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**Batts**

(10) **Patent No.: US 9,267,677 B2**
(45) **Date of Patent: Feb. 23, 2016**

(54) **DEVICE FOR GENERATING LARGE VOLUMES OF SMOKE**

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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 1333 days.

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(22) Filed: **Oct. 28, 2010**

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**Related U.S. Application Data**

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(51) **Int. Cl.**

| | |
|---|---|
| ***F22B 27/16*** | (2006.01) |
| ***F41H 9/06*** | (2006.01) |
| ***F42B 12/48*** | (2006.01) |
| *A01M 13/00* | (2006.01) |
| *A01M 29/12* | (2011.01) |
| *A01G 13/06* | (2006.01) |

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

CPC ***F22B 27/16*** (2013.01); ***F41H 9/06*** (2013.01); ***F42B 12/48*** (2013.01); *A01G 13/065* (2013.01); *A01M 13/00* (2013.01); *A01M 29/12* (2013.01)

(58) **Field of Classification Search**

CPC ..... F22B 27/16; F24B 12/48; F41H 9/06; A01M 13/00; A01M 29/12; A01G 13/065

USPC ..... 126/401, 405–408; 239/136, 133, 14.1; 102/334, 329, 364, 370, 513; 43/127, 43/129

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 571,811 | A * | 11/1896 | Valentine | 422/125 |
| 887,743 | A * | 5/1908 | Storm, Jr. | 126/401 |
| 1,554,219 | A * | 9/1925 | Kitchen | 392/495 |
| 1,764,387 | A * | 6/1930 | Buchet | 239/133 |
| 2,402,402 | A * | 6/1946 | Hickman | 43/129 |
| 2,835,533 | A * | 5/1958 | Baker | A01M 7/0089 239/129 |
| 3,037,939 | A * | 6/1962 | Andrews | A01M 13/00 159/4.02 |
| 3,055,144 | A * | 9/1962 | Johnson | A01G 13/065 126/59.5 |
| 3,074,199 | A * | 1/1963 | Johnson et al. | 43/129 |
| 3,109,821 | A | 11/1963 | York et al. | |
| 3,175,733 | A * | 3/1965 | Lerner | 222/146.3 |
| 3,214,860 | A * | 11/1965 | Johnson | 43/129 |
| 3,229,409 | A * | 1/1966 | Johnson | 43/129 |
| 3,239,960 | A * | 3/1966 | Stevens | 43/129 |
| 3,242,098 | A * | 3/1966 | Andrews | 422/305 |
| 3,349,042 | A * | 10/1967 | Andrews | 516/2 |
| 3,441,360 | A * | 4/1969 | Johnson | 431/345 |
| 3,447,532 | A * | 6/1969 | Poppendiek | B01F 3/04007 126/263.01 |
| 3,448,924 | A * | 6/1969 | Congdon | 239/129 |
| 3,496,668 | A * | 2/1970 | Slater et al. | 43/129 |
| 3,548,532 | A * | 12/1970 | Landwer | 43/129 |
| 3,582,496 | A * | 6/1971 | Pfaffenbach | 43/129 |
| 3,623,260 | A * | 11/1971 | Konle | 43/129 |
| 3,656,254 | A * | 4/1972 | Schmedes | A01M 13/00 43/129 |
| 3,727,588 | A * | 4/1973 | Ross | F22B 27/16 122/31.1 |
| 3,811,414 | A * | 5/1974 | Minton | F22B 21/26 122/250 R |

(Continued)

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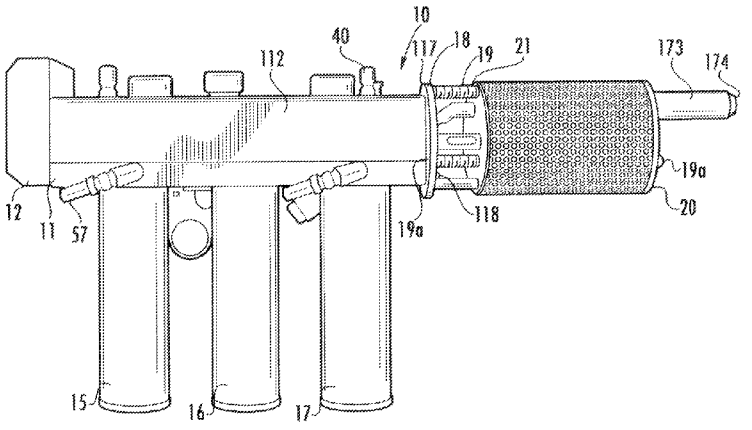
(57) **ABSTRACT**

The present invention relates to a hand held device for producing large volumes of smoke from a smoke producing solution. The design allows for repeated, fast, and lengthy heating of the heating chamber, and thus is an improvement over prior devices which can only be utilized in short bursts.

**20 Claims, 16 Drawing Sheets**



(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 3,888,415 | A * | 6/1975 | Koff et al. | 239/2.1 |
| 3,982,695 | A * | 9/1976 | Burchett | B05B 7/1613 122/250 R |
| 3,986,670 | A * | 10/1976 | Syveson | 239/133 |
| 3,990,987 | A * | 11/1976 | Rogers | B64D 1/20 239/171 |
| 4,282,903 | A * | 8/1981 | Powell | 137/893 |
| 4,291,629 | A | 9/1981 | Kezer | |
| 4,326,119 | A | 4/1982 | Swiatosz | |
| 4,349,723 | A | 9/1982 | Swiatosz | |
| 4,658,802 | A * | 4/1987 | Schultz | 126/271.2 A |
| 4,742,643 | A * | 5/1988 | Thompson, Jr. | F24H 1/165 122/248 |
| 4,818,843 | A * | 4/1989 | Swiatosz | A62B 27/00 392/397 |
| 4,836,452 | A * | 6/1989 | Fox | 239/338 |
| 4,871,115 | A | 10/1989 | Hessey | |
| 4,920,951 | A * | 5/1990 | Le Marchand et al. | 126/403 |
| 4,998,479 | A * | 3/1991 | Perham et al. | 102/334 |
| H000961 | H * | 9/1991 | Yu | F41H 9/06 165/154 |
| H001124 | H * | 1/1993 | Rouse et al. | 60/805 |
| 5,222,666 | A * | 6/1993 | Gnutel | A01M 7/006 222/146.3 |
| 5,246,675 | A * | 9/1993 | Castronovo | 422/305 |
| D362,043 | S * | 9/1995 | Batts et al. | D22/104 |
| 5,870,524 | A * | 2/1999 | Swiatosz | F41H 9/06 392/394 |
| 5,937,141 | A * | 8/1999 | Swiatosz | F22B 1/282 392/397 |
| 6,018,615 | A * | 1/2000 | Loblick | F41H 9/06 261/142 |
| 6,024,971 | A * | 2/2000 | Nachtman | A01M 29/12 424/400 |
| 6,087,935 | A * | 7/2000 | Berner et al. | 340/541 |
| 6,142,009 | A * | 11/2000 | Loblick | 73/40.7 |
| 6,189,453 | B1 * | 2/2001 | Lin | 102/334 |
| 6,260,546 | B1 * | 7/2001 | Vaughn | 123/585 |
| 8,236,240 | B2 * | 8/2012 | Childers et al. | 422/28 |
| 2007/0135307 | A1 * | 6/2007 | Olson et al. | 504/313 |
| 2009/0277973 | A1 * | 11/2009 | Kennon | 239/13 |
| 2010/0133354 | A1 * | 6/2010 | Vandoninck | 239/14.1 |
| 2010/0285436 | A1 * | 11/2010 | DeVore | 434/188 |
| 2011/0103778 | A1 * | 5/2011 | Batts | 392/405 |
| 2015/0226530 | A1 * | 8/2015 | Batts | F41H 9/06 102/334 |

* cited by examiner

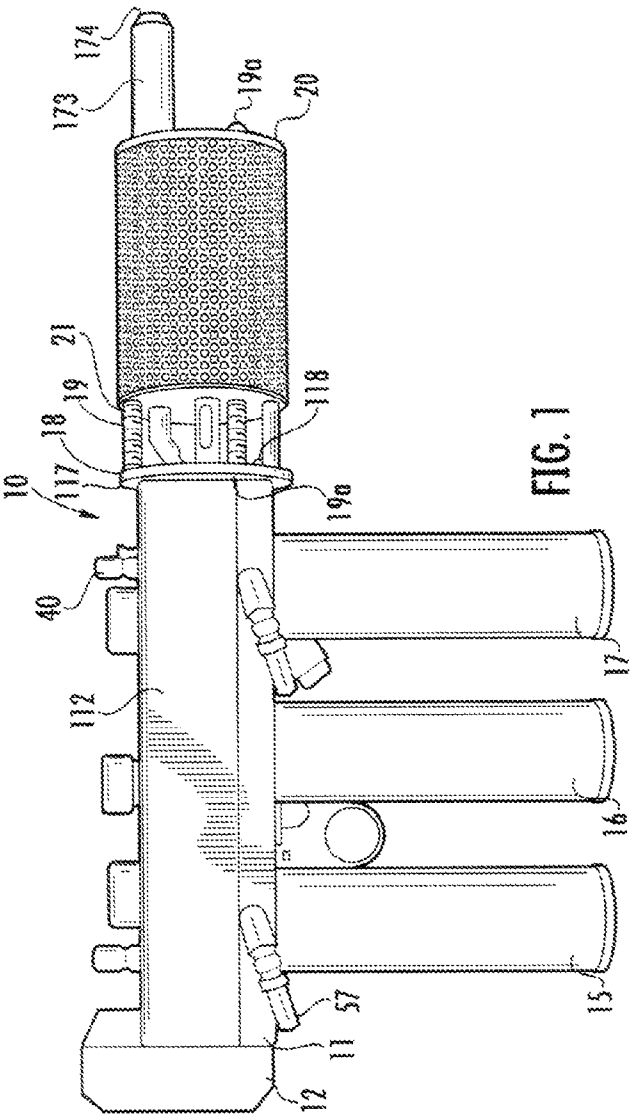

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FIG. 1

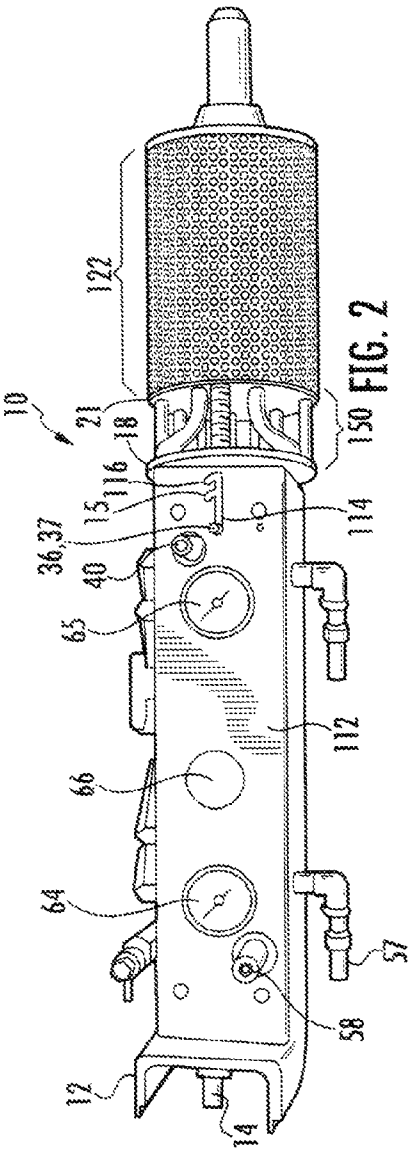
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FIG. 2

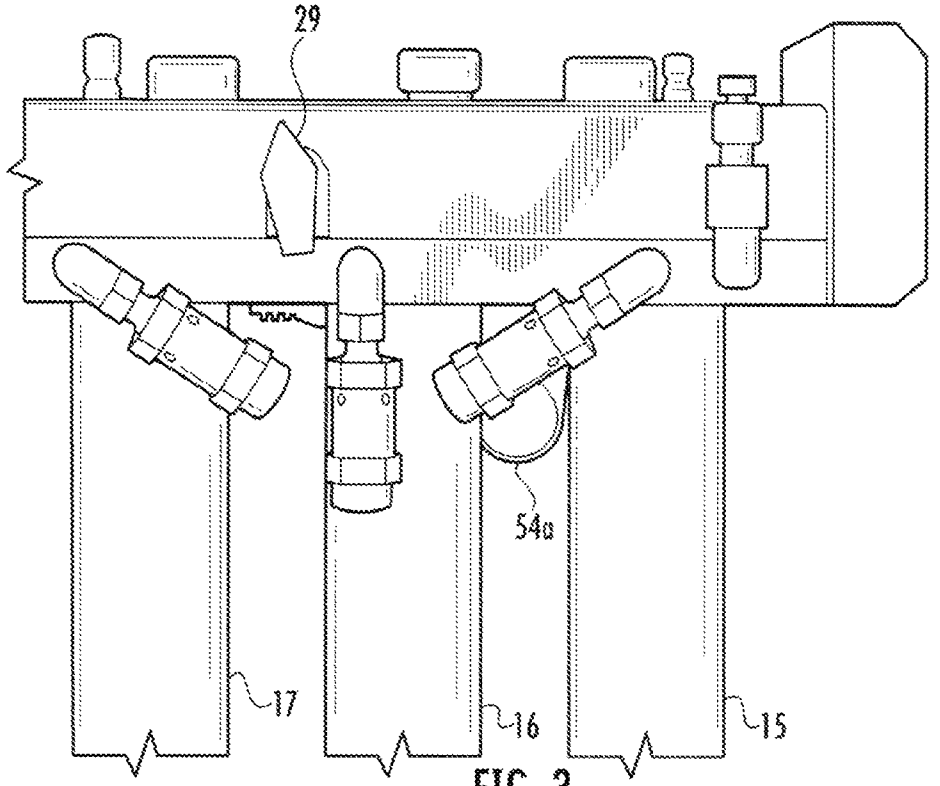


FIG. 3

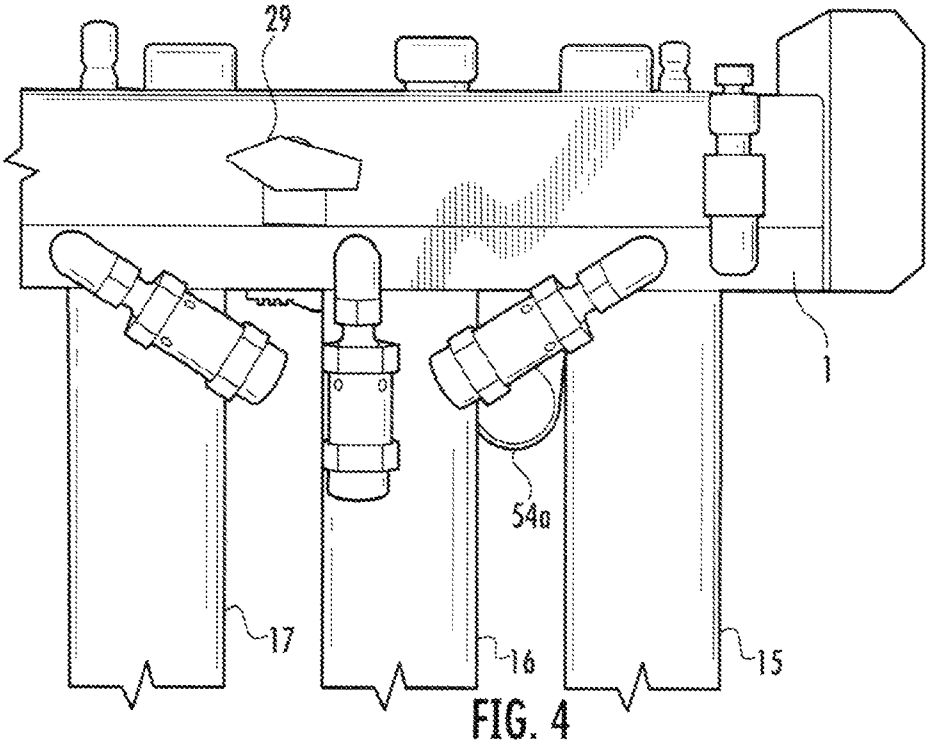


FIG. 4

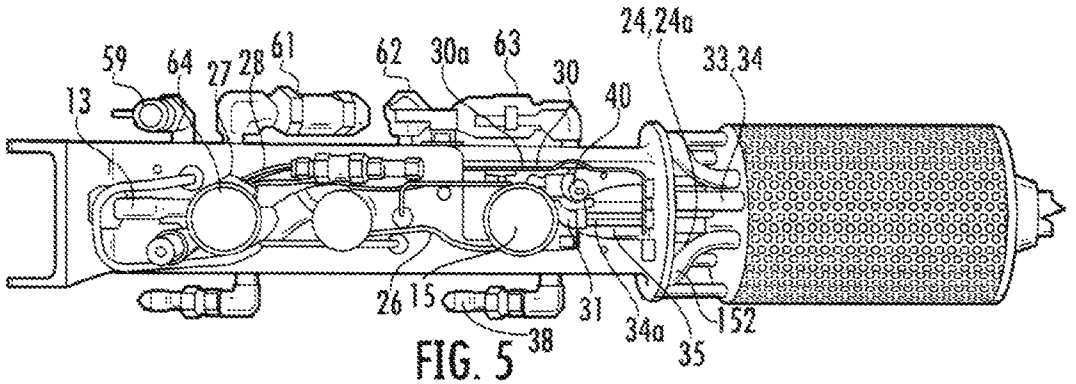
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FIG. 5

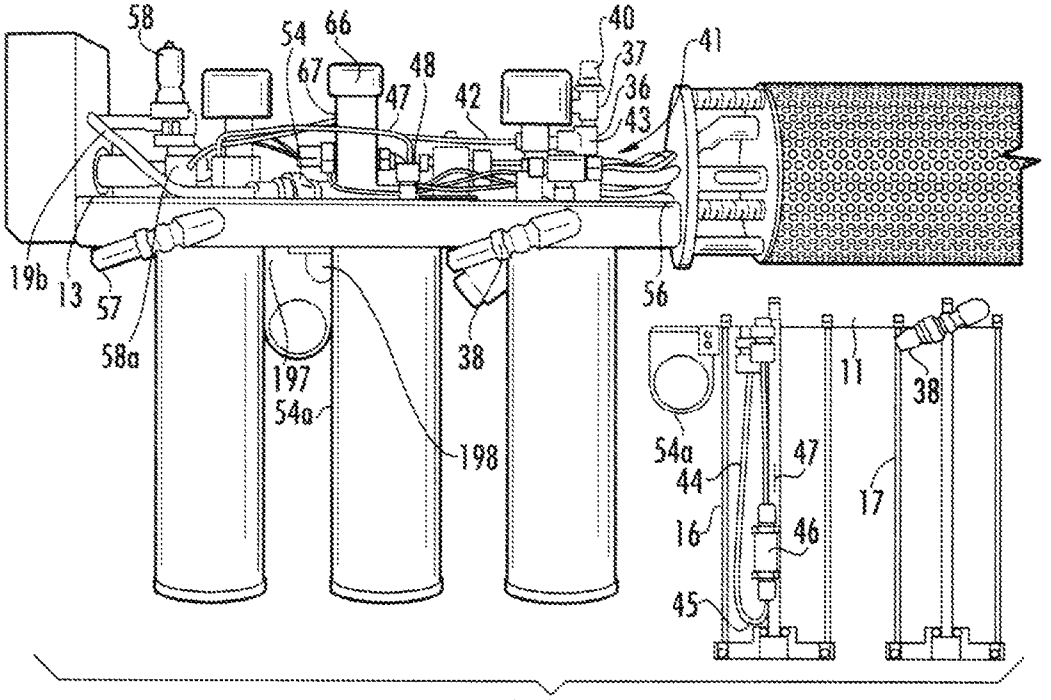
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FIG. 6

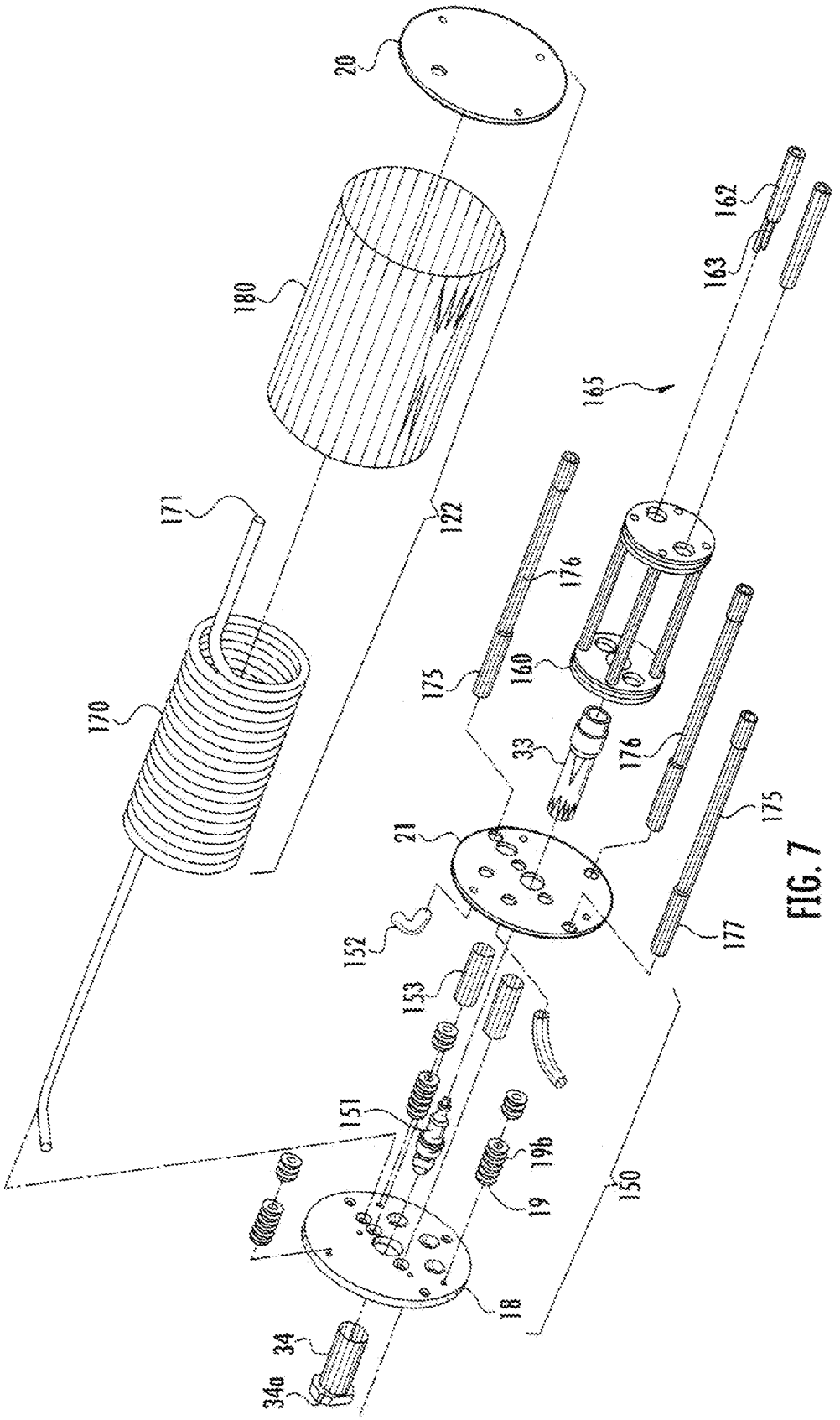
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FIG. 7

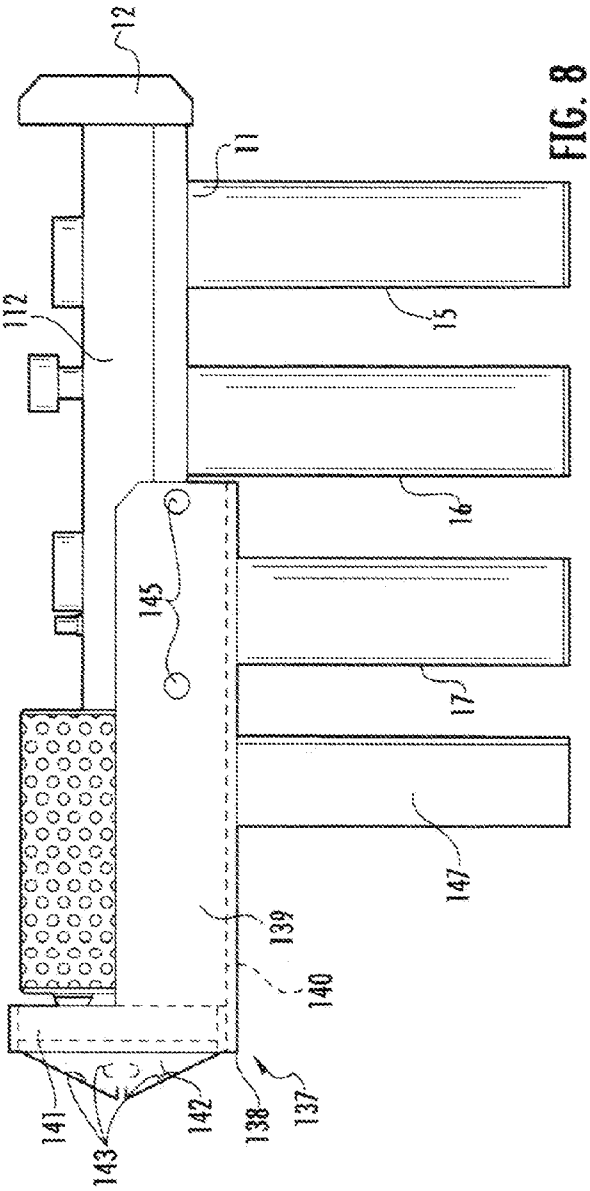
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FIG. 8

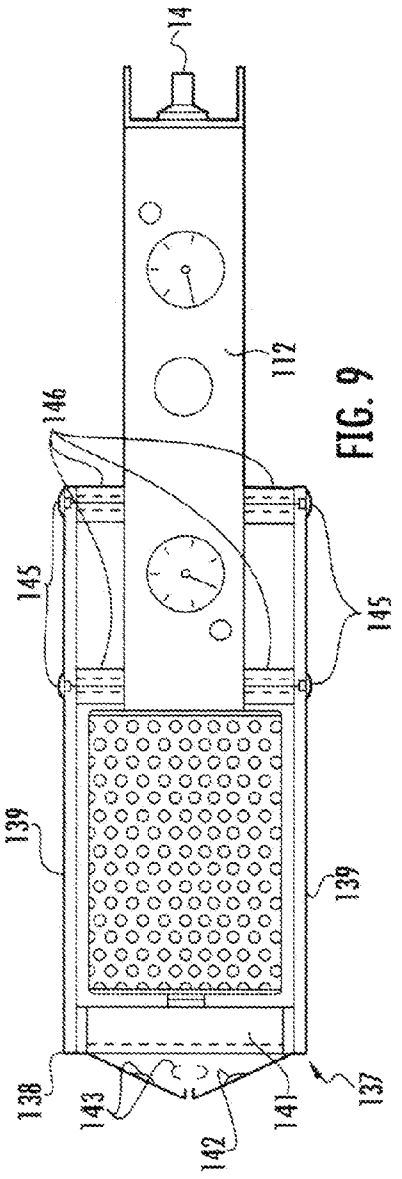
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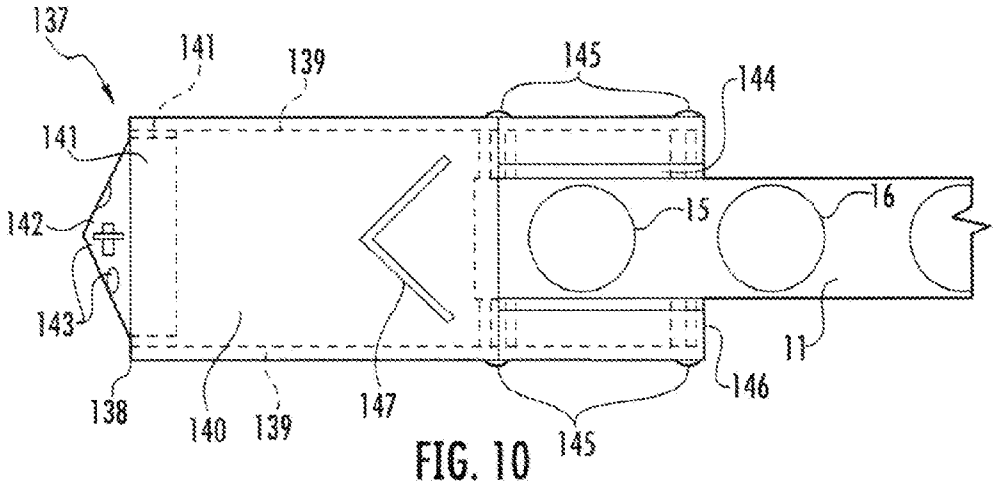
FIG. 9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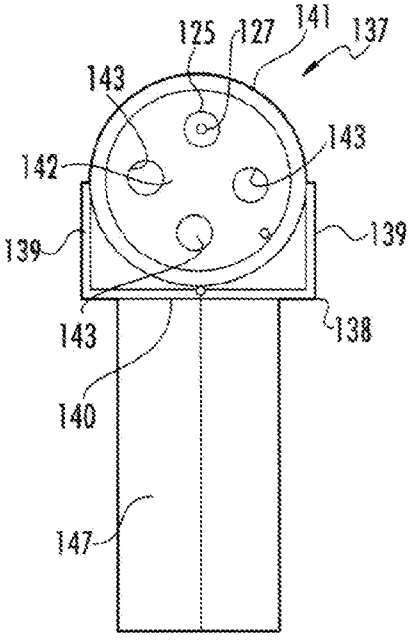
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FIG. 11

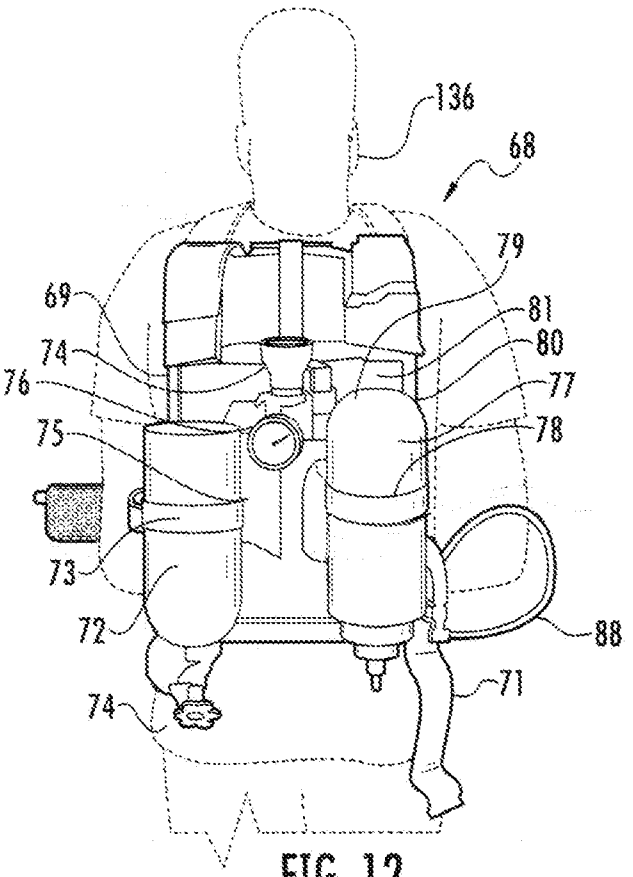
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FIG. 12

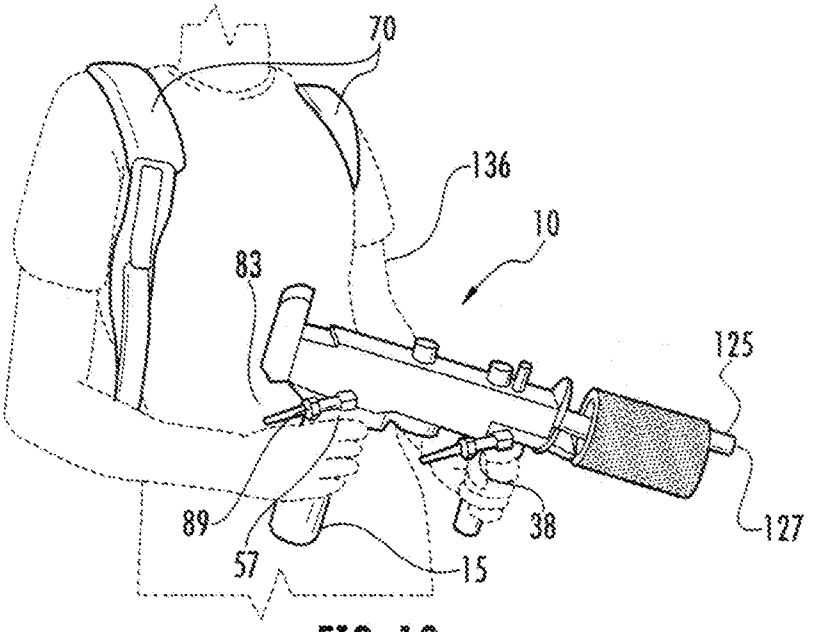
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FIG. 13

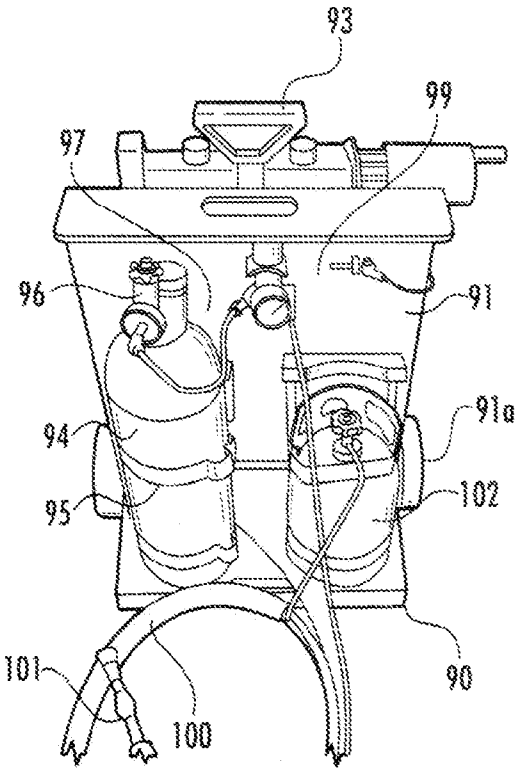
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FIG. 14

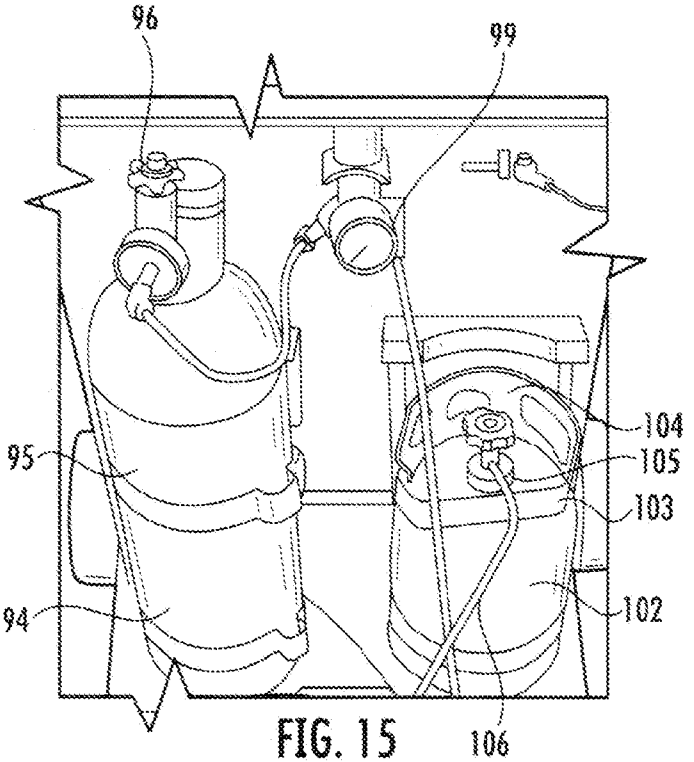
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FIG. 15

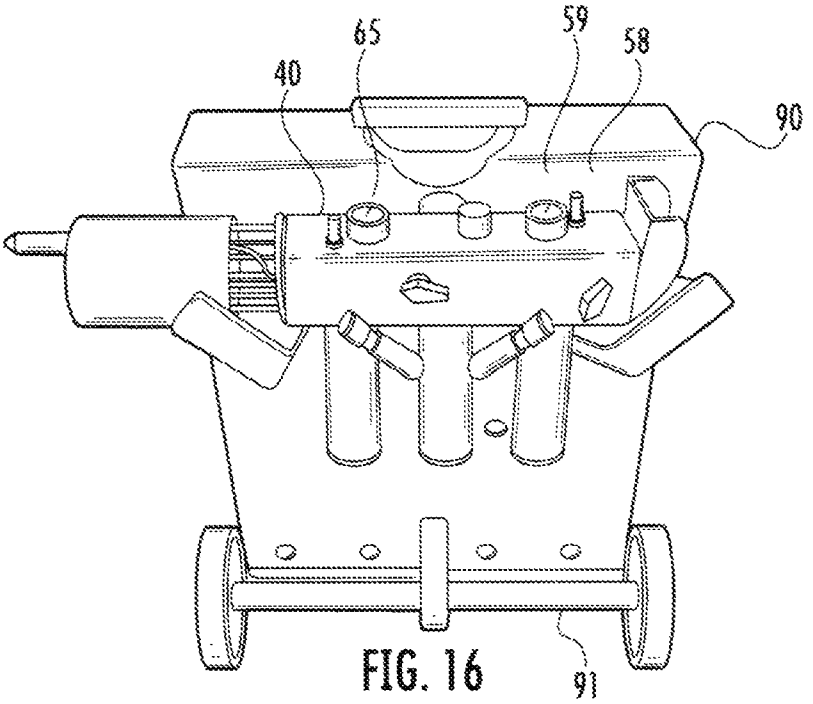



FIG. 16

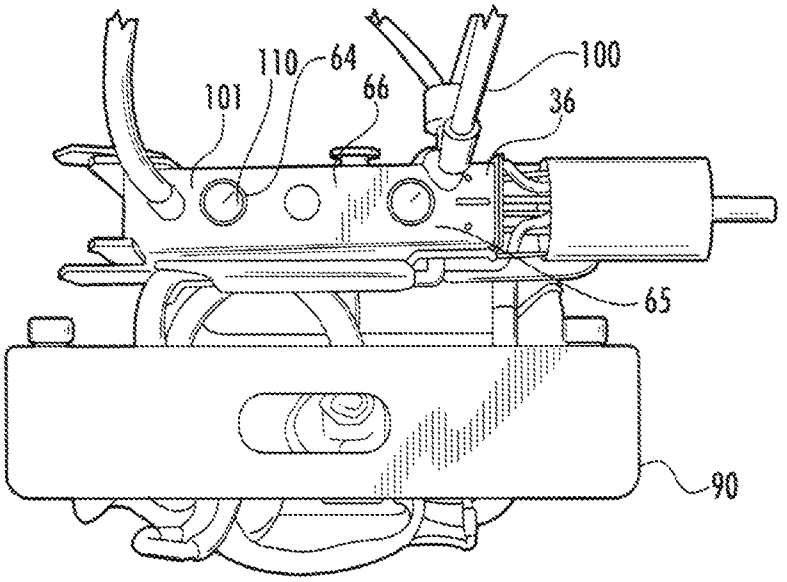



FIG. 17

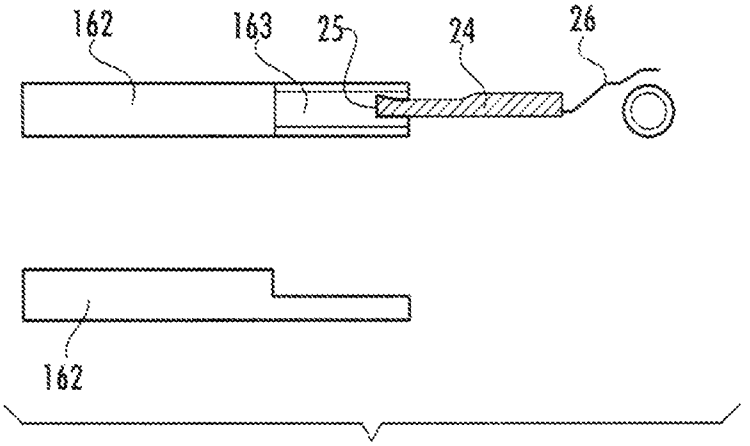



FIG. 18

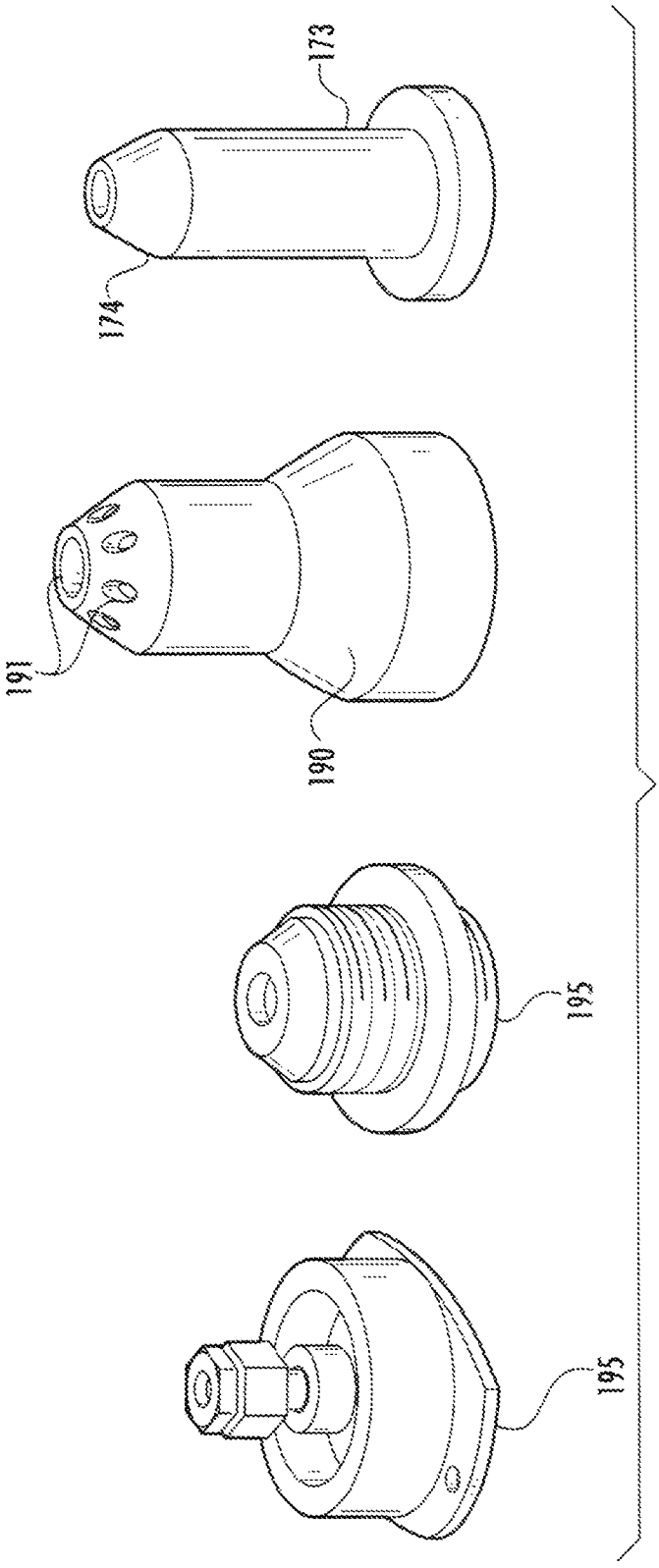



FIG. 19

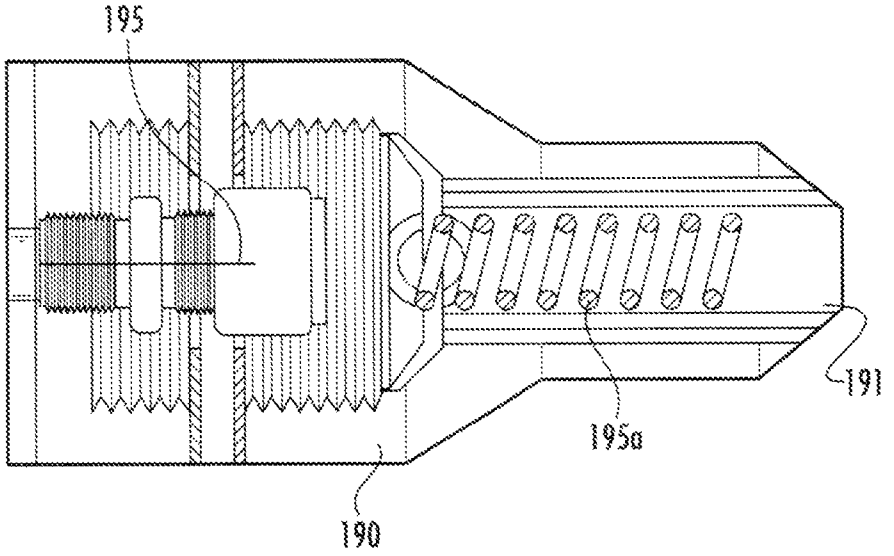
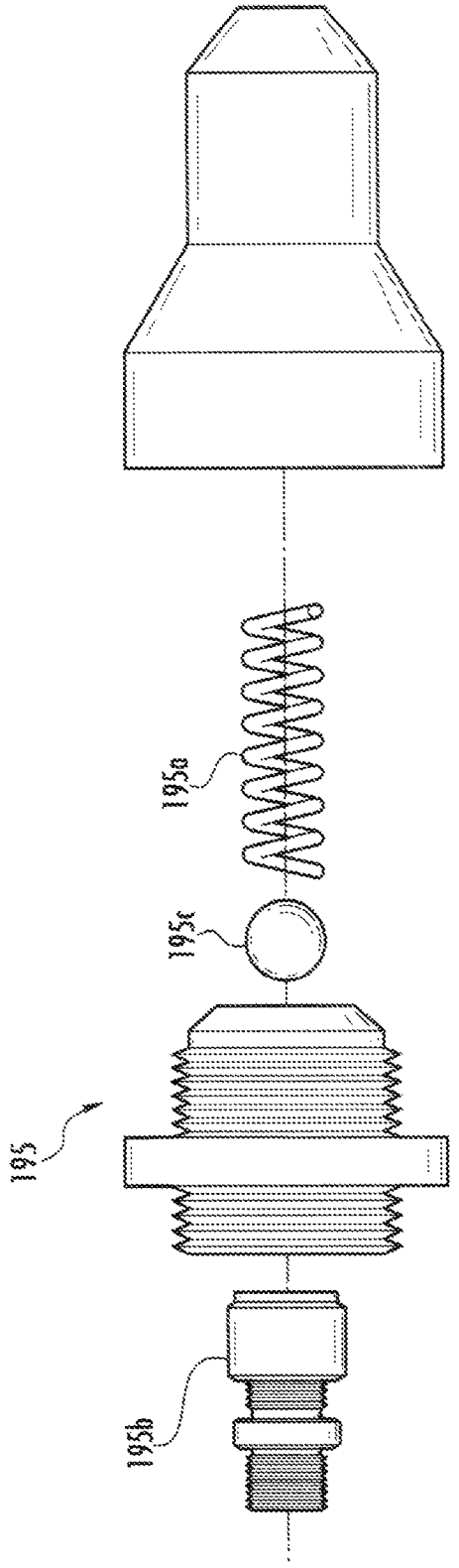



FIG. 19A

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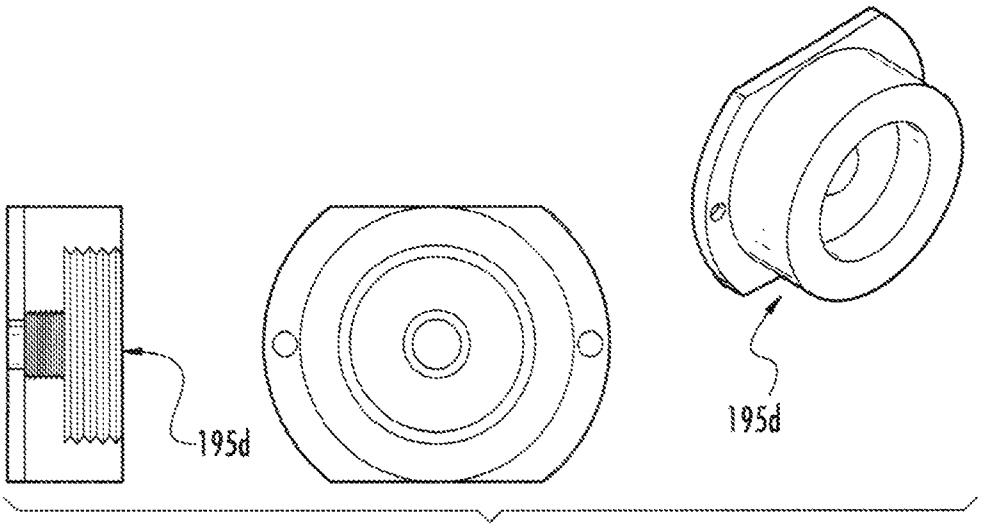


FIG. 19C

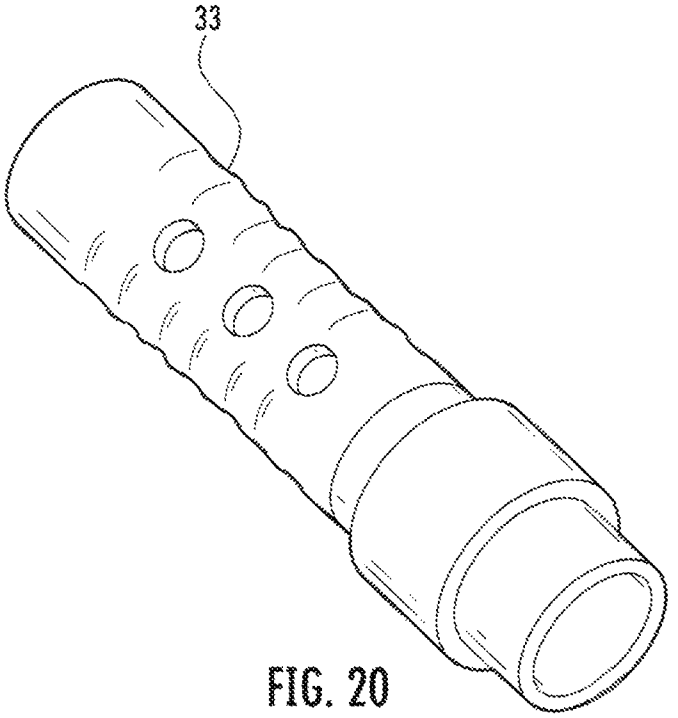


FIG. 20

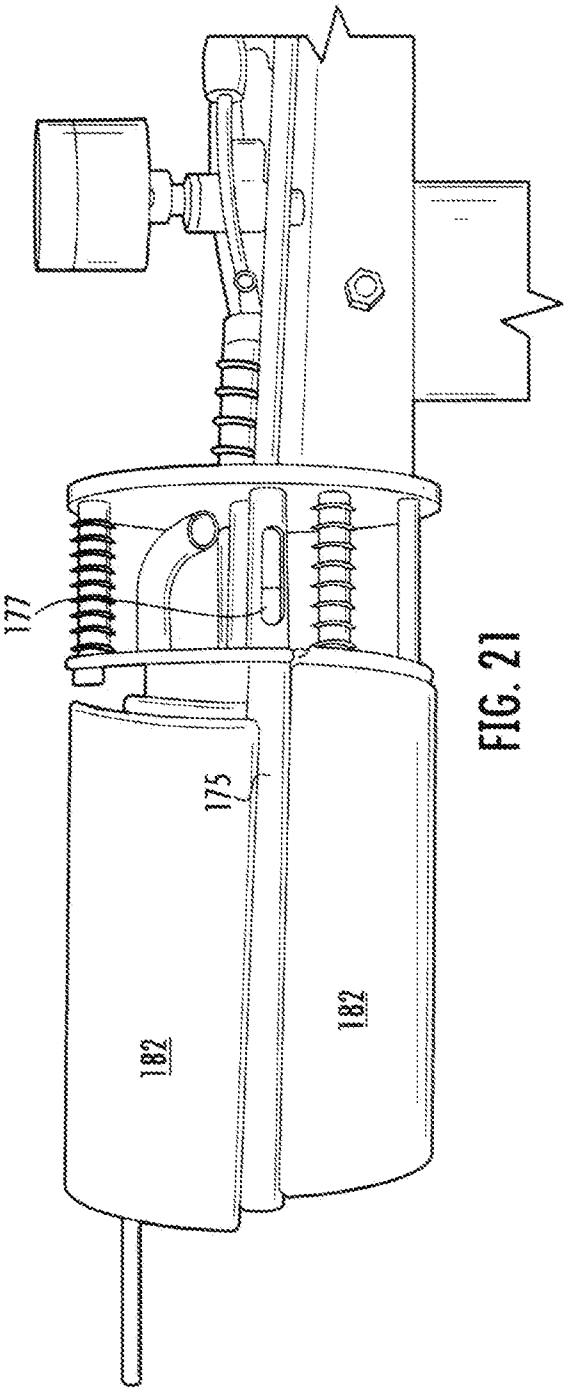


FIG. 21

# DEVICE FOR GENERATING LARGE VOLUMES OF SMOKE

This application claims priority of U.S. provisional application No. 61/255,998 filed on Oct. 29, 2009 and is included herein in its entirety by reference.

## COPYRIGHT NOTICE



## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to aerosol generation and, in particular, to a device that is useful for the production of high volumes of non-toxic simulated smoke for industrial use, military use, and the like.

2. Description of Related Art

The generation of a synthetic smoke has been used by the military during combat and training exercises. In addition, it is used by fire departments and police departments for their needs. On the industrial side, theater and motion picture companies frequently use synthetic smoke to simulate smoke for special effects. Typically, these larger uses involve passing a pressurized, smoke producing liquid near a heat source which vaporizes the liquid into a smoke gas. Usually non-toxic, the formulations can be oil or water based depending on the use and the desired effect. The heat source is usually either battery powered or a flame powered by an ignitable gas, such as liquid propane gas (LPG). The smoke producing liquid is usually pressurized by use of some gas that is inert in the process, such as air nitrogen or the like.

In use, the heating source is heated to a given temperature and then the pressurized, smoke producing liquid passes near the heat source vaporizing before exiting a spray or atomizing nozzle of some sort. Because the vaporization of the smoke producing liquid drains heat energy from the heat source, the problem that exists with these devices is that they can only be used for relatively short bursts since heating the liquid also cools the heat source. This is especially true with battery operated heat sources, and even gas fired heat sources have limited capacity to heat before cooling. In addition, smoke generators typically have limited operational capacity for smoke producing liquid prior to replacing the source or refilling them with additional fluid. An example of a device with such problems is exemplified in U.S. Pat. No. 4,998,479 to Perham et al., issued Mar. 12, 1991 which uses a gas burner in an ignition chamber and discharges the smoke generating gas through a heating coil having about 4 turns. The device has limited capacity for gas generating liquid and is only operable for short bursts before cooling below the vaporization temperature of smoke producing liquids since the heat chamber cools very quickly. In addition, the device cannot generate a dense, thick cloud of smoke as is necessary for many industrial uses. A further problem with this and other devices where an ignition spark ignites a gas, is that ignition is very haphazard and igniting the gas can take several tries leading to a dangerous explosive situation if too much gas accumulates in the ignition chamber before the gases ignite.

## BRIEF SUMMARY OF THE INVENTION

It has been discovered that venting the ignition chamber to the rear of the chamber allows for the chamber to not vent gasses to the side and increases the retention of heat during use. Even further, by including a spark capture tube, ignition is insured on the first try by capturing gas and regulating where the spark is generated. The present device is essentially self contained and maintenance free. The device can be made to be stand alone, dependent external propellant or fuel, or run both ways.

Accordingly, one embodiment of the invention relates to an aerosol device capable of generating smoke comprising:

a) a base portion for handling the device during use;

b) a heating chamber for vaporizing a smoke producing solution having an inlet side and a smoke outlet side the chamber comprising a fuel ignition chamber, one or more combustion gas exit pipe vents on the inlet side or exterior side for the release of combustion gas from the heating chamber, the chamber otherwise sealed for the release of the combustion gas and connected to the base portion;

c) a smoke producing solution pressurized by a propellant for the solution, operatively connected to the base and capable of delivering the smoke producing solution to coiled tubing positioned within the heating chamber and around the ignition chamber wherein the coil is operatively connected to an exit nozzle which is capable of dispersing the smoke producing solution once it is vaporized in the heating chamber; and

d) a fuel attached to the base and operably connected to the heating chamber for delivery of the fuel to the ignition chamber for ignition.

Another embodiment relates to an ignition system for lighting a gas fuel in a chamber comprising:

a) one or more hollow gas collection ignition tubes for positioning within the chamber at least a portion of the side of the tube open to receive gas fuel within the chamber; and

b) an electric spark igniter corresponding to each hollow tube, the tip of each igniter positioned within the open side portion of the corresponding tube.

Yet another embodiment relates to an aerosol device capable of generating smoke comprising:

a) a base portion for handling the device during use;

b) a heating chamber for vaporizing a smoke producing solution having an inlet side and a smoke outlet side the chamber comprising one or more combustion gas exit vents on the inlet side or the heating chamber side for the release of combustion gas from the heating chamber, the chamber otherwise sealed for the release of the combustion gas and connected to the base portion;

c) a smoke producing solution pressurized by a propellant for the solution, operatively connected to the base and capable of delivering the smoke producing solution to a coiled tubing positioned within the heating chamber wherein the coil is operatively connected to an exit nozzle which is capable of dispersing the smoke producing solution once it is vaporized in the heating chamber; and

d) a heater for heating the heating chamber to a temperature that will vaporize the smoke producing solution in the coil.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a right side elevational view of the aerosol generator and delivery device of the present invention.

FIG. **2** is a top plan view thereof.

FIG. **3** is a fragmentary left side elevational view of the generator.

FIG. **4** is a fragmentary view showing the fuel cutoff valve in the on position.

FIG. **5** is a top plan view with the frame housing removed and a partial cutaway of the aerosol generation portion of the aerosol generator and delivery device.

FIG. **6** is a right side elevational view with the frame housing removed and showing a partial cutaway view of the aerosol generation portion of the aerosol generator and delivery device.

FIG. **7** is an exploded view of the heating chamber that generates the aerosol.

FIG. **8** is a side elevational view of the aerosol generator and delivery system of the present invention with a ram attachment mounted thereon.

FIG. **9** is a top plan view of the ram attachment.

FIG. **10** is a bottom plan view thereof.

FIG. **11** is a front elevational view of such ram.

FIG. **12** is a perspective view of backpack mounted propellant, solution and fuel tanks.

FIG. **13** is a front elevational view of the user of the aerosol generator and delivery system of the present invention with the backpack inlet lines connected to such generator.

FIG. **14** is a front perspective view of the recharging station used in conjunction with the present invention.

FIG. **15** is a close-up front perspective view of such stations.

FIG. **16** is a perspective view of the recharging station with the aerosol generator resting thereon.

FIG. **17** is a top view of FIG. **16**.

FIG. **18** is a front and side perspective view of a spark igniter positioned in a gas collection substitute tube drawing.

FIGS. **19**, **19***a*, **19***b* and **19***c* depict an exploded view and assembled view of an exit nozzle having single and multiple exit holes and a check valve.

FIG. **20** is a perspective view of the air flow channel in larger view than FIG. **7**.

FIG. **21** is a view of the ceramic insulators used in the heating chamber.

## DETAILED DESCRIPTION OF THE INVENTION

While this invention is susceptible to embodiment in many different forms, there is shown in the drawings and will herein be described in detail specific embodiments, with the understanding that the present disclosure of such embodiments is to be considered as an example of the principles and not intended to limit the invention to the specific embodiments shown and described. In the description below, like reference numerals are used to describe the same, similar or corresponding parts in the several views of the drawings. This detailed description defines the meaning of the terms used herein and specifically describes embodiments in order for those skilled in the art to practice the invention.

Definitions

The terms "a" or "an", as used herein, are defined as one or as more than one. The term "plurality", as used herein, is defined as two or as more than two. The term "another", as used herein, is defined as at least a second or more. The terms "including" and/or "having", as used herein, are defined as comprising (i.e., open language). The term "coupled", as used herein, is defined as connected, although not necessarily directly, and not necessarily mechanically.

Reference throughout this document to "one embodiment", "certain embodiments", and "an embodiment" or similar terms means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, the appearances of such phrases or in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments without limitation.

The term "or" as used herein is to be interpreted as an inclusive or meaning any one or any combination. Therefore, "A, B or C" means any of the following: "A; B; C; A and B; A and C; B and C; A, B and C". An exception to this definition will occur only when a combination of elements, functions, steps, or acts are in some way inherently mutually exclusive.

The drawings featured in the figures are for the purpose of illustrating certain convenient embodiments of the present invention, and are not to be considered as limitation thereto. Term "means" preceding a present participle of an operation indicates a desired function for which there is one or more embodiments, i.e., one or more methods, devices, or apparatuses for achieving the desired function and that one skilled in the art could select from these or their equivalent in view of the disclosure herein and use of the term "means" is not intended to be limiting.

As used herein the phrase "aerosol device capable of generating smoke" refers to a device which can atomize or vaporize a liquid to a gaseous state by rapid heating and discharging the atomized gas to the surrounding environment. This type of device is capable of generating smoke by use of a smoke generating liquid which, when atomized or vaporized by flash heating, produces a synthetic smoke. Likewise, any liquid that one is desirous of converting to a vapor phase by flash vaporization could be utilized in such a device. The present invention is very useful in producing smoke, so while the majority of information relates to the production of smoke, it is understood that other products could be vaporized instead of or with the smoke producing liquid that generates smoke in the device.

As used herein a "smoke producing solution" refers to liquids which, when vaporized in a heat based smoke generating machine, create an artificial smoke. These liquids can be either water or oil based and depending on their particular use can be chosen for their opaqueness, their persistence or lack of persistence or the presence or lack thereof of residual particulate matter. Examples of such liquids (but not limited thereto) include propylene glycol, glycerin, mineral oil, shell ondina oil, and dipropylene glycol. Other ingredients may also be included in the smoke liquids including diluents, such as water, as well as other active ingredients. Secondary ingredients or additives, such as chemicals for dispersion in crowd control (e.g. pepper spray), chemicals for medical treatment or control in a military, other like situations, or for that matter any item to be dispersed quickly in an aerosol manner can be included in the smoke liquid for dispersion by use of the present invention device. One skilled in the art, given this disclosure, could easily select additives for inclusion with the smoke producing liquid in view of the compatibility, dispensability, and the like of the particular additive used in the present invention device. The smoke producing solution can be contained in a canister attached directly to the base, or in other embodiments it can be in a canister or large tank separate from the base, for example, in a backpack or on a floor mounted unit if even larger. It is usually added in a non-pressurized condition so screw fittings and the like can be used to place a cap on the container.

The smoke procuring solution is delivered to the heating chamber via tubing or the like. Within the heating chamber the tubing is coiled to increase the surface area exposed to heat. In one embodiment, the coil winds are tightly wound

(touching) and in other embodiments there are 6 or more, 12 or more, or 18 or more coil turns to the tubing before exiting the heating chamber. The tubing, upon exiting the chamber, makes use of a nozzle fitting to control the exiting vapors. A single hole nozzle is standard in the art for smoke generators. However, in one embodiment a novel nozzle has multiple holes to maximize the pattern and can also be fitted with a check valve to prevent back flow.

As used herein, the term "fuel" refers to a burnable substance for delivery to the heating chamber for the purpose of burning the fuel and heating the chamber. This can be a solid, liquid or gas type fuel, as desired, and one skilled in the art can deliver either of these to the heating chamber. In one embodiment the fuel is propane (LPG) or natural gas, which under pressure delivers a gas to the heating chamber. It is clear that other heating sources can be used in the heating chamber. In other embodiments the heat is provided by an electrical heating element. This, in some embodiments, is a battery or electric operated metal, ceramic, or the like, which heats up to a desired temperature upon placing an ac or dc current across the element. Typically, the temperature desirable for the heating chamber is from about 800 to about 1600 degrees Fahrenheit. For example, LPG burns at about 1200 degrees F. The fuel can be contained in a canister and in most embodiments is attached to the base wherein the canister can be refilled or replaced as necessary. It could of course be separate from the base as is the case with propellant and smoke producing solutions.

As used herein, the term "propellant" refers to a gas or other material added to the smoke producing solution so that the solution will travel from where ever it is stored to the heating chamber and out the present invention as smoke. Typical propellants for these solutions include air and nitrogen, though any propellant compatible with the device and the surrounding conditions could be used. In one embodiment the propellant is a vacuum pulling the smoke producing solution to the desired location. Where the fuel needs pressurization, the propellant, either the same or different from the propellant used for the smoke producing solution, could be used to assist the fuel in reaching the heating chamber. The smoke producing solution can be prepressurized, but in one embodiment of the present invention the propellant is in a separate container and delivered to pressurize the smoke producing solution as needed. The propellant can be contained in a canister attached directly to the base or in other embodiments it can be in a canister or large tank separate from the base, for example, in a backpack or on a floor mounted unit if even larger.

The present invention has two basic parts, a base portion and a heating chamber. The base portion is designed to attach things that need or can be kept cooler and to handle the device during use while the heating chamber side is designed to be brought to a temperature that can vaporize the smoke producing solution delivered to the heating chamber. The "heating chamber" can be either heated by a fuel or an electric heating element as described above. The heating chamber will have an inlet side where the smoke producing solution enters the chamber and an outlet side where the smoke exits.

A heating chamber has several elements to it. Two elements that will be in the heating chamber, regardless of how the chamber is heated, are any gases generated from the combustion of fuel or the heating process will not be vented directly out the side of the unit, rather out the inlet side or through side tubes. To release the gases in the chamber in this manner, the chamber is essentially sealed in all directions except for the inlet side which comprises one or more exit vents or tubes positioned in the side. The vents can be any type and positioned around the inlet side of the chamber. They can be of mixed types but sufficient to remove venting gas without substantially allowing heat to be released from the chamber (inlet side or side tubes). One type of vent in the inlet side would be a hollow exhaust pipe or a tube stuck on the outside of the inlet side in communication with the interior of the chamber. Yet another type would be a combustion gas tube placed in the chamber to collect combustion gas and then deliver the gas to the inlet side of the chamber and out of the chamber. Both embodiments can be seen in the drawings and examples which follow. A type of side tube can be seen in the drawings for gathering gas and delivering it out the side by creating an indirect pathway, thus trapping heat but releasing gas. The chamber can be sealed by using insulating material the frame tubing used, or any means that substantially seals the chamber except for exhaust vents to the release of the combustion gases. Of course, it must be sealed in a manner that retains the heat in the chamber as best as is possible, as well. Therefore, use of insulators, ceramics, mantles, and the like can be used. One particular embodiment is shown in the drawings which follow, but clearly other embodiments could be designed in view of the disclosure herein for heating the heating chamber.

Where a fuel is to be ignited in the heating chamber a "spark generator" can be used for igniting the fuel. Spark generators are generally used in the ignition of gasses. Usually they are a metal conductor, sometimes wrapped in a ceramic (a ceramic igniter) and when an electrical current (ac or dc) is applied, a spark travels from the tip of the igniter to a nearby piece of conductive material. An ignition button is positioned on the base portion or elsewhere to engage the igniter for igniting the fuel. In one embodiment there are 2 or more igniters to insure first time ignition especially when used in conjunction with a gas collection ignition tube. Such a gas collection tube is a hollow tube with a portion of the side of the tube removed so that gas can collect within the open side area of the tube. (See the drawings for an example.) The tip of the spark generator can be positioned roughly in the center of the area and since fuel accumulates in the tube open area, it is likely that ignition will occur every time. Once again, a plurality of these tubes can be used to further insure a first time lighting of the fuel. Note where desired, an air inlet including a choke (means to adjust amount of air mixture) may be necessary to ignite the gas. Obviously, while the heating chamber is sealed the air is important to keep the fuel ignited.

The "base portion" is attached to the heating chamber in a convenient manner. In one embodiment there is an insulating material in-between the base and the heating chamber. It is possible that there is a portion of the heating chamber that exists outside the chamber itself, such as the exit vents, the choke, and the like, for purposes of this invention that is still part of the heating chamber. Note, for example, where the insulator is in the drawings. In one embodiment the insulating material is an alumina silica ceramic, such as Alphabond 2300 from Thermal Ceramics. Other materials could also be used and one skilled in the art could chose those insulators in view of the teaching herein. The base portion is designed for mounting tubing, filters, buttons, valves, handles, on/off buttons, wires, canisters (if small enough), gauges, check valves, over flow valves, inlet valves for filling the device, or any part or means that benefits from being attached to the cool part of the device, or the like.

It should be noted that in some embodiments the base is made of aluminum and tubing, fittings and the like are made of stainless steel, niconel or the like, however, selection of other heat resistant materials is within the skill in the art in view of this disclosure.

Now referring to the drawings, the Figures will be discussed collectively since understanding of the invention is aided by referring back and forth to the various perspectives of the present invention. In some drawings, the covers on the base are removed and in others the covers are in place. The aerosol generation (including smoke generation) and delivery device of the present invention, indicated generally at **10**, includes a base **11** formed from a lightweight material, such as aluminum. The base and other parts of the invention can be left natural or colored, such as by aluminum coatings like anodizing. Fixedly mounted on one end of base **11** is a vertically disposed, channel shaped rear guard **12**. An electrical pulse generator **13** is mounted on the rear guard **12** with an ignition button **14** rearwardly projected therefrom as seen clearly in FIG. **5**.

A fuel canister **15**, aerosol creating solution canister **16**, and propellant canister **17** are all vertically mounted to the bottom of base **11** and outwardly project therefrom.

A front base plate **18** is fixedly secured to base **11** by means such as bolts **118**. An upper and two side heating chamber mounting rods **19** are secured to front base plate **18** by nuts **19***a* and outwardly project therefrom. The mounting rods **19** also display heat cooling fins **19***b* which aid in dissipating heat. On the outer end of chamber mounting rods **19** is an outlet side heat chamber cap **20** that is held in place by nuts **19***a*. Mounted on the heat chamber mounting rods **19**, intermediate the front base plate **18** and the outlet side heat chamber cap **20**, is inlet side heat chamber cap **21**.

An igniter **24** passes through inlet side heat chamber cap **21** and is mounted thereon; it is hidden behind igniter heat shield **24***a*. It should be noted that two or more igniters can be used to add redundancy to the ignition process. The igniter **24** also passes through inlet side heat chamber cap **21** with the end thereof being disposed in the burner chamber of the heating chamber **160**. The electrical pulse generator **13** is connected to igniter **24** by way of wire **26**.

When the ignition button **14** is pushed, the electrical pulse generator will send an electrical pulse through wire **26** to the dual ignition **24** which will cause a spark to be created at the tip **25** of both igniters. Since electrical ignition systems of this type are well known to those skilled in the art, further detailed discussion of the same is not deemed necessary.

Fitting **27** is mounted on base **11** and communicates with the interior of fuel canister **15**. Fuel line **28** is communicatively connected at one end to fitting **27** and at the other end to fuel filter **28***a* (not shown but inside fuel canister is a check valve) and then in turn to fuel cutoff valve **29**, which is also mounted on base **11**. Fuel line **28** is connected between cutoff valve **29** and the inlet side of fitting **30***a* mounted on base **11**. The outlet side of fitting **30***a* is connected to one end of fuel line **31** with the other end being connected to the gas burner, indicated generally at **160**.

An air mixing orifice housing **33** forms part of the gas burner **160**. An air control sleeve **34** is longitudinally mounted on air mixing orifice housing **33**. A shoulder **34***a* is provided on the rear portion of control sleeve **34** with a coil spring **35** disposed about the exterior of the sleeve between the rear of the front base plate **18** and shoulder **34***a* to bias the sleeve rearwardly.

An air flow adjuster lever **36** is fixedly secured to the upper portion of sleeve shoulder **34***a* at one end and has a manipulating handle **37** at the opposite end thereof as can clearly be seen in FIG. **6**.

A fuel quick connector coupling **38** is mounted on the right side of base **11**. This connector is communicatively connected to fuel line fitting **30** as indicated.

A propellant quick connector nipple **40** is mounted on elbow **43**. Fitting **41** connects to base **11** and communicates with the interior of propellant canister **17** and with elbow **43**. The inlet end of flexible line **44** is connected to the lower end of a fitting. At the bottom of the loop in flexible line **44** is a solution inlet orifice **45**. A one way check valve **46** is provided in flexible line **44** above orifice **45** to allow propellant and the solution picked up through orifice **45** to pass in the direction of arrow **47** while preventing flow in the opposite direction.

Flexible line **44** passes from check valve **46** into fitting **48** mounted on base **11**. Fitting **48** operatively connects line **49** to a fitting for further distribution of propellant and solution.

An internal passage within base **11** communicates between propellant solution and quick connect coupling **57**. A line connects trigger activated valve **54** (with trigger **54***a*). This valve **54** is in turn operatively connected to line **55** at one end with the other end being connected to coil inlet **56**.

A fuel quick connector nipple **58** is mounted on fitting **58***a* which is mounted on base **11** and communicates with the interior of fuel canister **15**.

A liquid level gauge **59** is mounted on the left side of base **11** with a tube extending therefrom into the interior of fuel canister **15**. When the canister is being filled through coupling **58** and the liquid level reaches the desired level, this is noted on the gauge **59**. The fueling of the canister can then be stopped. The purpose of this is that safety regulations do not allow the canister to be filled more than 80% full.

A fuel relief valve **61**, set at preferably 450 psi, is mounted on the left side of base **11** and communicates with the interior of fuel canister **15**. A propellant/solution relief valve **62** is also mounted on the left side of base **11** and communicates with the interior of solution canister **16**. This relief valve is also preferably set at 700 psi. Finally, a propellant relief valve **63** mounted on the left side of base **11** and communicates with the interior of propellant canister **17** and is set at 700 psi. The purpose of the relief valves **61**, **62** and **63** is to keep the canisters from exceeding a select pressure. Over filling of a cylinder could cause a cylinder to explode, and thus, their presence is a safety factor in using these devices. The pressure relief valves can be fixed pressure or in one embodiment one or more is an adjustable pressure.

A standard pressure gauge **64** is mounted on base **11** and communicates with the interior of fuel canister **15**. A second pressure gauge **65** is mounted on base **11** and communicates with the interior of propellant canister **16**.

A screw cap **66** acts as a closer for neck **67** that communicates with the interior of solution canister **16** so that the canister can be filled with solution, such as smoke solution.

Since the fuel, solution and propellant canisters **15**, **16** and **17** are of limited capacity, a backpack supply, indicated generally at **68**, is provided in FIGS. **12** and **13**. A backpack frame **69** has standard adjustable shoulder straps **70** and an adjustable waist strap **71**. Since backpack frames, shoulder straps, and waist straps are well known to those skilled in the art, further detailed discussion of the same is not deemed necessary.

A propellant tank **72** is mounted on backpack frame **69** by adjustable straps **73**. A standard cut-off valve **74** is mounted on tank **72**. Line **75** communicates between valve **74** and pressure gauge **76**.

A solution tank **77** is mounted on backpack frame **69** and is held in place by adjustable straps **78**. A valve **79** on solution tank **77** communicates through line **80** to mixing valve **81**. This mixing valve is also connected to line **75** from propellant tank **72**. Mixing valve **81** also communicates with one end of line **82**. The other of this line has a quick connect coupling **83**

adapted to be connected to propellant/solution quick connect **57** on the rear portion of base **11** of aerosol generation and delivery device **10**.

In FIGS. **14** and **15**, a recharging station, indicated generally at **90**, is used for recharging the pressurized fuel and propellant canisters of the aerosol generation and delivery device **10**. The solution contained within canister **16** is non-pressurized when being filled and the solution is poured into neck **67** after the screw cap **66** has been removed.

The recharging station **90** includes a horizontal frame **91** with wheels **91***a* rotatively mounted on opposite ends thereof. A vertical frame **92** is secured to horizontal frame **91** at one end with a handle **93** being provided on the other end.

A propellant tank **94** is mounted on one side of vertical frame **92** and is held in place by adjustable straps **95**.

A standard tank valve **96** is mounted on propellant tank **94**. One end of line **97** is connected to valve **96** with the other end being connected to a fitting. This fitting communicates with propellant pressure gauge **99**. The fitting is also connected to one end of line **100** with the other end connected to propellant quick connect coupling **101** which can be attached to coupling **40** on generator **10** for filling propellant canisters **16** and **17**.

Fuel tank **102** is mounted on the opposite side of vertical frame **92** from propellant tank **94** and is held in place by adjustable strap **103**.

A standard tank cut-off valve **104** is provided on fuel tank **102** and is connected to the LPG connector **105**. One end of fuel line **106** is connected to LPG connector **105** with the other end of the connector being connected to a propane shut-off valve **104**. Line **106** connects to fitting **101** which can connect to nipple **58**. The fitting **101** is out fitted with shut-off valve **110**. Fitting **101**, when connected to fuel quick connect nipple **58**, can be used to fill fuel canister **15** up to 80% when the liquid fuel enters the tube to give a visual reading on site gauge **64**. The refueling process will be stopped at that point.

The solution canister **16**, which is not pressurized during filling, can be filled through neck **67** after screw cap **66** has been removed as needed. After the solution canister has been filled and the screw cap **66** is replaced, such canister can be charged by the propellant prior to the generation of smoke by the smoke generator **10**.

A base housing **112** is mounted above base **11** and is secured in place by means such as screws. Exteriorly exposed above base housing **112** is fuel quick connect coupling **58**, fuel pressure gauge **64**, solution filler screw cap **66**, propellant pressure gauge **65**, propellant quick connect coupling **40**, and air flow adjuster lever **36** and its manipulating handle **37** as can clearly be seen in FIGS. **1** and **2**.

The air flow adjusting lever **36** passes through longitudinal slot **114** in the base housing **12**. This air flow adjusting lever slot has two L-shaped locking slots **115** and **116** on one side thereof as can clearly be seen in FIG. **2**. When the air flow adjusting lever **36** is in the position shown in FIG. **2**, the air control sleeve **34**, against the bias of spring **35**, will be in its most open position relative to the mixing orifice housing **33** of gas burner **160**. When the lever **36** is manipulated by handle **37** and placed in L-shaped slot **115** and is held in place by the bias of spring **35**, sleeve **34** partially closes the air mixing orifice housing **33**. When the lever **36** is in L-shaped slot **116**, the air control sleeve **34** closes off even more of the air mixing orifice housing **33** of burner **160**.

An insulating plate **117** is mounted between the front base plate **18** and base **11**. The base plate and the insulating plate are held in place by means such as bolts **118** that are threaded into base **11**.

Insulating plate **117** is made from a material that is commonly referred to as Alphabond 2300 which will eliminate over 70% of the heat that is generated in the heating chamber, indicated generally at **122**, from being transferred to the base **11**. The operation of the heating chamber **122** will hereinafter be described in greater detail.

In FIG. **7** we have an exploded view of heating chamber **122** and the air inlet/exit area **150** which is bound by base front plate **18** and inlet side heat chamber cap **21**.

The area **150** consists of several elements which are visible in other figures but for clarity are shown here in exploded view. Note that this area, among other purposes, is designed to keep the base cool by providing either insulation or cooling function to the heat generated in the heating chamber **122**. It is also designed to be an area for air inlet and for at least some air/heat expulsion.

The fuel line passes into the air area **150** and reaches the propane orifice **151** where the orifice, modulated by the control sleeve **34**, mixes fuel and air to the desired mixture (note, spring **56** which helps modulate sleeve **34** is not shown but can be seen in FIGS. **5** and **6**). This can be valuable when starting the device, i.e. use as a choke mechanism. The fuel line passes through inlet side chamber cap **21** and into the heating chamber **122**. The area **150** is also where combustion gas vent pipes **152** are positioned. The gas vent pipes **152** are positioned in area **150** to aid in removing combustion gases without significantly impacting the heat remaining in the heating chamber **122**. By back venting the gases, the chamber retains more heat than direct side venting (i.e. having a direct side opening for gases to escape), and thus, allows the unit to act more efficiently and retain heat longer. Also, igniter protective housing sleeves **153** insulate and transfer heat away from igniters **24** passing through the sleeves **153** in this area on their way to the heating chamber **122**.

A mixture of fuel and air are delivered to the heating chamber by mixing orifice **34** and specifically to the inner ignition chamber **160** via opening **34***a*. Positioned inside the chamber **160** are gas fuel collection tubes **162**. The gas collection tubes **162**, one for each igniter, help concentrate fuel in opening **163**. By positioning igniter tip **25** in opening **163**, a first time ignition is mostly guaranteed. By utilizing two or more igniters **24**, first time ignition is even further guaranteed. Igniters **24** are left out of FIG. **7** for clarity, but are shown in FIG. **18** positioned in a collection tube **162** in larger detail.

Ignition chamber **160** is then covered with heating mantle **165**. In operation, the air/gas mixture is delivered to ignition chamber **160**, the igniters **24** are engaged and the fuel in the ignition chamber **160** is ignited. Because of mantle **165**, the flame is contained in the chamber **160** as it would be inside a mantle on a gas camping lantern. The mantel **165**, in one embodiment, is a wire mesh made from a material, such as Inconel wire mesh, which will withstand temperatures well above 3000 degrees Fahrenheit.

Positioned around the ignition chamber **160** is stainless steel coil tubing **170** which contains the propellant/smoke material. It has been found from experience that coils **160** lying in juxtaposition to each other give superior combustion results over coils with fewer turns and/or that are spaced apart. In one embodiment there are 6 coils, in another there are 18 or more coils.

The heat from the ignition chamber **160** heats the smoke producing liquid to vaporization wherein it exits the coil at **171** before exiting nozzle **173**. Nozzle **173** has an axial opening **174** therein so that smoke created by combustion within coils **170** can be emitted therefrom. (Either single exit port or multiple port, as shown in FIGS. **19**, **19***a*, **19***b* and **19***c*, can be utilized). In order to further reduce combustion gases, again

while minimizing heat loss from heating chamber **122**, exhaust tubes **175** are utilized. The exhaust tubes **175** have exhaust collection ports **176** which are positioned toward the ignition chamber for collecting combustion gas and exit vent **177** for expelling the gas to the atmosphere. As can be seen, a plurality of exhaust tubes **175** are positioned in between the inlet side cap **21** and the outlet side cap **20** at the periphery of those caps. Obviously, the exhaust vent **177** is facing the exterior on a radius with the center of the ignition chamber **160**. These tabs also help retain heat. Also, positioned around the periphery are ceramic panels **182** which then seal the interior of the heating chamber **122** from severe heat loss compared with an open vent to the atmosphere situation. These panels can be made from an inorganic silica binder that will not smoke or produce noxious fumes during initial and subsequent firings. In one embodiment, these panels are made from a material sold under the trade name Alfabond 2300-H, which maintains its structural and mechanical strength and will not burn out. Materials other than ceramic (or other ceramics) could be used if they serve the same function and purpose. In the example of the drawings, 3 pieces of ceramic **182** are utilized and spaced by gas collection tubes **162**, but more or less pieces will be used based on how many, if at all, collection tubes **162** are utilized. Over the ceramic **182** and tubes **175** is placed a heat shield **180**. The shield **180** holds the ceramics **182** in place and further aids in holding heat to prevent or at least slow heat dissipation. The heat shield can be perforated as shown in FIGS. **1** and **2** in order to allow for combustion gas to escape. The ceramics **182** are shown in FIG. **21** and left out of FIG. **7** for clarity purposes. Not shown is an optional heating chamber nozzle burn cover, this over is designed to further retain heat and prevent accidental burns from the heating chamber. In one embodiment, the inner layer is fiber glass insulation, about ¼ to ¾ inches thick, with a center shell of a Kevlar/Nomex material. Other materials could also be utilized and is within the skill in the art.

Turning back to FIG. **3** and FIG. **4**, the fuel valve **29** is shown in the off position in FIG. **3** while shown in the on position in FIG. **4**. The fuel valve **29** can also be fitted with a locking means if desired.

The ram attachment, indicated generally at **137**, as in FIGS. **8** through **11**, is designed for use in police and military operations to protect the smoke generator during riot control, while flushing fugitives from building enclosures, and the like.

The ram attachment is composed of a channel member **138** having side walls **139** and a bottom **140**.

The front of the channel member **138** includes a ring **141** that is secured to the side walls **139** and bottom **140** by means such as weldment. An outwardly projecting concave plate **142** is secured to ring **141** by weldment or other suitable means. This plate has a plurality of openings **143** therein for dissipating heat as well as the upper opening being aligned with the opening **127** in nozzle **125** so that smoke can pass through such plate.

In the rear portion of the bottom **140** of channel member **138** has a 13-shaped opening **144** therein which allows the propellant canister **15** to project downwardly therethrough as shown particularly clear in FIG. **10**.

A plurality of bolts or other suitable securing means **145** pass-through the side walls **139** of channel member **138** as well as through spacers **146** and into base **11** of the smoke generator **10** to firmly hold the ram attachment **137** in place on said generator.

Finally, a V-shaped canister guard **147** is secured to the bottom **140** of channel member **138** by weldment or other suitable means and downwardly extends therefrom as can clearly be seen in FIG. **8** and FIG. **10**.

The ram attachment **137** can be quickly attached to the smoke generator **10** of the present invention by inserting bolts **145** and tightening the same. The ram attachment can be just as readily removed by simply loosening such bolts and moving the attachment away from the generator.

To use smoke generator **10** of the present invention as an independent unit, the fuel, propellant and solution canisters must be filled. If the recharging station **90** is used, the canisters **15**, **16** and **17** are placed on pads as shown in FIG. **16**.

The fuel quick connect coupling **101** is placed in operative engagement with fuel quick filling nipple **58**. Valve **104** is opened, as is valve **110**, to allow fuel to flow into fuel canister **15** until it reaches desired full capacity. This is visually seen on site gauge **59**. Valve **110** is then shut off, as is tank valve **104**, and the coupling is disconnected from nipple **58**.

Screw cap **66** on solution filling neck **67** is removed and liquid solution is poured from a suitable container (not shown) into the neck until the solution canister **16** is full. The screw cap **66** is then replaced. The smoke generator of the present invention is now charged and ready for operation.

Propellant quick connect coupling **101** is then connected to propellant quick coupling **40** on smoke generator **10**. The propellant tank valve **96** is opened as is valve of coupling **101**. The propellant canister **17** is then filled until the desired pressure is reached. The valves are then closed and coupling **101** disconnected from coupling **40**.

Handle **37** is adjusted in slot **114** for the proper setting of air control sleeve **34** on the air mixing orifice housing **33** of gas burner **160**. The cut-off valve **29** is now moved to the on position.

The igniter button **14** is then pushed which will cause the electrical igniter **13** to send an electrical pulse through a wire into igniter **24** which will cause an electrical arc at the tip **25** of the igniter **24**. Since the fuel cut-off valve is open, gas will flow from the canister to the line **28**, to the shut-off valve **29** and then from there through line **31** to burner **160** with the fuel/air mixture coming out the end **33** into burner chamber **160**. At this point the igniter will ignite the fuel in said ignition chamber **160**.

Due to the size and configuration of the device, within approximately 45 seconds adequate heat buildup will have occurred to combust the smoke solution passing through coils **170**, thus in less than one minute after firing off burner chamber **160**, the smoke generator of the present invention is ready to use.

The propellant from charged canister **17** passes through line **42** where the pressurized propellant enters flexible line **44** in solution chamber **16**. The pressurized propellant and the solution picked up through orifice **45** passed through check valve **46** and out the fitting **48**. This fitting is connected through line **49** which, through an internal passage, carries the propellant and solution to trigger activated valve **54**. The propellant/solution system is thus, charged and ready to operate.

Once the burner **160** has reached operating temperature, the user grasps the smoke generator as shown in FIG. **13**. When desired, the user simply pulls the trigger mechanism **54***a* downwardly with his or her finger which opens valve **54**. Pressurized propellant/solution then passes into coil **170**. As this propellant/solution passes through coil **170**, the solution is combusted. When the combusted solution exits coil outlet **171** through nozzle **173**, heavy non-toxic smoke is emitted therefrom so long as trigger mechanism **54***a* holds valve **54** open. By manipulating said trigger **54***a* short bursts of smoke can be generated or continuous smoke can be generated as desired.

When the smoke generator **10** is operated as a self contained unit, it can generate smoke for a cumulative time of approximately 45 minutes. This includes the time it is operated during short bursts as well as extended smoke generation.

Once the smoke generator has exhausted the charges in canisters **15**, **16**, and **17**, it must be recharged prior to further use. This can be accomplished herein as described above for the initial charging, of such generator at the recharging station **90** or by other suitable recharging arrangements.

Recharging the smoke generator **10** using the recharging station **90** takes approximately three minutes before the generator is again ready for operation.

When it is desired to operate the smoke generator of the present invention for extended periods of time, the back pack supply **68** is available.

The user **136** straps the back pack on, using shoulder straps **70** and waist strap **71** and makes adjustments for a comfortable fit.

The propellant/solution quick connect coupling **89** on line **88** is operatively connected to propellant/solution quick connect coupling **57** on base **11**. The fuel quick connect coupling on fuel line (not shown) is operatively connected to fuel quick connect nipple **38** mounted on base **11**. The propellant, solution and fuel valves **74** and **79** are then opened, allowing propellant and solution from tanks **72** and **77** to flow to the smoke generator **10** through quick connect nipple **57**. Fuel from tank **102** or other source is allowed to flow to the smoke generator through quick connect nipple **38**.

The smoke gun **10** is now ready for operation. The fuel can be turned on to burner **160** as herein above described and the ignition button **14** pushed to ignite the fuel in burner chamber **160**. After approximately 45 seconds heat up time, the trigger mechanism **54***a* can be manipulated to produce nontoxic smoke from the tip **174** of nozzle **173** in the same operating manner as herein described above for the generator when used as a self contained unit. The only difference is that, due to the larger capacity of the tanks on the back pack **68**, smoke can be generated for a cumulative time of between 2½ and 3 hours.

Once the supply in the back pack **68** has been exhausted, the valves can be closed and connectors **83** and **89** disconnected and the back pack removed from the user **136**. A fully charged back pack can then be put on and couplings **83** and **89** reconnected. The smoke generator **10** is now again ready for operation for an extended period of time as herein described above.

Lastly, FIGS. **19** through **19***c* depict two different versions of nozzles for use in the present device. Nozzle **173** with single exit **174** is shown on the far right of the picture. This is the nozzle shown in other Figures of the drawings. Nozzle **190** with multiple holes **191** is depicted, which allows for a different dispersal pattern than does nozzle **173**. The nozzle **190** is also fitted with check valve **195** which is two pieces as shown and fits inside nozzle **190**. FIG. **19***a* and FIG. **19***b* show a see through version of nozzle **190**, completely assembled and exploded. Connector fitting **195***b* attaches to check valve **195**. It is operated by spring **195***a* and ball bearing **195***c*. The entire nozzle is mounted using mounting bracket **195***d* in FIG. **19***c*.

Regarding trigger **54***a* operation, solution tube **196** supplies smoke solution to the trigger **54***a*. Operating trigger **54***a* opens a valve which allows solution to pass to the heating chamber coils. How much solution will pass can be adjusted by set screw **197** which determines how far the trigger can be pulled and thus, how far open the valve can be, Engaging trigger **54***a* is in a forwards and backwards motion, typical for most triggers. In order to resist side-to-side movement by trigger **54***a*, trigger guard **198** is utilized which creates a channel for trigger **54***a* to move forward and back with very little ability to move to the side without encountering the guard **198**.

From the above, it can be seen that the present invention has the advantage of providing a highly efficient smoke generator that can be used for extended periods of time. This generator is readily portable and yet, is highly efficient in producing either large amounts of smoke or bursts of smoke. It is infinitely controllable through the operation of trigger mechanism **54***a*. This generator is light weight which adds further to its versatility.

The present invention can be readily recharged when used as an independent unit or can just as readily be connected to a back pack supply for extended smoke generation. The back pack supply can also be quickly switched to a fresh supply when desired.

It is clear that the present device can be used with other ingredients added to the smoke for distribution, for example, pepper spray.

The present invention may, of course, be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of such invention. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

While the foregoing written description of the invention enables one of ordinary skill to make and use what is considered presently to be the best mode thereof, those of ordinary skill will understand and appreciate the existence of variations, combinations, and equivalents of the specific embodiment, method, and examples herein. The invention should therefore not be limited by the above described embodiment, method, and examples, but by all embodiments and methods within the scope and spirit of the invention.

What is claimed is:

**1**. An aerosol device capable of generating smoke comprising:

a) a base portion for handling the device during use the base portion having a front side;

b) a heating chamber for vaporizing a smoke producing solution having an inlet back side facing the base portion front side and having an inlet side cap and a smoke outlet side, a heating mantle, a perforated heat shield surrounding the side of the heating chamber, the chamber comprising a fuel ignition chamber, one or more combustion gas exit pipe vents on the inlet back side through the inlet side cap for the release of combustion gas from the heating chamber, and connected to the base portion, the heating chamber mounted in spaced relationship to the base portion on the base portion front side;

c) a smoke producing solution pressurized by a propellant for the solution, operatively connected to the base and capable of delivering the smoke producing solution to coiled tubing which is tightly wound such that the coils touch positioned within the heating chamber and around the ignition chamber wherein the coil is operatively connected to an exit nozzle which is capable of dispersing the smoke producing solution once it is vaporized in the heating chamber; and

d) a fuel attached to the base and operably connected to the heating chamber for delivery of the fuel to the ignition chamber for ignition.

2. A device according to claim 1 wherein one or more electric spark generators are positioned within the heating chamber for igniting fuel in the ignition chamber.

3. A device according to claim 2 wherein the one or more electric spark generators are positioned within a gas collection tube, the tube comprising a partially open side portion for collecting gas fuel in the heating chamber and sparking the gas fuel to ignition.

4. A device according to claim 1 wherein the one or more of the fuel gas, the propellant and the smoke producing liquid are in canisters mounted directly to the base.

5. A device according to claim 1 wherein one or more of the fuel gas, the propellant and the smoke producing liquid are in remote canisters from the base.

6. A device according to claim 1 wherein the one or more remote canisters are mounted on a back pack.

7. A device according to claim 1 wherein there is an insulating device positioned between the base and the heating chamber.

8. A device according to claim 1 which further comprises a wireless locating device for locating the position of the aerosol device.

9. A device according to claim 1 wherein there is at least one check value associated with at least one of the fuel gas, the propellant, and the smoke producing liquid.

10. A device according to claim 9 wherein the exit nozzle comprises a check valve.

11. A device according to claim 1 wherein at least one of the propellants, the smoke producing liquid and the gas fuel are fitted with a pressure release valve.

12. A device according to claim 1 wherein at least a portion of the device comprises a nickel-chromium alloy.

13. A device according to claim 1 wherein the exit pipe vent comprises at least one tube positioned in the space between the front side of the base and the inlet back side.

14. A device according to claim 1 wherein the coiled tubing has at least 6 turns to the coil.

15. A device according to claim 1 wherein the exit nozzle has a plurality of exit holes.

16. A device according to claim 1 wherein there is an additive in the smoke producing solution.

17. A device according to claim 16 wherein the additive is selected from the group comprising pepper spray.

18. A device according to claim 1 wherein the heating element is battery operated.

19. A device according to claim 1 wherein the heating chamber is held in spaced relationship to the base on the front of the base by connection to a plurality of mounting rods.

20. A device according to claim 1 wherein the heating mantle is ceramic.

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