Intens. Care Med. 4, 103 - 104 (1978)

Intensive Care Medicine

A Simple Alarm Device for the Bennet PR-2 Ventilator

Stephan Stoyanov and Søren Jørgensen
Institute of Anaesthetics, Odense University Hospital, Odense, Denmark

Abstract. A simple alarm device for use with the Bennet PR-2 ventilator is described. It is based on the operation of a photo-electric cell, is simple in construction, and can be used on other types of ventilators if the pressure gauge is compatible.

Key Words: Alarm, Ventilator, Bennet PR-2.

Considerable attention has been paid, for a number of years, to the problem of improving the safety of mechanical ventilation by means of alarm devices [1, 2, 3, 4]. Some ventilators have an alarm system incorporated, while others merely have an attachment for the connection of a separate system.

Security is especially important during the mechanical ventilation of infants. The small size of the endo-tracheal tube (2-3.5 mm), as well as of the adaptors connecting the endo-tracheal tube to the ventilator, may result in a very unstable connection. It is also common for certain head movements of the patient to cause the adaptor and endo-tracheal tube to become disconnected, and thus break the ventilator patient system. Further leakage in any part of the system will also result in a deficiency in the volume of gases supplied to the patient.

We have constructed a simple alarm device, made in the hospital engineering department, at a cost of about $ 75, for the Bennett PR-2 ventilator, which is the most frequently used ventilator in our Intensive Care Unit.

The glass cover of the system pressure gauge on the Bennett PR-2 respirator was replaced by an acrylic disc, which can be rotated as a dial. A photocell was attached to the inner surface of this disc, in a position so that after bending of the pointer approximately 30°, the tail end passes the photocell and breaks the light beam (Fig. 1). A mark was engraved on the disc of the pressure gauge, which can be rotated and the mark situated over the required pressure. Thus the tail end of the pointer will just reach the photocell and momentarily break the light beam as the ventilator reaches maximum inflation.

A box (Fig. 2) attached to the ventilator processes the information produced by the photcell; should the pointer not reach the photocell, then the alarm emitting unit in the box automatically produces an audible signal. This alarm signal can be delayed from 0 to 15 seconds by means of a dial on the box. Three lamps on the upper surface indicate "power", "alarm" and that the impulses from the photocell are reaching the control box, respectively. There is a dial to switch "off" and "on" the alarm system. A control switch (Fig. 3) permits the alarm system to be interrupted immediately by romote control – from the bed or incubator beside the ventilator. A red signal lamp situated beside the switch indicates that the alarm system has been temporarily put out of function.

Under normal working conditions the pointer of the pressure gauge rotates in a clock-wise direction during in-

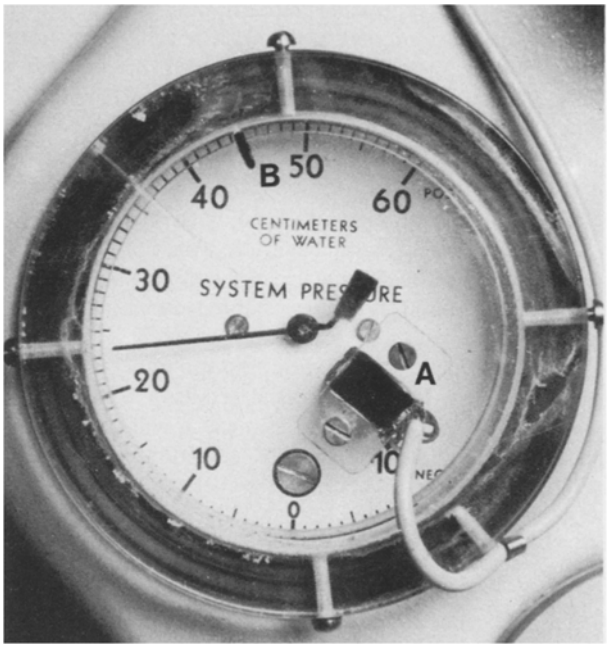

Fig. 1. Cover of the pressure gauge of the Bennet PR-2 respirator: A – photocell, B – the mark, placed at the required pressure of 45 cm of water

0342-4642/78/0004/0103/ $ 01.00

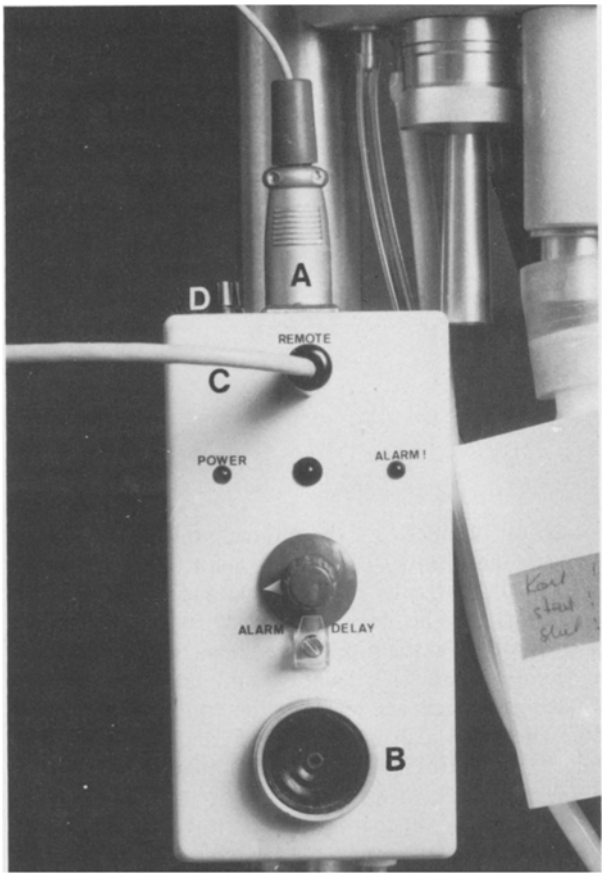

Fig. 2. The box "processing" the information from the photocell: A – cabel from the photocell, B – sound emitting unit, C – cabel to the control switch, D – "off" and "on" dial

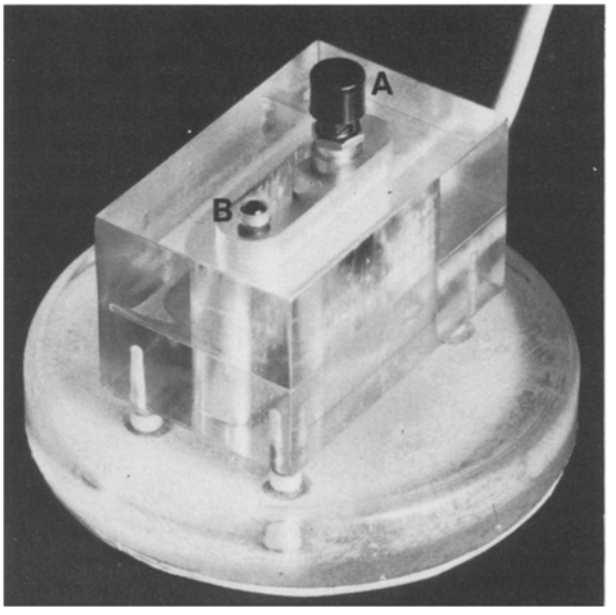

Fig. 3. The control switch: A – switch, B – red lamp, indicating temporary interruption of the alarm system

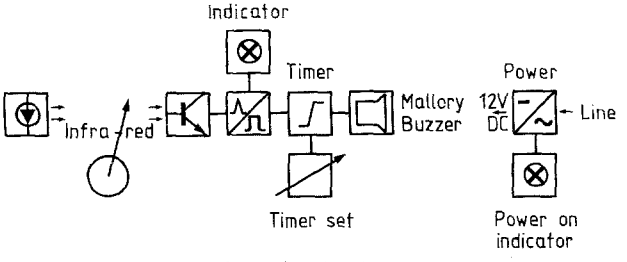

Fig. 4. The mounting scheme for the alarm system

flation and then returns to zero. It indicates, in cm of water, the pressure present in the system; at the same time the tail end interrupts the light beam and one impulse is transmitted to the control box. Following a decrease in the system pressure, irrespective of the cause, the tail end of the pointer will not cut the light beam and therefore impulses will be absent; the sensitivity is between 1 and 2 cm of water. If the "delay" is adjusted, for example to 5 seconds, then the alarm begins to function 5 seconds after the last impulse. This alarm signal stops immediately, should the required pressure in the system be reached once again.

During mechanical ventilation, the spontaneous inspiration of the patient will at times cause a drop in the system pressure. Thus the pointer of the gauge will not cut the light beam and the alarm will be activated. This can be avoided by setting the mark on the dial at a slightly lower pressure than is actually required. With proper adjustment of the position of the mark and "delay" very precise and accurate working of the alarm device can be achieved.

The electronic circuit and mounting of the components are shown in Figure 4.

There are advantages in the present system as compared to that described by Petty [3], there is a greater range in the "delay" system, and no problem of condensation. Compared to the alarm system described by Overton et al. [2], this unit appears to be simpler in design and construction. The possibility of a "misunderstanding" between the operator and the ventilator does not occur in this system, whereas it can in others. The device can also be employed on other types of ventilators, providing a system pressure gauge with sufficient movement of the pointer is present.

Acknowledgement. We wish to express our thanks to Kenneth Christensen and Poul Christensen, Engineering Department, for their contribution and very accurate construction of the alarm device.

References

1. Holmdahl M.H.: The respiratory care unit. Anastesiology **23**, 559 (1962)
2. Overton J.H., Miceli, R.M.: A disconnection alarm for the Bennet BA-4 ventilator. Anasth. intens. Care **4**, 159 (1976)
3. Petty T.L., Nett, L.M., et al: A simple ventilator warning device. Inhal. Ther. **14**, 67 (1969)
4. Sutton F.D.: A new ventilation monitor for intensive respiratory care unit. Respir. Care **19**, 196 (1974)

Dr. S. Stoyanov
Institute of Anaesthetics
University Hospital
Odense
Denmark