heating system exactly balanced to load conditions. To obtain the economies of mass production, factory built units must be standardized in a few models per manufacturer. Each model covers a range of capacities within the capacity of its fan to deliver air against the resistance of the unit and against the system resistance. For this reason, the unit performance will usually represent a compromise between actual load requirements and the rated capacity. Within the range of accuracy of most load calculations, this compromise is not objectionable.

If the condensing unit and cooling and heating coil surfaces are carefully selected, and if proper consideration is given to reduction of piping losses, the performance of the combined system will compare favorably with field assembled apparatus. A system, in which the air handling unit is separated from the condensing unit, is called a remote system, and the conditioning unit is designated as a remote unit. The economical capacities of remote units usually range from 10 to 40 tons.

For applications where load calculations are subject to considerable variance and where close control is not considered essential, further economies of factory assembly can be obtained by combining the air handling and condensing equipment in one unit. This effects another compromise between load calculations and equipment selection, since the capacity of the combined unit is then dependent on the predetermined balance between a particular coil and condensing unit. These combination units are called self-contained units and, under the aptly descriptive name *store conditioners*, find economical application in 3, 5, $7\frac{1}{2}$, 10, and 15 ton refrigeration capacities. These capacities, or limited multiples thereof, meet the load requirements of the majority of small and medium sized commercial establishments. With some modifications, these units can also be adapted to light industrial work.

To meet the requirements of individual comfort in small rooms and offices, where load calculations are subject to the indefinite design condition of *feeling cool*, self-contained units, called room coolers, find extensive and economical application. These units are usually restricted to summer and intermediate season operation, and range from $\frac{1}{3}$ to $1\frac{1}{2}$ tons of refrigeration capacity.

A special application of remote units is found in the unit air cooler which is used extensively in refrigeration work. Its primary function is to reduce temperatures in insulated and sealed storage spaces, and humidity control is a secondary consideration. Because of the small temperature differences between the coil and room temperatures, unit coolers handle three to five times as much air per ton as remote units used in air conditioning.

The attic fan or exhaust fan is sometimes referred to as a cooling unit, but since it contains no element of heat transfer, it is treated in Chapter 32, Fans.

COMPONENT PARTS OF UNIT TYPE EQUIPMENT

Units can be obtained for producing any of the required effects on air. As they function most satisfactorily when doing the work for which they were designed, field modifications are usually unadvisable because of expense involved as well as the possibility of causing unexpected difficulties in operation. The basic design considerations of unitary equipment are discussed in the next following paragraphs.

Remote Units. Remote units can be obtained in two general classes, horizontal as shown in Fig. 1 and vertical as in Fig. 2. Their construction is essentially the same, except for the drain pan and filter locations.

Casings. Casings are generally constructed of sheet metal with angle iron frames and with removable panels for access to coil connections, blower bearings, filters, and drain. Casings should be air tight. Panels should be tight fitting with cam or similar fastenings for easy opening. Panel openings at coils for heavy units should be large enough to receive coils after the casing is suspended. Frames should be fitted with lugs strong enough to suspend horizontal units. Non-metallic casings are of advantage in small remote units for reducing sound, particularly when propeller type fans are used.

Insulation. Remote units are available with waterproof and vermin-proof sound and heat absorbing insulation on the inside of the casing. They are also available with flanges and flanged access doors to permit insulation after installation.

Drain Pans. Because of the corrosive effect of mild picric, carbonic, and sulfurous acids absorbed by condensate, drain pans are usually made of 14 gage or heavier metal. They should be hot dipped galvanized after fabrication or otherwise treated to resist corrosion. Some manufacturers extend the drain pan under the entire unit, but in any case it should extend far enough to catch any condensate carried over from the coils. The drain connection should be readily accessible for cleaning and, in air conditioning work, should be generously sized and trapped. Some municipal codes require a minimum size of $1\frac{1}{4}$ I.P.S.

Blowers. The usual practice among manufacturers is to use light construction in the blowers in remote units, although a few are available with heavy duty blowers in the larger sizes. These blowers work under almost constant conditions without overload or shock and will usually last as long as the unit with reasonable maintenance. As lubrication of bearings is very important, it is good practice to locate the oil cups conveniently outside of the unit. In any application where considerable dehumidification or humidification is involved, such as in a system where the unit is handling 100 per cent outside air, it is important that the blowers be painted with asphaltum or other corrosion resistant paint to prevent excessive oxidation and corrosion of the blowers.

Some of the smaller suspended type units, Fig. 3, use propeller fans with a trailing edge blade in order to obtain required pressure characteristics with quiet operation. Since most of the motors driving these fans are direct connected and use brushes for starting, adequate access should be provided for maintenance and inspection.

Cooling Coils. The cooling and dehumidifying coils used in unit air conditioners are essentially the same as those used in central station units. The face area of the coil is usually fixed and the number of rows deep in the direction of air flow is the variable that determines capacity. It should be remembered, as noted in Chapter 39, that adequate coil surface is important for efficient performance of any system and that there is little economy in reducing coil depth to less than four rows.

Where multiple circuits are used in the larger coils, equal distribution of the cooling medium to the various circuits is vital in order to develop full capacity of the coil. The cooling coils also perform the function of dehumidification. To prevent carryover of condensate, eliminator plates