AUTOMATIC NON-REBREATHTHING VALVE

BY

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EFFICIENT ventilation of the anaesthetized patient, without carbon dioxide absorption, can be carried out using the valve to be described. It is simple, reliable, efficient and silent.

In figure 1 A and E are low resistance valves. P₁ and P₂ form a bypass opening into the balloon B, which lies free in the exit tube X. The balloon is made of very thin rubber and is of such a size that when inflated without any distension of its wall it completely occludes the exit tube. When collapsed it offers negligible resistance to expiration. T is a three-way tap which if desired will close P₁ and open P₂ to the atmosphere. The dotted lines indicate that the reservoir bag and the proximal end of the bypass may be placed anywhere between the gas machine and valve A.

*The valve in use.*

(a) During controlled or assisted respiration, pressure on the reservoir bag causes the balloon B to fill the exit tube, all the fresh gases passing into the patient's lungs. When the pressure is removed, the balloon collapses and the expired gases pass out through the exit tube.

(b) When the patient is breathing unaided, the balloon remains deflated throughout the cycle, unless the minute volume delivered from the machine exceeds that of the patient. In that case pressure rises in the system and ultimately the balloon will occlude the exit tube. To obviate the difficulty of adjusting the flow of gases exactly to match the patient's minute volume, the balloon may be vented to atmosphere and the bypass closed by tap T. The gas flow may then be set at a figure in excess of the patient's minute volume. This is particularly desirable where a facepiece is being used.

*Dimensions.*

Internal diameter of exit tube X 1 inch (2.5 cm) " bypass P₁ and P₂ 5/8 " (8mm)

Deadspace approx. 10 ml

*Resistance.*

(a) Inspiration:

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<thead>
<tr>
<th>Flow rate litres/min</th>
<th>Pressure drop mm H₂O</th>
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<td>30</td>
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<td>40</td>
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*Fig. 1*
(b) Expiration: Flow rate Pressure drop
litres/min mm H₂O
30 8
40 10
50 12
60 13

When controlled or assisted respiration is to be used throughout a case then the expiratory valve may be fixed widely open if so desired. This reduces the expiratory resistance to the low figure of 5 mm H₂O at 60 litres/min.

Any pattern of inspiration can be produced in the apnoeic patient. The reservoir bag must be completely released at the end of inspiration.

The valve responds instantly to the slightest inflation pressure. During controlled and assisted respiration the loss of fresh gas is approximately 5 per cent.

The valve has been in use for nearly twelve months and has proved completely reliable. The original balloon is still in use.

DISCUSSION

Ventilation of the apnoeic anaesthetized patient with mixtures of nitrous oxide and oxygen is usually effected either by a carbon dioxide absorbing system, circle or to-and-fro, or less efficiently by the ordinary "semi-closed" set-up. In both cases the excess gases are vented through a controlled leak simultaneously with the inspiratory stroke. It is sometimes difficult, especially for the inexperienced, to assess the actual amount of gaseous mixture entering the lungs. Degrees of resistance to inflation can also be difficult to appreciate.

The valve described provides a positive method of inflation. It will be noted that in all circumstances accurate control may be exercised over the patient's minute volume, thus helping to avoid the dangers of both over- and underventilation.

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