

6 • What are the advantages of a sized fuel for heating furnaces?

Because a sized fuel encourages a more uniform flow of air through the bed, the burning will be more uniform, and the bed will be less liable to develop holes and will require less attention. Uniformity of fuel size is more desirable as the area of the bed becomes smaller; it is less important with fuels that cake, but with sized fuels the caking will be more uniform and the air flow through the bed will be steadier. In addition, ash and pieces of slate are less likely to be segregated and to form lumps of clinker.

7 • Does the size of a fuel affect the quantity of air required to burn it at a given rate?

The total air required to give the same gas analysis at the stack is independent of the size of the fuel burned, but for non-caking fuels the ratio of the air passing through the fuel bed to the total air entering the burner base decreases, for the same thickness of bed, as the size of the fuel becomes smaller; this decrease is very rapid for sizes less than one inch. For coals that cake, this ratio will depend on the way the caked bed is broken up and on the size of the resulting pieces.

8 • Is the volatile matter which is given off when coals are burned of the same nature in all coals?

No. The products given off by coals when they are heated differ materially in the ratios by weight of the gases to the oils and tars. No heavy oils or tars are given off by anthracite, and very small quantities are given off by semi-anthracite. As the volatile matter in the coal increases to as much as 40 per cent of ash-free and moisture-free coal, increasing amounts of oils and tars are given up. For coals of higher volatile content, the relative quantity of oils and tars decreases, so it is low in the sub-bituminous coals and in lignite.

9 • Is smoke a primary product in the burning of fuels?

Visible smoke may include very small particles of carbon, oil, tar, water (condensed steam), and ash. Of these, the oils, tars, and ash are mainly primary products, and the water is partly primary. The carbon, which usually comprises the greater part of the smoke, results from the breaking up by heat of oils, tars, and such gases as methane, so it may be considered a secondary product.

10 • Is the sulphur in coals detrimental to combustion?

Not so far as is known, but its complete combustion gives only 25 per cent as much heat as is given by the same weight of carbon. Sulphur is undesirable because it causes corrosion of flues and stacks, and also because its gases pollute the atmosphere, and damage buildings and vegetation.

11 • How do deposits of soot on the surfaces of a boiler or heater affect the quantity of fuel burned?

There are two effects. The soot acts as an insulating layer over the surface and reduces the heat transmission to the water or air; the *Bureau of Mines Report of Investigations* No. 3272 shows that the loss of seasonal efficiency is not as great as has been believed and should not be over 6 per cent because the greater part of the heat is transmitted through the firepot. The soot clogs the passages and reduces the draft; the loss of efficiency from this action may be much more, and also the lack of draft results in unsatisfactory heating.

Chapter 28

AUTOMATIC FUEL BURNING EQUIPMENT

Residential Stokers, Apartment House Stokers, Commercial Stokers, Domestic Oil Burners, Commercial Oil Burners, Gas-Fired Appliances, Gas Boilers, Warm Air Furnaces, Space Heaters, Conversion Burners, Gas Appliances

AUTOMATIC, mechanical equipment for the efficient combustion of coal, oil, and gas is considered in this chapter.

MECHANICAL STOKERS

Coal can be burned more efficiently on a mechanical stoker than by hand firing. The burning of coal involves uniformity of stoking, proper distribution over the fuel bed, admission of air as required to the fuel bed, and means for removing ash. The proper burning of the fuel on the grate is the function of the stoker and depends upon the stoker design.

The burning of the volatile gases above the fuel bed is a matter of furnace design. The requirements are the same regardless of the type of stoker. Proper care should be taken to provide furnaces sufficiently liberal in volume and with grates at a sufficient distance from the heating surface in order to permit proper combustion of gases. The standards that have been most universally adopted for the proportioning of furnaces are those of the *Midwest Stoker Association*.

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. They may also be classified according to their uses. The following classification has been recommended by the *Stoker Manufacturers Association*.

Class 1. Up to 60 lb coal feed per hour (Household).

Class 2. 60 to 500 lb coal feed per hour (Apartment house and small commercial).

Class 3. 500 to 1200 lb coal feed per hour and less than 36 sq ft of grate area (General commercial heating and small high pressure steam plants).

Class 4. Over 1200 lb coal feed per hour and over 36 sq ft grate area (Large commercial and high pressure steam plants).

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