

New Hot Stage.

By W. S. LAZARUS-BARLOW, M.D., F.R.C.P.

PLATE VII.

THE inventor exhibited and described at the June Meeting a new form of warm stage, which can be heated by either gas or oil. The principle of the apparatus is that of a balance and a manometer combined. The stage itself is a brass box, which contains a series of flattened and communicating glass bulbs, connected with a mercury manometer of particular shape. A glass tap is fused into the manometer between it and the stage itself. Over the mercury in the open limb of the manometer is an iron float, suspended by silk from one arm of the beam of a balance. This beam is supported on a knife-edge, and is provided with an adjustable weight at the end distal from the warm stage, and a silver rod suspended by loops of platinum-iridium at the proximal end. The silver rod is bent downwards at one end, and is placed at right angles with the beam, both being in the horizontal plane. The bent portion of the silver rod dips into a small bath, which is brazed to the side of the warm stage, and contains paraffin of M.P. about 58° .

The apparatus works as follows. Heat from a flame is applied to the silver rod at the unbent end, and is conducted to the paraffin in the bath at the side of the stage, and thence to the stage itself. Variations in the temperature of the stage are conveyed to the air in the glass bulbs within the stage, and express themselves by expansion or contraction of that air, and therefore by variations in the level of the mercury in the manometer. These variations of the level of the mercury allow the entire weight of the iron float in the distal limb of the manometer to act upon the beam (when the mercury recedes sufficiently to lose contact with the float), or remove the entire weight of the float from the beam (when the mercury rises sufficiently to slacken the silk thread connecting the beam and the float). Intermediate positions of the mercury, of course, allow intermediate proportions of the weight of the float to act upon the beam. Hence the weight on the side of the beam towards the warm stage varies inversely as the volume of the air within the glass bulbs, i.e. inversely as the temperature of the stage itself. Consequently (the beam being free to move about its fulcrum) the cooler the stage the deeper the heated silver rod is plunged into the bath of paraffin, and *vice versa*; this greater immersion of the heated silver rod heats the stage, expands the air in the bulbs, raises the mercury in the distal limb of the manometer, supports the iron float, and allows the beam to revert to its original horizontal position—or

even become somewhat tilted in the opposite direction—with the result that less heat is given to the stage, the stage cools somewhat, and the cycle of events re-commences.

It will have appeared from the last paragraph that the construction of the beam and its component parts is of some importance. The beam itself is made of magnalium—a newly-discovered alloy of magnesium and aluminium, which is rigid and of low specific gravity—in order to re-act readily to slight variations in weight at either end. In commencing work, the beam is so adjusted by means of the adjustable weight and the silk thread attached to the float, that when the entire weight of the float is acting the beam is inclined downwards towards the stage, and the bent portion of the silver rod is well immersed in the paraffin; when the iron float is supported, the inclination of the beam is such that the silver rod is just above the level of the paraffin, and when the float just touches the surface of the mercury, the beam is horizontal.

Having arranged the beam satisfactorily, the glass tap connected with the glass bulbs is turned full open, and heat is applied to the silver rod. As soon as the desired temperature has been reached, as indicated by a thermometer inserted in one side of the stage, the glass tap is turned off, and the oscillations about that temperature commence. The stage shown had been kept at a temperature not varying more than 1° on either side of 100° F. day and night for a week.

In describing the apparatus (fig. 84, pl. VII.) the author referred to many difficulties met with during its evolution, and particularly that dependent upon the existence of an irregular expansion of copper about the temperature of 100° F. It was this which necessitated the employment of glass bulbs to contain the air, instead of allowing the stage itself to act as the air-containing closed box connected with the manometer.

The Bunsen burner for the apparatus is of a new model, being provided with a safety cock for shutting off the gas in case of accidental "firing back." This cock is situated close to the base of the burner on the horizontal tube, and is provided with a long arm, to which a spring is attached. This arm is soldered with soft solder to the bottom of the vertical tube of the burner, and in this position the gas is full on and the spring is stretched. If the Bunsen fires back, the lower part of the burner becomes rapidly heated, the solder melts, and the recoil of the spring turns the cock and shuts off the gas.

The author acknowledged the great help he had received in the preliminary stages from Mr. W. T. Hillier, M.R.C.S., his former assistant in the Cancer Research Laboratories of the Middlesex Hospital, and from Mr. Swift, of Tottenham Court Road, who made the finished apparatus from rough models and drawings.

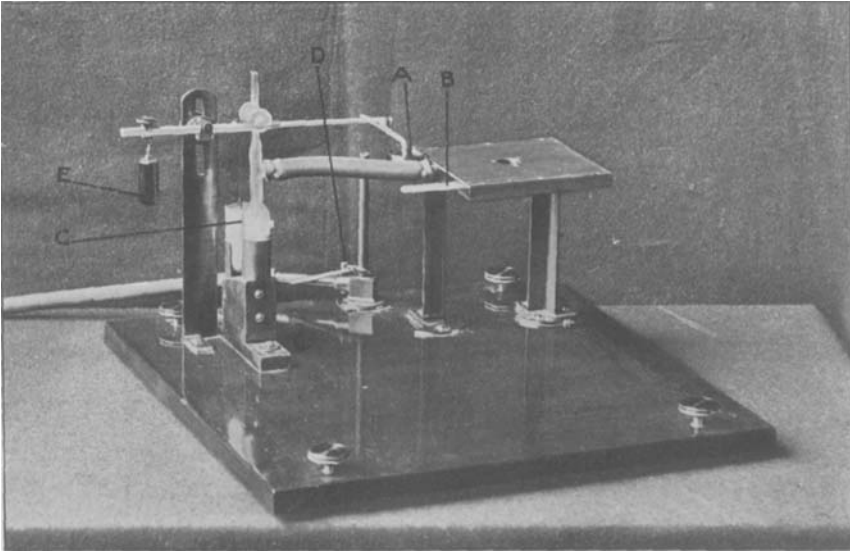


FIG. 84.

- A. Points to the paraffin bath brazed to the stage, into which dips the bent end of the silver heat-conducting rod.
- B. The thermometer.
- C. The manometer, with its glass tap on the limb (nearer the observer), and its open limb, over which hangs the iron float (further from the observer).
- D. The spring safety cock attached to the gas supply of the Bunsen burner.
- E. The adjustable weight at the distal end of the beam.