(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
21 July 2016 (21.07.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/114717 A1

(51) International Patent Classification:
G01N 27/62 (2006.01) *G01N 21/33* (2006.01)

(21) International Application Number:
PCT/SG2015/050003

(22) International Filing Date:
12 January 2015 (12.01.2015)

(25) Filing Language: English

(26) Publication Language: English

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *of inventorship (Rule 4.17(iv))*

[Continued on next page]

(54) Title: AN ENHANCED MEASUREMENT SYSTEM OF A PHOTO-IONIZATION DETECTOR WITH CAPABILITIES FOR AUTOMATIC CLEANING AND AUTOMATIC PURGING FEATURE

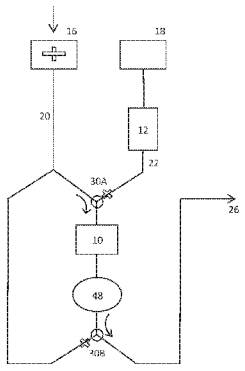


FIG. 1A

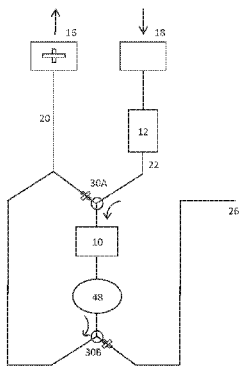


FIG. 1B

(57) Abstract: A purging and continuous measurement system for use with a Photo-Ionization Detector (PID) is disclosed. The system has a first conduit (20) for inflow of ambient gas at port (16) to be measured, during a measurement cycle, in an ionization chamber (10) of the PID, a pump (48), a second conduit (22) for flow of ambient air at port (18), and a cleaning chamber (10) of the PID which removes pollutants and contaminants in the ambient air, and a first valve (30A) for direct flow of ambient gas (16) or ambient air at port (18) into the ionization chamber (10) and a second valve (30B) for cleaned and filtered ambient gas at port (16) and ambient air at port (18) be flushed out air borne pollutants and contaminants left in the ionization chamber (10) by the ambient gas at port (16) after the measurement cycle, characterized in that the first valve (30A) is positioned in such a way that the first conduit (20) and the second conduit (22) entering the first valve (30A) and an exit from the first valve (30A) to the ionization chamber (10), and the second valve (30B) is positioned to the pump (48) and to an outflow conduit (26) into the atmosphere, and to the first conduit (20); during a measurement cycle in the first cycle, ambient gas at port (16) is drawn through the ionization chamber (10) by the operation of the pump (48), and during a second cycle which is a cleaning and a purging cycle, ambient air at port (18) is being cleaned in the cleaning chamber (12) and drawn to flush out air borne contaminants and pollutants in the ionization chamber (10), originating from the ionization of ambient gas at port (16) during the measurement cycle, and purges out through port (16) via the outflow conduit (20).

WO 2016/114717 A1

Published:

— *with international search report (Art. 21(3))*

— *with amended claims (Art. 19(1))*

TITLE OF THE INVENTION

AN ENHANCED MEASUREMENT SYSTEM OF A PHOTO-IONIZATION DETECTOR WITH CAPABILITIES FOR AUTOMATIC CLEANING AND AUTOMATIC PURGING FEATURE

FIELD OF THE INVENTION

The present invention relates to an automatic purging and automatic cleaning measurement system used with a volatile gas detector, with option to lead to a fixed Photo-Ionization Detector (PID), operating in continuous measurement mode.

BACKGROUND OF THE INVENTION

A Photo-Ionization Detector (PID) is a known device generally used for monitoring gases for:-

- Industrial hygiene and safety
- Indoor air quality
- Environmental contamination
- Cleanroom air quality

A PID uses high-energy photons, typically in the ultraviolet (UV) range, to break gas molecules into positively charged ions. A typical PID for detection of volatile gases consist of an ionization chamber, an UV lamp with sufficient energy to ionize the ionizable molecule, a voltage source for the accelerating electrode, and an amplifier capable of measuring the current flow. The ionizable molecules are bombarded by high-energy photons and are ionized when these molecules absorb high energy UV light. UV light excites these molecules, resulting in temporary loss of electrons in the molecules and the formation of positively charged ions, which is represented as:-

$$R + hv \longrightarrow R^+ + e^-$$

where R = ionizable molecule

hv= photon energy

R+ = parent molecule ion

e- = electron

In the ionization chamber, the R+ ion formed by the absorption of the UV photons are collected at an electrode where the current generated is proportional to the ionized species. Molecules with ionization potential below the energy of the UV source can be ionized. The current generated is therefore a measure of the analyse concentration.

As a stand-alone detector, a PID ionizes everything which comes into the ionization chamber with an ionization energy less than or equal to the lamp output. The gas to be measured may not be pure, containing dirt particles and other gaseous materials, and such dirt particles may be ionized too. After prolonged usage of the PID device, contamination such as dirt particles, oil particles, fluxes, water particles especially during high humidity condition, and contaminants adsorbed during prolong exposure to air, often builds up inside the ionization chamber. These contaminants are attracted to the electrodes, thus settling on them. Besides settling in the ionization chamber, the PID window, the electrodes, these pollutants and contaminants also settle on the inner surface tubes and the inlet pipes. In turn, the accuracy of volatile gas concentration measurement is affected as these contaminants interfere with the movement and collection of the ions and electrons on the electrodes. The contamination which have settled on the window of the PID also reduces the intensity of UV light and consequently affects the accuracy of the volatile gas concentration measurement. When this happens, the user has to take the PID apart to clean the electrodes and PID window by removing the contaminants. The cleaning will also require re-calibration with a standard zero gas (usually synthetic air/nitrogen) and span calibration gas (usually Isobutylene gas) in order to ensure the PID is accurate when put back into operation.

US Patent No. 6,225,633 discloses a photo-ionization detector (PID) comprising: (a) a detector housing having an ionization chamber disposed therein, said ionization chamber configured to allow gases to flow into and out of said ionization chamber; (b) an ultraviolet (UV) lamp positioned to transmit a UV light into the ionization chamber; (c) an ion detector disposed in said ionization chamber, said ion detector comprising a first electrode structure electrically biased to attract negatively charged particles, and a second electrode structure electrically biased to attract positively charged particles, wherein an electrical field between said first electrode structure and said second electrode structure is perpendicular to a direction of propagation of said UV light and wherein said electrical field is perpendicular to a direction of flow of gases.

US Patent No. 6,734,435 discloses a photo-ionization detector (PID) comprising: a control unit; and a gas detection unit that measures a current corresponding to a concentration of a volatile gas in an ambient gas, wherein the gas detection unit comprises: an ionization

chamber, through which the ambient gas flows; a UV lamp that ionizes the ambient gas in the ionization chamber; a bias electrode that is biased to repel positive ions resulting from the ionization of the ambient gas; and a measurement electrode that is biased to attract positive ions resulting from the ionization of the ambient gas, wherein the control unit controls the gas detection unit such that a flow of the ambient gas in the ionization chamber is intermittently interrupted, wherein the UV lamp converts oxygen in the closed ambient gas to ozone. The PID further comprises a container coupled to the ionization chamber, the container including an oxygen-containing gas, wherein the oxygen-containing gas is supplied into the ionization chamber when the flow of the ambient gas is interrupted in the ionization chamber, so that the oxygen-containing gas is converted to ozone.

US Patent No. 6959610 discloses a flow element manual purge system provided as a system ready to install to instrument tubing connected to the high pressure connection and low pressure connection of the differential pressure flow element. The system has a first purge/operate valve connected to the high pressure tubing, and a second purge/operate valve connected to the low pressure tubing. Each purge/operate valve is anticipated as being a three-way valve having an entry port, an exit port, and a discharge port. With the entry port in fluid communication with the pressure tubing, the discharge port is in fluid communication with a high pressure purge gas or liquid source, depending upon whether the flowing fluid is gas or liquid. Each exit port is in fluid communication with the inlets of an instrument zeroing and isolating valve, with the outlets of the zeroing and isolating valve in fluid communication with a differential pressure gauge.

Contamination of PID, including optical window reduces the UV intensity and therefore needs to be overcome. The contamination is often a polymer-like coating caused by the deposition of metal atoms, oil film, or dust particles, during the normal use of PID. A user must often disassemble PID to clean optical window. This cleaning is time consuming and burdensome. Accordingly, it is advantageous to provide a self-cleaning PID system.

The PID can give false positive readings due to the presence of water vapour. Rain often affects the performance of PID. High humidity can cause lamp fogging and affect its sensitivity. This can be significant when the moisture levels are high. When this happens, the effect of water vapour can be on the sensitivity of this detector. Water vapour can be quite damaging to the detector and therefore the detector certainly gives undesirable false alarms.

The signal produced by a PID may be quenched when measuring in high humidity environments. This attenuation is due to the ability of water, or/and other compounds with high ionization potential (IP) values to absorb the photons emitted by the UV lamp without

leading to the production of ion current. This reduces the number of energetic photons available to ionize target analyzes, causing the reading to drop.

When humidity level is high and the moisture condensates, the problem becomes even more significant, and shorting may occur and can even cause "false high readings" to over-range values, and thus the humidity results cause many false alarms.

Due to the fact that water vapour is often the major source of errors, typically in a fixed PID, many resorts to use the most cost effective "water trap" devices or filters, to filter off the water vapour. However, such "water trap" devices or filters are limited in such filtering capacities, and are often reach saturation before its useable life time. When this happens, water vapour would be drawn into the ionization chamber by the diaphragm pump, causing many undesirable problems on the PID, such as those mentioned above.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a purging with/without continuous measurement system for use with a Photo-Ionization Detector (PID) having a first conduit (20) for inflow of ambient gas at gas port (16) to be measured, during a measurement cycle, in an ionization chamber (10) of the PID, a pump (48), a second conduit (22) for flow of ambient air at the port (18), and a cleaning chamber (12) of the PID which removes pollutants and contaminants in the ambient air, and a first valve (30A) for direct flow of ambient gas at gas port (16) or ambient air at air port (18) into the ionization chamber (10) and a second valve (30B) for cleaned and filtered ambient gas at gas port (16) and the ambient air at air port (18) be flushed out air borne pollutants and contaminants left in the ionization chamber (10) by the ambient gas at port (16) after the measurement cycle, characterized in that the first valve (30A) is positioned in such a way that the first conduit (20) and the second conduit (22) entering the first valve (30A) and an exit from the first valve (30A) to the ionization chamber (10), and the second valve (30B) is positioned to the pump (48) and to an outflow conduit (26) into the atmosphere, and to the first conduit (20); during a measurement cycle in the first cycle, ambient gas at gas port (16) is drawn through the ionization chamber (10) by the operation of the pump (48), and out into the atmosphere via the outflow conduit (26); during a second cycle which is a cleaning and a purging cycle, ambient air at air port (18) is being cleaned in the cleaning chamber (12) and drawn to flush out air borne contaminants and pollutants in the ionization chamber (10) originating the ionization of ambient gas at port (16) during the measurement cycle, via the first conduit (20) and purges out through the gas port (16) and out into the atmosphere.

A further object of the present invention is to provide a purging and continuous measurement system for use with a Photo-Ionization Detector (PID) having a first conduit (20) for inflow of ambient gas at gas port (16A) to be measured, during a measurement cycle, in an ionization chamber (10) of the PID, a pump (48), and a first valve (30A) for direct flow of ambient gas at port (16A) or gas port (16B) into the ionization chamber (10) and a second valve (30B) for direct flow of ambient gas from the pump (48) into gas port (16A) via conduit (20) or into gas port (16B) via conduit (26).

Still another object of the present invention is to provide a cleaning purging and in the measurement system for use with a Photo-Ionization Detector (PID) having a first conduit (20) for inflow of ambient gas at port (16A) to be measured, during a measurement cycle, in an ionization chamber (10) of the PID, a second conduit (22) for in flow of ambient air (18) via a cleaning chamber (12) of the PID which removes pollutants and contaminants in the ambient air, an outflow conduit (26) linked to an ambient gas environment, and a first valve (30A) for direct flow of ambient gas at port (16A) or ambient air at port (18) into the ionization chamber (10), into the ionization chamber (10), a pump (48), and a second valve (30B) for cleaned and filtered ambient gas at port (16A) and ambient air at port (18) be flushed out air borne pollutants and contaminants left in the ionization chamber (10) by the ambient gas at port (16A) after the measurement cycle, characterized in that the first valve (30A) is positioned in such a way that the first conduit (20), the second conduit (22) and the outflow conduit (26) entering the first valve (30A), and exit to the ionization chamber (10); and the second valve (30B) is positioned from one side to the pump (48) linked to the ionization chamber (10) , and exit to the first conduit (20) and to an outflow conduit (26) linked to the atmosphere; during a measurement cycle in the first cycle, ambient gas at port (16A) is drawn through the ionization chamber (10) by the operation of the pump (48) to perform measurement and purging0at gas port (16B), and during a second cycle which is a cleaning and a purging cycle, ambient gas at port (16B) is drawn through the ionization chamber (10) by the operation of the pump (48) to perform measurement and purging at gas port (16A); and cleaning and purging in the third cycle, wherein the ambient air at port (18) is being cleaned in the cleaning chamber (12) and drawn to flush out air borne contaminants and pollutants in the ionization chamber originating the ionization of ambient gas at port (16A) during the measurement cycle, purging and cleaning process, via the outflow conduit (20); and cleaning and purging in the fourth cycle, wherein the ambient air at port (18) is being cleaned in the cleaning chamber (12) and drawn to flush out air borne contaminants and pollutants in the ionization chamber originating the ionization of ambient gas at port (16) during the measurement cycle, purging and cleaning process, via the outflow conduit (26);

Yet still another object of the present invention is to provide a purging and cleaning in a measurement system for use with a Photo-Ionization Detector (PID) having a first conduit (20) for inflow of ambient gas (16A) to be measured, an ionization chamber (10) of the PID, a pump (48), a second conduit (22) for flow of ambient air at port (18), and a cleaning chamber (10) of the PID which removes pollutants and contaminants in the ambient air, another inflow of ambient gas at port (16B), and a first valve (30A) for direct flow of ambient gas at port (16A) or ambient air at port (18) and exit into a second valve (30B), and the second valve (30B) being connected from a third valve (30C) and exit into the ionization chamber (10), and the third valve (30C) is connected to the outflow (26) and connected to the conduit (22) for flow of ambient air at port (18), and a fourth valve (30D) for direct flow from the pump (48) and exit into the atmosphere via gas port either at (16A) or (16B), characterized in that the first valve (30A) is positioned in such a way that the first conduit (20) and the second conduit (22) entering the first valve (30A), and exit and is linked to a second valve (30B), and a third valve (30C) is linked to an outflow conduit (26) and to the second conduit (22), and exit and is link to the second valve at (30B), with the other end connected to the ionization chamber (10), and the fourth valve (30D) is positioned in such a way with the pump (48) at one end and exit into the first conduit (20) connected at one end and the outflow conduct (26) connected at the other end leading into the atmosphere; and in the first cycle, measurement and purging is carried out, and in the second cycle, a cleaning and a purging, and the third cycle, a measurement and purging is carried out, and in the fourth cycle, cleaning and purging are carried out.

Still an object of the present invention is to provide a purging and cleaning in a measurement system for use with a PID, characterized in that having an ambient gas port (16A) that enters through the first conduit (20), a gas port (16B) that flows out through a gas outlet conduit (26), a first valve (30A), a second conduit (22) for flow of ambient air at port (18), and a cleaning chamber (12) of the PID which removes pollutants and contaminants in the ambient air, another second valve (30B), an ionization chamber (10), a pump unit (48), to purge out at ambient gas port (16B) via conduit (26), and is characterised in that the first valve (30A) is positioned in such a way that the first conduit (20) and the second outflow conduit (26) are entering the first valve (30A), and exit and is linked to a second valve (30B), and the second valve (30B) is linked to the conduit (22) leading from the cleaning chamber (12), and exit and is linked to the ionization chamber (10), and the pump unit (48), and the third valve (30C) is positioned in such a way with the pump (48) connected at one end and exit into the first conduit (20) connected at one end and the outflow conduct (26) connected at the other end leading into the atmosphere; and in the first cycle, measurement and purging is carried out, and in the second cycle, another measurement and purging is carried out, and in the third cycle, a

cleaning and purging is carried out, and in the fourth cycle, another cleaning and purging is carried out.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a block diagram showing the flow of ambient gas at port (16) for measurement during the first cycle in the operation of the purging and cleaning system used for a photo-ionization detector (PID) in accordance with the present invention;

FIG. 1B is a block diagram showing the flow of ambient air port (18) for cleaning and purging at port (16) during the second cycle in the operation of the purging and cleaning system used for a photo-ionization detector (PID) in accordance with the present invention;

FIG. 2A is a block diagram showing the flow of ambient gas at port (16A) for measurement and purging at port (16B) and continuous measurement in the first cycle of a photo-ionization detector (PID) in accordance with the present invention;

FIG. 2B is a block diagram showing the flow of ambient gas at port (16B) for measurement and purging at port (16A) and continuous measurement in the second cycle in the operation of a photo-ionization detector (PID) in accordance with the present invention;

FIG. 3A is a block diagram showing the flow of ambient gas at port (16A) for measurement and purging at port (16B) in the first cycle for the operation of a photo-ionization detector (PID) in accordance with the present invention, wherein two 4:3 valves or valve manifold are employed.

FIG. 3B is a block diagram showing the flow of ambient gas at port (16B) for measurement and purging at port (16A) in the second cycle for the operation of a photo-ionization detector (PID) in accordance with the present invention, wherein two 4:3 valves or valve manifold are employed.

FIG. 3C is a block diagram showing the flow of ambient air at port (18) for cleaning and purging at port (16A) in the third cycle of a photo-ionization detector (PID) in accordance with the present invention, wherein two 4:3 valves or valve manifold are employed.

FIG. 3D is a block diagram showing the flow of ambient air port (18) for cleaning and purging at port (16B) in repeating cycle of a photo-ionization detector (PID) in accordance with the present invention, wherein two 4:3 valves or valve manifold are employed.

FIG. 4A is a block diagram showing the flow of ambient gas at port (16A) for measurement and purging at port (16B) in the first cycle of a photo-ionization detector (PID) in accordance with the present invention.

FIG. 4B is a block diagram showing the flow of ambient air at port (18) for the cleaning and purging at port (16A) in the second cycle of a photo-ionization detector (PID) in accordance with the present invention.

FIG. 4C is a block diagram showing the flow of ambient gas at port (16B) for measurement and purging at port (16A) in the third cycle of a photo-ionization detector (PID) in accordance with the present invention.

FIG. 4D is a block diagram showing the flow of ambient air at port (18) for cleaning and purging at port (16B) in the fourth cycle of a photo-ionization detector (PID) in accordance with the present invention.

FIG. 5A is a block diagram showing the flow of ambient gas at port (16A) for measurement and purging at port (16B) in the first cycle of a photo-ionization detector (PID) in accordance with the present invention.

FIG. 5B is a block diagram showing the flow of ambient air at port (16B) for the measurement and purging at port (16A) in second cycle of a photo-ionization detector (PID) in accordance with the present invention.

FIG. 5C is a block diagram showing the flow of ambient gas at port (18) for cleaning and purging at port (16A) in the third cycle of a photo-ionization detector (PID) in accordance with the present invention.

FIG. 5D is a block diagram showing the flow of ambient air at port (18) for cleaning and purging at port (16B) in the fourth cycle of a photo-ionization detector (PID) in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the drawings, similar parts are identified by like reference numerals.

The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the invention are illustrated. The invention may, however, be embodied in different forms and should not be construed as limited

to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

Referring to FIG. 1A, there is shown the flow of ambient gas at port (16) for measurement during the first cycle in the operation of the purging and cleaning system used for a photo-ionization detector (PID) in accordance with the present invention. The purging and cleaning system provides the features that two 3:2 valves (30A, 30B) are employed and the use of a first conduit (20) and an outflow conduit (26) to control and to regulate the flow of ambient gas/or ambient air. The flow of ambient gas at port (16) through the first conduit (20) is measured and enters into the ionization chamber (10) of the PID without going through a cleaning chamber (12). The purging and cleaning system of the present invention comprises two or more than two valves, a first conduit (20) and an outflow conduit (26), and a cleaning chamber (12) linked to the ambient air inlet, and a second conduit (22) for flow of ambient air (18). The ionization chamber (10) of the PID removes pollutants and contaminants in the ambient air, and the first valve (30A) is used to direct the flow of ambient gas at port (16) or ambient air at port (18) into the ionization chamber (10) and a second valve (30B) for cleaned and filtered ambient gas (16) and ambient air at port (18) be flushed out air borne pollutants and contaminants left in the ionization chamber (10) by the ambient gas at port (16) after the measurement cycle. In accordance with a preferred embodiment of the present invention, the first valve (30A) is positioned in such a way that the first conduit (20) and the second conduit (22) entering the first valve (30A) and an exit from the first valve (30A) to the ionization chamber (10), and the second valve (30B) is positioned in such a way that an inlet of the valve (30B) is connected to a pump (48) and to an outflow conduit (26) into the atmosphere, and to the first conduit (20). As shown in FIG. 1A, during a measurement cycle in the first cycle, ambient gas at port (16) is drawn through the ionization chamber (10) by the operation of the pump (48) and measurement of the ambient gas at port (16) is done by the PID, and during a second cycle (as shown in FIG. 1B), which is a cleaning and a purging cycle, ambient air at port (18) is being cleaned in the cleaning chamber (12) and drawn to flush out air borne contaminants and pollutants, in the ionization chamber (10) of the PID, originating from the ionization of ambient gas at port (16) during the measurement cycle. The nett result of the first and second cycle is that the measurement process, and cleaning and purging process is alternating.

In the measuring process during the first cycle and cleaning and purging in the second cycle, the photon ionization detector (PID) is characterized in that two 3:2 valves are employed, and the first 3:2 valve (30A) is used to direct the flow of ambient gas at port (16) or ambient air at

port (18) into the ionization chamber (10). The second valve (30B) is a 3:2 valve to direct the ambient gas at port (16) after measurement to the outflow conduit (26) or to direct cleaned ambient air at port (18), that is being cleaned in the cleaning chamber (12) and drawn to fush out air borne contaminants and pollutants, in the ionization chamber (10) of the PID, originating from the ionization of ambient gas at port (16) during the measurement cycle, and purged out at port (16) via the first conduit (20). In accordance with the present process, the cleaning of ambient air (18) is carried out at the air cleaning chamber (12) and the purging of the ionization chamber (10) is done in the second cycle of the operation of PID.

FIG. 2A is a block diagram showing the flow of ambient gas at port (16A) for measurement and purging in every cycle of a photo-ionization detector (PID) in accordance with the present invention, and FIG. 2B is a block diagram showing the flow of ambient gas (16B) for measurement and purging in every cycle in the operation of a photo-ionization detector (PID) in accordance with the present invention in an alternating process. In this preferred embodiment, the purging and continuous measurement of the PID comprises two ambient gas ports (16A, 16B), a first conduit (20) and an outflow conduit (26), a first valve (30A), a second valve (30B), an ionization chamber (10) and a pump (48). The first valve (30A) is linked to a first conduit (20) and the outflow conduit (26), and to an ionization chamber (10), which connected to the pump (48). A second valve (30B) is connected to the pump (48), and one outlet of the second valve (30B) is connected to the first conduit (20) and the outflow conduit (26) to the ambient gas port (16B).

In operation, as shown in FIG. 2A, ambient gas port (16A) enters through the first conduit (20) and the first valve (30A) and to the ionization chamber (10), measuring is thus performed by PID, and the ambient gas passes through the second valve (30B) and via the outflow conduit (26) to purge port (16B). Referring to FIG. 2B, ambient gas at port (16B) now passes through the conduit (26) and the first valve (30A) to the ionization chamber (10), and then via the pump 48 and the second valve (30B) and the first conduit (20) to purge at the inlet for ambient gas at port (16A). The process for the system is alternating and the result is that continuous measurement and purging of the PID process is done in every cycle.

In the preferred embodiment as shown, two 3:2 valves are employed and in this operation, no cleaning process is conducted.

FIG. 3A is a block diagram showing the flow of ambient gas at port (16A) for measurement and purging in the first cycle for the operation of a photo-ionization detector (PID) in accordance with the present invention, wherein two valves (4:3 + 3:2) or valve manifold are employed. FIG. 3B is a block diagram showing the flow of ambient gas at port (16B) for

measurement and purging in the first cycle for the operation of a photo-ionization detector (PID) in accordance with the present invention, wherein two valves (4:3 + 3:2) or valve manifold are employed. FIG. 3C is a block diagram showing the flow of ambient air at port (18) via a cleaning chamber (12) for cleaning and purging in the third cycle of a photo-ionization detector (PID) in accordance with the present invention, wherein two valves (4:3 + 3:2) or valve manifold are employed.

In this preferred embodiment, two valves (4:3 + 3:2) (30A, 30B) are employed. The system according to the present invention provides a measurement, cleaning and double purging effect. As shown in FIG. 3A – the first cycle of measurement and purging operation, the system comprises a first ambient gas port (16A) and a gas port (16B), and an ambient air port (18) linked to a cleaning chamber (12). The first valve (30A) is connected to the first conduit (20) linked to the ambient gas port (16), the cleaning chamber (12) linked to the ambient gas port (18), and the second conduit (26) linked to the gas port (16B). The first valve (30A) is also connected to an ionization chamber (10). The second valve (30B) is connected to the first conduit (20) and the second conduit (26), and to the pump (48).

In operation, ambient gas at port (16A) passes through the first conduit (20) and valve (30A) to proceed to measurement and purging where the gas then exits through the second valve (30B) to purge the inlet of ambient gas (16B) via the outflow conduit (26). In other words, in the first cycle of the PID, measurement of ambient gas at port (16A) and purging is done at the first cycle. In the second cycle, ambient gas at port (16B) enters through the outflow conduit (26) and the first valve (30A), measurement and purging in the second cycle is carried out. Ambient gas at port (16B) is being measured at the ionization chamber (10) and then purges the ambient gas port (16A) via the first conduit (20). This is shown in FIG. 3B.

Referring to FIG. 3C, there is shown a block diagram of ambient air at port (18) during the cleaning and purging in the third cycle of a photo-ionization detector (PID) in accordance with the present invention. At this third cycle, ambient air (18) passes through the cleaning chamber (12) and the air is thus cleaned. The cleaned air passes from the chamber (12) through the first valve (30A) into the ionization chamber (10), to pump unit (48), and then through the second valve (30B) and the first conduit (20) to purge the ambient gas port (16A). Thus, at this third cycle operation, cleaning and purging is conducted. Referring to FIG. 3D, there is shown the fourth cycle of the operation of the system. Cleaning and purging process is carried out at this cycle. In the present preferred embodiment, the first valve (30A) is connected to conduit (22), linked to the cleaning chamber (12), the outflow conduit (26) linked to the gas port (16B), and the ionization chamber (10). The second valve (30B) is connected

to the pump (48) and the outflow conduit (26). Thus, at this forth cycle operation, cleaning and purging is conducted.

The net result of this arrangement is that measurement and purging is carried out at the first cycle and second cycle, and cleaning and purging is done at the third and fourth cycle, and the process is repeating.

FIG. 4A is a block diagram showing the flow of ambient gas (16A) for measurement and purging in the operation of the first cycle of a photo-ionization detector (PID) in accordance with the present invention. FIG. 4B is a block diagram showing the flow of ambient air (18) for the cleaning and purging in second cycle of a photo-ionization detector (PID) in accordance with the present invention. FIG. 4C is a block diagram showing the flow of ambient gas (16B) for measurement and purging in the third cycle of a photo-ionization detector (PID) in accordance with the present invention. FIG. 4D is a block diagram showing the flow of ambient air (18) for cleaning and purging in the fourth cycle of a photo-ionization detector (PID) in accordance with the present invention.

In this preferred embodiment, a plurality of valves, for example, four 3:2 valves are employed. All the four valves (30A, 30B, 30C, and 30D) are identical. As shown in FIG. 4A, the first valve (30A) is linked to a second valve (30B), and a third valve (30C) is also linked to the second valve (30B). One port of the first valve (30A) is linked to the first conduit (20) and another port thereof is linked to the cleaning chamber (12). The third valve (30C) has one port linked to the outflow conduit (26), and another port thereof is linked to the cleaning chamber (12), and another port thereof is linked to the second valve (30B).

FIG. 4A is a block diagram showing the flow of ambient gas during measurement and the purging in the first cycle of a photo-ionization detector (PID) in accordance with the present invention. Ambient gas port (16A) enters through the first conduit (20) and the first valve (30A) and the second valve (30B) all the way to the ionization chamber (10) and is pumped out by pump (48) and via the outflow conduit (26) to purge out at ambient gas port (16B). In this process or the first cycle, ambient gas port (16A) is measured and is purged at port (16B).

FIG. 4B shows the second cycle of the process in accordance with the present invention. During the second cycle, ambient air passes through port (18) to the cleaning chamber (12) where the ambient air is cleaned, then the cleaned air passes through the first valve (30A) to the second valve (30B) and then proceeds to the ionization chamber (10) and is pumped out via the forth valve (30D) to the first conduit (20) and purges out at the ambient gas port (16A). In the second cycle, ambient air is cleaned at the cleaning chamber (12) and is then used to purge at the ambient gas port (16A).

FIG. 4C is a block diagram showing the flow of ambient gas during measurement and the purging in the third cycle of a photo-ionization detector (PID) in accordance with the present invention. In this cycle, ambient gas port (16B) passes through the outflow conduit (26) to the third valve (30C) and then to the second valve (30B). The ambient gas then passes to the ionization chamber (10) and is then pumped to the first conduit (20) and purged here at (16A). In other words, in the third cycle, measurement and purging are being performed.

FIG. 4D is a block diagram showing the flow of ambient air during the cleaning and purging in the fourth cycle of a photo-ionization detector (PID) in accordance with the present invention. Ambient air port (18) flows in and is cleaned at the cleaning chamber (12), and then passes through the third valve (30C) and then to the second valve (30B); the cleaned air enters the ionization chamber (10) and pumped through the fourth valve (30D) to purge at the outflow conduit (26). In this preferred embodiment, measurement and purging process are done in the first cycle, and in the second cycle, cleaning and purging process are performed.

For first and third cycle, measurement and purging process are performed, and at the second and fourth cycle, cleaning and purging process are carried out. These processes are repeated in sequence, and accordingly, the PID of the preferred embodiment is always provided with a purging process.

FIG. 5A is a block diagram showing the flow of ambient gas port (16A) for measurement and purging in the first cycle of a photo-ionization detector (PID) in accordance with the present invention. FIG. 5B is a block diagram showing the flow of ambient gas port (16B) for measurement and purging in second cycle of a photo-ionization detector (PID) in accordance with the present invention. FIG. 5C is a block diagram showing the flow of ambient air port (18) for the cleaning and purging in third cycle of a photo-ionization detector (PID) in accordance with the present invention. FIG. 5D is a block diagram showing the flow of ambient air port (18) for the cleaning and purging in fourth cycle of a photo-ionization detector (PID) in accordance with the present invention.

In this preferred embodiment, a plurality of valves, for example, three 3:2 valves are employed. All the three valves (30A, 30B, and 30C) are identical. As shown in FIG. 5A, the first valve (30A) is positioned in such a way that the first conduit (20) and the second outflow conduit (22) (26) are entering the first valve (30A), and exit and is linked to a second valve (30B), and the second valve (30B), is linked to the conduit (22) leading from the cleaning chamber (12), and exit and is linked to the ionization chamber (10), and the pump unit (48), and the third valve (30C) is positioned in such a way with the pump (48) connected at one end and exit into

the first conduit (20) connected at one end and the outflow conduit (26) connected at the other end leading into the atmosphere.

Referring to FIG. 5A, ambient gas (16A) enters through the first conduit (20) and the first valve (30A) and the second valve (30B) all the way to the ionization chamber (10) and is pumped out by pump (48) and via the outflow conduit (26) to purge out at ambient gas port (16B). In this process or the first cycle, ambient gas port (16A) is measured and is purged at port (16B). FIG. 5B shows the second cycle of the process in accordance with the present invention. During the second cycle, ambient gas port (16B) enters through the outflow conduit (26) to the first valve (30A) and the second valve (30B) all the way to the ionization chamber (10) and is pumped out by pump (48) and via the first conduit (20) to purge ambient gas port (16A). Referring to FIG. 5C, there is shown the third cycle of the process in accordance with the present invention. Ambient air passes through port (18) to the cleaning chamber (12) where the ambient air is cleaned, then the cleaned air passes through the second valve (30B) and then proceeds to the ionization chamber (10) and is pumped out by pump (48) via the third valve (30C) to the first conduit (20) and purges the ambient gas port (16A). In other words, in the third cycle, measurement and purging are being performed.

FIG. 5D is a block diagram showing the flow of ambient air during the cleaning and purging in the fourth cycle of a photo-ionization detector (PID) in accordance with the present invention. Ambient air port (18) flows in and is cleaned at the cleaning chamber (12), and then passes through the second valve (30B) and then proceeds to the ionization chamber (10) and is pumped out by pump (48) via the third valve (30C) to the outflow conduit (26) and purges out at the ambient gas port (16B). In this preferred embodiment, purging processes are done in all the four cycles of the present invention.

While particular embodiments of the present invention have been shown and described, changes and modifications may be made without departing from this invention in its broader aspects and, therefore, the appended claims are to encompass within their scope all such changes and modifications as fall with the true spirit and scope of this invention.

CLAIMS:

1. A purging and cleaning feature in a measurement system for use with a Photo-Ionization Detector (PID) having a first conduit (20) for inflow of ambient gas at port (16) to be measured, during a measurement cycle, an ionization chamber (10) of the PID, a pump (48), a second conduit (22) for flow of ambient air port (18), and a cleaning chamber (10) of the PID which removes pollutants and contaminants in the ambient air, and a first valve (30A) for direct flow of ambient gas at port (16) or ambient air at port (18) into the ionization chamber (10) and a second valve (30B) for cleaned and filtered ambient gas at port (16) and ambient air at port (18) be flushed out air borne pollutants and contaminants left in the ionization chamber (10) by the ambient gas at port (16) after the measurement cycle,

characterized in that the first valve (30A) is positioned in such a way that the first conduit (20) and the second conduit (22) entering the first valve (30A) and an exit from the first valve (30A) to the ionization chamber (10), leading to the pump unit (48), and the second valve (30B) is positioned from the pump (48) and to an outflow conduit (26) into the atmosphere, and to the first conduit (20); during a measurement cycle in the first cycle, ambient gas at port (16) is drawn through the ionization chamber (10) by the operation of the pump (48), and during a second cycle which is a cleaning and a purging cycle, ambient air at port (18) is being cleaned in the cleaning chamber (12) and drawn to flush out air borne contaminants and pollutants in the ionization chamber originating the ionization of ambient gas (16) during the measurement cycle, via the outflow conduit (26).

2. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 1, characterized in that the first valve (30A) is a 3:2 valve which directs the flow of ambient gas at port (16) or ambient air at port (18) into the ionization chamber (10).

3. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 1, characterized in that the second valve (30B) is a 3:2 valve which directs the flushed out air borne contaminants and pollutants from the ionization chamber (10) to the outflow conduit (26) or to the first conduit (20).

4. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 1, characterized in that cleaning of ambient air at port (18) is carried out and purging of the ionization chamber (10) is done in the second cycle of the operation of PID.

5. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 3, characterized in that the cleaning of ambient air (18) is carried out in the cleaning chamber (12) of the PID.

6. A purging and cleaning feature in a measurement system for use with a Photo-Ionization Detector (PID) having a first conduit (20) for inflow of ambient gas at port (16) to be measured, during a measurement cycle, in an ionization chamber (10) of the PID, a pump (48), a second conduit (22) for flow of ambient air at port (18), and a cleaning chamber (10) of the PID which removes pollutants and contaminants in the ambient air, and a first valve (30A) for direct flow of ambient gas at port (16) or ambient air at port (18) into the ionization chamber (10) and a second valve (30B) for cleaned and filtered ambient gas at port (16) and ambient air at port (18) be flushed out air borne pollutants and contaminants left in the ionization chamber (10) by the ambient gas at port (16) after the measurement cycle.

7. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 1, characterized in that in the first cycle, the first valve (30A) is open to lead the ambient gas at port (16) to go to the ionization chamber (10) and the second valve (30 B) is open to lead to the outflow conduit (26) to the atmosphere.

8. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 1, characterized in that in the second cycle in withdrawal ambient air at port (18) via the cleaning chamber (12), the second valve (30A) is open to lead the purged air, containing of contaminant, to the atmosphere via the outflow conduit (26).

9. A purging and continuous measurement system for use with a Photo-Ionization Detector (PID) having a first conduit (20) for inflow of ambient gas at port (16) to be measured, during a measurement cycle, an ionization chamber (10) of the PID, an outflow conduit (26) through gas port (16B) linked to an ambient gas environment, a pump (48), and a first valve (30A) for direct flow of ambient gas at port (16A) and a second valve (30B) that is connected from the pump (48), and exit and is connected

to the first conduit (20) to the gas port (16A) and the outflow conduit (26) to the ambient gas port (16B), characterized in that the first valve (30A) is positioned in such a way that the first conduit (20), and the outflow conduit (26) entering the first valve (30A), and exit into the ionization chamber (10), and the second valve (30B) is positioned from the pump (48) linked to the ionization chamber (10), and exit and is linked to the first conduit (20) and to an outflow conduit (26) linked to the atmosphere; during a measurement and purging cycle in the first cycle, ambient gas at port (16A) is drawn through the ionization chamber (10) by the operation of the pump (48) to perform measurement and purging at gas port (16B) via the gas conduit (26), and during a second cycle which is another measurement and purging cycle, wherein the ambient air at port (16B) is being drawn by the pump (48) into the ionization chamber (10), purging via the outflow conduit (20) through gas port (16A).

10. The purging and continuous measurement system for use with a PID as claimed in Claim 9, characterized in that the first (30A) is a 3:2 valve, to direct flow of ambient gas at ports (16A), or (16B) and exit into the ionization chamber (10), leading to the pump (48).

11. The purging and continuous measurement system for use with a PID as claimed in Claim 9, characterized in that the second valve (30B) is a 3:2 valve, to direct the flushed out air borne contaminants and pollutants from the ionization chamber (10) to the outflow conduit (26) or to the first conduit (20).

12. A purging and cleaning feature in a measurement system for use with a Photo-Ionization Detector (PID) having a first conduit (20) for inflow of ambient gas at port (16A) to be measured, during a measurement cycle, in an ionization chamber (10) of the PID, a pump (48), a second conduit (22) for flow of ambient air (18), and a cleaning chamber (12) of the PID which removes pollutants and contaminants in the ambient air, another inflow of ambient gas at port (16B), and a first valve (30A) for direct flow of ambient gas at port (16A) or ambient air at port (18) and exit into a second valve (30B), and a second valve (30B) being connected from the third valve (30C) and exit into the ionization chamber (10), and the third valve (30C) is connected to the outflow (26) and connected to the conduit (22) for flow of ambient air at port (18), and a fourth valve (30D) for direct flow from the pump (48) and exit into the atmosphere via gas outlet either at port 16A or 16B, characterized in that the first valve (30A) is positioned in such a way that the first conduit (20) and the second conduit (22) entering the first

valve (30A), and exit and is linked to a second valve (30B), that is positioned such a way that one end is from the exit of valve (30A), another end exit from valve (30C), with the other exit end connected to the ionization chamber (10), and a third valve (30C) is linked to an outflow conduit (26) and to the second conduit (22), and exit and is linked to the second valve at (30B), and the fourth valve (30D) is positioned in such a way with the pump (48) at one end and exit into the first conduit (20) connected at one end and the outflow conduct (26) connected at the other end leading into the atmosphere; and in the first cycle, measurement and purging is carried out, and in the second cycle, a cleaning and a purging, and the third cycle, a measurement and purging is carried out, and in the fourth cycle, cleaning and purging are carried out.

13. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 12, characterized in that the first (30A) is a 3:2 valve, to direct flow of ambient gas at port (16A) or from a second conduit (22) for flow of ambient air (18), via a cleaning chamber (12) of the PID which removes pollutants and contaminants in the ambient air at port (18), and exit to a second valve (30B).

14. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 12, characterized in that the second valve (30B) is a 3:2 valve, to direct flow of ambient gas from exit of valve (30A), or flow from exit of a third valve (30C) and exit and into the ionization chamber (10), leading to the pump unit (48).

15. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 12, characterized in that the third valve (30C) is a 3:2 valve to direct gas flow to an outflow conduit (26) and to the second conduit (22), and exit and is linked to the second valve at (30B).

16. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 12, characterized in that the fourth valve (30D) is a 3:2 valve which is positioned in such a way with the pump (48) at one end and exit into the first conduit (20) connected at one end and the outflow conduit (26) connected at the other end leading into the atmosphere.

17. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 12, characterized in that measurement of ambient gas via port (16A) and (16B), and purging of the ionization chamber (10) and at gas ports (16B) and (16A), are done in the first and third cycle of the PID.

18. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 12, characterized in that cleaning of ambient air at port (18) through the cleaning chamber (12), and purging of the ionization chamber (10) and at gas ports, are done in the second and fourth cycle of the PID.

19. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 12, characterized in that the cleaning of ambient air at port (18) is carried out in the cleaning chamber (12) of the PID.

20. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 1, further comprising an outflow conduit (26) to outflow of ambient gas at port (16) from the ionization chamber (10) to the environment.

21. The purging and cleaning feature in a measurement system as claimed in Claim 1, wherein the purging in the second cycle, ambient air at port (18) passes through the cleaning chamber (12) to the ionization chamber (10) directed by the valve (30A), and then to conduit (20), purging through gas port (16) into the environment directed by the valve (30B).

22. A purging and cleaning feature in a measurement system for use with a Photo-Ionization Detector (PID) having a first conduit (20) for inflow of ambient gas at port (16A) to be measured, during a measurement cycle, in an ionization chamber (10) of the PID, a pump (48), a second conduit (22) for flow of ambient air port at (18), and a cleaning chamber (12) of the PID which removes pollutants and contaminants in the ambient air, another inflow of ambient gas at (16B), and a first valve (30A) for direct flow of ambient gas at port (16) into a second valve (30B), and a third valve (30C), and the second valve (30B) is connected to the ionization chamber (10) and one port of the second valve (30B) is connected to the first valve (30A), and the third valve (30C) is connected to an outflow conduit (26), one port of the third valve (30C) is connected to the first conduit (20), the ambient air at port (18) is used to flush out air borne pollutants and contaminants left in the ionization chamber (10) by the ambient gas (16) after the measurement cycle, characterized in that the first valve (30A) is positioned in such a way that 3:2 valve (30A) are connected to the first conduit (20), the second valve (30B) and the outflow tube (26) connected to the ambient gas port (16B), wherein the second valve (30B) is linked to the second conduit (22) connecting the cleaning chamber (12)

to gas port (18), and the exit of valve (30A), and exit into the ionization chamber (10), linked to the pump (48), and the third valve (30C) is positioned in such a way that one port is connected to the outflow conduct (26) linked to port (16B) into the atmosphere; and the next port is connected to the conduit (20) linked to port (16A), in the first cycle and second cycle, measurement and purging is carried out, and in the third and fourth cycle, a cleaning and a purging process is carried out, ambient air at port (18) is being cleaned in the cleaning chamber (12) and drawn to flush out air borne contaminants and pollutants in the ionization chamber (10) originating the ionization of ambient gas at ports (16A, 16B) during the measurement cycle.

23. A purging and cleaning feature in a measurement system for use with a Photo-Ionization Detector (PID) having a first conduit (20) for inflow of ambient gas at port (16A) to be measured during a measurement cycle, an ionization chamber (10) of the PID, a pump (48), a second conduit (22) for flow of ambient air (18), and a cleaning chamber (12) of the PID which removes pollutants and contaminants in the ambient air, another inflow of ambient gas at port (16B), and a first valve (30A) for direct flow of ambient gas at port (16A) or ambient air at port (18), via conduit (22) from cleaning chamber (12) linked to port (18), or outlet conduit (26) linked to port (16B), and exit into the ionization chamber (10), and the second valve (30B) for direct flow from the pump (48) and exit into the atmosphere via gas outlet either at port (16A) via conduit (20) or (16B) via conduit (26), characterized in that the first valve (30A) is positioned in such a way that the first conduit (20), the second conduit (22) and the outflow conduit (26), entering the first valve (30A), and exit and is linked to the ionization chamber (10), leading to the pump (48), and a second valve (30B) is positioned in such a way with the pump (48) at one end and exit into the first conduit (20) connected at one end and the outflow conduit (26) connected at the other end leading into the atmosphere; and in the first cycle, measurement and purging is carried out, and in the second cycle, a measurement and a purging, and the third cycle, a cleaning and purging is carried out, and in the fourth cycle, cleaning and purging are carried out.

24. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 23, characterized in that the first valve (30A) is a 4:3 valve.

25. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 23, characterized in that measurement of ambient gas via port (16A)

and (16B), and purging of the ionization chamber (10) and at gas ports (16B) and (16A), are done in the first and second cycle of the PID.

26. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 23, characterized in that cleaning of ambient air at port (18) through the cleaning chamber (12), and purging of the ionization chamber (10) and at gas ports, are done in the third and fourth cycle of the PID.

AMENDED CLAIMS
received by the International Bureau on 24 November 2015 (24.11.2015)

4. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 1, characterized in that cleaning of ambient air at port (18) is carried out and purging of the ionization chamber (10) is done in the second cycle of the operation of PID.

5. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 3, characterized in that the cleaning of ambient air (18) is carried out in the cleaning chamber (12) of the PID.

6. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 1, characterized in that in the first cycle, the first valve (30A) is open to lead the ambient gas at port (16) to go to the ionization chamber (10) and the second valve (30 B) is open to lead to the outflow conduit (26) to the atmosphere.

7. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 1, characterized in that in the second cycle in withdrawal ambient air at port (18) via the cleaning chamber (12), the second valve (30A) is open to lead the purged air, containing of contaminant, to the atmosphere via the outflow conduit (26).

8. A purging and continuous measurement system for use with a Photo-Ionization Detector (PID) having a first conduit (20) for inflow of ambient gas at port (16) to be measured, during a measurement cycle, an ionization chamber (10) of the PID, an outflow conduit (26) through gas port (16B) linked to an ambient gas environment, a pump (48), and a first valve (30A) for direct flow of ambient gas at port (16A) and a second valve (30B) that is connected from the pump (48), and exit and is connected to the first conduit (20) to the gas port (16A) and the outflow conduit (26) to the ambient gas port (16B), characterized in that the first valve (30A) is positioned in such a way that the first conduit (20), and the outflow conduit (26) entering the first valve (30A), and exit into the ionization chamber (10), and the second valve (30B) is positioned from the pump (48) linked to the ionization chamber (10), and exit and is linked to the first conduit (20) and to an outflow conduit (26) linked to the atmosphere; during a measurement and purging cycle in the first cycle, ambient gas at port (16A) is drawn through the ionization chamber (10) by the operation of the pump (48) to perform measurement and purging at gas port (16B) via the gas conduit (26), and during a second cycle which is another measurement and purging cycle, wherein the ambient

air at port (16B) is being drawn by the pump (48) into the ionization chamber (10), purging via the outflow conduit (20) through gas port (16A).

9. The purging and continuous measurement system for use with a PID as claimed in Claim 8, characterized in that the first (30A) is a 3:2 valve, to direct flow of ambient gas at ports (16A), or (16B) and exit into the ionization chamber (10), leading to the pump (48).

10. The purging and continuous measurement system for use with a PID as claimed in Claim 8, characterized in that the second valve (30B) is a 3:2 valve, to direct the flushed out air borne contaminants and pollutants from the ionization chamber (10) to the outflow conduit (26) or to the first conduit (20).

11. A purging and cleaning feature in a measurement system for use with a Photo-Ionization Detector (PID) having a first conduit (20) for inflow of ambient gas at port (16A) to be measured, during a measurement cycle, in an ionization chamber (10) of the PID, a pump (48), a second conduit (22) for flow of ambient air (18), and a cleaning chamber (12) of the PID which removes pollutants and contaminants in the ambient air, another inflow of ambient gas at port (16B), and a first valve (30A) for direct flow of ambient gas at port (16A) or ambient air at port (18) and exit into a second valve (30B), and a second valve (30B) being connected from the third valve (30C) and exit into the ionization chamber (10), and the third valve (30C) is connected to the outflow (26) and connected to the conduit (22) for flow of ambient air at port (18), and a fourth valve (30D) for direct flow from the pump (48) and exit into the atmosphere via gas outlet either at port 16A or 16B, characterized in that the first valve (30A) is positioned in such a way that the first conduit (20) and the second conduit (22) entering the first valve (30A), and exit and is linked to a second valve (30B), that is positioned such a way that one end is from the exit of valve (30A), another end exit from valve (30C), with the other exit end connected to the ionization chamber (10), and a third valve (30C) is linked to an outflow conduit (26) and to the second conduit (22), and exit and is linked to the second valve at (30B), and the fourth valve (30D) is positioned in such a way with the pump (48) at one end and exit into the first conduit (20) connected at one end and the outflow conduct (26) connected at the other end leading into the atmosphere; and in the first cycle, measurement and purging is carried out, and in the second cycle, a cleaning and a purging, and the third cycle, a measurement and purging is carried out, and in the fourth cycle, cleaning and purging are carried out.

12. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 11, characterized in that the first (30A) is a 3:2 valve, to direct flow of ambient gas at port (16A) or from a second conduit (22) for flow of ambient air (18), via a cleaning chamber (12) of the PID which removes pollutants and contaminants in the ambient air at port (18), and exit to a second valve (30B).

13. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 11, characterized in that the second valve (30B) is a 3:2 valve, to direct flow of ambient gas from exit of valve (30A), or flow from exit of a third valve (30C) and exit and into the ionization chamber (10), leading to the pump unit (48).

14. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 11, characterized in that the third valve (30C) is a 3:2 valve to direct gas flow to an outflow conduit (26) and to the second conduit (22), and exit and is linked to the second valve at (30B).

15. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 11, characterized in that the fourth valve (30D) is a 3:2 valve which is positioned in such a way with the pump (48) at one end and exit into the first conduit (20) connected at one end and the outflow conduit (26) connected at the other end leading into the atmosphere.

16. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 11, characterized in that measurement of ambient gas via port (16A) and (16B), and purging of the ionization chamber (10) and at gas ports (16B) and (16A), are done in the first and third cycle of the PID.

17. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 11, characterized in that cleaning of ambient air at port (18) through the cleaning chamber (12), and purging of the ionization chamber (10) and at gas ports, are done in the second and fourth cycle of the PID.

18. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 11, characterized in that the cleaning of ambient air at port (18) is carried out in the cleaning chamber (12) of the PID.

19. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 1, further comprising an outflow conduit (26) to outflow of ambient gas at port (16) from the ionization chamber (10) to the environment.

20. The purging and cleaning feature in a measurement system as claimed in Claim 1, wherein the purging in the second cycle, ambient air at port (18) passes through the cleaning chamber (12) to the ionization chamber (10) directed by the valve (30A), and then to conduit (20), purging through gas port (16) into the environment directed by the valve (30B).

21. A purging and cleaning feature in a measurement system for use with a Photo-Ionization Detector (PID) having a first conduit (20) for inflow of ambient gas at port (16A) to be measured, during a measurement cycle, in an ionization chamber (10) of the PID, a pump (48), a second conduit (22) for flow of ambient air port at (18), and a cleaning chamber (12) of the PID which removes pollutants and contaminants in the ambient air, another inflow of ambient gas at (16B), and a first valve (30A) for direct flow of ambient gas at port (16) into a second valve (30B), and a third valve (30C), and the second valve (30B) is connected to the ionization chamber (10) and one port of the second valve (30B) is connected to the first valve (30A), and the third valve (30C) is connected to an outflow conduit (26), one port of the third valve (30C) is connected to the first conduit (20), the ambient air at port (18) is used to flush out air borne pollutants and contaminants left in the ionization chamber (10) by the ambient gas (16) after the measurement cycle, characterized in that the first valve (30A) is positioned in such a way that 3:2 valve (30A) are connected to the first conduit (20), the second valve (30B) and the outflow tube (26) connected to the ambient gas port (16B), wherein the second valve (30B) is linked to the second conduit (22) connecting the cleaning chamber (12) to gas port (18), and the exit of valve (30A), and exit into the ionization chamber (10), linked to the pump (48), and the third valve (30C) is positioned in such a way that one port is connected to the outflow conduct (26) linked to port (16B) into the atmosphere; and the next port is connected to the conduit (20) linked to port (16A), in the first cycle and second cycle, measurement and purging is carried out, and in the third and fourth cycle, a cleaning and a purging process is carried out, ambient air at port (18) is being cleaned in the cleaning chamber (12) and drawn to flush out air borne contaminants and pollutants in the ionization chamber (10) originating the ionization of ambient gas at ports (16A, 16B) during the measurement cycle.

22. A purging and cleaning feature in a measurement system for use with a Photo-Ionization Detector (PID) having a first conduit (20) for inflow of ambient gas at port (16A) to be measured during a measurement cycle, an ionization chamber (10) of the PID, a pump (48), a second conduit (22) for flow of ambient air (18), and a cleaning chamber (12) of the PID which removes pollutants and contaminants in the ambient air, another inflow of ambient gas at port (16B), and a first valve (30A) for direct flow of ambient gas at port (16A) or ambient air at port (18), via conduit (22) from cleaning chamber (12) linked to port (18), or outlet conduit (26) linked to port (16B), and exit into the ionization chamber (10), and the second valve (30B) for direct flow from the pump (48) and exit into the atmosphere via gas outlet either at port (16A) via conduit (20) or (16B) via conduit (26), characterized in that the first valve (30A) is positioned in such a way that the first conduit (20), the second conduit (22) and the outflow conduit (26), entering the first valve (30A), and exit and is linked to the ionization chamber (10), leading to the pump (48), and a second valve (30B) is positioned in such a way with the pump (48) at one end and exit into the first conduit (20) connected at one end and the outflow conduit (26) connected at the other end leading into the atmosphere; and in the first cycle, measurement and purging is carried out, and in the second cycle, a measurement and a purging, and the third cycle, a cleaning and purging is carried out, and in the fourth cycle, cleaning and purging are carried out.

23. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 22, characterized in that the first valve (30A) is a 4:3 valve.

24. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 22, characterized in that measurement of ambient gas via port (16A) and (16B), and purging of the ionization chamber (10) and at gas ports (16B) and (16A), are done in the first and second cycle of the PID.

25. The purging and cleaning feature in a measurement system for use with a PID as claimed in Claim 22, characterized in that cleaning of ambient air at port (18) through the cleaning chamber (12), and purging of the ionization chamber (10) and at gas ports, are done in the third and fourth cycle of the PID.

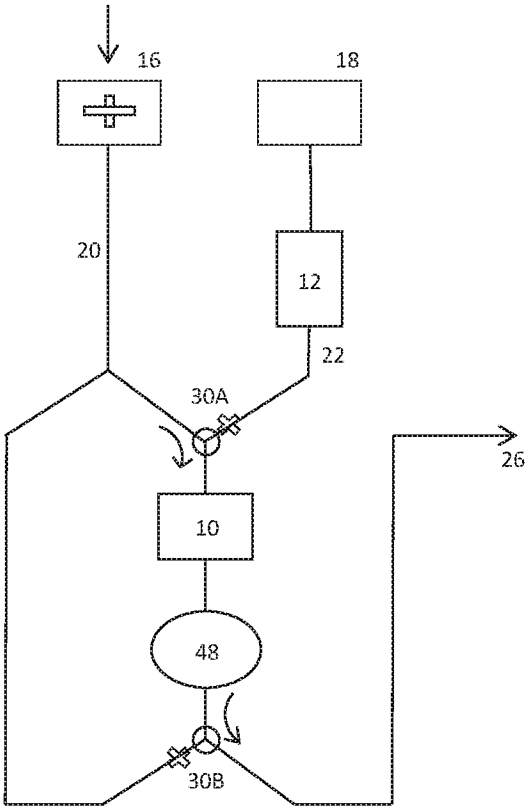


FIG. 1A

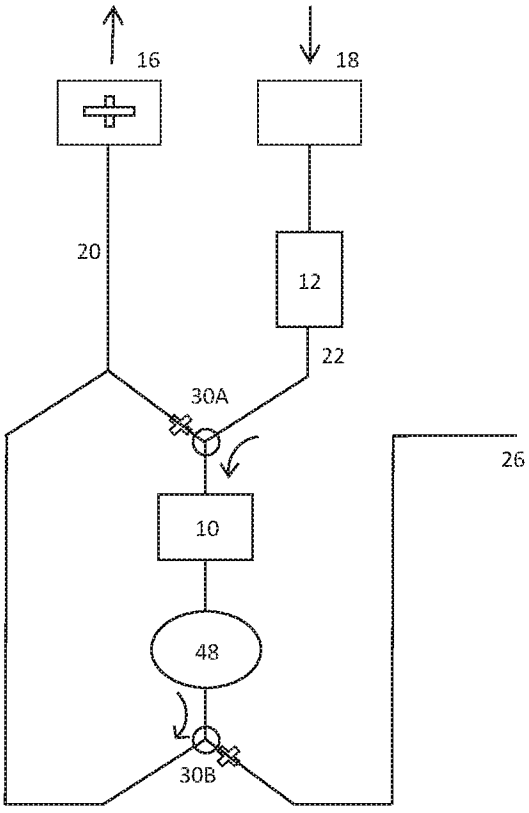


FIG. 1B

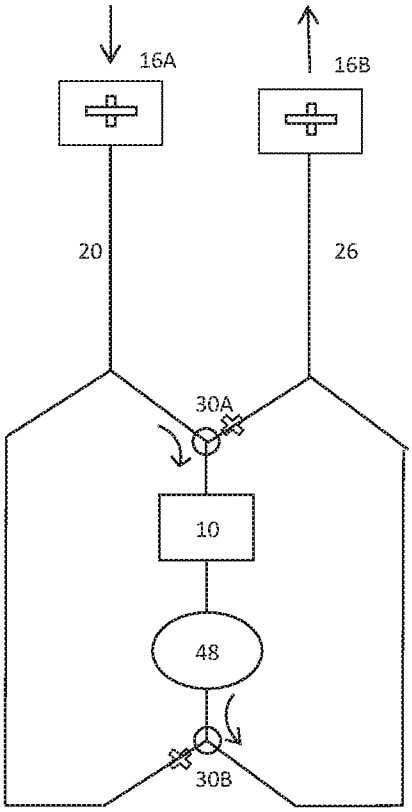


FIG. 2A

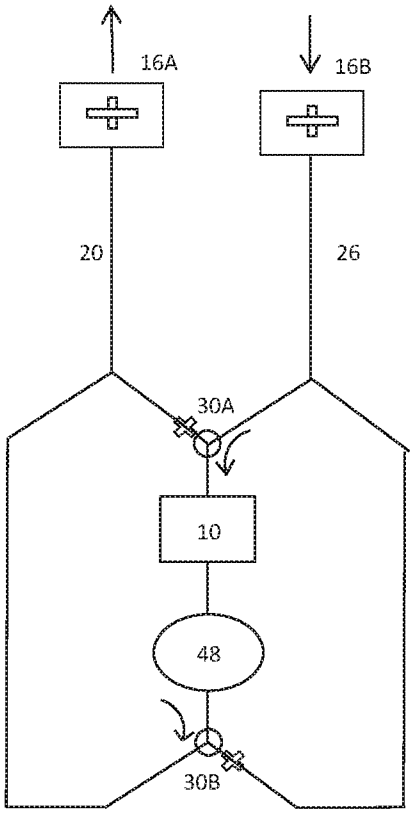


FIG. 2B

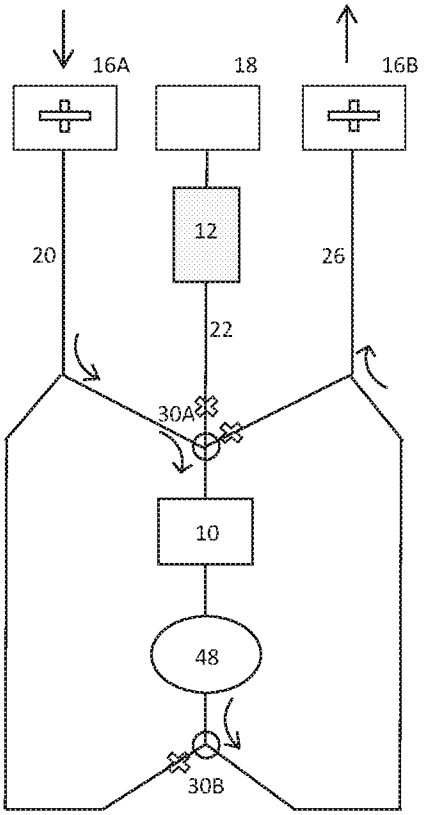

16A
18
16B
12
20
26
22
30A
10
48
30B

FIG. 3A

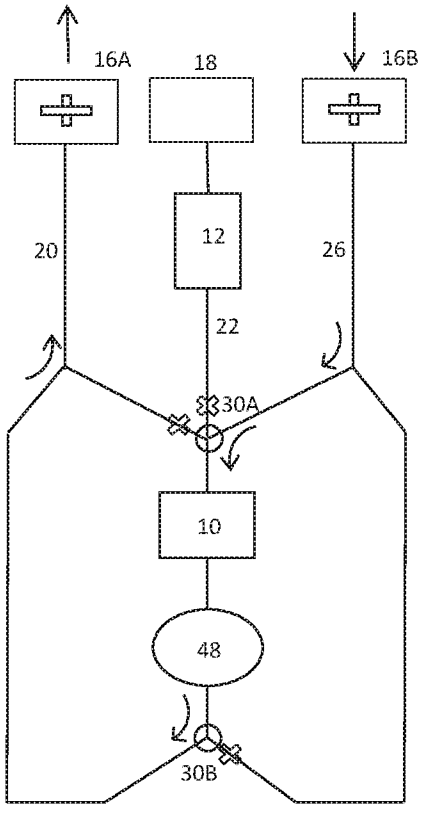

16A
18
16B
12
20
26
22
30A
10
48
30B

FIG. 3B

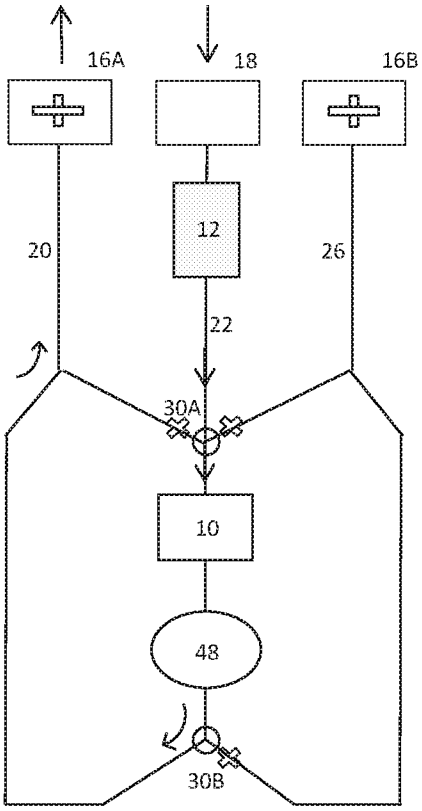
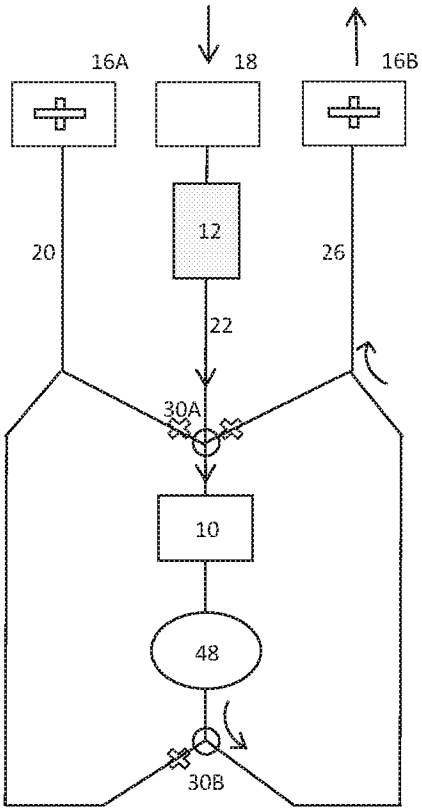

16A
18
16B
12
20
26
22
30A
10
48
30B

FIG. 3C


16A
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16B
12
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26
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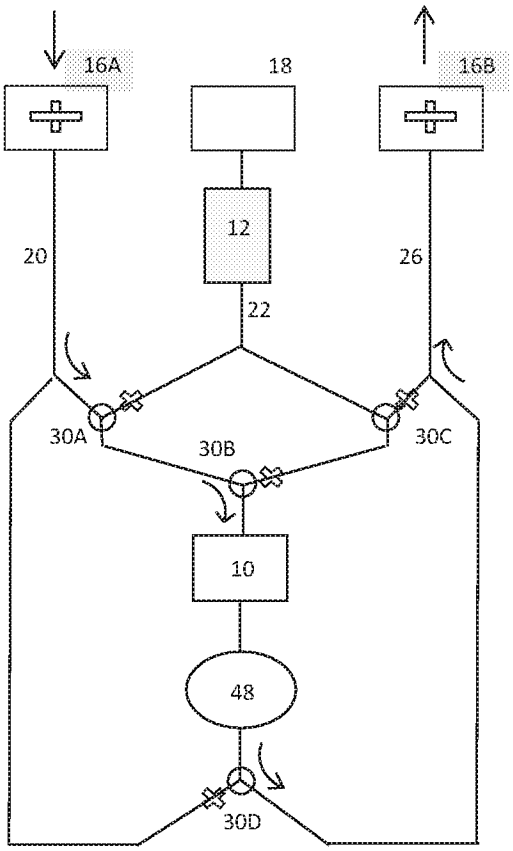
30A
10
48
30B

FIG. 3D


16A
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16B
12
20
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22
30A
30B
30C
10
48
30D

FIG. 4A

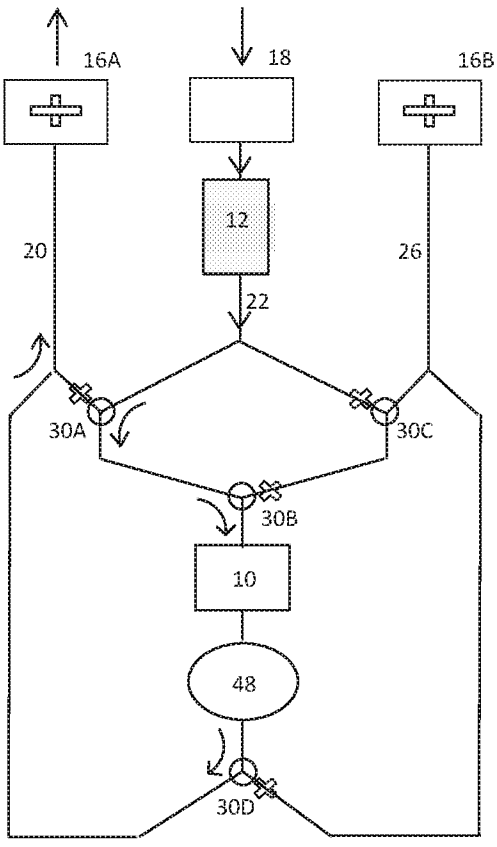
16A
18
16B
12
20
26
22
30A
30C
30B
10
48
30D

FIG. 4B

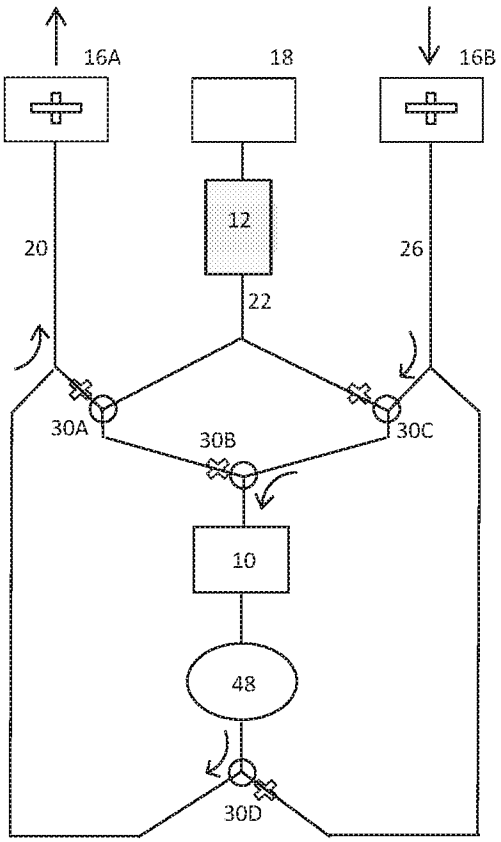
16A
18
16B
12
20
26
22
30A
30B
30C
10
48
30D

FIG. 4C

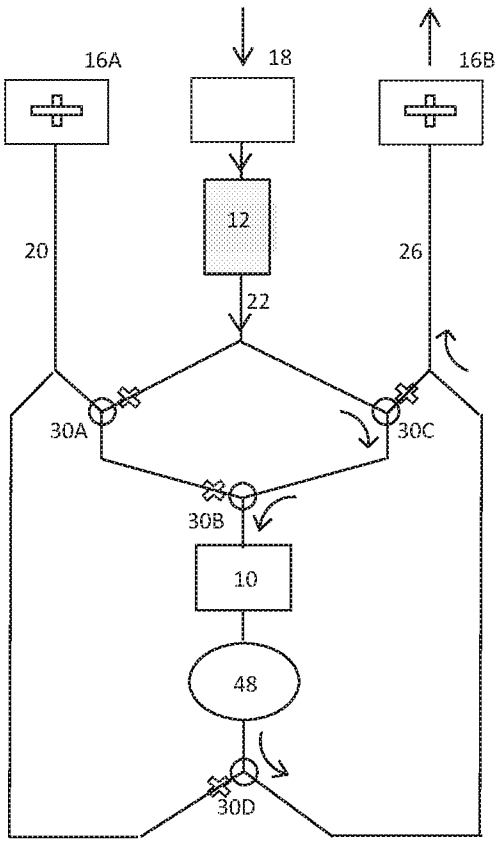
16A
18
16B
12
20
26
22
30A
30C
30B
10
48
30D

FIG. 4D

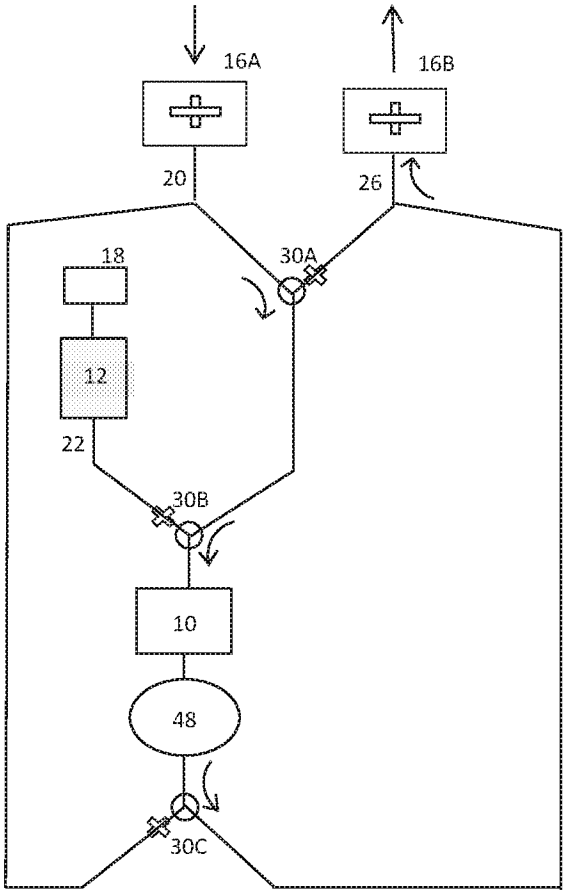
16A
16B
20
26
18
30A
12
22
30B
10
48
30C

FIG. 5A

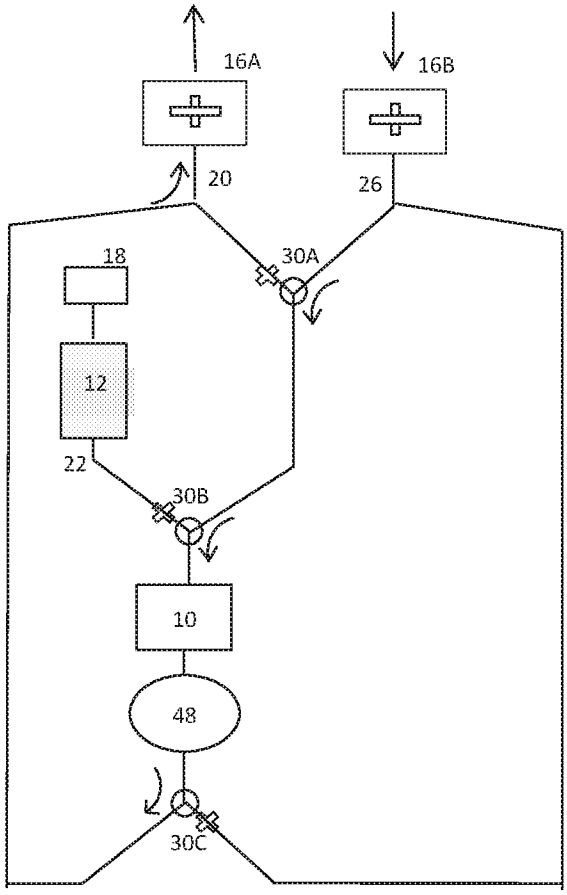
16A
16B
20
26
18
30A
12
22
30B
10
48
30C

FIG. 5B

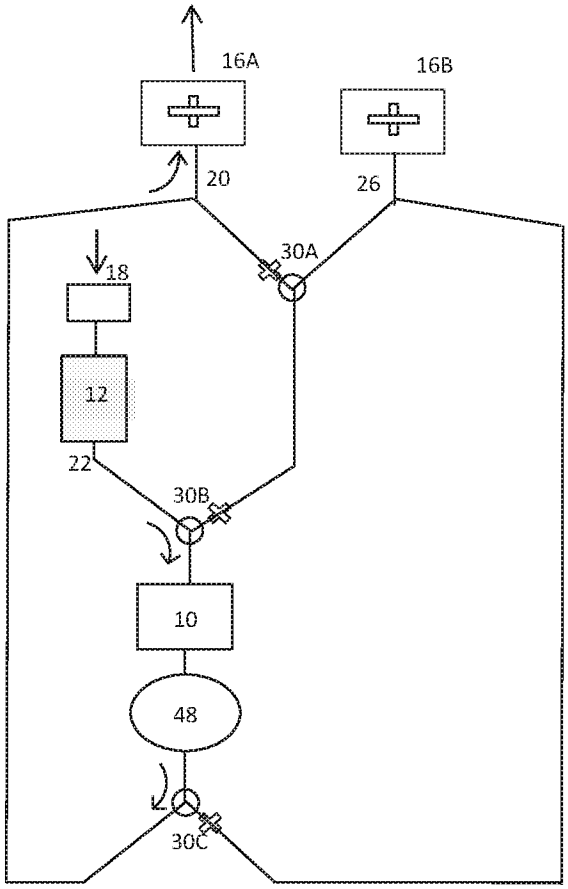
16A
16B
20
26
30A
18
12
22
30B
10
48
30C

FIG. 5C

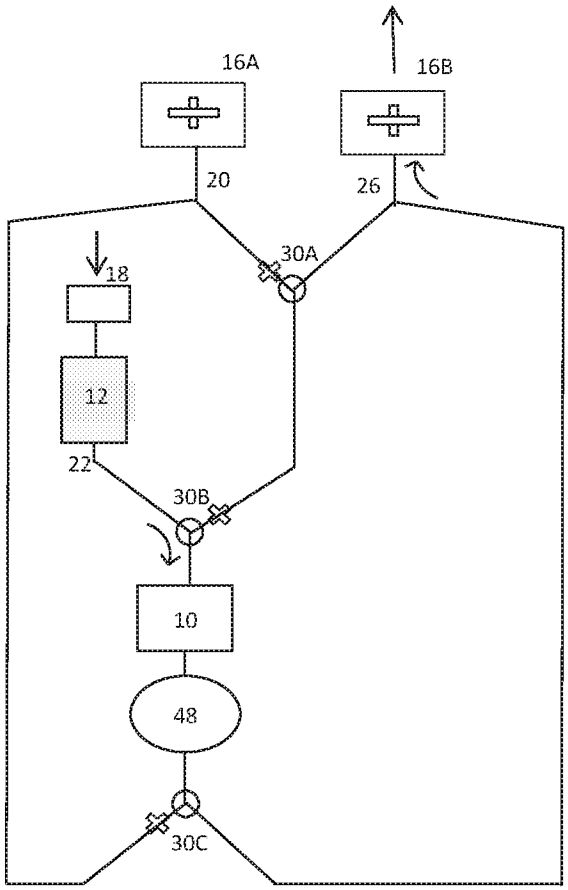
16A
16B
20
26
30A
18
12
22
30B
10
48
30C

FIG. 5D

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SG2015/050003

A. CLASSIFICATION OF SUBJECT MATTER

G01N 27/62(2006.01)i, G01N 21/33(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G01N 27/62; G01F 1/46; G01N 33/00; G01N 27/64; F24F 11/00; H01J 1/08; F24F 13/06; G01N 21/33

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & keywords: photo-ionization detector, purge, cleaning, chamber and valve

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6225633 B1 (SUN et al.) 01 May 2001 See abstract, column 7, line 6-column 8, line 67 and figures 1-5B.	6
A		1-5,7-26
Y	US 6959610 B1 (BOWERS, JAMES R.) 01 November 2005 See abstract, column 2, line 52-column 3, line 12 and figures 1, 2.	6
A		1-5,7-26
A	US 2002-0179846 A1 (SUN et al.) 05 December 2002 See abstract, paragraphs [0040]-[0044], claims 1-3 and figures 1-4.	1-26
A	US 2013-0152783 A1 (DOBBYN, GREGORY J.) 20 June 2013 See abstract, paragraphs [0070]-[0073], claims 22-27 and figures 1-3.	1-26
A	US 2007-0105494 A1 (LIN, XIANGQIAN) 10 May 2007 See abstract, paragraphs [0028]-[0059] and figures 1-6.	1-26

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 October 2015 (12.10.2015)	**12 October 2015 (12.10.2015)**

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SG2015/050003

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