Title

Constant-Pressure Leak-Rate Gage

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DISCLAIMER

CONSTANT-PRESSURE LEAK-RATE GAGE

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A method of metering the rate at which a gas is admitted into a vacuum system, which overcomes many of the difficulties encountered in the frequently used "Oil Manometer,"[1] has been developed. This method allows the metering of gases other than just air and at pressures other than atmospheric. Basically, the amount of gas admitted to the vacuum system is determined by the rate at which a mercury plug moves through a horizontally mounted glass tube of calibrated volume. For the model shown (Fig. 1) the metering tube is a length of glass capillary tubing of 3 mm inner diameter. Approximately 7 inches of tubing length were required for a volume of 1 cm^3, and the glass was scribed with 1/8-cm^3 divisions. The gage is installed between the gas cylinder and the needle valve feeding the vacuum system, and is constructed with standard O-ring seals so as to be vacuum-tight as well as to withstand an internal pressure of at least 30 psi.

All parts that contact mercury were made of stainless steel. Lucite was used as it is easily machined, and it allows visual inspection of the mercury position.

When it is desired to know the gas flow rate, the plunger is raised, placing a drop of mercury at the entrance to the metering tube and sealing it off. As the gas continues to flow to the vacuum system, the ball of mercury moves through the calibrated tube. The pressure drop across the mercury plug is only that required by frictional losses to the glass wall, a quantity that has been determined to be negligible. After passing through the metering tube, the mercury drops into a reservoir sufficiently large to store the mercury from a number of readings. By opening the valve and lowering the plunger, one can return the mercury by gravity to the input

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[1] Guthrie and Wakerling, Vacuum Equipment and Technique, page 95.

side of the gage. After the reservoir is emptied, the valve is closed to eliminate the possibility of a parallel gas path.

As the gage is completely encased, with no reference to nor access to air, it can be used for metering any gas desired; the inclusion of the pressure gage allows metering at pressures other than atmospheric.

The gage has proven extremely useful in determining ion-gage sensitivities and diffusion-pumping speeds for the various gases. The gage was specifically designed to determine the gas flow required by ion sources during actual operation.

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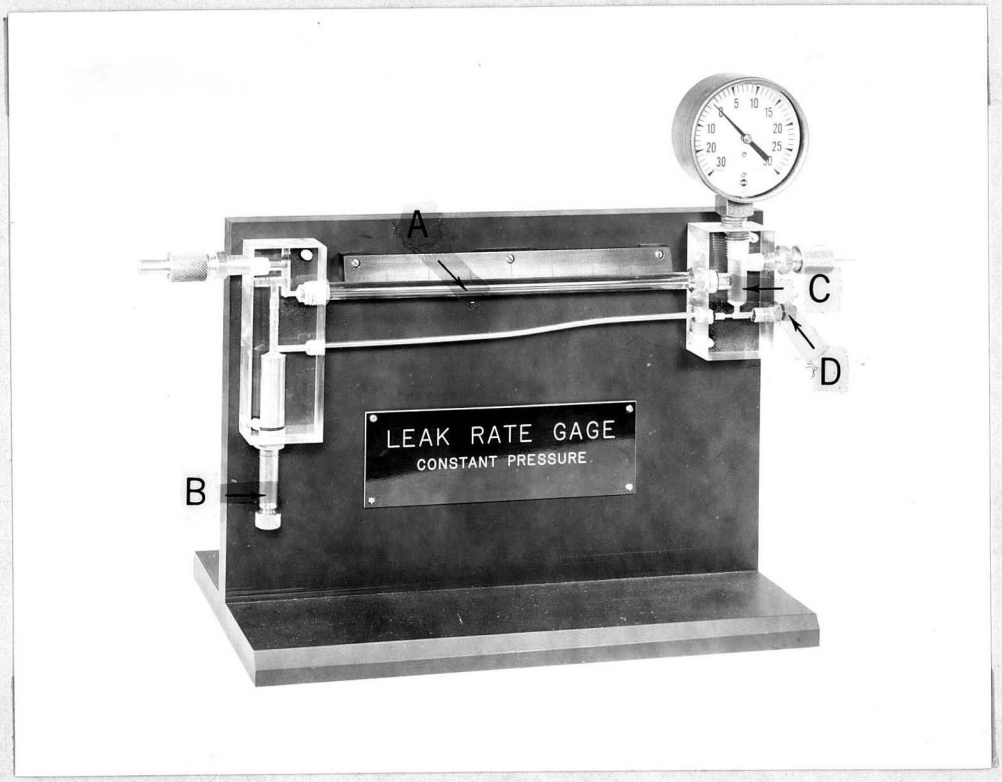

Fig. 1.

A = Metering tube

B = Plunger

C = Reservoir

D = Mercury return valve