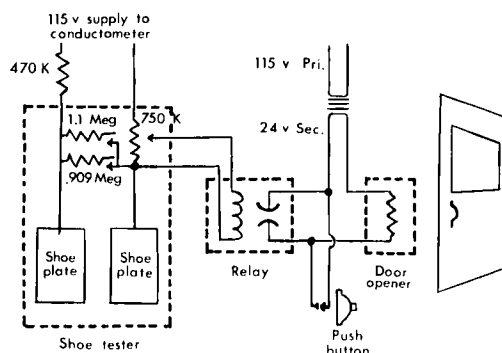


equipment or wiring failure, operation of the door opener by pushing this button will indicate whether this portion of the circuit is intact. The same push button can also be utilized to open the door in emergency situations, when there is no time to change clothing and put on conductive boots. The Shoe-Tester was further modified by constructing a vertical divider two inches high between the two foot plates. This partition makes it impossible to operate the mechanism by stepping on both plates simultaneously with one foot and in this way to defeat the purpose of the tester.

This combined conductometer-door opener was installed early in 1964 and has been used almost without interruption since then. We



Schematic diagram of circuit of conductometer-door opener.

believe that it has made a significant contribution to the better control of personnel conductivity.

Humidifying the Air-Shields Respirator

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The Air-Shields electric respirator has been modified to increase humidity and to provide a method for measuring it. The unheated spinning disc nebulizer produces a fog in the inspiratory tube of the respirator. The unheated corrugated breathing tube to the non-rebreathing valve which normally acted as a condensing chamber has been replaced with a wide bore plastic tubing which was wrapped with a six-foot 30-watt electric heat-band (fig. 1) such as is used to prevent freezing in exposed water pipes. A T-piece (fig. 2 C) through which a thermistor is threaded has been placed adjacent to the nonrebreathing valve (fig. 2 A). This measures temperature inside the short plastic tube (dew-point chamber) (fig. 2 B) between the T-piece and the valve. When the heat band is activated, the mist deposited on the inside of the plastic tubing is vaporized. The heat band (fig. 2 D) terminates at the metal T-piece so that the temperature distal will begin to fall in the area of the thermistor (fig. 2). When moisture condenses out on the inside of the dew-point

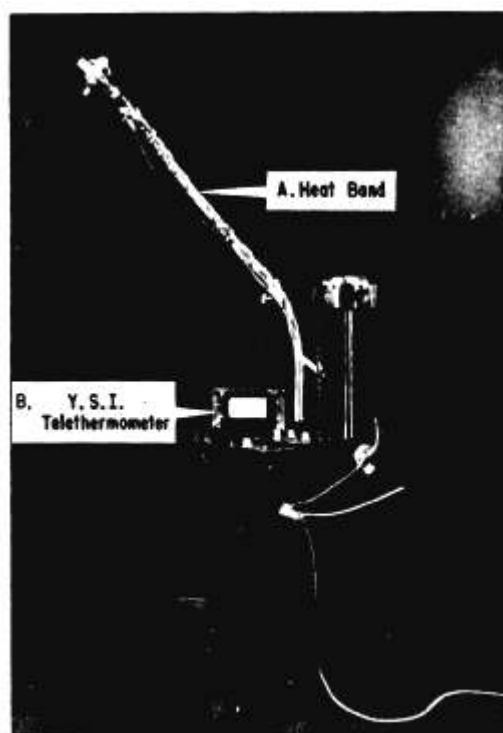


FIG. 1. A. Heat Band, extending over breathing tube from just proximal to nonrebreathing valve. B. Yellow Springs Instrument Telethermometer, connected to thermistor in dew point chamber.

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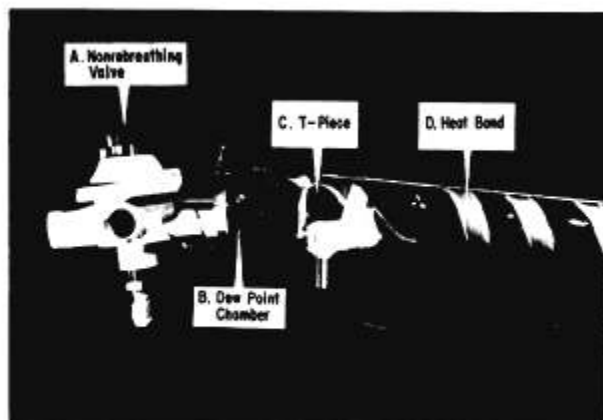


FIG. 2. A. Nonbreathing valve; B. dew point chamber, showing moisture condensation and thermistor; C. T-piece, and D. heat band, terminating a T-piece.

chamber in the area of the thermistor and the heat band is adjusted so as to produce a temperature of 37°C . in the thermistor, gases in this area are 100 per cent humidified at body temperature. Higher temperatures have been inhaled over prolonged periods without difficulty but offer no advantage.¹

Since there is a slight temperature drop through the nonbreathing valve, the patient inspires an atmosphere slightly below 37°C . At either high or low gas flows through the respirator, the variation in temperature (35° – 37.5°C .) and humidity as indicated by the dew-point chamber are relatively small. As greater volumes of gas are driven through the spinning disc humidifier, more moisture is carried to the heated breathing tube for vaporization. If the air volume is lower, less moisture is carried in. Because the specific heat of air, either dry or humidified, is relatively low, there is little temperature change with marked changes in gas flow along the continuously heated tubing.

The spacing of the heating coils near the thermistor in the dew-point chamber determines the temperature at which the gas will be inhaled. Care must be exercised that the coil does not overlap, and that insulating material not be placed on the outside or the coils will become too hot. The coils will not burn the skin on brief contact but may if permitted continuous contact.

Since heat loss by vaporization of water in the patient's airway and lungs is reduced or eliminated, heat loss through the skin must be permitted. A cool room and minimal covering

are all that is required except in hyperthermic patients where a cooling mattress may be needed. It should be remembered that *if cooling of the patient occurs through the respiratory tree, it does so largely at the expense of humidification*. Droplets (regardless of size) vaporized by the tracheo-bronchial mucosa cause a lowering of the temperature so that high absolute humidity does not result although relative humidity may be at 100 per cent.

We would like to suggest that supplying an inhaled atmosphere conditioned to body temperature and 100 per cent relative humidity is similar to that resulting from inhalation through the nasopharynx.⁴ This method is superior to any type of humidification by droplet, mist, or irrigation. Transpulmonary administration of fluids such as can result from continuous saline drip, intermittent irrigation or inhalation of droplets has no advantage over other routes of fluid administration and appears to have the disadvantage of increased bacterial growth, more mucosal irritation and maceration, and increased loss of surfactant.^{2, 3}

Requirements for conditioning inhaled air include humidifying it at body temperature *to prevent loss of water* from respiratory mucosa. The system described supplies these requirements in a simple and inexpensive manner. A provision is made for measurement of humidity to check on the effectiveness of the system. An explosion-safe technique is being devised for use with various inhalation systems during anesthesia.

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An Automatic Sighing Device

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The value of sighing for the prevention and treatment of atelectasis has been of recent interest. A device, herewith described, was designed to sigh automatically for patients during controlled or assisted respiration.

This device (fig. 1) consists of an electromagnet and its controls. The electromagnet fits the Bird respirator. In use, the instrument permits adjustment of the following parameters:

- (1) Sighing interval from 1 per minute to 1 per 30 minutes (control 1)
- (2) The duration of the sighing period from 1 per second to 1 per 30 seconds (control 2)
- (3) The depth of the sigh up to 50 cm. of water pressure (control 3).

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The above adjustments are accomplished essentially by controlling the current which activates the electromagnet. When activated, the electromagnet retards the return of the shaft on the Bird respirator to the "off" position until enough force is built up in the shaft to overcome the electromagnet. The greater the current flowing through the electromagnet, the more it retards the shaft and the deeper the sigh.

A schematic diagram of the electrical system appears in figure 2.

This sighing device has been used effectively during prolonged surgery, (using non-explosive agents), and in the Inhalation Therapy Department. It has been used continuously for up to six weeks and has func-

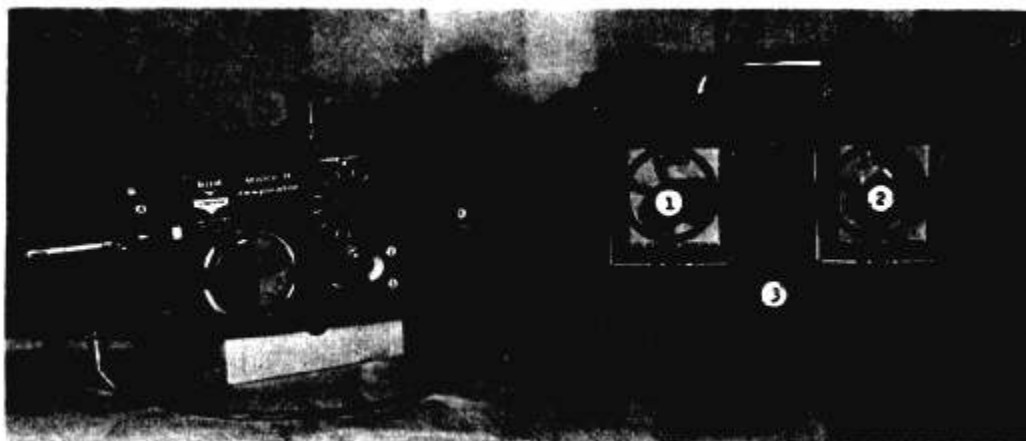


FIG. 1. Automatic sighing device.