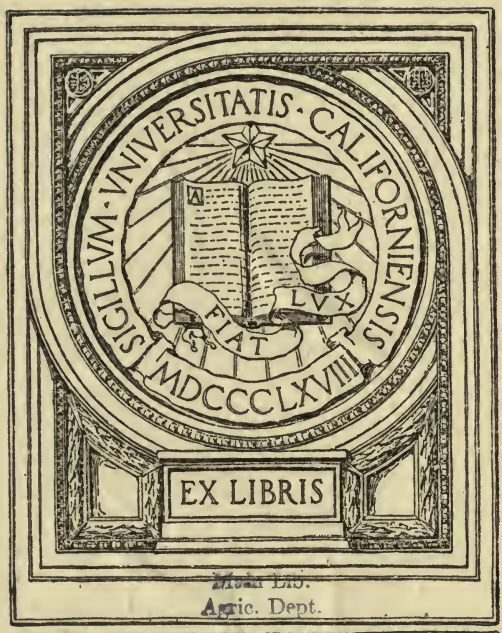
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Issued May 31, 1911.

# United States Department of Agriculture.

BUREAU OF CHEMISTRY—Circular No. 72.

H. W. WILEY, Chief of Bureau.

## AN ELECTRICALLY CONTROLLED CONSTANT TEMPERATURE WATER BATH FOR THE IMMERSION REFRACTOMETER.

By H. C. Gore, *Assistant Chemist, Division of Foods.*

The water bath of the immersion refractometer must be held within narrow limits at 17.5° C.—a temperature usually below that of the room. It is therefore cooled by the addition of cold water. Admitting tap water or ice water at a constant rate is unsatisfactory, as constant adjustment is required by changes in room temperature. The device herein described, by which water is added to the bath automatically, has given satisfaction during a period of many months. No claim to originality can be made, in view of the many devices of this kind which have been proposed.

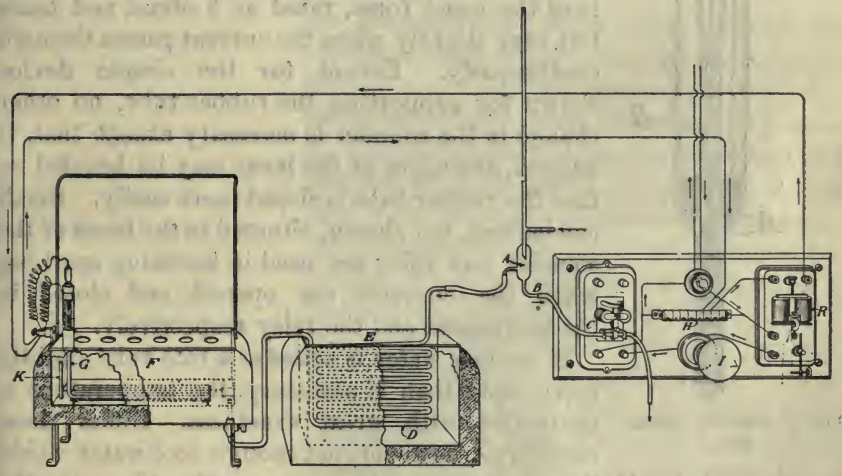


Fig. 1.—Apparatus for temperature control of refractometer bath.

The tap water runs through the sight tube A, figure 1, and is diverted to the bath when the rubber tube B is closed by the lever of the sounder C. In warm weather the water is cooled by passing it through the copper coil D, immersed in ice water in the vessel E. The refractometer bath F is provided with an overflow pipe K and is stirred by a current of air entering through a tube not shown; E and F are insulated by magnesia packing to prevent the condensation of moisture which occurs during warm humid weather.

The thermostat G consists of a long glass tube bent into a flat rectangular coil and fastened to a perforated brass plate resting on short legs on the bottom of the bath. It is filled with mercury and closed at one end. To the open end is sealed a device shown in detail in figure 2. Electric connection is made with the mercury in the thermostat through the platinum wire A, figure 2, which passes through the glass wall near the double seal. The low tension current which is made and broken in the thermostat at B and which operates the relay R, figure 1, is taken as a shunt from the 110-volt direct-lighting current by connecting the low-tension circuit across adjacent taps on the 1,000-ohm resistance coil H. There are seven such taps along the coil and the potential difference between two adjacent ones is about 14 volts when the coil is in the 110-volt circuit. The current which actuates the sounder is made and broken by the relay. It passes from the relay through the 32-candlepower lamp I, then through the electromagnets of the sounder, and back to the line, using the 110-volt direct current. The sounder is of the usual form, rated at 5 ohms, and heats but very slightly when the current passes through continuously. Except for the simple device shown for supporting the rubber tube, no other change in the sounder is necessary except that, if desired, the edges of the lever may be beveled so that the rubber tube is closed more easily. Small condensers, not shown, situated in the bases of the sounder and relay are used in lessening sparking when the currents are opened and closed in the thermostat and the relay respectively.

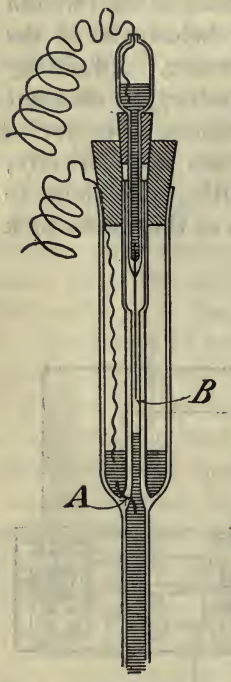


FIG. 2.—Detail of thermostat.

If cooling water is added at a rate very slightly more rapid than is necessary, the temperature is controlled with great exactness. Under these conditions, however, not enough cool water would be supplied should the room temperature rise considerably. On the other hand, if cold water is added too rapidly the bath becomes much undercooled at each addition. It has been found well so to regulate the supply that water is added to the bath about half the time. The temperature is then controlled within 0.1° C. irrespective of changes in room temperature.

Approved.

JAMES WILSON,
*Secretary of Agriculture.*