Table 1. Neutron albedo from the top 1 cm^3 of the moon's surface if the composition is assumed to be basaltic rock.

Element	No. of stars	No. of neutrons/star in the backward hemisphere*	Albedo neutrons/sec
O	0.0185	0.25	0.0046
Mg	.0012	1.0	.0012
Al	.0024	1.0	.0024
Si	.0080	1.0	.0080
Ca	.0019	1.2	.0023
Fe	.0018	1.5	.0027

* Energy between 0.5 and 12 mev.

energies lower than 600 mev have not been taken into account. Recent experiments show the existence of large numbers of particles of lower energy, but considerable uncertainty exists (*4*).

It may be said that, during solar flares, the intensity of particle radiation increases by several orders of magnitude and should yield a high neutron albedo on the surface of the moon (*5*).

M. V. K. APPA RAO*
Department of Physics and Astronomy, University of Rochester, Rochester 20, New York

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Differential Respirometer of Simplified and Improved Design

Abstract. *A differential respirometer, with a single reference flask for multiple active flasks, and with improved digital readout (in microliters, 0 to 500) volumometers, and which eliminates the need for glassware calibration, is described.*

A recent analysis of the construction and operation of respirometers suggested that a number of improvements might be possible and desirable.

First, the three-way-tail stopcock, as used in the conventional Warburg apparatus, appeared to be a needless and probably vestigial complexity. It permits the connection of the flask side of the manometer to the atmosphere or a source of gas, but a considerable extra amount of plumbing is required for gassing by evacuation, and a large amount of manipulation is needed for gassing by flow. A comprehensive discussion on altering gas atmospheres is given by Burris (*1*). The use of h-shaped tubes connected to the manometer serves to equalize the pressure applied to the two sides of the manometer, preventing displacement of the fluid during gas flow.

In the manometer design described here, a simple straight-through valve (Fig. 1) is placed between the two arms of the manometer at the level of the horizontal tube which goes to the flask. This valve may be open or closed, and performs the two functions necessary for an experiment which requires gassing: (i) to provide a connection to, and a free path between, the two arms of the manometer to equalize the pressures on the two columns of manometer fluid; and (ii) to connect the flask side of the manometer momentarily to the atmosphere for pressure equilibration.

The straight-through valve may be used either with a manometer with calibrated arms, or with a micrometric manometer in which a calibrated micrometer returns the manometer fluid to its balanced position by movement of a piston in the enclosed volume. This latter method gives a reading directly in microliters, which eliminates the need for calibration of glassware, and simplifies calculations. With the straight-through valve, parts can readily be placed so that, with the flow method of gassing, dead spots are minimized.

A constant pressure system has been used in respirometry for many years. It was facilitated when a mass-produced, plastic micrometer for gas displacement was produced by Roger Gilmont Industries. This represented an advance, but had the disadvantage that it did not have a digital readout. It had to be read like a machinist's micrometer. To overcome this, I designed a simple digital device in which the threaded portion of the micrometer passes through the three counter wheels, being slotted and keyed to the lowermost (Fig. 2). This was an original idea, but not new. An examination brought to my desk patents on similar devices, making a pile about 2.5 cm thick. The oldest was dated 1899. A minor improvement was gained by increasing the total displacement from 200 μl in the Gilmont to 500 μl in the model described.

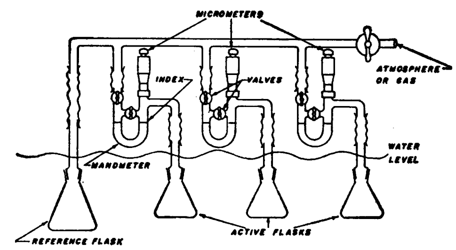

Fig. 1. Differential respirometer system with single reference flask.

The use of differential manometers for respiratory studies has been advantageous, as the influence of varying barometric pressure may thereby be eliminated. Differential manometers, however, have been little employed because of their complexity, fragility, and cumbersome size. It has been necessary to balance each flask containing a respiring material with a reference flask, cutting in half the number of measurements that can be made.

In a constant pressure system, as mentioned above, the change in volume is compensated by the measured movement of a plunger in the enclosed space. Thus there is no change in the level of the manometric fluid. Upon analysis, it became apparent that this permits the connection of a large number of manometer flask combinations to a single reference flask. This is illustrated schematically in Fig. 1. The effects of varying barometric pressure and moderate variations in temperature are elimi-

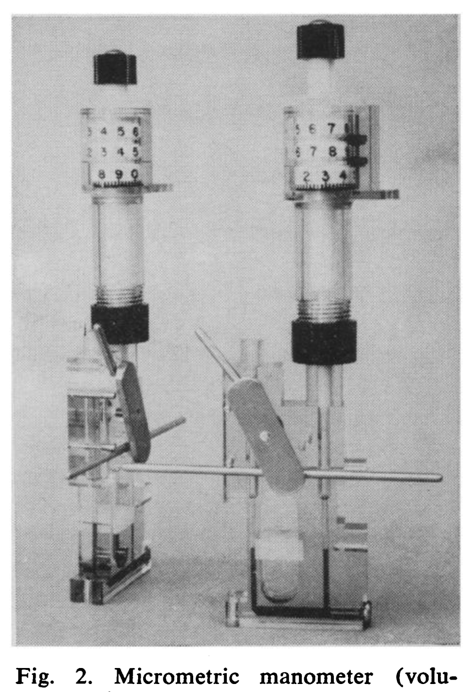

Fig. 2. Micrometric manometer (volumometer).

nated. In addition, with an attached barometer and a system for evacuation and supplying gas, an experiment can be conducted at either a standard pressure or at a pressure which may be chosen in order to simplify calculations.

Manometers constructed of glass are necessarily fragile, and are likely to be somewhat variable. More important, it is not convenient to provide definite stops for the valves at the off and on positions, nor is it convenient to provide strong spring-loading of the valves to prevent leakage. It appeared that Lexan, a clear and extremely tough plastic, would be a good choice for the body of a manometer, and that Delrin would be a good material for the stopcock inserts. The manometer shown was machined from block Lexan, but will be injection-molded in the future. The valves are spring-loaded, and have definite stops. An additional valve is provided to disconnect individual manometers from the manifold (Fig. 2).

In the operation of a respirometer, simultaneous opening and closing of the operating valves offers a great convenience. The construction mentioned above makes it possible to perform this function simply. Pressure on one lever will close all of these valves, and pressure on another will open all of them. The valves may also be operated individually.

In order to utilize more fully the possibilities inherent in a constant pressure system, a respirometer was constructed with stationary micrometric manometers (volumometers) (Fig. 3). These volumometers are each connected by means of a flexible plastic tube to a Warburg-type flask of whatever variety is needed for the experiment in progress. Shaking of the flasks is continuously variable in rate from 75 to 150 per minute, and in extent from 0 to 5 cm.

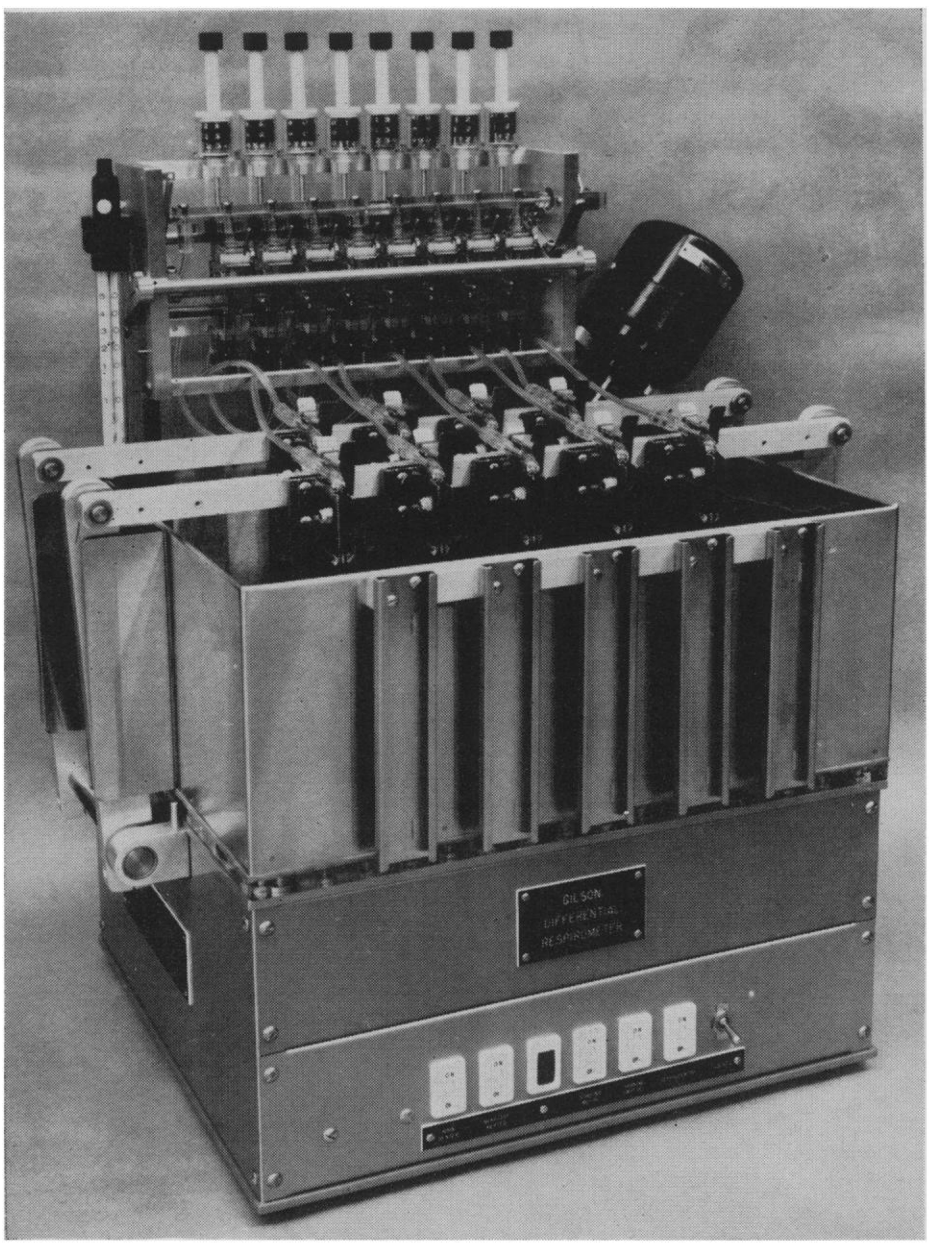

Fig. 3. Differential respirometer.

The respirometer constructed has a number of advantages for nondifferential as well as for differential respirometry: (i) a digital reading is obtained directly in microliters; (ii) calibration of the glassware is not necessary; (iii) the manometers are stationary, and easily read; (iv) all manometers are simultaneously visible; (v) spring-loaded valves have definite stops for off and on positions; (vi) valves may be simultaneously operated by levers for opening and closing; and (vii) a very solid construction can readily be employed.

The most significant improvement in technology in this apparatus is provided by a combination of the above-named advantages, with the immunity to changes in temperature and barometric pressure inherent in the differential connection. In comparison with the conventional nondifferential Warburg apparatus, the several-fold increase in accuracy and reproducibility of results of a differential system is achieved without the added bulk or complexity of multiple reference flasks.

W. E. GILSON
Gilson Medical Electronics, Middleton, Wisconsin, and
Department of Neurology, University of Wisconsin Medical School, Madison

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Geometry of the Perxenate Ion

Abstract. *A three-dimensional x-ray analysis of a crystalline solid of* Xe^{+8} *formed by the reaction of* XeF_6 *with sodium hydroxide solution indicates that it is sodium perxenate octahydrate,* $Na_4XeO_6 \cdot 8H_2O$. *The perxenate ion,* XeO_6^{-4}, *has approximately a regular octahedral configuration with a mean xenon-oxygen bond length of 1.875 Å.*

The reaction of XeF_6 with sodium hydroxide has been shown by Malm *et al.* (*1*) to produce compounds which contain octavalent xenon and which, on the basis of chemical analyses, prob-