SYMPOSIUM ON THE DEPOSITION OF ICE ON EXPOSED SURFACES

(Joint Meeting of the Society and the Institute of Refrigeration

held at the Royal Geographical Society's house on 30 *March* 1950)

Mr. G. SELIGMAN (British Glaciological Society) opened the meeting and welcomed members of the Institute of Refrigeration and representatives of the Royal Aircraft Establishment, the Admiralty, the London Transport Executive and those of several industrial undertakings. He extended a special welcome to Dr. Vincent J. Schaefer of the General Electric Company, Schenectady.

Dr. Ezer Griffiths, F.R.S. then took the Chair for the reading of papers by Messrs. J. K. HARDY, D. H. COOMBS, G. G. LILLEY and F. S. SUTHERBY.

THE PHYSICS OF THE DEPOSITION PROCESS

By J. K. HARDY

(Royal Aircraft Establishment)

(1) THE EFFECT OF FROST ON HEAT TRANSFER TO REFRIGERATED SURFACES

Heat is extracted from refrigerated chambers by a cooler through which the air in the chamber is circulated. It is transferred from the air to the cold surfaces, which are kept cold by a refrigerating machine. If temperatures approaching freezing or below are to be maintained in the chamber, the cooler, regarded as a heat exchanger, must be relatively clumsy and inefficient because of the effect of frost which forms on the cold surfaces. The frost is formed in part from humid air which enters the chamber from outside, but in the main by distillation from whatever produce is being stored in the chamber. The rate of formation is governed as much by the nature and quantity of the material being stored as by the characteristics of the cooler. The rate of frosting and the effect of frost on the performance of the cooler can be predicted by calculation, if the condition of the air as it enters the cooler, as determined by the material being stored, is known.

When air flows over a surface which is at a lower temperature, heat is transferred to the surface by convection. If conditions are such that water condenses on the surface, the rate of transfer of heat is increased by the latent heat of condensation; when frost forms, this is further increased by the latent heat of fusion. The total rate at which heat is transferred is the sum of the two components, sensible heat and latent heat, and, except for the effect which the total may have on the temperature of the surface, each may be calculated independently. Data on the transfer of sensible heat by convection are extensive; these may be used, also, to calculate the rate of the transfer of latent heat by condensation because the coefficients of transfer are related. The calculation of rate of condensation is no more difficult than that of the rate of transfer of heat by convection.

In the case of water vapour, it so happens that the diffusivity of the vapour in air is almost identical with the diffusivity of heat. This is the reason for the simplicity of the psychromatic equation as used in wet and dry bulb hygrometry. In consequence of this, the coefficient of transfer of heat, if expressed in an appropriate manner, will have the same value as the coefficient of transfer of water by condensation, or evaporation. The coefficient of transfer of heat, k_h, is defined by the equation which gives the rate of transfer per unit area, namely

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