In the case of boilers, the rating can be put in terms of square feet of equivalent direct radiation by dividing it by 240 for steam, and 150[2] for water. This gives what is called the *American Gas Association* rating, and is the manner in which all appliances approved by the *American Gas Association* Laboratory are rated. To use these ratings it is only necessary to increase the calculated heat loss or the equivalent direct radiation load by an appropriate amount for starting and piping, and to select the boiler or furnace with the proper rating.

The rating given by the *American Gas Association* Laboratory is not only a conservative rating when considered from the standpoint of capacity and efficiency, but is also a safe rating when considered from the standpoint of physical safety to the owner or caretaker. The rating that is placed upon an appliance is limited by the amount of gas that can be burned without the production of harmful amounts of carbon monoxide. This same limitation applies to all classes of gas-consuming heating appliances that are tested and approved by the Laboratory. Gas boilers are available with ratings up to 14,000 sq ft of steam, while furnaces with ratings up to about 500,000 Btu per hour are available. (See Chapter 23.)

Installation Features

One feature of the piping installation that adds to the satisfactory service rendered by gas boilers is provision for adequate and rapid venting of the air from steam heating systems. If air leaks into the steam distribution system during the period that the gas is turned off, and then vents out slowly when the thermostat calls for heat, the result will be a further cooling of the premises between the time that the thermostat calls for heat and the time that steam reaches the radiators. A freely venting steam or vapor system gives maximum economy and minimum temperature variation. When gas boilers are attached to existing heating plants, it is good practice to check the effectiveness of the venting devices and if necessary to replace them with more effective ones that will prevent the return of air into the heating system, and also to check the tightness of the piping.

Frequently when a coal boiler is already installed in a home, it is expedient to leave the coal boiler in place, and to cross-connect the gas boiler with it. Where gas heating is new to the community, it produces a more secure feeling in the customer's mind when putting in gas-fired house-heating equipment, if he knows that he can burn coal at any time he may desire. For steam or vapor installations, it is desirable to have the water line in both boilers at the same level.

REFERENCES

Stoker Information, Bulletin No. 5, Committee of Ten, 307 N. Michigan Avenue, Chicago, Ill.

Study of Performance Characteristics of Oil Burners and Low-Pressure Heating Boilers, by L. E. Seeley and E. J. Tavanlar (A.S.H.V.E. TRANSACTIONS, Vol. 37, 1931).

Intermittent Operation of Oil Burners, by L. E. Seeley and J. H. Powers (A.S.H.V.E. TRANSACTIONS, Vol. 38, 1932).

[2]A value of 160 for the heat emission of hot water radiators is used by many engineers. The actual heat emission, however, depends on the temperature of the water and of the surrounding air. See Chapters 30 and 33.

Comparison of Oil and Gas Firing in a Heating Boiler, by L. E. Seeley and E. J. Tavanlar (A.S.H.V.E. JOURNAL SECTION, *Heating, Piping and Air Conditioning*, October, 1933).

Air Supply and Its Effect on Performance of Oil Burners and Heating Boilers, by L. E. Seeley, J. H. Powers, and E. J. Tavanlar (A.S.H.V.E. TRANSACTIONS, Vol. 39, 1933).

Fuel Burning Rates and Power Requirements of Oil Burners in Relation to Excess Air, by L. E. Seeley and E. J. Tavanlar (A.S.H.V.E. TRANSACTIONS, Vol. 40, 1934).

Oil Burning in Residences, by D. W. Nelson (A.S.H.V.E. JOURNAL SECTION, *Heating, Piping and Air Conditioning*, July, 1935).

PROBLEMS IN PRACTICE

1 ● What features of furnace design are essential for the proper burning of the volatile coal gases above the fuel bed?

Adequate provisions should be made so that the furnace volume is sufficiently liberal and that the grates are a sufficient distance from the heating surfaces to permit the proper combustion of gasses.

2 ● Classify stokers as to construction and operation.

a. Overfeed flat grate.

b. Overfeed inclined grate.

c. Underfeed side cleaning type.

d. Underfeed rear cleaning type.

3 ● What classification may be made of stokers as to their use?

Class 1. For residences (Capacity less than 60 lb of coal per hour).

Class 2. For apartment houses and small commercial heating jobs (Capacity 60 to 500 lb of coal per hour).

Class 3. For general commercial heating and small high pressure steam plants (Capacity 500 to 1200 lb of coal per hour).

Class 4. For large commercial and high pressure steam plants (Capacity over 1200 lb of coal per hour and over 36 sq ft grate area).

4 ● What main parts are found in an underfeed residential stoker?

A *hopper* is supplied to hold coal which is fed by a *screw* or *plunger* into a *retort* provided with air openings called *tuyeres*. A *blower* supplies air under pressure for combustion, and a *gear case* provides for changes in coal feeding rates.

5 ● What is a dead-plate?

A dead-plate is a flat surface without air supply openings upon which the fuel rests while combustion of the fixed carbon is completed. Generally the ash is removed from the dead-plate.

6 ● What rate of coal burning is usually recommended for small underfeed stokers?

For continuous operation, 25 lb per square foot of grate surface is recommended; for short duration peaks, 30 lb.

7 ● What methods of oil atomization are used?

1. Throwing the oil from a rotating cup or disc.
2. Forcing the oil under high pressure through a nozzle.
3. Propelling the oil with a high velocity jet of air or steam.
4. Forcing an oil and air mixture through a nozzle.