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Schadler

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[54] **METHOD FOR OPERATING A HALOGEN DETECTION DIODE AND ARRANGEMENT FOR CARRYING OUT THE METHOD**

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[58] **Field of Search** 324/33; 340/237; 330/110; 73/25, 26

[56] **References Cited**

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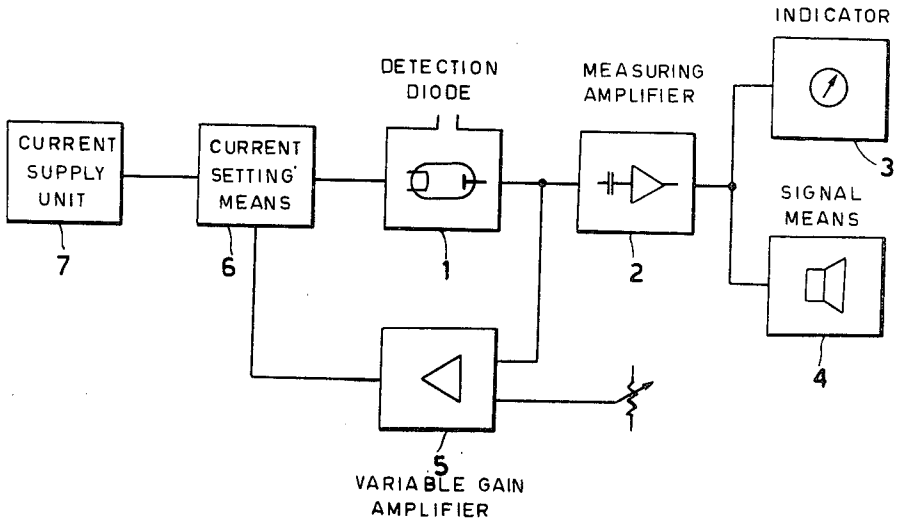
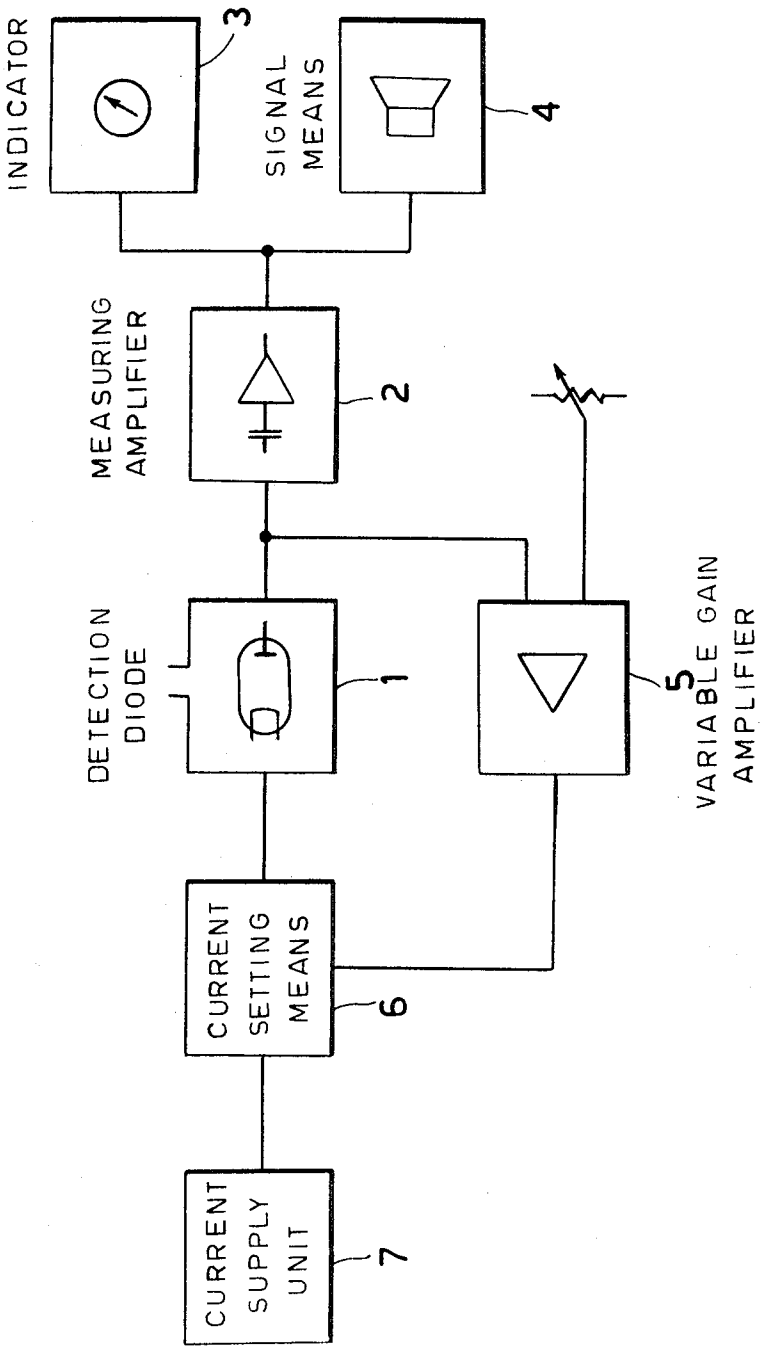
[57] **ABSTRACT**

In a method of operating a halogen detection diode having a filament-heated anode, which emits ions when impacted by halogen gas, and a cathode, fundamental ion current variations of the diode are constantly sensed and the filament heating current is regulated in accordance with the sensed ion current variations to counteract the ion current variations to maintain the fundamental ion current substantially constant. The ion current peak, which occurs under the action of an halogenous gas on the anode of the diode, is measured and serves as an indication of the halogen action. The arrangement for effecting the method includes a measuring amplifier connected to the cathode of the detection diode, an indicating meter and preferably an alarm device connected to the output of the measuring amplifier, a current supply for the filament and an adjusting means connecting the current supply to the filament. A variable gain amplifier is connected to the cathode of the detection diode and to the setting means to regulate the filament heating current in a corrective sense in accordance with sensed fundamental ion current variations. The arrangement and method are used primarily for checking leakage of an atmosphere containing an halogenous gas.

7 Claims, 1 Drawing Figure





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METHOD FOR OPERATING A HALOGEN DETECTION DIODE AND ARRANGEMENT FOR CARRYING OUT THE METHOD

FIELD OF THE INVENTION

This invention relates to halogen detection methods and apparatus and, more particularly, to an improved method of operating a halogen detection diode by which the fundamental ion current through the diode is maintained substantially constant, and to an improved arrangement for carrying out the method.

BACKGROUND OF THE INVENTION

Halogen detection diodes are used primarily for determining leakages in container walls wherein an atmosphere, containing an halogenous gas, is present on one side of the container wall to be checked while, on the other side, leakage of this gas through any leak in the wall is detected by means of a diode having a filament-heated anode and emitting ions in the presence of an halogenous gas. Such diodes and their use are already known and are described, for example, in Swiss Pat. No. 269,214.

A very annoying disadvantage of the so-called halogen detection diodes is that the fundamental ion current, which is the ion current flowing, in operation, through the diode, is subject to great fluctuations if no halogen strikes the heated anode. For unknown reasons, the ion current can decrease practically to zero, despite an apparent constant anode temperature, or it can increase to a multiple of its original value. During the time in which either no ion current or only a small ion current flows, the diode is insensitive to halogen, but prolonged operation with a too high ion current leads to a considerable reduction of the service life of the detection diode. It is thus necessary to check the fundamental ion current frequently, to ascertain that the diode is ready, that is, that it will respond to any incoming halogenous gas and will not be overloaded at the same time. By halogenous gas is understood gases and vapors which contain halogen atoms.

The greater the sensitivity of a halogen detection diode is, the more pronounced is the above-described disadvantage. This means that the effect is the more disturbing the smaller the gas inflow which is to be detected. In addition, not only does the fundamental ion current itself fluctuate, but the anode of the detection diode is "contaminated" for a certain time after the action of halogenous gas, that is, it responds to only a limited extent or not at all to any subsequent action of halogen. In order to eliminate this "contamination", the detection diode had to be rinsed or flushed with halogen-free gas after each major halogen action, and this has been time-consuming and cumbersome.

SUMMARY OF THE INVENTION

The object of the present invention is to reduce the above-described disadvantages and to provide a method for operating a halogen detection diode which, in particular, makes the frequent checking of the fundamental ion currents superfluous and which reduces substantially the so-called "contamination". It has been found that even the extent of the halogen action can be determined more accurately and quantitatively, in accordance with the invention, than possible heretofore. In addition, it has been found that an increase of the service life of the detection diode, which is the ion source, can be attained with the invention method.

The invention is further directed to a device or circuit for carrying out the invention method. Prior to the present invention, there were frequently used arrangements, as mentioned above, with which the halogen detection diode could be rinsed or flushed periodically with a halogen-free gas, for example, with fresh air. The new fundamental ion current measured after rinsing then serves as a starting point for the following determination of an halogenous gas inflow. In order to obtain a constant fundamental ion current, arrangements also have been used for maintaining the filament heating current of the anode at a constant value. Arrangements wherein the temperature of the anode is constantly measured by means of temperature sensors, and where the filament current is then regulated correspondingly, in order to obtain a constant anode temperature and thus a constant fundamental ion current, have also been suggested. However, it was found that although a certain improvement could be attained, compared to the method of maintaining the filament heating current constant, a constant fundamental emission, or tube constancy, could not be attained over a long run.

In accordance with the new method embodying the invention, the operation of a halogen detection arrangement is characterized in that the filament current, for heating the anode, is so regulated constantly by the diode, in accordance with the fundamental ion current, that all variations of the fundamental ion current are at least partly offset again.

In particular, the filament current is regulated constantly in a manner such that the fundamental ion current through the diode maintains a substantially constant value. In accordance with the invention, the filament current of the anode thus is reduced when the ion current, for example, increases when halogen acts on the anode, but is increased when the ion current diminishes. Due to this feature of the method, any variation of the ion current is more or less offset again within a short regulating period.

For detecting halogenous gas, there is used preferably the ion current peak which appears temporarily, until the above-described regulation becomes effective, when halogen acts on the anode of the detection diode.

If it is necessary only to find out if a leak of a minimum size exists, as is frequently the case in locating a leak, the measuring amplifier can be provided with a discriminator so that the indicator responds only to the leak, and indicates a leak, when the above-mentioned ion current peak exceeds a preselected threshold value when an halogenous gas enters the diode space. The variable itself, thus the ion current, can also be used as a measuring quantity.

An object of the invention is to provide an improved method of operating a halogen detection diode.

Another object is to provide an improved arrangement for implementing the method.

A further object is to provide such a method and arrangement in which the ion current is constantly sensed for variations and the filament heating current is constantly regulated in accordance with the sensed ion current variations.

For an understanding of the principles of the invention, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing, the single FIGURE is a schematic block diagram of an arrangement for operating a halogen detection diode in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, the signal current or ion current of a halogen detection diode **1** is amplified by the logarithmically or linearly working measuring amplifier **2**, and the ion current is indicated on the indicator **3**. Either in conjunction with indicator **3** or alternatively, the ion current may be used to activate an alarm or signal device **4**, connected in parallel with indicator **3** to the output of amplifier **2**.

In accordance with the invention, the ion current or signal current at the output of halogen detection diode **1** is supplied to a variable gain amplifier **5** connected, in controlling relation, with setting means **6** for the filament heating current for the anode of diode **1**. Setting means **6** is supplied with filament heating current by a current supply unit **7**. Variable gain amplifier **5** controls setting means **6** in a manner such that the current, from supply unit **1**, fed to the heating filament, is decreased or increased automatically when the ion current through diode **1** attains a value above or below, respectively, an adjustable nominal value.

For example, a nominal value of 5 microamperes can be set. As soon as the ion current of diode **1** varies, due to a fluctuation or due to the action of halogen, variable gain amplifier **5** supplies a signal to setting means **6** to adjust the filament heating current in a direction to counteract the variation. The time constant of the control circuit preferably is so selected that the ion current peak, occurring under the action of halogen during the regulation period, can be easily measured or recorded, while the relatively slow fluctuations of the fundamental ion current provide no measurable deflection of the indicating means **3**.

Experience has shown that the objectives of the invention can be fully attained by the invention method and the invention arrangement. The invention method can be used not only for locating leaks but also when halogenous gases or vapors have to be detected.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. In a method of operating a halogen detection diode having a filament-heated anode, which emits ions when contacted by gas or vapors containing halogen, and a cathode, and having a fundamental ion current flowing therethrough, the improvement comprising constantly sensing the fundamental ion current of the diode to detect variations therein; and constantly regulating the filament-heating current in accordance with the sensed fundamental ion current variations to counteract the fundamental ion current variations in the diode.

2. In a method of operating a halogen detection diode, the improvement claimed in claim **1**, in which the filament heating current is constantly regulated to a value such that the fundamental ion current through the diode maintains a substantially constant value.

3. In a method of operating a halogen detection diode, the improvement claimed in claim **1**, including detecting the ion current peak which occurs responsive to contact of halogen containing vapor or gas with the anode of the detection diode; and utilizing such ion current peak as an indication of halogen action on the anode of the detection diode.

4. In a halogen detection arrangement including a halogen detection diode, having a filament-heated anode, which emits ions when contacted by gases or vapors containing halogen, and a cathode, a measuring amplifier connected to the output of the diode, an indicator connected to the output of the measuring amplifier, and a current supply unit for supplying heating current to the filament of the diode, the improvement comprising, in combination, control means connected to the output of said detection diode and responsive to the fundamental ion current therethrough, and connected in controlling relation with the filament heating current supply to said diode; said control means automatically regulating the filament heating current in accordance with the fundamental ion current through said diode.

5. In a halogen detection arrangement, the improvement claimed in claim **4**, in which said control means includes a filament heating current setting means connected between said current supply unit and said detection diode.

6. In a halogen detection arrangement, the improvement claimed in claim **5**, in which said control means includes a variable gain amplifier connected to the output of said detection diode and to said setting means.

7. In a halogen detection arrangement, the improvement claimed in claim **4**, in which said control means regulates the filament heating current to control the temperature of the anode of said detection diode in a direction to maintain the fundamental ion current through said detection diode at a substantially constant value.

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