collector on the negative side of the fan or by lining the housing and blades with rubber.

If no future expansion of an exhaust system is contemplated, the fan motor should be chosen to provide the calculated air volume. Should, however, the exhaust system be required to handle more air in the future, the motor should be adequate for the maximum load anticipated. Further information regarding the choice of fans and motors is given in Chapter 17.

PROTECTION AGAINST CORROSION

The removal of gases and fumes in many chemical plants requires that metals used in the construction of the exhaust system be resistant to

TABLE 6. LOSS THROUGH 90-DEG ELBOWS

ELBOW CENTER LINE RADIUS IN PER CENT OF PIPE DIAMETER	LOSS IN PER CENT OF VELOCITY HEAD
50	75
100	26
150	17
200 to 300	14

chemical corrosion. A list of the materials which may be used to resist the action of certain fumes is given in Table 7. Hoods and ducts when short, may frequently be constructed of wood and be quite effective.

TABLE 7. MATERIALS TO BE USED FOR THE PROTECTION OF EXHAUST SYSTEMS AGAINST CORROSION[a]

TYPE OF FUME CONVEYED	PROTECTIVE MATERIAL TO BE USED
Chlorine	Rubber lining or chrome-nickle alloys
Hydrogen sulphide	Aluminum coated iron, aluminum, high chrome-nickle alloys
Ammonia	Iron or steel
Sulphurous gases	High chrome-nickle alloys
Hydrocholric acid	Rubber lining, chrome-nickle alloys
Nitrous gases	Nickle-chrome alloys

[a]Condensed from data given by Chilton and Huey (*Industrial and Engineering Chemistry*, Vol. 24, 1932).

Rubberized paints are available and may be applied as protective coatings in handling such gases and fumes as chlorine and hydrochloric acid.

Chapter 22

CENTRAL FAN HEATING SYSTEMS

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 CENTRAL fan system is an indirect system of heating, ventilating, or air conditioning in which fans and blowers distribute air through ducts from one centrally located plant. This chapter considers heating and humidifying systems of this type; 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 and other small buildings is covered in Chapter 23.

TYPES OF SYSTEMS

In the indirect type of central fan heating and air conditioning system, 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, 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-