Example 8. An apartment building has a hot water requirement as follows:

60 lavatories	× 2	=	120 gal per hour
30 bath tubs	× 20	=	600 gal per hour
30 showers	× 75	=	2250 gal per hour
60 kitchen sinks	× 10	=	600 gal per hour
15 laundry tubs	× 20	=	300 gal per hour
Maximum hourly requirement		=	3870 gal per hour
Hourly heating capacity	= 3870 × 0.30	=	1161 gal per hour
Storage capacity	= 1161 × 1.25	=	1450 gal per hour

METHODS OF HEATING WATER

Service water generally is heated either by direct combustion of fuel or by an intermediate carrier such as steam or hot water. A third method, also in use, is by contact with electrically heated surfaces. The oldest

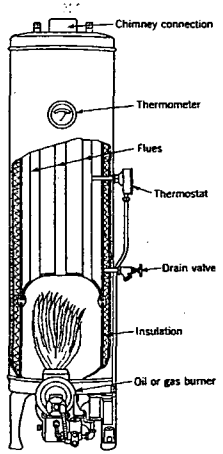

FIG. 7. OIL- OR GAS-FIRED STORAGE TYPE WATER HEATER

method is by fire on one side of a metal barrier and water on the other. If the water surfaces in such a method of heat transfer are small, and if the water carries a heavy proportion of precipitable salts, the water passages soon clog and then burn out. A familiar example of trouble is that with the water back of the firebox in the kitchen stove or the pipe coil inserted into the firebox of a warm air furnace. The critical water temperature at which the lime, magnesia, etc. collect on hot surfaces, varies with the character and proportions of the solids, but generally such deposits are not a serious trouble with water temperatures lower than 140 F.

Coal burning direct-fired water heaters frequently are of cored-out cast-iron, with water entirely surrounding the combustion chamber. They are also made of steel with water tubes which in some cases form racks to suspend garbage above the fire. These heaters are generally so small that low temperature combustion at poor efficiency ensues. Mud and scale may eventually close the water ways.

Oil burning direct-fired water heaters usually are of steel and operate with higher flame temperature and better efficiency then commensurate sized coal burning heaters. They have the same tendency to *lime up*, and the water passages should be large in cross-section and accessible for periodic cleaning.

A domestic hot water heater adapted to burn either oil or gas is shown in Fig. 7. The combustion chamber is rather large, with flues extending vertically through the hot water storage compartment. The thermostat is placed at about the center of the tank.

Gas burning direct-fired water heaters may also be of water tube type, usually having spiral copper coils around which the gas flames are directed to pass. While these heaters, when well insulated, reach high efficiency, the water tubes are especially subject to clogging if the water carries dissolved minerals and is heated above approximately 140 F.

Gas-fired water heaters may also be of the instantaneous type. Such a heater uses no storage tank, but contains sufficient length of copper coil

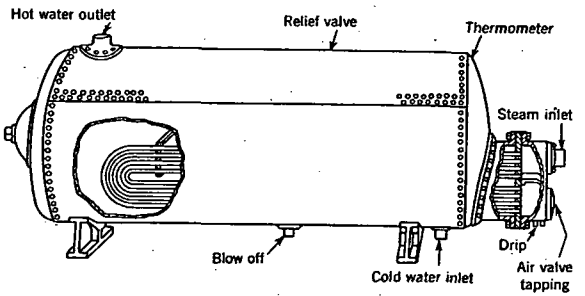

FIG. 8. INDIRECT HEATING COIL IN STEEL TANK

that the water may be heated to the desired temperature during a single passage through it.

The main gas valve on this type of heater is operated by water pressure, and opens wide whenever a faucet is opened. A second gas valve, operated by a thermostat in the outgoing water, throttles the gas to control the leaving water temperature.

Heaters of this type are economical in operation, since, except for the pilot flame, gas is consumed only when hot water is actually being used. These heaters should not be used with hard water, since the long coils become quickly clogged with scale.

Indirect water heaters employ a carrrier, such as steam, between the fire and the water. The domestic water preferably circulates around the outside of the steam tubes which are submerged within a tank.

A typical indirect heating coil in a steel tank is shown in Fig. 8. The coils usually are of copper and are *U* shaped to permit expansion and contraction. Where straight tubes are used, one end of the tube is usually expanded into a *floating* head to take care of expansion. In any type of construction the heat transfer surface should be capable of easy