problems connected with the chemistry of respiration and the mechanism of enzyme action can best be solved by a study of oxidative gaseous exchange of plant material under various gaseous mixtures. A precision apparatus for mixing gases in various proportions is therefore needed in all physiological and biochemical laboratories.

The two gases are stored in two gas holders, preferably of the same dimensions, inside which they are maintained throughout at the atmospheric pressure.[7] With the aid of suction applied by means of a single mercury leveling bulb the gases are drawn into two 50 cc pipettes. The same leveling bulb is employed for forcing simultaneously both the gases through a common exit, which results in the formation of a highly satisfactory gas mixture. In the construction of the apparatus, two broken 50 cc automatic pipettes A and B are joined together with two Y-tubes G and H (Fig. 1). The free end of the lower Y-tube is connected

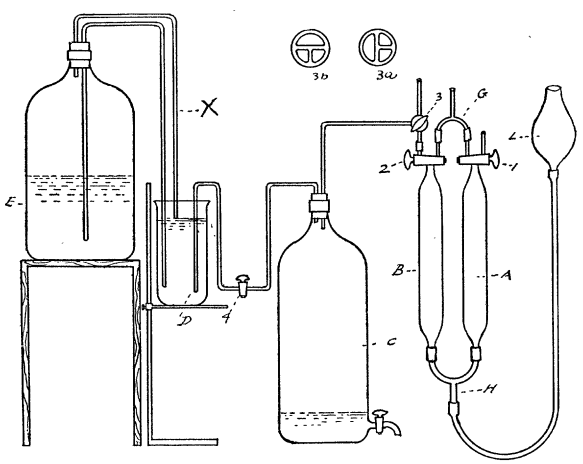

FIG. 1. Apparatus for mixing gases in various proportions.

with a mercury leveling bulb (capacity about 130 cc) through a piece of half-pressure rubber tubing, and that of the upper Y-tube serves as an exit for the gas mixture. The water reservoir E is connected by a siphon to a beaker D, in which the water is maintained at a constant level by means of another twice-bent tube X, which is so placed that the water reservoir E ceases to communicate with the external air the moment the water in the beaker attains a certain level and closes the orifice of the tube X. As a result of this the further draining of water into the beaker is stopped. The beaker D communicates through a glass tubing, which carries a tap as well, with the gas holder C. A three-way stopcock connects the gas holder with the pipette B (Fig. 1). The pipette A is connected to a similar equipment (not shown in the figure) for holding the gas at the atmospheric pressure throughout the experimental period.

[7] Magness and Diehl, *Jour. Agr. Res.*, 27: 1, 1924.

The manipulation is easy. The taps 1 and 2 are turned so that the pipettes communicate with the gas holders. The three-way stopcock 3 is turned in the position 3a and the other stopcock connected with the pipette A (not shown in the figure) is also turned in a similar position. Now the mercury leveling bulb L is raised until the mercury stands just above the stopcock 3, when it should also stand at a similar position in the stopcock connected with the pipette A. Subsequent to this tap 4 is opened and the stopcock 3 is turned in the position 3b and the gases from the two gas holders (one not shown in the figure) are drawn into the pipettes and immediately expelled out of them through the free end of the Y-tube G. This serves to wash the connecting tubes between the gas holders and the pipettes with pure gases. Again the taps 1 and 2 are turned and the gases drawn into the pipettes. The pipettes are once more put in communication with the Y-tube G and as the leveling bulb L is raised a gas mixture issues through the exit which may be directly introduced into the respiration apparatus or stored in a gas holder.

Due to the fact that a double pressure control is exercised—the gases inside the gas holders are maintained at the same pressure and withdrawn therefrom with suction of same magnitude—the results, as tested by means of Haldane's gas-analysis apparatus, are invariably found to be satisfactory. One of the main advantages of this device is that the gas mixtures so prepared need not be analyzed afterwards and may be directly used for experimentation. But it is advisable in all cases to allow the gas mixture directly into the respiration apparatus as the storage of gas mixtures may cause errors due to the different solubilities of the two gases. If two pure gases are used a mixture containing 50 per cent. of each is obtained. This mixture may be stored in one gas holder, while the other may be filled with the pure gas. The mixture obtained under such conditions will be 75 per cent. of one gas and 25 per cent. of the other. By repeating the process a great variety of gas mixtures of varying proportions is easily obtainable.

B. N. SINGH
P. B. MATHUR

BENARES HINDU UNIVERSITY
INDIA

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