11 ● Explain the term efficiency of a natural draft chimney.

The efficiency of a chimney is the ratio of the work it does in moving gases to the theoretical amount of power it generates.

12 ● How is the available draft used in a heating plant?

The available draft at the base of the chimney is used to overcome the loss in pressure through the grate, the fuel bed, the boiler passes, the breeching.

13 ● What are some of the factors that influence the draft loss through the fuel bed?

Uniformity and size of coal, the amount of ash mixed with the fuel on the grate, thickness of fuel bed, rate of combustion, amount of air supply as related to the coal burning rate.

14 ● How does the volatile matter content affect the draft loss through the fuel bed?

The higher the volatile content and the lower the fixed carbon content, the lower the draft loss.

15 ● In what cases will there be no fuel bed draft loss?

In oil, gas, and powdered fuel firing the fuel is mixed and burned in suspension; consequently, no measurable resistance is encountered in the combustion zone.

16 ● Is it possible to state an average value for the draft loss through a boiler and its setting?

No. The draft loss varies widely and depends on many factors such as the size and type of gas passageways. The manufacturer is usually able to supply such information.

17 ● Of what significance is the CO_2 content of stack gases in establishing draft loss?

The CO_2 content of the exit gases is a measure of the completeness of the combustion and the amount of excess air supplied. Low CO_2 indicates a high excess of air and hence a high draft loss.

18 ● What two effects does an economizer have on the draft loss?

An economizer offers resistance to the flow of gases over the added surfaces; it lowers the temperature of the gases going to the chimney and therefore decreases the available draft. This decrease often necessitates the addition of forced draft.

19 ● What main provisions should be considered in good chimney construction?

Chimneys should be air-tight and connected to only one smoke opening. The chimney top should be high enough above surroundings so the wind will not strike it at any angle above the horizontal. Chimney walls should be not less than one brick in width, and they should be lined with fire-clay tile of the size required for the attached heating unit. Tile lining sizes are stated as outside dimensions; therefore, their effective dimensions are less by the thickness of the wall.

20 ● What is the purpose of a back-draft diverter as used on gas burning units?

Since the fuel is supplied under pressure independent of draft it is necessary to free the unit from the variable chimney draft and to supply air for combustion in direct proportion to the supply of fuel gas. The back-draft diverter protects the pilot and burners from down-drafts.

Chapter 11

AUTOMATIC FUEL BURNING EQUIPMENT

Classification of Stokers, Combustion Process and Adjustments, Furnace Design, Classification of Oil Burners, Combustion Chamber Design, Classification of Gas-Fired Appliances

AUTOMATIC mechanical equipment for the combustion of solid, liquid and gaseous fuels is considered in this chapter.

MECHANICAL STOKERS

A mechanical stoker is a device that feeds a solid fuel into a combustion chamber, provides a supply of air for burning the fuel under automatic control and, in some cases, incorporates a means of removing the ash and refuse of combustion automatically. Coal can be burned more efficiently by a mechanical stoker than by hand firing because the stoker provides a uniform rate of fuel feed, better distribution in the fuel bed and positive control of the air supplied for combustion.

Stokers may be divided into four types according to their construction, namely, (1) overfeed flat grate, (2) overfeed inclined grate, (3) underfeed side cleaning type, and (4) underfeed rear cleaning type.

Overfeed Flat Grate Stokers

This type is represented by the various chain- or traveling-grate stokers. These stokers receive fuel at the front of the grate in a layer of uniform thickness and move it back horizontally to the rear of the furnace. Air is supplied under the moving grate to carry on combustion at a sufficient rate to complete the burning of the coal near the rear of the furnace. The ash is carried over the back end of the stoker into an ashpit beneath. This type of stoker is suitable for small sizes of anthracite or coke breeze and also for bituminous coals, the characteristics of which make it desirable to burn the fuel without disturbing it. This type of stoker requires an arch over the front of the stoker to maintain ignition of the incoming fuel. Frequently, a rear combustion arch is required to maintain ignition until the fuel is fully consumed. A typical traveling-grate stoker is illustrated in Fig. 1.

Another and distinct type of overfeed flat-grate stoker is the spreader (Fig. 2) or sprinkler type in which coal is distributed either mechanically or by air over the entire grate surface. This type of stoker has a wide application on small sized fuels and on certain special fuels such as lignites, high-ash coals, and coke breeze.