Patient Regulation of Mechanical Ventilation. HARRY J. LOWE, M.D., JAMES O. ELAM, M.D., JOHN L. EVERS, PH.D., AND CLINTON D. JANNEY, PH.D. *Department of Anesthesiology, Roswell Park Memorial Institute, Buffalo 3, New York.* This study establishes the feasibility of management of mechanical ventilation according to the patient's regulatory mechanisms. The ventilator is adjusted to produce self-limiting periods of assist and control operation which produce fluctuations in alveolar ventilation above and below that required to produce carbon dioxide homeostasis. The scheme of such management is designated as "servo-cycling" because the interplay between the patient's requirements and the automatic operation of the ventilator resembles a servo system. The variations observed in arterial *p*H and P_{CO_2} during this interplay are referred to as the range of the "apneic threshold." *Methods:* 45 surgical patients, ages 17–81, were studied. Preferably, induction was carried out using the ventilator as an assistor. The controller rate was set to approximately 80 per cent of the observed assisted (patient's spontaneous) rate and the tidal volume increased every six to twelve breaths by 50 to 100 cc. until apnea supervened and controller operation (hypoventilation) began. The control phase of ventilation (decreased alveolar ventilation per minute) gradually increased retention of blood carbon dioxide and spontaneous inspirations (assistor operations) were again initiated. Since the patient's assisted spontaneous rate was greater than the control rate of the ventilator (stroke volume constant), alveolar ventilation was increased above that required for carbon dioxide homeostasis and apnea reinstituted. Arterial blood *p*H and P_{CO_2} were obtained prior to premedication, at frequent intervals during anesthesia when the ventilator was assisting or controlling, and during recovery with spontaneous breathing. Servo-cycling, once established, usually continued without further readjustment irrespective of surgical stimulation or muscle relaxant. *Results:* Nine patients undergoing major surgery lasting two to eight hours were anesthetized with cyclopropane and succinylcholine or thiopental-nitrous oxide and succinylcholine and servo-cycled at the desired plane of anesthesia. When persistant controller or assistor operation was observed, the anesthesia was lightened or deepened respectively to reinstitute servo-cycling. Servo-cycling thus served as an indicator for changing depths of anesthesia. Normal blood *p*H and P_{CO_2} values were maintained throughout. For a given patient, the variation during servo-cycling was $\pm$ 0.015 *p*H unit and $\pm$ 6 mm. Hg P_{CO_2}. The effect of deeper anesthetic planes was to lower the blood *p*H (or increase the blood P_{CO_2}) at which servo-cycling occurred. During stable anesthesia and controller operation of the ventilator, the patient's spontaneous respiratory effort was precipitated by rebreathing carbon dioxide. The blood *p*H and P_{CO_2} were determined by sampling after the first assisted ventilation and rebreathing was discontinued. The blood *p*H and P_{CO_2} were again determined when the ventilator returned to control operation. The values obtained showed a remarkably constant and reproducible blood *p*H and P_{CO_2} at the point of first assist and first control operation and characterizes the range of the "apneic threshold" at a given depth of anesthesia. Since the same "apneic threshold" was observed with several combinations of tidal volume and rate producing the same alveolar ventilation, several other procedures for initiating servo-cycling are possible once the desired depth of anesthesia is established. [*This study was supported in part by Contract DA-49-007-MD-507 with the Research and Development Command, Office of the Surgeon General, Department of the Army.*]