

INDIRECT HUMIDIFIERS

Indirect humidifiers are similar in operation to spray-type air washers, except that the water is sprayed directly against the current of incoming air. Such humidifiers comprise a chamber usually 10 ft or more in length, through which the air is drawn at a velocity from 500 to 700 ft per minute. Inside the chamber are placed one or more banks of nozzles distributed over the cross-sectional area of the chamber to produce a uniform spray. These nozzles create a finely divided spray through centrifugal action and require water pressures for effective humidification of from 35 to 45 lb per square inch. At the intake of the humidifying chamber there is provided a set of baffles for distribution of the air and for preventing the spray from escaping from the chamber. At the outlet of the humidifier chamber there is provided an eliminator. This eliminator, consisting of a series of metal baffles, is so designed as to separate all of the free, unevaporated moisture from the humidified air. Thus the air leaving the humidifier is completely saturated, but without any entrainment or unevaporated water particles. Such humidifiers are used only in connection with ventilating systems. They are practically always placed on the inlet side of the ventilating fan. Provision is made for warming the water in winter so that the air may be saturated at a definite temperature. The heating of the water usually is controlled by means of a thermostat placed in the path of the saturated air leaving the humidifier and controlling the heater through which the spray water passes.

In other cases, particularly in industrial work where high humidities are maintained, the control of the dew-point temperature is effected by a thermostat controlling the mixture of outside air and return air from the building by means of fresh and return air dampers at the inlet of the humidifier.

In industrial work the dew-point regulation is effected in winter time by both of these means operating in conjunction. In those installations where all outside air must be employed, it is usual to provide in front of the air washer certain pre-heater coils of sufficient capacity to bring the air to a temperature slightly above the freezing point. In summer time operation, whenever the outside wet-bulb temperature is above the minimum dew-point desired in the building, all outside air supply is taken and it will be observed from the psychrometric principles discussed in Chapter 27 that the air issuing from the humidifier will have been cooled to the wet-bulb temperature of the entering air, provided, of course, that the water is neither heated nor cooled by recirculation, which is usually the case in such installations.

In most manufacturing processes relatively little moisture is added to, or extracted from, the air in the room by the process itself, and as windows and doors are closed, conditions in the room rapidly stabilize to the moisture content of the entering air. Thus, it is possible to control the relative humidity within the room by proportioning the quantity of the air in accordance with the heat sources within the room, such as heat from machinery and the occupants, electric lights, sunlight and outside radiation. The quantity of air to be supplied for each unit of heat thus removed is definitely dependent upon the relative humidity to be carried.

For example, if 50 per cent relative humidity is to be carried in the room the ventilation must be restricted so there shall be a rise of 20 deg between the temperature of the entering air and that of the air in the room itself. Smaller temperature rises would give increased relative humidities. In textile mills, for instance, with the humidities usually carried it is possible to keep the room temperature within about 12 deg of the outside wet-bulb temperature. Inasmuch as the wet-bulb temperature on hot days is usually 15 deg to 25 deg lower than the dry-bulb temperature, the mill temperature will be below the outside temperature and provision has to be made by inward transfer of heat through the walls for the heat thus absorbed. The general layout of such a system of

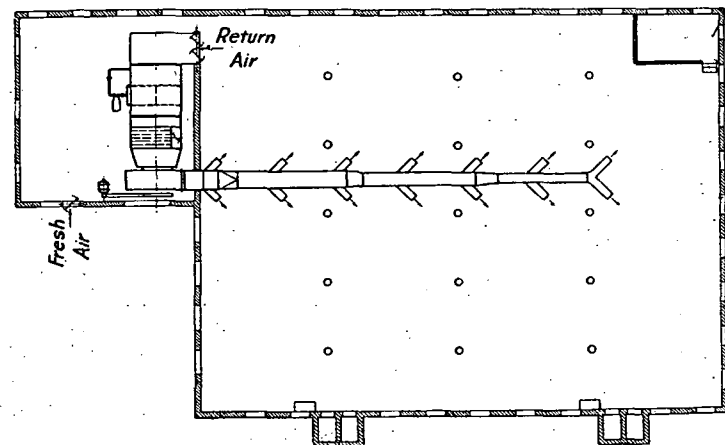


FIG. 1. LAYOUT OF A FACTORY SYSTEM OF HUMIDIFICATION AND AIR CONDITIONING

humidification and air conditioning is shown in Fig. 1. Data on the design of central fan systems are given in Chapter 31.

Dew-point control is particularly applicable where there are a number of different departments to be served from one central equipment, and where there is but little change in the moisture content of the air in the room due to moisture changes in the materials processed or due to excessive air leakage from outside.

Another system of control which is used considerably, especially where there is but one room to be controlled from one apparatus and where there may be considerable moisture change in the room itself due to local conditions, is to adjust the dew point at the apparatus, either continuously or intermittently, by means of a hygrostat placed in the room and so connected as to vary either the temperature or quantity of spray water used in the humidifier, or both. This system may be designated as *direct relative humidity control*.

In direct humidity control installations the temperature and humidity