2. In fan system tunnel dryers and in humidifiers, the wet bulb temperature remains constant throughout, while the dry bulb temperature gradually falls to the wet bulb temperature when the air becomes saturated.
3. The wet bulb temperature and temperature of evaporation are dependent simple physical relations of moisture density specific heat and density of air, and latent heat of evaporation.
4. The above relation may be conveniently expressed in simplified terms of vapor pressure, temperature and barometric pressure by two psychrometric equations, one of which holds for all temperatures and humidities above 32 deg. fahr. and for all barometrical pressures, the other for all wet bulb temperatures below 32 deg. fahr.
5. The wet bulb temperature or evaporation temperature is most important from the standpoint of air conditioning, as it determines the total heat content of the air, and any change in heat content is indicated by a corresponding change in wet bulb temperature.
6. The vapor pressure exerted by moisture in hygroscopic materials is discussed and it has been shown that the vapor pressure of hygroscopic moisture varies with the moisture content and with the temperature.
7. Experimental data has been given on the rate of evaporation from a free water surface at various air velocities and the means for calculating the same have been indicated.
8. A method for calculating the comparative rates of evaporation of hygroscopic moisture in materials has been developed.
9. The fundamental principles underlying the drying or moistenin of materials with air are shown to be based on vapor pressure and upon the wet bulb temperature or temperature of evaporation.
10. In conclusion, it should be emphasized that the underlying principles and data herein given, while exact of themselves, cannot except in a few limited cases be directly applied in calculating the performance of the numerous types of dryers upon the market. These data must necessarily be supplemented by practical tests upon each type of dryer or system of air circulation. The chief value of these data is that they permit a rational interpretation of the results obtained in practice and permit very accurate determinations of the variation in results which will be secured by varying the conditions of drying, such as air velocity, temperature and humidity.

APPENDIX

The following data is used in the determination of the theoretical wet bulb or temperature of evaporation.

In the fundamental formula:

$$W = \frac{r'W' - C_{pa}(t - t')}{r' + C_{ps}(t - t')}$$

and for wet bulb temperatures below 32 deg.:

$$W = \frac{(r' + 144)\,W' - C_{pa}(t - t')}{(r' + 144) + C_{ps}(t - t')}$$

W' is determined from the formula:

$$W' = \frac{Se'}{P - e'}$$

where W' = the weight of water contained in 1 lb. of dry air at saturation at temperature t';

S = the specific weight of water vapor at the temperature t';

P = the barometric pressure;

e' = the vapor pressure in inches of mercury at t'.

The values of e are taken from the tables of Marks and Davis above 32 deg. and the values determined by Prof. C. F. Marvin below 32 deg. The values of S are determined from the corresponding volume tables in which the errors have been eliminated by plotting a curve. This curve gives the formula for S in terms of e as follows:

$$S = 0.6221 + 0.0015\sqrt{e} + 0.00004445\,e^{1.25}$$

The theoretical value of S is 0.6221, which has been used by the Government. It will be seen, however, that this rises considerably with the vapor pressure and temperature.

The instantaneous heat of air is

$$C_{pa} = 0.24024 + 0.000009\,t \text{ deg. fahr.}$$

This is approximately the same value which the writer quoted from W. F. G. Swann (Phil. Trans. Royal Soc., series A, vol. 210, pp. 199-238, 1909) in the writer's paper before The American Society