A NEW VALVE FOR CONTROLLED RESPIRATION ANAESTHESIA

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The soda lime absorption technique was introduced into clinical anaesthesia to remove the patient's carbon dioxide during spontaneous respiration anaesthesia (Waters, 1924). When controlled respiration anaesthesia was described under the name "ether apnoea" ten years later by Guedel and Treweek (1934), soda lime was again used to absorb the patient's carbon dioxide. The introduction of the costly gas cyclopropane at the same time (Waters and Schmidt, 1934) made the soda lime absorption technique essential. Because of its powerful central respiratory depressant effect, it was soon appreciated that cyclopropane was an aid to controlled respiration and was safer when employed in this manner (Guedel, 1940).

More recently the use of curare with cyclopropane or other anaesthetic agents has made the technique of controlled respiration anaesthesia relatively easy and widely used. Soda lime absorption of carbon dioxide continues, however, to be the only method employed in manual controlled respiration anaesthesia, even when cyclopropane is not used, as in the technique of curare, thiopentone, nitrous oxide-oxygen supplemented by pethidine or ether if necessary (Gray and Rees, 1952).

THE NON-RETURN EXPIRATORY VALVE

Against this background of the soda lime absorption of carbon dioxide, this paper will describe a simpler means of removing carbon dioxide together with the other expired gases by the use of a non-return expiratory valve (fig. 1). The use of a unit containing an expiratory valve and an inspiratory valve (non-return) is as old as anaesthesia itself; Morton's original draw-over inhaler contained these valves, as did Snow's facepiece. The idea is basic and at the present time similar valves are to be found in the "Oxford Vaporizer No. 1" (Macintosh and Mendelssohn, 1941). In America the Stephen-Slater (1948) non-rebreathing valve is widely used. They all, however, were designed primarily for use during spontaneous respiration anaesthesia.

The valve illustrated is designed for use during controlled respiration anaesthesia. It is a modification of the non-return expiratory valve on the "Oxford Vaporizer No. 1" and it can be seen that the new design simply provides a means of closing the expiratory valve quickly and effectively by a press-button. It is used with any continuous-flow machine with a reservoir bag. The addition of a press-button to expiratory valves is due to the
work of Salt (1947), and this convenience has been increasingly added to anaesthetic equipment.

Mushin and Mapleson (1954) clearly pointed out the essentials of an ideal valve and the one under discussion compares favourably with their criteria. The expiratory valve is of the disc-and-pin type, with a light conical spring and exceptionally large expiratory ports to minimize resistance. The press-button, which contains a separate spring, pushes the disc on to its seating. The non-return valve is of thin rubber and is mounted so as to be easily removed if the unit is to be used as an ordinary expiratory valve.

USE OF THE VALVE

In order to use this new valve for controlled respiration, on a patient anaesthetized, curarized, and intubated, the valve is simply connected to the distal end of the concertina tubing of any Boyle's or continuous-flow machine, the new valve replacing the ordinary valve. The patient is inflated by closing the expiratory valve with the press-button and by squeezing the reservoir bag at the same time; the non-return valve during this period is open. Release of both the press-button and the reservoir bag allows expiration to occur; during this period the non-return valve is closed and all expired gases leave
the circuit through the expiratory valve. The total flow of nitrous oxide-oxygen is 6 to 8 litres per minute.

The valve has been used to provide controlled respiration anaesthesia for the past four years in a wide variety of operations including abdominal, thoracic, and neuro-surgery. In the latter case and in other head operations where the anaesthetic machine and anaesthetist are at the foot of the table, the press-button may be operated by a remote control attachment which screws on to the upper threads just below the press-button. The remote control is based on the work of Mushin and Ezard (1950).

The main advantage of the valve is its simplicity in providing an effective means of removing carbon dioxide during controlled respiration anaesthesia. In a recent critical review of the carbon dioxide absorption technique, Baumgarten and Betcher (1954) point out the hazards existing in all types of soda lime circuits: increased resistance, increased temperature of gases, exhausted soda lime, the accumulation of water vapour, and the dilution of gases. All of these are avoided by the non-return expiratory valve.

This non-return expiratory valve may also be used as a non-rebreathing valve during spontaneous respiration anaesthesia (Stephen and Slater, 1948). And by removing the non-return valve, which easily slides out, the unit may be used as an ordinary expiratory valve.

SUMMARY

The development of soda lime absorption of carbon dioxide in relation to controlled respiration anaesthesia has been outlined. A simple valve which removes carbon dioxide together with the other expired gases, and may be used on any anaesthetic machine, has been introduced. The use of this valve during controlled respiration anaesthesia has been described. Its advantages over the soda lime absorption technique have been stated.

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This valve may be obtained from A. Charles King Limited.

REFERENCES