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GAS CELL

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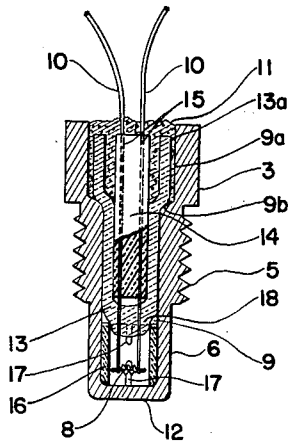


FIG. 2a.

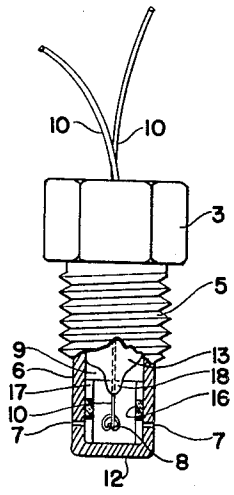


FIG. 2b.

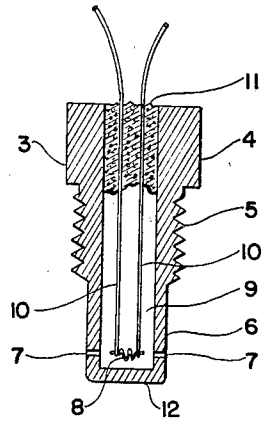


FIG. 1.

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GAS CELL

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3 Claims. (Cl. 73—51)

This invention relates to a novel gas cell for use in apparatus to analyze gases by the thermal conductivity method which, when manufactured in commercial quantities, will be of uniform constants of performance.

Previously, the general practice in designing gas cells for anlyzing gases by the thermal conductivity method has been to provide an elongated cell with a straight filament fixed therein held in position by tension means. In this type of cell the space which is filled with gas is relatively large, the filament is subject to distortion, the path of the gas through the cell is relatively long. Although this type of cell may be satisfactory for laboratory work, the above-mentioned features comprise serious disadvantages both in operation in a commercial analyzer such as that described in my Patent No. 2,080,660 and in uniform manufacture in commercial quantities. In my above-mentioned patent I have shown a gas cell which overcomes some of these disadvantages. Instead of using a long piece of straight wire, I have used a short, spiral filament which is held in the gas cell by lead-in wires thus reducing the length of the path of the gas through the cell. There remain, however, many difficulties in the manufacture of this type of cell. Prominent among these are the difficulties of properly positioning the filament with relation to the bottom of the cell, properly positioning the filament with respect to the side walls of the cell, keeping the lead-in wires from touching each other or the side walls of the cell, preventing the distortion of the lead-in wires during the baking of the cement used to seal them in the cell.

A further difficulty is encountered in manufacturing this type of cell. If only a small amount of cement is used, a large air space is left above the active filament, this must be filled with gas and then cleared out for each test. This considerably slows the speed of operation because of the time required to clear the gas out of the dead space above the filament. I have found that it is impractical to try to fill this dead space with cement, because in doing so the excess amount of cement used will run to the bottom of the cell or adhere to the filament sometimes completely covering the filament.

By my present invention I have overcome these disadvantages and provided a gas cell which is very compact, accurate and efficient and easy to manufacture uniformly in commercial quantities.

A better understanding of my invention may be had by reference to the accompanying drawing in which Fig. 1 is a cross-sectional view through the center of the kind of gas cell in former use and Figs. 2*a* and 2*b* are cross-sectional views on different axes through the center of my improved gas cell.

Referring to Fig. 1, the gas cell formerly used consists of a casing 3, the upper part of which is formed as a bolt-head 4, so that it may be readily seized in order to turn it into position in the cell block. Below this bolt-head the cell is, for a portion of its length, threaded as is shown at 5, so that it may be screwed into the cell block. The lower portion of the cell is of a reduced diameter as shown at 6. Near the bottom of the cell two or more holes, 7, 7, are bored to permit the gas to be analyzed or the standard gas, as the case may be, to enter the cell and surround the filament 8.

The filament 8 is located in a cylindrical opening 9, extending to the bottom wall 12 of the cell and is firmly attached to lead-in wires 10, 10. These lead-in wires enter through an opening at the top of the cell and after being properly positioned are, for a portion of their length, surrounded by cement 11 which then must be baked to hold the filament in the proper position.

It is obvious in the manufacture of such a cell that it is very difficult to hold the lead-in wires in proper position while inserting the cement 11 so that the filament 8 in every case will be the same distance from the bottom 12 of the cell. It is also difficult to hold these lead-in wires so that the axis of the filament 8 will remain parallel to the bottom 12 of the cell and to keep the lateral spacing of the filament 8 from the side walls 6 the same in every case. Variations in these distances will seriously affect the conductive characteristics of the cell and will thus prevent the use of two cells, one for the standard gas and one for the gas to be analyzed, in the same cell block unless careful choice from a number of cells is made to get two cells which perform as a pair, that is, which have spacings which do not vary.

A further difficulty arises when the cement 11 is dried out by a heat process. Gas or air bubbles formed during this baking cause distortion in the lead-in wires 10, 10 which will change the position of the filament 8. This distortion will affect the spacing of the filament relative to the cell walls with the detrimental results noted above. The distortion in the lead-in wires caused by this heating is in many cases sufficient to cause a short circuit either by adjacent turns in the spiral filament touching or by the lead-in wires

touching each other or touching the wall 6 of the cell. In such case the cell is inoperative and useless.

Having experienced the difficulties mentioned above in the manufacture of these cells in commercial quantities, I have discovered an arrangement in which the position of the filament may be easily made uniform in all cells. This consists in mounting the lead-in wires in a glass butt which has an enlarged portion resting against a shoulder in the gas cell and thus positioning the filament accurately.

Referring to Fig. 2*a*, the cylindrical opening 9 in the cell has at the top an enlarged portion 9*a*. The lead-in wires before being placed in the cell are sealed in a glass spacing member 13 having a butt portion 18. The lead-in wires are sealed in this glass butt. Since this process is visible, the distance of the filament from the end of the butt 18 can readily be determined so that the position of the filament 8 with relation to the butt 18 can be easily and accurately made alike in different cells. The spacing member 13 has an enlarged portion 13*a*. The diameter of this portion 13*a* is too great for it to go below the shoulder 9*b* terminating the enlarged portion 9*a* of the cell. Therefore, the position of the filament 8 with relation to the bottom 12 of the cell and also with relation to the side walls is accurately defined by first mounting it in the butt portion of this spacing member 13.

After the lead-in wires are firmly positioned in the butt 18, the spacing member 13 is placed in the cell so that the enlarged portion 13*a* thereof rests against the shoulder 9*b* in the gas cell, then cement 11 is placed in the cell to hold the spacing member 13 tightly in place. The diameter of the enlarged portion 13*a* of the spacing member is a little less than the diameter of the enlarged portion 9*a* of the casing and cement 11 fills this small annular space. If desired, the inside of the spacing member 13 may be completely filled with cement.

It is to be noted that the open space into which the gases flow can be made much smaller in this type of cell than in that described in Fig. 1. This increases the efficiency of the cell and the speed with which a gas sample may be cleared out for a subsequent reading on a different sample.

While I have mentioned above a glass spacing member 13, it is to be understood that this may be made of any material which can be readily shaped in the form shown, will withstand without deformation the heat required to bake the cement, and will be an electric insulator.

While it is not essential to my invention, I find it is of advantage to use an insulating sleeve 14 placed inside of the spacing member 13. This sleeve which may be of any ceramic insulating material has two longitudinal openings 15, 15 through which the lead-in wires 10, 10 pass. This prevents any possibility of the lead-in wires coming in contact with each other, and permits the use of a non-insulating cement.

I have also found it of advantage to use an insulating ceramic sleeve 16 surrounding the filament. This is loosely placed in the opening 9 before the spacing member 13 is fitted therein. The sleeve 16 has two slots or more or holes 17 and when placed in the cell the sleeve 16 is rotated so that the slots 17 register with the openings 7 so that the gas to be analyzed can surround the filament 8.

If desired, the thickness of the sleeve 16 may be made sufficiently great so that the top thereof will form a shoulder against which an enlarged portion of the spacing member 13 may rest and the spacing member may be positioned by this means instead of by resting against the shoulder 9*b* in the wall of the cell. However, in a small size cell it is undesirable to use the space required for making the sleeve 16 of sufficient thickness for this purpose and I prefer to position the spacing member 13 as shown in Fig. 2*a* except in larger sized cells.

While a preferred embodiment of the present invention has been hereinbefore described, it will be readily apparent that many and various changes and modifications in form, structure and arrangement of the parts may be made without departing from the spirit of the invention and it will be understood that all and any such changes and modifications are contemplated as a part of this invention as defined in the appended claims.

What I claim is:

1. A cell for analyzing gases by the heat conductivity method comprising a shell having an internal opening for substantially its entire length, said internal opening having an enlarged portion and a narrow portion forming a substantially square shoulder therebetween, an insulating spacing member disposed therein having an enlarged portion, a narrow portion and a butt portion, said enlarged portion being of too great diameter to fit within the narrow portion of the opening in the cell, a spiral filament connected to lead-in wires passing through said insulating spacing member and firmly attached to the butt portion thereof by reason of which the position of the filament relative to the walls of the cell is determined and said filament is held away from and below said butt portion and means for sealing said insulating spacing member and lead-in wires in said shell all forming a unitary sealed structure.

2. A cell for analyzing gases by the heat conductivity method comprising a shell, an insulating spacing member held in a fixed position therein by an internal abutment in said shell, a resistance filament firmly attached to but spaced away from said insulating spacing member by lead-in wires and an insulating sleeve surrounding said filament but spaced therefrom to prevent it touching the walls of said shell and a seal for holding said spacing member in position.

3. A cell for analyzing gases by the heat conductivity method comprising a shell, a hollow insulating spacing member held in a fixed position therein by an internal abutment in said shell, a resistance filament firmly attached to said insulating spacing member by lead-in wires, said lead-in wires passing through the end of said insulating spacing member, an insulating sleeve within said insulating spacing member having channels through which said lead-in wires pass and an insulating sleeve surrounding said filament to prevent it touching the walls of said shell and a seal for holding said spacing member in position.

WILLIAM GEORGE GOW.