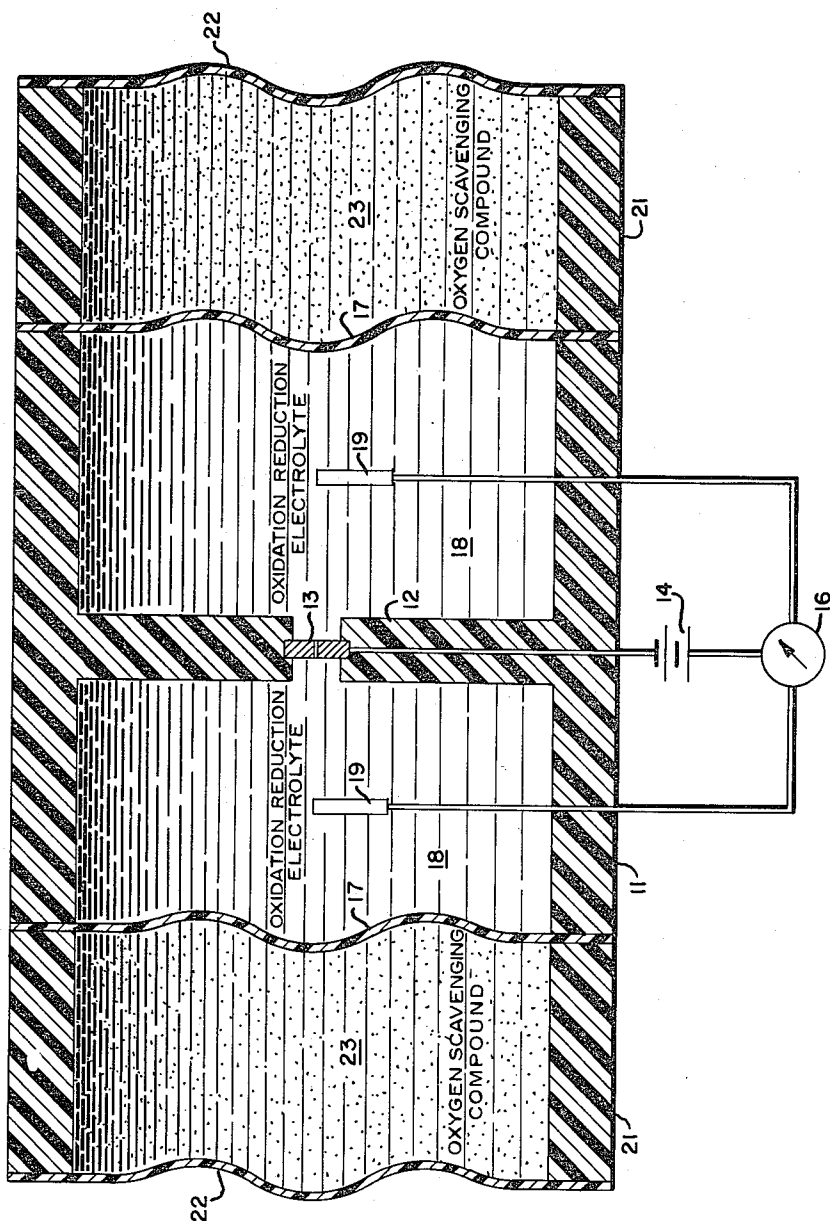


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ELECTROLYTIC DETECTOR CELL WITH ADJACENT COMPARTMENTS
CONTAINING PROTECTIVE COMPOUND
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ELECTROLYTIC DETECTOR CELL WITH ADJACENT COMPARTMENTS CONTAINING PROTECTIVE COMPOUND

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(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America without the payment of any royalties thereon or therefor.

The invention relates to an electrolytic detector cell which is highly resistant to the effects of oxygen gas that would normally diffuse through the housing thereof. More particularly, this application is concerned with a new and improved electrolytic detector cell having a plurality of diaphragms defining a pair of chambers disposed about the detector cells and filled with an oxygen getter compound.

In the electrolytic detector cells used prior to this invention, the active chemical ions in solution were subject to poisoning by oxygen diffusing into the detector solution through the relatively thin diaphragms of the cell from the ambient air. For example in an I_3^- - I^- solution, oxygen diffusing through the flexible diaphragm surrounding the solution reacted with the I^- ion producing I_3^- ions, thereby altering the sensitivity of the detector.

Prior to this invention it was the practice to incorporate a plastic bag containing O_2 scavenging compounds into the hydraulic housing of the detector to prevent oxygen from diffusing into the detector. The plastic bag in effect became a hydraulic shunt with respect to the detector insofar as oxygen diffusion was concerned. However, the plastic bag material had to be carefully selected in order to eliminate compatibility problems between the detector hydraulic fluid and detector component parts. Furthermore, this method was but a temporary expedient and by no means eliminated all of the oxygen diffusion through the diaphragm.

A second method of combating the absorption of oxygen by the electrolytic fluid was to incorporate oxygen scavenging compounds directly into the hydraulic detector fluid. This mode of combating is ineffective if the detector is to be stored for long periods because of the oxygen scavenging compounds are not completely inert with respect to the other detector parts such as the rubber and different emf metals. Thus, the oxygen scavenging compounds can be expected to become desensitized because of its reactivity with components of the cell. Furthermore, the thin diaphragms of the detector cell admit appreciable quantities of oxygen into the detector and the oxygen scavenging compound is quickly depleted by chemical reaction with the oxygen.

Accordingly, it is one object of this invention to provide a new and improved electrolytic detector cell of sensitivity which does not vary over long periods of storage.

Another object of this invention is the provision of a new and improved detector cell including an oxygen getter compound for preventing deleterious O_2 absorption into the housing containing the electrolytic detector fluid.

Still another object of this invention is to provide a detector cell having a pair of O_2 scavenging chambers adjacent to the electrolytic detector compartment for preventing O_2 diffusion through the diaphragm of that com-

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partment and presenting no compatibility problems with the components of the cell.

A still further object is the provision in an electrolytic detector cell of a pair of chambers containing oxygen scavenging compounds disposed adjacent each of the diaphragms of the detector cell and hydraulically coupled thereto for transmitting pressure signals to the cell and eliminating the diffusion of oxygen into the cell.

These and many other objects will become more readily apparent when the drawing is considered along with the attendant description.

Referring now to the drawing which shows in section one embodiment of my invention, it is seen that the detector cell is composed of a housing 11 having an apertured wall 12 interiorly thereof. Disposed within the aperture in wall 12 is an active electrode 13 which is connected by a biasing battery 14 to a meter 16. A pair of thin flexible diaphragms 17 are disposed at either end of the housing and together with wall 12 define a pair of compartments 18 containing an oxidation-reduction electrolytic detector solution such as an I_3^- - I^- ion system. A pair of electrodes 19 are each disposed in the respective compartments and are externally connected to the positive terminal of battery 14 via meter 16.

The above described portion of this cell is old and known in the art. It operates upon the flexure of diaphragms 17 to bring electrolytic solution through the active orifice electrode 13 to produce an output voltage in the circuit between electrode 13 and an appropriate electrode 19. A more complete description of the basic principles of this type of cell is more fully described in a brochure entitled "Solion-Principles of Electrochemistry and Low-Power Electrochemical Devices," published by the U.S. Naval Ordnance Laboratory in 1957 and currently available in revised form as a publication having the same title as publication No. PB 131931 of the U.S. Department of Commerce, Office of Technical Services. A pair of hollow members 21 are secured to the outer peripheral portion of the appropriate diaphragm 17. Each member 21 has an outer diaphragm 22 secured thereto defining a pair of chambers 23, one on either side of the compartments 18. These outermost chambers 23 are filled with oxygen getter compound. Since the getter compounds are not in contact with the electrolytic fluid, no compatibility problems are presented. The number of oxygen getter compounds suitable for the purpose is extremely large. Nevertheless a few examples are given merely as an indication of the extent of the range of suitable compounds which optionally may be employed; electrolytic solutions such as contained in the main chambers may be used if it is desired, however if an electrolytic solution containing an I_3^- - I^- system is disposed in chamber 23 it is necessary that a pair of polarizing electrodes be disposed within each chamber to maintain the polarization of the ions, paint dryers such as the linseed oil series, castor oil either in pure form or mixed with an inert solution is also suitable, the organo metallic compounds (Grignard series), organic amino and (NH_4) derivative series in pure or solvent form also may serve as the getter compound. Lineoleate compounds and long chain fatty acid series have also been successfully used as the getter compound. A Pyrogallate solution in alkaline form is another suitable oxygen scavenger.

Since the chambers 23 are completely filled, they serve not only to absorb oxygen diffusing through the outer diaphragm 22 but provide an hydraulic connection between the outer diaphragm 22 and the inner diaphragm 17 thereby transmitting any pressure or acoustic signals to the electrolytic detector fluid in compartments 18. The wall of casing 11 is sufficiently thick to inhibit substantial oxygen diffusion into compartments 18 while the outer chambers 23 filled with an oxygen scavenging com-

pound prevent diffusion of oxygen through the relatively thin diaphragms 17. The diffusion oxygen reacts with the oxygen scavenging compound and is thereby absorbed by or reacts with said compound and is unavailable for diffusion through diaphragm 17 into the chambers 18 containing the electrolyte solution. Thus, is provided a detector cell having a very stable sensitivity even over prolonged periods of storage.

While I have described this invention with particularity with reference to but one preferred embodiment thereof, 10 it will be apparent to one skilled in the art after reading and understanding the above description that it is by no means so limited. Accordingly, the example given hereinabove is to be construed as illustrative only and the invention is to be defined only by the terms of the ap- 15 pended claims.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. An electrolytic detector cell comprising;
 - (a) a housing having an apertured wall integrally 20 formed therewith,
 - (b) a first pair of diaphragms secured to said housing on opposite sides of said wall and together therewith defining a pair of compartments,
 - (c) an electrolytic detector solution filling said com- 25 partments,
 - (b) an orifice electrode disposed within the aperture in said wall and externally connected to an electric circuit,
 - (e) a pair of electrodes, each electrode of said pair 30 of electrodes being disposed within a respective one of said compartments and externally connected to said orifice electrode by an electrical biasing circuit,
 - (f) a second pair of diaphragms,
 - (g) a first and second means respectively securing a 35 respective one of said second pair of diaphragms in spaced relationship with a respective one of said first pair of diaphragms and together therewith defining a pair of chambers, one of said chambers disposed 40 externally of a respective one of said pair of compartments and,
 - (h) an oxygen scavenging compound filling each of said pair of chambers to absorb any oxygen that would tend to diffuse through said second pair of 45 diaphragms to prevent diffusion of any oxygen through said first pair of diaphragms and poisoning of the electrolytic detector solution.
2. An electrolytic detector cell comprising;
 - (a) a housing,
 - (b) a first pair of diaphragms closing the exterior por- 50 tion of said housing, said diaphragms being normally exposed to the ambient environment of the detector cell,
 - (c) an oxidation-reduction solution substantially filling said housing,
 - (d) a plurality of exteriorly connected electrodes disposed in said solution and together therewith providing an electrolytic detector cell,
 - (e) an orifice electrode disposed within said housing 60 between said electrodes and electrically coupled thereto exteriorly of said housing,
 - (f) means disposed between said plurality of electrodes and supporting said orifice electrode within said housing,
 - (g) a second pair of diaphragms,
 - (h) first and second means respectively securing a 65 respective one of said second pair of diaphragms in spaced relationship with a respective one of said first pair of diaphragms and together therewith forming a pair of chambers and
 - (i) a liquid containing oxygen getter compound substantially filling each of said chambers 70 whereby the oxygen getter compound in said chambers

protects the oxidation-reduction solution in said housing from oxidation by the ambient environment.

3. An electrolytic detector cell comprising:

- (a) a housing,
- (b) a pair of compartments disposed within said housing,
- (c) means disposed within said housing and separating said pair of compartments,
- (d) orifice electrode means supported by the compartment separating means,
- (e) a pair of electrodes disposed one each in said compartments, said electrodes being of opposite polarity to said orifice electrode means,
- (f) an oxidation-reduction electrolytic fluid substantially filling said compartments, said fluid having the property of being poisoned by oxygen,
- (g) a pair of diaphragms each disposed about a respective compartment for closure thereof,
- (h) a second pair of diaphragms,
- (i) first and second means respectively securing a 55 respective one of said second pair of diaphragms in spaced relationship with a respective one of said first pair of diaphragms and together therewith defining a fluid chamber on the outside of each of said pair of diaphragms and
- (j) a liquid including an oxygen scavenging compound substantially filling each of said chambers to prevent poisoning of the oxidation-reduction electrolytic fluid by ambient oxygen.

4. An electrolytic detector cell comprising;

- (a) a relatively thick-walled housing,
- (b) an internal aperture wall affixed to said housing,
- (c) an orifice electrode disposed within said aperture,
- (d) a first pair of relatively thin diaphragms disposed at opposite ends of said housing and together with said apertured wall defining a pair of electrolytic compartments having said thin diaphragms as their outward walls,
- (e) an oxidation-reduction electrolytic fluid filling said compartments,
- (f) a pair of electrodes each disposed within a respective one of said compartments,
- (g) external circuit means for biasing said last-named electrodes with respect to said orifice electrode and for connecting said electrodes to said orifice electrode,
- (h) a second pair of diaphragms,
- (i) first and second means respectively securing a 60 respective one of said second pair of diaphragms in spaced relationship with a respective one of said first pair of diaphragms and together therewith defining a pair of chambers outwardly adjacent to said first pair of diaphragms and
- (j) a quantity of oxygen scavenging liquid disposed within said chambers for absorbing oxygen that would normally diffuse through said first pair of diaphragms into the electrolytic solution and for hydraulically connecting said second pair of diaphragms with said first pair of diaphragms.

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