AN IMPROVED CLINICAL DERMOMHΜΜETER*

CAPTAIN HERBERT JASPER, R.C.A.M.C.

(Received for publication January 15, 1945)

INTRODUCTION

It has been shown by Richter and his associates that measurements of the electrical resistance of the skin provide an accurate and objective means of diagnosis in peripheral nerve injuries. Areas of high resistance may be mapped out with a small exploratory electrode held in the hand, with the reference electrode attached to the ear lobe that has been punctured with a pin prick to eliminate its skin resistance. These areas of high resistance represent skin that has lost its sympathetic nerve supply. They can be outlined with a high degree of accuracy and usually correspond closely to the area accurately mapped as analgesic or anaesthetic, and may be related only to an area of hypaesthesia. The high skin resistance is due principally to the inactivity of the sweat glands in a denervated area.

The "dermometer" recommended by Richter, and accepted as standard issue by the U.S. Army Medical Corps, was found to possess certain disadvantages which stimulated the design of a different model to recommend for Canadian service. Such an instrument should be much more "fool proof" in operation (e.g., in the Richter instrument the meter will be severely damaged if the testing electrodes are accidentally placed in contact with each other).

SPECIFICATIONS

The dermohmometer is mounted in a wooden box measuring $8\frac{1}{2} \times 8 \times 8$ inches, as shown in Fig. 1. Its total weight, including electrodes and electrode paste contained in a special compartment in the cover, is 7 pounds. It consists principally of nine standard flash-light batteries, a 0-50 microammeter, with a special contact on its deflecting needle which prevents overload, a double pole 7 contact Yaxley switch, seven fixed resistors, and two binding posts.

The wiring diagram is shown in Fig. 2. Six separate sensitivities are provided by the six contacts on the tap switch $S$, which connects different numbers of batteries giving 1.5, 3.0, 4.5, 7.5, 10.5 and 13.5 volts. This method of sensitivity control eliminates the necessity of constant current drain from a potentiometer across the batteries. Also no current can flow from the batteries unless a contact is made between electrode terminals $E$.

As the voltage is increased, the resistance in series with the meter is increased in such a manner that the current flowing would equal 500 microamperes should there be a short circuit between the binding posts at $E$. This would burn out the 0–50 microammeter were it not for the platinum leaf contact in the meter, which is closed at full deflection of the needle. This immediately reduces to one tenth the current passing through the meter.

The measurement of resistance values to an accuracy of 4 to 5 per cent

---

* This paper is a report on an investigation carried out for the Associate Committee on Army Medical Research, National Research Council, Ottawa, and the Research Division, Director General of Medical Services, National Defence Headquarters, Ottawa, Ontario, Canada.
Fig. 1. Clinical dermohmmeter, shown (left) closed and (right) ready for use. Dimensions: $8\times8\times8$ inches. Weight: 7 pounds. All accessories are contained in the cover, which is turned back during use.

may be obtained from calibration curves provided (Fig. 3). This is sufficiently accurate for clinical purposes. In mapping a high resistance area it is more important to have a sharp delineation than to have accurate measure-

Fig. 2. Wiring diagram of dermohmmeter. The meter used (A) is a 0–50 microammeter with a special platinum contact to the deflecting needle. The testing electrodes are attached to the binding posts (E). Six sensitivities are provided by turning the ganged rotary switches ($S_1$ and $S_2$). See text for further description.
ment of absolute resistance values, although the latter may be important in judging recovery in the course of re-examination. Sharp delineation is provided by the potential overloading the meter by a factor of ten.
The range of resistance covered by this dermohmmeter is from 27,000 ohms to 13,500,000 ohms, which has been found to be adequate for all clinical cases encountered to date, and extends by about 3 times the range of the Richter instrument. This extension of range minimizes the necessity for causing the individual to perspire before clear differentiation can be made between denervated and adjacent normal skin.

CONCLUSIONS

A clinical dermohmmeter is described for use in the diagnosis of peripheral nerve injuries. It has the following principal characteristics:

1. The instrument is small and self-contained with all accessories. (Dimensions: $8\frac{1}{2} \times 8 \times 8$ inches. Weight: 7 pounds.)

2. A wide range of resistance values, 27,000 ohms to 13.5 megohms, may be measured with an accuracy of 4 to 5 per cent.

3. Sharp delineation of denervated skin areas is obtained by potentially overloading the meter by a factor of 10, at each of six sensitivities.

4. The meter is completely protected against damage from short circuit of the testing electrodes.

5. Long life of standard flash-light batteries is assured by circuit design which eliminates a potentiometer across the batteries and by making it impossible to close the box without the current being effectively turned off.

REFERENCE