and return air as shown in Fig. 4, or they may be equipped with reheaters and take in 100 per cent dehumidified air.

The systems illustrated in Figs. 1 to 4 may have either spray dehumidifiers or surface coils, and the latter may use either cold water or direct expansion refrigerant. In a few cases both sprays and coils are used. The coils may then be installed within the spray chamber, either in series with the sprays or below them. In making the selection between spray and surface dehumidifiers, certain advantages of each should be considered. The fact that a spray dehumidifier is usually designed to deliver saturated or nearly saturated air, tends to simplify the control problem. In this case the dry-bulb temperature is also the dew-point, and hence a dew-point control can be arranged by using a simple duct thermostat. Other advantages of the spray system are that it may be used for hu-

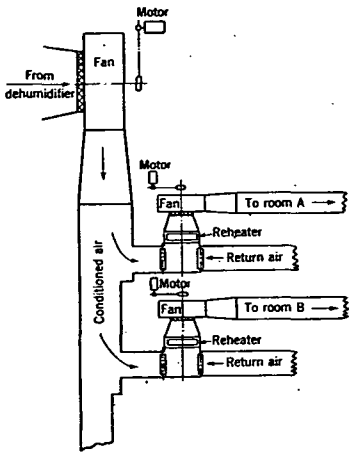

FIG. 4. CENTRAL DEHUMIDIFYING PLANT AND LOCAL RECIRCULATING FANS

midifying in winter or for evaporative cooling when the outside wet-bulb temperature is low.

Surface coil dehumidifiers seldom deliver saturated air. A wet-bulb depression of 2 to 5 F (or more) is usual, and with this higher dry-bulb temperature (for a given dew-point), reheating may be unnecessary as indicated in Table 1. Where the surface coil system can be used with direct expansion of refrigerant, it is comparatively low in initial and operating costs, but some localities have refrigeration codes which restrict the use of direct-expansion coils in the air stream. Therefore, local codes should be consulted by the engineer before a system employing direct expansion methods is designed. The performance of a surface type dehumidifier is affected by air velocity, refrigerant velocity, temperature and moisture content of the entering air, piping arrangement and coil design, and these variations must be taken into account in the design of a system which includes a surface-type unit.

TABLE 1. ROOM HEAT LOAD RATIOS FOR TYPICAL SUMMER COMFORT CONDITIONING

Room Heat Load Ratios[a]	Typical Classes of Room Service or Load				
	No. Occupants or Sources of Vapor	Private Office or Residence	Restaurant or Crowded Office	Auditorium at Capacity or Crowded Restaurant	Ballroom at Capacity
Sensible Heat / Total Heat	1.00	0.90	0.80	0.70	0.60
Total Heat / Sensible Heat	1.00	1.11	1.25	1.43	1.67
Latent Heat / Total Heat	0	0.10	0.20	0.30	0.40
Total Heat / Latent Heat	....	10.00	5.00	3.33	2.50
Sensible Heat / Latent Heat	....	9.00	4.00	2.33	1.50
Latent Heat / Sensible Heat	0	0.11	0.25	0.43	0.67
Dry-bulb Temperature of Air at Room Inlets, to Maintain Typical Room Conditions of 80 F Dry-bulb, 50 per cent Relative Humidity					
Air entering saturated[b]	60.0	58.6	56.5	53.0	35.0
Air entering with 4 F wet-bulb depression	66.5	65.4	64.1	61.8	56.0
Air entering with 8 F wet-bulb depression	72.6	72.1	71.6	70.5	68.0

[a]The overall heat load ratio for the dehumidifier will be different from the heat load ratio for the room. The extent of the difference will depend on the quantity and condition of the outside air used, upon the magnitude of the duct losses, and upon whether or not reheat or by-pass are used.

[b]Typical air conditions leaving the central conditioner are: With spray dehumidifier, 0 to 2 F wet-bulb depression. With surface-type dehumidifier, 1 to 6 F wet-bulb depression. With by-pass or reheat, 4 to 10 F wet-bulb depression.

DESIGNING THE SYSTEM

The general procedure for the design of a central system is as follows:

1. Calculate the sensible heat and latent heat gains for each room or space to be conditioned. (See Chapters 6, 7 and 8).
2. Establish the temperature of air leaving the supply inlets.
3. Calculate the quantity of air to be circulated.
4. Estimate the temperature rise in the duct system.
5. Determine the volume of outside air to be introduced. (See Chapter 3).
6. Calculate the heat to be removed by cooling and dehumidifying apparatus, and the type and arrangement of apparatus to be used.
7. Calculate the size of the reheating equipment, if any.
8. Select cooling and dehumidifying equipment, and refrigerating and reheating equipment, from manufacturers' data and performance curves.
9. Design the air filtering and distribution system, the air outlets and inlets. (See Chapters 26, 28 and 29).
10. Calculate the total static pressure of the system.
11. Select the fan, motor and drive. (See Chapters 27 and 38).
12. Select the pump and motor.
13. Design the control system. (See Chapter 37.)