

The burners are located in the base at the bottom of an enclosed combustion chamber. The products of combustion pass around baffles within the heating element, and out the flue at the back near the top. They are well adapted not only for residence room heating but also for stores and offices.

Radiant heaters give off considerable portion of their heat in the form of radiant energy emitted by an incandescent refractory that is heated by a Bunsen flame. They are made in numerous shapes and designs and in sizes ranging from two to fourteen or more radiants. An atmospheric burner is supported near the center of the base. Others have a group of small atmospheric burners supported on a manifold attached to the base. Most radiant heaters are portable; however, there are also types which are encased in a jacket that fits into the wall with a grilled front.

Gas-fired steam and hot water radiators are other types of room heating appliances. They are made in a large variety of shapes and sizes and are similar in appearance to the ordinary steam or hot water radiator. A separate combustion chamber is provided in the base of each radiator and is usually fitted with a one-piece burner. They may be secured in either the vented or unvented types, and with steam pressure, thermostatic or room temperature controls.

Warm air radiators are similar in appearance to steam or hot water radiators. They are usually constructed of sheet metal hollow sections. The products of combustion circulate through the sections and are discharged from a flue or into the room, depending upon whether the radiator is of the vented or unvented type.

Unit heaters are used extensively for heating large spaces such as stores, garages, and factories. These heaters consist of a burner, heat exchanger, fan for distributing the air, draft hood, thermostatic pilot and controls for burners and fan. They are usually mounted in an elevated position from which the heated air is directed downward by louvers.

Combustion Process and Adjustments

Most domestic gas burners are of the atmospheric injection (Bunsen) type in which primary air is introduced, and mixed with the gas in the throat of the mixing tube. A ratio of about 3 parts primary air to 1 part gas for manufactured gas, and a $5\frac{1}{2}$ to 1 ratio for natural gas, are generally used as theoretical values. The amount of excess air required in practice depends upon several factors, notably; uniformity of air distribution and mixing, direction of gas travel from burner, and the height and temperature of combustion chamber.

Secondary air is drawn into gas appliances by natural draft. As with other fuels, excess secondary air constitutes a loss, and should be reduced to a proper minimum, which usually cannot be less than 25 to 35 per cent if the appliance is to meet the severe combustion requirements for A.S.A. approval. Yellow flame burners depend upon secondary air, alone, for combustion.

The flame produced by atmospheric injection burners is non-luminous. Air shutter adjustments for manufactured gas should be made by closing the air shutter until yellow flame tips appear and then by opening the air shutter to a final position at which the yellow tips just disappear. This

type of flame obtains ready ignition from port to port and also favors quiet flame extinction. When burning natural gas the air adjustment is generally made to secure as blue a flame as obtainable.

Due to the use of draft hoods and gas pressure regulators both the input and combustion conditions of gas appliances are maintained quite uniform until deposits of dirt, corrosion, or scale accumulate in the air inlet openings, burner ports or on the heating surface. Periodic cleaning

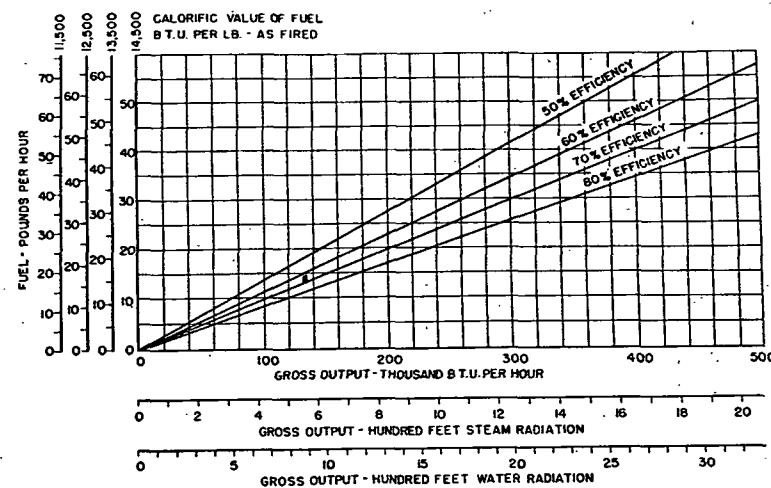


FIG. 18. COAL FUEL BURNING RATE CHART

is therefore necessary to keep any gas appliance in proper operating condition.

Measurement of the Efficiency of Combustion

The efficiency of combustion may be judged from the percentage of carbon dioxide (CO_2), oxygen (O_2) and carbon monoxide (CO) in the flue gases. The CO_2 and O_2 may be obtained by means of an Orsat apparatus but the CO must be determined by more accurate equipment. It is customary to use simple indicators to determine whether CO is present and to make adjustments of the appliances to reduce the CO below 4/100 of one per cent before continuing tests in which the CO_2 and O_2 can then be found by use of the Orsat apparatus. Since the ultimate CO_2 for any gas depends on the total hydrogen content the quality of the combustion should not be judged from the value of the CO_2 in the flue gas without reference to the ultimate CO_2 obtainable. Practical values of CO_2 will usually be from 8 to 11 per cent depending on the gas used.

Rating for Gas Appliances

Input rating for a gas appliance is established by demonstrating that the appliance can meet the Approval Requirements of the A.S.A. The