A is the total heat in Btu contained in the mixture above 0 deg F, and is to be referred to column of figures at left side of chart.

B is the grains of moisture of water vapor contained in each pound of the saturated mixture and is to be referred to the figures at the left side of the chart.

C is the grains of moisture or water vapor per cubic foot of saturated mixture, and is to be referred to the figures at the left side of the chart and divided by ten.

D is the weight in decimal fractions of a pound, of one cubic foot of the saturated mixture, and is referred to the first column of figures to the right of the saturation line between the vertical dry-bulb temperature lines 170 and 180 F. The relative density of the mixture is read in a similar manner from the same curve by the column of figures between the vertical dry-bulb temperature lines 180 and 190 F.

E is similar to *D* but is for dry air, devoid of all moisture or water vapor. For convenience, the approximate absolute temperature of 500 F is given at 40 F on the satura-

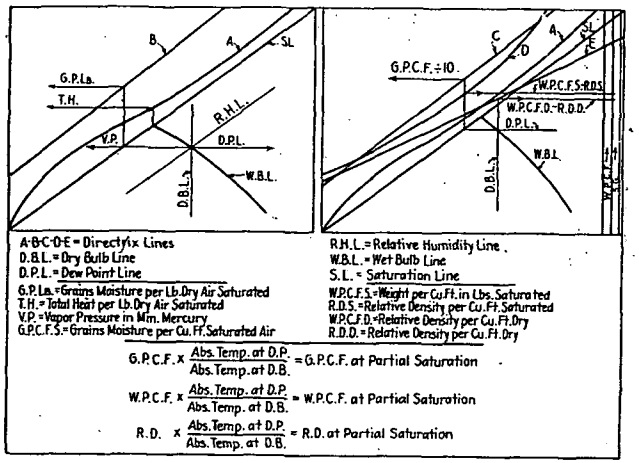

FIG. 2. DIAGRAMS SHOWING PROCEDURE TO FOLLOW IN USING BULKELEY CHART

tion line for the purpose of calculating volume, weight per cubic foot and relative density at partial saturation.

Examples in Use of Chart (Fig. 1)

Example 3. Relative Humidity: At the intersection of the 78-F wet-bulb line and the 95-F dry-bulb line, the relative humidity is read directly on the straight diagonal lines as 45.7 per cent.

Example 4. Dew-Point: At the intersection of the 78-F wet-bulb line, the dew-point temperature is read directly on the horizontal temperature lines as 70.9 F.

Example 5. Vapor Pressure: At the intersection of the 78-F wet-bulb line and the 95-F dry-bulb line, pass in a horizontal direction to the left of the chart and on the logarithmic scale read the vapor pressure as 19.4 millimeters of mercury. (Divide by 25.4 for inches).

Example 6. Total Heat Above 0 Deg in Mixture per Pound of Dry Air Saturated with Moisture: From where the wet-bulb line joins saturation line, pass in vertical direction on 78-F dry-bulb line to its intersection with curve *A* and on the logarithmic scale at the left of the chart read 40.6 Btu per pound of mixture. The use of this curve to obtain total heat in the mixture at any wet-bulb temperature is a great convenience, as the number of Btu required to heat the mixture and humidify, as well as the refrigeration required to cool and dehumidify the mixture, can be obtained by taking the difference in total heat before and after treatment of the mixture.

Example 7. Grains of Moisture per Pound of Mixture: From 70.9 F dew-point temperature on the saturation line, pass vertically to the intersection with curve *B* and on the logarithmic scale at the left read 114 grains of moisture per pound.

Example 8. Grains of Moisture per Cubic Foot of Mixture, Partially Saturated: From 70.9 F dew-point temperature on the saturation line proceed in a vertical direction to curve *C*, and on the logarithmic scale to the left read 83.3, which divided by 10, gives 8.33 grains. A temperature of 70.9 F is equal to an absolute temperature of 530.9, and 95 F equals 555 F, absolute temperature. Therefore, $\frac{530.9}{555} \times 8.33 = 7.97$ grains per cubic foot of partially saturated mixture.

Example 9. Grains of Moisture per Cubic Foot of Dry Air, Saturated: Starting at the saturation line at the desired temperature, pass in vertical direction to curve *C* and on logarithmic scale, on left, read and divide by 10.

Example 10. Weight per Cubic Foot of Dry Air and Relative Density: From point where, for example, the 70-F vertical dry-bulb line intersects curve *E*, pass to right side and read 0.075 lb; if cubic feet per pound is desired, divide 1 by this amount. The relative density is read immediately to the right as 1.00.

Example 11. Weight per Cubic Foot of Saturated Air and Relative Density: From point where, for example, the 70 F vertical line intersects the curve *D*, pass to the right and read weight per cubic foot as 0.07316 with a relative density of 0.9755 for saturated air at 70 F.

Example 12. Weight per Cubic Foot and Relative Density of Partially Saturated Air: Air at 50 F and a wet-bulb temperature of 46 F is to be heated to 130 F. The wet- and dry-bulb lines intersect at a dew-point temperature of 42 F. Pass to the left where this dew-point line intersects the saturation line and then pass in a vertical direction to where the 42 F dry-bulb line intersects with curve *D*. Then pass directly to the right and read the weight per cubic foot of saturated air at 42 F as 0.07844 and the relative density as 1.046. The absolute temperature at 42 F is 502 F, and at 130 F is 590 F. Therefore, $\frac{502}{590} = 0.851$. The weight of 1 cu ft of air at 50 F dry-bulb and 46 F wet-bulb when heated to 130 F is $0.07844 \times 0.851 = 0.06675$, and the relative density is $1.046 \times 0.851 = 0.89$.

CALCULATION OF VAPOR PRESSURE

A formula has also been derived which will permit the approximate calculation of the vapor pressure from the wet-bulb temperature observation. This is useful particularly in determining relative humidities for conditions other than the standard barometric conditions for which the psychrometric chart is made. The formula for expressing this relationship is:

$$e = e' - \frac{(P - e')(t - t')}{2{,}800 - 1.3t'} \qquad (5)$$

where

e = partial pressure of the moisture in the air, which also equals vapor pressure corresponding to the dew point.
e' = the vapor pressure corresponding to saturation at wet-bulb temperature t'.
P = the barometric pressure.
t = dry-bulb temperature in deg fahr.
t' = wet-bulb temperature in deg fahr.

TOTAL HEAT

In cooling and dehumidifying air, it is necessary to take into consideration not only the sensible heat of the air itself but the latent heat of the moisture removed, as in Example 2.