The column delivers into a small siphon attached to one end of a balance beam, and a counterweight *C* on the other side of the beam is used for adjustment. A mercury switch clipped to the top centre of the beam makes contact when the weight of liquid in the siphon tilts the beam. At the moment contact is made, a relay *A* underneath a trolley of test tubes is operated, and a lagged relay *B*, taking small current, switches this off very quickly afterwards. The trolley is moved along one division in this time by a weight, *W*, and pulley system. The siphon empties shortly after this, thereby releasing relay *B*; but this simply switches off the current and there is no movement of the trolley. During this time, and while the siphon is refilling, any last drips from the siphon are collected in the same tube.

The trolley in use has only sixteen holes drilled for test tubes spaced $1\frac{1}{4}$ in. apart. The design of the trolley may easily be modified to take more tubes or even flasks if a larger volume is required. Beneath the holes a strip of $\frac{1}{8}$ -in. steel has been drilled and tapped for 16 6.B.A. 'cheesehead' bolts which connect with the catch of relay *A*.

The volume that the siphon delivers can be adjusted with glass beads, and the counterweight moved accordingly.

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¹ Randall and Martin, *Biochem. J.*, **44**, ii (1949).

² Phillips, *Nature*, **164**, 544 (1949).

Measurement of Small Differential Pressures at Low Absolute Pressures

IN the course of a study of the flow of gases through powders at reduced pressures, it was necessary to be able to measure pressure differences of the order of 1–60 microns mercury in the absolute pressure range 1–100 microns mercury. Such small pressure differences have been measured by using two McLeod gauges, and the method has been reported elsewhere¹. It was found that pressure differences of a small order could not be accurately measured using two separate McLeod gauges, even when a cathetometer was used for reading the mercury levels. Consequently, an alternative method and apparatus were developed and their principles are described here.

The apparatus (Fig. 1) consists basically of two McLeod bulbs connected on each end of a capillary oil manometer. The pressure difference applied between *A* and *B* is initially shown as a minute difference in the levels of the manometer filled with high-vacuum oil. Mercury contained in the reservoirs driven by the atmospheric pressure fills the bulbs and encloses the volumes of gas above the level *YY*. The final mercury level is reached at *XX* (approximate height of mercury 76 cm.). Thus the gas which originally occupied the bulbs and capillary tubes up to the level *XX* is compressed into the capillary manometer tubes above the oil. In the apparatus built in our experiments the compression ratio was about 20 : 1, thus increasing the observed differential pressure about twenty times, which was easily read with the cathetometer.

A simple theory of this apparatus is as follows. Let the actual pressure drop be $\Delta p = P_A - P_B$.

Fig. 1

Left-hand side: V_1 = volume of bulb + capillary between the levels *XX* and *YY*.

V_2 = volume of capillary between *XX* and oil level.

Right-hand side: V_3 = volume of bulb + capillary between the levels *XX* and *YY*.

V_4 = the volume of capillary between *XX* and oil level.

When the gas is compressed by raising mercury into the bulbs and up to the level *XX*, the following relation applies:

$$P_A (V_1 + V_2) = P_A' V_2; \text{ that is, } P_A' = \frac{V_1 + V_2}{V_2} P_A$$

$$P_B (V_3 + V_4) = P_B' V_4; \text{ that is, } P_B' = \frac{V_3 + V_4}{V_4} P_B$$

If $V_3 \approx V_2$ and $V_4 \approx V_1$ and $V_2 \ll V_1$;

$$\Delta p' \approx \frac{V_1}{V_2} \Delta p.$$

Hence the actual pressure drop Δp can be magnified by the ratio of the volumes of the bulb to that of the capillary manometer.

When $(V_3 - V_2)$ and $(V_4 - V_1)$ are not zero, then a plot of $\Delta p'$ versus Δp at different values of P_B will give the value of the expression:

$$\frac{(V_3 - V_2) + (V_4 - V_1)}{V_2}.$$

The differential pressures at low pressure may thus be obtained either from the final equation or from a graph and converted into the mercury readings applying the known density ratio of mercury to the oil.

In order to ensure complete pressure equilibrium, a period of $\frac{1}{2}$ –1 hr. was allowed to lapse between the compression of the gas and the final measurement of the oil levels. The method itself gives very reproducible results and is simple in operation.

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¹ Knudsen, *Ann. Phys.*, **28**, 999 (1909).