A Mixed Expired Gas Sampler

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Rapid-response analyzers for measuring individual gas concentrations in gas mixtures are now available for CO₂, O₂, N₂, and CO. An important component which has been missing, however, is a rapid mixing and sampling chamber for expired gases. Krogh and Linhardt¹ and Conroe et al.² collected expired gas in giant spirometers; others have collected it in meteorological balloons and analyzed for individual gas concentrations at the end of the experiment. Until now, there has been no apparatus which could rapidly mix and sample expired gases continuously, especially during exercise studies, for matching up with the arterial blood gases and ventilatory volume at any specified time. Briscoe and Courmand³ approached the problem by using a system of two balloons which collected the expired gas alternately for 30-second periods. When one was being filled the other one was emptied into a Tissot Spirometer by pressing the balloon manually between two wooden boards suspended on either side of it.

The mixing chamber used by Bates, Boucot and Dormer⁴ had the fan motor built inside, which introduced other variables, especially temperature variables due to the heat generated. Attempts have been made⁵ to sample mixed expired gases by passing them through boxes filled with metal-scrapings to ensure proper mixing; this has its own disadvantages, such as resistance, condensation of water vapor in the system, and delay in the downward

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**Fig. 1. Mixed expired gas sampler.**
slope of the record of the gas concentration. The present apparatus was designed to ensure rapid mixing and continuous sampling for individual gas concentrations without losing any volume, as the gas going to the analyzer is fed back to the system so that total expired volume remains unaltered.

The apparatus (fig. 1) consists of a 12-inch diameter plexiglass cylinder with an inner partition. The proximal chamber, towards the left side of the figure, is approximately 3 liters in volume. The fan at the bottom of the chamber is driven electromagnetically and the motor is located outside the chamber, thus preventing any alteration in temperature of the mixing and sampling chambers. Outgoing gas passes through four circular holes (thick arrows), each with half the diameter of the intake-tube, so that total incoming and outgoing circulations are the same. Mixed gas is sampled by a glass tube through a hole at the center of the partition. The distal part of the apparatus acts as a buffering chamber and the returning gas from the analyzer is fed back into this chamber at the center of the outlet. This helps in rapid evacuation of this chamber by setting up a venturi effect.

This apparatus is airtight and has negligible resistance. Variation in temperature is so minimal that temperature correction is not necessary. The initial response time for adults is 18-20 seconds, since only three breaths provide adequate air to fill the bottom half of the mixing chamber.

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A Simple Device for Continuous Measurement of Inspired Oxygen Concentration

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There is increasing recognition of the need for continuous monitoring of inspired oxygen concentrations delivered by ventilators to critically-ill patients. Despite advances in the development of calibrated air-oxygen mixing devices, it is nonetheless still important to have the capability for continuous recording of moment-to-moment changes in the delivered concentration of oxygen.

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At Wilford Hall USAF Medical Center the device described here (fig. 1) enables the physician and nurse to be continuously cognizant of changes in the inspired oxygen concentration. The figure shows a standard plastic three-way stopcock, attached to B, the input line of a Beckman oxygen analyzer. The male arm of the plastic stopcock is inserted into the superior opening of a standard Bird Y piece connector, C, which is in turn attached to the patient (D). The entire assembly is then connected to the ventilator. When the control lever of the stopcock is

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