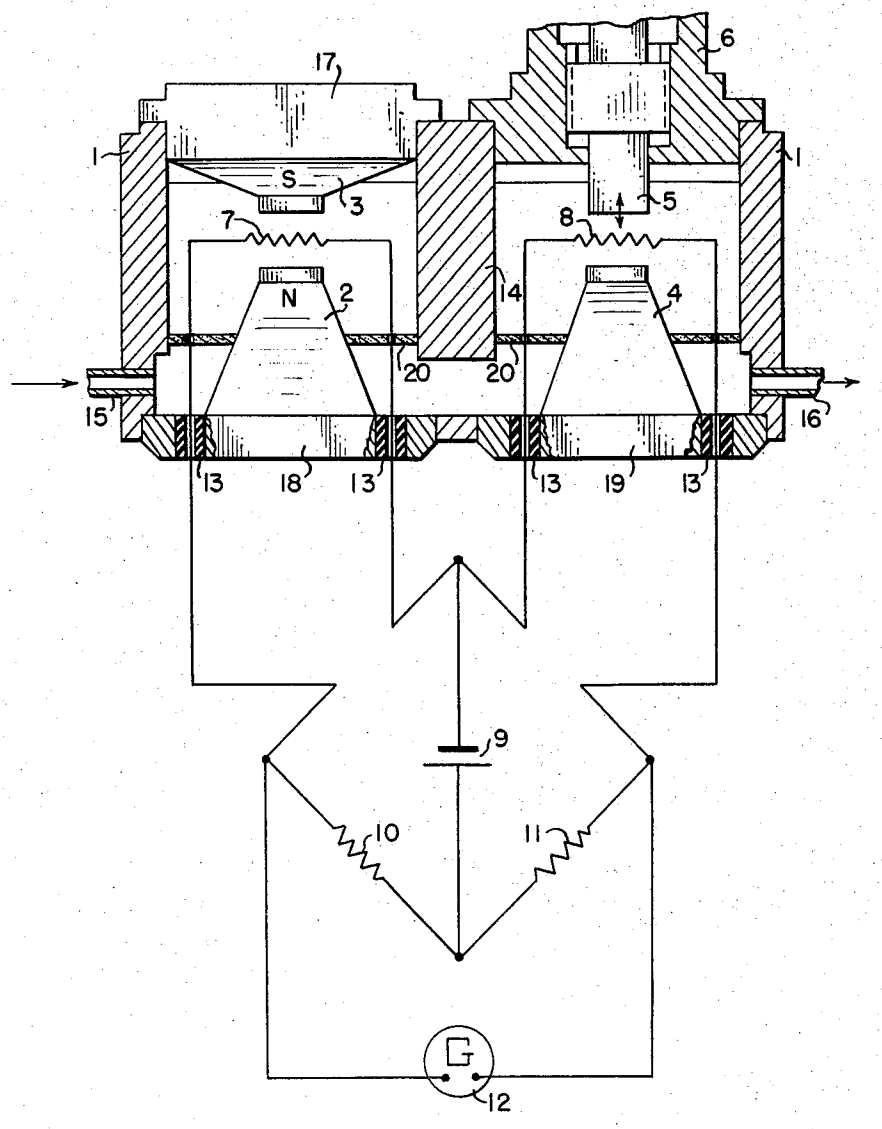
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METHOD FOR COMPENSATING THE INFLUENCE OF THE CARRIER-GAS IN MAGNETIC GAS-ANALYSERS

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METHOD FOR COMPENSATING THE INFLUENCE OF THE CARRIER-GAS IN MAGNETIC GAS-ANALYSERS

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The invention relates to devices for analysing gases by making use of their paramagnetism; the invention thus relates for instance and particularly to oxygen measuring devices. In these apparatuses a nonhomogeneous magnetic field is produced within a measuring chamber which is fed with the gas to be examined. A heating element, particularly a heating wire, is placed on a spot of large nonhomogeneity of the magnetic field, producing there a local heating. This gives rise to gas convection. If paramagnetic gases are present a further gas stream is produced which is superimposed on the heat convection and caused by changes of the paramagnetic property of gases in case these latter are heated. This gas stream is called "magnetic wind." In a comparison chamber fed with the same gas as the measuring chamber and containing also a heating element but being not exposed to a magnetic field only the natural heat convection occurs. The different cooling of the heating elements in both the chambers is measured, whereby the content of paramagnetic gas present in the mixture to be examined can be determined.

It is the object of the invention to render the indication of such an apparatus independent of the composition of the carrier gas. The carrier gas is understood to include all non-paramagnetic components of the gaseous mixture.

The carrier gas has influence upon the indication inasmuch as the loss of heat of the heating element depends on the heat conducting properties, the viscosity, the specific heat and the density of the gas components. Furthermore the surrounding of the heating elements plays a role; this however, usually is the same for both the chambers.

Now, if no paramagnetic gases are present in the mixture, the indication should be zero independent of the other components of the gas. This generally is achieved by providing an adjustable nonmagnetic body in the comparison chamber. This body is adjusted until with no paramagnetic gases present the indication remains zero when changing the composition of the gas.

The magnetic wind, however, also depends on the heat conducting properties, viscosity etc. of the mixture to be examined, i.e. even after adjustment in the zero point the indication will be influenced by the composition of the carrier gas. The content of paramagnetic gas, for instance O_2, being constant the indication still will vary according to the composition of the carrier gas (for example pure N_2 or N_2+CO_2 or N_2+some percent Ar).

The invention avoids this dependability of the indication on the composition of the carrier gas. It was found that the influence of the composition of the carrier gas upon the magnetic wind can be compensated within broad ranges by making changeable the heat loss conditions within the comparison chamber by means of an adjustable nonmagnetic body. In making the adjustment the chambers are fed with gases the content of which on paramagnetic gases is constant whilst the composition of the carrier gas is varied; the adjustable body then is shifted so that the influence of the carrier gas composition upon the indication disappears or reaches a minimum. This complete or at least far reaching independence of the carrier gas composition is valid indeed only for that point of the scale which has been used in making this adjustment. It was found, however, that also in the neighbourhood of this point the independence of the carrier gas composition is fulfilled to a high degree. The accuracy of measurement in many applications is thus considerably increased, for often an exact indication is required only in a certain range. At the zero point the independence of the gas composition does not exist, at least not so exactly as at the point at which the adjustment has been done. This however, does not cause severe troubles, since for adjusting the zero point usually a special test gas has to be used which easily can be obtained in constant composition. Instead of adjusting the zero point, the device advantageously may be adjusted at that point, where the independence of the carrier gas composition is valid. This preferably will be done if the zero point is suppressed and hence not on the scale. Therefore devices with suppressed zero point are preferable applications of the invention, for example devices for examining breath gas or determining the purity of O_2-gas. In devices for measuring breath gas the scale extends say from 16 to 21% O_2, in devices for determining the purity of O_2-gas from 90–100% O_2. The carrier gas consists in the first mentioned case of N_2 with a varying content of CO_2 and in the last mentioned case there may be present N_2 (sometimes other gases too) as well as some percent Ar.

The adjustment preferably is made at that point where the highest accuracy is desired. Then the independence of the carrier gas composition is best fulfilled at and near this point of the scale.

The accompanying figure shows as an example a magnetic gas-analyser provided with an adjustable nonmagnetic member by means of which the claimed method can be performed. The analyser is shown in section and the measuring circuit is indicated schematically. The metal housing **1** is divided into two chambers by a wall **14**. The lefthand chamber is the measuring chamber, the righthand chamber serves as comparison chamber. **15** is the inlet for the test gas, **16** the outlet. The chambers are closed by parts **17**, **18**, **19** and **6** and **5**. The number **20** designates a grid. Within the measuring chamber there is arranged a permanent magnet. Its north and south-pole are numbered **2** and **3** respectively. The comparison chamber contains a nonmagnetic body **4**, shaped like the north pole of the measuring chamber and a likewise nonmagnetic member **5** shiftable within part **6** in a direction shown by the double arrow. The gas is heated by the heating wires **7** and **8**, which are connected into a bridge circuit as shown in the drawing. The bridge is fed by a battery **9**; **10** and **11** are two resistances, **12** is the indicating instrument. The leads of the heating wires are insulated against parts **18** and **19** by insulating pieces **13**.

I claim:

1. A method for calibrating an analyser for paramagnetic gases which contains a pair of resistor heating elements one of which is situated between magnetic pole pieces and the other adjacent a dummy pole piece, said method comprising passing a gaseous mixture including a fixed proportion of paramagnetic gas and a substantially non-magnetic carrier gas past the elements at substantially the same rates; determining the difference in resistance of the elements; varying the composition of the carrier gas while keeping the proportion of paramagnetic gas within said mixture constant and disposing matter adjacent said other heater in a position where the said

difference is a minimum value during the varying of the composition of the carrier gas.

2. In the production of checking instruments for oxygen content of gases in which instruments there are a pair of gas chambers each containing a resistance heater element and a magnet for one of the elements, the steps for making the instruments serviceable comprising passing a mixture of oxygen and carrier gas through said instrument and indicating relative resistances of said heaters; varying the composition of the carrier gas while keeping the oxygen content of the mixture constant; altering the configuration of one of said chambers until the differences between the resistances reaches a minimum during the varying of the composition of the carrier gas, and fixing the configuration of said one of said chambers when said minimum is reached.

3. In the operation of a paramagnetic gas analyser having an adjustable comparison gas chamber wall, the process of calibrating the analyser, said process comprising passing a mixture of a paramagnetic gas and a carrier gas through the analyser; registering the response of the

analyser to the passage of said mixture; varying the composition of the carrier gas while keeping the paramagnetic gas content of the mixture constant; adjusting the position of said wall during the variation of the carrier gas composition; and fixing the position of the wall when the latter is in position for minimum change of response with respect to variations in the composition of the carrier gas.

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