e.g., tile, wood, etc.), the opposite may be true, e.g., the rotating/agitator member **16** (e.g., brush bar) may be off, and the air-agitation blower **30** may be on. It should also be appreciated, however, that a four pin embodiment may allow for the rotating/agitator member **16** (e.g., brush bar) and the air-agitation blower **30** to be powered independently of each other.

[0039] According to one aspect, the present disclosure features a surface cleaning apparatus comprising and upper portion and a surface cleaning head. The upper portion includes a handle and a suction motor. The surface cleaning head is pivotably connected to the upper portion and includes a vacuum inlet fluidly coupled to the suction motor and an air-agitation blower assembly. The air-agitation blower assembly comprises at least one air-agitation blower configured to generate a pressurize air flow and at least one discharge nozzle fluidly. The air-agitation blower includes an air pump and an air-agitation motor drivingly connected to the air pump, wherein the air-agitation motor is independent from the suction motor. The discharge nozzle is fluidly coupled to the air pump and is configured to discharge the pressurized air flow to form an air-blast agitation flow.

[0040] According to another aspect, the present disclosure features a surface cleaning apparatus comprising an upper portion, a surface cleaning head pivotably connected to the upper portion, and step-down voltage rectifier circuitry. The upper portion includes a handle and a suction motor, wherein said suction motor is an AC motor comprising a plurality of windings. The surface cleaning head includes a vacuum inlet fluidly coupled to the suction motor, an air-agitation blower assembly, and at least one discharge nozzle. The air-agitation blower assembly comprises at least one air-agitation blower configured to generate a pressurize air flow. The air-agitation blower includes an air pump and an air-agitation motor drivingly connected to the air pump, wherein the air-agitation motor is a DC motor. The discharge nozzle is fluidly coupled to the air pump and configured to discharge the pressurized air flow to form an air-blast agitation flow. The step-down voltage rectifier circuitry comprises at least a portion of the plurality of windings of the AC suction motor configured to step down an input AC voltage to the AC motor to a stepped down AC voltage, and at least one rectifier configured to convert the stepped down AC voltage to a DC voltage for supply to the DC air-agitation motor.

[0041] According to yet another aspect, the present disclosure features a surface cleaning apparatus comprising an upper portion including a handle, one or more motors configured to provide a vacuum air flow and a pressurized air-agitation air flow, and a surface cleaning head pivotably connected to the upper portion. The surface cleaning head includes a vacuum inlet fluidly coupled to the vacuum air flow, at least one discharge nozzle configured to discharge the pressurized air flow to form an air-blast agitation flow, and at least one plenum fluidly coupled between the one or more motors providing the pressurized air-agitation air flow and the discharge nozzle, wherein a ratio (A/a) of a cross-sectional area (A) of the plenum to a cross-sectional area (a) of the discharge nozzle is greater than or equal to 4:1.

[0042] While the principles of the invention have been described herein, it is to be understood by those skilled in the art that this description is made only by way of example and not as a limitation as to the scope of the invention. Other embodiments are contemplated within the scope of the present invention in addition to the exemplary embodiments shown and described herein. Modifications and substitutions by one of ordinary skill in the art are considered to be within the scope of the present invention.

What is claimed is:

1. A surface cleaning apparatus, comprising:
an upper portion including a handle;
a suction motor; and
a surface cleaning head pivotably connected to said upper portion, said surface cleaning head including:
a vacuum inlet fluidly coupled to said suction motor;
an agitation chamber fluidly coupled to said vacuum inlet;
a rotating agitator at least partially disposed within said agitation chamber; and
an air-agitation blower assembly comprising:
at least one air-agitation blower configured to generate a pressurize air flow, said at least one air-agitation blower including:
an air pump; and
an air-agitation motor drivingly connected to said air pump, said air-agitation motor being independent from said suction motor; and
at least one discharge nozzle fluidly coupled to said air pump and disposed behind said rotating agitator and configured to discharge said pressurized air flow to dislodge debris and direct said debris towards said rotating agitator.

2. The surface cleaning apparatus of claim **1**, wherein said surface cleaning head further includes at least one wheel disposed proximate a rear portion of said surface cleaning head.

3. The surface cleaning apparatus of claim **2**, wherein said at least one discharge nozzle is located generally between said rotating agitator and said at least one wheel.

4. The surface cleaning apparatus of claim **2**, wherein said at least one discharge nozzle is configured to direct debris generally away from said rear portion of said surface cleaning head.

5. The surface cleaning apparatus of claim **2**, wherein said at least one discharge nozzle is disposed behind said vacuum inlet.

6. The surface cleaning apparatus of claim **1**, wherein said agitation chamber includes a dirty air inlet and said rotating agitator is partially disposed through said dirty air inlet, wherein said at least one discharge nozzle is further disposed behind said dirty air inlet.

7. The surface cleaning apparatus of claim **1**, wherein said rotating agitator is driven by a rotational drive motor which is separate from said air-agitation motor.

8. The surface cleaning apparatus of claim **1**, wherein said surface cleaning head further includes at least one plenum fluidly coupled between said air pump and said at least one discharge nozzle.

9. The surface cleaning apparatus of claim **8**, wherein a ratio (A/a) of a cross-sectional area (A) of said at least one plenum to a cross-sectional area (a) of said at least one discharge nozzle is greater than or equal to 4:1.

10. The surface cleaning apparatus of claim **9**, wherein said ratio (A/a) is greater than or equal to 5:1.

11. The surface cleaning apparatus of claim **1**, wherein said suction motor is an AC motor and wherein said air-agitation motor is a DC motor.

12. The surface cleaning apparatus of claim **11**, wherein at least one winding of said AC suction motor is configured to step down said input AC voltage to a stepped down AC voltage.

13. The surface cleaning apparatus of claim **12**, further comprising at least one rectifier configured to convert said stepped down AC voltage to a DC voltage for supply to said DC air-agitation motor.

14. The surface cleaning apparatus of claim **1**, wherein said at least one discharge nozzle comprises at least one baffle.

15. A surface cleaning apparatus, comprising:

an upper portion including a handle;

one or more motors configured to provide a vacuum air flow and a pressurized air-agitation air flow;

a surface cleaning head including a front portion and a rear portion, said rear portion pivotably connected to the upper portion and including at least one wheel, the surface cleaning head including:

a vacuum inlet fluidly coupled to said vacuum air flow;

an agitation chamber fluidly coupled to said vacuum inlet;

a rotating agitator at least partially disposed within said agitation chamber; and at least one discharge nozzle disposed between said rotating agitator and said rear portion and configured to discharge said pressurized air flow to direct said debris towards said rotating agitator.

16. The surface cleaning apparatus of claim **15**, wherein said air-agitation blower assembly further comprises at least one plenum fluidly coupled between said one or more motors providing said pressurized air-agitation air flow and said at least one discharge nozzle, wherein a ratio (A/a) of a cross-sectional area (A) of said at least one plenum to a cross-sectional area (a) of said at least one discharge nozzle is greater than or equal to 4:1.

17. The surface cleaning apparatus of claim **16**, wherein said ratio (A/a) is greater than or equal to 5:1.

18. The surface cleaning apparatus of claim **15**, wherein said one or more motors includes at least one suction motor and at least one air-agitation motor, wherein said at least one suction motor is an AC motor and wherein said at least one air-agitation motor is a DC motor.

19. The surface cleaning apparatus of claim **18**, further comprising step-down voltage rectifier circuitry comprising at least a portion of a plurality of windings of said AC suction motor configured to step down an input AC voltage to said AC motor to a stepped down AC voltage and at least one rectifier configured to convert said stepped down AC voltage to a DC voltage for supply to said DC air-agitation motor

20. The surface cleaning apparatus of claim **15**, wherein said at least one discharge nozzle comprises at least one baffle configured to increase said air flow proximate lateral edges of said surface cleaning head.

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