$$t_s = \frac{9.78 \times 57.3 - 102}{8.78} = 52.3$$

(5) The total coil load may be calculated from the enthalpy difference across the coil and the air quantity using the weight of dry air instead of the weight of the mixture.

$$q_t = G_a\,(h_1 - h_2)$$
$$= 1700\,(49.24 - 23.77) = 43{,}200 \text{ Btu per (hr) (sq ft of face area)}$$

where

G_a = weight of dry air per (hour) (square foot of coil face area).
h_1 = enthalpy of air vapor mixture entering coil, Btu per pound of dry air.
h_2 = enthalpy of air vapor mixture leaving coil, Btu per pound of dry air.

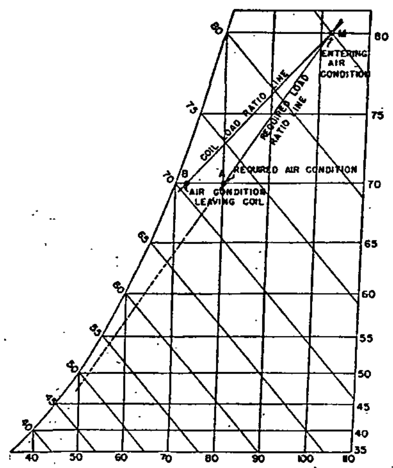

FIG. 14. PSYCHROMETRIC LAYOUT FOR COIL SELECTION USING REHEAT

(6) The refrigerant temperature may be found from Equation 9

$$\frac{43{,}200}{15 \times 6 \times \frac{325}{15}} = (t_s - t_r) = 22.1$$

Therefore, $t_r = (52.3 - 22.1) = 30.2$.

Thus a coil 6 rows deep, operating at a refrigerant temperature of 30.2 F and a face velocity of 400 fpm, is required; and it will carry a total load of 43,200 Btu per (hour) (square foot of face area). The air conditions leaving the coil are too low for the conditions of the problem and therefore it is necessary to by-pass air at the entering condition to obtain the desired result of 80.5 F dry-bulb and 73 F wet-bulb.

Although the preceding solution is satisfactory, it may be more desirable in some cases to use a higher refrigerant temperature and employ reheat to obtain the desired load ratio. Such a solution is shown in Fig. 14. In this case, the coil load ratio line intersects the saturation curve and, therefore, a coil of any depth may be selected.

If a coil depth of 6 rows is maintained, the exit air conditions for the coil are indicated at point B Fig. 14 as 72.3 F dry-bulb and 70.8 F wet-bulb, and the surface temperature will be:

$$t_s = \frac{9.78 \times 72.3 - 102}{8.78} = 69.0$$

The coil load will be: $q_t = 1700\,(49.24 - 34.66) = 24{,}800$ Btu per (hour) (square foot of face area) and the refrigerant temperature will be found from Equation 9:

$$\frac{24{,}800}{15 \times 6 \times \frac{325}{15}} = (t_s - t_r) = 12.7$$

Therefore, $t_r = 69.0 - 12.7 = 56.3$.

Thus, for the case where reheat is used, a coil 6 rows deep operating at a refrigerant temperature of 56.3 F is required. The total coil load will be 24,800 Btu per (hour) (square foot of face area) but the actual effective load will be less by the amount of reheat required. Therefore, for a given load, a larger coil and more refrigerating capacity are required when reheat is used.

LETTER SYMBOLS USED IN CHAPTER 35

η = fin efficiency.
A = external area of coil, square feet per (square foot of coil face area) (row of coil depth).
$B = \dfrac{t_1 - t_{dp1}}{t_2 - t_{dp2}}$.
D = internal diameter of tube, inches.
G = air mass velocity, pounds per (hour) (square foot of coil face area).
G_a = dry air mass velocity, pounds dry air per (hour) (square foot of coil face area).
f_i = film coefficient of heat transfer between fluid and internal coil surface, Btu per (hour) (square foot internal surface) (Fahrenheit degree mean temperature between fluid and surface).
f_o = film coefficient of heat transfer between air and external coil surface, Btu per (hour) (square foot external surface) (Fahrenheit degree mean temperature difference between air and coil).
h_1 = enthalpy of air-vapor mixture entering coil, Btu per pound of dry air.
h_2 = enthalpy of air-vapor mixture leaving coil, Btu per pound of dry air.
k = conductivity of pipe or tube material, Btu (square foot) (hour) (Fahrenheit degree per inch thickness).
L = thickness of tube wall, inches.
N = number of rows of coil depth.
n = a constant, exponent of G in Equation 8, obtained by plotting, on logarithmic coordinates, G against values of f_o. The value of n is the slope of the line.
q_s = sensible heat transferred, Btu per (hour) (square foot of coil face area).
q_t = total heat transferred by coil, Btu per (hour) (square foot of face area).
R = ratio between external and internal surface of tube.
t = average water temperature, Fahrenheit degrees.
t_1 = dry-bulb temperature of air entering coil, Fahrenheit degrees.
t_2 = dry-bulb temperature of air leaving coil, Fahrenheit degrees.
t_m = minimum dry-bulb temperature possible without dehumidification, Fahrenheit degrees.
t_{dp1} = dew-point of air entering coil, Fahrenheit degrees.