the free moisture bears a very intimate relation to the material itself. The relation is on the border line between chemical and physical, precisely as is the case with the solution of a soluble salt in water.

It is a well known physical fact that free water, whether in a vacuum or exposed to atmosphere, generates a vapor pressure at its surface which is identical with the pressure of the saturated water vapor at the same temperature as the water. In other words, a free body of water tends to saturate the space surrounding it until the vapor tension in the space and at the surface of the water are at an equilibrium. If no heat from outside were applied, then this vapor tension at the surface of the water and the final temperature of the air and saturated vapor in the given space would be the true or theoretical wet bulb temperature.

The force producing the evaporation is the vapor pressure at the surface of the water corresponding to the water temperature. The heat to maintain this vapor pressure, however, is supplied from the air where no other source of heat is available, as in the case of the wet bulb thermometer and similar phenomena.

In insoluble hygroscopic materials the vapor tension of the water in the material is apparently the same as the vapor pressure corresponding to the temperature of the material whenever the material contains more moisture than it is capable of absorbing hygroscopically. Whenever the moisture in the material is less than the maximum possible hygroscopic moisture content, the vapor pressure of the moisture in the material is less than the vapor pressure corresponding to the temperature of the material. This apparent reduction in vapor pressure of the hygroscopic material is probably caused by the affinity of the partially saturated material for moisture.

The vapor pressure corresponding to a given constant temperature decreases in a definite manner as the content of hygroscopic moisture in the material is decreased and, of course, it increases with the increase of the moisture content up to the saturation point of the material, where it is presumably the same as the vapor pressure for free water. The vapor pressure exerted by the hygroscopic material in a given material may be conveniently expressed as a percentage of the pressure of saturated water vapor at the same temperature.

Fig. 3 gives the percentage of vapor pressure exerted by the hygroscopic moisture in American cotton at 77 deg. fahr., according to determinations made by Schloesing. It will be seen from this that the vapor pressure increases relatively slowly with a small moisture content and also with a high moisture content, while the most rapid

increase of vapor pressure occurs at about 38 per cent of normal vapor pressure, or at about 5 parts moisture per 100 parts of dry material. This vapor pressure curve is characteristic of all hygroscopic materials, although the corresponding percentages of moisture in the material vary widely with the nature of the material.

The absolute vapor pressure of the moisture in the material is, as previously stated, dependent upon the temperature of the material, as well as upon its hygroscopic moisture content. Material that is exposed to an atmosphere having a lower vapor pressure than that of the moisture in the material, the hygroscopic moisture will tend to evaporate from the material until an equilibrium in vapor tension

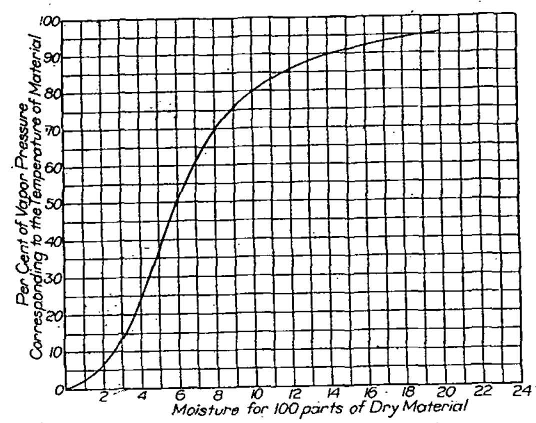

FIG. 3. VAPOR PRESSURE OF MOISTURE IN AMERICAN COTTON AT 77 DEG. FAHR.

between the moisture in the material and the moisture in the atmosphere is reached. In this process sensible heat is absorbed either from the material or the atmosphere or both and converted into latent heat of the water vapor released. Conversely, when the vapor tension in the material is lower than that of the surrounding atmosphere moisture is actually absorbed by the material from the atmosphere until the two vapor pressures are equalized. In this absorption process the water vapor is actually condensed into a liquid within the material and the latent heat of absorption is liberated, raising both the temperature of the material and of the surrounding air a corresponding amount. This is an effect often overlooked by engineers. A dry product will liberate heat very rapidly in the absorption of moisture and in some cases so rapidly as to injure the product when there is a high temperature of the saturated