2. Indirect Heaters

a. Hot Water or Steam Radiators. Electric immersion units (1) to heat water in radiators, or (2) to generate steam. Each radiator is a separate unit connected to the electric wiring system.

b. Central Heating Plant Using Instantaneous Heating. (1) Air heated by passing directly over electric heating elements, and then circulated by a duct system to the spaces to be heated. (2) Steam generated in electric boiler at times and in quantities required by the heating demand. (3) Water heated to the temperatures and in quantities required for the heating demand.

c. Central Heating Plant Using Thermal Storage. This is described in the following paragraph and is applicable to warm air, hot water and steam heating.

STORAGE OR OFF-PEAK SYSTEM OF HEATING

The off-peak storage system of electric heating is intended to take advantage of the low off-peak electrical energy rates which some power companies are now making available if the energy is taken at hours when the generating stations are not working at full capacity. Insulated tanks of water are heated during hours designated by the power company and the stored heat is used as required by the building under thermostatic control.

Power companies in various parts of the country are investigating and sponsoring development of off-peak electrical house heating and are preparing to support its widespread use. The nature of the load and its bettering effect on the power factor and load curve is favorable both to the public utility and the consumer.

The characteristics of the electric heating load, when used with the thermal storage system are ideal from the electrical operating standpoint. The units are non-inductively wound so that the load is unity power factor, and the load is timed so as to be used exactly at the time specified by those responsible for the operation of the systems. It is, therefore, corrective in its effect and tends to fill up the valleys in the load curve. It corrects the inherent peak characteristics of the domestic load in that it places a load at hours when otherwise a resident would use no electricity. The electricity is taken at the hours when the electric light and power company most desires load and the stored heat is used during the day when it is needed to heat the house.

The public service companies charge usually a rate of about 1 cent per kilowatt-hour or less if the energy is taken during the period specified. This rate does not make electricity a price-competitor of oil and natural gas for heating, but in some localities it compares favorably with manufactured gas. The high cost of the equipment necessary for this type of heating system is sometimes a prohibiting factor.

Hot Water System

The tank used with these storage systems is heavily insulated and is equipped with built-in electrical heating elements. The size of the tank

is a function of the heat loss of the building and of the length of the periods allowed by the utility company, during which electricity may be used for heating. The water in the tank is warmed to a temperature of 250 to 300 F, and circulated through the heating system in the building by means of a pump, the regulation of the flow of the water in the system being thermostatically controlled.

Warm-Air System

The scheme developed for warm-air heating systems makes use of the same kind of tank. A housing is built around the tank, from which radiate the supply ducts to the registers in the rooms. The return air ducts from the house are connected back to the tank housing. An extended surface type of unit heater is mounted within the housing with its flow and return connections joined to the top and bottom of the hot water storage tank. The fan on the unit heater is controlled by the house thermostat, which causes the desired day and night temperatures to be maintained in the rooms.

Because a fan is used to circulate the warm air, the effect of a furnace system is obtained, and it is possible to use small ducts and of such shapes as will accommodate themselves architecturally to the structure of the house, which of course cannot usually be done with warm air where the circulation is solely by natural convection.

Domestic Hot Water Heaters

The storage principle for using electricity at off-peak periods is also applied to domestic hot water heaters. Installations of this type of electrical heating have been made in many houses in the middle west during the past five years.

COMPARATIVE HEATING COSTS WITH ELECTRICITY

Cost comparisons between various fuels and electricity for house heating should be made on a heat unit basis, giving due consideration in each case to efficiency. A rate of 1 cent per kilowatt-hour is equivalent to a cost of about $3.00 per 1,000,000 Btu, assuming a transmission loss through the wiring system of 2 per cent. A comparison between the cost of heating with electricity and the cost of heating with coal, oil or gas may be made by referring to Chapters 15, 16 and 17.

The importance of insulation and weatherstripping for electrically heated houses cannot be over-emphasized. The remarks in Chapter 17 on this subject apply equally to electric heating. The more costly the fuel, the greater the need for insulation, weatherstripping and storm sash.

HEAT EQUIVALENTS OF ELECTRICITY

The relation between electrical energy and heat and power is given by the following equations:

1 horsepower = 746 watts.
= 33,000 ft lb per min

1 Btu = 777.64 ft lb