

be used in place of the grilles. It is essential that the roof and the attic walls be free from air leaks.

Boxed-in fans are units in which the fan is installed within the attic in a box or housing directly over a central ceiling grille, or in a bulkhead enclosing an attic stair. The fan may be connected by a duct system to the grilles in individual rooms. Outdoor air entering through the windows of the rooms below is discharged into the attic space and escapes to the outside through louvers, dormer windows, or screened openings under the eaves.

Another version of the attic fan is the *window fan* for use when attic application is not feasible or no attic is available. Supplied with a perforated or expanded metal enclosure and mounted in either the upper or lower window section, this fan is easy to install or move to another location.

The locations of the fan, the outlet openings, and grilles should be selected after consideration of the room and attic arrangements in order to give uniform air distribution in the individual rooms served. If the outlet for the air is not on the side away from the direction of the prevailing wind as in the case of the boxed-in fan, openings should be provided on all sides. Kitchens should be separately ventilated because of the fire hazard, and to prevent the spread of cooking odors.

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 possible complaints are not forthcoming.

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 24

Cooling, Dehumidification and Dehydration

Definitions and Methods, Adsorbents, Absorbents, Nature of Processes, Temperature—Pressure—Concentration Relations, Dehydration Methods, Auxiliaries, Controls, Performance, Economics

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 efficiency of the surface¹. The contacting surface may be that of the medium such as a finely atomized spray or the bed of a solid dehydrating 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 involves its reduction in temperature due to the abstraction 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 (evaporation), 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,

¹The 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).