MODIFICATION OF THE BIRD VENTILATOR FOR USE DURING SPONTANEOUS RESPIRATION

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SUMMARY

By incorporating an Ayre T-piece system into the circuit for the Bird ventilator, efficient humidification and nebulization of drugs can be provided for patients breathing spontaneously. This modification has proved very useful during “weaning” of patients from prolonged intermittent positive pressure ventilation, and other advantages of using this circuit are mentioned.

The Bird Mark 8 ventilator is a pressure-cycled, flow-adjustable machine which utilizes a high pressure (60 lb./sq.in) source of oxygen, with or without air entrainment, as driving gas (Mushin, Rendell-Baker and Thompson, 1959). It may be automatic in action or patient-triggered, and can be used for controlled or assisted ventilation, or for intermittent positive pressure breathing therapy in the treatment of such conditions as asthma, atelectasis and pulmonary congestion, and for respiratory “education” of patients with chronic pulmonary disease prior to operation and anaesthesia.

Two nebulizers can be incorporated in the breathing circuit of the Bird ventilator (Cushing and Miller, 1965):

1. The large 500 ml capacity Crown mainstream nebulizer (i.e. where the main flow from the machine is directed into the primary spray from the nebulizer); this produces a dense concentrated mist suitable for aqueous humidification of the entire respiratory tract.

2. A small 10 ml capacity nebulizer which may be incorporated as a mainstream or sidestream device, and produces a less dense mist of small particle size suitable for administration of bronchodilators, steroids, antibiotics, mucolytic and anti-foam agents.

When “weaning” a patient from intermittent positive pressure ventilation, the machine can be used to provide continuous oxygen (or oxygen-enriched air) and humidification, with the patient breathing spontaneously, by incorporating an Ayre T-piece system between ventilator and patient as shown in figure 1.

In this case the only ventilator adjustment necessary is to flow; a Wright anemometer is attached to the expiratory limb of the T-piece and the minimum setting of the flow control which ensures continuous movement of the anemometer needle is taken as that flow which prevents any rebreathing. A small pressure (4.5 cm H₂O) will register on the manometer of the ventilator, so that it is best to have the pressure setting at least 10 cm H₂O to prevent any cycling over to the expiratory phase and thus ensure continuous flow. The spring-loaded expiratory valve remains closed.

The system can be used with tracheostomy or endotracheal tube (or even with a face mask if desired) and the main advantages claimed are:

1. The circuit affords a very efficient method, with direct connection to the patient, of providing both continuous humidification and intermittent aerosol therapy during spontaneous ventilation. The system can be used with 100 per cent oxygen or with air entrainment (appropriate flow settings will differ).

2. Intermittent positive pressure ventilation can be resumed with ease and rapidity, should the conditions warrant it.

3. The expiratory limb of the T-piece system will provide some resistance to expiration. By retarding expiratory pressure drop and thus “splinting” the bronchi, bronchial collapse and air-trapping may be prevented in patients with chronic obstructive lung disease (Safar and...
Kunkel, 1965) after sudden cessation of the inspiratory phase.

To produce further retardation of the expiratory phase a bag and valve may be attached to the end of the expiratory limb (thus converting from Mapleson E to Mapleson D circuits). The flow requirements should be the same (Mapleson, 1954). Alternatively, the T-piece can be exchanged for a Y-piece with the fresh gas flow directed towards the patient (Harrison, 1964) thus further increasing resistance to expiration.

REFERENCES

VARIANTE DU VENTILATEUR DE BIRD
POUR USAGE AU COURS DE LA
RESPIRATION SPONTANEE

SOMMAIRE
Par incorporation d’un système avec pièce en T d’Ayre dans le circuit du ventilateur de Bird, on peut obtenir une humidification suffisante et une nébulisation médicamenteuse suffisante pour l’administration à des personnes respirant spontanément. Cette variante s’est montrée très utile pour le “sevrage” de malades ayant subi une ventilation prolongée à pression intermittente positive, certains autres avantages dans l’utilisation de cet appareil sont mentionnés.

MODIFIZIERUNG DES BIRD-VENTILATORS
ZUR ANWENDUNG WAHREND SPONTANER
ATEMTATIGKEIT

ZUSAMMENFASSUNG