A DEVICE FOR PERSPIRATION MEASUREMENTS

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Measurement of sweat excretion in diseases related to hypohydrosis is beset with many difficulties. To increase the sensitivity of the instrument it is usual to employ a more sensitive galvanometer, or to increase the voltage of the supply. However, use of a more sensitive galvanometer causes the apparatus to be less portable, and it can then be used only as a fixed installation. However, increase in the voltage supply is not without its effect in the measurement of sweat secretion. Only weak potentials not exceeding 4.5 V are imperceptible by man and without any effect on perspiration. However, with a greater potential, the electrical current stimulates the sweat glands and increases perspiration. The result is a reduction in the cutaneous resistance, an increase in current, and a greater excitation of the sweat glands. The resistance of the skin falls progressively until no further measurements can be made.

In the device described a circuit is used in which the current passing through the sensitive element is amplified by a transistor device before passing through the galvanometer. A relatively insensitive galvanometer can then be used and at the same time a comparatively low potential of 4.5 V may be employed. The arrangement makes it possible to record perspiration at a single supply potential, either after amplification of the current, or directly without amplification.

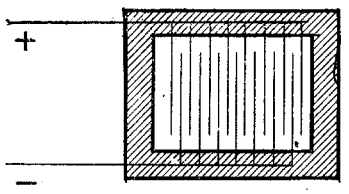

Fig. 1. Diagram of the sensitive element.

We have used the sensitive element described in 1948 by N. N. Mishchuk [1]; it consists of several rows of fine nickel wires stretched in a rectangular frame made from insulating material. The frame measures 1.5 · 1 cm, and the distance between the wires is 1 mm. All the even-number wires are connected to a common lead, and all the odd wires are connected to a 2nd lead (Fig. 1).

The galvanometer was made by the Leningrad Institute of Instrument Production, and consisted of a magnetic and electrical system having an internal resistance of 49 ohm and a sensitivity given by: $1° = 0.8^{-6} \times 10^{-6}$ A.

The use of the shunt R_1 (Fig. 2) makes it possible to measure large amounts of sweat by reducing the galvanometer sensitivity. The shunt is chosen to be of a size such that when corrected the sensitivity of the device is reduced 10 times. Resistance R_3 is also found empirically, and adjusted so that a potential of 4.5 V deflected the needle of the galvanometer to give a full-scale reading.

The apparatus operates as follows: For control of the supply voltage closure of switch K_2 and opening switch, K_3 disconnects the sensitive element and brings the fixed resistor R_3 into circuit. Potentiometer R_2 is set to give a current which will cause full-scale deflection of the galvanometer needle.

To measure small quantities of sweat, the amplifier is brought into the circuit: K_5 and K_6 move from position 1 to position 2, and contacts K_7, K_8, K_9, and K_{10} close. These contacts are all included in a jack, so that the amplifier may be brought into circuit by a single manual movement. The amplifier is set as follows: the sensitive element is disconnected and replaced by a 1 mΩ resistance and potentiometer R_5, which is set to produce a current giving a full-scale reading. Potentiometer R_6 serves to set the needle of the galvanometer at 0 by changing the current used to compensate the initial current of the collector. When the sensitive element is brought into the circuit, the apparatus is ready for use.

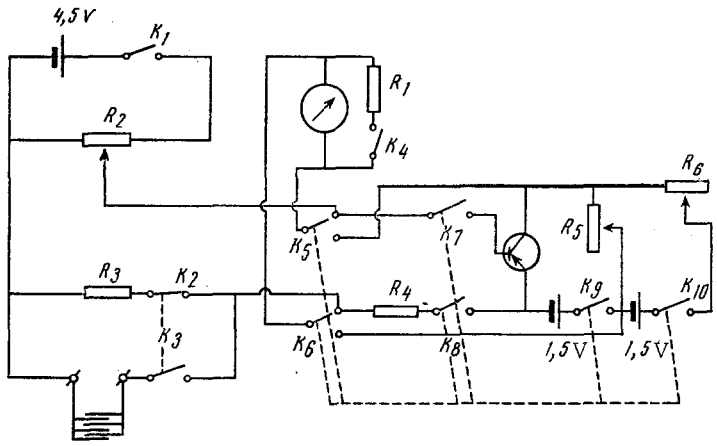

Fig. 2. Diagram of the device for the measurement of perspiration. Resistances: R_1 - shunt; R_2 - 1 kΩ; R_3 - 56 kΩ; R_4 - 20 kΩ; R_5 - 200 kΩ; R_6 - 56 kΩ.

SUMMARY

A new design of instrument is described for measurement of perspiration, and is based on Mishchuk's principle. An amplifier based on a transistor triode was used to increase sensitivity. The device may also be used for measurement of amounts of perspiration too small to be detected by Mishchuk's instrument. The instrument is portable and contains its own power supply.

LITERATURE CITED

1. N. N. Mishchuk. A method for the electrical measurement of perspiration, and an account of its experimental and clinical use [in Russian] Leningrad (1948).