may be placed in front of the epiglottis and raised sufficiently to visualize the cords after the method of Macintosh. A small

FIGURE 1

catheter size 12 French, 12 cm. in length with a wire stilet inserted, has been found to be most adaptable. After the tube is in place, a glass trap is attached to facilitate suction and administer oxygen. The scope is used for *visualizing* the *cords only*. One should *work outside* the blade to insert the tube. The only criticism of the instrument has been that it is too small through which to work. It was not designed to be used as a guide for the catheter. If this point is

FIGURE 2

kept in mind, the anesthetist, with diligent practice, can become expert in infant intubation.

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A METHOD OF ADMINISTERING ETHER-AIR BY CONTINUOUS INSUFFLATION

Surgical procedures about the head in children are fraught with many anesthetic problems. A clear airway may be hard to maintain. Many anesthetists fear intubation because of possible glottic edema during a long operation. The nature of the surgical procedure itself has inconvenienced the anesthetist in establishing and maintaining a free airway since it is important that the surgeon have complete freedom without being hampered by the too close presence of the anesthetist or anesthetic equipment.

If the child is intubated, care must be taken to use a fairly small tube, and to allow no storage of carbon dioxide. Anesthesia apparatus is constructed mainly for adult use and it is difficult to alter it for efficient use in children.

The following apparatus was designed to meet the demands for better anesthesia in children for operations about the head. As

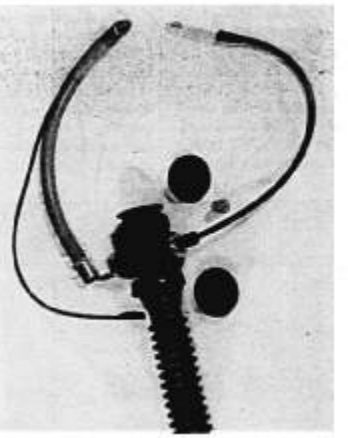

FIG. 1. Detailed closeup of apparatus showing inlet and outlet valves, endotracheal tube attachment, and adapter for suctioning, with suction catheter in place through opening and into endotracheal tube.

the details of its construction evolved, it was found to have a significant field of usefulness in all patients to whom ether-air or ether-air-oxygen by open insufflation was considered the method of choice. It has, therefore, been used for brain surgery in adults, with gratifying results.

The rubber midsection was cut away from an oronasal B.L.B. mask and used as the foundation for the equipment, leaving four openings; two which permitted exhalation, one to which the oronasal mask was attached and a fourth to which the bag was inserted. Two one-way valves were inserted into the openings which had been used for exhalation, as demonstrated in the accompanying photograph (fig. 1). The valves were placed so that the direction of the flow of the gases was through the inlet valve, into the endotracheal tube and out again through the outlet valve. A metal adapter was inserted into a third outlet of the midsection, onto which the endotracheal tube was attached. The fourth outlet was plugged by a metal adapter which had an opening large enough to admit a number 18 French catheter. This opening was closed by a cork. When suction of the tracheobronchial tree was

FIG. 2. Completed apparatus showing corrugated tubing and reservoir bag.

needed, the cork could be removed and the suction catheter inserted through the opening and into the endotracheal tube (fig. 1). A length of corrugated rubber tubing was then attached to the inlet valve side of the midsection. The length of this tube could be adjusted for the needs of the anesthetist. At the distal end of the corrugated tubing a reservoir bag was attached and an inlet adapter inserted to admit the continuous air-ether mixture (fig. 2).

After anesthesia is initiated and the endotracheal tube, with or without an endotracheal cuff, is inserted (an inflatable cuff is very seldom used in a young individual but almost routinely in the older child or the adult), the compressed air valve from wall or tank is opened and a flow is adjusted which will keep the reservoir bag inflated without tension. An air flow of 4 to 8 liters per minute is usually sufficient. A tubing is connected from the compressed air outlet to a Richardson ether bottle, and from the ether bottle to the inlet of the apparatus (fig. 3). The tubing between the Richardson bottle and the endotracheal apparatus may have a Y glass adapter, one end being attached to the oxygen tank for additions of oxygen. On inspiration, the patient breathes the ether-air from the inlet tube and reservoir bag, causing the reservoir bag to deflate. The expired mixture is shunted off through the exhalation valve and the mild back pressure inflates the reservoir bag. In this manner, the bag becomes a recording of the respiratory activity of the patient. When patients are placed in the prone position, this bag activity makes an easy method of observing the patient's respiration. Rhythmic pressure on the bag also permits artificial respiration, should respiratory

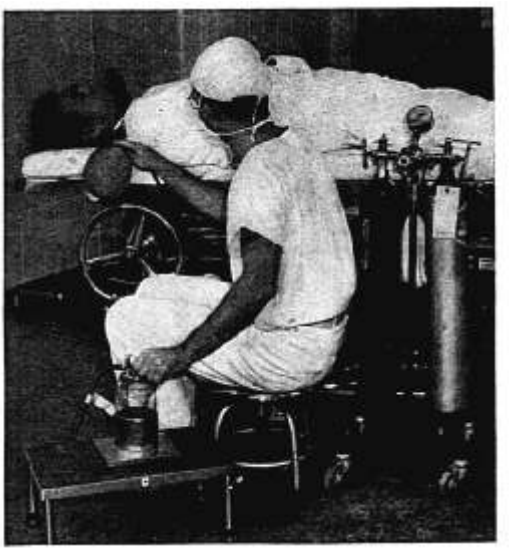

FIG. 3. Apparatus in place, with attachment to Richardson Ether Bottle and oxygen by means of a Y tube.

amplification be necessary or apnea ensue. The apparatus is light in weight and can readily be attached by adhesive strips to the sheet or pillow.

We have used this method for all operations on the eye requiring general anesthesia during the past year. It meets the needs for quiet anesthesia and minute to minute control. It is a true continuous flow method which permits no carbon dioxide storage as its dead space is negligible.

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For the information of anesthesiologists who are contemplating application for certification by the American Board of Anesthesiology, Inc., or who are training physicians for the specialty, the following questions have been employed for Part I (written) examination in the past in *Physics and Chemistry:*

1. What is the chemical composition of "soda lime"? What chemical reactions take place when it comes in contact with exhaled air? What is the source of water formed in the breathing bag when the "to and fro" absorption method is being used?
2. What is the approximate boiling point of ethyl ether? Discuss the significance of this knowledge in devising means for the administration of the agent.
3. What is the chemical formula of tribromethanol? What is the maximum solubility of tribromethanol in water? In amylene hydrate? What is "Avertin"?
4. For what purpose is a helium-oxygen atmosphere administered under a slight positive pressure? In what condition might one expect benefit from such a therapeutic procedure and why?
5. Define: Volume per cent, vapor pressure, absolute humidity, heat of vaporization, partial pressure of a gas.
6. Briefly outline a method for the quantitative determination of each gas in an anesthetic atmosphere containing nitrogen, oxygen, carbon dioxide and cyclopropane.