Several studies have shown that alveolar ventilation could be maintained with tidal volume less than anatomical dead space if the respiratory frequency was high enough (2, 5, 8, 9, 10, 11). However mechanisms by which effective gas exchange occurs are not well understood.

Methodological problems encountered in the measurement of tidal volume and CO$_2$ clearance can explain this lack of understanding. It is the reason why we studied at first CO$_2$ elimination on high frequency ventilation on a model lung. We took a particular care in the determination of the linearity and the frequency response of different systems of measurements. This study was carried out to determine the relationship between tidal volume, respiratory frequency and CO$_2$ elimination.

**METHODS**

An artificial lung (MANLEY, Resistance = 5 cm H$_2$O/l/sec, compliance 20 or 50 ml/cm H$_2$O) was connected to a high frequency jet ventilator (3) built in the department. Frequency and I/E Ratio could be varied independently. 4 solenoId valves were arranged in parallel so that tidal volume ($V_t$) could be changed without modification of the driving pressure (3 Atm). Pulsed gas was delivered through an uncompliant tube (I.D. 4 mm) to an injector (1.8 mm I.D., 2 cm in length). This injector was situated at the middle of a T piece directly connected to the Tracheal tube (9 mm I.D.). The volume between the top of the endotracheal tube and the lung was 35 mls.
Accurate measurement of $V_T$ during HFJV is difficult. We were unable to estimate $V_T$ from the flow because of the lack of linearity of screen pneumotachograph or vortex flowmeter. $V_T$ was measured as the pressure swings of 125 l closed plethysmograph by an high frequency, low pressure transducer (EMT 33) and recorded on an ink jet recorder. The flat response of the system was above 15 Hz. Plethysmograph was calibrated by injecting air into the box 100 mls steps, the lung being inside the box. As the time constant of the box was long (50 sec), the compression in the box was considered as adiabatic (1).

Continuous flow of CO$_2$ was added into the lung. The amount of CO$_2$ added was adjusted in order to obtain a stable mean fraction of CO$_2$ in the lung (6 %). This FCO$_2$ was continuously recorded (capnograph Gould MARK III) and the CO$_2$ flow was read on a calibrated rotameter. Before this study, we found...