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PRESSORMETER

The apparatus described below, called the "Pressormeter," is presented as a simple device which may be useful in monitoring the peripheral circulation during anesthesia. It is an outgrowth of similar instruments built by Keating (1) and Downing (2), and includes a provision for oscilloscopic scanning and permanent recording. It consists of a microphone connected to an ammeter. In use, the microphone is placed over the radial artery at the wrist and pulsations are noted on the ammeter. Since the microphone is sensitive to lateral thrusts of the arterial wall, the excursion of the ammeter needle is a function of the pulse pressure; the number of oscillations per minute is, of course, the pulse rate.

The wrist-piece is adapted from a throat microphone. One of these microphones is completely filled with carbon to lessen the effect of position. The cord leading to the throat attachment is cut and about 2 inches of outer insulation is removed to decrease the torsion of the wires on the wrist-piece. The wires are soldered to the back of the

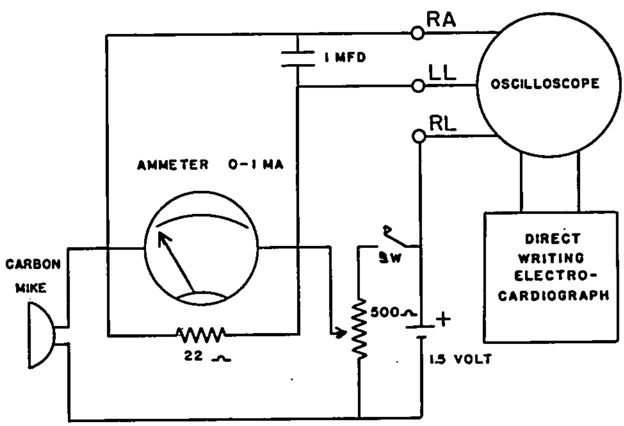

FIG. 1. Electrical schema for the Pressormeter. Parts: One 3½ inch (0–1 milliamp) DC ammeter; one throat mike; one 2 connector jack; one 500 ohm potentiometer; one 22 ohm resistor; one 1.0 mfd condenser; three binding posts; one ammeter case; one 1½ volt battery, and SPST switch.

microphone and the assembly is completed by covering the wires by a Bakelite cap. The other electrical components, listed in figure 1, are mounted in a steel ammeter case.

The Pressormeter can be attached to an infusion pole by a steel clip bolted to the back of the case. Binding posts for RA and LL are insulated from the case. A Cambridge Cardioscope and a Simpliscribe can be used for oscilloscopic scanning and permanent recordings. Inasmuch as the resistance of the Cardioscope is relatively high, the ammeter is not affected by its use. The sensitivity of the oscilloscope is adjusted so that 1 cm. deflection represents 10 millivolts. Permanent recordings can be made without interposing the oscilloscope. When used alone, the sensitivity of the direct-writing electrocardiograph is reduced, and precautions for the use of this instrument in hazardous locations must be observed. Oscilloscopic scanning and permanent recordings are useful for teaching purposes but are not essential to the use of the Pressormeter. The instrument uses a 1½ volt battery and the current drain is low. It can be used in hazardous locations (3).

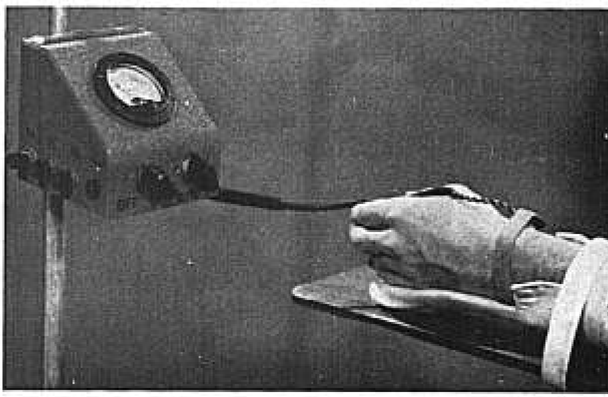

FIG. 2. Photograph of instrument in use.* The Pressormeter is secured to an infusion pole. The arm is supported on an arm board and immobilized by a half cast of plaster. The wrist-piece is held in place by a rubber band.

The Pressormeter is calibrated in millimeters of mercury pulse pressure. The wrist-piece is held in place by a rubber band with the microphone directly over the radial artery (fig. 2). The pulse pressure is taken by conventional methods. The volume control is varied to bring the systolic swing of the needle to the 0 mark of the face plate shown in figure 3C. The diastolic ebb of the needle deflection is noted and the appropriate scale is used, high, medium, or low, according to the particular requirements. The sensitivity of the needle varies with anatomical differences, location of the microphone and rubber band tension. When the appropriate scale has been chosen, an increase of the fluctuation of the needle to the 10 mark on the right of 0 indicates an increase in pulse pressure of 10 mm. of mercury. Large pulse pressures, as for instance 80 mm. of mercury, can be estimated by multiplying the scale value of 40 mm. of mercury by 2.

In calibrating the Pressormeter a normotensive patient with a pulse pressure of 30 mm. of mercury is chosen. The wrist-piece is adjusted so the needle swings between

* By Tom Woodward, Department of Photography, St. Raphael's Hospital, New Haven, Connecticut.

.35 ma. and .6 ma. (as shown in figure 3A) on the original 0–1 ma. scale. By varying the volume control, readings are taken when the systolic level of the needle is varied from the 0.2 ma. mark to the 0.9 ma. mark. These readings are transferred to graph paper as shown in figure 3B. There is a logarithmic proportion between A, B, and C. By using the center of a slide rule, these relative fluctuations are transferred to a new face plate resulting in the scale shown in figure 3C.

The instrument is a useful aid during anesthesia, particularly for counting the pulse rate and estimating pulse pressure at times when the anesthetist's hands are occupied

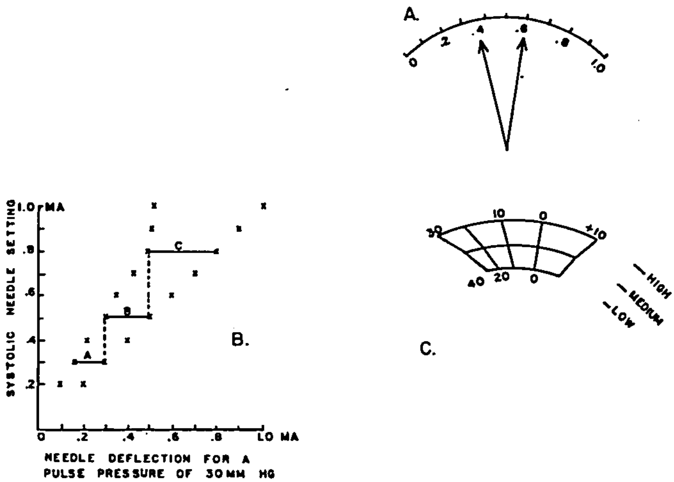

FIG. 3. Details of calibration: A. Needle deflection for a pulse pressure of 30 mm. of Hg. B. Graph of relative fluctuations of needle at various settings of volume control for a pulse pressure of 30 mm. of Hg. There is a logarithmic proportion between A, B, and C. C. The face plate of a Pressormeter. Three scales of sensitivity are plotted of high, medium and low sensitivity. A scale is chosen in use that corresponds to the pulse pressure determined by conventional methods. An increase of the needle deflection to the 10 mark indicates an increase of 10 mm. of Hg pulse pressure.

with other procedures. Likewise, cardiac irregularities are quickly noted by observing irregularities in the needle movement.

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NEW APPARATUS

The electroencephalogram is a valuable addition to the armamentarium of the anesthesiologist during general anesthesia, to aid in judging the depth of anesthesia, hypoxia, hypercapnia and cerebral ischemia.

The ideal instrument for operating room use to monitor the electroencephalographic activity should (1) present an adequate visual record of the cortical activity and (2) provide a method for preserving a permanent record of these patterns. Simplicity and ease of operation are important, and the instrument should be mobile so that it can be easily moved from room to room. It should be designed for use in hazardous locations.

Recently we evaluated an instrument which incorporates the electroencephalogram and the electrocardiogram in one instrument, with an associated, remote direct-writing recorder.* This instrument allows alternate selection of bipolar electroencephalographic leads and any electrocardiographic lead for the visualization on a long persistence screen of an oscilloscope tube.

We have used this instrument in a series of anesthetized patients and found that the electroencephalographic patterns produced on the visual scope were easily interpreted. Simultaneous records obtained on a conventional electroencephalographic recorder were identical. Electroencephalograms recorded on the remote direct-writing electrocardiograph were satisfactory, inasmuch as the electrocardiographic recorder has a higher natural frequency than the conventional electroencephalographic recorder. No interference from the extraneous sixty cycle fields was experienced when adequate grounding of the instrument was accomplished. No special precautions were taken in shielding the rooms although the operating theaters have conductive flooring and operating tables are grounded. We have found this instrument to be dependable and simple to operate.

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* Available from the Cambridge Instrument Company, New York, N. Y.