TABLE 3. DENSITY OF LITHIUM CHLORIDE SOLUTIONS

Concentration, Pound Mols (42.4 lb) *LiCl* per 1000 lb Water	Temperature F Deg						
	0	50	100	150	200	250	300
0							
2		1.045	1.037	1.026	1.012		
4	1.090	1.085	1.076	1.064	1.052		
6	1.124	1.119	1.111	1.100	1.087		
8	1.156	1.150	1.143	1.132	1.122		
10	1.188	1.181	1.172	1.162	1.152	1.142	
12	1.217	1.209	1.199	1.188	1.178	1.168	
14	1.242	1.235	1.225	1.214	1.203	1.192	
16		1.257	1.248	1.236	1.226	1.215	
18		1.279	1.270	1.259	1.248	1.237	
20			1.291	1.280	1.279	1.568	
22				1.310	1.289	1.278	1.267
24				1.317	1.307	1.296	1.286
26					1.313	1.312	1.302
28					1.338	1.327	1.318
30						1.34	1.33
32							1.35

Example 1. Determine the dew-point, wet-bulb, per cent saturation and humidity ratio of air in equilibrium at 100 F with pure lithium chloride solution of density 1.270.

Solution. From Table 1 the concentration of a solution of density 1.270 at 100 F is 18.0 *M*. From Fig. 2 the dew-point of 18 *M* lithium chloride at 100 F is 43.7 F. From Table 1, Chapter 3, the partial pressure of water over the solution is 0.2857 in. of Hg, and the humidity ratio is 0.00602 lb per pound dry air. From the Mollier Diagram the wet-bulb is 66.3 F, and the per cent saturation is 14 per cent.

Example 2. Determine the boiling point, and freezing point of 18 *M* lithium chloride solutions.

Solution. From Table 1, boiling point (standard) is 285.8 F, freezing point is 58.1 F.

Example 3. Calculate the heat of vaporization of 1 lb of water from a large amount of 18 *M* lithium chloride solution at the boiling point.

Solution. The heat of boiling is equal to the heat of mixing plus the heat of boiling pure water at the same temperature. The heat of mixing from Table 1 at 18 *M* and 285.8 F is 145 − (0.186 × 285.8) = 92 Btu per pound. The heat of vaporization of water from steam tables at 285.8 F is 920 Btu per pound. Therefore the heat of vaporization of water from the solution is 920 + 92 = 1012 Btu per pound.

Example 4. One thousand pounds of air per minute at 100 F dry-bulb with a dew-point of 70 F and 36.7 per cent saturation are passed over 18 *M* lithium chloride solution. The rate of flow of the solution is 200 gpm and the entering temperature is 80 F. The air leaves the absorber at 85 F dry-bulb and dew-point of 35 F. Calculate (*a*) the heat to be removed from the lithium chloride solution to maintain these conditions, and (*b*) the temperature rise of the solution in passing through the absorber.

Solution. (*a*) The enthalpy of the entering air at 100 F dry-bulb and 36.7 per cent saturation = $h_a + \mu h_{as}$ = 24.029 + (0.367 × 47.70) = 41.54 Btu per pound (Table 1, Chapter 3).

The per cent saturation of the air leaving at 85 F dry-bulb and 35 F dew-point is 16.2. Enthalpy of leaving air = 20.42 + 0.162 × 29.01 = 25.12 Btu per pound (Table 1, Chapter 3).

Heat to be extracted from air = 1000 (41.54 − 25.12) = 16,420 Btu per minute. Heat of mixing = 145 − (0.186 × 80) = 130 Btu per pound of moisture removed. From Table 1, Chapter 3, the moisture removal per pound of air = 0.01582 − 0.00428 = 0.01154 lb. Heat of mixing for 1000 lb of air = 1000 × 0.01154 × 130 = 1500 Btu. Total heat extraction = 16,420 + 1500 = 17,920 Btu per minute.

(*b*) The weight of solution circulated is 200 × 1.27 (Table 1) × 8.33 = 2116 lb per minute. Its heat capacity = 2116 × 0.631 (Table 1) = 1335 Btu per (minute) (Fahrenheit degree). The temperature rise = 17,920 ÷ 1335 = 13.4 F.

DEHUMIDIFICATION WITH SOLID SORBENTS

One type of equipment suitable for producing dehumidification with solid drying agents utilizes an apparatus with continuously rotating beds or dampers as illustrated in Fig. 4. The apparatus consists essentially of a cylinder or drum filled with a dehumidifying or drying agent. Air flow through the drum is directed by baffles which permit three independent air streams to flow through the adsorbing material. One air stream consists of the wet air which is to be dehumidified. The second is heated activation air used for drying that part of the dehumidifying material which has become saturated. The third air stream pre-cools the bed to permit an immediate pickup of moisture when that part of the bed returns to the dehydration cycle.

In the rotating bed apparatus, the baffle sheets are stationary and the screened bed rotates at a definite speed to permit the proper time of contact in the activation, cooling and dehumidifying cycles. In the

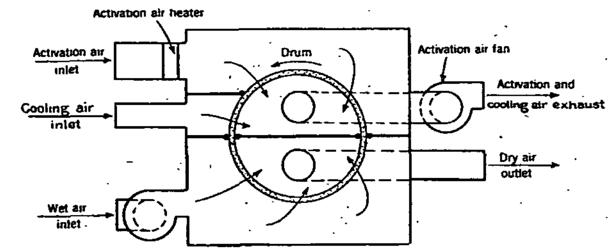

FIG. 4. SOLID ADSORBENT DEHUMIDIFIER—ROTATING BED TYPE

rotating damper apparatus, the bed remains stationary and a sectionalized damper rotates. This rotating damper produces the same general effect as if the stationary baffles previously mentioned rotated.

Clean air for activation is supplied at temperatures normally ranging from 300 to 350 F. Any source of clean heated air can be used such as air heated by electric heaters or steam coils, or air indirectly heated by coal or oil fired interchangers. Direct fired heaters are usually designed for gas since there must be no condensable, tarry, combustion products to contaminate the adsorbent. To avoid excessive contamination or clogging of the absorbent bed by dust it is frequently desirable to provide filters for the activation air.

Where activation air heating coils are supplied with steam at 80 lb per square inch gage pressure or higher, activation efficiency will remain normal and moisture removal capacity will not be reduced. When lower steam pressures are used, incomplete reactivation will result in reduced moisture removal.

Another type of solid adsorption equipment uses two complete sets of stationary adsorbing beds, arranged so that one set is dehumidifying the air while the other set is being activated. With the dampers in the position shown in Fig. 5, air to be dried flows through one set of beds and is dehumidified, while activation air is heated and circulated through the other set. After activation is complete, the beds are cooled by shutting off the activation air heaters and allowing unheated air to circulate through them.

After the beds have adsorbed moisture to a degree which begins to