can be conveniently cared for electrically. Fan type unit heaters delivering warm air at the floor zone are very effective.

CONTROL

Because the efficiency of electric heat production is the same for large or small units, it is possible to reduce heat waste to a minimum by applying local heating, locally controlled. Radiant heaters are usually controlled manually but new methods for automatic control are described in Chapter 41 on Radiant Heating. For all convection and fan circulation heaters thermostatic control is essential for economical operation. For duct systems having a variable volume of air flow the electric heater control must automatically vary the heat input in coordination with the changes in air volume and demand for heat.

CALCULATING CAPACITIES

The methods of calculating heat losses outlined in Chapters 6, 7, and 8 may be used for electric heating exactly as for fuel heating. The total heat requirements in Btu per hour may then be converted into the electrical rating of an equivalent heating system by using the equation:

$$\frac{\text{Total Btu per hour}}{3415} = \text{kw rating of required electric heating} \qquad (1)$$

For comparison with steam radiation:

$$\frac{3415 \text{ Btu (one kwhr)}}{240} = 14.2 \text{ sq ft of steam radiation}$$

While many empirical rules based on cubic contents, floor areas, etc., are used in steam heating practice, they should never be used to determine size of equipment for an electrical heating installation.

POWER PROBLEMS

The first point to determine is the cost of the power which is available for electric heating. Unlike fuels, there is no uniform cost for electric power because of the unequal cost of distribution to large and small users. The fact that electricity cannot be economically stored, but must be used as fast as it is generated, makes it impossible to operate power plants at uniform loads; hence, even the time of use may affect the cost of power.

Special low rates are sometimes available during certain prescribed hours of use, but wherever the use of power is unrestricted a demand charge based upon the rated connected load of each heating device must form part of the basic rate structure, so that unlike fuel heating, the cost of operating electric heating systems depends not only upon the actual energy used but also upon the demand charge for the available electrical service.

Homes are almost universally supplied with lighting current of 115 volts, which can only be used economically for small heaters. Usually

the service lines will not permit more than plug-in devices. The Underwriters permit approved heaters of 1320 watts or less to be plugged into approved baseboard receptacles. Where homes have 230 volt service for cooking and water heating, and rates are favorable, larger heaters can be installed. For industrial purposes, heaters should be designed to use polyphase power, which is usually supplied at 220, 440 or 550 volts. All polyphase heaters should be balanced between phases.

INSULATION

The value of building construction which incorporates built-in insulation to reduce the outward heat loss in winter and the inward heat gain in summer has been placed in the spotlight by the increasing adoption of complete air conditioning. With electric heating, adequate insulation is very important and will pay even better returns on the investment than for less expensive fuels.

PROBLEMS IN PRACTICE

1 ● Under what conditions are electric heaters most feasible?

a. When electric power rates are low and other fuels high in cost.

b. Where the total required heat is not great and cost of attention tends to offset the higher actual energy cost of electricity.

c. Where saving of space, elimination of a chimney and lower first cost of equipment are deciding factors.

d. Where intermittent and local auxiliary use avoids the necessity of keeping up steam with large losses in long pipe lines.

e. Where accurate local automatic control reduces the total heat losses enough to compensate for the higher energy rate for electricity over other fuels.

f. For isolated or unattended rooms and small buildings where other heat sources are not readily available.

g. For underground rooms and vaults where the return or disposal of condensation is difficult or where freezing may occur at times.

h. Where corrosive conditions make pipe lines expensive to maintain.

i. Where the use of power for heating can be staggard to avoid periods of other use such as large motors, and thus prevent an increase of the basic demand charges for electrical service.

j. For fall and spring use, and as auxiliary to help out other heating systems at important points during extremely cold weather.

k. Where dust, gases, odor, noise, or access for attendants must be excluded.

l. As booster heaters in central fan systems to permit local temperature control in individual rooms.

2 ● On what basis should electrical heating cost be compared with other fuels?

a. Initial investment with interest and depreciation.

b. Operating cost for energy.

c. Saving in repairs and attendance.

d. Economy due to local accurate temperature regulation.

e. Safety, convenience, and cleanliness.

f. Saving in space.