tions should be made in accordance with recommendations shown in the publications of the *American Gas Association.*

Controls

Temperature controls for gas burners are described in Chapter 39. Some central heating plants are equipped with push-button or other manual control. The main gas valve may be of either the snap action or throttling type. Automatic electric ignition is available.

Sizing of Gas Piping

Piping for gas appliances should be of adequate size, and so installed as to provide a supply of gas sufficient to meet the maximum demand without undue loss of pressure between the point of supply (the meter) and the burner. The size of gas pipe required depends upon the following:

1. Maximum gas consumption to be provided.
2. Length of pipe and number of fittings.
3. Allowable loss in pressure from the outlet of the meter to the burner.
4. Specific gravity of the gas.

To obtain the cubic feet per hour of gas required by the burner, divide the Btu input at which the burner will be adjusted, by the average Btu heating value per cubic foot of the gas.

Capacities of different sizes and lengths of pipe, in cubic feet per hour, with a pressure drop of 0.3 in. of water column for a gas of 0.60 sp gr, are shown in Table 1. In adopting a 0.3 in. pressure drop, due allowance for an ordinary number of fittings was made.

To convert the figures given in Table 1 to capacities for another gas of different specific gravity, multiply the tabular values by the multipliers shown in Table 2.

COMMERCIAL AND INDUSTRIAL GAS EQUIPMENT

No attempt can be made, due to space limitation, to describe or classify the varied types of equipment used for commercial and industrial applications. Much of the equipment utilized is custom built to suit a particular process. Certain standard parts such as venturi and burner head sets, ring burners, proportional mixers, or compressors, are purchased for assembly in existing equipment, usually by the installer. Furnaces to provide particular atmospheres or for annealing, soaking pits, metal melting, etc. are usually engineered by industrial gas equipment manufacturers.

Burners utilized in industrial equipment often operate at gas pressures higher than encountered in domestic usage. High pressure gas provides flexibility of control required in the production of constant temperatures. In addition, air-gas ratios can be closely maintained under throttling conditions, and heat liberation per cubic foot of combustion space is considerably greater than can be achieved with lower pressures.

A few of the many basic types of burners used are as follows: single-pipe high pressure, proportional mixing, pre-mix, two-pipe high pressure, and atmospheric.

The *single-pipe high pressure burner* system utilizes gas delivered to the orifice of a venturi at pressures from 10 to 50 psig. A constant pressure compressor, sometimes remotely placed, is occasionally used to increase the

gas pressure. The velocity of the gas issuing from the orifice entrains primary air which is controlled by an air shutter on the venturi tube. An advantage of this system is that when the gas pressure is reduced (lowering the input) the air-gas ratio will remain constant over a fairly wide range.

In the *proportional mixing burner*, an enclosed type venturi is used and high pressure air is delivered through an orifice. The resulting partial vacuum entrains the gas which is supplied through a zero pressure governor. When the air pressure is reduced, the amount of gas entrained is similarly reduced, thus maintaining a constant air-gas ratio over a side fuel capacity range.

The *pre-mix burner* system embodies a compressor which mixes air and gas intimately and discharges the mixture through pipes to the burners

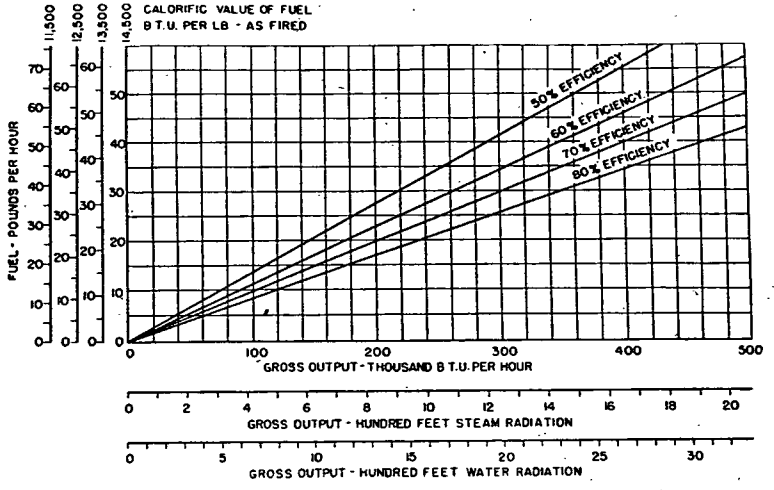

FIG. 21. COAL FUEL BURNING RATE CHART

where it is discharged through orifices and burned. The pre-mix compressor can be remotely installed and the mixture can be closely controlled.

The *two-pipe high pressure burner* system utilizes both air and gas under pressure, both being delivered through orifices and mixed prior to delivery to the burner.

The *atmospheric burner* system is not commonly used. It consists of a burner supplied with gas at a pressure of 2 to 12 in. water. A portion of the air or primary air required for combustion is entrained from the atmosphere by the stream of gas issuing from an orifice, and the air-gas mixture is delivered through a venturi mixing tube to the burner head and parts. About 40 to 60 percent of the air required for combustion is in the form of primary air and the remainder, known as secondary air, is supplied from the air surrounding the flame.

Each system embodies characteristics essential for certain applications. It is strongly recommended that proper and qualified engineering authorities be consulted prior to the purchase, installation, or operation of industrial gas equipment.