temperature of the air mixture in the coil falls below the entering dew-point temperature, moisture removal proceeds. The indications are that the lower the leaving dry-bulb temperature below the entering dew-point temperature, the less will be the difference between the leaving dry-bulb temperature and the leaving dew-point temperature.

The first portion of a cooling coil (in the direction of air flow) may function in the same manner as a dry cooling coil. Where the moisture removal starts, the cooling surfaces also continue the removal of sensible heat, thereby carrying the load due to both. As saturation is approached in the cooling coil, each degree of sensible cooling is approximately matched by a

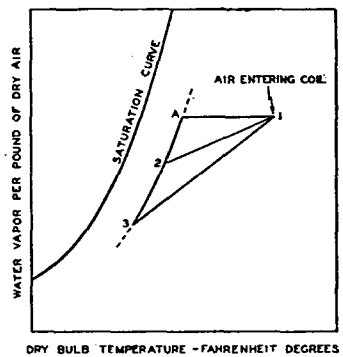

FIG. 12. PERFORMANCE OF DEHUMIDIFYING COIL

corresponding degree of dew point decrease. However, while the sensible heat removal from the dry air remains approximately constant per degree change, the amount of latent heat removal per degree of dew point change varies considerably because moisture content varies widely at different temperatures.

For example, the following tabulation compares the amount of moisture removal involved in a reduction of one degree of dew point from 60 to 59 F with the removal from 50 to 49 F:

DEW POINT	$W_s \times 10^3$ lb/(lb)	DEW POINT	$W_s \times 10^3$ lb/(lb)
60	11.080	50	7.658
59	10.690	49	7.374
DIFFERENCE	0.390	DIFFERENCE	0.284

The above values are given in Table 2, Chapter 3.

When cooling coils act as dehumidifying coils, the performance can be predicted accurately only from tests at a sufficient number of points to establish the definite performance characteristics of the coil under varying conditions of loading and of entering air. Dehumidifying coils employing volatile refrigerants are generally rated in conjunction with specific refrigerant distributing and flow control equipment. The combination of the coil with its refrigerant control equipment (such as distributor and expansion valve, and capillary tube or float valve) must be tested at both the higher and lower capacities of its rated range. The lower capacities

impose a test on the distributor to provide equal distribution and on the control to modulate without *hunting* at the lower capacities. The higher capacities result in a greater pressure drop through the coil system and a test of the maximum feeding capacity of the flow control device at various *head pressures*.

Most coil manufacturers have their own methods of producing performance rating tables from a suitable number of coil performance tests. Several such methods have been reported in the literature of the industry. A standard titled Standard Methods of Testing and Rating Forced-Circulation Air-Cooling and Air-Heating Coils has been completed by the *Heating and Cooling Coil Manufacturers' Association* and the *Air-Conditioning and Refrigeration Institute*.

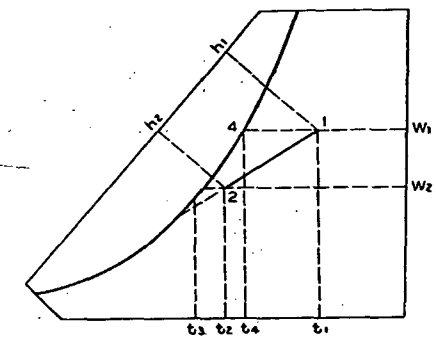

FIG. 13. PSYCHROMETRIC ARRANGEMENT OF COOLING COIL IN CENTRAL SYSTEM

DETERMINING REFRIGERATION LOAD

The following determination of the refrigeration load shows a division of the true *sensible* and *latent heat* loss of the air, which is accurate within the limitations of the data. These divisions will not correspond to load determination obtained from approximate factors or constants.

The total refrigeration load q_t of a cooling and dehumidifying coil (or air washer) is indicated on Fig. 13 and consists of the following components:

1. The *sensible heat* q_s removed from the dry air and moisture in cooling from entering temperature t_1 to leaving temperature t_2.
2. The *latent heat* q_e removed to condense the moisture at the dew-point temperature t_4 of the entering air.
3. The heat of *subcooling* q_w removed from the condensate in cooling it from the condensing temperature t_4 to the leaving condensate temperature t_3.

Items 1, 2, and 3 may be related by

$$q_t = q_s + q_e + q_w \tag{5}$$

If only the *total heat* value is desired, it may be computed by

$$q_t = (h_1 - h_2) - (W_1 - W_2)h_{w2} \tag{6}$$

where

h_1 and h_2 = enthalpy at points 1 and 2 respectively.