CLXXXVII.—*A Simple Electrically Controlled Thermostat.*

By JOHN ARNOLD CRANSTON.

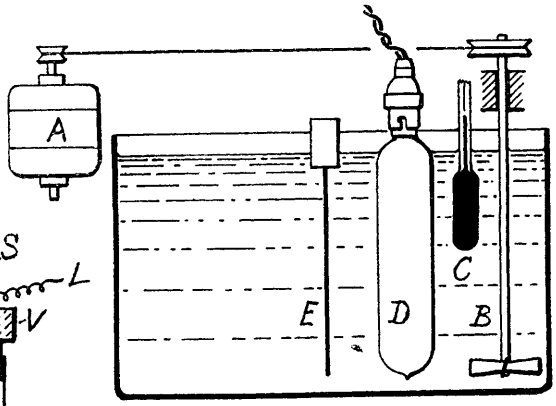
THIS thermostat is of a type that has been in use for a number of years in this laboratory, and as it has certain advantages in respect of compactness and economy in use of electric current, a description of it seems desirable.

The vessel (Fig. 1) consists of a glass accumulator jar, 40 × 28 × 22 cm., of 25 litres capacity; it is divided into two approxi-

mately equal portions by a glass plate, *E*, which is suspended from its sides and serves to improve the efficiency of stirring by directing the flow of the water from the stirrer into a one-way stream round the tank. Water is kept in the vessel to a level some 2 cm. above this plate.

The rear portion of the vessel contains (i) a heating lamp *D*, of the Robertson radiator type consuming 1 amp. at 250 volts,

FIG. 1.



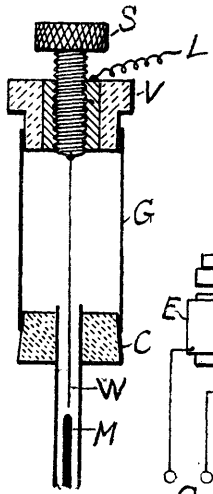


FIG. 2.

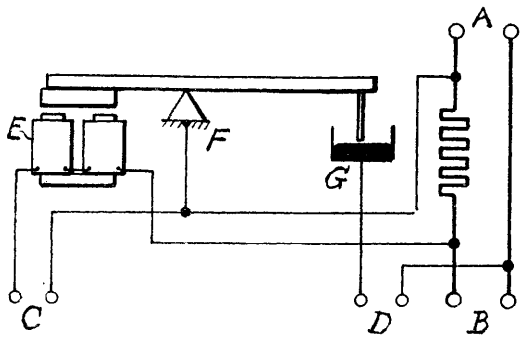


FIG. 3.

(ii) a stirrer *B*, consisting of a monel metal propeller mounted on a shaft which is connected to a bicycle hub and driven by an electric motor or hot-air engine *A*, (iii) a thermoregulator *C*, consisting of a bulb with a capillary stem. A piece of platinum wire, sealed into the bulb, enables electrical contact to be made with the mercury within. A piece of nichrome wire, *W* (Fig. 2), acts as the other terminal of the circuit and makes and breaks contact with the surface of the mercury *M* in the capillary tube. The wire is soldered to the base of the screw *S*, which is in electrical

contact with the lead-in wire L. The screw is mounted in a vulcanite cap V, supported by a glass tube G and rubber cork C. By means of this screw, contacts may be set to operate at any desired temperature.

The thermoregulator circuit includes a coil of wire E (Fig. 3) of the electric-bell type, above which is suspended a piece of soft iron attached to the lever arm of a balance; when expansion of mercury in the capillary tube closes this circuit, the current flowing through the coil attracts the soft iron and so draws the other lever arm out of a trough of mercury G, thus breaking the main circuit of the heating lamp. The regulator circuit requires a low-voltage current, which is obtained by inserting a piece of nichrome wire of about 7 ohms resistance in the main circuit driving the motor stirrer, and by tapping the current from the ends of this wire. A convenient form of resistance is the wireless rheostat.

If it is desired to maintain the temperature constant for an experiment lasting several weeks, and the circumstances are such that a single failure in the make-and-break system, with its consequent rise in temperature, would ruin the experiment, the following precaution can be adopted. A second thermoregulator can be inserted in parallel with the first, but set to operate at a slightly higher temperature than the desired one.

Since a continuous flow of electric current is necessary to operate the thermoregulator, economy of current is effected by using it to drive the motor instead of having a lamp in circuit providing useless illumination.

The electrical connexions are shown diagrammatically in Fig. 3; an ordinary electrical wall block, $9'' \times 9''$, is used for mounting (i) all the required terminals, (ii) the make-and-break of the heating circuit, (iii) the shunt for the low-voltage current supply, and (iv) two condensers of about 0·5 microfarad capacity each. These are inserted to minimise the sparks in the two make-and-break circuits.

A test with a Beckmann thermometer showed the variation of temperature at 25° to be 0·03°.

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