

heating coil may provide the necessary heating capacity, and the steam supply to this coil may be modulated, either manually or automatically, in accordance with the temperature required in the room.

4 ● How may temperature control be obtained in a room heated by a duct system?

Air may enter the room from the central fan system at a predetermined minimum temperature. Heaters placed in the duct to bring the air up to this temperature should be equipped with face and by-pass dampers which may be adjusted by a positioning damper motor to give temperature control.

5 ● How may temperature control be obtained in a room cooled by a self-contained mechanical unit?

The fan operation may be controlled by a manual switch, while a room thermostat in conjunction with a solenoid valve may regulate the flow of the refrigerant to the coil. The thermostatic circuit might be operative only when the fans are running; and the compressor might be controlled by refrigerant pressure.

6 ● How may temperature control be obtained in a room heated by an automatically-fired warm air furnace?

A room thermostat might control the combustion unit; and a limit switch in the top of the furnace unit, when at a low setting of its control might operate the fan whenever there is a rise of temperature, and when at a high setting of its control it might shut off the combustion unit. A room humidity control operating a solenoid valve on the water supply to the humidifier, or operating a relay on the recirculating pump motor to the humidifier, may be connected in parallel with the fan motor. Humidification may be supplied only when heat is supplied and when the humidity control acts in conjunction with a time switch.

7 ● How may humidity be controlled in a unit humidifier for a steam or hot water heating plant?

Since heat is required for evaporation, a temperature limit switch, preferably of the immersion type, may be placed in the heating supply riser to cause the unit to be inoperative when heat is not available. A room humidity control will operate a solenoid valve on the water supply to the sprays. Both the solenoid valve and the humidity control may be electrically wired in parallel with a fan motor, and be subject to the temperature limit switch.

8 ● Discuss a control system, including control of humidity, for the heating cycle of a central fan system of air conditioning.

During the heating cycle it is necessary to vary the amount of outdoor air drawn into the system in accordance with the temperature of that air. It is also advisable to adjust the volume of return air when mixing it with the outdoor air so that the resultant mixture will be of constant volume delivered to the preheater coils at some predetermined constant temperature.

The reheating coil determines the dry-bulb temperature of the delivered air, so if the conditioner is equipped with both face and by-pass dampers on this coil it is obvious that these dampers should be controlled by a thermostat located at some representative position in the space being supplied with the conditioned air. If this thermostat is in turn connected with auxiliary apparatus which will vary the damper settings, it will be possible to pass more or less air through the reheater as the temperature falls or rises.

A low-limit temperature control might also be mounted in the discharge duct as a precaution against blowing cold air into the space. Such control would actuate the dampers of the reheater when the duct temperature fell below a predetermined minimum regardless of the demands of the master controller.

The amount of steam supplied to the reheater coils should be a function of the position of the dampers. If the face dampers are closed no heat is required, and to conserve steam suitable interconnection between the damper motor and the control valve should be made in order that this valve will close whenever the damper valve is closed. By adding modulating auxiliary apparatus to the steam valve, it may be made to operate proportionately to the setting of the dampers.

Chapter 15

AIR POLLUTION

Sources of Air Pollution, Effects of Air Pollution on Health, Pulmonary Effects, Occlusion of Solar Radiation, Industrial Air Pollution, Abatement of Atmospheric Pollution, Smoke Abatement, Dust and Cinder Abatement

THIS chapter considers the hygienic aspects of atmospheric pollution and the methods by which this pollution may be lessened. Information concerning the cleaning of air brought into buildings for ventilating purposes will be found in Chapter 16, and a discussion of the exhausting of dusts and toxic gases from factories and industrial plants is considered in Chapter 21.

The impurities which contribute to atmospheric pollution include carbon from the combustion of fuels, particles of earth, sand, ash, rubber tires, leather, animal excretion, stone, wood, rust, paper, threads of cotton, wool, and silk, bits of animal and vegetable matter, and pollen. Microscopic examination of the impurities in city air shows that a large percentage of the particles are carbon. (See Fig. 1, Chapter 16, for size of impurities in air.)

Dust, Fumes, Smoke

The most conspicuous sources of atmospheric pollution may be arbitrarily classified according to the size of the particles as dusts, fumes, and smoke. *Dusts* are particles of solid matter varying from 1.0 to 150 microns in size. *Fumes* include particles resulting from chemical processing, combustion, explosion, and distillation, ranging from 0.1 to 1.0 micron in size. *Smoke* is composed of fine soot or carbon particles, less than 0.1 micron in size, which result from incomplete combustion of carbonaceous materials, such as coal, oil, tar, and tobacco. In addition to carbon and soot, smoke contains unconsumed hydrocarbon gases, sulphur dioxide, sulphuric acid, carbon monoxide, and other industrial gases capable of injuring property, vegetation, and health.

The lines of demarcation in these three classifications are neither sharp nor positive, but the distinction is descriptive of the nature and origin of the particles, and their physical action. Dusts settle without appreciable agglomeration, fumes tend to aggregate, smoke to diffuse. Particles larger than one micron will eventually settle out by gravitation; particles smaller will remain in suspension as permanent impurities unless they agglomerate to sizes larger than one micron.