nection into the fan. Air tends to take the path of least resistance and, if the dehumidifier resistance is high, and if the return duct resistances are low, this situation is apt to occur. A recirculating air fan, instead of a back-draft damper, may be required for this case, if the failure of return air to reach the dehumidifier or conditioner is a serious matter under reduced load conditions.

LOCATION OF APPARATUS

In general, the outdoor-air intake, preheaters, and return air connections precede the conditioner, while the bypass, reheaters and fan follow it. In the case of a blow-through system, where the fan is located ahead of the conditioner, the leakage of air at the conditioner is outward, instead of inward, and may be accompanied by water leakage.

The location of the complete apparatus assembly, including the dehumidifier, will be dependent on the type of building, spaces available, structural characteristics, etc. The type of conditioner used may limit the location under certain conditions. Where cooling coils employing chilled water or brine as the cooling agent are used, there are few limitations with regard to location other than those of pumping power, working pressures, piping costs, etc. Where spray dehumidifiers are used, very definite limitations present themselves, and these may require certain extraneous equipment to make the system workable. If several spray-type dehumidifiers are located on different levels, thus involving different water pressures, a surge or storage tank, to which the return water from each dehumidifier can be taken, is required. Should the water level in the pan of the dehumidifiers be low in relation to that of the surge tank, return water pumps will be required, and these pumps will have to be operated until the water supply lines are drained in order to prevent flooding of the lower dehumidifiers. Where spray dehumidifiers are on the same level, equalizing lines between the pans may be required if a storage tank is not provided. It is exceedingly important that water-tight drained floors be provided under all overhead cooling systems, since water condensed out of the air generally will be present and may damage the interior finish of the rooms below the apparatus.

All of the various pieces of equipment from the outdoor air intake through the fan usually are connected together by sheet metal casings. Frequently, the building structure or specially constructed walls or partitions may be used to form a portion of the casing. In any case the casing or connection must be sufficiently sturdy for the required duty. Sheet metal work must be well braced not only to prevent vibration under pulsations in air flow, but also to withstand the abuse of normal usage. Casings should be braced wherever access doors are installed, and all large panels should be adequately reinforced by structural steel.

Accessibility for Service

Each apparatus layout should be made with accessibility in mind. Where cooling convectors are used, space for removing and repairing or replacing them should be provided. Adequate space should be provided for the servicing and replacement of eliminators. Filters must be so located that the proper cleaning, replacement or routine servicing can be accomplished without difficulty. Free access to the bearings of all moving machinery is a necessity. Provision should be made for the replacement of any parts that are subject to wear, deterioration or damage, such as filters, fanwheels, motors, pump impellers, or heat transfer surface.

CHAPTER 31

AIR DISTRIBUTION

Definitions, Standards for Satisfactory Conditions, Principles of Air Distribution, Ventilating Jets in Air Distribution, Outlet Performance, Outlet Types, Outlet Location and Selection, Direction and Volume Control, Return and Exhaust Intakes, Specific Applications.

CORRECT air distribution is essential in warm air heating, ventilating, and air conditioning systems. Even though a system delivers the required quantity of conditioned air to a room, unsatisfactory conditions result if the air is poorly distributed.

This chapter deals with room air distribution only; the transmission of air through ducts is treated in Chapter 32, Air Duct Design. The objectives of this chapter are to:

1. Describe the present state of air distribution problems by discussing ventilating jets in room air distribution.
2. Present general information on practical air distribution problems by discussing outlet performance, outlet types, and also location, selection, and control of outlets.
3. Illustrate the use of the basic concepts and of the practical experience gained in air distribution by discussing specific applications.

Further pertinent information on air distribution will be found in Chapter 6, Physiological Principles; Chapter 12, Heating Load; Chapter 13, Cooling Load; Chapter 19, Gravity Warm Air Systems; Chapter 20, Forced Warm Air Systems; Chapter 25, Unit Heaters and Unit Ventilators; Chapter 26, Unit Air Conditioners and Unit Air Coolers; Chapter 30, Central Systems for Air Conditioning; Chapter 41, Sound Control; Chapter 48, Transportation Air Conditioning; Chapter 52, Instruments and Measurements.

DEFINITIONS

The following definitions referring to air distribution equipment have gained general acceptance.

1. *Supply Opening or Outlet:* Any opening through which air is delivered into a space which is being heated, or cooled, or humidified, or dehumidified, or ventilated.
2. *Exhaust Opening or Return:* Any opening through which air is removed from a space which is being heated, or cooled, or humidified, or dehumidified, or ventilated.
3. *Outside Air Opening:* Any opening used as an entry for air from outdoors.
4. *Damper:* A device used to vary the volume of air passing through a confined cross-section by varying the cross-sectional area.
5. *Grille:* A covering for any opening and through which air passes.
6. *Register:* A grille equipped with a damper or control valve.
7. *Free Area:* The total minimum area of the openings in the air outlet or inlet through which air can pass.
8. *Core Area:* The total plane area of that portion of a grille, included within lines tangent to the outer edges of the outer openings through which air can pass.
9. *Free Area Ratio:* The ratio of the free area to the core area.
10. *Coefficient of Discharge:* Ratio of area at vena contracta to area of opening.
11. *Aspect Ratio:* The ratio of length to width of an opening or core of a grille.