solving for X_{m_2}

$$X_{m_2} = X_{m_1} \frac{P_1 T_2}{P_2 T_1}.$$

Experimentally the composition of the gaseous mixture X_{m_2} flowing from the vaporizer at ambient conditions P_2 and T_2 can be obtained by filling the cell and recording the absorbance as in case one. Knowing the absorbance, X_{m_1} can be read directly from the standard curve (fig. 2), and X_{m_2} can be obtained from the equation above in which the temperature must be given in absolute degrees.

The Heidbrink vaporizer was calibrated for methoxyflurane (Penthrane) using the above described method. Determinations of the gaseous mixture compositions were performed at dial settings of 3, 4, 5, 6, 7, 8, 9 and 10 for each of the following oxygen flows: 0.5, 2, 4 and 6 liters per minute. The composition determinations at the various flows and dial settings of the vaporizer were done at atmospheric pressure of 674 mm. and room temperature of 22° C. (295° K.). The results obtained are given in table 2.

Summary

A general infrared spectrophotometric method is presented by which it is possible to calibrate vaporizers for volatile anesthetics at any oxygen flow and dial setting and at any atmospheric pressure and room temperature conditions. Once a standard curve has been determined at a suitable wavelength and at ambient conditions, all that is required to find the composition of a gaseous mixture from the vaporizer is to sweep and fill an infrared gas cell and to record the absorbance at the specified wavelength. Simple calculations yield the flow composition from the absorbance, the standard curve, the atmospheric pressure and the room temperature (case one and case two).

References

1. Wasmuth, C. E., Greig, J. H., Homi, H., Moraca, P. P., Isil, N. H., Bitte, E. M., and Hale, D. E.: Methoxyflurane: a new anesthetic agent, Cleveland Clin. Quart. 27: 174, 1960.
2. Hudon, F.: Methoxyflurane, Canad. Anaesth. Soc. J. 8: 544, 1961.
3. Power, J. D.: McGill University experiences with methoxyflurane, Canad. Anaesth. Soc. J. 8: 488, 1961.
4. Bellamy, L. J.: The Infra-Red Spectra of Complex Molecules. New York, John Wiley & Sons, Inc., 1958.
5. Meites, L., and Thomas, H. C.: Advanced Analytical Chemistry. New York, McGraw-Hill Book Company, Inc., 1958, p. 328.
6. Ewing, G. W.: Instrumental Methods of Chemical Analysis. New York, McGraw-Hill Book Company, Inc., 1960, p. 77.
7. Ewing, G. W.: Instrumental Methods of Chemical Analysis. New York, McGraw-Hill Book Company, Inc., 1960, p. 24.

GADGETS

Calibrating Device for Temperature Recording

Robert W. Toft, M.S.*

A widely-used technique for monitoring body temperature is by a rectal or esophageal thermistor probe, in conjunction with a readout device such as the Tele-Thermometer (Yellow Springs Instruments). The probe, which is essentially a resistor with a high temperature coefficient of resistance, forms one arm of a Wheatstone bridge circuit; the imbalance of the bridge (which reflects the temperature of the probe) is read out on a meter calibrated to read temperature directly.

If the Tele-Thermometer is also equipped with recorder output terminals, a continuous written record of variations in temperature may be produced. In setting up a recorder for this purpose, however, it is necessary to locate

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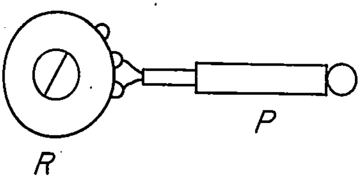

FIG. 1. R = variable resistor. P = probe (phone plug).

at least two temperature indications on the paper (and more if the temperature range is sufficiently large to include the nonlinearity inherent in the probe-bridge arrangement). This can be done by immersing the probe in water at two (or more) different temperatures in the desired range. This method, however, is time consuming, inconvenient, and potentially sloppy.

A rapid, convenient, and inexpensive device for accomplishing this calibration has been in use in our laboratories for several months, with excellent results. As shown in figure 1, it comprises a variable resistor (*e.g.*, a wire-wound potentiometer) wired to a phone plug which fits the *probe* input of the Tele-Thermometer. Varying the resistance mimics the behavior of the probe as the temperature changes (resistance decreases as temperature rises), and the meter can be set to read any temperature desired.

In use, the resistor is adjusted so that the meter indicates the lowest temperature expected, and the base-line of the recorder is set; the resistor is then set to indicate the highest temperature expected, and the sensitivity of the recorder is adjusted to give the desired pen deflection. After a recheck of the base-line, any number of intermediate points may be selected and a mark on the paper produced for each, thus rapidly obtaining a complete calibration curve. During periods of prolonged use, the calibration may be quickly checked for drift in the probe or recorder.

TABLE 1. Resistance of Thermistor Probe at Various Temperatures

Temp., ° C.	R, ohms
40	1,100
35	1,400
30	1,800
25	2,100
20	2,700
15	3,200
10	4,700
5	5,300
0	7,000

The value of the resistor required is dictated by the lowest temperature to be recorded. We have found that a resistance of about 7000 ohms enables us to calibrate at temperatures as low as 0° C. As a guide to the selection of a resistor for any given lower limit, the approximate resistance of a typical (interchangeable) probe at various temperatures is given in table 1.

The cost of this device should not exceed $2, or the parts may even be salvaged from electronic equipment no longer in use. Its construction is obviously simple.

A New Mask

DAVID D. COHEN, M.D.*

Fitting a mask is often a difficult and vexing problem. Fitting the sunken face of the edentulous patient or the patient with an indwelling naso-gastric tube can be particularly difficult. With spontaneous respiration, the anesthetic gases may be greatly diluted by air. With assisted or controlled respiration, adequate positive pressure cannot be developed. These difficulties are frequently encountered during inhalation therapy and can be overcome by using the mask described as an oxygen mask or positive pressure mask.

A disposable, universally well-fitting, trans-

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