glass to rise up to or slightly above the simultaneous outside air temperature, hence no heat can flow from outside air to the glass at this time.

10 ● What should be the dry- and wet-bulb temperatures in a restaurant when the outdoor dry-bulb temperature is 95 F?

Dry-bulb, 80 F; wet-bulb, 65 F (Table 2, Chapter 3).

11 ● In an office building in which the occupants remain indoors most of the day, what is the most desirable indoor dry-bulb temperature and relative humidity in summer?

76.5 F and 50 per cent relative humidity (Fig. 6, Chapter 3).

12 ● An office with western exposure in a building having concrete floors is cooled only during office hours. If the windows are bare and unshaded, what is the maximum cooling load in the office due to solar radiation through the windows?

215 × 0.97 × ½ = 104 Btu per square foot of glass per hour (Fig. 1 and Table 4, Chapter 8; note that only one-half of the heat need be considered because of absorption by the floor).

13 ● A 7 × 4 ft west window is equipped with an inside aluminum finished Venetian blind which is adjusted to fully cover the window when the sun shines. The net glass area if 75 per cent of the total area of the window. What is the cooling load due to the window at 10 a.m. and 4 p.m. assuming solar radiation as shown in Fig. 1 and dry-bulb temperatures as follows: 10 a.m., outside 85 F and inside 77 F; 4 p.m., outside 95 F and inside 80 F?

10 a.m.: $H_t = 28 \times 1.13\ (85 - 77) = 253$ Btu per hour (Equation 1, Chapter 8 and Table 13, Chapter 5).

4 p.m.: 28 × 0.75 = 21 sq ft net glass area.

21 × 215 × 0.58 = 2619 Btu per hour (Fig. 1 and Table 4, Chapter 8).

14 ● What is the cooling load of an ice cream cabinet in a restaurant due to a ¼ hp refrigerating machine having an air-cooled condenser?

4250 × ¼ = 1062.5 Btu per hour (Table 5, Chapter 8).

Chapter 9

CENTRAL SYSTEMS FOR HEATING AND HUMIDIFYING

Types of Systems, Blow-Through, Draw-Through, Heating Units, Design, Temperatures, Weight of Air to be Circulated, Temperature Loss in Ducts, Heat Supplied, Heating Units and Washer, Grate Area, Boiler Selection, Weight of Condensate, Static Pressure, Fans and Control

A FAN system of heating depends upon fans and blowers to distribute air through ducts from one centrally located plant. This chapter considers heating and humidifying systems of this type whereas similar systems arranged for cooling and dehumidifying are discussed in Chapter 10. A special type of central fan system, the mechanical warm air or fan furnace system, which is especially adapted to residences, churches, halls, and other small buildings, is covered in Chapter 24.

TYPES OF SYSTEMS

In the indirect type of central fan heating and air conditioning systems, steam is usually the medium by which heat is transferred from the boiler, or other source of heat, to the heating units. If the system is intended solely for heating, the air is passed over one or more stacks or batteries of heating units and then conveyed to the spaces for which it is intended through a system of ducts. In some cases, a predetermined amount of outside air is introduced for ventilating purposes, whereas in others the moisture content is controlled by passing the air through a washer or humidifier. If the apparatus is designed to control simultaneously the temperature, humidity, air motion, and distribution, it is known as an air conditioning system.

In the *split system*, the heating is accomplished by means of radiators or convectors, and the ventilating or air conditioning by means of the central fan apparatus. In the *combined system*, the entire operation of heating, ventilating, and air conditioning is handled by the central fan system.

A common arrangement of the central fan system of heating is illustrated by Fig. 1 and consists of a fan, a heating unit (heater) enclosed by a sheet metal casing connected with the suction side of the fan, a sheet metal casing connected to the heating unit casing run to the outside of the building and provided with an adjustable opening inside the building for recirculation of the air when desired, and a duct system attached to the fan outlet to convey and distribute the air to various parts of the building to be warmed by the apparatus. The fan is ordinarily motor-driven; there are, however, many cases when a direct-connected steam engine may be used to advantage. In this event the exhaust from the engine can be con-