clinically testing a system based upon the use of these lower two parameters. We have found this system to be very useful for many, but not all, clinical situations. We have added to this simpler EEG analyzer system, the simultaneous monitoring of the EMG from the same EEG electrodes. The EMG provides an indication of both EEG muscle contamination and the state of relaxation of the patient. The use of the zero-axis crossing frequency and the average rectified amplitude of the fundamental EEG wave is particularly effective when the anesthetic agent and given dosage produces an EEG whose frequency spectrum is reasonably well-defined and unimodal. The simpler technique does not provide as complete a waveform analysis when the anesthetic type or given dosage produces a bimodal spectral response where we have a significant amount of EEG activity at two widely separated frequencies. It has been our experience that many of the clinical dosage levels of halothane, enflurane and nitrous oxide do in fact have a reasonably well-defined, unimodal spectral response, and hence the simpler EEG analytical system is indeed effective with these agents.

We wish to point out that we have not abandoned or lost interest in the more complicated form of the derivative analysis which includes all six parameters. For example, Levy et al. correctly point out in their figures 6 and 7 that the basic EEG zero-axis crossing frequency (F0) does not respond to off-axis maxima and minima and thus, in certain cases can give an erroneous indication of the rhythms within the EEG wave. It can be seen through the calculus that first derivative zero-axis crossing frequency (F1) detects basic undifferentiated wave maxima and minima irrespective of whether or not there is an actual axis crossing of the basic wave. This higher-order parameter would then be useful in detecting situations where there is considerable off-axis EEG activity. The second derivative zero-axis crossing frequency (F2) looks further into the basic EEG wave, in that it is a measure of the frequency of the inflection points of the basic undifferentiated wave.

A question in which we are most interested is, How much sensitivity or ability to look further and further into an EEG wave is necessary for every day clinical monitoring use? We have attempted to address this question for two anesthetic agents in a paper just completed which documents the use of the 6-parameter derivative EEG analytical technique working along with cardiovascular parameters in discriminating among several dosage levels of the agents, halothane and enflurane, as used with nitrous oxide. In this study we allow a stepwise discriminant analysis to "pick" the most effective EEG and/or cardiovascular parameters for separating the chosen anesthetic dosages. For the anesthetic agents and dosages used in the study, the discriminant analysis picked the basic EEG zero-axis crossing frequency (F0) as the best discriminator among the dosages, followed by higher-order EEG parameters, followed by cardiovascular parameters. The study made clear to us that basic EEG frequency (F0) was a good discriminator between anesthetic dosages for the agents and dosages tested, but that clearly significant improvement in separating anesthetic dosages could be attained by the use of the additional EEG parameters and the cardiovascular parameters.

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A Simple In-circuit Vaporizer for Closed-circuit Anesthesia

To the Editor: —Introduction of volatile liquid anesthetics into a low-flow or closed, carbon dioxide absorption circuit is facilitated by providing a controllable injection port on the expiratory limb of the circuit close to the absorber. No such port is commercially available.
First thought was given to the utilization of a Bird polysulfone bifurcation to serve as the vaporizing chamber. Exposure to the pure vapor of enflurane for a 10-day period resulted in no obvious interaction and, by reason of its transparency, it appeared ideal. Later, it was discovered that when exposed to anesthetic concentrations of halothane or methoxyflurane, the polysulfone gradually softened and cracked. At once it became apparent that all metal construction was essential.

A simple device which has proven satisfactory in extensive clinical practice was designed (fig. 1). This device consists of a metal sleeve 4.5 cm long, and with ends that are sized to be inserted between the expiratory breathing tube and the absorber. A hole is drilled in the sleeve to accept the hub of a 30-gauge non-disposable Luer-Lok needle. The needle is then shortened to 0.075 cm and bearing-silver soldered in place. The fluorocarbons attack lead solder. The Luer-Lok fitting permits the firm attachment of a glass syringe. A 10-ml syringe, when filled with any fluorocarbon anesthetic and attached in the upright position, will result in no flow through the 30-gauge channel until considerable pressure is applied to the plunger. In practice, a 5-ml syringe is employed and refilled as needed. An average 70-kg adult will only require 6.5 ml of halothane, or 13.5 ml of enfurane for a three-hour operation.

Although experience has demonstrated that it is not necessary, if desired, a metal or nylon stopcock may be interposed between the syringe and the injection port. Clear plastic stopcocks (polyvinylchloride) should be avoided since they react with the fluorocarbons. In any event, a nylon stopper is attached to the port shoulder to close the channel when the closed system is not being employed.

Bronze millings were placed inside the metal sleeve to promote vaporization of the anesthetic, albeit there is not general agreement that this is necessary in a rapidly circulating system.

We believe the device fills the need for a simple vaporizer for closed-circuit anesthesia. The cost should be approximately $35.00.*