

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF FLORIDA
MIAMI DIVISION

AIR ESSCENTIALS, INC.,	)	
a Florida corporation,	)	
	)	
Plaintiff,	)	Case No. 24-cv-20594-KMW
	)	
vs.	)	
	)	
AROMA360, LLC,	)	
a Florida Limited Liability Company,	)	
	)	
Defendant.	)	

AMENDED COMPLAINT

Plaintiff, AIR ESSCENTIALS, INC. ("AIR ESSCENTIALS" or "Plaintiff"), hereby files its Amended Complaint for Patent Infringement against Defendant, AROMA360, LLC ("AROMA360" or "Defendant") and alleges as follows:

NATURE OF CLAIMS / SUBJECT MATTER JURISDICTION

1. This is an action for patent infringement under the patent laws of the United States, 35 U.S.C. § 101, et seq.
2. This Court has subject matter jurisdiction over this action pursuant to 28 U.S.C. §§ 1331 and 1338.

THE PARTIES

3. Plaintiff is a corporation duly organized and existing under the laws of the State of Florida, having a principal address at 1800 N.W. 96th Avenue, Doral, Florida 33172.
4. Defendant is a limited liability company duly organized and existing under the laws of the State of Florida, having a principal address at 2058 N.W. Miami Court, Miami, Florida

33127.

5. Upon information and belief, Defendant has many subsidiaries incorporated in the state of Florida and itself is managed by another corporate entity, Elev8te LLC. Plaintiff expects that discovery will reveal whether other entities are liable for the acts complained of herein.

PERSONAL JURISDICTION AND VENUE

6. Personal jurisdiction is properly established in this District because, upon information and belief, AROMA360 resides in this District or otherwise has sufficient contacts in the Southern District of Florida to be deemed to reside in this District, and because AROMA360 has engaged in acts of patent infringement within this District, said acts being the subject of this Complaint.

7. Personal jurisdiction is also established in this District pursuant to Florida Statute § 48.193 *et. seq.*, as, upon information and belief, the tortious acts complained of herein were committed in the State of Florida; the property infringed upon is situated in the State of Florida, as disclosed in detail hereinafter; and, the acts were directed at AIR ESSSENTIALS, an entity operating in Florida.

8. Personal jurisdiction is also established in this District as, upon information and belief, AROMA360 has sufficient contacts in the State of Florida because AROMA360 knowingly sells and/or offers to sell infringing products and services within the State of Florida, including within this District.

9. Venue is properly established in this District pursuant to 28 U.S.C. § 1391(b), § 1391(c), and § 1400(b) as, upon information and belief, AROMA360 resides in this District, has sufficient contacts in the Southern District of Florida to be deemed to reside in this District, and/or because AROMA360 has a regular and established place of business in this District and has

engaged in acts of patent infringement within this District, said acts being the subject of this Complaint.

AIR ESSSENTIALS AND ITS U.S. PATENTS

10. AIR ESSSENTIALS provides leading edge scent delivery systems and develops high quality aroma and essential oil blends for retail, hospitality, entertainment, event, and other commercial clients and has been in business since 2007.

11. AIR ESSSENTIALS has developed its own line of proprietary and patented mechanisms for scent diffusers.

12. AIR ESSSENTIALS began filing patent applications for its inventive “Fluid Dispersion Assembly” in 2012 and its first patent, U.S. Patent No. 9,126,215 issued on September 8, 2015.

13. Since that time, AIR ESSSENTIALS has continued to develop its intellectual property portfolio. The patents-in-suit, U.S. Patent No. 10,583,449 (“the ‘449 Patent”), U.S. Patent No. 9,527,094 (“the ‘094 Patent”) and U.S. Patent No. 10,092,918 (“the ‘918 Patent”), were duly and lawfully issued for fluid dispersion assemblies (“the Patented Inventions”) on March 10, 2020, December 27, 2016, and October 9, 2018, respectively. True and correct copies of the ‘449 Patent, the ‘094 Patent, and the ‘918 Patent are attached hereto as Exhibit A.

14. AIR ESSSENTIALS is the owner by way of assignment of all right and title in and to the ‘449 Patent, the ‘094 Patent, and the ‘918 Patent.

15. AIR ESSSENTIALS has never authorized AROMA360 to make, use, sell, offer to sell, and/or import into the United States, and/or its territories, any fluid dispersion assemblies, as recited in the claims of the ‘449 Patent, the ‘094 Patent, and/or the ‘918 Patent, or to otherwise practice the Patented Inventions.

AROMA360's INFRINGING ACTIONS

16. On or around 2012 or 2013, the principals of AROMA360 approached the principals of AIR ESSSENTIALS to discuss a potential business relationship that would allow AROMA360 to offer scent diffusers.

17. Discussions did not meaningfully advance and no relationship was formed.

18. Upon information and belief, the principals of AROMA360 used ill-gotten and sensitive information to form a competitive enterprise in order to intentionally compete with AIR ESSSENTIALS.

19. To wit, AROMA360 has been selling various scent diffusers, including one that it calls Museum360 HVAC Scent Diffuser.

20. On November 13, 2023 AIR ESSSENTIALS sent a letter to AROMA360 to demand that AROMA360 cease-and-desist its activities relative to the infringing Museum360 HVAC Scent Diffuser, but AROMA360 has refused to cease its infringement.

21. As a result of AIR ESSSENTIALS' further investigation, it is believed that AROMA360 continues to make, use, sell, offer to sell, and/or import into the United States, and/or its territories, including within the Southern District of Florida, various fluid dispersion assemblies which encompass the Patented Inventions and infringe one or more of the '449 Patent, the '094 Patent, and the '918 Patent. Specifically:

- a. Exhibit B includes true and correct screenshots from AROMA360's website at www.aroma360.com depicting the Museum360 HVAC Scent Diffuser;
- b. Exhibit D includes true and correct screenshots depicting the DaVinci360 Scent Diffuser; and
- c. Exhibit F includes true and correct screenshots depicting the VanGogh360 Scent

Diffuser.

22. The Museum360 HVAC Scent Diffuser, DaVinci360 Scent Diffuser, and VanGogh360 Scent Diffuser are collectively referred to as “the Accused Diffusers.”

23. AIR ESSSENTIALS believes that AROMA360 offers other scent diffusers that infringe U.S. Patent Nos. 9,126,215; 9,527,094; 10,092,918; and/or 10,583,449 and expects that discovery will reveal additional evidence pertaining to additional instances of patent infringement; in particular, AROMA360 has sold diffusers under the “XL” and “DELUXE” brand names. Additionally, AROMA360 has sold previous versions of diffusers under the brand names “MUSUEM360”, “DAVINCI360”, and “VANGOGH360” that appear different than those currently offered for sale, but are still believed to be within the scope of AIR ESSSENTIALS’ patents.

24. The Accused Diffusers include, *inter alia*, a diffusion unit at least partially defining a diffusion chamber; a discharge port disposed in fluid communication between the diffusion chamber and the surrounding airspace; and a diffusion assembly comprising an atomizer assembly, the diffusion assembly disposed in an operative engagement with the diffusion unit.

25. Upon information and belief, despite knowledge of the same, AROMA360 has and continues to infringe the ‘449 Patent, the ‘094 Patent, and the ‘918 Patent in complete deliberate, wanton, and willful disregard of AIR ESSSENTIALS’ rights in and to the ‘449 Patent, the ‘094 Patent, and the ‘918 Patent by making, using, selling, offering to sell, and/or importing into the United States, and/or its territories, the Accused Diffusers and/or other fluid dispersion assemblies which encompass the Patented Inventions and infringe the ‘449 Patent, the ‘094 Patent, and/or the ‘918 Patent, thereby deriving unlawful gains and profits. Upon information and belief, AROMA360 will continue to infringe the ‘449 Patent, the ‘094 Patent, and/or the ‘918 Patent in

deliberate, wanton, and willful disregard of AIR ESSSENTIALS' patent rights and to AIR ESSSENTIALS' irreparable damage, unless restrained by this Court.

26. AROMA360's actions constitute infringement of the '449 Patent, the '094 Patent, and/or the '918 Patent, directly, literally, and/or under the doctrine of equivalents, and such actions are deliberate, wanton, and willful.

COUNT I – DIRECT INFRINGEMENT OF U.S. PATENT NO. 10,583,449

WHEREFORE, AIR ESSSENTIALS requests the relief sought in its Prayer for Relief, below.

27. AIR ESSSENTIALS incorporates herein each and every allegation set forth Paragraphs 1 through 26, as if fully set forth herein.

28. Upon information and belief, AROMA360's aforesaid acts constitute direct infringement of independent claims 1 and 7 and dependent claims 4, 8-10 of the '449 Patent, either literally or under the doctrine of equivalents, pursuant to 35 U.S.C. § 271(a).

29. Upon information and belief, AROMA360 had notice of its infringement, therefore, AROMA360's infringement of independent claims 1 and 7 and dependent claims 4, 8-10 of the '449 Patent has been willful, wanton, and deliberate.

30. A preliminary claim chart for independent claim 7 of the '449 Patent specifically relating to the Museum360 HVAC Scent Diffuser, and an alphabetic key for the same, is attached hereto as Exhibit C.

31. A preliminary claim chart for independent claim 7 of the '449 Patent specifically relating to the DaVinci360 Scent Diffuser, and an alphabetic key for the same, is attached hereto as Exhibit E.

32. A preliminary claim chart for independent claim 7 of the '449 Patent specifically

relating to the VanGogh360 Scent Diffuser, and an alphabetic key for the same, is attached hereto as Exhibit G.

33. In addition, the filing and service of this Complaint serve as actual notice and knowledge of infringement of the '449 Patent on the part of AROMA360, such that all of AROMA360's post-suit infringement of claims 1 and 7 and dependent claims 4, 8-10 of the '449 Patent is willful, wanton, and deliberate.

34. AROMA360's aforesaid acts have caused and will continue to cause great and irreparable injury, harm, and damage to AIR ESSSENTIALS, and, upon information and belief, unless said acts are restrained by this Court, they will continue.

35. AIR ESSSENTIALS has no adequate remedy at law.

COUNT II – DIRECT INFRINGEMENT OF U.S. PATENT NO. 10,092,918

WHEREFORE, AIR ESSSENTIALS requests the relief sought in its Prayer for Relief, below.

36. AIR ESSSENTIALS incorporates herein each and every allegation set forth Paragraphs 1 through 26, as if fully set forth herein.

37. Upon information and belief, AROMA360's aforesaid acts constitute direct infringement of independent claims 1 and 5 and dependent claims 3-4 and 6-8 of the '918 Patent, either literally or under the doctrine of equivalents, pursuant to 35 U.S.C. § 271(a).

38. Upon information and belief, AROMA360 had notice of its infringement, therefore, AROMA360's infringement of independent claims 1 and 5 and dependent claims 3-4 and 6-8 of the '918 Patent has been willful, wanton, and deliberate.

39. A preliminary claim chart for independent claim 5 of the '918 Patent specifically relating to the VanGogh360 Scent Diffuser, and an alphabetic key for the same, is attached hereto

as Exhibit H.

40. The filing and service of this Complaint serve as actual notice and knowledge of infringement of the '918 Patent on the part of AROMA360, such that all of AROMA360's post-suit infringement of independent claims 1 and 5 and dependent claims 3-4 and 6-8 of the '918 Patent is willful, wanton, and deliberate.

41. AROMA360's aforesaid acts have caused and will continue to cause great and irreparable injury, harm, and damage to AIR ESSSENTIALS, and, upon information and belief, unless said acts are restrained by this Court, they will continue.

42. AIR ESSSENTIALS has no adequate remedy at law.

COUNT III – DIRECT INFRINGEMENT OF U.S. PATENT NO. 9,527,094

WHEREFORE, AIR ESSSENTIALS requests the relief sought in its Prayer for Relief, below.

43. AIR ESSSENTIALS incorporates herein each and every allegation set forth Paragraphs 1 through 26, as if fully set forth herein.

44. Upon information and belief, AROMA360's aforesaid acts constitute direct infringement of independent claim 7 and dependent claims 8-9, 11 of the '094 Patent, either literally or under the doctrine of equivalents, pursuant to 35 U.S.C. § 271(a).

45. Upon information and belief, AROMA360 had notice of its infringement, therefore, AROMA360's infringement of independent claim 7 and dependent claims 8-9, 11 of the '094 Patent has been willful, wanton, and deliberate.

46. A preliminary claim chart for independent claim 7 of the '094 Patent specifically relating to the DaVinci360 Scent Diffuser, and an alphabetic key for the same, is attached hereto as Exhibit I.

47. The filing and service of this Complaint serve as actual notice and knowledge of infringement of the '094 Patent on the part of AROMA360, such that all of AROMA360's post-suit infringement of independent claim 7 and dependent claims 8-9, 11 of the '094 Patent is willful, wanton, and deliberate.

48. AROMA360's aforesaid acts have caused and will continue to cause great and irreparable injury, harm, and damage to AIR ESSENTIALS, and, upon information and belief, unless said acts are restrained by this Court, they will continue.

49. AIR ESSENTIALS has no adequate remedy at law

PRAYER FOR RELIEF

WHEREFORE, Plaintiff, Air Essentials, Inc. prays:

A. That this Court adjudge that AROMA360 has infringed and is infringing AIR ESSENTIALS' rights in the '449 Patent, the '094 Patent, and the '918 Patent, directly, literally, and/or under the doctrine of equivalents, in violation of 35 U.S.C. § 271, and that AROMA360's infringement has been and continues to be willful;

B. That AIR ESSENTIALS be awarded damages adequate to compensate it for the damages it has suffered as a result of AROMA360's infringement of the '449 Patent, the '094 Patent, and the '918 Patent, and that such damages be trebled, pursuant to 35 U.S.C. § 284;

C. That AROMA360 be ordered to pay pre-judgment interest to AIR ESSENTIALS on all amounts awarded and post-judgment interest until paid at the maximum lawful rate;

D. That, pursuant to 35 U.S.C. § 283, or as otherwise authorized, AROMA360, its officers, agents, servants, employees, attorneys and all persons acting in concert or participation with it who receive actual notice of the Court's order, be permanently enjoined from:

(1) directly or indirectly manufacturing, using, selling, offering for sale, or

importing into the United States and/or its territories the Accused Diffusers and/or any fluid dispersion assemblies that infringe the '449 Patent, the '094 Patent, and/or the '918 Patent, directly or indirectly, literally or under the doctrine of equivalents; and

(2) attempting, causing, or assisting any of the above-described acts.

E. That the Court retain jurisdiction of this action for the purpose of enabling AIR ESSSENTIALS to apply to the Court at any time for such further orders and interpretation or execution of any order entered in this action; for the modification of any such order; for the enforcement or compliance therewith; and for the punishment of any violations thereof;

F. That AROMA360 be ordered to pay AIR ESSSENTIALS' attorneys' fees, as provided by 35 U.S.C. § 285, or as otherwise authorized;

G. That AROMA360 be ordered to pay AIR ESSSENTIALS' taxable and non-taxable costs, as provided by 35 U.S.C. § 284, Fed.R.Civ.P. 54, or as otherwise authorized;

H. That AROMA360 be ordered to pay AIR ESSSENTIALS damages adequate to compensate it for the damages it has suffered as a result of AROMA360's infringement of the '449 Patent, the '094 Patent, and the '918 Patent, and that such damages are in no event less than a reasonable royalty for AROMA360's use of the inventions that are the subject of the '449 Patent, the '094 Patent, and the '918 Patent, together with interest and costs as fixed by the Court, pursuant to 35 U.S.C. § 284;

I. That the Court award an accounting of AROMA360's profits from the sale of any fluid dispersion assemblies that infringe the '449 Patent, the '094 Patent, and/or the '918 Patent, directly or indirectly, literally or under the doctrine of equivalents, through trial or final adjudication; and

J. That AIR ESSSENTIALS be awarded such other and further relief, at law or in equity, as the Court may deem just.

JURY DEMAND

Plaintiff, Air Esscentials, Inc., demands a trial by jury as to all issues triable of right by a jury.

Respectfully submitted,

Dated: June 11, 2024

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EXHIBIT A



US010583449B1

(12) **United States Patent**
Levy et al.

(10) **Patent No.:** **US 10,583,449 B1**
(45) **Date of Patent:** ***Mar. 10, 2020**

(54) **FLUID DISPERSION ASSEMBLY**

(71) Applicant: **Air Esscentials Inc.**, Miami, FL (US)

(72) Inventors: **Marc T. Levy**, Palmetto Bay, FL (US);
Craig Huck, Waterford, PA (US);
Steven Semoff, New City, NY (US)

(73) Assignee: **Air Esscentials Inc.**, Miami, FL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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

CPC **B05B 7/2494** (2013.01); **A61L 9/14** (2013.01); **B05B 1/002** (2018.08); **B05B 7/0012** (2013.01); **B05B 7/2424** (2013.01); **B05B 7/2491** (2013.01); **B05B 14/00** (2018.02)

(58) **Field of Classification Search**

CPC **B05B 11/046**; **B05B 7/2494**; **B05B 14/00**; **B05B 1/002**; **B05B 15/00**; **B05B 7/0012**; **B05B 7/2424**; **B05B 7/2491**; **B05B 7/2405**; **B05B 7/005**; **B05B 7/006**; **B05B 11/08**; **B05B 11/3042**; **A61M 15/0036**; **A61M 16/14**; **A61M 16/201**; **A61M 11/06**; **A61L 9/14**
USPC **239/427**, **310**, **311**
See application file for complete search history.

(21) Appl. No.: **16/154,373**

(22) Filed: **Oct. 8, 2018**

Related U.S. Application Data

(63) Continuation-in-part of application No. 15/353,951, filed on Nov. 17, 2016, now Pat. No. 10,092,918, which is a continuation-in-part of application No. 14/844,650, filed on Sep. 3, 2015, now Pat. No. 9,527,094, which is a continuation of application No. 13/838,634, filed on Mar. 15, 2013, now Pat. No. 9,126,215.

(60) Provisional application No. 61/694,500, filed on Aug. 29, 2012.

(51) **Int. Cl.**

B05B 7/06 (2006.01)
B05B 7/24 (2006.01)
B05B 1/00 (2006.01)
A61L 9/14 (2006.01)
B05B 7/00 (2006.01)
B05B 14/00 (2018.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,985,299 A * 10/1976 Brenez **B05B 11/046**
239/119

* cited by examiner

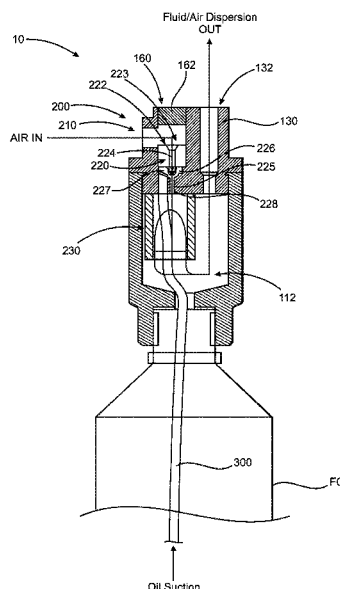
Primary Examiner — Davis D Hwu

(74) *Attorney, Agent, or Firm* — Malloy & Malloy, P.L.

(57) **ABSTRACT**

A fluid dispersion assembly comprises a diffusion unit disposed in fluid communication with a fluid container, the assembly being powered by a compressed air source. The diffusion unit at least partially defines a diffusion chamber, and includes a diffusion assembly containing an atomizer assembly which, in combination with the diffusion chamber, generates a fluid dispersion from a mixture of compressed air and an operative fluid, for example, fragrant oils, essential oils, odor neutralizers, disinfectants such as triethylene glycol, air sanitizers, etc.

19 Claims, 7 Drawing Sheets

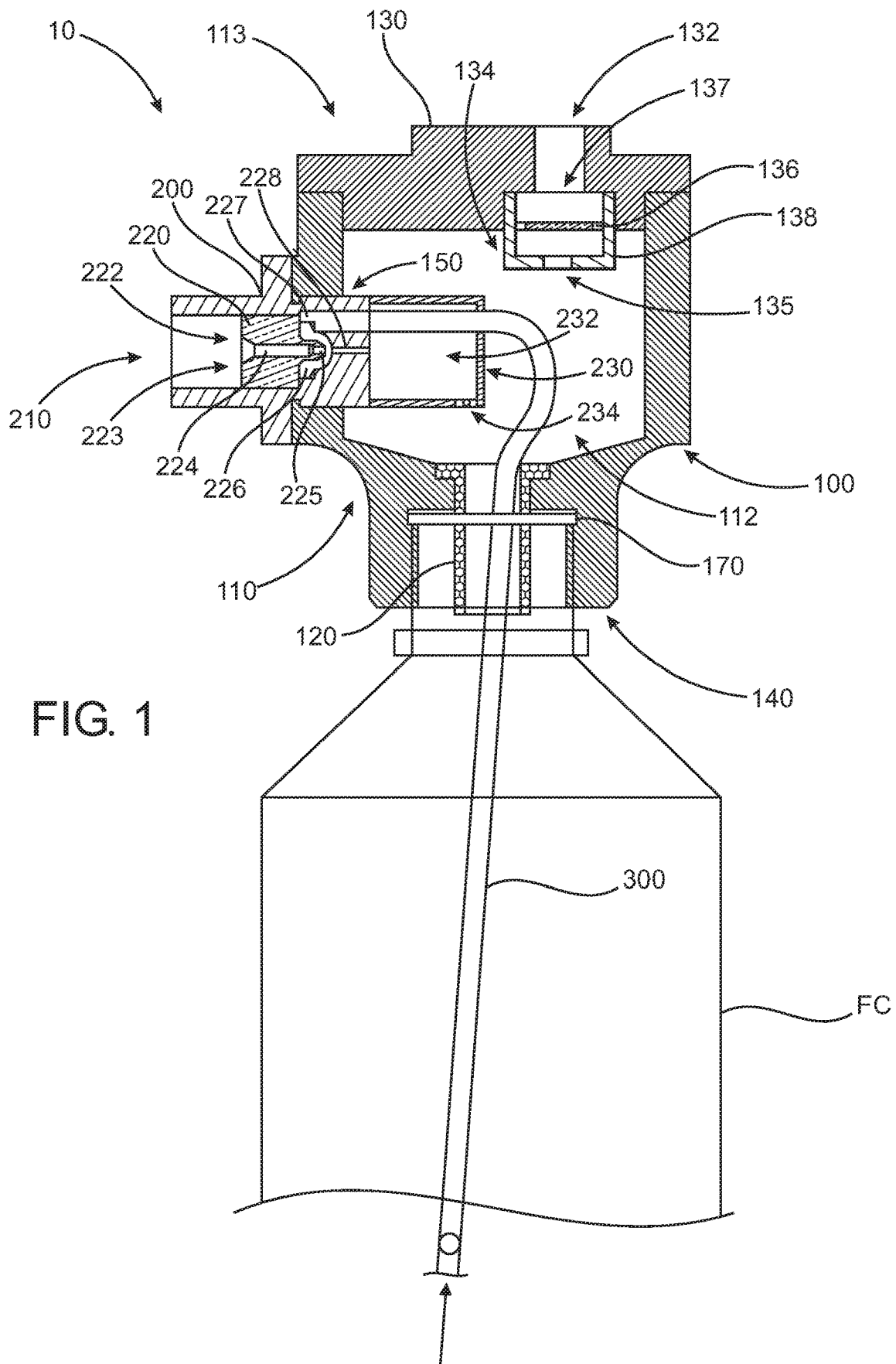


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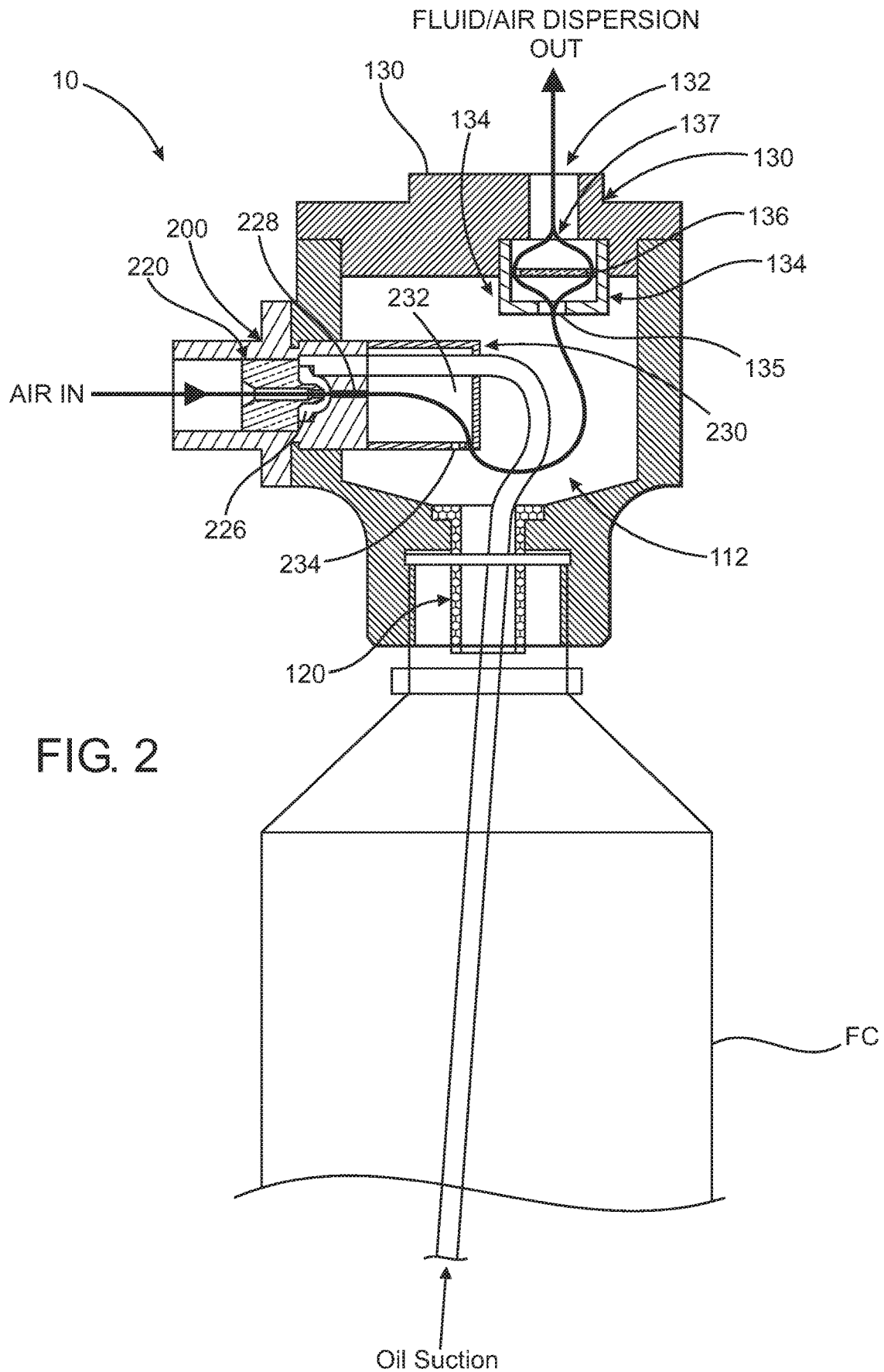


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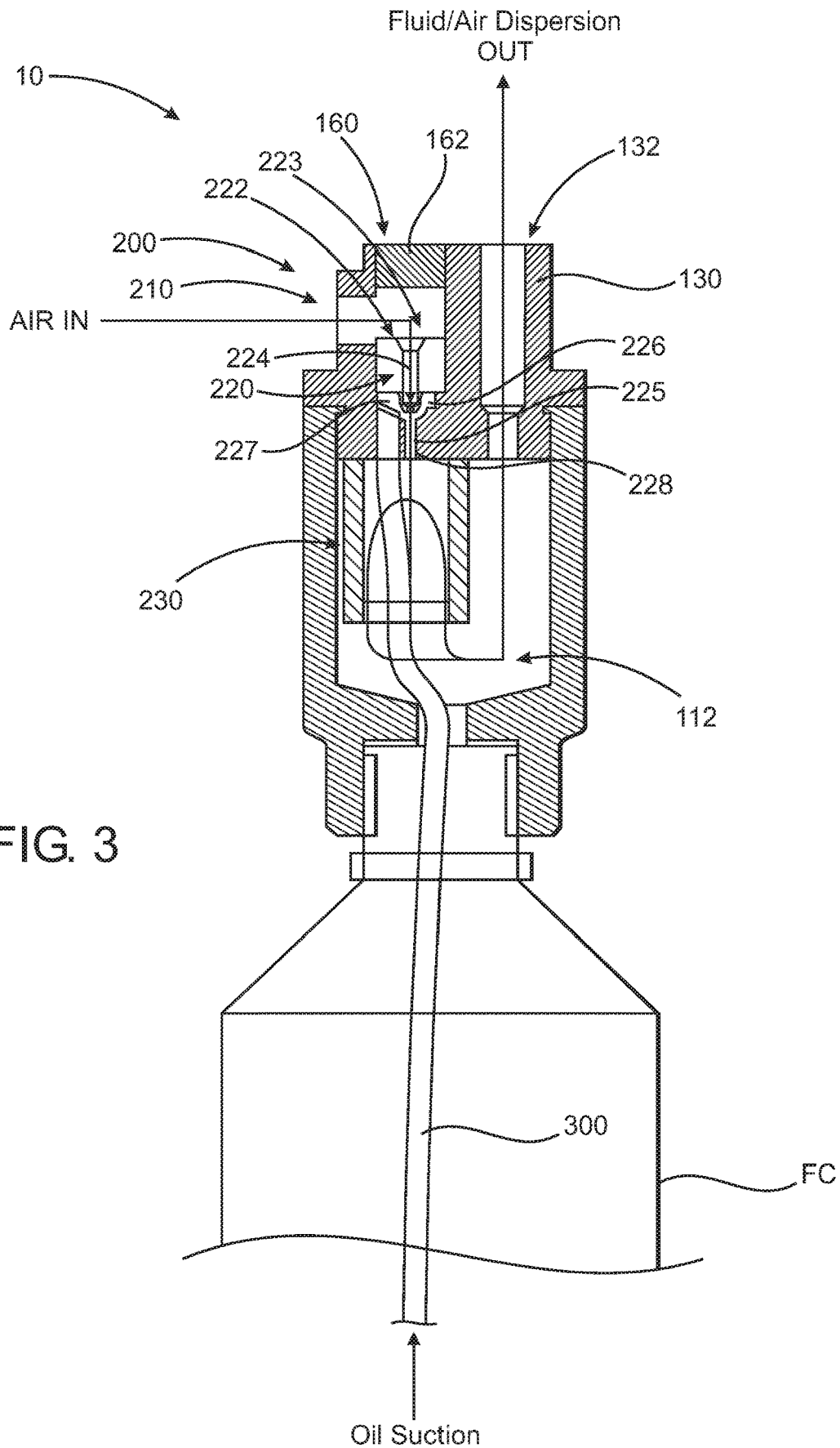


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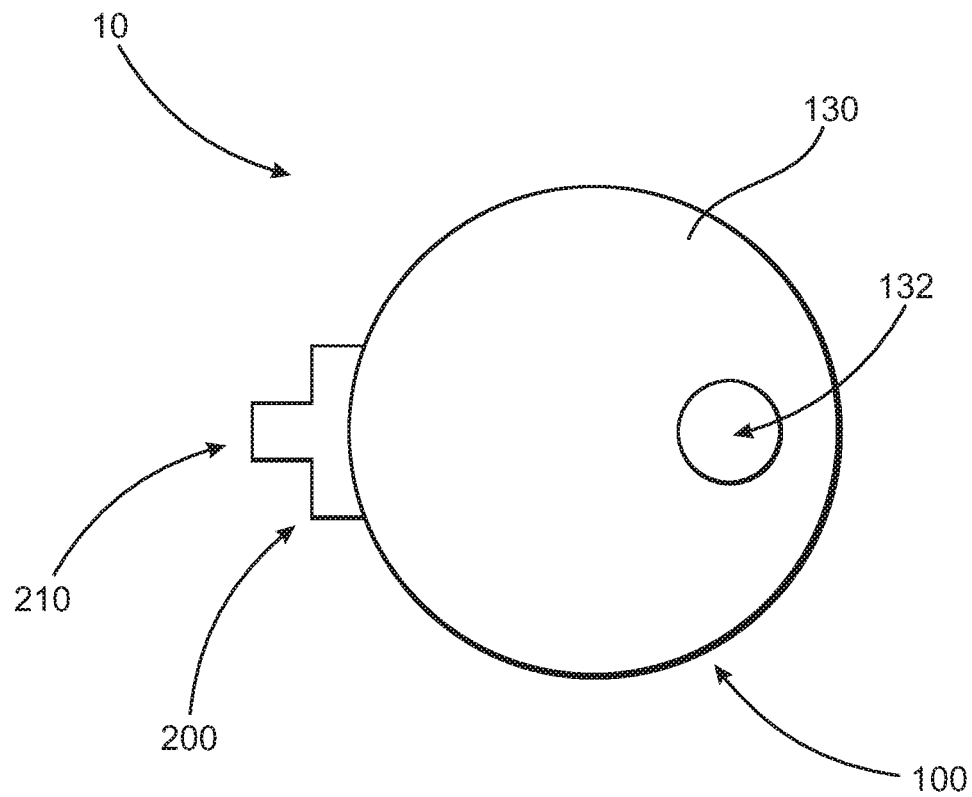


FIG. 4

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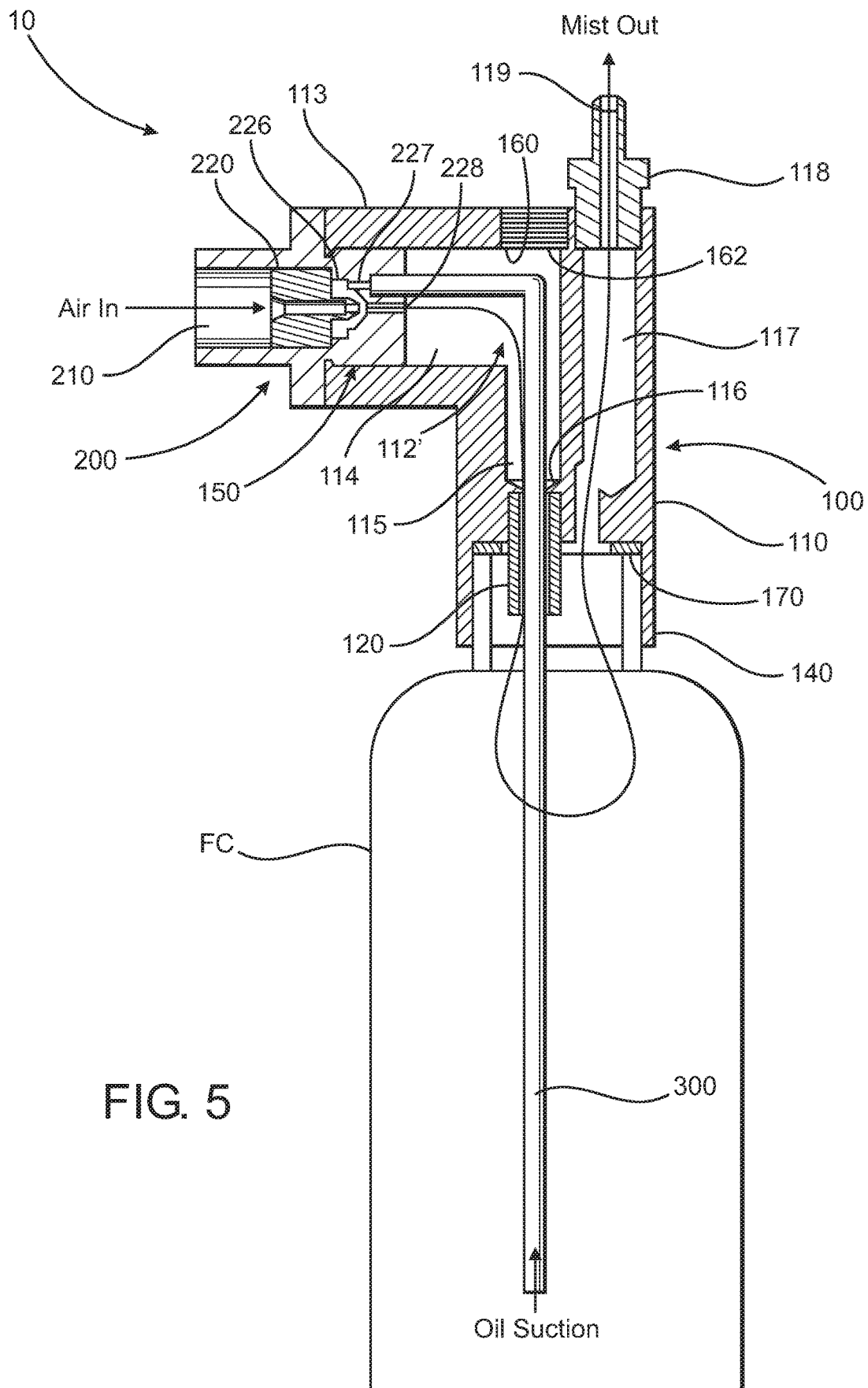


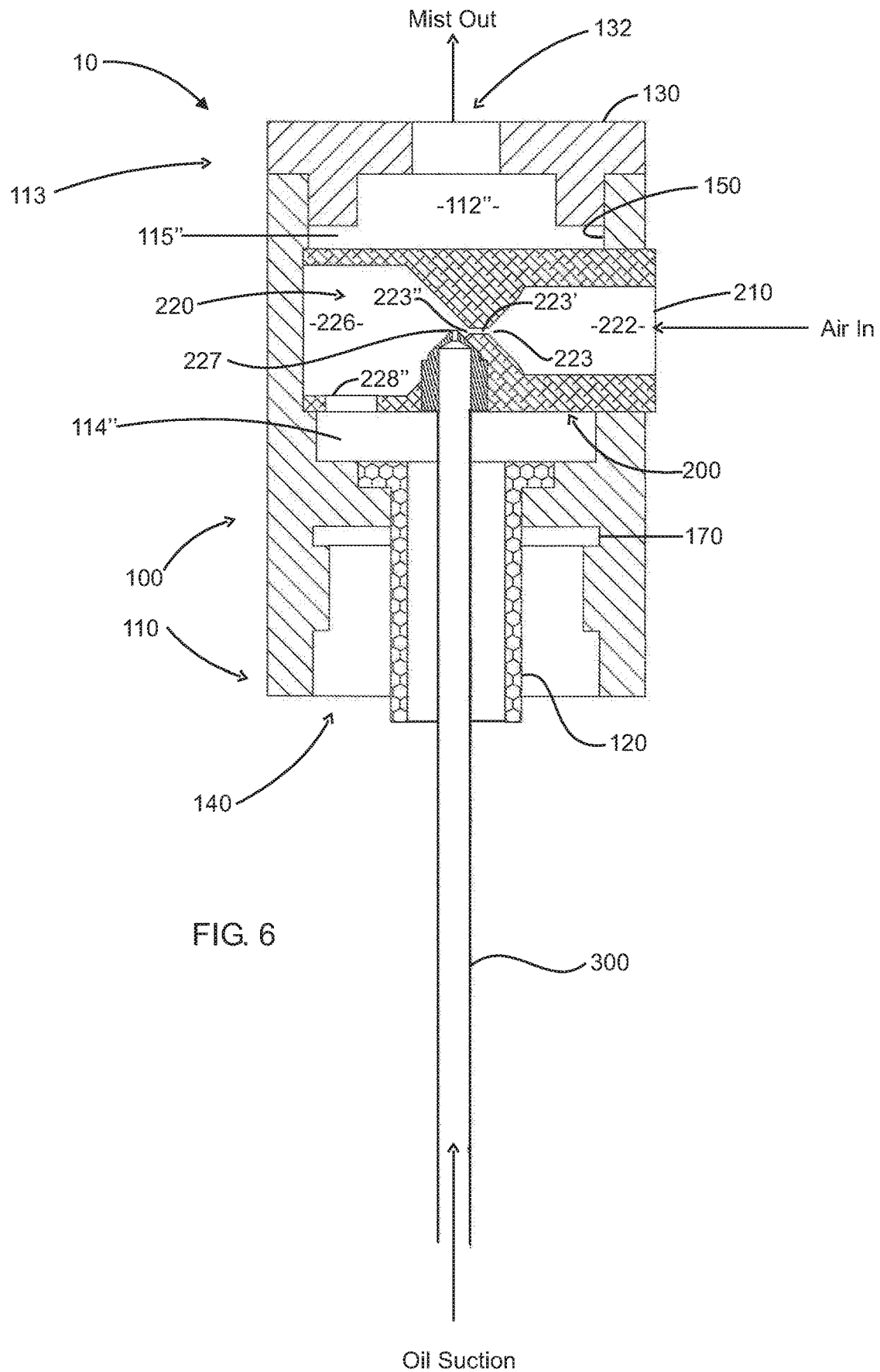
FIG. 5

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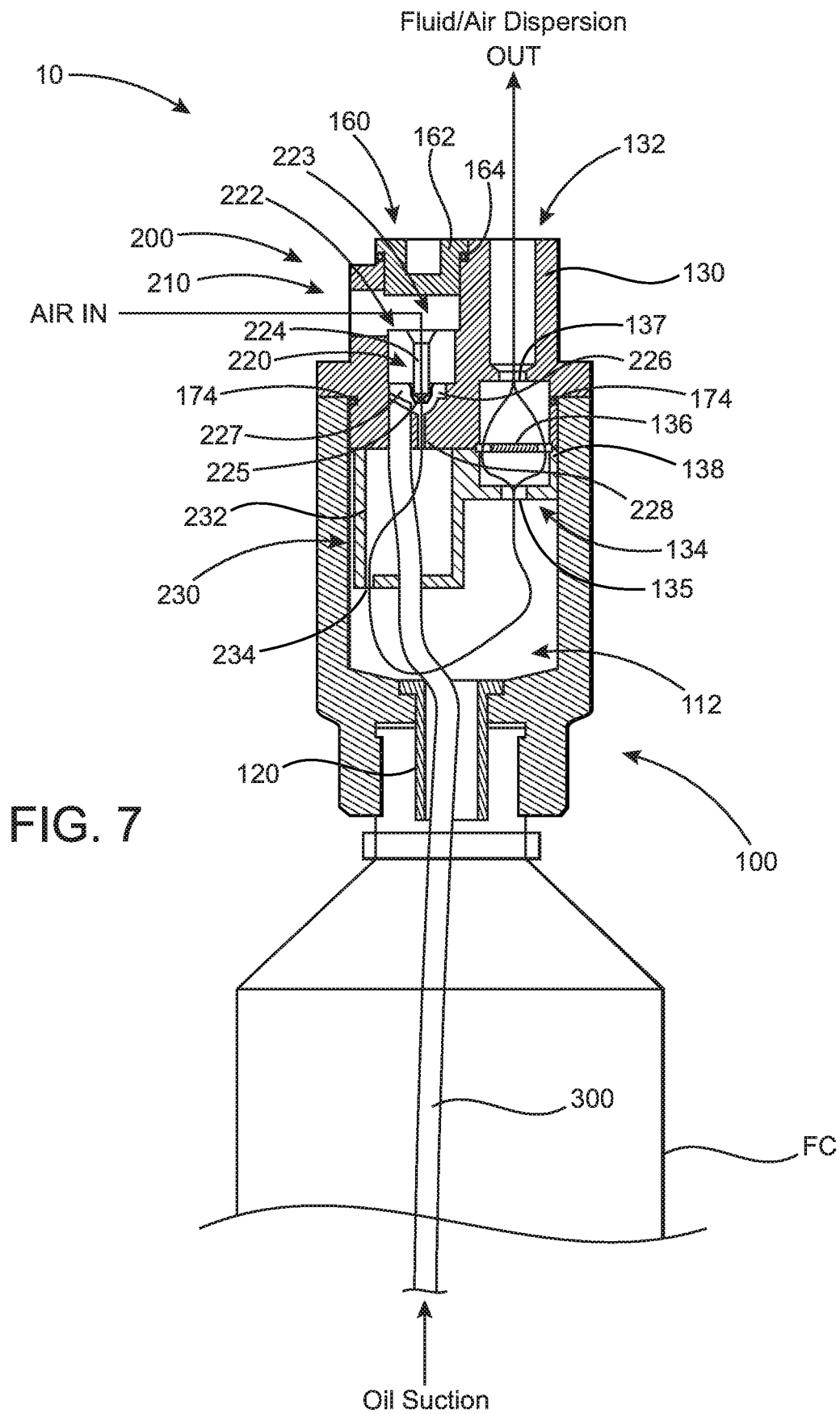


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FLUID DISPERSION ASSEMBLY**BACKGROUND OF THE INVENTION****Field of the Invention**

This invention relates generally to the field of dispersion of various fluids including, but not limited to, fragrant oils, essential oils, odor neutralizers, disinfectants, e.g., triethyl-ene glycol, air sanitizers, and the like, into a generally enclosed airspace.

Description of the Related Art

There are various devices that can be used to deliver fragrant oils, essential oils, as well as other fluids into the air. Spray cans are commonly used, however, such devices require a user to repeatedly and manually spray when and where necessary. Plug-in devices that heat oils for dispersion into the air are also commonly used, but they require constant heating of the oil via an electrical outlet, which consumes energy and poses a potential fire hazard.

Fluid diffusion devices utilizing forced and/or compressed air for delivery of fragrant oils, essential oils, or other liquids are desirable alternatives to spray cans and plug-in devices since they do not require heating or constant user interaction, however, they have drawbacks as well. One drawback of many known fluid diffusion devices utilizing forced air is that they tend to make an undesirable and often, depending on the location, such as an office or other place of business, a disruptive amount of noise when in operation. In particular, the release of a fluid dispersed in the forced and/or compressed air from such a device is often unacceptably noisy.

As such, there is a need for a fluid dispersion assembly that is designed to significantly reduce the amount of noise generated during operation. A further need exists for such a fluid dispersion assembly to not only operate more quietly, but to operate quietly while generating a fluid dispersion in air having a uniform particle size distribution, such that dosing of an airspace with a particular liquid, whether it be oil, sanitizer, disinfectant, etc., can be predicted within acceptable limits.

SUMMARY OF THE INVENTION

The present invention addresses the need for a forced air diffusion and dispersion assembly for fluids such as fragrant oils, essential oils, odor neutralizers, disinfectants, air sanitizers, etc., that significantly reduces the amount of noise generated during operation. In at least one embodiment, the present invention is directed to a fluid dispersion assembly which operatively engages a fluid container, and is powered by a compressed air source. The fluid dispersion assembly includes a diffusion unit having oppositely disposed ends, which at least partially defines a diffusion chamber. The diffusion chamber is structured so as to facilitate formation of a fluid dispersion comprising a plurality of substantially uniform droplets prior to discharge from the diffusion chamber.

In at least one embodiment, a cap is cooperatively configured in sealing engagement with one of the oppositely disposed ends of the diffusion unit. Furthermore, the cap may be removably attached to the diffusion unit. The cap includes a discharge port disposed in communication with the diffusion chamber such that the fluid dispersion can exit the diffusion chamber and into an airspace surrounding the

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fluid dispersion assembly, while the assembly is in use. In some embodiments, the cap may include a service access port disposed therethrough. The service access port may also include a service access plug removably disposed therein, wherein removal of the service access plug allows for removal, repair, and/or cleaning of the internal components of the fluid dispersion assembly.

The present fluid dispersion assembly, in at least one embodiment, further includes a container interconnect affixed to a different one of the oppositely disposed ends of the diffusion unit which is cooperatively structured to interconnect the diffusion unit to the fluid container in a substantially sealed relationship. In at least one embodiment, a sealing washer is provided to facilitate formation of the substantially sealed relationship, and a drip tube is disposed in an interconnecting relation between the diffusion chamber and the fluid container, in at least one further embodiment, to protect the sealing washer from contact with the operative fluid(s).

In one embodiment, a diffusion assembly is disposed in an operative engagement with the diffusion unit via a cartridge port. The diffusion assembly is removably engaged with the cartridge port, in at least one embodiment. In some embodiments, the cartridge port is disposed directly through the diffusion unit between the oppositely disposed ends. The cartridge port may be oriented on the diffusion unit such that the diffusion assembly is at a substantially perpendicular orientation to the diffusion unit upon engagement therewith. In at least one other embodiment, a cartridge port is disposed through the cap. The diffusion assembly comprises an atomizer assembly, which in one embodiment comprises an inlet channel, a mixing chamber, and an atomizer exhaust channel, wherein the inlet channel is interconnected to the compressed air source and the mixing chamber comprises a fluid inlet disposed in fluid communication with the fluid in the fluid container. Compressed air and fluid are initially mixed together in the mixing chamber to form a fluid dispersion.

These and other objects, features and advantages of the present invention will become clearer when the drawings as well as the detailed description are taken into consideration.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature of the present invention, reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is a cross-sectional elevation of one illustrative embodiment of a fluid dispersion assembly as disclosed in the present specification.

FIG. 2 is a cross-sectional elevation of the illustrative embodiment of the fluid dispersion assembly of FIG. 1 showing the path of flow of air and the fluid/air dispersion therethrough.

FIG. 3 is a cross-sectional view of another illustrative embodiment of a fluid dispersion assembly as disclosed in the present specification.

FIG. 4 is a plan view of the illustrative embodiment of the fluid dispersion assembly of FIGS. 1 and 2.

FIG. 5 is a cross-sectional elevation of one further illustrative embodiment of a fluid dispersion assembly in accordance with the present specification.

FIG. 6 is a cross-sectional elevation of yet another illustrative embodiment of a fluid dispersion assembly in accordance with the present specification.

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FIG. 7 is a cross-sectional elevation of still one further illustrative embodiment of a fluid dispersion assembly in accordance with the present specification.

Like reference numerals refer to like parts throughout the several views of the drawings.

DETAILED DESCRIPTION

As illustrated in the accompanying figures, and with initial reference to FIGS. 1 and 2, the present invention is directed to a fluid dispersion assembly, generally indicated as 10, powered by a compressed air source. In at least one embodiment, the fluid dispersion assembly 10 is further structured to operatively engage a fluid container (FC). The fluid dispersion assembly 10 is structured to combine an amount of an operative fluid with compressed air to generate a fluid dispersion.

More in particular, a “fluid dispersion” in accordance with the present specification shall mean a mixture of an operative fluid in air comprising a plurality of substantially uniform droplets of the operative fluid dispersed throughout the air. Further, and once again, as used in the present specification, “substantially uniform droplets” shall mean droplets having substantially the same diameter. In at least one embodiment, the plurality of “substantially uniform droplets” each have a diameter in the range of about one micron (1 μ m), in another embodiment, the diameter of the droplets is in the range of about three microns (3 μ m), and, in one further embodiment, droplet diameter is in the range of about five microns (5 μ m).

The fluid dispersion assembly 10 includes a diffusion unit 100 having oppositely disposed ends, as at 110 and 113, as shown in the illustrative embodiment of FIG. 1. The diffusion unit 100 at least partially defines a diffusion chamber 112, and in at least one embodiment, the diffusion chamber 112 is substantially enclosed within diffusion unit 100. The diffusion unit 100 may be constructed of any rigid material or materials which are chemically inert, or at least chemically resistant to the intended operative fluid(s) which include, but once again are not limited to, fragrant oils, essential oils, essential oil extracts, odor neutralizers, disinfectants, e.g., triethylene glycol, air sanitizers, etc. Further, the material of construction selected for the diffusion unit 100 must be capable of withstanding compressed air at operative pressures, which may range anywhere from about 5 to 50 psig, in most embodiments of the present fluid dispersion assembly 10. In one lower pressure embodiment, the operating pressure of the present fluid dispersion assembly 10 is in the range of about 5 to 10 psig, and in one further embodiment, the operating pressure is in a range of between about 5 to 7 psig. Conversely, a higher pressure embodiment of the present fluid dispersion assembly 10 operates at pressures in the range of about 20 to 25 psig, and in the range of between about 23 to 24 psig in yet one further embodiment. As such, the material or materials of construction of a diffusion unit 100 in accordance with the present invention may include metals, engineered plastic materials, e.g., polyvinyl chloride, high-density polyethylene, etc., and/or composite materials, just to name a few.

In one embodiment, a cap 130 is cooperatively configured and disposed in a sealing engagement with one of the oppositely disposed ends 110, 113 of the diffusion unit 100. The cap 130 includes a discharge port 132 therethrough in communication with the diffusion chamber 112, and provides a point of release of the fluid dispersion from the diffusion chamber 112 into the airspace surrounding the fluid dispersion assembly 10. In at least one embodiment, the cap

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130 is removably attached in a sealing engagement to the diffusion unit 100. FIG. 4 is a plan view of the embodiment of the fluid dispersion assembly 10 as shown in FIGS. 1 and 2, and shows the cap 130 having a discharge port 132 disposed therethrough. As shown in the embodiment of FIG. 3, the cap 130 may include a service access port 160 disposed therethrough. The service access port 160 includes a service access plug 162 removably disposed therein, wherein removal of the service access plug 162 allows access for removal and cleaning or repair of a diffusion assembly 200, as disclosed in greater detail below.

The fluid dispersion assembly 10, in at least one embodiment, includes a container interconnect 140 which is cooperatively structured to interconnect the diffusion unit 100 to the fluid container (FC) in a substantially sealed relationship. In one embodiment, the container interconnect 140 is disposed at a different one of the oppositely disposed ends 110, 113, opposite of cap 130 of the diffusion unit 100. A sealing washer 170 is disposed between the diffusion unit 100 and the fluid container (FC), in at least one embodiment, so as to provide a substantially sealed relationship between the diffusion unit 100 and the fluid container (FC). The sealing washer 170 may be constructed from any of a variety of materials such as, but not limited to, rubber, nylon, plastic, PVC, TEFLON, or a composite material, once again, provided the material of construction is chemically inert or at least chemically resistant to the operative fluid(s).

In one further embodiment of a fluid dispersion assembly 10 in accordance with the present invention, a drip tube 120 is disposed in an interconnecting relation between the diffusion unit 100 and the fluid container (FC). As shown in FIGS. 1 and 2, the drip tube 120 is disposed through a sealing washer 170, and thus, the drip tube 120 serves to minimize contact between the sealing washer 170 and the operative fluid, by essentially preventing the operative fluid from making contact in and around the sealing washer 170 disposed between the fluid container (FC) and the container interconnect 140. More in particular, the drip tube 120 channels any operative fluid which may agglomerate and/or accumulate in the diffusion chamber 112 through the drip tube 120 directly back into the fluid container (FC) without contacting the sealing washer 170, once again, as shown in FIGS. 1 and 2.

The container interconnect 140 may be structured in a variety of ways to allow interconnection to the fluid container (FC). As one example, the container interconnect 140 may be threaded, internally or externally, such that the diffusion unit 100 is interconnected to the fluid container (FC) by screwing the container interconnect 140 into place onto corresponding threads on the neck of the fluid container (FC). In at least one other embodiment, the container interconnect 140 comprises one portion of a quick-connect type fitting and the fluid container (FC) comprises a complimentary portion of such a quick-connect type fitting whereby once operatively engaged, a substantially sealed relationship is created between the diffusion unit 100 and the fluid container (FC). In at least some embodiments, the substantially sealed relationship is further enhanced by a sealing washer 170, as disclosed above.

In at least one embodiment, a cartridge port 150 is provided into the diffusion chamber 112 to facilitate operative engagement of a diffusion assembly 200 with the diffusion chamber 112. The diffusion assembly 200 may be removably engaged with the cartridge port 150 to aid in removal and replacement and/or cleaning of the diffusion assembly 200 and/or components thereof. In some embodiments, the cartridge port 150 is disposed directly through the

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diffusion unit **100** and into the diffusion chamber **112**, and is positioned between the oppositely disposed ends **110**, **113**. In at least one embodiment, the cartridge port **150** is disposed on the diffusion unit **100** such that the diffusion assembly **200** is disposed in a substantially perpendicular orientation relative to the diffusion unit **100** when operatively engaging the cartridge port **150**, such as is shown in the illustrative embodiment of FIG. 1. The diffusion assembly **200** is also shown disposed substantially perpendicular to the diffusion unit **100** in the plan view of FIG. 4. In at least one other embodiment, the cartridge port **150** is disposed through the cap **130**. In yet another embodiment, the diffusion assembly **200** comprises an integral component of the cap **130** itself, such as in the embodiment of FIG. 3.

As illustrated in FIGS. 1 and 3, the diffusion assembly **200** comprises an air inlet **210** and an atomizer assembly **220**. The atomizer assembly **220** comprises an atomizer air inlet channel **222**, a mixing chamber **226**, and an atomizer exhaust channel **228**. The atomizer air inlet channel **222** is interconnected to the compressed air source via the air inlet **210**. Moreover, the atomizer air inlet channel **222** may also include an inlet aperture **223**, a first portion **224** and a second portion **225**. The first portion **224** and the second portion **225** are collectively structured to facilitate delivery of compressed air into the mixing chamber **226**. The first portion **224** of the atomizer air inlet channel **222** may comprise a larger diameter than the second portion **225**, such as is shown in the illustrative embodiment of FIG. 1. Of course, it is within the scope and intent of the present invention for the atomizer air inlet channel **222** to comprise a constant diameter along its entire length, i.e., a diameter of a first portion **224** is substantially equal to a diameter of a second portion **225**.

Further, the mixing chamber **226** comprises a fluid inlet **227** disposed in fluid communication with an operative fluid in the fluid container (FC) via a fluid delivery tube **300**. The fluid delivery tube **300** is disposed in a fluid communicating relation between the atomizer assembly **220** and the fluid container (FC) to facilitate delivery of an amount of the operative fluid into the atomizer assembly **220**. In at least one embodiment, the fluid delivery tube **300** connects to the atomizer assembly **220** via the fluid inlet **227** into the mixing chamber **226**.

As shown in FIGS. 1 and 2, the fluid inlet **227** is substantially perpendicular to a compressed air flowpath through the atomizer assembly **200**. More in particular, and with reference to FIG. 1, the compressed air flowpath extends horizontally through the air inlet **210**, atomizer air inlet channel **222**, mixing chamber **226**, and out through the atomizer exhaust **228**.

As such, when compressed air is supplied to the diffusion assembly **200**, a corresponding amount of operative fluid is drawn into the mixing chamber **226** through the fluid delivery tube **300** as a result of the venturi effect of the compressed air flowing past the opening of the fluid inlet **227** into the mixing chamber **226**. More in particular, at each different compressed air flowrate, i.e., each “predetermined amount” of compressed air which is dictated and fixed by a compressed air operating pressure supplied to diffusion assembly **200**, a different corresponding and substantially constant amount, i.e., a “preselected amount” of an operative fluid corresponding to each different predetermined amount of compressed air, will be drawn into the mixing chamber **226**. More importantly, the “predetermined amount” of compressed air and the “preselected amount” of the operable fluid are initially mixed together in the mixing chamber **226** to form a fluid dispersion. The diffusion chamber **112** is

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further structured to facilitate the formation of a plurality of substantially uniform droplets, as defined herein, in the fluid dispersion prior to discharge from the diffusion chamber **112** through discharge port **132**.

As illustrated in FIGS. 1 and 2, the fluid dispersion assembly **10** also includes a suppressor assembly **230** disposed in communication with the diffusion assembly **200**. The suppressor assembly **230** comprises a suppression chamber **232**, disposed in a communicating relation with the atomizer exhaust channel **228** of the atomizer assembly **220**. More in particular, the suppression chamber **232** receives the fluid dispersion from the mixing chamber **226**. The suppressor assembly **230** helps to suppress the noise generated during operation of the fluid dispersion assembly **10** as it disrupts the path of flow of the fluid dispersion out of the atomizer assembly **200** and into diffusion chamber **112**, and therefore, disrupts and dampens the sound waves associated therewith. Further, the walls of the suppressor assembly **230** itself serve to absorb and dampen the sound waves generated by the flow of the fluid dispersion out of the mixing chamber **236** through atomizer exhaust channel **228**.

The suppressor assembly **230** may also include a suppressor discharge port **234** to facilitate transfer of the fluid dispersion from the suppressor chamber **232** into the diffusion chamber **112**. In at least one embodiment, such as is shown in FIG. 1, the suppressor discharge port **234** is located through a low point in the suppressor chamber **232**. Of course, as shown in the alternative embodiment of FIG. 2, the suppressor discharge port **234** is located through the sides of the suppressor chamber **232**.

In at least one embodiment, a fluid dispersion assembly **10** in accordance with the present specification further includes a silencer assembly **134** in communication with the discharge port **132**, such as is illustrated in FIGS. 1 and 2. The silencer assembly **134** serves to further minimize the amount of noise generated during operation of the fluid dispersion assembly **10**. The silencer assembly **134** comprises a baffle **136** disposed in a silencer chamber **138** between a silencer inlet **135** and a silencer outlet **137**. The baffle **136** is structured and disposed to further disrupt the flow of the fluid dispersion through the fluid dispersion assembly **10**, and more specifically, through the silencer chamber **138**. In at least one embodiment, the silencer inlet **135** is disposed relative to the baffle **136** to at least partially, if not substantially, direct the flow of the fluid dispersion towards the baffle **136**, so as to maximize the disruption of flow. Once again, as disclosed above with regard to the suppressor assembly **230**, the disruption in the flow of the fluid dispersion through the silencer assembly **134** also creates a disruption and dampening of the sound waves associated therewith. As a result, the amount of noise generated during the operation of a fluid dispersion assembly **10** in accordance with the present specification is significantly reduced.

FIG. 5 is illustrative of an alternative embodiment of a fluid dispersion assembly **10**, wherein a modified diffusion chamber **112'** is configured to suppress and/or dampen sound waves generated during operation, similar to the suppressor assembly **230** disclosed above. However, as will be appreciated from the following disclosure, the diffusion chamber **112'** of the embodiment of FIG. 5 serves to suppress sound waves generated during operation without the need for a separate suppression chamber, as in previously disclosed embodiments.

Before addressing the modified diffusion chamber **112'** of the embodiment of FIG. 5, it is noted that, in many respects, the fluid dispersion assembly **10** of FIG. 5 is similar to the previously disclosed embodiments herein. To begin, the

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fluid dispersion assembly **10** of FIG. **5** comprises a diffusion unit **100** having oppositely disposed ends **110**, **113**, and a diffusion chamber **112'** disposed therebetween. Unlike previously disclosed embodiments, however, the fluid dispersion assembly **10** of FIG. **5** includes a service access port **160** having a removable service access plug **162** disposed directly through one end **113** of the diffusion unit **100**, rather than through a separate cap disposed at one end of the unit **100**.

The fluid dispersion assembly **10** of FIG. **5** further comprises a container interconnect **140** cooperatively structured to interconnect the diffusion unit **100** to a fluid container (FC) in a substantially sealed relationship and, as before, a sealing washer **170** is provided to maintain a substantially sealed relationship.

A cartridge port **150** is disposed through one side of the diffusion unit **100**, in the illustrative embodiment of FIG. **5**, and a diffusion assembly **200** is operatively positioned therethrough and into fluid communication with diffusion chamber **112'**, as in previously disclosed embodiments. The diffusion cartridge **200** includes an air inlet **210** disposed in communication with an atomizer assembly **220**. Further, and as in previously disclosed embodiments, when compressed air is supplied to the diffusion assembly **200**, and more in particular, atomizer assembly **220**, through air inlet **210**, a corresponding amount of fluid is drawn into a mixing chamber **226** from the fluid container (FC) through a fluid delivery tube **300**, as a result of the venturi effect of compressed air flowing past the opening of a fluid inlet **227** into the mixing chamber **226**. As a result, a fluid dispersion is formed and discharged from the atomizer assembly **220** through atomizer exhaust channel **228**, and directly into diffusion chamber **112'**.

As noted above, and as may be seen with reference to FIG. **5**, the diffusion chamber **112'** of the present embodiment comprises a modified configuration. Specifically, the modified diffusion chamber **112'** comprises an upside down L-shaped configuration, wherein a first axial portion **114** of the diffusion chamber **112'** is disposed in a substantially axial orientation adjacent and relative to the discharge of the atomizer exhaust channel **228**. A second transverse portion **115** of the diffusion chamber **112'** is disposed in a substantially downwardly directed orientation, as shown in FIG. **5**, substantially transverse or perpendicular to the direction of flow from atomizer exhaust channel **228**.

The second or transverse portion **115** of the modified diffusion chamber **112'**, in at least one embodiment, comprises a fluid return lip **116** disposed at a lower end thereof in a surrounding relation to incoming fluid delivery tube **300**. The fluid return lip **116**, in at least one embodiment, extends downwardly and outwardly from the walls of the second portion **115** of the diffusion chamber **112'**, such that any liquid which coalesces in the diffusion chamber **112'** along the walls thereof, will be directed into drip tube **120**, disposed in an abutting relation along the underside of the fluid return lip **116**, and back into fluid container (FC).

More importantly, the fluid dispersion discharged from the atomizer assembly **220** through atomizer exhaust channel **228** into diffusion chamber **112'** is interrupted and redirected by virtue of axial portion **114** and transverse portion **115** therein. The interruption and redirection of flow in the modified diffusion chamber **112'** during operation of the fluid dispersion assembly **10** in accordance with the present embodiment, serves to suppress or dampen sound waves generated therein, in a similar manner as the suppression chamber **232** of previously disclosed embodiments. Further, the restricted discharge from the transverse portion

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115 of the modified diffusion chamber **112'** may serve to further suppress or dampen sound waves, thus reducing the noise generated during operation to an even greater extent.

After being discharged from the diffusion chamber **112'**, the fluid dispersion enters the freeboard above the liquid in the fluid container (FC), the freeboard serving as a quasi-diffusion chamber prior to final discharge of the fluid dispersion from the diffusion unit **100**. A discharge chamber **117** is disposed in fluid communication with the freeboard of the fluid container (FC), such that the fluid dispersion can pass therethrough, into a discharge head **118** and out through discharge channel **119** into the airspace surrounding the fluid dispersion assembly **10**, as shown in the illustrative embodiment of FIG. **5**.

Turning next to the illustrative embodiment of FIG. **6**, the present invention is directed to yet another embodiment of a diffusion unit **100** of a fluid dispersion assembly **10** which is also powered by a compressed air source (not shown). In at least one embodiment, the fluid dispersion assembly **10** is further structured to operatively engage a fluid container, and to combine an amount of an operative fluid with compressed air to generate a fluid dispersion.

As before, a "fluid dispersion" in accordance with the present invention shall mean a mixture of an operative fluid in air comprising a plurality of substantially uniform droplets of the operative fluid dispersed throughout the air. Further, and once again, as used in the present specification, "substantially uniform droplets" shall mean droplets having substantially the same diameter. In at least one embodiment, the plurality of "substantially uniform droplets" each have a diameter in the range of about one micron (1 μm), in another embodiment, the diameter of the "substantially uniform droplets" is in the range of about three microns (3 μm), and, in one further embodiment, the plurality of "substantially uniform droplets" each have a diameter in the range of about five microns (5 μm). In another embodiment, the plurality of "substantially uniform droplets" comprise a diameter in a range of about 2 to 3 microns, and in yet one further embodiment, the plurality of "substantially uniform droplets" comprise a diameter in a range of about 2.3 to 3 microns.

In at least one embodiment, a diffusion unit **100** comprises oppositely disposed ends, as at **110** and **113**. Further, a diffusion unit **100** at least partially defines a diffusion chamber **112"**, and in at least one embodiment, the diffusion chamber **112"** is substantially enclosed within diffusion unit **100**. As before, the diffusion unit **100** may be constructed of any rigid material or materials which are chemically inert, or at least chemically resistant to the intended operative fluid(s) which include, but once again are not limited to, fragrant oils, essential oils, essential oil extracts, odor neutralizers, disinfectants, e.g., triethylene glycol, air sanitizers, etc.

Further, the material of construction selected for the diffusion unit **100** must be capable of withstanding compressed air at operative pressures, which may range anywhere from about 5 to 50 psig, in most embodiments of the present fluid dispersion assembly **10**. In one lower pressure embodiment, the operating pressure of the present fluid dispersion assembly **10** is in the range of about 5 to 10 psig, and in one further embodiment, the operating pressure is in a range of about 5 to 7 psig. Conversely, a higher pressure embodiment of the present fluid dispersion assembly **10** operates at pressures in the range of about 20 to 25 psig, and in the range of about 23 to 24 psig in yet one further embodiment. As such, the material or materials of construction of a diffusion unit **100** in accordance with the present invention may include metals, engineered plastic materials,

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e.g., polyvinyl chloride, high-density polyethylene, etc., and/or composite materials, just to name a few.

In one embodiment, a cap **130** is cooperatively configured and disposed in a sealing engagement with one of the oppositely disposed ends **110**, **113** of the diffusion unit **100**. The cap **130** includes a discharge port **132** therethrough in communication with the diffusion chamber **112**", and provides a point of release of a fluid dispersion from the diffusion chamber **112**" into the airspace surrounding the fluid dispersion assembly **10**. In at least one embodiment, the cap **130** is removably attached in a sealing engagement to the diffusion unit **100**.

The fluid dispersion assembly **10**, in at least one embodiment, includes a container interconnect **140** which is cooperatively structured to interconnect the diffusion unit **100** to a fluid container in a substantially sealed relationship. In one embodiment, the container interconnect **140** is disposed at a different one of the oppositely disposed ends **110**, **113**, opposite of the cap **130** of the diffusion unit **100**. A sealing washer **170** is disposed between the diffusion unit **100** and the fluid container, in at least one embodiment, so as to provide a substantially sealed relationship between the diffusion unit **100** and the fluid container (not shown). The sealing washer **170** may be constructed from any of a variety of materials such as, but not limited to, rubber, nylon, plastic, PVC, TEFLON, or a composite material, once again, provided the material of construction is chemically inert or at least chemically resistant to the operative fluid(s).

In one further embodiment of a fluid dispersion assembly **10** in accordance with the present invention, a drip tube **120** is disposed in an interconnecting relation between the diffusion unit **100** and the fluid container. As shown in FIG. 6, the drip tube **120** is disposed through a sealing washer **170**, and thus, the drip tube **120** serves to minimize contact between the sealing washer **170** and the operative fluid, by essentially preventing the operative fluid from making contact in and around the sealing washer **170** disposed between the fluid container (not shown) and the container interconnect **140**. More in particular, the drip tube **120** channels any operative fluid which may agglomerate and/or accumulate in the diffusion chamber **112**" through the drip tube **120** directly back into the fluid container (not shown) without contacting the sealing washer **170**, once again, as shown in FIG. 6.

As before, the container interconnect **140** may be structured in a variety of ways to allow interconnection to the fluid container. As one example, the container interconnect **140** may be threaded, internally or externally, such that the diffusion unit **100** is interconnected to the fluid container by screwing the container interconnect **140** into place onto corresponding threads on the neck of the fluid container. In at least one other embodiment, the container interconnect **140** comprises one portion of a quick-connect type fitting and the fluid container comprises a complimentary portion of such a quick-connect type fitting whereby once operatively engaged, a substantially sealed relationship is created between the diffusion unit **100** and the fluid container. In at least some embodiments, the substantially sealed relationship is further enhanced by a sealing washer **170**, as disclosed above.

In at least one embodiment, a cartridge port **150** is provided into the diffusion chamber **112**" to facilitate operative engagement of a diffusion assembly **200** with the diffusion chamber **112**". The diffusion assembly **200** may be removably engaged with the cartridge port **150** to aid in removal and replacement and/or cleaning of the diffusion assembly **200** and/or components thereof. As shown in the

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illustrative embodiment of FIG. 6, the cartridge port **150** is disposed directly through the diffusion unit **100** and into the diffusion chamber **112**", and is positioned between the oppositely disposed ends **110**, **113**. In accordance with the illustrative embodiment of FIG. 6, the cartridge port **150** is disposed on the diffusion unit **100** such that the diffusion assembly **200** is disposed in a substantially perpendicular orientation relative to the diffusion unit **100** when operatively engaging the cartridge port **150**. As further illustrated in the embodiment of FIG. 6, while operatively disposed in the diffusion chamber **112**", the diffusion assembly **200** is disposed between the upper chamber **115**" and the lower chamber **114**" of the diffusion chamber **112**". In at least one other embodiment, the cartridge port **150** is disposed through the cap **130**. In yet another embodiment, the diffusion assembly **200** comprises an integral component of the cap **130** itself.

As illustrated in FIG. 6, the diffusion assembly **200** comprises an air inlet **210** and an atomizer assembly **220**. The atomizer assembly **220** comprises an atomizer air inlet channel **222**, a mixing chamber **226**, and an atomizer exhaust aperture **228**". The atomizer air inlet channel **222** is interconnected to the compressed air source via the air inlet **210**. Moreover, the atomizer air inlet channel **222** includes an inlet aperture **223** and an outlet aperture **223**", as may be seen in FIG. 6. As may also be seen in the illustrative embodiment of FIG. 6, the inlet aperture **223** and outlet aperture **223**" are substantially equal in diameter, and is the channel **223**' disposed therebetween.

Further, the mixing chamber **226** comprises a fluid inlet **227** disposed in fluid communication with an operative fluid in the fluid container via a fluid delivery tube **300**. The fluid delivery tube **300** is disposed in a fluid communicating relation between the atomizer assembly **220** and the fluid container to facilitate delivery of an amount of the operative fluid into the atomizer assembly **220**. In at least one embodiment, the fluid delivery tube **300** connects to the atomizer assembly **220** via the fluid inlet **227** into the mixing chamber **226**.

As shown in FIG. 6, the fluid inlet **227** is substantially perpendicular to a compressed air flowpath through the atomizer assembly **200**. More in particular, and with reference to FIG. 6, the compressed air flowpath extends horizontally through the air inlet **210**, atomizer air inlet channel **222**, inlet aperture **223**, channel **223**', and outlet aperture **223**", into mixing chamber **226**, and out through the atomizer exhaust aperture **228**".

As such, when compressed air is supplied to the diffusion assembly **200**, a corresponding amount of operative fluid is drawn into the mixing chamber **226** through the fluid delivery tube **300** as a result of the venturi effect of the compressed air flowing over the opening of the fluid inlet **227** into the mixing chamber **226**. More in particular, at each different compressed air flowrate, i.e., each "predetermined amount" of compressed air which is dictated and fixed by a compressed air operating pressure supplied to diffusion assembly **200**, a different corresponding and substantially constant amount, i.e., a "preselected amount" of an operative fluid corresponding to each different predetermined amount of compressed air, will be drawn into the mixing chamber **226**. More importantly, the "predetermined amount" of compressed air and the "preselected amount" of the operable fluid are initially mixed together in the mixing chamber **226** to form a fluid dispersion. The diffusion chamber **112**" is further structured to facilitate the formation of a plurality of substantially uniform droplets, as defined hereinabove, in

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the fluid dispersion prior to discharge from the diffusion chamber **112"** through discharge port **132**.

FIG. 6 is illustrative of an alternative embodiment of a diffusion unit **100** having a modified diffusion chamber **112"**. More in particular, the modified diffusion chamber **112"** is configured to suppress and/or dampen sound waves generated during operation, similar to the suppressor assembly **230** disclosed above. However, as will be appreciated from the following, the modified diffusion chamber **112"** of the embodiment of FIG. 6 serves to suppress sound waves generated during operation without the need for a separate suppression chamber, as in previously disclosed embodiments.

As noted above, and as may be seen with reference to FIG. 6, the diffusion chamber **112"** of the present embodiment comprises a modified configuration. Specifically, the modified diffusion chamber **112"** comprises a lower chamber **114"** which is disposed below and adjacent to the discharge of a fluid dispersion through the atomizer exhaust aperture **228"**. An upper chamber **115"** of the diffusion chamber **112"** is disposed above the diffusion assembly **200**, as shown in FIG. 6, substantially opposite to the direction of flow of a fluid dispersion from atomizer exhaust aperture **228"**.

More importantly, the fluid dispersion discharged from the atomizer assembly **220** through atomizer exhaust aperture **228"** into diffusion chamber **112"** is interrupted and redirected by virtue of lower chamber **114"** and upper chamber **115"** therein. The interruption and redirection of flow in the modified diffusion chamber **112"** during operation of the fluid dispersion assembly **10** in accordance with the present embodiment, serves to suppress or dampen sound waves generated therein, much like the suppression chamber **232** of previously disclosed embodiments. Further, the restricted discharge from the upper chamber **115"** of the modified diffusion chamber **112"** serves to further suppress or dampen sound waves, thus reducing the noise generated during operation to an even greater extent.

After being discharged from the mixing chamber **226** through the atomizer exhaust aperture **228"**, the fluid dispersion is at least partially deflected into the freeboard above the liquid in the fluid container, the freeboard serving as a quasi-diffusion chamber prior to final discharge of the fluid dispersion from the diffusion unit **100** through discharge port **132** and into the airspace surrounding the fluid dispersion assembly **10**. A portion of the fluid dispersion is also deflected against the bottom surface of the lower chamber **114"** of the modified diffusion chamber **112"** and upwardly into the upper chamber **115"** of the modified diffusion chamber **112"** before being discharged through discharge port **132** into the airspace surrounding the fluid dispersion assembly **10**.

FIG. 7 presents yet one further illustrative embodiment of a fluid dispersion assembly **10** in accordance with the present invention. As before, the fluid dispersion assembly **10** is powered by a compressed air source. In at least one embodiment, the fluid dispersion assembly **10** is further structured to operatively engage a fluid container (FC). Also as before, the fluid dispersion assembly **10** as shown in the illustrative embodiment of FIG. 7 is structured to combine an amount of an operative fluid with compressed air to generate a fluid dispersion.

Once again, a "fluid dispersion" in accordance with the present specification shall mean a mixture of an operative fluid in air comprising a plurality of substantially uniform droplets of the operative fluid dispersed throughout the air. Further, and once again, as used in the present specification,

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"substantially uniform droplets" shall mean droplets having substantially the same diameter. In at least one embodiment, the plurality of "substantially uniform droplets" each have a diameter in the range of about one micron (1 μ m), in another embodiment, the diameter of the droplets is in the range of about three microns (3 μ m), and, in one further embodiment, droplet diameter is in the range of about five microns (5 μ m).

The fluid dispersion assembly **10** includes a diffusion unit **100**, as shown in the illustrative embodiment of FIG. 7. The diffusion unit **100** at least partially defines a diffusion chamber **112**, and in at least one embodiment, the diffusion chamber **112** is substantially enclosed within diffusion unit **100**. As before, the diffusion unit **100** may be constructed of any rigid material or materials which are chemically inert, or at least chemically resistant to the intended operative fluid(s) which include, but once again are not limited to, fragrant oils, essential oils, essential oil extracts, odor neutralizers, disinfectants, e.g., triethylene glycol, air sanitizers, etc. Further, the material of construction selected for the diffusion unit **100** must be capable of withstanding compressed air at operative pressures, which may range anywhere from about 5 to 50 psig, in most embodiments of the present fluid dispersion assembly **10**. In a lower pressure embodiment, the operating pressure of the present fluid dispersion assembly **10** is in the range of about 5 to 10 psig, and in one further embodiment, the operating pressure is in a range of between about 5 to 7 psig. Conversely, a higher pressure embodiment of the present fluid dispersion assembly **10** operates at pressures in the range of about 20 to 25 psig, and in the range of between about 23 to 24 psig in yet one further embodiment. As such, the material or materials of construction of a diffusion unit **100** in accordance with the present invention may include metals, engineered plastic materials, e.g., polyvinyl chloride, high-density polyethylene, etc., and/or composite materials, just to name a few.

Looking further to the illustrative embodiment of FIG. 7, a cap **130** is cooperatively configured and disposed in a sealing engagement with the diffusion unit **100**. The cap **130** includes a discharge port **132** therethrough in communication with the diffusion chamber **112**, and provides a point of release of the fluid dispersion from the diffusion chamber **112** into the airspace surrounding the fluid dispersion assembly **10**. In at least one embodiment, the cap **130** is removably attached in a sealing engagement to the diffusion unit **100**. An O-ring **174** is provided in at least one embodiment to minimize the release of compressed air through the interface between the diffusion unit **100** and the cap **130**. The O-ring **174** assures quieter operation of the present fluid dispersion assembly **10**, which is an important operational consideration in certain environments where the fluid dispersion assembly **10** may be installed, such as, by way of example only, in an office setting. Similar to the sealing washer **170** described above, O-ring **174** may be constructed from any of a variety of materials such as, but not limited to, rubber, nylon, plastic, PVC, TEFLON, or a composite material, once again, provided the material of construction is chemically inert or at least chemically resistant to the operative fluid(s).

As further shown in the illustrative embodiment of FIG. 7, the cap **130** includes a service access port **160** disposed therethrough. The service access port **160** includes a service access plug **162** removably disposed therein, wherein removal of the service access plug **162** allows access for removal and cleaning or repair of a diffusion assembly **200**, as disclosed in greater detail below. As also shown in the illustrative embodiment of FIG. 7, an O-ring **164** is provided, once again, to minimize the release of compressed air

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between the cap **130** and the service access plug **162**. This again assures quieter operation of the present fluid dispersion assembly **10**. As before, this is an important operational consideration in certain environments where the fluid dispersion assembly **10** may be installed. Similar to washer **170** and O-ring **174** described above, O-ring **164** may be constructed from any of a variety of materials such as, but not limited to, rubber, nylon, plastic, PVC, TEFLON, or a composite material, once again, provided the material of construction is chemically inert or at least chemically resistant to the operative fluid(s).

Similar to the previously described embodiments of a fluid dispersion assembly **10** in accordance with the present invention, the fluid dispersion assembly **10** as shown in the illustrative embodiment of FIG. **7** includes a container interconnect which is cooperatively structured to interconnect the diffusion unit **100** to the fluid container (FC) in a substantially sealed relationship.

In at least one embodiment of a fluid dispersion assembly **10** in accordance with the present invention, a drip tube **120** is disposed in an interconnecting relation between the diffusion unit **100** and the fluid container (FC), such as is shown in FIG. **7**. More in particular, the drip tube **120** channels any operative fluid which may agglomerate and/or accumulate in the diffusion chamber **112** through the drip tube **120** directly back into the fluid container (FC).

As further shown in the illustrative embodiment of FIG. **7**, the present fluid dispersion assembly **10** includes a diffusion assembly **200** which comprises an air inlet **210** and an atomizer assembly **220**. The atomizer assembly **220** comprises an atomizer air inlet channel **222**, a mixing chamber **226**, and an atomizer exhaust channel **228**. The atomizer air inlet channel **222** is interconnected to the compressed air source via the air inlet **210**. Moreover, the atomizer air inlet channel **222** may also include an inlet aperture **223**, a first portion **224** and a second portion **225**. The first portion **224** and the second portion **225** are collectively structured to facilitate delivery of compressed air into the mixing chamber **226**. The first portion **224** of the atomizer air inlet channel **222** may comprise a larger diameter than the second portion **225**, such as is shown in the illustrative embodiment of FIG. **7**. Of course, it is within the scope and intent of the present invention for the atomizer air inlet channel **222** to comprise a constant diameter along its entire length, i.e., a diameter of a first portion **224** is substantially equal to a diameter of a second portion **225**.

Further, the mixing chamber **226** comprises a fluid inlet **227** disposed in fluid communication with an operative fluid in the fluid container (FC) via a fluid delivery tube **300**. The fluid delivery tube **300** is disposed in a fluid communicating relation between the atomizer assembly **220** and the fluid container (FC) to facilitate delivery of an amount of the operative fluid into the atomizer assembly **220**. In at least one embodiment, the fluid delivery tube **300** connects to the atomizer assembly **220** via the fluid inlet **227** into the mixing chamber **226**.

As such, when compressed air is supplied to the diffusion assembly **200**, a corresponding amount of operative fluid is drawn into the mixing chamber **226** through the fluid delivery tube **300** as a result of the venturi effect of the compressed air flowing past the opening of the fluid inlet **227** into the mixing chamber **226**. More in particular, at each different compressed air flowrate, i.e., each "predetermined amount" of compressed air which is dictated and fixed by a compressed air operating pressure supplied to diffusion assembly **200**, a different corresponding and substantially constant amount, i.e., a "preselected amount" of an operative

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fluid corresponding to each different predetermined amount of compressed air, will be drawn into the mixing chamber **226**. More importantly, the "predetermined amount" of compressed air and the "preselected amount" of the operable fluid are initially mixed together in the mixing chamber **226** to form a fluid dispersion. The diffusion chamber **112** is further structured to facilitate the formation of a plurality of substantially uniform droplets, as defined herein, in the fluid dispersion prior to discharge from the diffusion chamber **112** through discharge port **132**.

As further shown in the illustrative embodiment of FIG. **7**, the fluid dispersion assembly **10** also includes a suppressor assembly **230** disposed in communication with the diffusion assembly **200**. The suppressor assembly **230** comprises a suppression chamber **232**, disposed in a communicating relation with the atomizer exhaust channel **228** of the atomizer assembly **220**. More in particular, the suppression chamber **232** receives the fluid dispersion from the mixing chamber **226**. The suppressor assembly **230** helps to suppress the noise generated during operation of the fluid dispersion assembly **10** as it disrupts the path of flow of the fluid dispersion out of the atomizer assembly **200** and into diffusion chamber **112**, and therefore, the suppressor assembly **230** disrupts and dampens the sound waves associated therewith. Further, the walls of the suppressor assembly **230** itself serve to absorb and dampen the sound waves generated by the flow of the fluid dispersion out of the mixing chamber **236** through atomizer exhaust channel **228**.

The suppressor assembly **230** may also include a suppressor discharge port **234** to facilitate transfer of the fluid dispersion from the suppressor chamber **232** into the diffusion chamber **112**. In at least one embodiment, such as is shown in FIG. **7**, the suppressor discharge port **234** is located through a low point in the suppressor chamber **232**.

As further shown in the illustrative embodiment of FIG. **7**, the fluid dispersion assembly **10** also includes a silencer assembly **134** in communication with the discharge port **132**. The silencer assembly **134** serves to further minimize the amount of noise generated during operation of the fluid dispersion assembly **10**. The silencer assembly **134** comprises a baffle **136** disposed in a silencer chamber **138** between a silencer inlet **135** and a silencer outlet **137**. The baffle **136** is structured and disposed to further disrupt the flow of the fluid dispersion through the fluid dispersion assembly **10**, and more specifically, through the silencer chamber **138**. In at least one embodiment, the silencer inlet **135** is disposed relative to the baffle **136** to at least partially, if not substantially, direct the flow of the fluid dispersion towards the baffle **136**, so as to maximize the disruption of flow. Once again, as disclosed above with regard to the suppressor assembly **230**, the disruption in the flow of the fluid dispersion through the silencer assembly **134** also creates a disruption and dampening of the sound waves associated therewith. As a result, the amount of noise generated during the operation of a fluid dispersion assembly **10** in accordance with the present specification is significantly reduced.

It is further envisioned that at least one embodiment of the fluid dispersion assembly **10** of the present invention is operated via a programmable timer to control a fragrance intensity and character in an airspace by metering the fragrance delivered in an enclosed environment. The fluid dispersion assembly **10** delivers a specific amount of a fragrance, i.e., the delivery rate, based upon such factors as the specific physical configuration of the atomizer assembly **220** and the fluid container (FC)/fluid delivery tube **300**, the pressure and volume of the compressed air supplied into air

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inlet 210, as well as the physical properties of the fragrance itself, such as, viscosity, surface tension, vapor pressure, etc., wherein the delivery rate is measured in grams per minute of a fragrance dispersed. The perceived fragrance intensity in a specific airspace is measured from a sensory point of view using a labeled magnitude scale. The data is directly correlated to the amount of fragrance delivered and may be measured in either grams per liter or grams per cubic meter. Since the delivery rate is fixed, fragrance intensity is controlled by cycling the fluid dispersion assembly 10 through an on/off programming cycle every minute to deliver the intensity and character levels that are desired by a user. The optimization process is a function of dosing time per minute and a user's desired fragrance experience.

Since many modifications, variations and changes in detail can be made to the described preferred embodiment of the invention, it is intended that all matters in the foregoing description and shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense. Thus, the scope of the invention should be determined by the appended claims and their legal equivalents.

What is claimed is:

1. A fluid dispersion assembly operatively engages a container of an operative fluid and a compressed air source and generates and discharges a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:

a diffusion unit at least partially defining an enclosed diffusion chamber,

a discharge port disposed in fluid communication between said diffusion chamber and the surrounding airspace, a diffusion assembly disposed in an operative engagement with said diffusion unit,

wherein said diffusion assembly comprises an atomizer assembly, said atomizer assembly comprising an atomizer air inlet channel, a fluid inlet, a mixing chamber, and an atomizer exhaust aperture, and

said atomizer air inlet channel interconnected to the compressed air source and said fluid inlet disposed in fluid communication with the operative fluid in the container, the compressed air and the operative fluid mix together in said mixing chamber to form the fluid dispersion.

2. The fluid dispersion assembly as recited in claim 1 further comprising a cap cooperatively configured and disposed in a sealing engagement with said diffusion unit.

3. The fluid dispersion assembly as recited in claim 1 further comprising a drip tube disposed in an interconnecting relation between said diffusion chamber and the container.

4. The fluid dispersion assembly as recited in claim 1 wherein said diffusion chamber facilitates formation of the fluid dispersion prior to discharge of the fluid dispersion from said diffusion chamber through said discharge port and into the surrounding airspace.

5. The fluid dispersion assembly of claim 1 further comprising a silencer assembly having a silencer inlet, a silencer outlet, and a baffle.

6. The fluid dispersion assembly of claim 5 wherein said baffle partially restricts movement of the fluid dispersion through said silencer chamber from said silencer inlet to said silencer outlet, thereby dampening sound waves generated during operation of said fluid dispersion assembly.

7. A fluid dispersion assembly is operatively interconnected to a container of an operative fluid and a compressed

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air source to generate and discharge a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:

a diffusion unit at least partially defining a diffusion chamber,

a discharge port disposed in fluid communication between said diffusion chamber and the surrounding airspace, and

a diffusion assembly disposed in an operative engagement with said diffusion unit, wherein said diffusion assembly comprises an atomizer assembly, said atomizer assembly comprising an atomizer air inlet channel, a fluid inlet, a mixing chamber, and an atomizer exhaust aperture.

8. The fluid dispersion assembly as recited in claim 7 wherein said atomizer air inlet channel is interconnected to the compressed air source and said fluid inlet disposed in fluid communication with the operative fluid in the container, the compressed air and the operative fluid mix together in said mixing chamber to form the fluid dispersion.

9. The fluid dispersion assembly as recited in claim 8 wherein said diffusion chamber facilitates formation of the fluid dispersion prior to discharge of the fluid dispersion from said diffusion chamber through said discharge port and into the surrounding airspace.

10. The fluid dispersion assembly as recited in claim 7 further comprising a container interconnect operatively interconnecting said diffusion unit to the container.

11. The fluid dispersion assembly as recited in claim 7 further comprising a drip tube disposed in an interconnecting relation between said diffusion chamber and the container.

12. The fluid dispersion assembly of claim 7 further comprising a silencer assembly having a silencer inlet, a silencer outlet, and a baffle.

13. A fluid dispersion assembly interconnects to a container of an operative fluid and a compressed air source and generates and discharges a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:

a diffusion unit having an enclosed diffusion chamber, a diffusion assembly disposed in an operative engagement with said diffusion unit,

said diffusion assembly comprises an atomizer assembly having an atomizer exhaust aperture, and

said diffusion chamber facilitates formation of the fluid dispersion prior to discharge of the fluid dispersion from said diffusion chamber, wherein the fluid dispersion discharged from said atomizer exhaust aperture into said diffusion chamber is directed into and interrupted in a suppression chamber, thereby dampening sound waves generated during operation of said fluid dispersion assembly.

14. The fluid dispersion assembly as recited in claim 13 wherein said atomizer assembly further comprises an atomizer air inlet channel, a fluid inlet, and a mixing chamber.

15. The fluid dispersion assembly as recited in claim 14 wherein said atomizer air inlet channel is interconnected to the compressed air source and said fluid inlet is disposed in fluid communication with the preselected fluid in the container, wherein the compressed air and the preselected fluid are mixed together in said mixing chamber to form the fluid dispersion.

16. The fluid dispersion assembly as recited in claim 13 further comprising a drip tube disposed in an interconnecting relation between said diffusion chamber and the container.

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17. The a fluid dispersion assembly as recited in claim 16 wherein said drip tube is disposed to direct coalesced fluid from the diffusion chamber back into the container of operative fluid.

18. The assembly of claim 13 further comprising a 5
silencer assembly having a silencer inlet, a silencer outlet,
and a baffle.

19. The assembly of claim 18 wherein said baffle partially
restricts movement of the fluid dispersion through said
silencer chamber from said silencer inlet to said silencer 10
outlet, thereby dampening sound waves generated during
operation of said fluid dispersion assembly.

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Levy et al.

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(54) **FLUID DISPERSION ASSEMBLY**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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Related U.S. Application Data

(63) Continuation-in-part of application No. 14/844,650, filed on Sep. 3, 2015, now Pat. No. 9,527,094, which is a continuation of application No. 13/838,364, filed on Mar. 15, 2013, now Pat. No. 9,126,215.

(60) Provisional application No. 61/694,500, filed on Aug. 29, 2012.

(51) **Int. Cl.**
B05B 7/06 (2006.01)
B05B 7/24 (2006.01)
A61L 9/14 (2006.01)
B05B 15/04 (2006.01)
B05B 14/00 (2018.01)

(52) **U.S. Cl.**
CPC **B05B 7/2424** (2013.01); **A61L 9/14** (2013.01); **B05B 7/2491** (2013.01); **B05B 7/2494** (2013.01); **B05B 14/00** (2018.02); **B05B 15/0406** (2013.01)

(58) **Field of Classification Search**

CPC B05B 7/2405; B05B 15/00; B05B 7/0425; B05B 7/005; B05B 7/006; B05B 17/0646; B05B 17/04; B05B 7/0012; B05B 7/2494; B05B 7/2491; B05B 15/0406; B05B 11/08; B05B 11/3042; A61M 15/0036; A61M 16/14; A61M 16/201; A61M 11/06; A61L 9/14
USPC 239/427, 310
See application file for complete search history.

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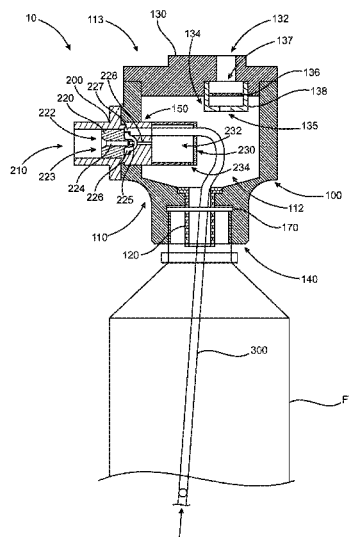
Primary Examiner — Davis Hwu

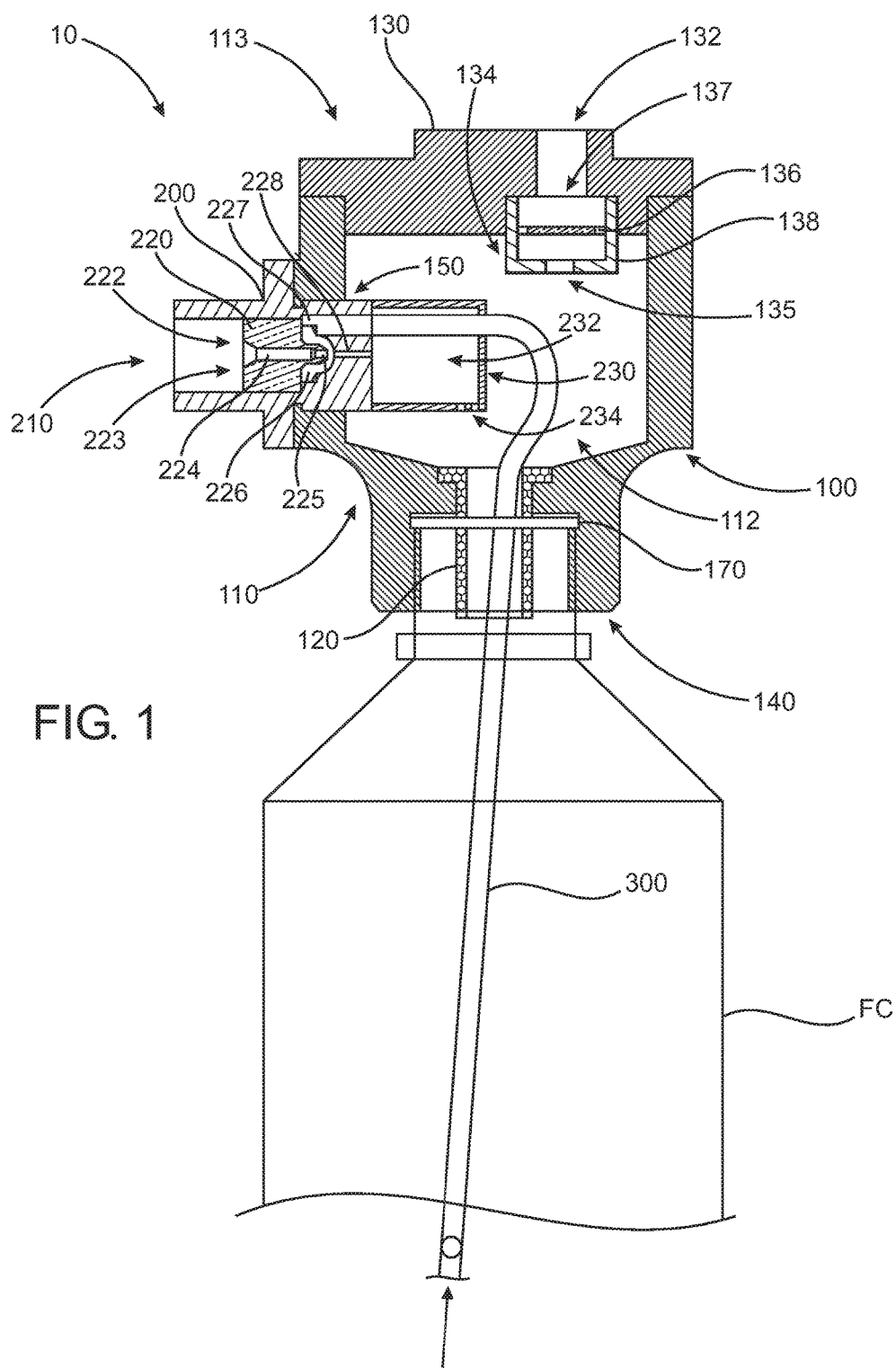
(74) *Attorney, Agent, or Firm* — Malloy & Malloy, P.L.

(57) **ABSTRACT**

A fluid dispersion assembly comprises a diffusion unit disposed in fluid communication with a fluid container, the assembly being powered by a compressed air source. The diffusion unit at least partially defines a diffusion chamber, and includes a diffusion assembly containing an atomizer assembly which, in combination with the diffusion chamber, generates a fluid dispersion from a mixture of compressed air and an operative fluid, for example, fragrant oils, essential oils, odor neutralizers, disinfectants such as triethylene glycol, air sanitizers, etc.

15 Claims, 6 Drawing Sheets



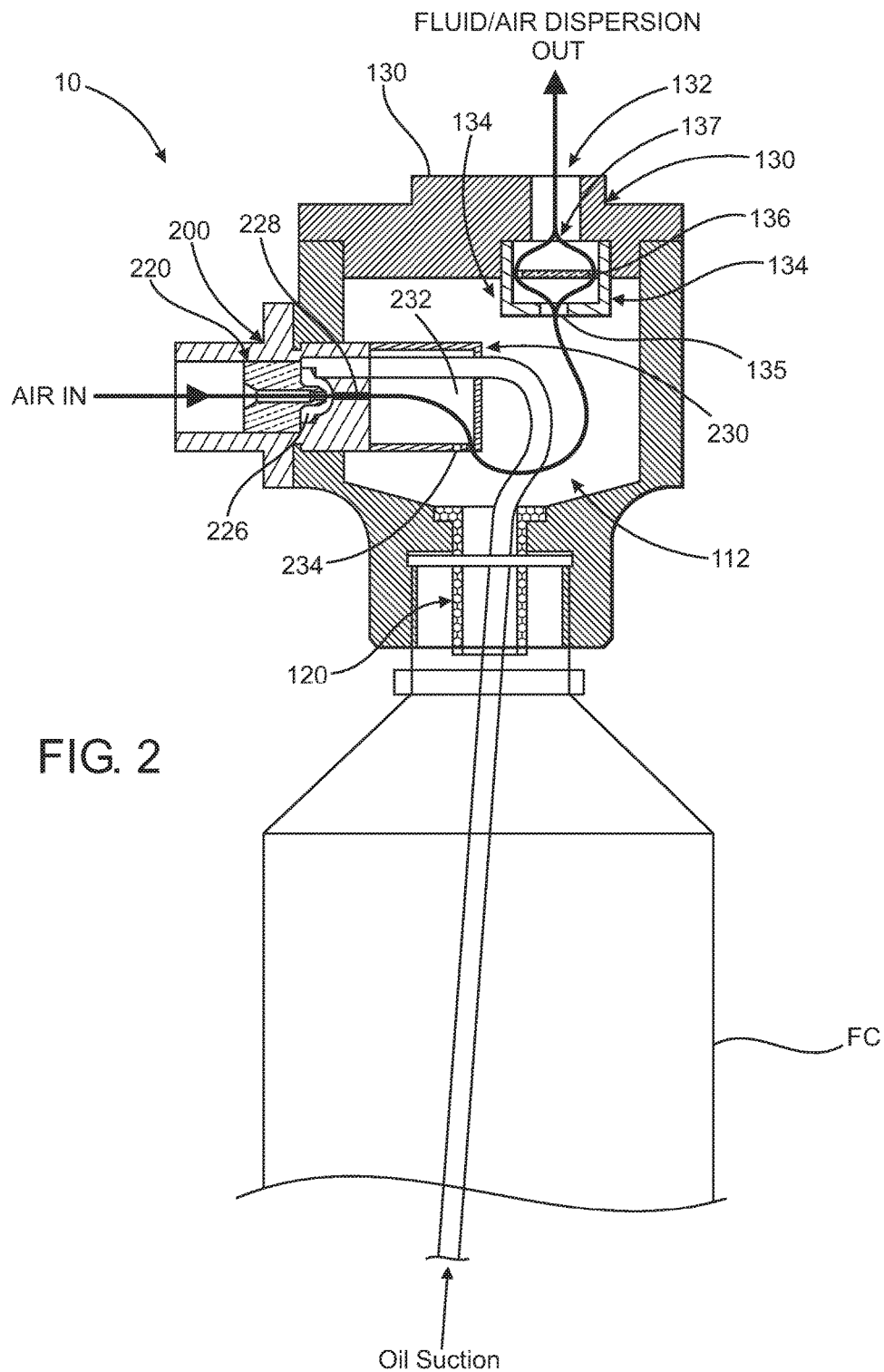


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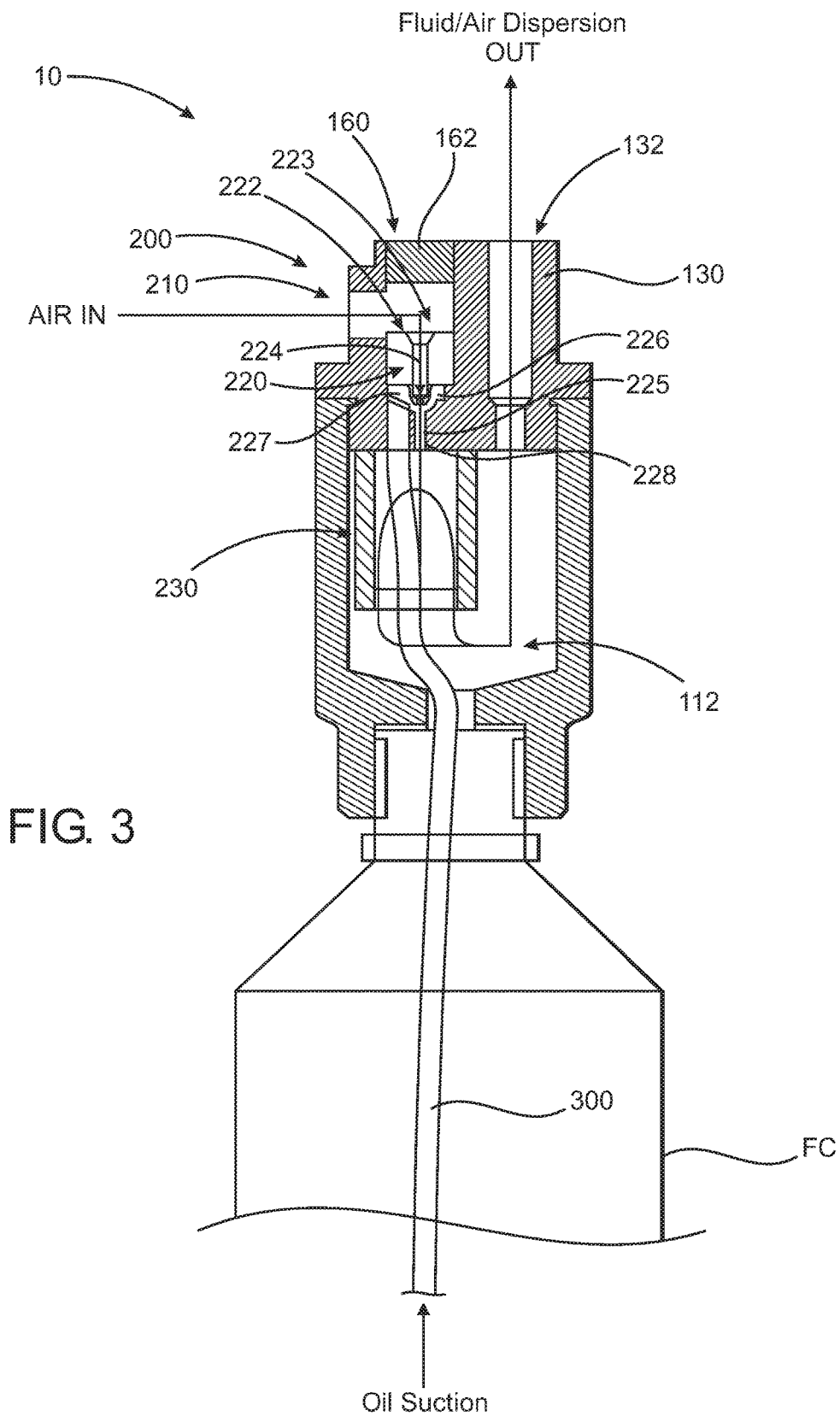


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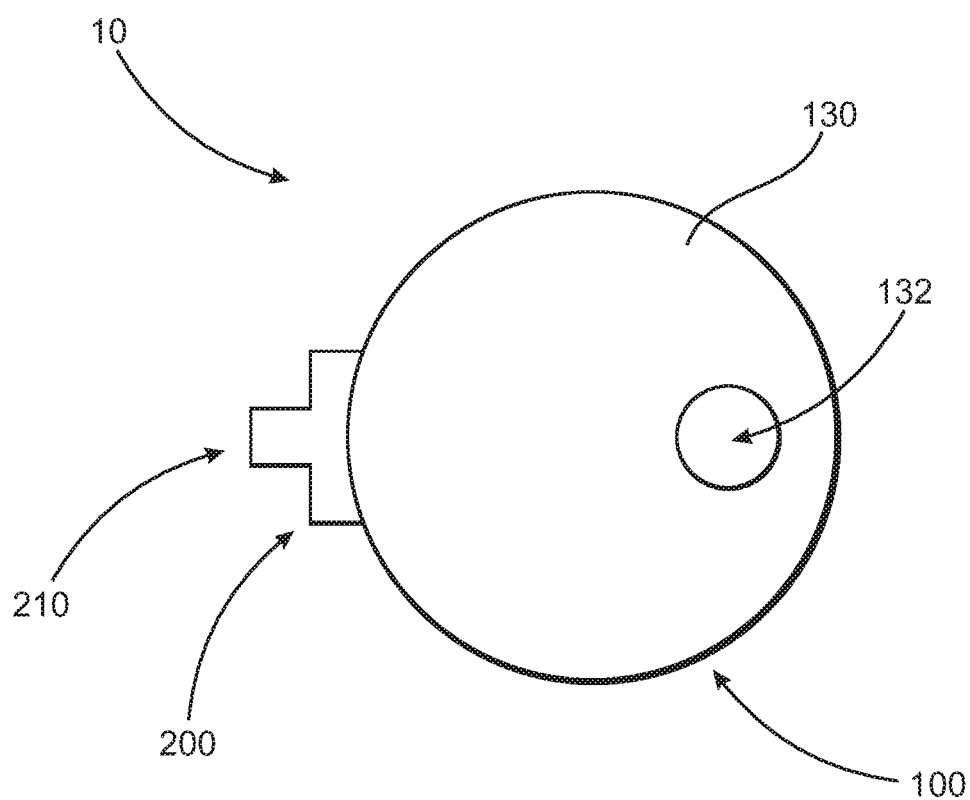


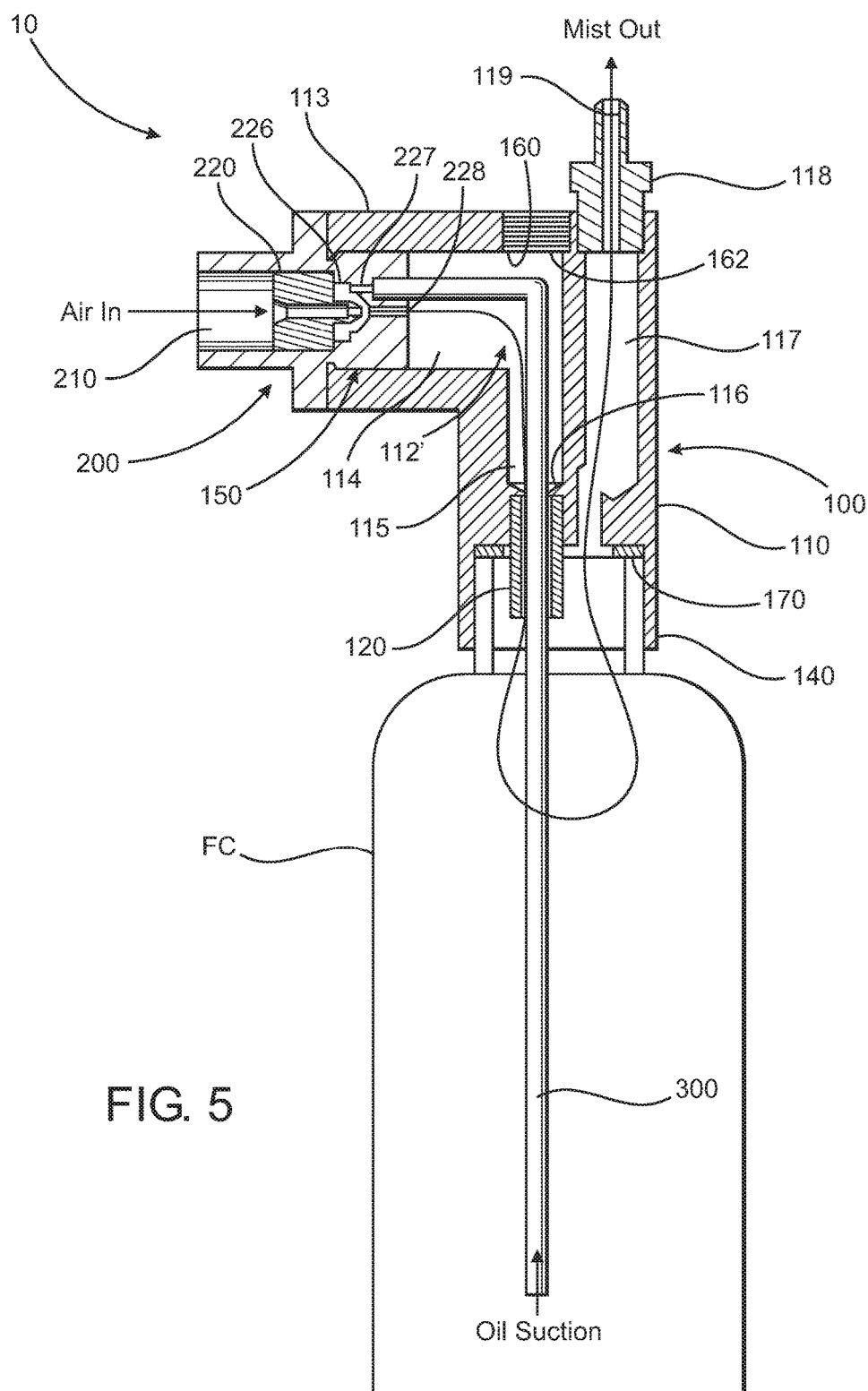
FIG. 4

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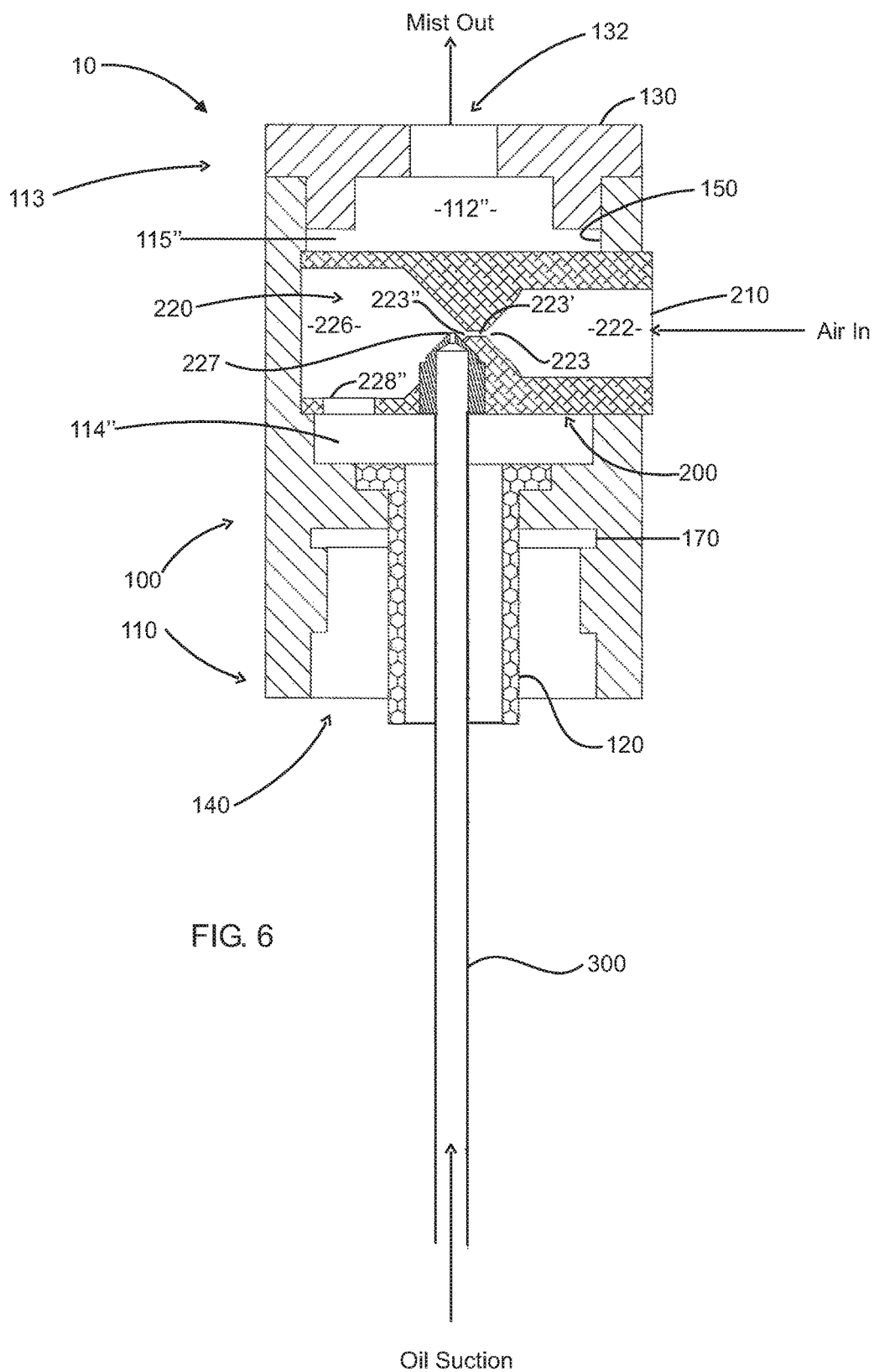


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FLUID DISPERSION ASSEMBLY**BACKGROUND OF THE INVENTION****Field of the Invention**

This invention relates generally to the field of dispersion of various fluids including, but not limited to, fragrant oils, essential oils, odor neutralizers, disinfectants, e.g., triethyl-ene glycol, air sanitizers, and the like, into a generally enclosed airspace.

Description of the Related Art

There are various devices that can be used to deliver fragrant oils, essential oils, as well as other fluids into the air. Spray cans are commonly used, however, such devices require a user to repeatedly and manually spray when and where necessary. Plug-in devices that heat oils for dispersion into the air are also commonly used, but they require constant heating of the oil via an electrical outlet, which consumes energy and poses a potential fire hazard.

Fluid diffusion devices utilizing forced and/or compressed air for delivery of fragrant oils, essential oils, or other liquids are desirable alternatives to spray cans and plug-in devices since they do not require heating or constant user interaction, however, they have drawbacks as well. One drawback of many known fluid diffusion devices utilizing forced air is that they tend to make an undesirable and often, depending on the location, such as an office or other place of business, a disruptive amount of noise when in operation. In particular, the release of a fluid dispersed in the forced and/or compressed air from such a device is often unacceptably noisy.

As such, there is a need for a fluid dispersion assembly that is designed to significantly reduce the amount of noise generated during operation. A further need exists for such a fluid dispersion assembly to not only operate more quietly, but to operate quietly while generating a fluid dispersion in air having a uniform particle size distribution, such that dosing of an airspace with a particular liquid, whether it be oil, sanitizer, disinfectant, etc., can be predicted within acceptable limits.

SUMMARY OF THE INVENTION

The present invention addresses the need for a forced air diffusion and dispersion assembly for fluids such as fragrant oils, essential oils, odor neutralizers, disinfectants, air sanitizers, etc., that significantly reduces the amount of noise generated during operation. In at least one embodiment, the present invention is directed to a fluid dispersion assembly which operatively engages a fluid container, and is powered by a compressed air source. The fluid dispersion assembly includes a diffusion unit having oppositely disposed ends, which at least partially defines a diffusion chamber. The diffusion chamber is structured so as to facilitate formation of a fluid dispersion comprising a plurality of substantially uniform droplets prior to discharge from the diffusion chamber.

In at least one embodiment, a cap is cooperatively configured in sealing engagement with one of the oppositely disposed ends of the diffusion unit. Furthermore, the cap may be removably attached to the diffusion unit. The cap includes a discharge port disposed in communication with the diffusion chamber such that the fluid dispersion can exit the diffusion chamber and into an airspace surrounding the

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fluid dispersion assembly, while the assembly is in use. In some embodiments, the cap may include a service access port disposed therethrough. The service access port may also include a service access plug removably disposed therein, wherein removal of the service access plug allows for removal, repair, and/or cleaning of the internal components of the fluid dispersion assembly.

The present fluid dispersion assembly, in at least one embodiment, further includes a container interconnect affixed to a different one of the oppositely disposed ends of the diffusion unit which is cooperatively structured to interconnect the diffusion unit to the fluid container in a substantially sealed relationship. In at least one embodiment, a sealing washer is provided to facilitate formation of the substantially sealed relationship, and a drip tube is disposed in an interconnecting relation between the diffusion chamber and the fluid container, in at least one further embodiment, to protect the sealing washer from contact with the operative fluid(s).

In one embodiment, a diffusion assembly is disposed in an operative engagement with the diffusion unit via a cartridge port. The diffusion assembly is removably engaged with the cartridge port, in at least one embodiment. In some embodiments, the cartridge port is disposed directly through the diffusion unit between the oppositely disposed ends. The cartridge port may be oriented on the diffusion unit such that the diffusion assembly is at a substantially perpendicular orientation to the diffusion unit upon engagement therewith. In at least one other embodiment, a cartridge port is disposed through the cap. The diffusion assembly comprises an atomizer assembly, which in one embodiment comprises an inlet channel, a mixing chamber, and an atomizer exhaust channel, wherein the inlet channel is interconnected to the compressed air source and the mixing chamber comprises a fluid inlet disposed in fluid communication with the fluid in the fluid container. Compressed air and fluid are initially mixed together in the mixing chamber to form a fluid dispersion.

These and other objects, features and advantages of the present invention will become clearer when the drawings as well as the detailed description are taken into consideration.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature of the present invention, reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is a cross-sectional elevation illustrative of one embodiment of a fluid dispersion assembly as disclosed in the present specification.

FIG. 2 is a cross-sectional elevation illustrative of another embodiment of a fluid dispersion assembly as disclosed in the present specification.

FIG. 3 is a cross-sectional view illustrative of yet another embodiment of a fluid dispersion assembly as disclosed in the present specification.

FIG. 4 is a plan view illustrative of an embodiment of a fluid dispersion assembly as disclosed in the present invention.

FIG. 5 is a cross-sectional elevation illustrative of one further embodiment of a fluid dispersion assembly in accordance with the present specification.

FIG. 6 is a cross-sectional elevation illustrative of yet another further embodiment of a fluid dispersion assembly in accordance with the present specification.

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Like reference numerals refer to like parts throughout the several views of the drawings.

DETAILED DESCRIPTION

As illustrated in the accompanying figures, and with initial reference to FIGS. 1 and 2, the present invention is directed to a fluid dispersion assembly, generally indicated as **10**, powered by a compressed air source. In at least one embodiment, the fluid dispersion assembly **10** is further structured to operatively engage a fluid container (FC). The fluid dispersion assembly **10** is structured to combine an amount of an operative fluid with compressed air to generate a fluid dispersion.

More in particular, a “fluid dispersion” in accordance with the present specification shall mean a mixture of an operative fluid in air comprising a plurality of substantially uniform droplets of the operative fluid dispersed throughout the air. Further, and once again, as used in the present specification, “substantially uniform droplets” shall mean droplets having substantially the same diameter. In at least one embodiment, the plurality of “substantially uniform droplets” each have a diameter in the range of about one micron (1 μ m), in another embodiment, the diameter of the droplets is in the range of about three microns (3 μ m), and, in one further embodiment, droplet diameter is in the range of about five microns (5 μ m).

The fluid dispersion assembly **10** includes a diffusion unit **100** having oppositely disposed ends, as at **110** and **113**, in at least one embodiment. The diffusion unit **100** at least partially defines a diffusion chamber **112**, and in at least one embodiment, the diffusion chamber **112** is substantially enclosed within diffusion unit **100**. The diffusion unit **100** may be constructed of any rigid material or materials which are chemically inert, or at least chemically resistant to the intended operative fluid(s) which include, but once again are not limited to, fragrant oils, essential oils, essential oil extracts, odor neutralizers, disinfectants, e.g., triethylene glycol, air sanitizers, etc. Further, the material of construction selected for the diffusion unit **100** must be capable of withstanding compressed air at operative pressures, which may range anywhere from about 5 to 50 psig, in most embodiments of the present fluid dispersion assembly **10**. In one lower pressure embodiment, the operating pressure of the present fluid dispersion assembly **10** is in the range of about 5 to 10 psig, and in one further embodiment, the operating pressure is in a range of between about 5 to 7 psig. Conversely, a higher pressure embodiment of the present fluid dispersion assembly **10** operates at pressures in the range of about 20 to 25 psig, and in the range of between about 23 to 24 psig in yet one further embodiment. As such, the material or materials of construction of a diffusion unit **100** in accordance with the present invention may include metals, engineered plastic materials, e.g., polyvinyl chloride, high-density polyethylene, etc., and/or composite materials, just to name a few.

In one embodiment, a cap **130** is cooperatively configured and disposed in a sealing engagement with one of the oppositely disposed ends **110**, **113** of the diffusion unit **100**. The cap **130** includes a discharge port **132** therethrough in communication with the diffusion chamber **112**, and provides a point of release of the fluid dispersion from the diffusion chamber **112** into the airspace surrounding the fluid dispersion assembly **10**. In at least one embodiment, the cap **130** is removably attached in a sealing engagement to the diffusion unit **100**. FIG. 4 is a plan view of the embodiment of the fluid dispersion assembly **10** as shown in FIGS. 1 and

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2, and shows the cap **130** having a discharge port **132** disposed therethrough. As shown in the embodiment of FIG. 3, the cap **130** may include a service access port **160** disposed therethrough. The service access port **160** includes a service access plug **162** removably disposed therein, wherein removal of the service access plug **162** allows access for removal and cleaning or repair of a diffusion assembly **200**, as disclosed in greater detail below.

The fluid dispersion assembly **10**, in at least one embodiment, includes a container interconnect **140** which is cooperatively structured to interconnect the diffusion unit **100** to the fluid container (FC) in a substantially sealed relationship. In one embodiment, the container interconnect **140** is disposed at a different one of the oppositely disposed ends **110**, **113**, opposite of cap **130** of the diffusion unit **100**. A sealing washer **170** is disposed between the diffusion unit **100** and the fluid container (FC), in at least one embodiment, so as to provide a substantially sealed relationship between the diffusion unit **100** and the fluid container (FC). The sealing washer **170** may be constructed from any of a variety of materials such as, but not limited to, rubber, nylon, plastic, PVC, TEFLON, or a composite material, once again, provided the material of construction is chemically inert or at least chemically resistant to the operative fluid(s).

In one further embodiment of a fluid dispersion assembly **10** in accordance with the present invention, a drip tube **120** is disposed in an interconnecting relation between the diffusion unit **100** and the fluid container (FC). As shown in FIGS. 1 and 2, the drip tube **120** is disposed through a sealing washer **170**, and thus, the drip tube **120** serves to minimize contact between the sealing washer **170** and the operative fluid, by essentially preventing the operative fluid from making contact in and around the sealing washer **170** disposed between the fluid container (FC) and the container interconnect **140**. More in particular, the drip tube **120** channels any operative fluid which may agglomerate and/or accumulate in the diffusion chamber **112** through the drip tube **120** directly back into the fluid container (FC) without contacting the sealing washer **170**, once again, as shown in FIGS. 1 and 2.

The container interconnect **140** may be structured in a variety of ways to allow interconnection to the fluid container (FC). As one example, the container interconnect **140** may be threaded, internally or externally, such that the diffusion unit **100** is interconnected to the fluid container (FC) by screwing the container interconnect **140** into place onto corresponding threads on the neck of the fluid container (FC). In at least one other embodiment, the container interconnect **140** comprises one portion of a quick-connect type fitting and the fluid container (FC) comprises a complementary portion of such a quick-connect type fitting whereby once operatively engaged, a substantially sealed relationship is created between the diffusion unit **100** and the fluid container (FC). In at least some embodiments, the substantially sealed relationship is further enhanced by a sealing washer **170**, as disclosed above.

In at least one embodiment, a cartridge port **150** is provided into the diffusion chamber **112** to facilitate operative engagement of a diffusion assembly **200** with the diffusion chamber **112**. The diffusion assembly **200** may be removably engaged with the cartridge port **150** to aid in removal and replacement and/or cleaning of the diffusion assembly **200** and/or components thereof. In some embodiments, the cartridge port **150** is disposed directly through the diffusion unit **100** and into the diffusion chamber **112**, and is positioned between the oppositely disposed ends **110**, **113**. In at least one embodiment, the cartridge port **150** is

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disposed on the diffusion unit **100** such that the diffusion assembly **200** is disposed in a substantially perpendicular orientation relative to the diffusion unit **100** when operatively engaging the cartridge port **150**, such as is shown in the illustrative embodiment of FIG. 1. The diffusion assembly **200** is also shown disposed substantially perpendicular to the diffusion unit **100** in the plan view of FIG. 4. In at least one other embodiment, the cartridge port **150** is disposed through the cap **130**. In yet another embodiment, the diffusion assembly **200** comprises an integral component of the cap **130** itself, such as in the embodiment of FIG. 3.

As illustrated in FIGS. 1 and 3, the diffusion assembly **200** comprises an air inlet **210** and an atomizer assembly **220**. The atomizer assembly **220** comprises an atomizer air inlet channel **222**, a mixing chamber **226**, and an atomizer exhaust channel **228**. The atomizer air inlet channel **222** is interconnected to the compressed air source via the air inlet **210**. Moreover, the atomizer air inlet channel **222** may also include an inlet aperture **223**, a first portion **224** and a second portion **225**. The first portion **224** and the second portion **225** are collectively structured to facilitate delivery of compressed air into the mixing chamber **226**. The first portion **224** of the atomizer air inlet channel **222** may comprise a larger diameter than the second portion **225**, such as is shown in the illustrative embodiment of FIG. 1. Of course, it is within the scope and intent of the present invention for the atomizer air inlet channel **222** to comprise a constant diameter along its entire length, i.e., a diameter of a first portion **224** is substantially equal to a diameter of a second portion **225**.

Further, the mixing chamber **226** comprises a fluid inlet **227** disposed in fluid communication with an operative fluid in the fluid container (FC) via a fluid delivery tube **300**. The fluid delivery tube **300** is disposed in a fluid communicating relation between the atomizer assembly **220** and the fluid container (FC) to facilitate delivery of an amount of the operative fluid into the atomizer assembly **220**. In at least one embodiment, the fluid delivery tube **300** connects to the atomizer assembly **220** via the fluid inlet **227** into the mixing chamber **226**.

As shown in FIGS. 1 and 2, the fluid inlet **227** is substantially perpendicular to a compressed air flowpath through the atomizer assembly **200**. More in particular, and with reference to FIG. 1, the compressed air flowpath extends horizontally through the air inlet **210**, atomizer air inlet channel **222**, mixing chamber **226**, and out through the atomizer exhaust **228**.

As such, when compressed air is supplied to the diffusion assembly **200**, a corresponding amount of operative fluid is drawn into the mixing chamber **226** through the fluid delivery tube **300** as a result of the venturi effect of the compressed air flowing past the opening of the fluid inlet **227** into the mixing chamber **226**. More in particular, at each different compressed air flowrate, i.e., each "predetermined amount" of compressed air which is dictated and fixed by a compressed air operating pressure supplied to diffusion assembly **200**, a different corresponding and substantially constant amount, i.e., a "preselected amount" of an operative fluid corresponding to each different predetermined amount of compressed air, will be drawn into the mixing chamber **226**. More importantly, the "predetermined amount" of compressed air and the "preselected amount" of the operable fluid are initially mixed together in the mixing chamber **226** to form a fluid dispersion. The diffusion chamber **112** is further structured to facilitate the formation of a plurality of

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substantially uniform droplets, as defined herein, in the fluid dispersion prior to discharge from the diffusion chamber **112** through discharge port **132**.

As illustrated in FIGS. 1 and 2, the fluid dispersion assembly **10** also includes a suppressor assembly **230** disposed in communication with the diffusion assembly **200**. The suppressor assembly **230** comprises a suppression chamber **232**, disposed in a communicating relation with the atomizer exhaust channel **228** of the atomizer assembly **220**. More in particular, the suppression chamber **232** receives the fluid dispersion from the mixing chamber **226**. The suppressor assembly **230** helps to suppress the noise generated during operation of the fluid dispersion assembly **10** as it disrupts the path of flow of the fluid dispersion out of the atomizer assembly **200** and into diffusion chamber **112**, and therefore, disrupts and dampens the sound waves associated therewith. Further, the walls of the suppressor assembly **230** itself serve to absorb and dampen the sound waves generated by the flow of the fluid dispersion out of the mixing chamber **236** through atomizer exhaust channel **238**.

The suppressor assembly **230** may also include a suppressor discharge port **234** to facilitate transfer of the fluid dispersion from the suppressor chamber **232** into the diffusion chamber **112**. In at least one embodiment, such as is shown in FIG. 1, the suppressor discharge port **234** is located through a low point in the suppressor chamber **232**. Of course, as shown in the alternative embodiment of FIG. 2, the suppressor discharge port **234** is located through the sides of the suppressor chamber **232**.

FIG. 5 is illustrative of an alternative embodiment of a fluid dispersion assembly **10**, wherein a modified diffusion chamber **112'** is configured to suppress and/or dampen sound waves generated during operation, similar to the suppressor assembly **230** disclosed above. However, as will be appreciated from the following disclosure, the diffusion chamber **112'** of the embodiment of FIG. 5 serves to suppress sound waves generated during operation without the need for a separate suppression chamber, as in previously disclosed embodiments.

Before addressing the modified diffusion chamber **112'** of the embodiment of FIG. 5, it is noted that, in many respects, the fluid dispersion assembly **10** of FIG. 5 is similar to the previously disclosed embodiments herein. To begin, the fluid dispersion assembly **10** of FIG. 5 comprises a diffusion unit **100** having oppositely disposed ends **110**, **113**, and a diffusion chamber **112'** disposed therebetween. Unlike previously disclosed embodiments, however, the fluid dispersion assembly **10** of FIG. 5 includes a service access port **160** having a removable service access plug **162** disposed directly through one end **113** of the diffusion unit **100**, rather than through a separate cap disposed at one end of the unit **100**.

The fluid dispersion assembly **10** of FIG. 5 further comprises a container interconnect **140** cooperatively structured to interconnect the diffusion unit **100** to a fluid container (FC) in a substantially sealed relationship and, as before, a sealing washer **170** is provided to maintain a substantially sealed relationship.

A cartridge port **150** is disposed through one side of the diffusion unit **100**, in the illustrative embodiment of FIG. 5, and a diffusion assembly **200** is operatively positioned therethrough and into fluid communication with diffusion chamber **112'**, as in previously disclosed embodiments. The diffusion cartridge **200** includes an air inlet **210** disposed in communication with an atomizer assembly **220**. Further, and as in previously disclosed embodiments, when compressed air is supplied to the diffusion assembly **200**, and more in

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particular, atomizer assembly 220, through air inlet 210, a corresponding amount of fluid is drawn into a mixing chamber 226 from the fluid container (FC) through a fluid delivery tube 300, as a result of the venturi effect of compressed air flowing past the opening of a fluid inlet 227 into the mixing chamber 226. As a result, a fluid dispersion is formed and discharged from the atomizer assembly 220 through atomizer exhaust channel 228, and directly into diffusion chamber 112'.

As noted above, and as may be seen with reference to FIG. 5, the diffusion chamber 112' of the present embodiment comprises a modified configuration. Specifically, the modified diffusion chamber 112' comprises an upside down L-shaped configuration, wherein a first axial portion 114 of the diffusion chamber 112' is disposed in a substantially axial orientation adjacent and relative to the discharge of the atomizer exhaust channel 228. A second transverse portion 115 of the diffusion chamber 112' is disposed in a substantially downwardly directed orientation, as shown in FIG. 5, substantially transverse or perpendicular to the direction of flow from atomizer exhaust channel 228.

The second or transverse portion 115 of the modified diffusion chamber 112', in at least one embodiment, comprises a fluid return lip 116 disposed at a lower end thereof in a surrounding relation to incoming fluid delivery tube 300. The fluid return lip 116, in at least one embodiment, extends downwardly and outwardly from the walls of the second portion 115 of the diffusion chamber 112', such that any liquid which coalesces in the diffusion chamber 112' along the walls thereof, will be directed into drip tube 120, disposed in an abutting relation along the underside of the fluid return lip 116, and back into fluid container (FC).

More importantly, the fluid dispersion discharged from the atomizer assembly 220 through atomizer exhaust channel 228 into diffusion chamber 112' is interrupted and redirected by virtue of axial portion 114 and transverse portion 115 therein. The interruption and redirection of flow in the modified diffusion chamber 112' during operation of the fluid dispersion assembly 10 in accordance with the present embodiment, serves to suppress or dampen sound waves generated therein, in a similar manner as the suppression chamber 232 of previously disclosed embodiments. Further, the restricted discharge from the transverse portion 115 of the modified diffusion chamber 112' may serve to further suppress or dampen sound waves, thus reducing the noise generated during operation to an even greater extent.

After being discharged from the diffusion chamber 112', the fluid dispersion enters the freeboard above the liquid in the fluid container (FC), the freeboard serving as a quasi-diffusion chamber prior to final discharge of the fluid dispersion from the diffusion unit 100. A discharge chamber 117 is disposed in fluid communication with the freeboard of the fluid container (FC), such that the fluid dispersion can pass therethrough, into a discharge head 118 and out through discharge channel 119 into the airspace surrounding the fluid dispersion assembly 10, as shown in the illustrative embodiment of FIG. 5.

Turning next to the illustrative embodiment of FIG. 6, the present invention is directed to yet another embodiment of a diffusion unit 100 of a fluid dispersion assembly 10 which is also powered by a compressed air source (not shown). In at least one embodiment, the fluid dispersion assembly 10 is further structured to operatively engage a fluid container, and to combine an amount of an operative fluid with compressed air to generate a fluid dispersion.

As before, a "fluid dispersion" in accordance with the present invention shall mean a mixture of an operative fluid

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in air comprising a plurality of substantially uniform droplets of the operative fluid dispersed throughout the air. Further, and once again, as used in the present specification, "substantially uniform droplets" shall mean droplets having substantially the same diameter. In at least one embodiment, the plurality of "substantially uniform droplets" each have a diameter in the range of about one micron (1 μm), in another embodiment, the diameter of the "substantially uniform droplets" is in the range of about three microns (3 μm), and, in one further embodiment, the plurality of "substantially uniform droplets" each have a diameter in the range of about five microns (5 μm). In another embodiment, the plurality of "substantially uniform droplets" comprise a diameter in a range of about 2 to 3 microns, and in yet one further embodiment, the plurality of "substantially uniform droplets" comprise a diameter in a range of about 2.3 to 3 microns.

In at least one embodiment, a diffusion unit 100 comprises oppositely disposed ends, as at 110 and 113. Further, a diffusion unit 100 at least partially defines a diffusion chamber 112", and in at least one embodiment, the diffusion chamber 112" is substantially enclosed within diffusion unit 100. As before, the diffusion unit 100 may be constructed of any rigid material or materials which are chemically inert, or at least chemically resistant to the intended operative fluid(s) which include, but once again are not limited to, fragrant oils, essential oils, essential oil extracts, odor neutralizers, disinfectants, e.g., triethylene glycol, air sanitizers, etc.

Further, the material of construction selected for the diffusion unit 100 must be capable of withstanding compressed air at operative pressures, which may range anywhere from about 5 to 50 psig, in most embodiments of the present fluid dispersion assembly 10. In one lower pressure embodiment, the operating pressure of the present fluid dispersion assembly 10 is in the range of about 5 to 10 psig, and in one further embodiment, the operating pressure is in a range of about 5 to 7 psig. Conversely, a higher pressure embodiment of the present fluid dispersion assembly 10 operates at pressures in the range of about 20 to 25 psig, and in the range of about 23 to 24 psig in yet one further embodiment. As such, the material or materials of construction of a diffusion unit 100 in accordance with the present invention may include metals, engineered plastic materials, e.g., polyvinyl chloride, high-density polyethylene, etc., and/or composite materials, just to name a few.

In one embodiment, a cap 130 is cooperatively configured and disposed in a sealing engagement with one of the oppositely disposed ends 110, 113 of the diffusion unit 100. The cap 130 includes a discharge port 132 therethrough in communication with the diffusion chamber 112", and provides a point of release of a fluid dispersion from the diffusion chamber 112" into the airspace surrounding the fluid dispersion assembly 10. In at least one embodiment, the cap 130 is removably attached in a sealing engagement to the diffusion unit 100.

The fluid dispersion assembly 10, in at least one embodiment, includes a container interconnect 140 which is cooperatively structured to interconnect the diffusion unit 100 to a fluid container in a substantially sealed relationship. In one embodiment, the container interconnect 140 is disposed at a different one of the oppositely disposed ends 110, 113, opposite of the cap 130 of the diffusion unit 100. A sealing washer 170 is disposed between the diffusion unit 100 and the fluid container, in at least one embodiment, so as to provide a substantially sealed relationship between the diffusion unit 100 and the fluid container (not shown). The sealing washer 170 may be constructed from any of a variety

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of materials such as, but not limited to, rubber, nylon, plastic, PVC, TEFLON, or a composite material, once again, provided the material of construction is chemically inert or at least chemically resistant to the operative fluid(s).

In one further embodiment of a fluid dispersion assembly 10 in accordance with the present invention, a drip tube 120 is disposed in an interconnecting relation between the diffusion unit 100 and the fluid container. As shown in FIG. 6, the drip tube 120 is disposed through a sealing washer 170, and thus, the drip tube 120 serves to minimize contact between the sealing washer 170 and the operative fluid, by essentially preventing the operative fluid from making contact in and around the sealing washer 170 disposed between the fluid container (not shown) and the container interconnect 140. More in particular, the drip tube 120 channels any operative fluid which may agglomerate and/or accumulate in the diffusion chamber 112" through the drip tube 120 directly back into the fluid container (not shown) without contacting the sealing washer 170, once again, as shown in FIG. 6.

As before, the container interconnect 140 may be structured in a variety of ways to allow interconnection to the fluid container. As one example, the container interconnect 140 may be threaded, internally or externally, such that the diffusion unit 100 is interconnected to the fluid container by screwing the container interconnect 140 into place onto corresponding threads on the neck of the fluid container. In at least one other embodiment, the container interconnect 140 comprises one portion of a quick-connect type fitting and the fluid container comprises a complimentary portion of such a quick-connect type fitting whereby once operatively engaged, a substantially sealed relationship is created between the diffusion unit 100 and the fluid container. In at least some embodiments, the substantially sealed relationship is further enhanced by a sealing washer 170, as disclosed above.

In at least one embodiment, a cartridge port 150 is provided into the diffusion chamber 112" to facilitate operative engagement of a diffusion assembly 200 with the diffusion chamber 112". The diffusion assembly 200 may be removably engaged with the cartridge port 150 to aid in removal and replacement and/or cleaning of the diffusion assembly 200 and/or components thereof. As shown in the illustrative embodiment of FIG. 6, the cartridge port 150 is disposed directly through the diffusion unit 100 and into the diffusion chamber 112", and is positioned between the oppositely disposed ends 110, 113. In accordance with the illustrative embodiment of FIG. 6, the cartridge port 150 is disposed on the diffusion unit 100 such that the diffusion assembly 200 is disposed in a substantially perpendicular orientation relative to the diffusion unit 100 when operatively engaging the cartridge port 150. As further illustrated in the embodiment of FIG. 6, while operatively disposed in the diffusion chamber 112", the diffusion assembly 200 is disposed between the upper chamber 115" and the lower chamber 114" of the diffusion chamber 112". In at least one other embodiment, the cartridge port 150 is disposed through the cap 130. In yet another embodiment, the diffusion assembly 200 comprises an integral component of the cap 130 itself.

As illustrated in FIG. 6, the diffusion assembly 200 comprises an air inlet 210 and an atomizer assembly 220. The atomizer assembly 220 comprises an atomizer air inlet channel 222, a mixing chamber 226, and an atomizer exhaust aperture 228". The atomizer air inlet channel 222 is interconnected to the compressed air source via the air inlet 210. Moreover, the atomizer air inlet channel 222 includes

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an inlet aperture 223 and an outlet aperture 223", as may be seen in FIG. 6. As may also be seen in the illustrative embodiment of FIG. 6, the inlet aperture 223 and outlet aperture 223" are substantially equal in diameter, as is the channel 223' disposed therebetween.

Further, the mixing chamber 226 comprises a fluid inlet 227 disposed in fluid communication with an operative fluid in the fluid container via a fluid delivery tube 300. The fluid delivery tube 300 is disposed in a fluid communicating relation between the atomizer assembly 220 and the fluid container to facilitate delivery of an amount of the operative fluid into the atomizer assembly 220. In at least one embodiment, the fluid delivery tube 300 connects to the atomizer assembly 220 via the fluid inlet 227 into the mixing chamber 226.

As shown in FIG. 6, the fluid inlet 227 is substantially perpendicular to a compressed air flowpath through the atomizer assembly 200. More in particular, and with reference to FIG. 6, the compressed air flowpath extends horizontally through the air inlet 210, atomizer air inlet channel 222, inlet aperture 223, channel 223', and outlet aperture 223", into mixing chamber 226, and out through the atomizer exhaust aperture 228".

As such, when compressed air is supplied to the diffusion assembly 200, a corresponding amount of operative fluid is drawn into the mixing chamber 226 through the fluid delivery tube 300 as a result of the venturi effect of the compressed air flowing over the opening of the fluid inlet 227 into the mixing chamber 226. More in particular, at each different compressed air flowrate, i.e., each "predetermined amount" of compressed air which is dictated and fixed by a compressed air operating pressure supplied to diffusion assembly 200, a different corresponding and substantially constant amount, i.e., a "preselected amount" of an operative fluid corresponding to each different predetermined amount of compressed air, will be drawn into the mixing chamber 226. More importantly, the "predetermined amount" of compressed air and the "preselected amount" of the operable fluid are initially mixed together in the mixing chamber 226 to form a fluid dispersion. The diffusion chamber 112" is further structured to facilitate the formation of a plurality of substantially uniform droplets, as defined hereinabove, in the fluid dispersion prior to discharge from the diffusion chamber 112" through discharge port 132.

FIG. 6 is illustrative of an alternative embodiment of a diffusion unit 100 having a modified diffusion chamber 112". More in particular, the modified diffusion chamber 112" is configured to suppress and/or dampen sound waves generated during operation, similar to the suppressor assembly 230 disclosed above. However, as will be appreciated from the following, the modified diffusion chamber 112" of the embodiment of FIG. 6 serves to suppress sound waves generated during operation without the need for a separate suppression chamber, as in previously disclosed embodiments.

As noted above, and as may be seen with reference to FIG. 6, the diffusion chamber 112" of the present embodiment comprises a modified configuration. Specifically, the modified diffusion chamber 112" comprises a lower chamber 114" which is disposed below and adjacent to the discharge of a fluid dispersion through the atomizer exhaust aperture 228". An upper chamber 115" of the diffusion chamber 112" is disposed above the diffusion assembly 200, as shown in FIG. 6, substantially opposite to the direction of flow of a fluid dispersion from atomizer exhaust aperture 228".

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More importantly, the fluid dispersion discharged from the atomizer assembly 220 through atomizer exhaust aperture 228" into diffusion chamber 112" is interrupted and redirected by virtue of lower chamber 114" and upper chamber 115" therein. The interruption and redirection of flow in the modified diffusion chamber 112" during operation of the fluid dispersion assembly 10 in accordance with the present embodiment, serves to suppress or dampen sound waves generated therein, much like the suppression chamber 232 of previously disclosed embodiments. Further, the restricted discharge from the upper chamber 115" of the modified diffusion chamber 112" serves to further suppress or dampen sound waves, thus reducing the noise generated during operation to an even greater extent.

After being discharged from the mixing chamber 226 through the atomizer exhaust aperture 228", the fluid dispersion is at least partially deflected into the freeboard above the liquid in the fluid container, the freeboard serving as a quasi-diffusion chamber prior to final discharge of the fluid dispersion from the diffusion unit 100 through discharge port 132 and into the airspace surrounding the fluid dispersion assembly 10. A portion of the fluid dispersion is also deflected against the bottom surface of the lower chamber 114" of the modified diffusion chamber 112" and upwardly into the upper chamber 115" of the modified diffusion chamber 112" before being discharged through discharge port 132 into the airspace surrounding the fluid dispersion assembly 10.

It is further envisioned that at least one embodiment of the fluid dispersion assembly 10 of the present invention is operated via a programmable timer to control a fragrance intensity and character in an airspace by metering the fragrance delivered in an enclosed environment. The fluid dispersion assembly 10 delivers a specific amount of a fragrance, i.e., the delivery rate, based upon such factors as the specific physical configuration of the atomizer assembly 220 and the fluid container (FC)/fluid delivery tube 300, the pressure and volume of the compressed air supplied into air inlet 210, as well as the physical properties of the fragrance itself, such as, viscosity, surface tension, vapor pressure, etc., wherein the delivery rate is measured in grams per minute of a fragrance dispersed. The perceived fragrance intensity in a specific airspace is measured from a sensory point of view using a labeled magnitude scale. The data is directly correlated to the amount of fragrance delivered and may be measured in either grams per liter or grams per cubic meter. Since the delivery rate is fixed, fragrance intensity is controlled by cycling the fluid dispersion assembly 10 through an on/off programming cycle every minute to deliver the intensity and character levels that are desired by a user. The optimization process is a function of dosing time per minute and a user's desired fragrance experience.

Since many modifications, variations and changes in detail can be made to the described preferred embodiment of the invention, it is intended that all matters in the foregoing description and shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense. Thus, the scope of the invention should be determined by the appended claims and their legal equivalents.

Now that the invention has been described,

What is claimed is:

1. A fluid dispersion assembly operatively engages a container of an operative fluid and a compressed air source and generates and discharges a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:

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a diffusion unit at least partially defining an enclosed diffusion chamber, wherein said diffusion chamber comprises an upper chamber and a lower chamber, a discharge port disposed in fluid communication between said diffusion chamber and the surrounding airspace, a diffusion assembly disposed in an operative engagement with said diffusion unit, wherein said diffusion assembly comprises an atomizer assembly, said diffusion assembly is disposed between said upper chamber and said lower chamber, said atomizer assembly comprising an atomizer air inlet channel, a fluid inlet, a mixing chamber, and an atomizer exhaust aperture, and said atomizer air inlet channel interconnected to the compressed air source and said fluid inlet disposed in fluid communication with the operative fluid in the container, wherein the compressed air and the operative fluid are mixed together in said mixing chamber to form the fluid dispersion.

2. The fluid dispersion assembly as recited in claim 1 further comprising a cap cooperatively configured and disposed in a sealing engagement with said diffusion unit.

3. The fluid dispersion assembly as recited in claim 1 wherein said atomizer exhaust aperture is disposed in a communicating relation between said mixing chamber and said lower chamber to facilitate transfer of the fluid dispersion therebetween.

4. The fluid dispersion assembly as recited in claim 1 wherein said diffusion chamber facilitates formation of the fluid dispersion prior to discharge of the fluid dispersion from said diffusion chamber through said discharge port and into the surrounding airspace.

5. A fluid dispersion assembly is operatively interconnected to a container of an operative fluid and a compressed air source to generate and discharge a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:

a diffusion unit at least partially defining a diffusion chamber, wherein said diffusion chamber comprises an upper chamber and a lower chamber,

a discharge port disposed in fluid communication between said diffusion chamber and the surrounding airspace, and

a diffusion assembly disposed in an operative engagement with said diffusion unit, wherein said diffusion assembly comprises an atomizer assembly, said diffusion assembly is disposed between said upper chamber and said lower chamber.

6. The fluid dispersion assembly as recited in claim 5 wherein said atomizer assembly comprising an atomizer air inlet channel, a fluid inlet, a mixing chamber, and an atomizer exhaust aperture.

7. The fluid dispersion assembly as recited in claim 6 wherein said atomizer air inlet channel is interconnected to the compressed air source and said fluid inlet disposed in fluid communication with the operative fluid in the container, wherein the compressed air and the operative fluid are mixed together in said mixing chamber to form the fluid dispersion.

8. The fluid dispersion assembly as recited in claim 7 wherein said diffusion chamber facilitates formation of the fluid dispersion prior to discharge of the fluid dispersion from said diffusion chamber through said discharge port and into the surrounding airspace.

9. The fluid dispersion assembly as recited in claim 5 further comprising a container interconnect operatively interconnecting said diffusion unit to the container, wherein

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said container interconnect comprises a sealing washer disposed between said diffusion unit and the container.

10. The fluid dispersion assembly as recited in claim **9** further comprising a drip tube, said drip tube disposed in an interconnecting relation between said diffusion chamber and the container through said sealing washer, wherein said drip tube minimizes contact between said sealing washer and the operative fluid.

11. A fluid dispersion assembly interconnects to a container of an operative fluid and a compressed air source and generates and discharges a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:

a diffusion unit having an enclosed diffusion chamber, said diffusion chamber comprising oppositely disposed portions therein,

said diffusion chamber comprises an upper chamber and a lower chamber,

a diffusion assembly disposed in an operative engagement with said diffusion unit between said upper chamber and said lower chamber,

said diffusion assembly comprises an atomizer assembly having an atomizer exhaust aperture,

said lower chamber disposed below and adjacent said atomizer exhaust aperture, and

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said diffusion chamber structured to facilitate formation of the fluid dispersion prior to discharge of the fluid dispersion from said diffusion chamber, wherein the fluid dispersion discharged from said atomizer exhaust aperture into said diffusion chamber is interrupted and redirected in said lower chamber, thereby dampening sound waves generated during operation of said fluid dispersion assembly.

12. The fluid dispersion assembly as recited in claim **11** wherein said atomizer assembly further comprises an atomizer air inlet channel, a fluid inlet, and a mixing chamber.

13. The fluid dispersion assembly as recited in claim **12** wherein said atomizer air inlet channel is interconnected to the compressed air source and said fluid inlet is disposed in fluid communication with the preselected fluid in the container, wherein the compressed air and the preselected fluid are mixed together in said mixing chamber to form the fluid dispersion.

14. The fluid dispersion assembly as recited in claim **11** further comprising a drip tube.

15. The a fluid dispersion assembly as recited in claim **14** wherein said drip tube is disposed to direct coalesced fluid from the diffusion chamber back into the container of operative fluid.

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Levy et al.

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(45) **Date of Patent:** ***Dec. 27, 2016**

(54) **FLUID DISPERSION ASSEMBLY** USPC 239/427, 337, 338, 426, 433
See application file for complete search history.

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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(21) Appl. No.: **14/844,650**

Primary Examiner — Davis Hwu

(22) Filed: **Sep. 3, 2015**

(74) *Attorney, Agent, or Firm* — Malloy & Malloy, P.L.

Related U.S. Application Data

(63) Continuation of application No. 13/838,364, filed on Mar. 15, 2013, now Pat. No. 9,126,215.

(60) Provisional application No. 61/694,500, filed on Aug. 29, 2012.

(51) **Int. Cl.**
B05B 7/06 (2006.01)
B05B 7/24 (2006.01)
B05B 15/04 (2006.01)
A61L 9/14 (2006.01)

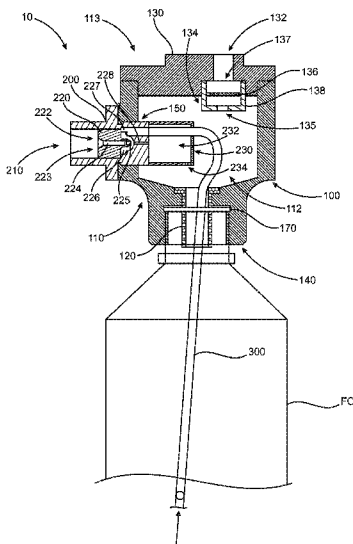
(52) **U.S. Cl.**
CPC **B05B 7/2494** (2013.01); **A61L 9/14** (2013.01); **B05B 7/2491** (2013.01); **B05B 15/0406** (2013.01)

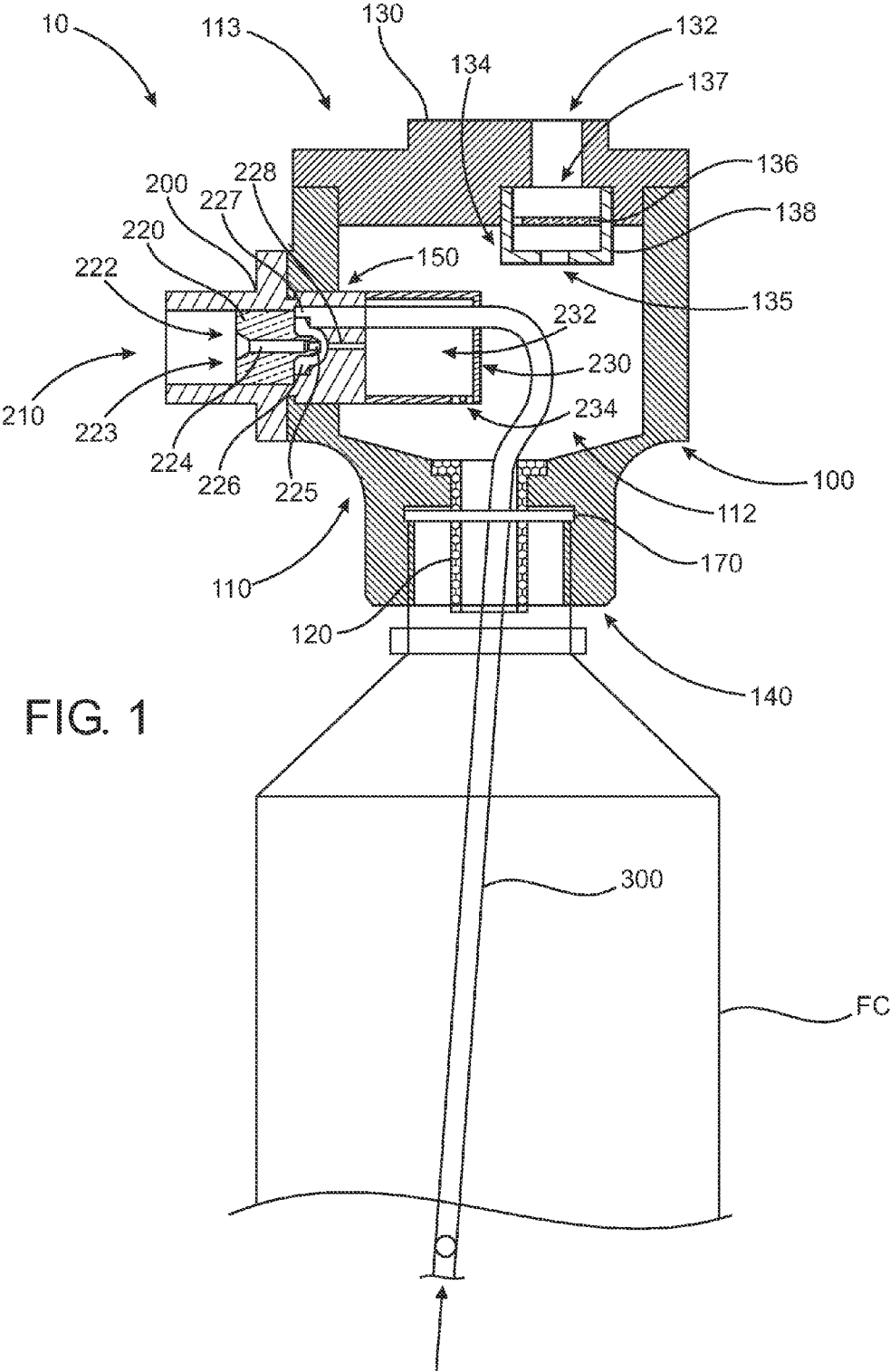
(58) **Field of Classification Search**
CPC B05B 1/08; B05B 11/3042; B05B 7/066; B05B 7/2491; B05B 17/0646; B05B 17/04

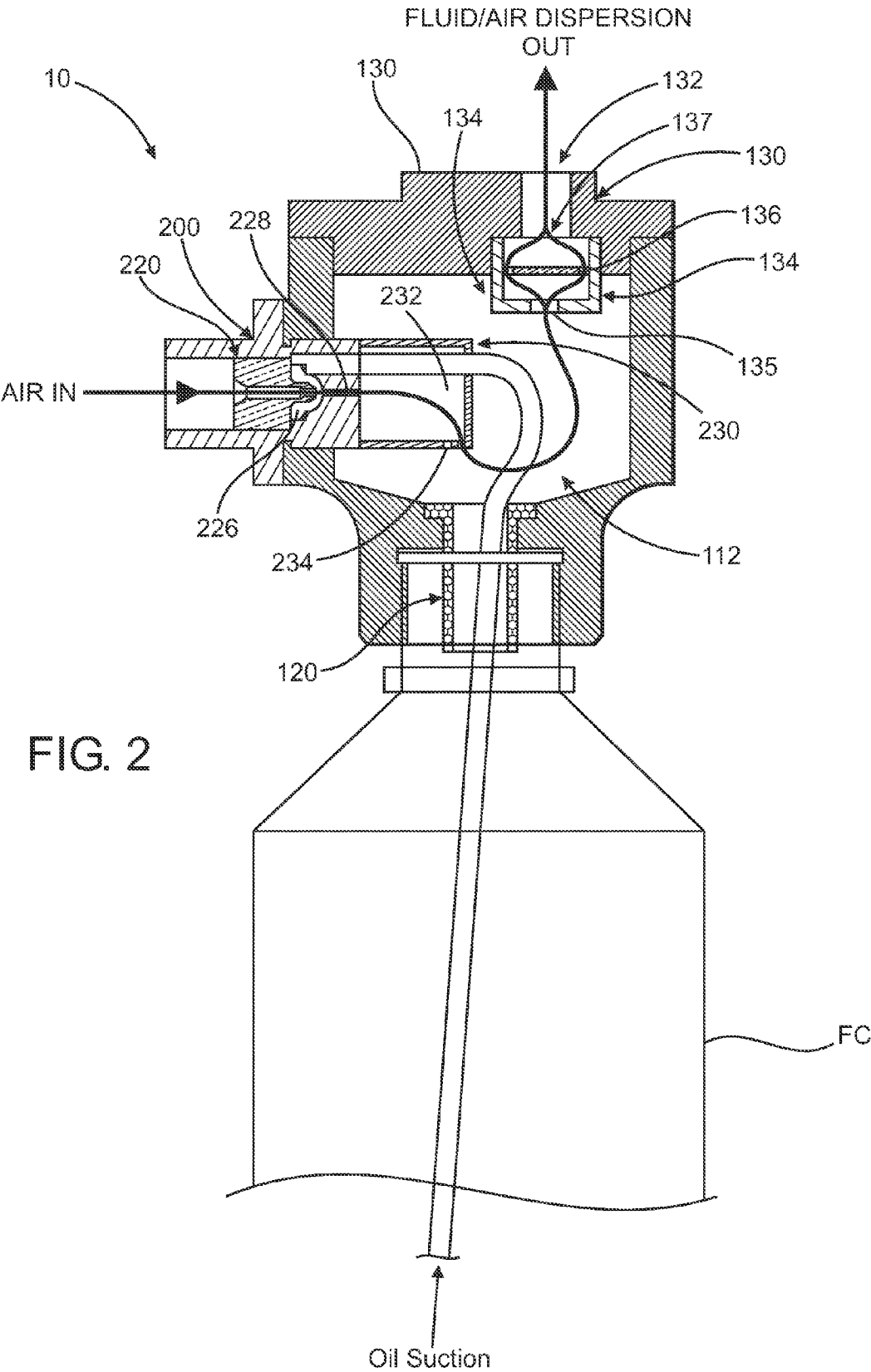
(57) **ABSTRACT**

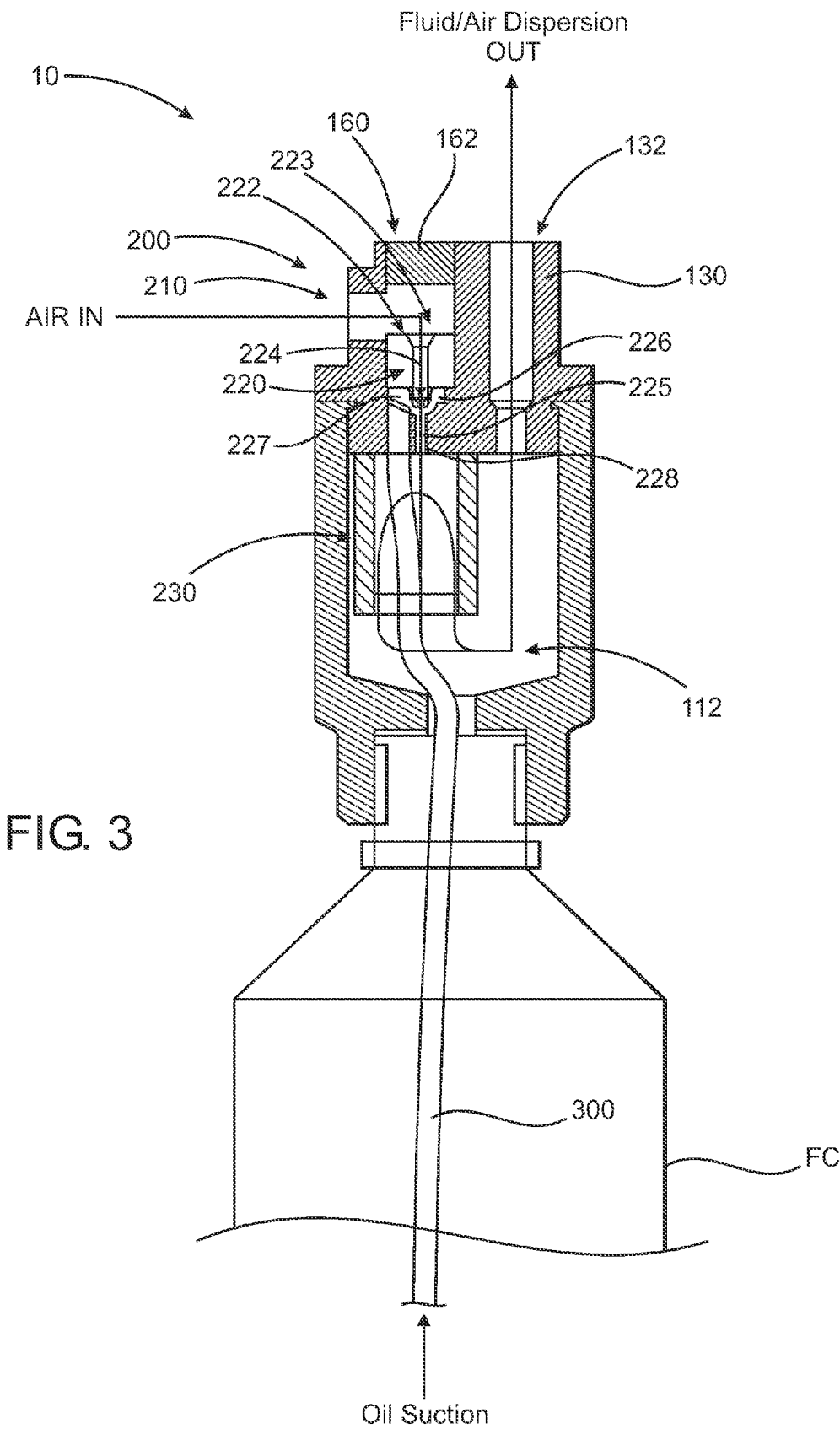
A fluid dispersion assembly comprises a diffusion unit disposed in fluid communication with a fluid container, the assembly being powered by a compressed air source. The diffusion unit at least partially defines a diffusion chamber, and includes a diffusion assembly containing an atomizer assembly which, in combination with the diffusion chamber, generates a fluid dispersion from a mixture of compressed air and an operative fluid, for example, fragrant oils, essential oils, odor neutralizers, disinfectants such as triethylene glycol, air sanitizers, etc. The diffusion unit may include a suppressor assembly and/or a silencer assembly to reduce the amount of noise generated during operation. In one alternate embodiment, a modified diffusion chamber is provided which functions as a suppression chamber, thereby reducing the noise generated during operation of the assembly.

20 Claims, 5 Drawing Sheets









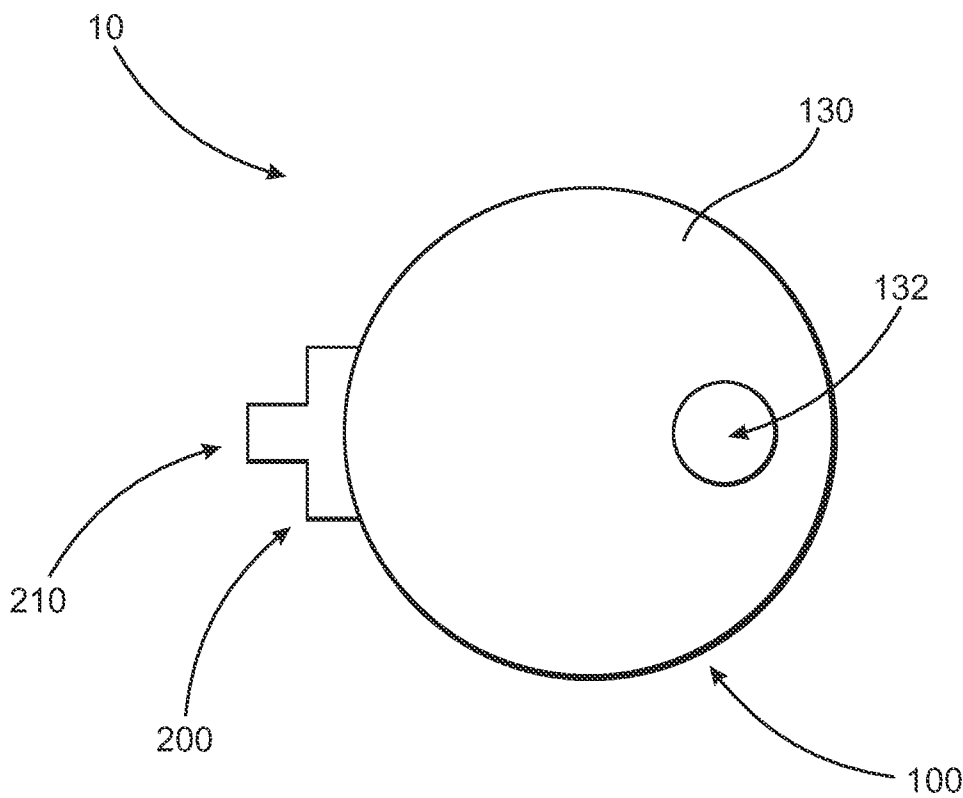


FIG. 4

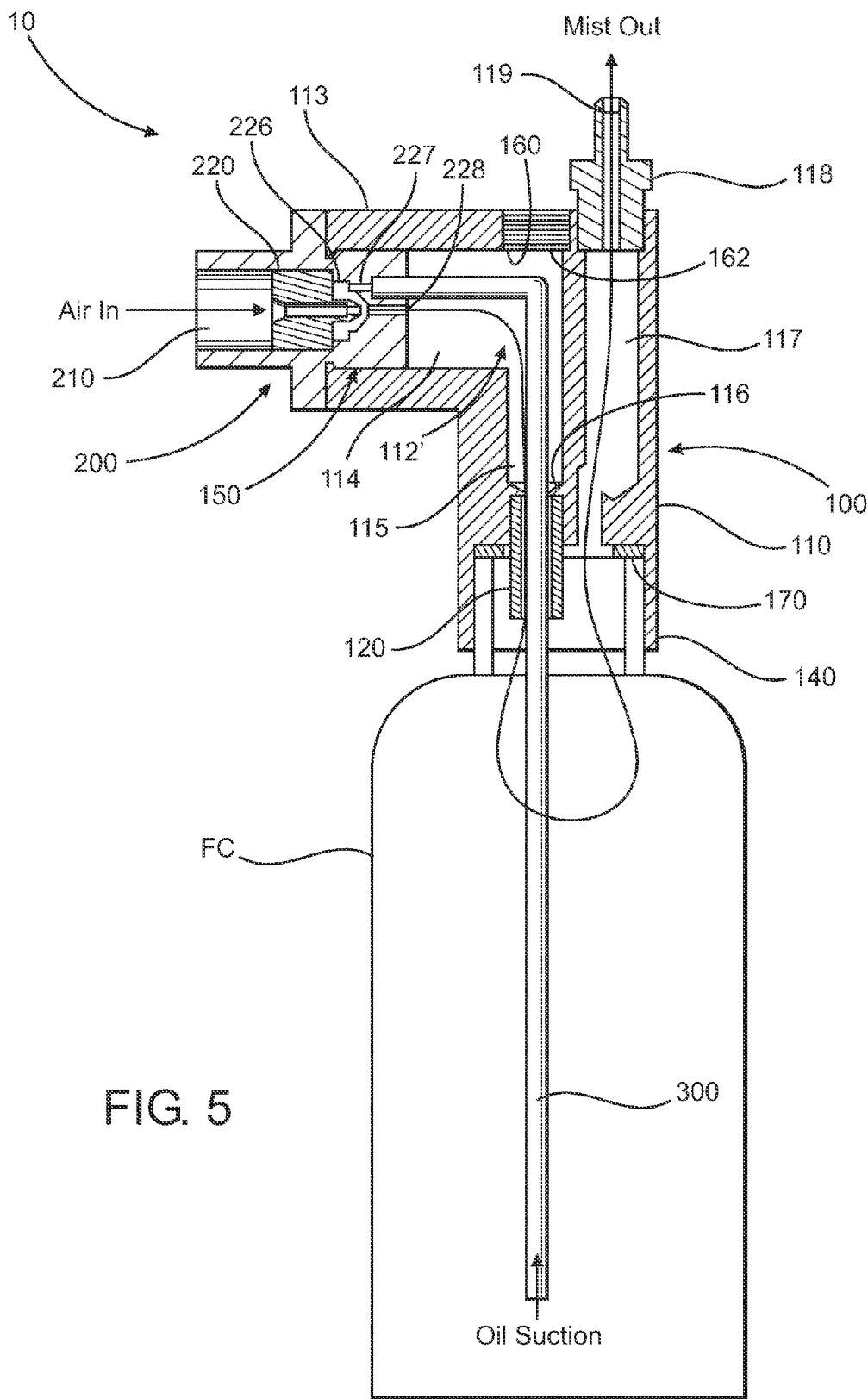


FIG. 5

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FLUID DISPERSION ASSEMBLY

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates generally to the field of dispersion of various fluids including, but not limited to, fragrant oils, essential oils, odor neutralizers, disinfectants, e.g., triethylene glycol, air sanitizers, and the like, into a generally enclosed airspace.

Description of the Related Art

There are various devices that can be used to deliver fragrant oils, essential oils, as well as other fluids into the air. Spray cans are commonly used, however, such devices require a user to repeatedly and manually spray when and where necessary. Plug-in devices that heat oils for dispersion into the air are also commonly used, but they require constant heating of the oil via an electrical outlet, which consumes energy and poses a potential fire hazard.

Fluid diffusion devices utilizing forced and/or compressed air for delivery of fragrant oils, essential oils, or other liquids are desirable alternatives to spray cans and plug-in devices since they do not require heating or constant user interaction, however, they have drawbacks as well. One drawback of many known fluid diffusion devices utilizing forced air is that they tend to make an undesirable and often, depending on the location, such as an office or other place of business, a disruptive amount of noise when in operation. In particular, the release of a fluid dispersed in the forced and/or compressed air from such a device is often unacceptably noisy.

As such, there is a need for a fluid dispersion assembly that is designed to significantly reduce the amount of noise generated during operation. A further need exists for such a fluid dispersion assembly to not only operate more quietly, but to operate quietly while generating a fluid dispersion in air having a uniform particle size distribution, such that dosing of an airspace with a particular liquid, whether it be oil, sanitizer, disinfectant, etc., can be predicted within acceptable limits.

SUMMARY OF THE INVENTION

The present invention addresses the need for a forced air diffusion and dispersion assembly for fluids such as fragrant oils, essential oils, odor neutralizers, disinfectants, air sanitizers, etc., that significantly reduces the amount of noise generated during operation. In at least one embodiment, the present invention is directed to a fluid dispersion assembly which operatively engages a fluid container, and is powered by a compressed air source. The fluid dispersion assembly includes a diffusion unit having oppositely disposed ends, which at least partially defines a diffusion chamber. The diffusion chamber is structured so as to facilitate formation of a fluid dispersion comprising a plurality of substantially uniform droplets prior to discharge from the diffusion chamber.

In at least one embodiment, a cap is cooperatively configured in sealing engagement with one of the oppositely disposed ends of the diffusion unit. Furthermore, the cap may be removably attached to the diffusion unit. The cap includes a discharge port disposed in communication with the diffusion chamber such that the fluid dispersion can exit the diffusion chamber and into an airspace surrounding the fluid dispersion assembly, while the assembly is in use. In some embodiments, the cap may include a service access port disposed therethrough. The service access port may also

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include a service access plug removably disposed therein, wherein removal of the service access plug allows for removal, repair, and/or cleaning of the internal components of the fluid dispersion assembly.

The present fluid dispersion assembly, in at least one embodiment, further includes a container interconnect affixed to a different one of the oppositely disposed ends of the diffusion unit which is cooperatively structured to interconnect the diffusion unit to the fluid container in a substantially sealed relationship. In at least one embodiment, a sealing washer is provided to facilitate formation of the substantially sealed relationship, and a drip tube is disposed in an interconnecting relation between the diffusion chamber and the fluid container, in at least one further embodiment, to protect the sealing washer from contact with the operative fluid(s).

In one embodiment, a diffusion assembly is disposed in an operative engagement with the diffusion unit via a cartridge port. The diffusion assembly is removably engaged with the cartridge port, in at least one embodiment. In some embodiments, the cartridge port is disposed directly through the diffusion unit between the oppositely disposed ends. The cartridge port may be oriented on the diffusion unit such that the diffusion assembly is at a substantially perpendicular orientation to the diffusion unit upon engagement therewith. In at least one other embodiment, a cartridge port is disposed through the cap. The diffusion assembly comprises an atomizer assembly, which in one embodiment comprises an inlet channel, a mixing chamber, and an atomizer exhaust channel, wherein the inlet channel is interconnected to the compressed air source and the mixing chamber comprises a fluid inlet disposed in fluid communication with the fluid in the fluid container. Compressed air and fluid are initially mixed together in the mixing chamber to form a fluid dispersion.

These and other objects, features and advantages of the present invention will become clearer when the drawings as well as the detailed description are taken into consideration.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature of the present invention, reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is a cross-sectional elevation illustrative of one embodiment of a fluid dispersion assembly as disclosed in the present specification.

FIG. 2 is a cross-sectional elevation illustrative of another embodiment of a fluid dispersion assembly as disclosed in the present specification.

FIG. 3 is a cross-sectional view illustrative of yet another embodiment of a fluid dispersion assembly as disclosed in the present specification.

FIG. 4 is a plan view illustrative of an embodiment of a fluid dispersion assembly as disclosed in the present invention.

FIG. 5 is a cross-sectional elevation illustrative of one further embodiment of a fluid dispersion assembly in accordance with the present specification.

Like reference numerals refer to like parts throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As illustrated in the accompanying figures, and with initial reference to FIGS. 1 and 2, the present invention is

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directed to a fluid dispersion assembly, generally indicated as **10**, powered by a compressed air source. In at least one embodiment, the fluid dispersion assembly **10** is further structured to operatively engage a fluid container (FC). The fluid dispersion assembly **10** is structured to combine an amount of an operative fluid with compressed air to generate a fluid dispersion.

More in particular, a “fluid dispersion” in accordance with the present specification shall mean a mixture of an operative fluid in air comprising a plurality of substantially uniform droplets of the operative fluid dispersed throughout the air. Further, and once again, as used in the present specification, “substantially uniform droplets” shall mean droplets having substantially the same diameter. In at least one embodiment, the plurality of “substantially uniform droplets” each have a diameter in the range of about one micron (1 μm), in another embodiment, the diameter of the droplets is in the range of about three microns (3 μm), and, in one further embodiment, droplet diameter is in the range of about five microns (5 μm).

The fluid dispersion assembly **10** includes a diffusion unit **100** having oppositely disposed ends, as at **110** and **113**, in at least one embodiment. The diffusion unit **100** at least partially defines a diffusion chamber **112**, and in at least one embodiment, the diffusion chamber **112** is substantially enclosed within diffusion unit **100**. The diffusion unit **100** may be constructed of any rigid material or materials which are chemically inert, or at least chemically resistant to the intended operative fluid(s) which include, but once again are not limited to, fragrant oils, essential oils, essential oil extracts, odor neutralizers, disinfectants, e.g., triethylene glycol, air sanitizers, etc. Further, the material of construction selected for the diffusion unit **100** must be capable of withstanding compressed air at operative pressures, which may range anywhere from about 5 to 50 psig, in most embodiments of the present fluid dispersion assembly **10**. In one lower pressure embodiment, the operating pressure of the present fluid dispersion assembly **10** is in the range of about 5 to 10 psig, and in one further embodiment, the operating pressure is in a range of between about 5 to 7 psig. Conversely, a higher pressure embodiment of the present fluid dispersion assembly **10** operates at pressures in the range of about 20 to 25 psig, and in the range of between about 23 to 24 psig in yet one further embodiment. As such, the material or materials of construction of a diffusion unit **100** in accordance with the present specification may include metals, engineered plastic materials, e.g., polyvinyl chloride, high-density polyethylene, etc., and/or composite materials, just to name a few.

In one embodiment, a cap **130** is cooperatively configured and disposed in a sealing engagement with one of the oppositely disposed ends **110**, **113** of the diffusion unit **100**. The cap **130** includes a discharge port **132** therethrough in communication with the diffusion chamber **112**, and provides a point of release of the fluid dispersion from the diffusion chamber **112** into the airspace surrounding the fluid dispersion assembly **10**. In at least one embodiment, the cap **130** is removably attached in a sealing engagement to the diffusion unit **100**. FIG. 4 is a plan view of the embodiment of the fluid dispersion assembly **10** as shown in FIGS. 1 and 2, and shows the cap **130** having a discharge port **132** disposed therethrough. As shown in the embodiment of FIG. 3, the cap **130** may include a service access port **160** disposed therethrough. The service access port **160** includes a service access plug **162** removably disposed therein, wherein removal of the service access plug **162** allows

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access for removal and cleaning or repair of a diffusion assembly **200**, as disclosed in greater detail below.

The fluid dispersion assembly **10**, in at least one embodiment, includes a container interconnect **140** which is cooperatively structured to interconnect the diffusion unit **100** to the fluid container (FC) in a substantially sealed relationship. In one embodiment, the container interconnect **140** is disposed at a different one of the oppositely disposed ends **110**, **113**, opposite of cap **130** of the diffusion unit **100**. A sealing washer **170** is disposed between the diffusion unit **100** and the fluid container (FC), in at least one embodiment, so as to provide a substantially sealed relationship between the diffusion unit **100** and the fluid container (FC). The sealing washer **170** may be constructed from any of a variety of materials such as, but not limited to, rubber, nylon, plastic, PVC, TEFLON, or a composite material, once again, provided the material of construction is chemically inert or at least chemically resistant to the operative fluid(s).

In one further embodiment of a fluid dispersion assembly **10** in accordance with the present specification, a drip tube **120** is disposed in an interconnecting relation between the diffusion unit **100** and the fluid container (FC). As shown in the FIGS. 1 and 2, the drip tube **120** is disposed through a sealing washer **170**, and thus, the drip tube **120** serves to minimize contact between the sealing washer **170** and the operative fluid, by essentially preventing the operative fluid from making contact in and around the sealing washer **170** disposed between the fluid container (FC) and the container interconnect **140**. More in particular, the drip tube **120** channels any operative fluid which may agglomerate and/or accumulate in the diffusion chamber **112** through the drip tube **120** directly back into the fluid container (FC) without contacting the sealing washer **170**, once again, as shown in FIGS. 1 and 2. The container interconnect **140** may be structured in a variety of ways to allow interconnection to the fluid container (FC). As one example, the container interconnect **140** may be threaded, internally or externally, such that the diffusion unit **100** is interconnected to the fluid container (FC) by screwing the container interconnect **140** into place onto corresponding threads on the neck of the fluid container (FC). In at least one other embodiment, the container interconnect **140** comprises one portion of a quick-connect type fitting and the fluid container (FC) comprises a complimentary portion of such a quick-connect type fitting whereby once operatively engaged, a substantially sealed relationship is created between the diffusion unit **100** and the fluid container (FC). In at least some embodiments, the substantially sealed relationship is further enhanced by a sealing washer **170**, as disclosed above.

In at least one embodiment, a cartridge port **150** is provided into the diffusion chamber **112** to facilitate operative engagement of a diffusion assembly **200** with the diffusion chamber **112**. The diffusion assembly **200** may be removably engaged with the cartridge port **150** to aid in removal and replacement and/or cleaning of the diffusion assembly **200** and/or components thereof. In some embodiments, the cartridge port **150** is disposed directly through the diffusion unit **100** and into the diffusion chamber **112**, and is positioned between the oppositely disposed ends **110**, **113**. In at least one embodiment, the cartridge port **150** is disposed on the diffusion unit **100** such that the diffusion assembly **200** is disposed in a substantially perpendicular orientation relative to the diffusion unit **100** when operatively engaging the cartridge port **150**, such as is shown in the illustrative embodiment of FIG. 1. The diffusion assembly **200** is also shown disposed substantially perpendicular to the diffusion unit **100** in the plan view of FIG. 4. In at least

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one other embodiment, the cartridge port **150** is disposed through the cap **130**. In yet another embodiment, the diffusion assembly **200** comprises an integral component of the cap **130** itself, such as in the embodiment of FIG. **3**.

As illustrated in FIGS. **1** and **3**, the diffusion assembly **200** comprises an air inlet **210** and an atomizer assembly **220**. The atomizer assembly **220** comprises an atomizer air inlet channel **222**, a mixing chamber **226**, and an atomizer exhaust channel **228**. The atomizer air inlet channel **222** is interconnected to the compressed air source via the air inlet **210**. Moreover, the atomizer air inlet channel **222** may also include an inlet aperture **223**, a first portion **224** and a second portion **225**. The first portion **224** and the second portion **225** are collectively structured to facilitate delivery of compressed air into the mixing chamber **226**. The first portion **224** of the atomizer air inlet channel **222** may comprise a larger diameter than the second portion **225**, such as is shown in the illustrative embodiment of FIG. **1**. Of course, it is within the scope and intent of the present invention for the atomizer air inlet channel **222** to comprise a constant diameter along its entire length, i.e., a diameter of a first portion is substantially equal to a diameter of a second portion.

Further, the mixing chamber **226** comprises a fluid inlet **227** disposed in fluid communication with an operative fluid in the fluid container (FC) via a fluid delivery tube **300**. The fluid delivery tube **300** is disposed in a fluid communicating relation between the atomizer assembly **220** and the fluid container (FC) to facilitate delivery of an amount of the operative fluid into the atomizer assembly **220**. In at least one embodiment, the fluid delivery tube **300** connects to the atomizer assembly **220** via the fluid inlet **227** into the mixing chamber **226**.

As shown in FIGS. **1** and **2**, the fluid inlet **227** is substantially perpendicular to a compressed air flowpath through the atomizer assembly **200**. More in particular, and with reference to FIG. **1**, the compressed air flowpath extends horizontally through the air inlet **210**, atomizer air inlet channel **222**, mixing chamber **226**, and out through the atomizer exhaust **228**.

As such, when compressed air is supplied to the diffusion assembly **200**, a corresponding amount of operative fluid is drawn into the mixing chamber **226** through the fluid delivery tube **300** as a result of the venturi effect of the compressed air flowing past the opening of the fluid inlet **227** into the mixing chamber **226**. More in particular, at each different compressed air flowrate, i.e., each “predetermined amount” of compressed air which is dictated and fixed by a compressed air operating pressure supplied to diffusion assembly **200**, a different corresponding and substantially constant amount, i.e., a “preselected amount” of an operative fluid corresponding to each different predetermined amount of compressed air, will be drawn into the mixing chamber **226**. More importantly, the “predetermined amount” of compressed air and the “preselected amount” of the operable fluid are initially mixed together in the mixing chamber **226** to form a fluid dispersion. The diffusion chamber **112** is further structured to facilitate the formation of a plurality of substantially uniform droplets, as defined herein, in the fluid dispersion prior to discharge from the diffusion chamber **112** through discharge port **132**.

As illustrated in FIGS. **1** and **3**, the fluid dispersion assembly **10** also includes a suppressor assembly **230** disposed in communication with the diffusion assembly **200**. The suppressor assembly **230** comprises a suppression chamber **232**, disposed in a communicating relation with the atomizer exhaust channel **228** of the atomizer assembly **220**.

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More in particular, the suppression chamber **232** receives the fluid dispersion from the mixing chamber **226**. The suppressor assembly **230** helps to suppress the noise generated during operation of the fluid dispersion assembly **10** as it disrupts the path of flow of the fluid dispersion out of the atomizer assembly **200** and into diffusion chamber **112**, and therefore, disrupts and dampens the sound waves associated therewith. Further, the walls of the suppressor assembly **230** itself serve to absorb and dampen the sound waves generated by the flow of the fluid dispersion out of the mixing chamber **236** through atomizer exhaust channel **238**.

The suppressor assembly **230** may also include a suppressor discharge port **234** to facilitate transfer of the fluid dispersion from the suppressor chamber **232** into the diffusion chamber **112**. In at least one embodiment, such as is shown in FIG. **1**, the suppressor discharge port **234** is located through a low point in the suppressor chamber **232**. Of course, as shown in the alternative embodiment of FIG. **2**, the suppressor discharge port **234** is located through the sides of the suppressor chamber **232**.

FIG. **5** is illustrative of an alternative embodiment of a fluid dispersion assembly **10**, wherein a modified diffusion chamber **112'** is configured to suppress and/or dampen sound waves generated during operation, similar to the suppressor assembly **230** disclosed above. However, as will be appreciated from the following disclosure, the diffusion chamber **112'** of the embodiment of FIG. **5** serves to suppress sound waves generated during operation without the need for a separate suppression chamber, as in previously disclosed embodiments.

Before addressing the modified diffusion chamber **112'** of the embodiment of FIG. **5**, it is noted that, in many respects, the fluid dispersion assembly **10** of FIG. **5** is similar to the previously disclosed embodiments herein. To begin, the fluid dispersion assembly **10** of FIG. **5** comprises a diffusion unit **100** having oppositely disposed ends **110**, **113**, and a diffusion chamber **112'** disposed therebetween. Unlike previously disclosed embodiments, however, the fluid dispersion assembly **10** of FIG. **5** includes a service access port **160** having a removable service access plug **162** disposed directly through one end **113** of the diffusion unit **100**, rather than through a separate cap disposed at one end of the unit **100**.

The fluid dispersion assembly **10** of FIG. **5** further comprises a container interconnect **140** cooperatively structured to interconnect the diffusion unit **100** to a fluid container (FC) in a substantially sealed relationship and, as before, a sealing washer **170** is provided to maintain a substantially sealed relationship.

A cartridge port **150** is disposed through one side of the diffusion unit **100**, in the illustrative embodiment of FIG. **5**, and a diffusion assembly **200** is operatively positioned therethrough and into fluid communication with diffusion chamber **112'**, as in previously disclosed embodiments. The diffusion cartridge **200** includes an air inlet **210** disposed in communication with an atomizer assembly **220**. Further, and as in previously disclosed embodiments, when compressed air is supplied to the diffusion assembly **200**, and more in particular, atomizer assembly **220**, through air inlet **210**, a corresponding amount of fluid is drawn into a mixing chamber **226** from the fluid container (FC) through a fluid delivery tube **300**, as a result of the venturi effect of compressed air flowing past the opening of a fluid inlet **227** into the mixing chamber **226**. As a result, a fluid dispersion is formed and discharged from the atomizer assembly **220** through atomizer exhaust channel **228**, and directly into diffusion chamber **112'**.

As noted above, and as may be seen with reference to FIG. 5, the diffusion chamber 112' of the present embodiment comprises a modified configuration. Specifically, the modified diffusion chamber 112' comprises an upside down L-shaped configuration, wherein a first axial portion 114 of the diffusion chamber 112' is disposed in a substantially axial orientation adjacent and relative to the discharge of the atomizer exhaust channel 228. A second transverse portion 115 of the diffusion chamber 112' is disposed in a substantially downwardly directed orientation, as shown in FIG. 5, substantially transverse or perpendicular to the direction of flow from atomizer exhaust channel 228.

The second or transverse portion 115 of the modified diffusion chamber 112', in at least one embodiment, comprises a fluid return lip 116 disposed at a lower end thereof in a surrounding relation to incoming fluid delivery tube 300. The fluid return lip 116, in at least one embodiment, extends downwardly and outwardly from the walls of the second portion 115 of the diffusion chamber 112', such that any liquid which coalesces in the diffusion chamber 112' along the walls thereof, will be directed into drip tube 120, disposed in an abutting relation along the underside of the fluid return lip 116, and back into fluid container (FC).

More importantly, the fluid dispersion discharged from the atomizer assembly 220 through atomizer exhaust channel 228 into diffusion chamber 112' is interrupted and redirected by virtue of axial portion 114 and transverse portion 115 therein. The interruption and redirection of flow in the modified diffusion chamber 112' during operation of the fluid dispersion assembly 10 in accordance with the present embodiment, serves to suppress or dampen sound waves generated therein, in a similar manner as the suppression chamber 232 of previously disclosed embodiments. Further, the restricted discharge from the transverse portion 115 of the modified diffusion chamber 112' may serve to further suppress or dampen sound waves, thus reducing the noise generated during operation to an even greater extent.

After being discharged from the diffusion chamber 112', the fluid dispersion enters the freeboard above the liquid in the fluid container (FC), the freeboard serving as a quasi-diffusion chamber prior to final discharge of the fluid dispersion from the diffusion unit 100. A discharge chamber 117 is disposed in fluid communication with the freeboard of the fluid container (FC), such that the fluid dispersion can pass therethrough, into a discharge head 118 and out through discharge channel 119 into the airspace surrounding the fluid dispersion assembly 10, as shown in the illustrative embodiment of FIG. 5.

In at least one embodiment, a fluid dispersion assembly 10 in accordance with the present specification further includes a silencer assembly 134 in communication with the discharge port 132, such as is illustrated in FIGS. 1 and 2. The silencer assembly 134 serves to further minimize the amount of noise generated during operation of the fluid dispersion assembly 10. The silencer assembly 134 comprises a baffle 136 disposed in a silencer chamber 138 between a silencer inlet 135 and a silencer outlet 137. The baffle 136 is structured and disposed to further disrupt the flow of the fluid dispersion through the fluid dispersion assembly 10, and more specifically, through the silencer chamber 138. In at least one embodiment, the silencer inlet 135 is disposed relative to the baffle 136 to at least partially, if not substantially, direct the flow of the fluid dispersion towards the baffle 136, so as to maximize the disruption of flow. Once again, as disclosed above with regard to the suppressor assembly 230, the disruption in the flow of the fluid dispersion through the silencer assembly 134 also creates a dis-

ruption and dampening of the sound waves associated therewith. As a result, the amount of noise generated during the operation of a fluid dispersion assembly 10 in accordance with the present specification is significantly reduced.

It is further envisioned that at least one embodiment of the fluid dispersion assembly 10 of the present invention is operated via a programmable timer to control a fragrance intensity and character in an airspace by metering the fragrance delivered in an enclosed environment. The fluid dispersion assembly 10 delivers a specific amount of a fragrance, i.e., the delivery rate, based upon such factors as the specific physical configuration of the atomizer assembly 220 and the fluid container (FC)/fluid delivery tube 300, the pressure and volume of the compressed air supplied into air inlet 210, as well as the physical properties of the fragrance itself, such as, viscosity, surface tension, vapor pressure, etc., wherein the delivery rate is measured in grams per minute of a fragrance dispersed. The perceived fragrance intensity in a specific airspace is measured from a sensory point of view using a labeled magnitude scale. The data is directly correlated to the amount of fragrance delivered and may be measured in either grams per liter or grams per cubic meter. Since the delivery rate is fixed, fragrance intensity is controlled by cycling the fluid dispersion assembly 10 through an on/off programming cycle every minute to deliver the intensity and character levels that are desired by a user. The optimization process is a function of dosing time per minute and a user's desired fragrance experience.

Since many modifications, variations and changes in detail can be made to the described preferred embodiment of the invention, it is intended that all matters in the foregoing description and shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense. Thus, the scope of the invention should be determined by the appended claims and their legal equivalents.

Now that the invention has been described,
What is claimed is:

1. A fluid dispersion assembly operatively engages a container of an operative fluid and a compressed air source and generates and discharges a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:
 - a diffusion unit at least partially defining an enclosed diffusion chamber,
 - a service access port at least partially defining an access opening into said diffusion unit, and a service access plug removably disposable in a sealing engagement with said service access port,
 - a discharge port disposed in fluid communication between said diffusion chamber and the surrounding airspace,
 - a diffusion assembly disposed in an operative engagement with said diffusion unit, wherein said diffusion assembly comprises an atomizer assembly,
 - said atomizer assembly comprising an atomizer air inlet channel, a fluid inlet, a mixing chamber, and an atomizer exhaust channel,
 - said atomizer air inlet channel interconnected to the compressed air source and said fluid inlet disposed in fluid communication with the operative fluid in the container, wherein the compressed air and the operative fluid are mixed together in said mixing chamber to form the fluid dispersion, and
 - a suppressor assembly disposed in communication with said diffusion assembly, said suppressor assembly comprising a suppression chamber structured to dampen sound waves generated during operation of said fluid dispersion assembly.

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2. The fluid dispersion assembly as recited in claim 1 further comprising a cap cooperatively configured and disposed in a sealing engagement with said diffusion unit.

3. The fluid dispersion assembly as recited in claim 2 wherein said service access port is disposed through said cap.

4. The fluid dispersion assembly as recited in claim 1 wherein said atomizer exhaust channel is disposed in a communicating relation between said mixing chamber and said suppression chamber to facilitate transfer of the fluid dispersion therebetween.

5. The fluid dispersion assembly of claim 1 wherein said suppressor assembly further comprises a suppressor discharge port disposed between said suppression chamber and said diffusion chamber to facilitate transfer of the fluid dispersion from said suppression chamber into said diffusion chamber.

6. The fluid dispersion assembly as recited in claim 1 wherein said diffusion chamber facilitates formation of the fluid dispersion prior to discharge of the fluid dispersion from said diffusion chamber through said discharge port and into the surrounding airspace.

7. A fluid dispersion assembly is operatively interconnected to a container of an operative fluid and a compressed air source to generate and discharge a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:

- a diffusion unit at least partially defining a diffusion chamber,
- a discharge port disposed in fluid communication between said diffusion chamber and the surrounding airspace,
- a diffusion assembly disposed in an operative engagement with said diffusion unit, wherein said diffusion assembly comprises an atomizer assembly, and
- a silencer assembly having a silencer inlet, a silencer outlet, and a baffle, wherein said baffle partially restricts movement of the fluid dispersion through said silencer chamber from said silencer inlet to said silencer outlet, thereby dampening sound waves generated during operation of said fluid dispersion assembly.

8. The fluid dispersion assembly as recited in claim 7 wherein said atomizer assembly comprising an atomizer air inlet channel, a fluid inlet, a mixing chamber, and an atomizer exhaust channel.

9. The fluid dispersion assembly as recited in claim 8 wherein said atomizer air inlet channel is interconnected to the compressed air source and said fluid inlet disposed in fluid communication with the operative fluid in the container, wherein the compressed air and the operative fluid are mixed together in said mixing chamber to form the fluid dispersion.

10. The fluid dispersion assembly as recited in claim 7 further comprising a suppressor assembly disposed in communication with said diffusion assembly, said suppressor assembly comprising a suppression chamber structured to dampen sound waves generated during operation of said fluid dispersion assembly.

11. The fluid dispersion assembly as recited in claim 7 wherein said diffusion chamber facilitates formation of the fluid dispersion prior to discharge of the fluid dispersion from said diffusion chamber through said discharge port and into the surrounding airspace.

12. The fluid dispersion assembly as recited in claim 7 further comprising a container interconnect operatively interconnecting said diffusion unit to the container, wherein

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said container interconnect comprises a sealing washer disposed between said diffusion unit and the container.

13. The fluid dispersion assembly as recited in claim 12 further comprising a drip tube, said drip tube disposed in an interconnecting relation between said diffusion chamber and the container through said sealing washer, wherein said drip tube minimizes contact between said sealing washer and the operative fluid.

14. A fluid dispersion assembly interconnects to a container of an operative fluid and a compressed air source and generates and discharges a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:

- a diffusion unit having an enclosed diffusion chamber, said diffusion chamber comprising oppositely disposed portions therein,
- a diffusion assembly disposed in an operative engagement with said diffusion unit, wherein said diffusion assembly comprises an atomizer assembly having an atomizer exhaust channel,
- one of said oppositely disposed portions of said diffusion chamber comprises an axial portion disposed in an adjacent substantially axial orientation relative to said atomizer exhaust channel,
- another of said oppositely disposed portions of said diffusion chamber comprises a transverse portion disposed in a spaced apart substantially perpendicular orientation relative to said atomizer exhaust channel, and

said diffusion chamber structured to facilitate formation of the fluid dispersion prior to discharge of the fluid dispersion from said diffusion chamber, wherein the fluid dispersion discharged from said atomizer exhaust channel into said diffusion chamber is interrupted and redirected in said axial portion and said transverse portion, thereby dampening sound waves generated during operation of said fluid dispersion assembly.

15. The fluid dispersion assembly as recited in claim 14 further comprising a discharge chamber disposed in fluid communication with said diffusion chamber and a discharge head, said discharge head comprising a discharge channel disposed to direct the fluid dispersion from said discharge chamber into the airspace surrounding said fluid dispersion assembly.

16. The fluid dispersion assembly as recited in claim 14 wherein said atomizer assembly further comprises an atomizer air inlet channel, a fluid inlet, and a mixing chamber.

17. The fluid dispersion assembly as recited in claim 16 wherein said atomizer air inlet channel is interconnected to the compressed air source and said fluid inlet is disposed in fluid communication with the preselected fluid in the container, wherein the compressed air and the preselected fluid are mixed together in said mixing chamber to form the fluid dispersion.

18. A fluid dispersion assembly is interconnected to a container of an operative fluid and a compressed air source to generate and discharge a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:

- a diffusion unit having a substantially enclosed diffusion chamber,
- a diffusion assembly operatively engages said diffusion unit, wherein said diffusion assembly comprises an atomizer assembly,
- said diffusion chamber comprising an axial portion disposed in an axial orientation relative to said atomizer assembly,
- said diffusion chamber further comprising a transverse portion disposed in a spaced apart substantially per-

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pendicular orientation relative to said atomizer assme-
bly, wherein said transverse portion comprises a fluid
return lip disposed at a lower end thereof and a drip
tube disposed adjacent and abutting said fluid return
lip, and 5
a discharge chamber disposed in fluid communication
with said diffusion chamber and a discharge head, said
discharge head comprising a discharge channel dis-
posed to direct the fluid dispersion from said discharge
chamber into the surrounding airspace. 10
19. The assembly as recited in claim 18 wherein said fluid
return lip is disposed to direct coalesced fluid from said
diffusion chamber into said drip tube.
20. The assembly as recited in claim 19 wherein said drip
tube is disposed to direct said coalesced fluid into the 15
container.

* * * * *

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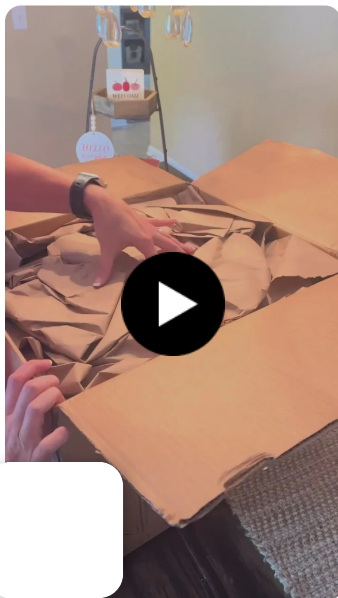
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Aroma360 4 weeks ago

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Verified Reviewer 



New Customer

I just received the museum360 and my husband hooked it up. David is the customer service rep who has helped me with the purchase and he even had me add his direct number in my phone. He has always responded back to me when I have reached out. We had a little bit of difficulty with the settings but someone from technical customer service called and walked my husband and I through. So far I am very satisfied with our decision to purchase this diffuser. Thank you! I look forward to be a long time customer. My husband and I are going to Miami and plan on touring the warehouse!

Was this helpful?  1  0

K

Kelly

4 months ago

Verified Buyer 



Worth It

I ordered this machine but was in back order and company send museum 360xl in its place but if this machine is anything like the museum xl 360 it's totally worth the money

Was this helpful?  3  0



Aroma360

4 months ago

Thanks so much for leaving your honest feedback with us, Kelly! We appreciate it. Happy Scenting!

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❄ Waterless Cold-Air Diffusion

🐾 Cruelty free

🌿 Pure Luxury Fragrances

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The foundation of Aroma360 is built on two primary principles — to provide a healthy scenting solution for homes and businesses, and to educate people about the incredible benefits of Aromachology.

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- Search
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- Return and Exchange Policy
- Privacy Policy
- Terms of Service
- Aroma360 Gift Card
- Become An Affiliate
- Student, Graduate, and Military
- Careers
- Blogs
- Aroma360 Talk
- Brand Ambassadors
- Return Portal
- Do not sell or share my personal information



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🎵

in

✉

United States (USD \$) ▼

English ▼

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We accept







hotels, malls or large home. All of these products



fragrances. These fragrances are made from





EXHIBIT C

Preliminary Claim Chart Key for Independent Claim 7 of U.S. Patent No. 10,583,449

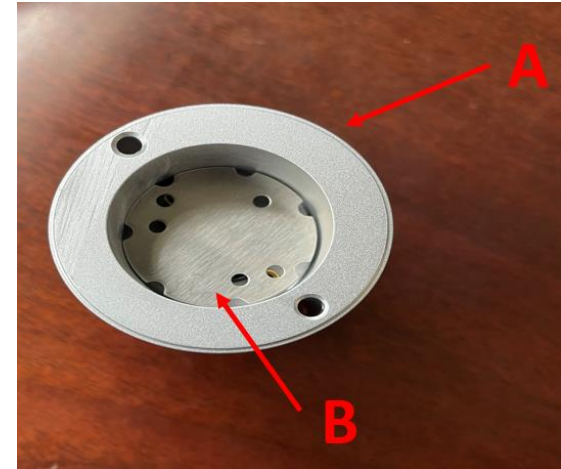
Alphabetic Representation	Independent Claim 7 of U.S. Patent No. 10,583,449
Z	“A fluid dispersion assembly is operatively interconnected to a container of an operative fluid and a compressed air source to generate and discharge a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:”
A	“a diffusion unit”
B	“a diffusion chamber”
C	“a discharge port”
D	“a diffusion assembly”
E	“an atomizer assembly”
F	“an atomizer air inlet channel”
G	“a fluid inlet”
I	“a mixing chamber”
J	“an atomizer exhaust aperture”

Preliminary Claim Chart for Independent Claim 7 of U.S. Patent No. 10,583,449

(*This preliminary claim chart is not intended to be limiting and Air Essentials expressly reserves the right to modify and/or alter it as needed based upon further discovery)

Independent Claim 7 of U.S. Patent No. 10,583,449	Identification of Corresponding Element in the Museum360 HVAC Scent Diffuser
A fluid dispersion assembly is operatively interconnected to a container of an operative fluid and a compressed air source to generate and discharge a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:	 hotels, malls or large home. All of these products are available for purchase online or at their

a diffusion unit at least partially defining a diffusion chamber,



a discharge port disposed in fluid communication between said diffusion chamber and the surrounding airspace, and



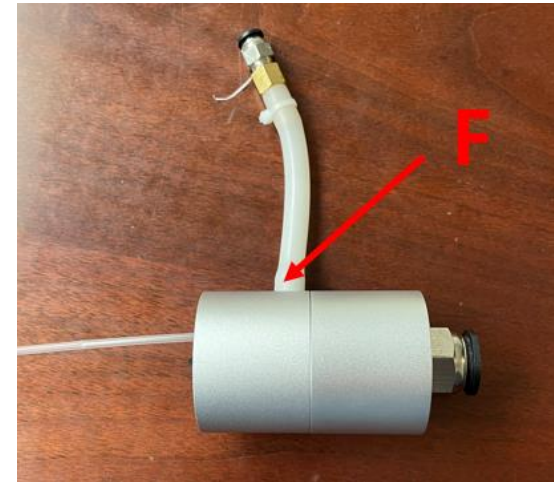
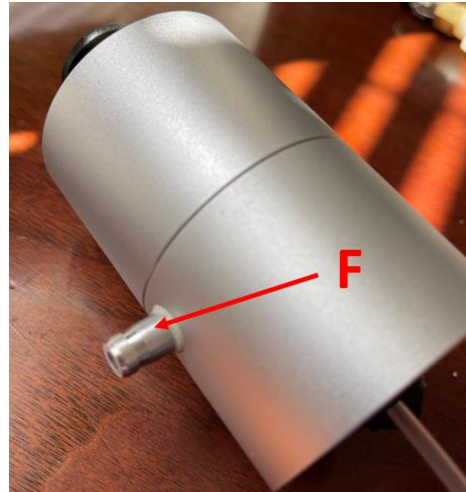
a diffusion assembly disposed in an operative engagement with said diffusion unit,



wherein said diffusion assembly comprises an atomizer assembly,



said atomizer assembly comprising an atomizer
air inlet channel,



a fluid inlet,



a mixing chamber, and



an atomizer exhaust aperture.



EXHIBIT D











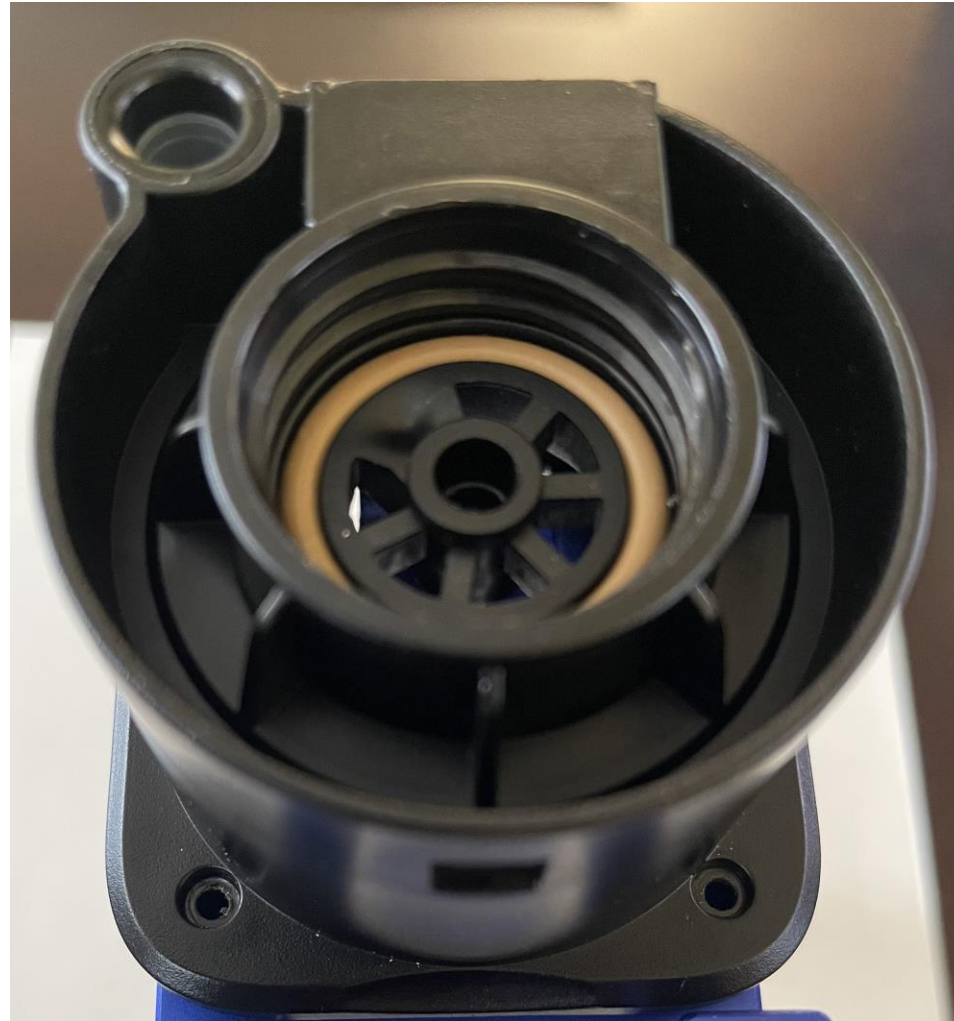
















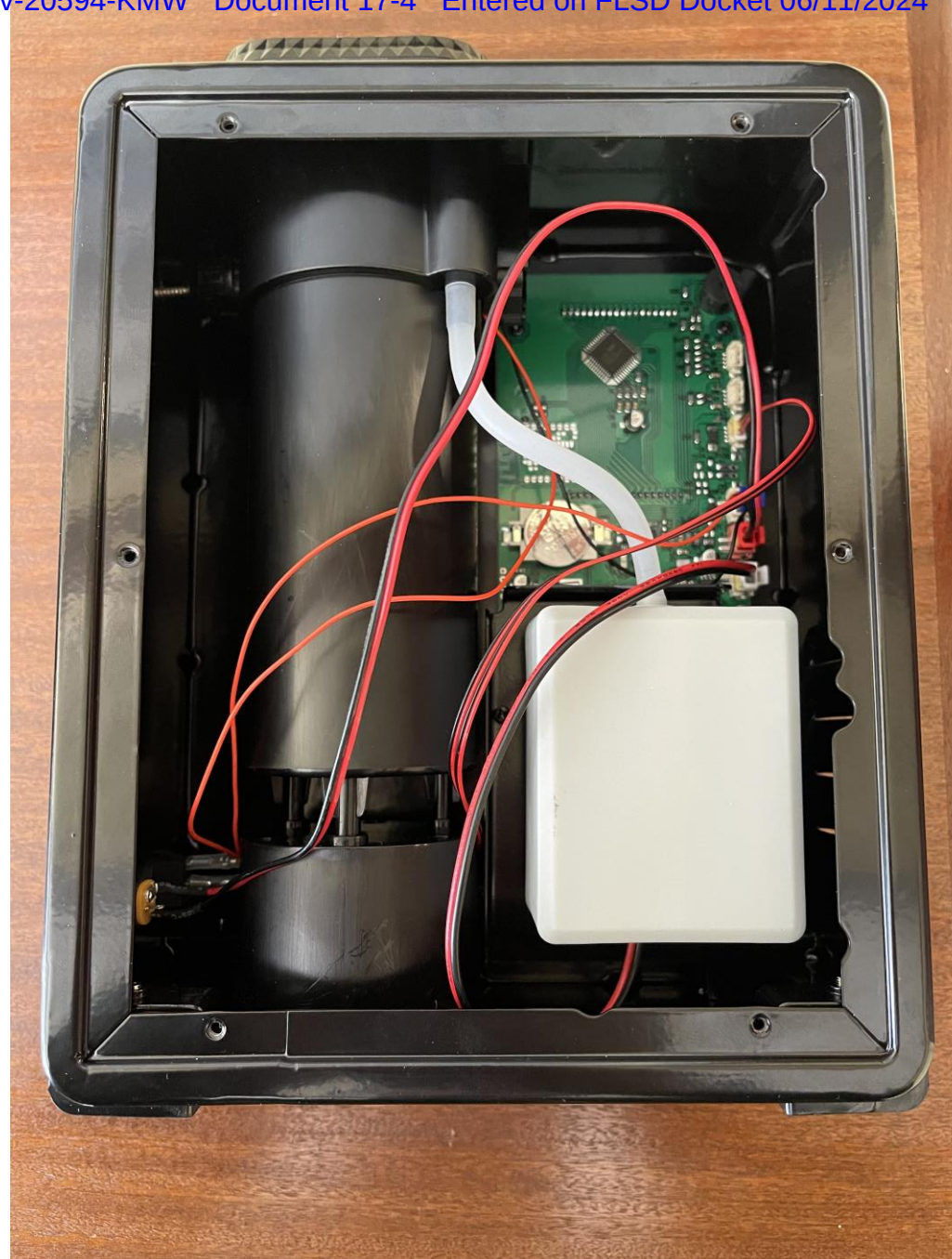


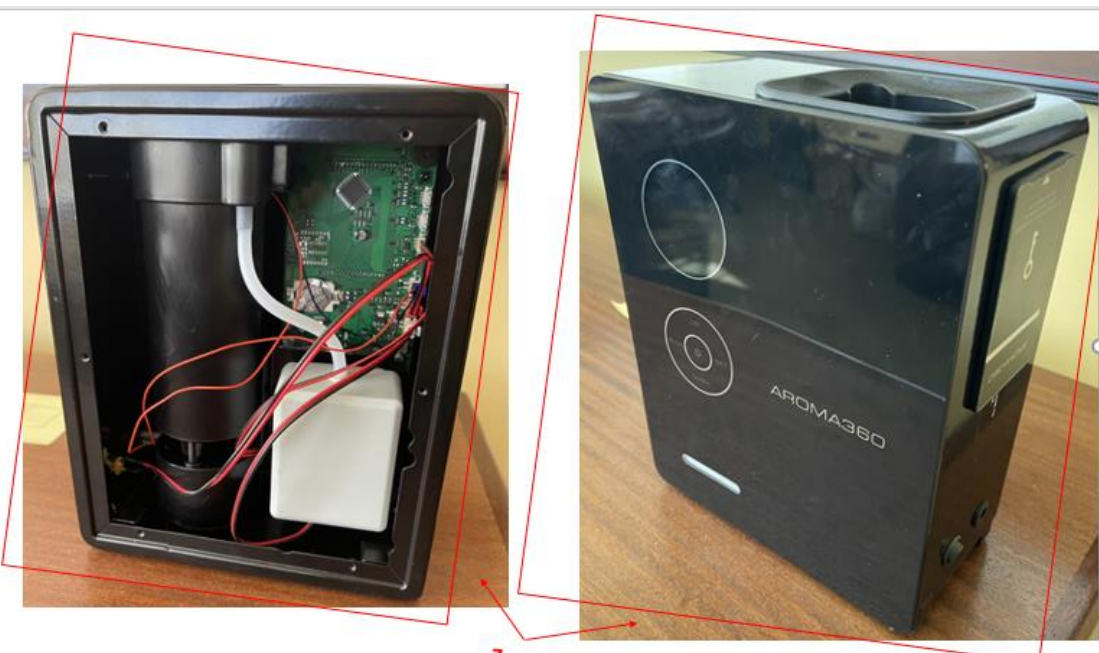
EXHIBIT E

Preliminary Claim Chart Key for Independent Claim 7 of U.S. Patent No. 10,583,449

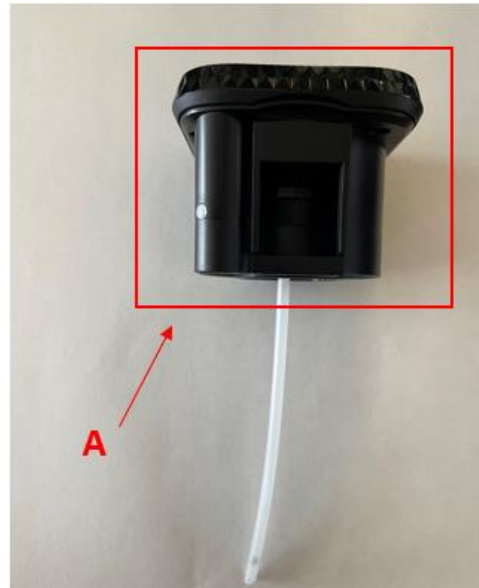
Alphabetic Representation	Independent Claim 7 of U.S. Patent No. 10,583,449
Z	“A fluid dispersion assembly is operatively interconnected to a container of an operative fluid and a compressed air source to generate and discharge a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:”
A	“a diffusion unit”
B	“a diffusion chamber”
C	“a discharge port”
D	“a diffusion assembly”
E	“an atomizer assembly”
F	“an atomizer air inlet channel”
G	“a fluid inlet”
I	“a mixing chamber”
J	“an atomizer exhaust aperture”

Preliminary Claim Chart for Independent Claim 7 of U.S. Patent No. 10,583,449

(*This preliminary claim chart is not intended to be limiting and Air Essentials expressly reserves the right to modify and/or alter it as needed based upon further discovery)

Independent Claim 7 of U.S. Patent No. 10,583,449	Identification of Corresponding Element in the DaVinci360 Scent Diffuser
A fluid dispersion assembly is operatively interconnected to a container of an operative fluid and a compressed air source to generate and discharge a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:	

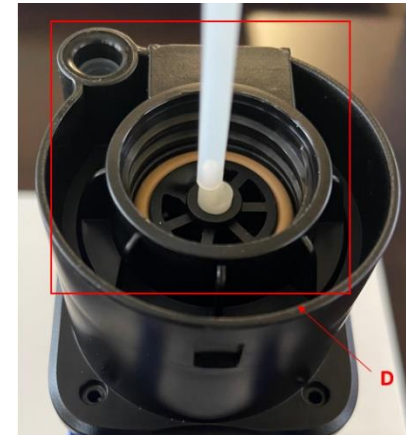
a diffusion unit at least partially defining a diffusion chamber,



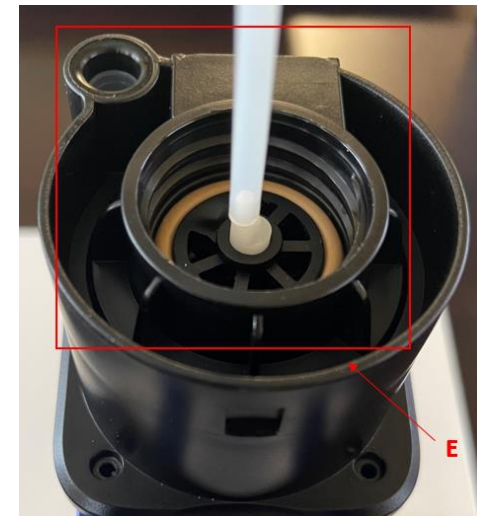
a discharge port disposed in fluid communication between said diffusion chamber and the surrounding airspace, and



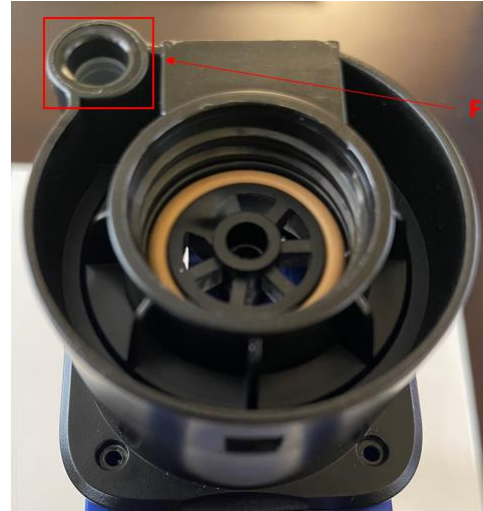
a diffusion assembly disposed in an operative engagement with said diffusion unit,



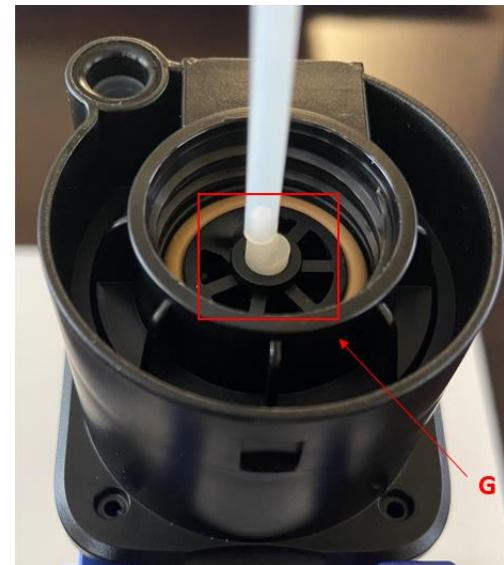
wherein said diffusion assembly comprises an atomizer assembly,



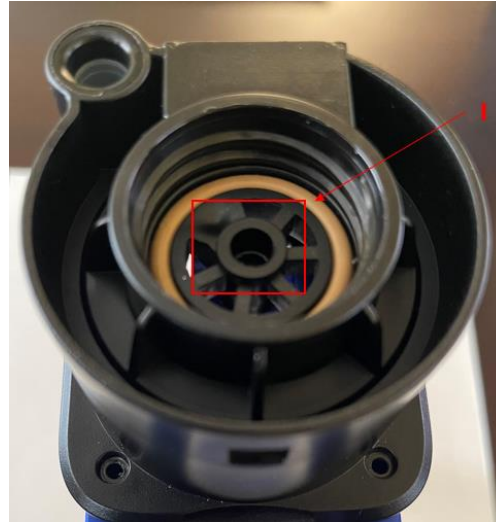
said atomizer assembly comprising an atomizer air inlet channel,



a fluid inlet,



a mixing chamber, and



an atomizer exhaust aperture.

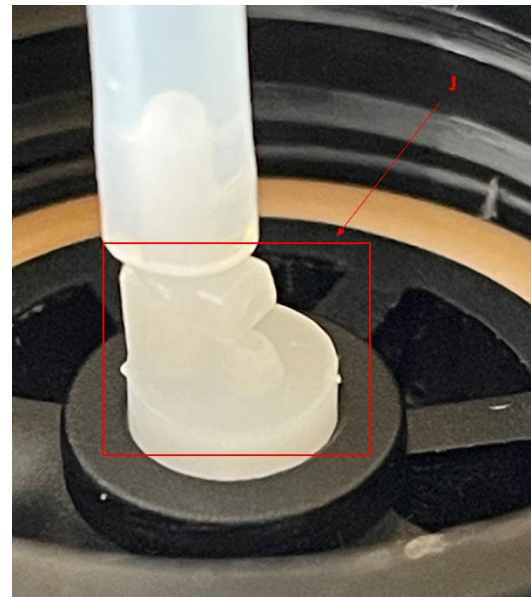


EXHIBIT F











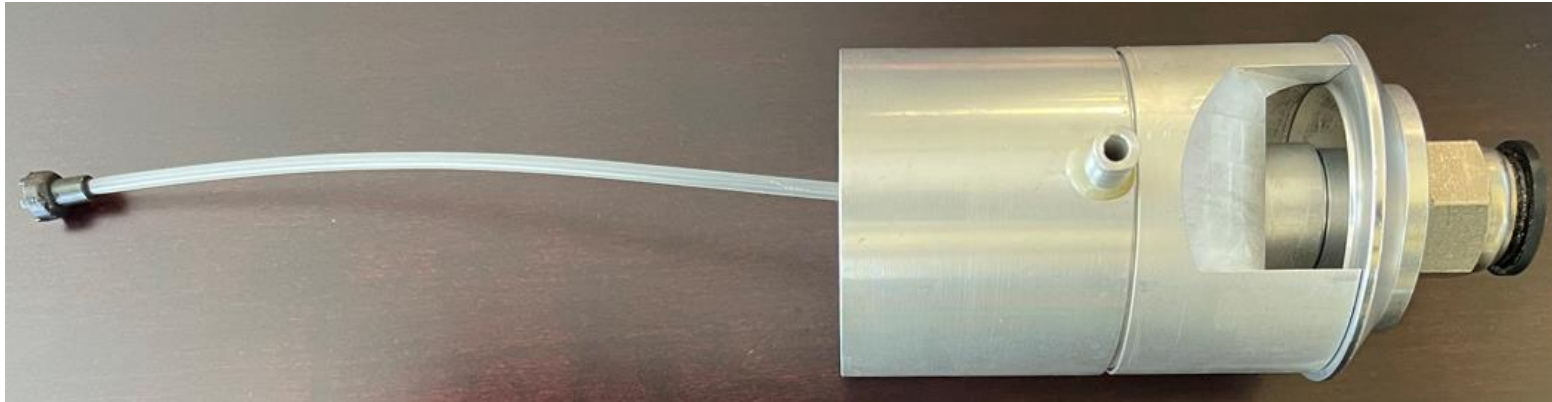




EXHIBIT G

Preliminary Claim Chart Key for Independent Claim 7 of U.S. Patent No. 10,583,449

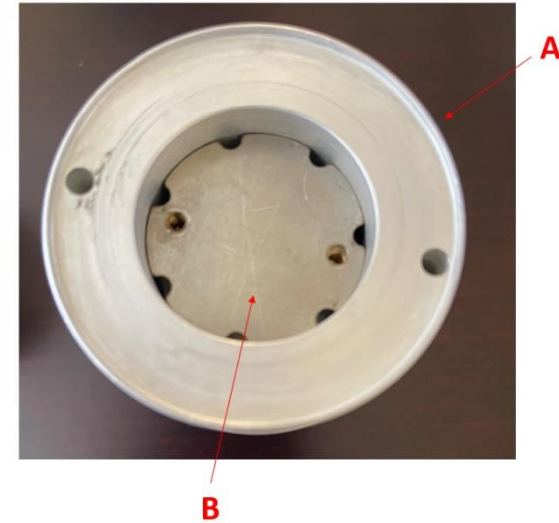
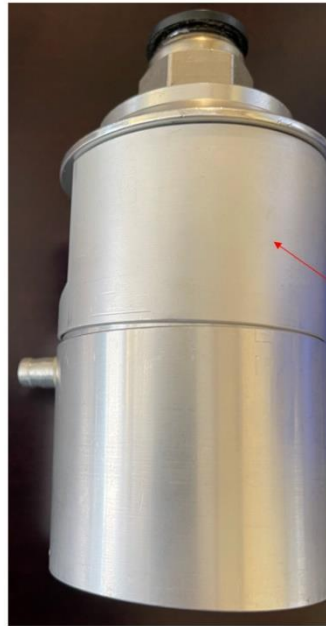
Alphabetic Representation	Independent Claim 7 of U.S. Patent No. 10,583,449
Z	“A fluid dispersion assembly is operatively interconnected to a container of an operative fluid and a compressed air source to generate and discharge a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:”
A	“a diffusion unit”
B	“a diffusion chamber”
C	“a discharge port”
D	“a diffusion assembly”
E	“an atomizer assembly”
F	“an atomizer air inlet channel”
G	“a fluid inlet”
I	“a mixing chamber”
J	“an atomizer exhaust aperture”

Preliminary Claim Chart for Independent Claim 7 of U.S. Patent No. 10,583,449

(*This preliminary claim chart is not intended to be limiting and Air Essentials expressly reserves the right to modify and/or alter it as needed based upon further discovery)

Independent Claim 7 of U.S. Patent No. 10,583,449	Identification of Corresponding Element in the VanGogh360 Scent Diffuser
A fluid dispersion assembly is operatively interconnected to a container of an operative fluid and a compressed air source to generate and discharge a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:	   Z

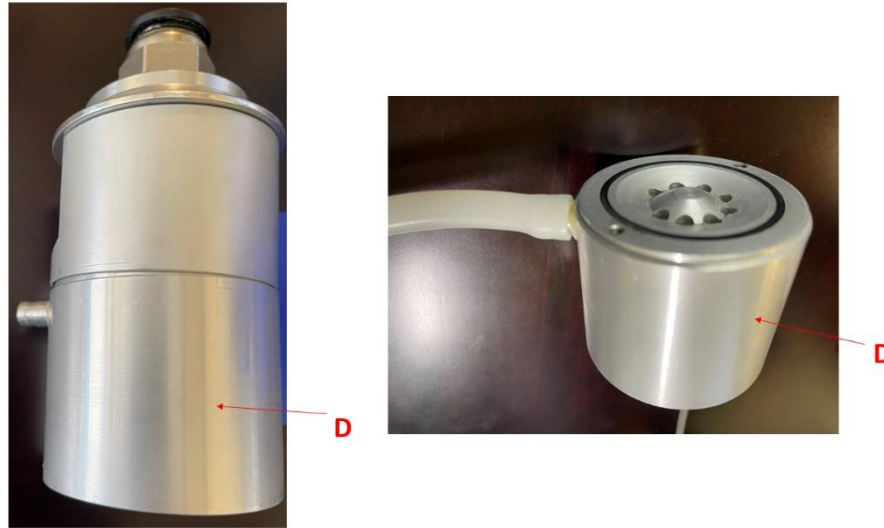
a diffusion unit at least partially defining a diffusion chamber,



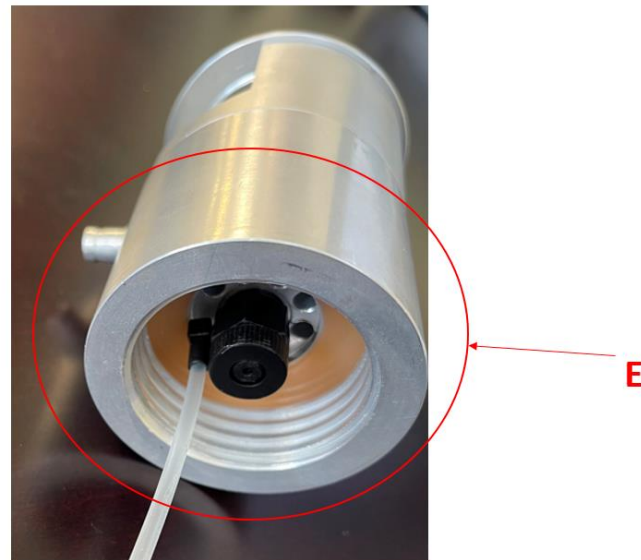
a discharge port disposed in fluid communication between said diffusion chamber and the surrounding airspace, and



a diffusion assembly disposed in an operative engagement with said diffusion unit,



wherein said diffusion assembly comprises an atomizer assembly,



said atomizer assembly
comprising an atomizer air inlet
channel,

F

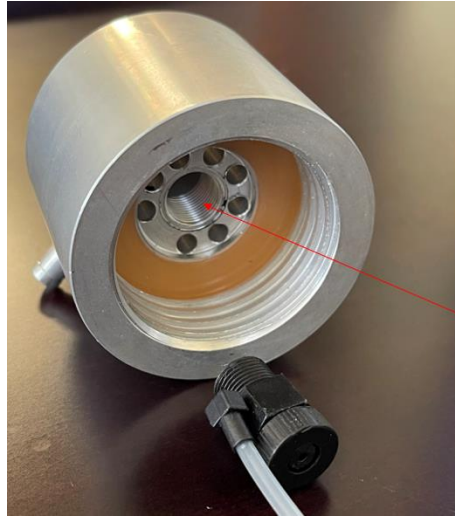


a fluid inlet,

G



a mixing chamber, and



an atomizer exhaust aperture.



EXHIBIT H

Preliminary Claim Chart Key for Independent Claim 5 of U.S. Patent No. 10,092,918

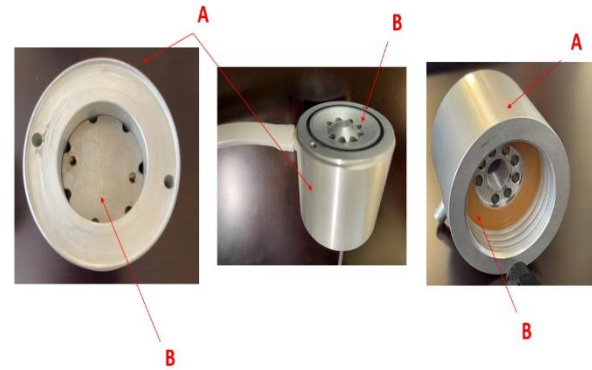
Alphabetic Representation	Independent Claim 5 of U.S. Patent No. 10,092,918
Z	“A fluid dispersion assembly is operatively interconnected to a container of an operative fluid and a compressed air source to generate and discharge a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:”
A	“a diffusion unit”
B	“a diffusion chamber”
C	“an upper chamber”
D	“a lower chamber”
E	“a discharge port”
F	“a diffusion assembly”
G	“an atomizer assembly”

Preliminary Claim Chart for Independent Claim 5 of U.S. Patent No. 10,092,918

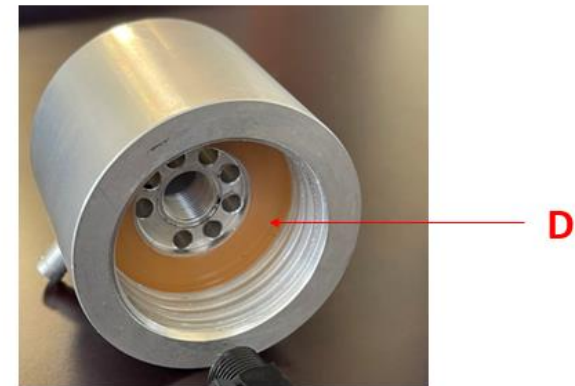
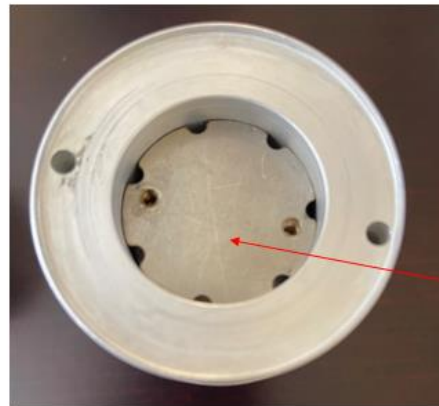
(*This preliminary claim chart is not intended to be limiting and Air Essentials expressly reserves the right to modify and/or alter it as needed based upon further discovery)

Independent Claim 5 of U.S. Patent No. 10,092,918	Identification of Corresponding Element in the VanGogh360 Scent Diffuser
A fluid dispersion assembly is operatively interconnected to a container of an operative fluid and a compressed air source to generate and discharge a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:	   Z

a diffusion unit at least partially defining a diffusion chamber,



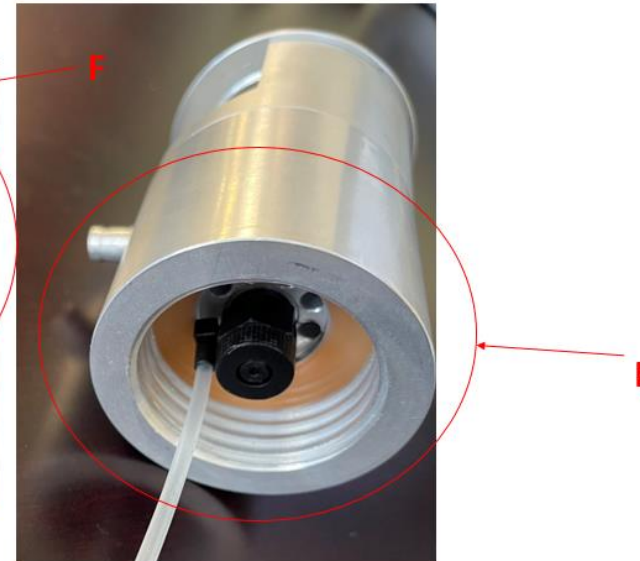
wherein said diffusion chamber comprises an upper chamber and a lower chamber,



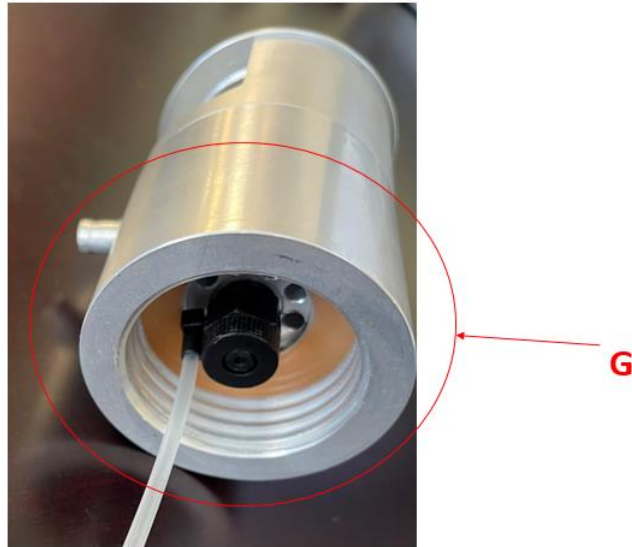
a discharge port disposed in fluid communication between said diffusion chamber and the surrounding airspace, and



a diffusion assembly disposed in an operative engagement with said diffusion unit,



wherein said diffusion assembly comprises an atomizer assembly,



said diffusion assembly is disposed between said upper chamber and said lower chamber.

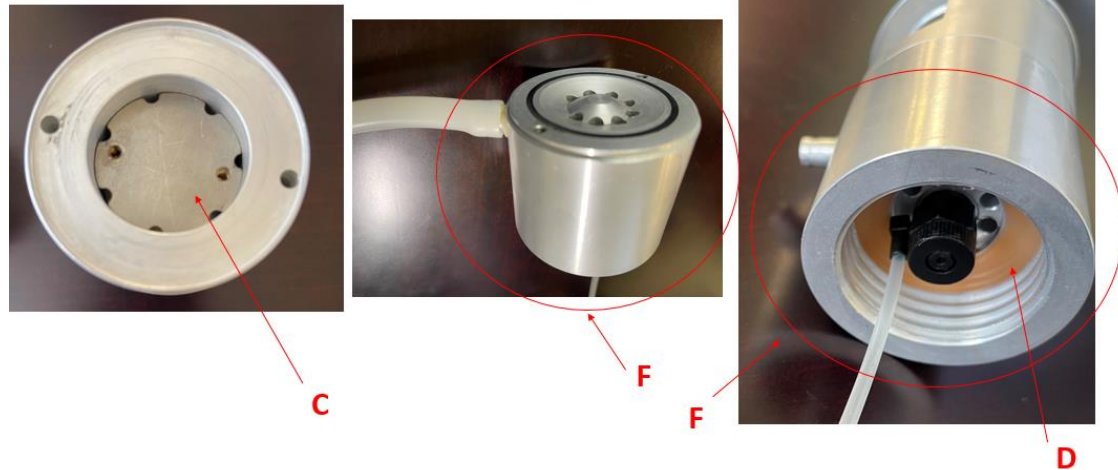


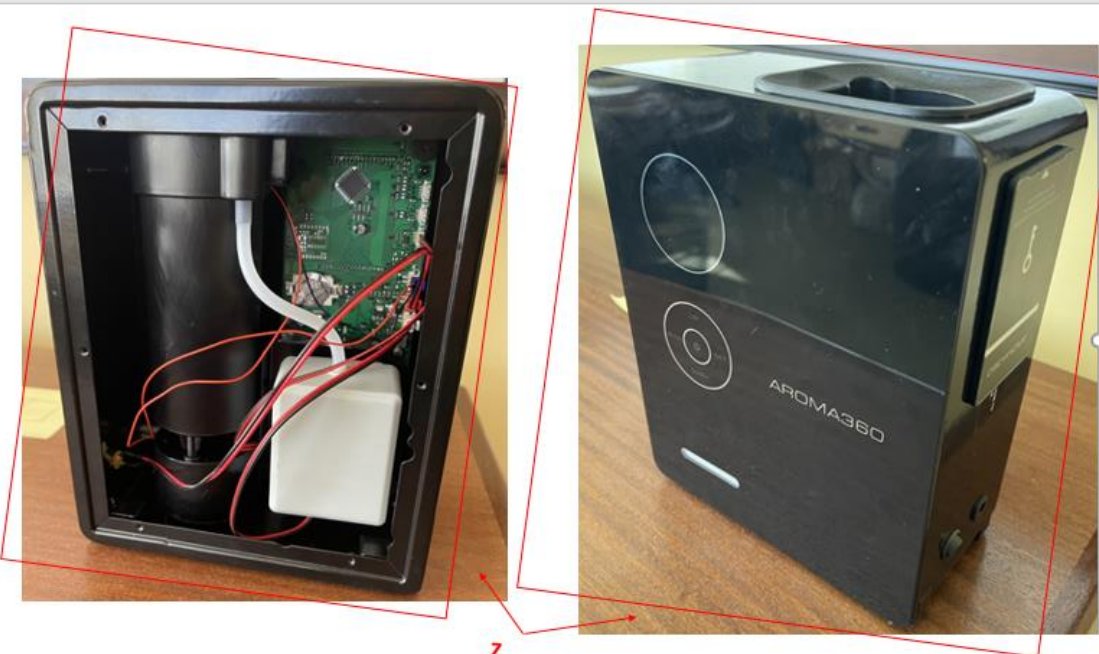
EXHIBIT I

Preliminary Claim Chart Key for Independent Claim 7 of U.S. Patent No. 9,527,094

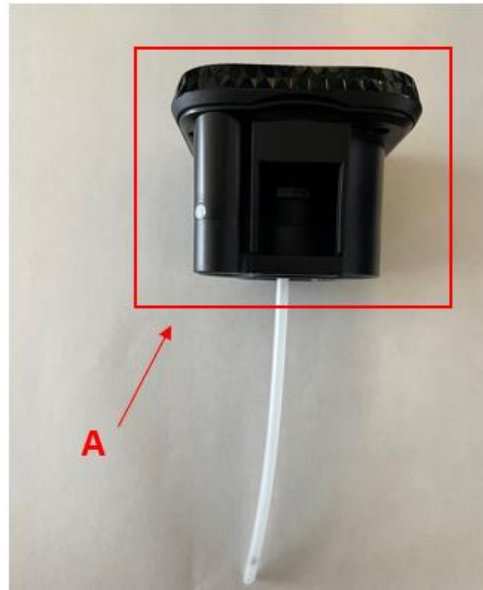
Alphabetic Representation	Independent Claim 7 of U.S. Patent No. 9,527,094
Z	“A fluid dispersion assembly is operatively interconnected to a container of an operative fluid and a compressed air source to generate and discharge a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:”
A	“a diffusion unit”
B	“a diffusion chamber”
C	“a discharge port”
D	“a diffusion assembly”
E	“an atomizer assembly”
F	“a silencer assembly”
G	“a silencer inlet”
H	“a silencer outlet”
I	“a baffle”

Preliminary Claim Chart for Independent Claim 7 of U.S. Patent No. 9,527,094

(*This preliminary claim chart is not intended to be limiting and Air Essentials expressly reserves the right to modify and/or alter it as needed based upon further discovery)

Independent Claim 7 of U.S. Patent No. 9,527,094	Identification of Corresponding Element in the DaVinci360 Scent Diffuser
A fluid dispersion assembly is operatively interconnected to a container of an operative fluid and a compressed air source to generate and discharge a fluid dispersion into a surrounding airspace, said fluid dispersion assembly comprising:	 The image consists of two photographs of the DaVinci360 Scent Diffuser. The left photograph shows the internal components of the device, which are housed within a black plastic casing. The components include a green circuit board, a white container, and red wiring. The right photograph shows the exterior of the device, which is a black rectangular unit with a circular diffuser on the front and the text 'AROMA360' printed on it. Red lines and arrows connect the internal components to the exterior unit, indicating the correspondence between the two views.

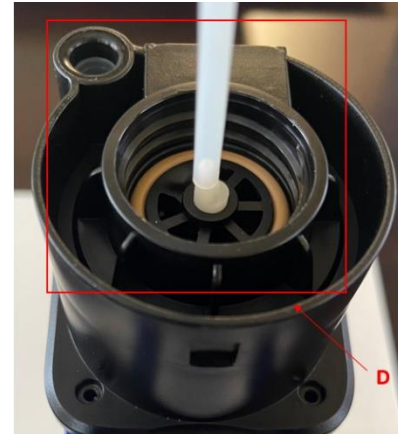
a diffusion unit at least partially defining a diffusion chamber,



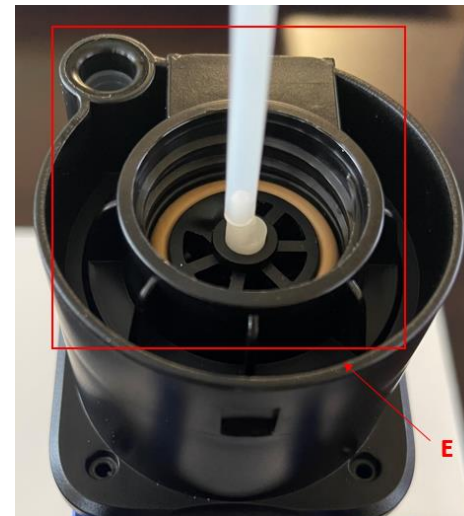
a discharge port disposed in fluid communication between said diffusion chamber and the surrounding airspace,



a diffusion assembly disposed
in an operative engagement
with said diffusion unit,



wherein said diffusion
assembly comprises an
atomizer assembly, and



a silencer assembly having a
silencer inlet,



F



G

a silencer outlet, and



H

a baffle, wherein said baffle partially restricts movement of the fluid dispersion through said silencer chamber from said silencer inlet to said silencer outlet, thereby dampening sound waves generated during operation of said fluid dispersion assembly.

