The window fan may be located in a hall or an unused bedroom. Noise of operation is more of a problem with the window fan than with the attic type, although care should be taken to locate either type of fan so that occupants are not disturbed.

These fans range in capacity from 3000 to 30,000 cfm. The window type usually does not exceed 8000 cfm, while the most generally used attic type ranges from 8000 to 16,000 cfm. Power consumption is under 50 watts an hour per 1000 cfm of rated output for the 8000 cfm fan and larger while the watts input for smaller fans is greater than this figure. Improved results can be secured with the window fan by closing off parts of the house where ventilation is not desired.

CHAPTER 23

Dehumidification

Definitions and Methods, Dehumidification by Sorption, Estimating Loads, Location and Use of Equipment, Equipment Auxiliaries, Equipment Performance, Comparison of Methods of Dehumidification

THE interchange of sensible or latent heat between air and a controlling medium requires (1) that the controlling medium be held at the necessary temperature or vapor pressure to produce a flow of heat or moisture in the desired direction, and (2) that sufficient contact be obtained between the air and the controlling medium to produce the desired final air condition under the temperature or vapor pressure head causing the heat flow. The medium may be brought into direct contact with the air by means of a water spray or steam humidifier or the heat transfer may be effected through a barrier surface such as that of a steam radiator or direct expansion cooling coil.

Heat interchange is obtained when molecules of air are brought into close proximity with the medium or heat transfer surface. These molecules then re-mix and transfer heat to other molecules in the air stream. For a given heat head the effectiveness of interchange is a direct function of the number of such successive contacts, and is a measure of the effiency of the surface[1]. The contacting surface may be that of the medium such as a finely atomized spray or the bed of a solid dehumidifying agent; or a chilled or warmed metal surface, as in a coil; or a combination of medium and surface, as in a packed tower, in which the medium produces the interchange and the surface provides the necessary contact area.

DEFINITIONS AND METHODS

There are several basic methods of producing the necessary difference in temperature or vapor pressure between air and the medium employed to achieve cooling or dehumidification, or both simultaneously:

Cooling of air refers to the reduction in temperature resulting from the removal of sensible heat. It is always a result of contact with a medium held at a temperature lower than that of the air. Cooling may be accompanied by moisture addition (humidification), by moisture extraction (dehumidification), or by no change of moisture content whatever. Moisture change, if present, is considered as a secondary or by-product effect. As previously stated, the medium may be directly in contact with the air (as water, brine, or ice), or indirectly through a barrier wall (as cooling surface). When the latter method is used, and the surface temperature is held above the air dew-point, only cooling occurs without moisture interchange.

Evaporative Cooling involves the adiabatic exchange of energy between air and a water spray or wetted surface. The water assumes the wet-bulb temperature of the air, which remains constant during its traverse of the exchanger. No heat is added or abstracted from the medium (water), which is continually recirculated. Cooling of the air occurs due to the temperature and vapor pressure difference between entering air and water at the wet-bulb temperature. Humidification occurs as a result of the vapor pressure exerted by the water which is higher than that corresponding to the entering air dew-point. Since this is an adiabatic exchange, the enthalpy of the air vapor mixture remains constant, while the dew-point rises and the dry-bulb falls, and the loss of sensible heat exactly equals the gain in latent heat (neglecting radiation losses). The maximum available temperature reduction is the difference between entering dry- and wet-bulb temperatures. Equipment delivering air at a dry-bulb temperature equal to the wet-bulb temperature is termed *completely* saturating or 100 per cent efficient, since the air

[1]The Contact Mixture Analogy Applied to Heat Transfer with Mixtures of Air and Water Vapor, by W. H. Carrier (*A.S.M.E. Transactions*, Vol. 59, 1937).