customers having a high load factor (relatively low demand), and those having a low load factor (relatively high demand). The utility company must maintain sufficient capacity to serve the high demand customers, and the cost of the increased plant investment is divided equally among the users, so the high demand customers are benefited at the expense of the others.

3. *Demand Rates.* These refer to any method of charge based on a measured maximum load during a specified period of time.

The *flat demand rate* is usually expressed in dollars per thousand pounds of demand per month or per annum. It is based on the size of a customer's installation, and is seldom used except where a meter is not practicable.

The *Wright demand rate* is similar in calculation to the block rate, except that it is expressed in terms of hours' use of the maximum demand. It is seldom used, but forms the basis for other forms of rates.

The *Hopkinson demand rate* is divided into two elements:

(*a*) A charge based upon the demand, either estimated or measured.

(*b*) A charge based upon the amount of steam consumed.

This rate may be modified by dividing the quantities of steam demanded and consumed into blocks charged for at different rates.

The *Doherty rate* is divided into three elements:

(*a*) A charge based upon demand.

(*b*) A charge based upon steam consumed.

(*c*) A customer charge.

In the *Hopkinson rate,* the last two elements are combined into one element.

Demand rates are comparatively new and are not yet widely used. While they are equitable and competitive, they are difficult for the average layman to understand. They are of benefit to utility companies and to consumers because the investment and operating costs can be divided, to suit the particular circumstances, into demand, customer, and consumption groups through the use of some modification of the Hopkinson rate. Demand rates are an advantage to the customer in that the use of such a rate reduces the rate per thousand pounds to the long-hour user.

Fuel Price Surcharge. It is usually desirable to establish a rate upon a specified basic cost of fuel to the utility company. Where there are wide variations in the price of fuel, it is also desirable to add a definite charge per thousand pounds of steam sold for each increment of increase in the price of fuel. This surcharge automatically compensates for the variations without necessitating frequent changing of the whole rate structure.

Some utility companies include a labor surcharge as well as a coal surcharge.

CHAPTER 30

CENTRAL SYSTEMS FOR AIR CONDITIONING

Features of Systems, Zoning, Humidity Control, Cooling Load, Heating Load, Air Quantity and Effectual Temperature Difference, Low and High Pressure Induction Convectors, Evaporative Cooling, Precooling, Sensible Cooling with Unwetted Coils, Run-Around System, Selection of Type of System, Location of Apparatus, Design Procedure

THE term, central, applied to an air conditioning system implies that the equipment such as fans, coils, filters and their encasement are designed for assembly in the field rather than in a factory as a unit. As a central system usually serves several different rooms, individual controls are required for each room.

FEATURES OF CENTRAL SYSTEMS

One advantage of a central air supply system is that one apparatus serving many rooms may involve a lower investment cost than that for a number of self-contained plants, each serving a single room. A central system may occupy basement or attic space that is relatively unimportant, whereas individual factory-assembled apparatus placed in each room may occupy otherwise valuable space. Another advantage of a central system is accessibility for servicing, since it is possible to provide doors in the encasement for cleaning and inspecting all of the component parts in a manner usually superior to that practicable with compact factory-assembled equipment.

Central air conditioning systems usually are connected by ducts with the various rooms served, and preferably have exhaust fans that may effect complete removal and disposal of any desired proportion of the air. The exhaust fan may return air to the supply system for recirculation, as a measure of economy of fuel or refrigeration.

Central air conditioning systems are served by heating and refrigerating equipment which may be located at some distance from the air supply apparatus, and which may serve one or more central air supply systems.

Year-Round Air Supply System

Fig. 1 is a plan of a year-round air supply system. Outside air may enter from the left at A, desirably from an intake on the side of the building least exposed to solar heat, and not close to the ground or to a sun-heated or dust-gathering roof. The damper B for proportioning the volume of outside air, is interlocked with the return air damper C in such manner that as the outside air volume increases the return air volume decreases. The return air duct D, shown diagrammatically, comes from the exhaust fan. All the air, it will be observed, must pass through the filters E, and there is ample room on both the inlet and outlet sides of the filters for servicing them. The filters may be of mechanically cleaned type, of replaceable cell type, or may be electronic, as described in Chapter 34.

The cleaned air passes to the equipment that changes its temperature and humidity. Except in very warm climates, a heating or tempering coil F is required to warm the air to a temperature above freezing. Usu-