## NOTE

**A New Variable Resistance.**—The following is a description of a new form of variable resistance which has the advantages of ease and cheapness of construction, great sensitivity, low temperature coefficient and complete absence of contact resistance.

A column of mercury contained in a glass tube carries the current. Its length remains constant and the variation of resistance is effected by varying the cross section by sliding a glass rod up or down in the tube. The construction is evident from the diagram. Contact with the mercury is made by platinum wires sealed in place as shown. The copper connecting wires make contact with the platinum through mercury cups. Thermoelectric potential effects at these junctions are avoided by surrounding both with a mass of mercury, which will maintain a sensibly uniform temperature. The wide bore of the tubing, apart from that in which the plunger slides, gives the instrument a very low total resistance. This, together with the low temperature coefficient of resistance of mercury, makes the temperature correction very small.

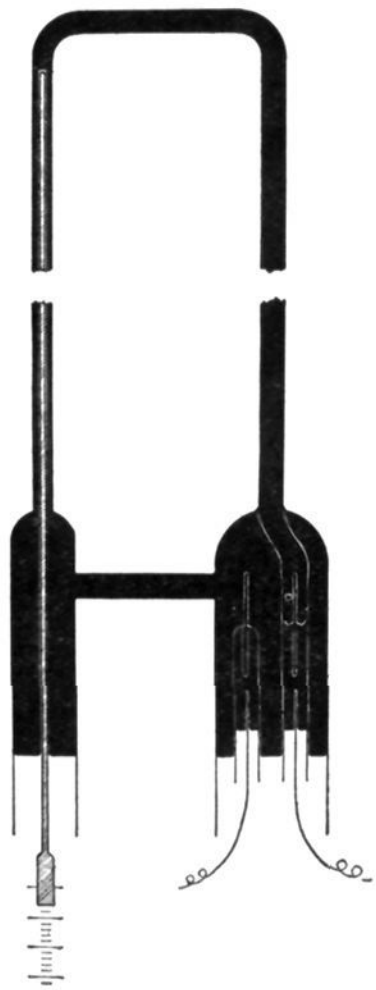

Fig. 1.

The sensitivity can be varied by varying the relative dimensions. The one actually constructed was used in connection with a resistance box reading to 0.1 ohm, and has a total maximum resistance of 0.305 ohm at 24.5°. The column of mercury is about 60 cm. long and 0.3 cm. in diameter and the plunger is about 0.1 cm. in diameter. The instrument is mounted on a board and set on the floor so that the top of the plunger is at a convenient height. An ordinary pinch-clamp, fixed to the frame, is used to hold the plunger at any point where it is set. A scale, graduated in millimeters, is placed behind the plunger.

The instrument was calibrated by inserting it in a Wheatstone-bridge circuit and taking readings of resistance (using a variable resistance previously described)[1] at every 10 cm. on the plunger scale; also by observing the movement of the plunger necessary to change the resistance by 0.1 ohm, at various portions of the plunger scale. It was found that the scale from 10 to 60 cm. was perfectly uniform and that 32.5 cm. was equivalent to 0.1 ohm at 24.5°; for example, 1 cm. equals 0.003 ohm. As the position

[1] Maass and Wright, THIS JOURNAL, **43**, 1179 (1921).

of the plunger can easily be read to 1 mm., the instrument can be read to 0.0003 ohm.

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# MENTHOL STUDIES. I. MENTHYL ESTERS OF THE NITRO- AND AMINOCINNAMIC ACIDS

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The material presented here is a preliminary study undertaken with a view to the synthesis of aromatic terpene compounds to be used in chemotherapeutic studies in tuberculosis.

The assumption is made that a chemical compound used for the purpose of destroying the *B. tuberculosis* directly, must come in contact with the bacillus. To accomplish this, since the tubercle is an avascular system, the chemical compound must penetrate the wall of the tubercle by diffusion (that is, solubility), must pass through the caseous material found in the older tubercles at least, and finally through the waxy material associated with the bacillus itself, the nature of which has been shown by chemical analyses to be compounds of the lipoidal type.[1] Opinion differs whether this waxy material is merely in close contact with the bacillus or actually encases the bacillus in an armor effect, spoken of as the "waxy capsule." Terpenes, due to their ability in general to dissolve lipoids, should be effective in penetrating such a system, or at least capable of concentration in proximity of the organism. The function of the menthol is to ascertain if such an increased solubility can be realized.

## Experimental Part

**General Procedure for Preparing Menthyl Esters.**—The acid to be esterified was refluxed with thionyl chloride in the proportion of 0.1 mole of acid to 0.5 mole of thionyl chloride for one hour, or until solution resulted. The excess of thionyl chloride was then removed on a steam-bath at 5 mm. pressure or less. To the acid chloride 0.25 mole of menthol was added and the mixture was heated in a glycerine-bath at 130° until hydrogen chloride fumes were no longer given off. When reaction was complete the excess of menthol was removed at 110° and 5 mm. pressure. The residue was purified by crystallization from a suitable solvent or by distillation under reduced pressure.

[1] Aronson, *Berl. klin. Wochschr.*, **47**, 1617 (1910).