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(71) Applicant and

(72) Inventor (for all designated States except US):
RICHARDS, Edward [US/US]; 6030 S.W. 55th Street,
Davie, FL 33314 (US).

(74) Agent: **FISCHER, Ury**; Lott & Friedland, P.A., Post Of-
fice Drawer 141098, Coral Gables, FL 33114-1098 (US).

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(54) Title: HARD SURFACE CLEANER

(57) Abstract: A surface cleaner, comprising a tank having a fluid-filled part and an air-filled part; a vacuum pump; a fluid pressure pump; a cleaning head having a cleaning chamber and a vacuum chamber, the cleaning chamber forming a cavity bounded by a surface to be cleaned, the vacuum chamber having an inlet lip at the periphery of the cleaning chamber; jet nozzles mounted within the cleaning chamber; wherein the pressure pump draws fluid from the tank and ejects it into the cleaning chamber through the nozzles; wherein the vacuum pump maintains a low pressure in the air-filled part of the tank and a high pressure in the cleaning chamber; and wherein the inlet lip is in fluid communication with the air-filled part of the tank portion whereby fluid ejected into the cleaning chamber is drawn into the inlet lip and returned to the tank.



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HARD SURFACE CLEANER

[001] Priority Claim

[002] This application claims priority to and the benefit of the filing date of corresponding U.S. Provisional Application Serial No. 61/046,621, filed on April 21, 2008, the disclosure and contents of which are expressly incorporated herein by reference.

[003] Technical Field

[004] The present invention relates to high-pressured fluid cleaning systems for cleaning indoor and outdoor floor surfaces.

[005] Background Art

[006] Several existing cleaning systems use an extractor method wherein a detergent cleaning fluid is distributed by the device along the floor surface and the

device simultaneously extracts the fluid and the dirt from the floor surface using a suction source in a continuous operation as the device moves along the surface. However, a number of these systems require maintaining two separate tanks within the device such that a first tank contains the unused cleaning fluid and a second tank contains the recovered fluid and dirt that was extracted from the floor surface. Once filled with dirty fluid, the second tank has to be removed in order to discard the dirty fluid and to be cleaned. Also, the first tank must be replenished with new cleaning fluid. Therefore, it would be advantageous to be able to reuse the recovered cleaning fluid such that the device only needs to carry one tank and to eliminate the additional time and expense it takes to continuously remove, clean and replenish to the two separate tanks. The present invention provides a novel and efficient cleaning device and system that contains only one tank and recycles the fluid recovered from the floor surface using a filter mechanism in order for the fluid to be reused.

[007] In addition, several of these existing cleaning systems that use a cleaning fluid extractor method distribute a cleaning chemical or solution along the floor surface and rely generally on the chemical or solution to clean the floor. In some instances, the device includes a sponge, brush or squeegee having an abrasive surface for scrubbing the floor in combination with the distributed chemical or solution. However, these types of harsh chemicals, solutions and tools having

abrasive surfaces can cause damage to the floor surface. The present invention beneficially eliminates the possibility of scratching or damaging the floor surface by cleaning the floor surface using pressurized fluid distribution to dislodge any dirt or debris.

[008] Furthermore, many of the existing cleaning systems that use a cleaning fluid extractor method leave behind a wet floor surface as it is impossible to be able to extract all of the fluid that was distributed along the floor surface when using a suction source. This results in a dangerous and slippery condition and requires additional time for drying before the floor surface is ready to be used. Accordingly, it would be beneficial for the cleaning device to be capable of simultaneously drying the floor surface immediately after it has been cleaned such that a portion of the floor is cleaned and dried in the instance that the device passes over that floor portion. The present invention provides an efficient method of distributing forced air from the device along the just cleaned floor portion using the air vacuum that is required for the suction source to operate. Thus, the cleaned floor portion can be dried without using any additional energy or resources to implement the drier function.

[009] Disclosure of Invention

[010] The present invention is a portable and self-contained high-pressure fluid cleaning apparatus for use on a variety of surface floor coverings and in particular, on indoor and outdoor hard surface floor coverings that contain grooves and crevices that are ordinarily difficult to clean, such as tile, grout, epoxy and stained concrete. The apparatus operates simultaneously as both a fluid pressure cleaning device and as a wet-dry vacuum such that dirt and debris is effectively dislodged from the floor surface and is simultaneously picked up along with the ejected cleaning fluid by the vacuum suction of the apparatus. Through the use of one or more cartridge-type filter elements, the dirty cleaning fluid that is removed from the floor surface can be recycled and reused thereafter such that only one fluid tank is needed for both operations of the apparatus.

[011] The apparatus is comprised of a tank portion, a power portion and a cleaning head portion. The tank portion is comprised of a tank that is positioned on a base wherein the tank's volume is partially filled with a suitable amount of cleaning fluid. The cleaning fluid is introduced into the tank through an opening in the tank that may be closed and sealed. The remaining volume of the tank contains air. The tank portion has a closeable opening for adding or removing cleaning fluid. When closed, the tank portion is hermetically sealed in order that a negative

pressure vacuum can be maintained inside the tank portion. Located within the fluid-containing volume inside the tank are one or more cartridge-type filter elements of suitable particle size for adequately filtering the recycled cleaning fluid.

[012] The power portion is preferably located below the tank and is comprised of a vacuum pump and a pressure pump. Each pump may be powered by its own independent motor or both pumps may be powered from a mutual single motor. The motors may be electric or gasoline powered. The vacuum pump provides the suction that is needed to maintain the negative pressure in the air-filled portion or cavity of the sealed tank using a vacuum line that extends from the vacuum pump to the air-filled portion of the tank. In addition, the exhaust air from the vacuum pump is routed through a pressurized air line to a pressurized air inlet on the cleaning head portion.

[013] The pressure pump provides pressurized cleaning fluid to a jet nozzle that is located in the cleaning head portion and directs the cleaning fluid onto the floor surface at high velocity. Prior to entering the pressure pump, the cleaning fluid is filtered through the filter element located in the tank portion. The filtered cleaning fluid is fed into the pressure pump through a supply line that extends from the outlet side of the filter element in the fluid-containing volume of the tank to the

pressure pump. The pressure pump provides a flow of pressurized cleaning fluid to the water jet nozzle through a pressure line that extends from the pressure pump to the water jet nozzle.

[014] The cleaning head portion of the apparatus, which is optionally detachable, is comprised of a double-walled shroud having inner and outer walls and further includes the jet nozzle, an annular vacuum chamber, a pressurized air inlet and a vacuum port. The inner wall of the shroud of the cleaning head portion defines an inner chamber in which the jet nozzle is located and which is fluidly connected to the pressurized air inlet.

[015] The water jet nozzle is fed cleaning fluid by the pressure pump through the pressure line as described above. Simultaneously, pressurized air is provided to the inner chamber of the cleaning head through the pressurized air inlet which, as described above, is fed by the exhaust from the vacuum pump in the power portion. The pressurized air provides dual benefits: (a) it creates an “air cushion” effect which facilitates displacement of the device over the surface being cleaned; and (b) it forces air and cleaning fluid to the periphery of the inner chamber where, as described below, it is ingested through the annular vacuum chamber and is returned to the tank portion.

[016] The annular vacuum chamber is contained between the inner and outer walls of the cleaning head shroud and is fluidly connected to the vacuum port. The annular vacuum chamber includes an inlet lip that is disposed peripherally around the inner cleaning chamber so that pressurized air and cleaning fluid exiting the inner chamber is ingested through the inlet lip and exits through the vacuum port. The vacuum port is connected by a suction return line to the air-filled volume or cavity of the tank, which, as previously stated, generates suction through a negative pressure differential.

[017] A skirt barrier may optionally be applied along the periphery of the outer wall of the cleaning head shroud such that it contacts the floor surface and prevents the cleaning head portion from contacting the floor. The skirt barrier may also serve as a physical barrier to prevent cleaning fluid and pressurized air from leaking outside the cleaning head, thus improving the integrity of the air cushion generated by the pressurized air and simultaneously preventing dirt and cleaning fluid from escaping before being vacuumed into to the tank portion. The skirt may be formed from a material that is suitable for wiping the floor surface in order to further aid in dislodging dirt and debris from the floor surface.

[018] Optionally, an annular pressure chamber may be provided which envelops the annular vacuum chamber and provides a curtain of pressurized air through a lip

disposed peripherally around the lip of the annular vacuum chamber. The pressurized air curtain provides additional lift further facilitating displacement of the cleaner and also provides a further barrier to prevent cleaning fluid and pressurized air from escaping before being vacuumed into the tank portion. The pressurized air curtain also facilitates the drying of the surface immediately after it has been cleaned. The air in the annular pressure chamber may optionally be heated to further facilitate drying.

[019] In order to further facilitate movement of the apparatus along the floor surface, two or more wheels may be incorporated into the base of the apparatus.

[020] In operation, the apparatus is powered through a switch, or a series of switches, that sequentially energizes the vacuum and pressure pumps. When the apparatus is powered, the vacuum and pressure pumps are fully primed. Cleaning fluid from the tank is then drawn by the pressure pump through the one or more filter elements and down through the supply line and into the pressure pump. The cleaning fluid is ejected at high pressure by the pressure pump through the jet nozzle in the inner chamber of the cleaning head portion and is forcibly directed downwards onto the floor surface thereby dislodging any dirt and other debris on the floor surface. Simultaneously, pressurized air is fed into the inner chamber of the cleaning head. The force of the ejected fluid combined with the pressurized air

provides buoyancy to allow the entire apparatus to be easily displaced on the surface being cleaned.

[021] As the apparatus is being pushed across the floor surface, the inlet lip of the annular vacuum chamber comes into position directly above the freshly cleaned floor surface and the dislodged dirt and debris is vacuumed through the inlet lip and is returned into the tank. As previously stated, this process is aided by the pressurized air inside the inner chamber of the cleaning head.

[022] Once inside the tank, the dirty fluid is drawn through the filter element(s) by gravitational force and by the pressure pump thus removing the dirt and debris contained in the fluid. The fluid can then be recycled and re-used for cleaning.

[023] In order for the apparatus to perform optimally, the apparatus may optionally be equipped with controls that can adjust the pressure differential between the inner chamber of the cleaning portion and the annular vacuum chamber. Depending on the physical characteristics of floor surface that is being cleaned, the operator of the apparatus may vary said pressure differential to optimize the cleaning force, buoyancy and vacuuming force.

[024] **Brief Description of the Drawings**

[025] **FIG. 1** is a side view of an exemplary embodiment of the present invention.

[026] FIG. 2 is a fluid flow diagram of an apparatus in accord with the present invention.

[027] FIG. 3 is a cross-sectional view of the cleaning head portion of the apparatus of FIG. 1.

[028] FIG. 4 is a bottom elevational view of the cleaning head portion of the apparatus of FIG. 1.

[029] FIG. 5 is a cross-sectional view of an alternative embodiment of the cleaning head portion of the apparatus of FIG. 1.

[030] FIG. 6 is a bottom elevational view of an alternative embodiment of the cleaning head portion of the apparatus of FIG. 1.

[031] **Modes of Carrying Out the Invention**

[032] For a better understanding of the present invention, reference may be had to the following detailed description taken in conjunction with the appended claims and the accompanying drawings.

[033] The present invention is a portable, self-contained hard surface floor cleaning apparatus 1 that operates simultaneously as a water pressure cleaning device and a wet-dry vacuum. The apparatus is suitable for use in both indoor and outdoor spaces on a variety of hard surface floor coverings such as tile, grout,

epoxy and stained concrete. The apparatus is comprised of a tank portion **2**, a power portion **3** and a cleaning head portion **4** that may optionally be detachable.

[034] **FIG. 1** depicts an embodiment of the present invention. The tank portion **2** is comprised of a tank **5** that is preferably positioned upright above the power portion **3** wherein the tank's volume is partially filled with a suitable cleaning fluid **6** that is fed through a supply line **9** to the power portion **3** of the apparatus. Both the tank portion **2** and the power portion **3** are positioned upright on a base **22**.

[035] Preferably, the tank **5** is cylindrical in shape and may be made from a durable, molded plastic or other suitable material. The tank **5** may be removable for cleaning or to simplify fluid or filter servicing. In addition, the tank **5** may be made wholly or partially transparent in order that the volume level and cleanliness of the contained cleaning fluid **6** may be monitored by the user. The supply line **9** is preferably made from molded rigid conduit but any other suitable material is acceptable.

[036] The cleaning fluid **6** may be any solvent, such as water, and may optionally include detergent additives and/or anti-foaming agents. The remaining volume of the tank contains air **12** to allow a negative pressure to be maintained in the tank portion **2**. The tank portion **2** includes an opening **30** for adding or removing cleaning fluid **6**, said opening **30** being closeable and providing a hermetic seal upon

closing. For this purpose a hinged door **7**, or other suitable mechanism, such as, for example, a screw-cap may be provided. Located within the fluid-containing volume inside the tank **5** are one or more cartridge-type filter elements **8** which are removable for cleaning and replacement. The filter element (or elements) **8** should be of suitable particle size such that it adequately filters the recycled cleaning fluid and provides sufficient fluid flow to the power portion **3** as described more fully below.

[037] The power portion **3** is preferably located below the tank **5** and above base **22**. The power portion **3** is comprised of a vacuum pump **10** and a pressure pump **11**. Each pump may be powered by its own independent motor or both pumps may be powered from a single motor. The motors may be electric or gasoline powered and a power cord **23** may be provided for connecting the apparatus to an electrical power source. The motors may be set to different speeds and/or pressures through the use of switching mechanisms known in the art. In addition, it is preferred that one or more safety mechanisms known in the art, such as a “dead man’s switch”, be employed in order that the motor(s) and/or the pumps are automatically turned off for protection of their components. A mercury switch may also be employed to shut off the apparatus in the event it has tipped over.

[038] As depicted in the fluid flow diagram in **FIG. 2**, the vacuum pump **10** provides the suction that is needed to maintain a negative pressure in the air cavity **12** of the tank **5** through a vacuum line **13** that extends from the vacuum pump **10** into the air cavity **12** of the tank **5**. As described in further detail below, the type and speed of the vacuum pump **10** are dependent upon the amount of pressure that is needed to maintain a negative pressure in the tank **5** and the amount of suction needed in the cleaning head portion **4**. In one embodiment, the vacuum pump **10** is capable of creating a static pressure of 50-115 psi and an air flow of 80-180 cfm. The vacuum line **13** is preferably made from molded rigid conduit but any other suitable material is acceptable.

[039] The exhaust air from vacuum pump **10** is routed through a pressurized air line **31** to a pressurized air inlet **32** on the cleaning head portion **4**. This pressurized air provides positive air pressure through one or more cleaning chamber air inlets **28** within the inner cleaning chamber **33** of the cleaning head portion **4** which lifts the apparatus and facilitates its displacement during operation. In an alternative embodiment (not shown on **FIG. 2** but discussed in **FIGS. 5** and **6**) exhaust air may also optionally be routed through pressurized air line **31** to and pressurized air inlet **32** to an annular pressure chamber with an exit lip that provides additional buoyancy and also provides a barrier to prevent cleaning fluid and pressurized air from escaping before being vacuumed.

[040] The pressure pump **11** is fed by the filtered cleaning fluid **6** from inside the tank **5** through the supply line **9** that extends between the tank **5** and the pressure pump **11**. The pressure pump **11** provides a flow of pressurized cleaning fluid **6** to a jet nozzle **15** within the detachable cleaning head portion **4** through a pressure line **16**. (See **FIG. 2**). As also described in further detail below, the type and speed of the pressure pump **11** is dependent upon the amount of pressure needed to draw the cleaning fluid **6** from the tank **5** and the force at which the cleaning fluid **6** must exit the jet nozzle **15** in the cleaning head portion **4**. In one embodiment, the pressure pump **11** is capable of creating a pressure of between 1,400 psi and 2,000 psi. The pressure line **16** is preferably made from flexible reinforced conduit but any other suitable material is acceptable.

[041] As shown in detail in **FIGS. 3** and **4**, the cleaning head portion **4** is comprised of a double-walled shroud **24** wherein an annular vacuum chamber **25** is defined between the inner and outer walls (**26** and **27** respectively) of the shroud **24**. The inner wall **26** of the shroud **24** defines an inner cleaning chamber **33** within the cleaning head portion **4**. The cleaning head portion **4** is further comprised of a jet nozzle **15**, a pressurized air inlet **32** and a vacuum port **17**.

[042] The jet nozzle **15** is located within the inner cleaning chamber **33** and may optionally be attached to an arm **14** that rotates at high velocity in response to the

flow of the pressurized cleaning fluid **6**. In alternate embodiments of the present invention, more than one jet nozzle **15** and arm **14** may be employed. As described above, the jet nozzle **15** is fed by the pressure pump **11** via pressure line **16**.

[043] The vacuum port **17** is positioned on the cleaning head portion **4** and is in fluid communication with the annular vacuum chamber **25**. Connected to the vacuum port **17** is a suction line **18** that returns “dirty” fluid to the air-filled cavity **12** of the tank **5**. The suction line **18** is preferably made from molded rigid conduit but other suitable materials are acceptable. The annular vacuum chamber includes an inlet lip **35** that is disposed peripherally around the inner cleaning chamber **33** so that pressurized air and cleaning fluid exiting the inner cleaning chamber **33** is ingested through the inlet lip **35** and exits through the vacuum port **17**. The vacuum port is connected by suction return line **18** to the air-filled cavity **12** of the tank **5**.

[044] In addition, pressurized air exhausted from the vacuum pump **10** is fed into the inner cleaning chamber **33** by means of one or more cleaning chamber air inlets **28** through pressurized air inlet **32** and pressurized air line **31**. The pressurized air creates a positive air pressure differential within the inner cleaning chamber **33** that lifts the cleaner **1** and counteracts the suction force that is created by the vacuum pump **10** at the inlet lip **35** thereby giving the apparatus **1** buoyancy off the floor

surface in order that the cleaning head portion **4** moves easily and smoothly across the floor surface. The pressurized air also forces cleaning fluid **6** to be displaced to the periphery of the inner cleaning chamber **33** where it is ingested into the annular vacuum chamber **25** through the inlet lip **35** from where it is returned to the tank **5**.

[045] A skirt **21** or other type of barrier may be applied to the periphery of the cleaning head portion **4** just outside the inlet lip **35** such that it contacts the floor surface. The skirt **21** acts as a spacer creating a gap between the cleaning head portion **4** and the floor surface in order to prevent the cleaning head portion **4** from coming into direct contact with, and potentially damaging, the floor surface. The skirt **21** also acts as a barrier to prevent cleaning fluid and debris to escape from being vacuumed. The skirt **21** may be formed from a material that is suitable for wiping the floor surface in order to further aid in dislodging dirt and debris from the floor surface. The skirt **21** may consist of broom bristles, or other suitable materials.

[046] In order to move the apparatus **1** along the floor surface, wheels **19** are incorporated onto the base **22** of the apparatus **1**. For example, the apparatus **1** may include one or more 6" inch rear wheels and one or more 1.5" inch front caster wheels. The wheels may be manually rolled over the floor surface using a handle **20**. Alternatively, the wheels **19** can be powered or power-assisted.

[047] In operation, the present invention functions simultaneously as a water pressure cleaning device and a wet-dry vacuum. With respect to the water pressure cleaning function, the tank 5 is initially partially filled with a suitable amount of cleaning fluid 6 via the hinged door 7 or another opening in the tank that may be closed and sealed. The apparatus is powered into an ON position preferably by both an electric switch (not shown) that is associated with the vacuum pump 10 and a pressure sensor (not shown) that is associated with the pressure pump 11. As shown in the fluid flow diagram in FIG. 2, when the apparatus 1 is powered into an ON position and the vacuum pump 10 and the pressure pump 11 are fully primed, the cleaning fluid 6 in the tank 5 is drawn by the pressure pump 11 through the filter element 8 and down through the supply line 9 into the pressure pump 11.

[048] The cleaning fluid is then ejected at a high pressure by the pressure pump 11 through the jet nozzle 15 inside the inner cleaning chamber 33 in the cleaning head portion 4 and is forcibly directed downwards onto the floor surface thereby dislodging any dirt and debris that is on the floor. The jet nozzle 15 can optionally rotate at a high rate of speed as it ejects fluid. The rotation of the jet nozzle 15 can be generated naturally in reaction to the fluid's exit through the nozzle, or through alternate means such as through the use of a small motor (not shown).

[049] As the cleaner 1 is pushed across the floor surface, the inlet lip 35 moves directly above the freshly ejected cleaning fluid and the dislodged dirt and debris such that the fluid, dirt and debris is ingested into the annular vacuum chamber 25 and through the suction line 18 into the vacuum air-filled cavity 12 of the tank 5. Simultaneously, pressurized air generated by the exhaust from the vacuum pump 10 is fed into the inner cleaning chamber which generates positive pressure within the inner cleaning chamber 33 and aids in forcing the fluid, dirt and debris into the annular vacuum chamber 25. Closing the cycle, gravity and suction from the pressure pump 11 causes the used cleaning fluid 6 entering the tank 5 to flow through the one or more filter elements 8 prior to the fluid being recycled into the pressure pump 11.

[050] It should be noted that the pressurized air emanating from the vacuum pump's 10 exhaust will be, in most types of pneumatic pumps, at a warmer temperature than ambient air, which further assist in drying of the freshly cleaned floor. In an embodiment of the present invention the exhaust air may be additionally heated through the use of an electric radiator or through other methods known in the art.

[051] In an alternative embodiment of the present invention, shown in FIGS. 5 and 6, the shroud 24 may contain a third external wall 37 which creates an

additional annular pressure chamber **38** that surrounds the annular vacuum chamber **25**. The annular pressure chamber **38** has an exit lip **39** peripherally situated around the inlet lip **35** of the vacuum annular chamber **25**. The annular pressure chamber **38** is in fluid communication with pressurized air inlet **32** so that, like the inner cleaning chamber **33**, it receives pressurized air from the exhaust of the vacuum pump **10**. In operation the pressurized air enters the annular pressure chamber **38** through the pressurized air inlet **32** and exits through the exit lip **39** creating an air curtain that supplements or replaces the function of the skirt **21** and provides additional lift to facilitate displacement of the cleaner.

[052] In order for the apparatus **1** to operate optimally, it is desirable to have a suitable pressure balance or differential between, on the one hand, the suction at the annular vacuum chamber **25**, and on the other hand the fluid exiting the jet nozzle **15**, the air pressure inside the inner cleaning chamber **33**, and if used, the annular pressure chamber **38**.

[053] This optimal pressure differential can be achieved through controls that regulate the amount of vacuum and pressure generated through the vacuum pump **10** and pressure pump **11**. The pressure differential can, in some embodiments, be manually adjusted by the operator to suit different types of floor surfaces and to different preferences regarding the facility with which the cleaner should be

displaced along the floor. In other embodiments, there may be one or more pre-selected settings that adjust the pressure differential to a set of “factory settings” determined to be suitable to a variety of floor types.

[054] In yet another embodiment of the present invention, the pressurized air that is fed to the pressurized air inlet **32** may originate from an auxiliary air pump (not shown) rather than from the exhaust of the vacuum pump **10**.

[055] In the foregoing description, the present invention has been described with reference to specific exemplary embodiments thereof. It will be apparent to those skilled in the art that a person understanding this invention may conceive of changes or other embodiments or variations, which utilize the principles of this invention without departing from the broader spirit and scope of the invention. The specification and drawings are, therefore, to be regarded in an illustrative rather than a restrictive sense. Accordingly, it is not intended that the invention be limited except as may be necessary in view of the appended claims.

CLAIMS

I claim:

1. A surface cleaner, comprising:
 - a sealed tank portion having a fluid-filled part and an air-filled part;
 - a pneumatic vacuum pump having an inlet and an exhaust;
 - a fluid pressure pump having an inlet and an exhaust;
 - a cleaning head portion having an inner cleaning chamber and an annular vacuum chamber, said inner cleaning chamber forming a hollow cavity which is bounded at its lower end by a surface to be cleaned, said annular vacuum chamber having an inlet lip disposed at the periphery of said inner cleaning chamber;
 - one or more jet nozzles mounted within said inner cleaning chamber;
 - wherein said inlet of said pressure pump is in fluid communication with said fluid-filled part of said sealed tank portion drawing fluid from said sealed tank portion;
 - wherein said exhaust of said pressure pump is in fluid communication with said one or more jet nozzles thus ejecting said drawn fluid from said sealed tank portion into said inner cleaning chamber through said one or more jet nozzles;
 - wherein said inlet of said vacuum pump is in fluid communication with said air-filled part of said sealed tank portion maintaining a lower than atmospheric pressure in said air-filled part;

wherein said exhaust of said vacuum pump is in fluid communication with said inner cleaning chamber maintaining a higher than atmospheric pressure in said inner cleaning chamber; and

wherein said inlet lip of said annular vacuum chamber is in fluid communication with said air-filled part of said sealed tank portion whereby said fluid ejected into said inner cleaning chamber is drawn into said inlet lip and returned to said air-filled part of said sealed tank.

2. The surface cleaner of claim 1 wherein one or more filters are disposed between said inlet of said pressure pump and said fluid-filled part of said sealed tank so as to substantially remove debris from said fluid before it enters said pressure pump.

3. The surface cleaner of claim 2 wherein said one or more filters are removable.

4. The surface cleaner of claim 1 further comprising a skirt disposed peripherally around said inlet lip of said annular vacuum chamber.

5. The surface cleaner of claim 1 wherein said one or more jet nozzles rotate while ejecting fluid into said inner cleaning chamber.

6. The surface cleaner of claim 1 wherein said annular vacuum chamber is formed by inner and outer walls of said cleaning head portion.

7. The surface cleaner of claim 1 further comprising means for regulating the pressure within said sealed tank portion.

8. The surface cleaner of claim 1 further comprising means for regulating the pressure within said inner cleaning chamber.

9. The surface cleaner of claim 1 further comprising means for regulating the pressure at which said fluid is ejected into said cleaning chamber through said one or more jet nozzles.

10. The surface cleaner of claim 1 wherein said sealed tank portion is removable.

11. The surface cleaner of claim 1 further comprising:
in said cleaning head portion, an annular pressure chamber, said annular pressure chamber having an exit lip disposed at the periphery of said inlet lip of said annular vacuum chamber; and

wherein said annular pressure chamber is in fluid communication with said exhaust of said vacuum pump whereby pressurized air is ejected through said exit lip of said annular pressure chamber.

12. The surface cleaner of claim 11 further comprising means for regulating the pressure within said annular pressure chamber.

13. A surface cleaner, comprising:
- a removable sealed tank portion having a fluid-filled part and an air-filled part;
 - a pneumatic vacuum pump having an inlet and an exhaust;
 - a fluid pressure pump having an inlet and an exhaust;
 - a cleaning head portion having an inner cleaning chamber and an annular vacuum chamber, said inner cleaning chamber forming a hollow cavity which is bounded at its lower end by a surface to be cleaned, said annular vacuum chamber formed by inner and outer walls of said cleaning head portion and having an inlet lip disposed at the periphery of said inner cleaning chamber;
 - one or more jet nozzles mounted within said inner cleaning chamber;
 - a skirt disposed peripherally around said inlet lip of said annular vacuum chamber;
- wherein said inlet of said pressure pump is in fluid communication with said fluid-filled part of said sealed tank portion drawing fluid from said sealed tank portion;
- wherein said exhaust of said pressure pump is in fluid communication with said one or more jet nozzles thus ejecting said drawn fluid from said sealed tank portion into said inner cleaning chamber through said one or more jet nozzles;

wherein said inlet of said vacuum pump is in fluid communication with said air-filled part of said sealed tank portion maintaining a lower than atmospheric pressure in said air-filled part;

wherein said exhaust of said vacuum pump is in fluid communication with said inner cleaning chamber maintaining a higher than atmospheric pressure in said inner cleaning chamber;

wherein said inlet lip of said annular vacuum chamber is in fluid communication with said air-filled part of said sealed tank portion whereby said fluid ejected into said inner cleaning chamber is drawn into said inlet lip and returned to said air-filled part of said sealed tank;

wherein one or more filters are disposed between said inlet of said pressure pump and said fluid-filled part of said sealed tank so as to substantially remove debris from said fluid before it enters said pressure pump;

wherein said one or more filters are removable;

wherein said one or more jet nozzles rotate while ejecting fluid into said inner cleaning chamber;

wherein the pressure within said sealed tank portion is variable through regulating means;

wherein the pressure within said inner cleaning chamber is variable through regulating means; and

wherein the pressure at which said fluid is ejected into said cleaning chamber through said one or more jet nozzles is variable through regulating means.

14. The surface cleaner of claim 13 further comprising:

in said cleaning head portion, an annular pressure chamber, said annular pressure chamber having an exit lip disposed at the periphery of said inlet lip of said annular vacuum chamber; and

wherein said annular pressure chamber is in fluid communication with said exhaust of said vacuum pump whereby pressurized air is ejected through said exit lip of said annular pressure chamber.

15. The surface cleaner of claim 14 further comprising means for regulating the pressure within said annular pressure chamber.

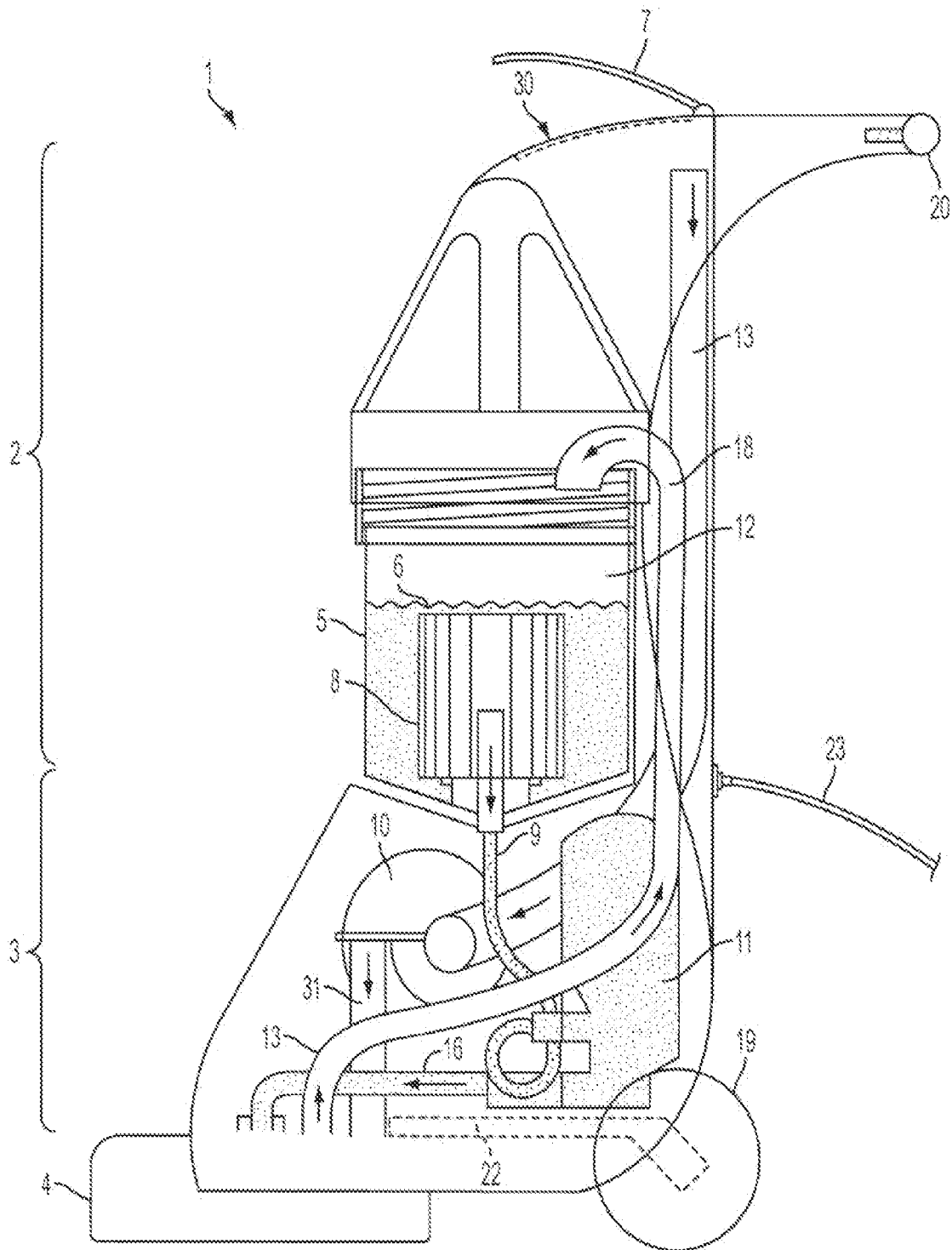


FIG. 1

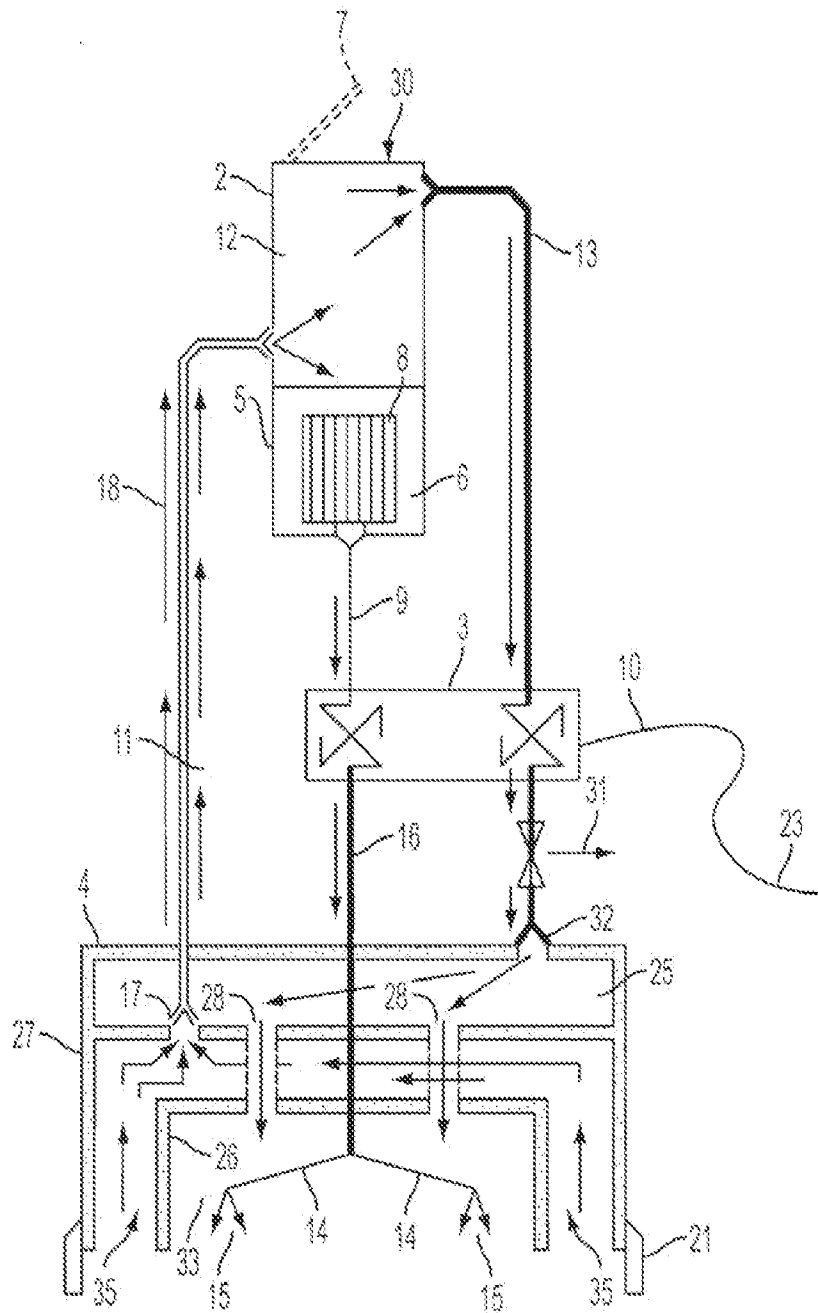


FIG. 2

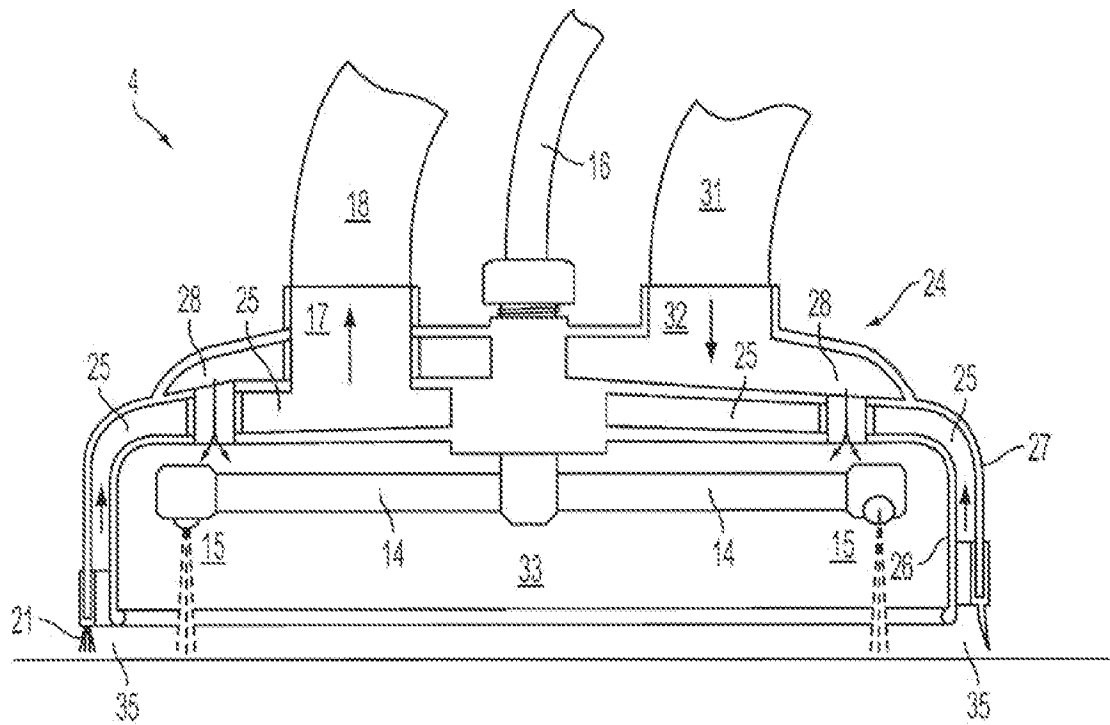


FIG. 3

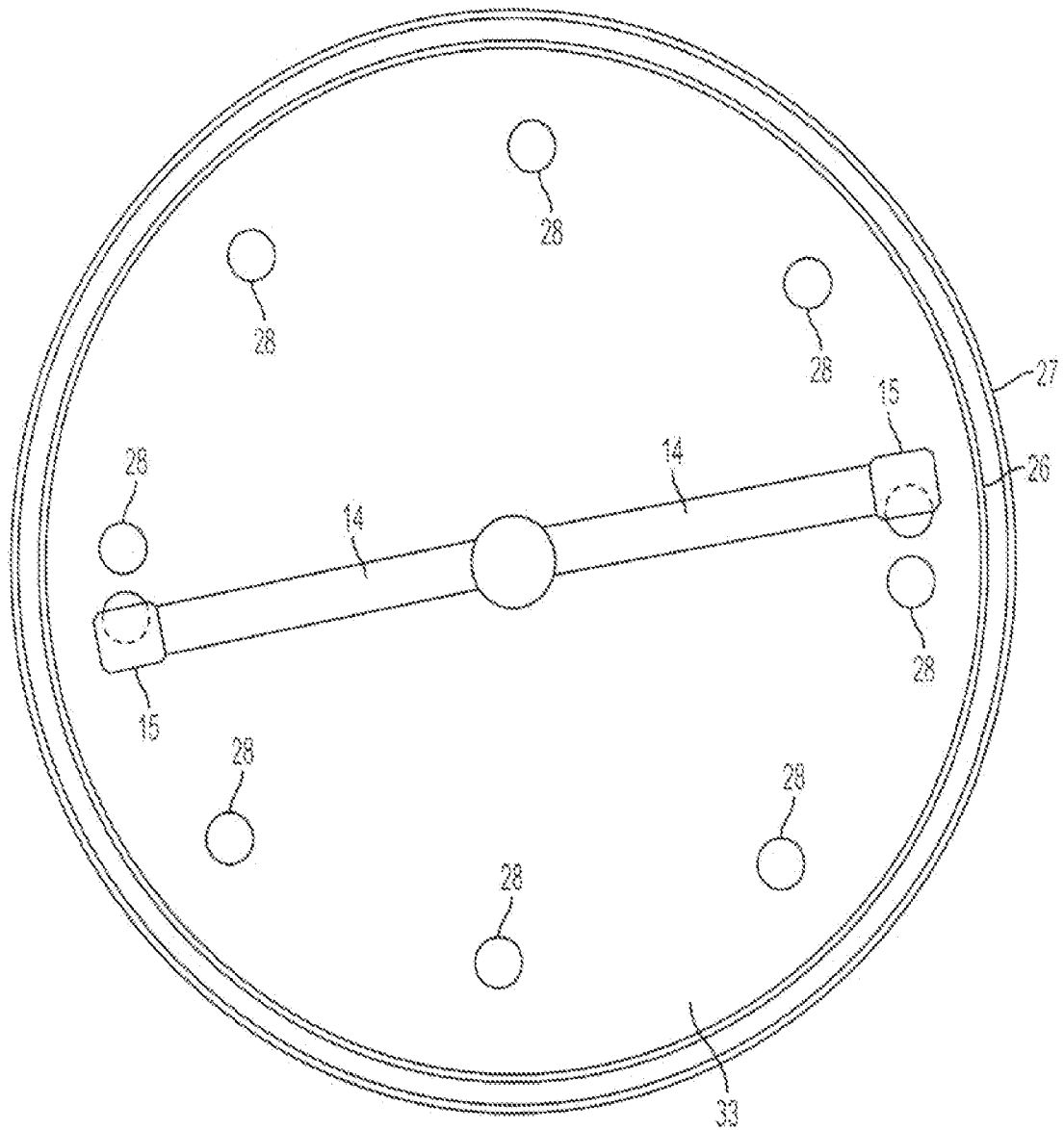


FIG. 4

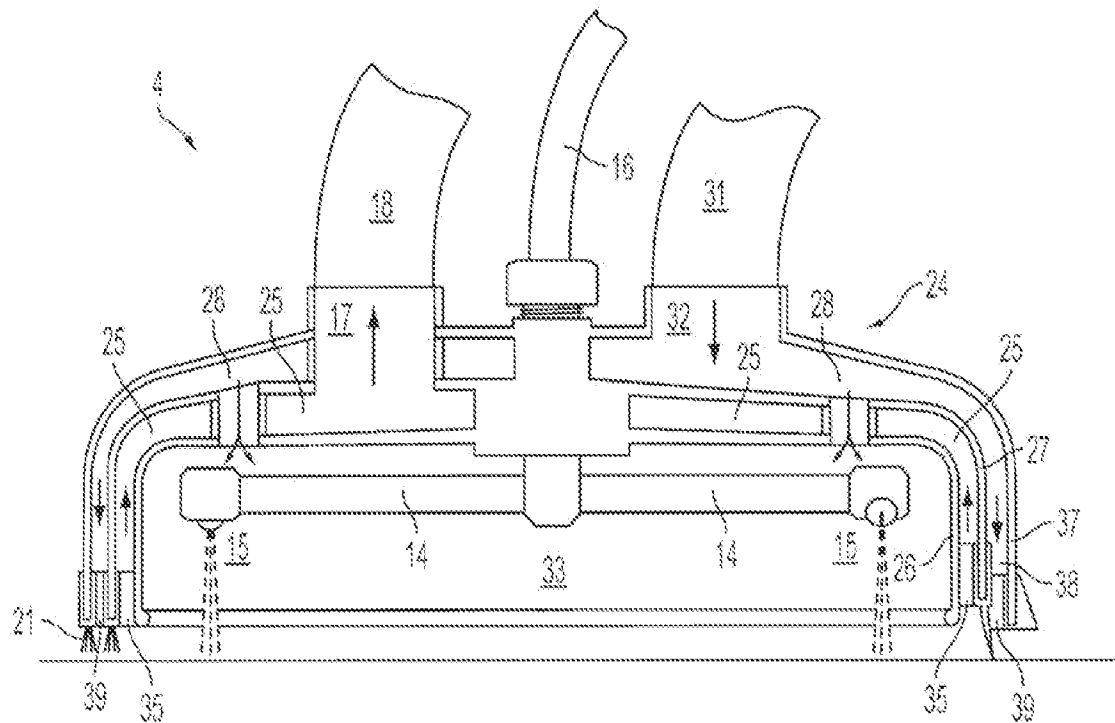


FIG. 5

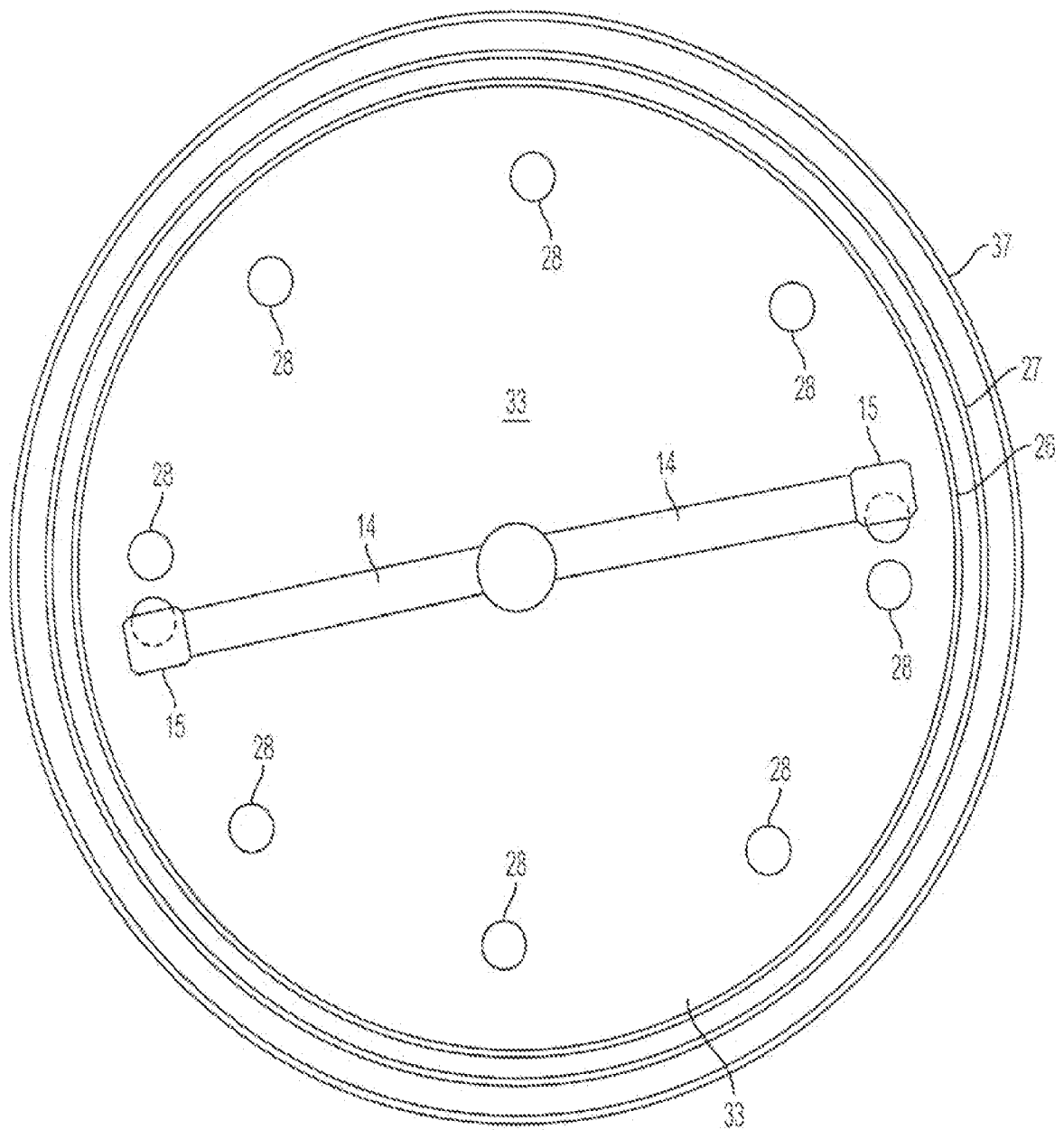


FIG. 6