From Equation 2, $V = 4005 f \sqrt{h_t}$.

From the theory of air flow, $V = 4005 \sqrt{h_v}$.

Hence, $\sqrt{h_v} = f \sqrt{h_t}$.

or

$$f = \sqrt{\frac{h_v}{h_t}} = \sqrt{\frac{1.6}{2.0}} = 0.89$$

11 ● A tank, 4 ft by 8 ft, contains a fluid which gives off injurious vapors. A large hood is located 30 in. above the top of the tank and extends slightly over its edges. Assuming that a velocity of 60 fpm is required to adequately control the vapors near the edges of the tank, calculate the air flow required.

Using Equation 4, $P = 2 \times 4 + 2 \times 8 = 24$ ft; $D = 30$ inches $= 2.5$ ft; $V = 60$ fpm.

Hence, $Q = 1.4 \times 24 \times 2.5 \times 60 = 5040$ cfm.

12 ● Silica dust with a specific gravity of 2.65 is being conveyed in a duct system. The velocity measured in a vertical portion of the system is found to be 2700 fpm. What is the maximum diameter particle transported at this velocity?

Using Equation 5a, $2700 = 13{,}300 \times \frac{2.65}{3.65} \times d^{0.570}$

from which

$$d = (0.28)^{1.75} = 0.11 \text{ in.}$$

Chapter 22

FAN SYSTEMS OF HEATING

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 9. 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 23.

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-