

mended that the slides in the firing door be kept closed, as the thinner fuel bed around the sides allows enough air to get through.

Burning Coke

Coke is a very desirable fuel and usually will give satisfaction as soon as the user learns how to control the fire. Coke ignites and burns very rapidly with less draft than anthracite coal. In order to control the air admitted to the fuel it is very important that all openings or leaks into the ashpit be closed tightly. A coke fire responds more rapidly than an anthracite fire to the opening of the dampers. This is an advantage in warming up the system, but it also makes it necessary to watch the dampers more closely in order to prevent the fire from burning too rapidly. A deep fuel bed always should be maintained when burning coke. The grates should be shaken only slightly in mild weather and should be shaken only until the first red particles drop from the grates in cold weather. Since coke weighs only about half as much as anthracite per cubic foot only about half as much can be put in the firepot, so it will be necessary to fire oftener. The best size of coke for general use, for small firepots where the fuel depth is not over 20 in., is that which passes over a 1 in. screen and through a $1\frac{1}{2}$ in. screen. For large firepots where the fuel can be fired over 20 in. deep, coke which passes over a 1 in. screen and through a 3 in. screen can be used, but a coke of uniform size is always more satisfactory. Large sizes of coke should be either mixed with fine sizes or broken up before using.

Dustless Coal

The practice of treating the more friable coals to allay the dust they create is increasing. The coal is sprayed with a solution of calcium chloride or a mixture of calcium and magnesium chlorides. Both these salts are very hygroscopic and their moisture under normal atmospheric conditions keeps the surface of the coal damp, thus reducing the dust during delivery and in the cellar, and obviating the necessity of sprinkling the coal in the bin.

The coal is sometimes treated at the mine, but more usually by the local distributor just before delivery. The solution is sprayed under high pressure, using from 2 to 4 gal or from 5 to 10 lb of the salt per ton of coal, depending on its friability and size.

Pulverized Coal

Installations of pulverized coal burning plants in heating boilers are of the unit type, in which the pulverized coal is delivered into the furnace immediately after grinding, together with the proper amount of preheated air. With this apparatus, where the necessary furnace volume is obtainable, high efficiencies can be obtained.

A 150-hp boiler has generally been considered the smallest size for which pulverized fuel is feasible. Complications are introduced if an installation with a single boiler has to take care of very light loads.

Hand Firing

Hand firing is the oldest and the most widely used method of burning coal for heating purposes. To keep the fuel bed in proper condition where hand firing is used, the following general rules should be observed:

1. Remove ash from fuel bed by shaking the grates whenever fresh fuel is fired. This removes ash from the fire, enables the air to reach the fuel, and does away with the formation of clinker which is melted ash.
2. Supply the boiler with a deep bed of fuel. Nothing is gained by attempting to fire a small amount of fuel. A deep bed of fuel secures the most economical results.
3. Remove ash from ashpit at least once daily. Never allow ash to accumulate up to the grates. If the ash prevents the air from passing through, the grate bars will burn out and much clinker trouble will be experienced.

The principal requirements for a *hand-fired furnace* are that it shall have enough grate area and combustion space. The amount of grate area required is dependent upon the desired combustion rate.

The furnace volume is influenced by the kind of coal used. Bituminous coals, on account of their long-flaming characteristic, require more space in which to burn the gases of combustion completely than do the coals low in volatile matter. For burning high volatile coals provision should be made for mixing the combustible gases thoroughly so that combustion is complete before the gases come in contact with the relatively cool heating surfaces. An abrupt change in the direction of flow tends to mix the gases of combustion more thoroughly.

OIL

Uniform oil specifications were prepared in 1929 by the *American Oil Burner Association*, in cooperation with the *American Petroleum Institute*, the U. S. Bureau of Standards, the *American Society for Testing Materials* and other interested organizations. Oil fuels were classified into six groups, as indicated by Table 3. When these specifications were prepared, it was generally accepted that the first three grades were adapted to domestic use, while the last three were suitable only for commercial and industrial burners. Today domestic installations are using No. 4 of the so-called *heavy-oil* group, due principally to the fact that No. 4 oils in general are being offered of better grade and adaptability than those called for in the commercial specifications.

Since the specifications as originally drawn provide for maximum limits only for the several grades, this differentiation has not proved stable. Realizing how unsatisfactory it is to have specifications which permit the substitution of one grade for another, the U. S. Bureau of Standards in cooperation with the *American Society for Testing Materials* is figuring on a new set of specifications providing for definite limits for each grade. When these specifications are adopted, it is expected that the *National Board of Fire Underwriters* will retest all burners using oils of the maximum specifications for the grade so that if a burner is approved for a certain grade it will burn any oil meeting the specifications for that particular grade.

Several burners adapted to industrial use have recently been listed for automatic operation with No. 5 oil. Usually oils No. 5 or 6 require preheating for proper operation, but where conditions are favorable, No. 5 can be used without the equipment that this entails.

There are two reasons for the trend to lower grades of oil. While the lighter oils contain slightly more heat units per pound, the weight per