

end of the tube will help to keep the sulphur from working loose.)¹² This insulated rod was then inserted into the large hole in the stopper. (See Fig. 6.) The inlet and outlet tubes, T and O, were of ordinary glass tubing, about 4 mm. inside diameter, fitting tightly in the other two holes. To insure tightness the tubes and the edge of the stopper were coated with vaseline.

At the last an ordinary cork with inlet and outlet tubes about twice the cross-section of the first was tried. This seemed to give promise of more rapid results if the cork could be made as air tight as the rubber stopper.

¹²I am indebted to Professor Wm. Strieby of Colorado College for suggestions regarding this method of insulation.

TWO ELECTRICAL THERMOSCOPES.

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The various manifestations of heat in physical phenomena are of such importance that a delicate thermoscope for their detection and illustration in the lecture room is highly desirable. Several different instruments intended for this purpose were made and tested before adopting the type of thermoscope described in the December number of SCHOOL SCIENCE AND MATHEMATICS.

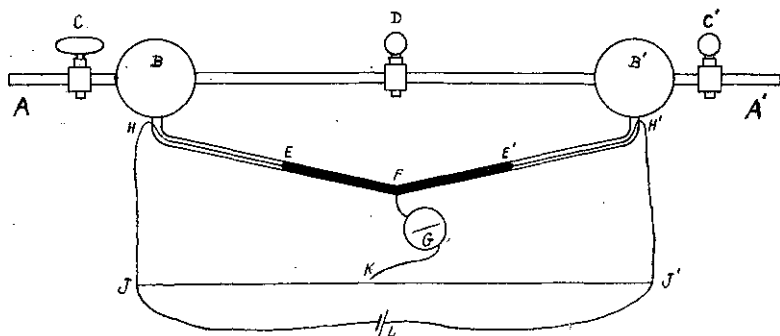
It was at first believed that an electrical thermoscope would be feasible when used with a delicate projection galvanometer. A spot of light reflected on a translucent scale about two meters from the galvanometer was used as an indicator. Two types of instruments were used, one being of unusual sensitiveness, but their adjustment was found quite difficult.

In both instruments the source of heat was applied in accessory bulbs similar to those described in my former article. These bulbs were attached to A or A' with rubber tubes about 40 cm. long.

In the illustration B and B' are bulbs about 3 cm. in diameter attached to both an upper and a lower tube. The lower tube is about 2 mm. in internal diameter and has a fine platinum wire running through its entire length. At H, F and H' are heavier wires leading to a Wheatstone slide wire bridge JJ'. A column

of mercury EE' fills about one-half of the lower tube. L is a cell, K a contact key, and G a delicate d'Arsonval galvanometer.

With the stop-cocks C , D , and C' a limited control of the instrument is possible. If an accessory bulb is attached at A and the source of heat is comparatively small, the stop-cock C'



is kept open; with a larger source it is closed; while with an excessive heat the stop-cock D is opened momentarily.

When a reading was to be taken the contact key K was moved along the wire of the Wheatstone bridge until no deflection of the galvanometer resulted. A thermal change in the accessory bulb attached to A moved the mercury column in the lower tube, thus changing the resistance in the two branches HF and FH' of the bridge. On again depressing the key a deflection of the galvanometer resulted, whose magnitude varied with that of the thermal effect.

In the second instrument the platinum wire through the lower wire was omitted, but the electrodes H , F , and H' retained. Half of the tube was filled with mercury as before, and the upper ends with an electrolyte. The electrodes H , F , and H' were connected to the slide wire bridge as in the other instrument.

The objection to this type of thermoscope was its instability, due to its great sensitiveness. When made with a lower tube but a few centimeters long and of very small internal diameter, a high grade galvanometer and an accessory bulb with a rock salt face the instrument should be capable of detecting a temperature change of the order of $1/10,000,000^\circ \text{C}$.