# A Simple Air-conditioning Chamber for Laboratory Experiments.

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FOR the carrying out of various investigations on the physical and physico-chemical properties of wood, which are now in progress in this laboratory, it was considered necessary that such experiments should be conducted under controlled conditions of temperature and humidity. The importance of having constant temperature and humidity conditions during the course of an experiment has been recognised in recent years not only in timber physics but also in other branches of research, such as the study of textile fibres, paper pulp, drying of paints, corrosion of metals, etc. Several authors have described methods of controlling temperature in large air thermostats (*vide* Clark, *Hydrogen Ions*, 1925, p. 232; U. R. Evans, *J. Soc. Chem. Ind.*, 1931, **40**, p. 66; and W. H. J. Vernon, *Trans. Farad. Soc.*, 1931, 27, pp. 241). For controlling the relative humidity of air in a chamber various arrangements have been described,

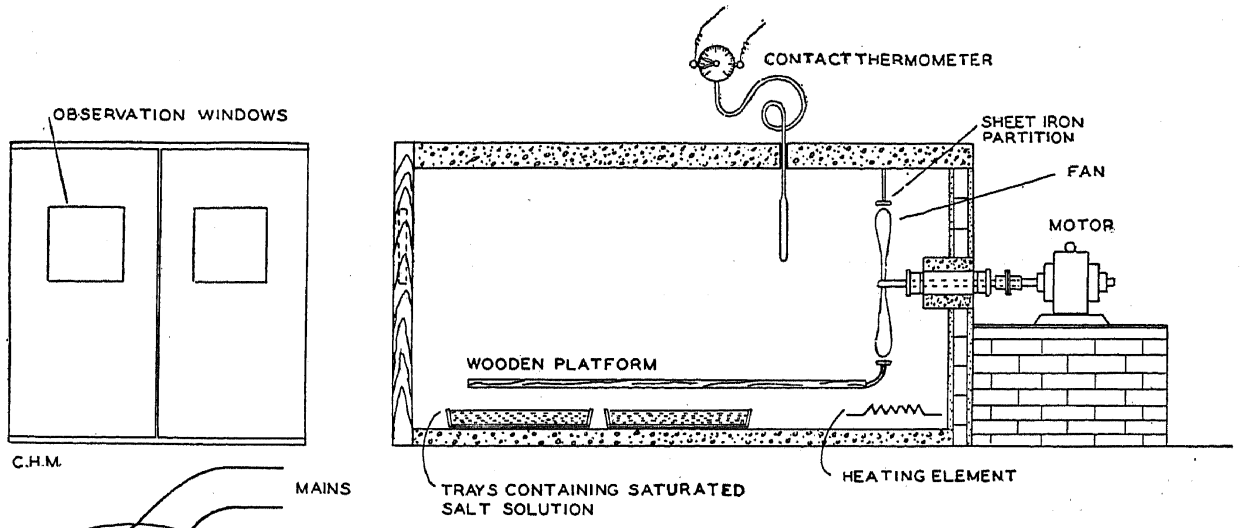


FIG. 1.

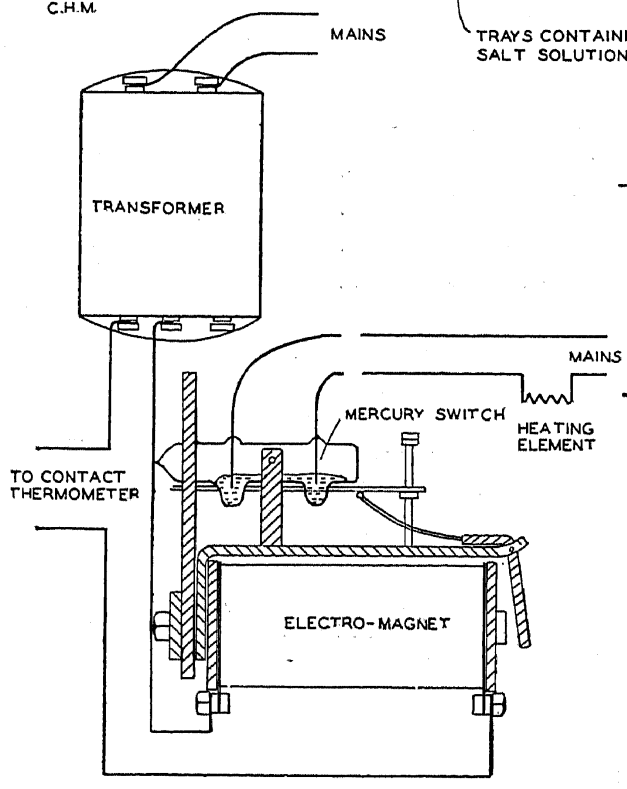


FIG. 2.

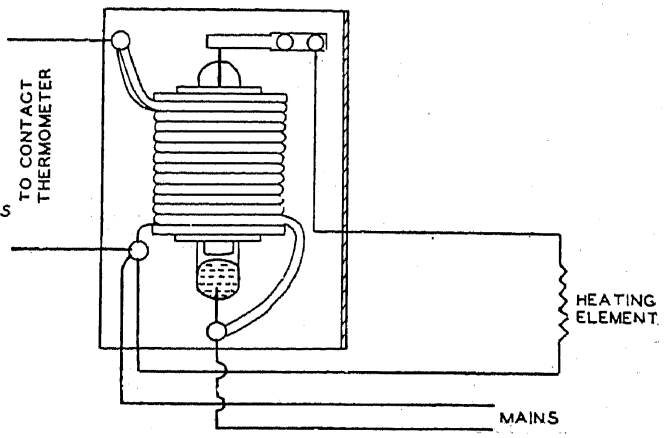


FIG. 3.

that of Vernon and Whitby (*Trans. Farad. Soc.*, 1931, **27**, p. 248) being quite accurate. The method, however, could not be adopted for large-scale experiments on the shrinkage and swelling of wood, where a rapid and uniform circulation of air is desired.

After several preliminary experiments, it was found that the most suitable arrangement was to circulate air by means of a propeller fan inside a closed chamber, control the relative humidity of air by means of saturated salt solutions, and maintain the desired temperature by means of heating elements operated by contact thermometers and mercury switch relays. Fig. 1 shows the constructional details of the cabinet.

The chamber is constructed of brickwork and concrete, as wood was found to warp badly with alterations in humidity from one extreme to the other. It is about 5 ft. long, 3 ft. wide and 3 ft. high. The inner walls of the chamber are plastered with a special water-proof cement and are further painted with a moisture-proof composition to reduce the absorptive capacity of the brickwork. The front is provided with two hinged wooden doors, each having a small glass window, through which the specimens inside can be reached without opening the door, thus avoiding any considerable disturbance of conditions inside the chamber. For air circulation, the blades of a fan are mounted on a shaft running in ball bearings as shown in the sketch and the fan is driven by an electric motor. The fan is placed in the centre of a sheet iron partition at the back of the chamber. A wooden platform divides the chamber into two parts, the lower one having trays containing saturated salt solution for maintaining the desired humidity. At the back of the trays one or more electric heating elements are fitted to supply the heat necessary for maintaining the required temperature.

For temperature control, a distance reading mercury-in-steel thermometer with adjustable electric contacts of the type manufactured by Messrs. Negretti and Zambra, London, is used. Mercury-in-glass contact thermometers manufactured by Messrs. Hermann Juchheim of Ilmenau, Germany, have also been found satisfactory. The latter have the advantage that sparking does not spoil the mercury contacts on account of the presence of an inert gas sealed in the capillary tube. The electrical arrangements adopted are shown in Figs. 2 and 3. Two kinds of circuits have been used, one operating with an Isenthal 'mercury switch type' relay and the other with a 'Vertex' regulator manufactured by Juchheim. The latter type differs from the former and other usual types in its manner of operation, in that the heating circuit is switched on when the magnet coil is excited. It essentially consists of a magnet system and a plunger type mercury switch. The system is connected directly to the mains, when the magnet is excited, which pulls the plunger down, thus switching on the heating circuit. When the proper temperature is attained, the current is closed through the contact thermometer shunting the magnet coil with the result that the heating circuit is switched off.

For control of humidity, as mentioned above, saturated salt solutions are used, which are kept in trays on the floor of the chamber.

The salts which we have used in our work and the relative humidities obtained are given below. For other humidities, a suitable selection can be made from the data given in the *International Critical Tables* (*vide* 1, p. 67).

| Chemicals | Relative humidity at 35° C. |
|---|---|
| Water only .. | 95% |
| $NH_4Cl$ and $KNO_3$ .. | 70% |
| $Na_2Cr_2O_7.2H_2O$ .. | 52% |
| $K_2CO_3.2H_2O$ .. | 42% |
| $KC_2H_3O_2$ .. | 28% |

Chambers as described above have been running in this laboratory for over two years. With reasonable care the largest variation in temperature is not more than 0·1°C. and the humidity variations seldom exceed 3%. Higher sensitivity with regard to temperature control can of course be attained by using a toluene regulator of sufficient capacity and by more efficient lagging of the chamber.