*where*

$X$ = cost of heating with coal in dollars per million Btu.
$c$ = cost of coal in dollars per ton.
$C_o$ = calorific value of coal, Btu per pound.
$E_c$ = over-all or house efficiency for coal, expressed as a decimal.

*Example 4.* If coal having a calorific value of 13,000 Btu per pound costs $10.00 per ton, the cost per million Btu, assuming an efficiency of 60 per cent, will be:

$$X = \frac{500 \times 10}{13{,}000 \times 0.60} = \$0.64$$

**Oil**

$$Y = \frac{1{,}000{,}000 \times p}{C_o \times W \times E_o} \tag{5}$$

*where*

$Y$ = cost of oil in dollars per million Btu.
$p$ = cost of oil in dollars per gallon.
$C_o$ = calorific value of oil, Btu per pound.
$W$ = weight of oil per gallon, pounds.
$E_o$ = over-all or house efficiency for oil, expressed as a decimal.

*Example 5.* If oil having a calorific value of 141,000 Btu per gallon ($C_o \times W$) costs 10¢ ($0.10) per gallon, the cost per million Btu, assuming an efficiency of 70 per cent, will be:

$$Y = \frac{1{,}000{,}000 \times 0.10}{141{,}000 \times 0.70} = \$1.01$$

**Gas**

$$Z = \frac{1000g}{C_g \times E_g} \tag{6}$$

*where*

$Z$ = cost of heating with gas in dollars per million Btu.
$g$ = average cost of gas, including demand and commodity charges, dollars per thousand cubic feet.
$C_g$ = calorific value of gas, Btu per cubic foot.
$E_g$ = over-all or house efficiency for gas, expressed as a decimal.

*Example 6.* If manufactured gas, having a calorific value of 535 Btu per cubic foot, costs $1.00 per thousand cubic feet, the cost per million Btu, assuming an efficiency of 80 per cent, will be:

$$Z = \frac{1000 \times 1.00}{535 \times 0.80} = \$2.33$$



## Chapter 17

# MECHANICAL STOKERS

***Classification According to Construction and Operation: Overfeed Flat Grate Stokers; Overfeed Inclined Grate Stokers; Underfeed Side Cleaning Stokers; Underfeed Rear Cleaning Stokers; Classification According to Uses: Domestic Stokers; Small Industrial Stokers; Large Industrial Stokers; Power Type Stokers; Furnace Design.***

ASSUMING the same intelligence in handling the fire, coal can be burned more efficiently on a mechanical stoker than on any kind of hand fired grate. This does not necessarily mean that a stoker installation may be more economical because the amount of coal burned may be so small or the cost of the installation so high, that the savings with stokers may not be sufficient to pay for the investment. The operation of burning coal involves uniformity in stoking, proper distribution over the fuel bed, admission of air as required to all parts of the fuel bed and disposal of the ash. The handling of the volatile gas is largely a matter of furnace design but since this gas forms a considerable portion of the heating value of the coal, it may also be said that the proper handling of this gas is a function of firing. All mechanical stokers must provide means of taking care of these several functions in order fully to serve their purpose.

### CLASSIFICATION BASED ON CONSTRUCTION AND OPERATION

Stokers may be divided into four types according to their construction and operation, 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 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 clinker forming characteristics of which make it desirable to burn the fuel without disturbing it. This type of stoker invariably requires the use of an arch over the front of the stoker to maintain ignition of the incoming fuel and to maintain the volatile at a temperature suitable for combustion. Frequently, a rear combustion arch is required to maintain ignition until the fuel is fully consumed.