TABLE 3. PRESSURE LOSSES IN DICHLORODIFLUOROMETHANE SUCTION REFRIGERANT LINES (CONCLUDED)

Copper Pipe Actual O.D. Inches	Capacity Btu per Hour	Pressure Drop in Pounds per Square Inch per 100 Ft[a]						
		Refrigerant Temperature Deg F						
		−10	0	10	20	30	40	50
4⅛	400,000	1.0	0.8	0.6	0.4	0.4	0.3	0.3
	600,000	2.4	1.8	1.4	1.1	0.9	0.7	0.6
	800,000	4.1	3.1	2.4	2.0	1.6	1.3	1.1
	1,000,000	6.6	4.8	3.7	3.0	2.5	2.0	1.6
	1,200,000	10.0	7.1	5.4	4.4	3.5	2.9	2.4
	1,400,000		10.0	7.5	5.9	4.8	3.9	3.3
	1,600,000			10.0	7.7	6.2	5.1	4.2
	1,800,000				10.0	7.9	6.4	5.3
	2,000,000					9.7	7.9	6.6
	2,200,000						9.5	7.9

[a]Length of tubing includes the average number of fittings.

ADSORPTION SYSTEMS

A diagrammatic representation of an open solid material adsorption system is shown in Fig. 9. Two or more beds of the adsorbent are used so that one bed may be used as an adsorber while another is being reactivated. Most adsorption systems use some internal means of heating the adsorbent bed before activation, and cooling it after activation. Thus, the use of relatively high room temperatures and comparatively large amounts of outside air are desirable in connection with these systems. In order to offset the effect of high air temperature, some effort is made to keep the humidity lower than usual.

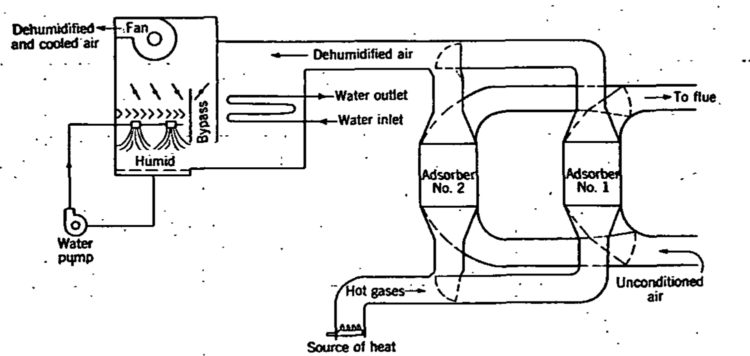

FIG. 9. OPEN SOLID MATERIAL ADSORPTION SYSTEM

Silica Gel

Silica gel has two applications when used to replace refrigeration. In the one principally used, the air from which moisture is to be extracted is taken through silica gel beds by suction or pressure fans, and by means of this process the moisture becomes adsorbed by the silica gel and the air leaves at a lower dew-point and a higher sensible temperature than those at which it entered. If this air is passed over surface coolers in which tap water or another cooling medium is flowing through tubes, a certain amount of sensible heat will be removed. The air leaves the surface cooler or interchanger with the same dew-point with which it emerged from the silica gel beds, but with a lower dry-bulb temperature, although the dry-bulb temperature may be higher than the temperature of the air entering the silica gel beds.

In another method, the first two of the steps outlined are duplicated, and in addition the air is carried through a spray type washer. Because the air enters the washer with a low wet-bulb, and because adiabatic saturation will take place at a temperature close to the entering wet-bulb, considerable cooling of the air can be accomplished; but this can be done only with a consequent increase of the dew-point.

It is necessary to reactivate the silica gel after it has adsorbed about 25 per cent of its own weight in the form of moisture. As reactivation requires a high temperature and since silica gel is only active at low temperatures, cooling of the beds must also be completed before they can be used again. This necessitates three stages in the silica gel containers and requires either three beds of silica gel or one bed divided and automatically put in position. The reactivation is usually done by means of gas or oil fires and the cooling of the beds by means of indirect water cooling or by means of small quantities of dehydrated air taken from the system beyond the interchanger.

Activated Alumina

The application is quite similar to that employed for silica gel; that is, the material is exposed to the air flow and after reaching about 75 per cent saturation is reactivated by removing the moisture adsorbed by means of applied heat. The actual scheme generally followed in the use of this material for continuous service varies somewhat from silica gel inasmuch as the material is placed in three units which are used consecutively for the different steps. These steps permit each unit to operate as follows: (1) in series with the preceding unit, (2) alone, and (3) in series with the following unit. This plan allows for adsorption, reactivation, and cooling, in a manner similar to that used with silica gel.

Taking a single unit, when it is in the (1) step and operating with the preceding unit, the alumina adsorbs approximately 25 per cent of the moisture in the air and takes up about 1.3 per cent of its weight of water. During the second step when it is operating alone, it takes up 100 per cent of the moisture in the air until the weight of the water adsorbed is brought up to about 6.7 per cent. During the third step when the unit is operating with the succeeding unit, it extracts about 75 per cent of the moisture in the air until the water weight adsorbed comes up to about 10 per cent of