

A typical domestic hot water heater as shown in Fig. 5 is arranged with upper and lower heating elements for the usual type of off-peak heating service. The lower heating element is under the control of the off-peak time switch. However, the upper heating element is usually connected to the line so that, in case the supply of hot water in the tank becomes exhausted, the top thermostat can turn on the top heater and heat a small supply of water. The top heater will not heat the water in the tank below its location, but when the off-peak period arrives the lower heater is turned on and the entire tank becomes heated.

HEATING BY REVERSED CYCLE REFRIGERATION

Reversed refrigeration is frequently referred to as a *heat pump* since the electric motor driving the refrigerating compressor furnishes the motive power to transfer heat from one temperature to a higher temperature

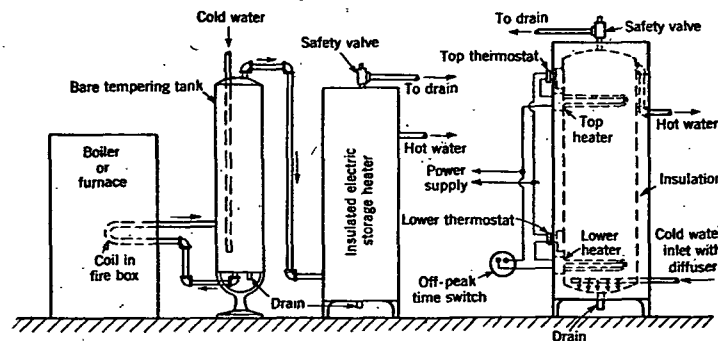


FIG. 4. PIPING ARRANGEMENT FOR CONNECTING ELECTRIC WATER HEATER TO FIRE-BOX COIL

FIG. 5. DOMESTIC HOT WATER HEATER FOR OFF-PEAK SERVICE

level. The compressor acts as a reversible refrigerating unit to extract heat from the outdoor air in winter and deliver it indoors for heating purposes, and, by a reversal, to extract heat from the indoor air in summer and discharge it outdoors. For details see Chapter 39.

CALCULATING CAPACITIES

In calculating electric heating capacity one kilowatt is equal to 3413 Btu per hour or 14.2 sq ft equivalent direct steam radiation.

All of the energy applied to an electric resistor is transformed into heat. The output of an electric heater is a fixed constant, unaffected by the temperature of the surrounding air and the total load on an electric heating system is the total wattage of the connected electric heaters.

RADIANT DRYING

Lacquers and similar surface films can be very effectively dried by radiation. Special electric lamp bulbs have been developed which give off a high percentage of infra-red and similar heat rays². These are mounted in very efficient reflectors. For continuous manufacturing processes these reflectors are mounted in tunnels through which conveyors pass. For

local applications, as for example paint drying in automobile repair shops, they may be mounted on portable racks. Objects of relatively large surface area in proportion to their weight, and fabricated materials having a rather high heat absorption, may be satisfactorily heated by such a source.

In the application of this type of drying the composition of the paint or lacquer is important. In general, lacquers and those enamels using synthetic resins react most favorably. Other applications include the drying of ink, glue, and water, the softening of celluloid and bakelite for punching or shearing, and a wide variety of other uses³.

ELECTRONIC HEATING BY INDUCTION AND ELECTROSTATIC MEANS

These methods differ radically from resistance heating as they employ high frequency radio waves to apply the energy which produces heat. High frequency heating has many important industrial uses and opens up a whole new field of special applications where extreme accuracy and speed are vital.

Metals can be heated by induction. When the work is placed in a magnetic field within a high frequency coil, eddy currents immediately produce heat in the body of the metallic piece. The speed and intensity of this heating can be regulated by controlling the high frequency currents producing the magnetic field and the location of the spot heated by the position of the work piece within the coil. Induction heating is very useful in special processes such as melting metals, brazing, forging, heat treating, etc. It is possible to apply localized heat so rapidly that conduction cannot draw the heat away before it has time to accomplish the desired purpose at a particular spot. One example is the rapid hardening of a tool edge or tip too quickly for scale to form.

Dielectric materials can be heated internally by introducing them into an electrostatic field between high frequency electrode plates. Foods can be sterilized, plywoods bonded, plastics heated, granular or crystalline materials dehydrated, and countless other products heated quickly and uniformly, although they are poor thermal conductors and resist heat applied to their exteriors. Electrostatic heating is ideally suited for continuous production processes as the materials can pass through the heating field quickly with very short exposures to the high frequency radio waves.

POWER PROBLEMS

The cost of electric energy varies because of several factors. Distribution costs differ for 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 electric plants at uniform loads; hence, even the time of use may affect the cost of electricity. Special low rates are sometimes available during certain prescribed hours of use.

Since the cost of production and distribution depends not only upon the quantity of energy used but also upon the maximum rate at which it is used, electric energy is often sold on a demand rate basis. In some cases, the demand charge is based upon the rated connected load, in other cases, upon the maximum demand as indicated by a demand meter.

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