In Figs. 1 and 2 are given the curves showing the probable per cent of error in the observed wet bulb depression referred to the theoretical wet bulb depression. This is what is termed the radiation error previously referred to. It will be noted that at the higher temperatures the percentage of error is exceedingly small, while at the very low temperatures the percentage of error becomes quite appreciable. The greatest error in degrees, of course, occurs in perfectly dry air. The maximum possible degrees of error in the depression is somewhat less at the lower temperatures than it is at the higher temperatures, as the per cent of error must necessarily follow the increments of total heat corresponding to the various wet bulb temperatures. Also, the maximum depressions increase somewhat faster with the temperature than do the increments of total heat.

The vapor pressures in these formulae are based on the Marks & Davis tables above 32 deg. and Professor C. F. Marvin's tables of vapor pressures below 32 deg., and these seem to be the most accurate ones available and are in perfect agreement with each other

Maximum Absorbing Capacity of Air.—The maximum amount of moisture which a pound of air with known temperature and moisture content will absorb when brought finally to the point of saturation is given by the following formula:

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

where W = the initial weight of moisture contained in one pound of dry air;

W' = the pounds of moisture contained in one pound of dry air if saturated at the wet bulb temperature at the given barometric pressure;

C_{pa} = the specific heat of air;

C_{ps} = the specific heat of water vapor;

t = the dry bulb temperature;

t' = the wet bulb temperature;

r' = the latent heat of evaporation.

Usually at standard barometric pressure this means that each pound of air will have a maximum absorbing and evaporating capacity of one and one-half grain of moisture for each degree of wet bulb depression.

In practical application, air cannot usually be brought to complete saturation and the dryer will have a per cent of efficiency depending upon the ratio of the actual to the theoretical maximum absorption. In the commercial types of dryers this will usually

vary from 50 to 80 per cent. In many types of compartment dryers it is necessary to maintain certain definite relative humidities. In these the absorbing capacity of the air can be exactly determined, as it is the difference between the maximum absorbing capacity of the air in the dryer at known relative humidity and therefore known wet bulb depression and the theoretical moisture absorbing capacity of the air introduced.

APPLICATION OF PSYCHROMETRIC PRINCIPLES TO THE DRYING AND CONDITIONING OF MATERIALS

A very interesting and practical application of psychrometric principles is in the drying and moistening of hygroscopic materials with air. In the drying of materials two different and distinct states of the material must always be taken into consideration. In the first state there is free water present in excess of the moisture which will be normally reabsorbed by the material when subjected to a saturated water vapor or saturated air. It is in this state where most of the drying has to be accomplished. In the second condition there is only hygroscopic material present, i.e., moisture which the material will absorb of itself from more or less saturated air.

The amount of moisture which can be contained by the material in the first state is variable and is either dependent upon its porosity, as in the sponge, or upon the limits of semi-fluid consistency as in flour dough. In both cases the moisture content is to a large extent determined by previous mechanical treatment, such as pressing or centrifugal action. There is a point at which the material will contain a large percentage of free moisture which cannot be removed by any mechanical action. The free moisture in the material has a very simple physical relation to the material and is evaporated with practically the same ease that moisture would be evaporated from a free water surface, except as its diffusion may be retarded by the natural lack of porosity of the material, as for example in the drying of chicle.

The maximum regain, that is, the maximum amount of moisture which materials will hold in saturated air due to their hygroscopic properties, is a very definite quantity for each material but varies greatly with different materials. For example, at 95 per cent relative humidity, cotton will hold from 19 to 20 per cent of moisture, silk will hold from 22 to 24 per cent of moisture, while wool will hold from 26 to 27 per cent of moisture. Above this to saturation the moisture content will increase rapidly to probably from 6 to 10 per cent higher in each case.

The hygroscopic moisture in the material as distinguished from