

coals; but it is long. Much smoke and soot are possible, if improperly fired, especially at low rates of burning.

Sub-bituminous coals occur in the western states; they are high in moisture when mined and tend to break up as they dry or when exposed to the weather; they are liable to ignite spontaneously when piled or stored. They ignite easily and quickly and have a medium length flame, are non-caking and free-burning; the lumps tend to break into small pieces if poked; very little smoke and soot are formed.

Lignite is of woody structure, very high in moisture as mined, and of low heating value; it is clean to handle. It has a greater tendency than the sub-bituminous coals to disintegrate as it dries, and it also is more liable to spontaneous ignition. Freshly mined lignite, because of its high moisture, ignites slowly. It is non-caking. The char left after the moisture and volatile matter are driven off burns very easily, like

TABLE 3. STANDARD ANTHRACITE SIZING SPECIFICATIONS*

SIZE	TEST MESH, IN.		ROUND MESH			MAXIMUM IMPURITIES, PER CENT	
	Through	Over	Oversize		Undersize	Slate ^b	Bone
			Max. Per Cent	Max. Per Cent	Min. Per Cent		
Broken.....	4 3/8	3 1/4	—	15	7 1/2	1 1/2	2
Egg.....	3 1/4 to 3	2 1/16	5	15	7 1/2	1 1/2	2
Stove.....	2 1/16	1 5/8	7 1/2	12 1/2	7 1/2	2	3
Nut.....	1 5/8	1 1/16	7 1/2	10	5	3	4
Pea.....	1 1/16	3/16	10	15	7 1/2	4	5
Buckwheat.....	3/16	3/16	10	15	7 1/2	12 Ash	
Rice.....	3/16	3/16	10	15	7 1/2	13 Ash	
Barley.....	3/16	3/16	10	20	10	—	

* Approved and adopted by *Anthracite Committee*, State Street Building, Harrisburg, Pa.

^b When slate content on Broken to Pea inclusive is less than above standards, bone content may be correspondingly increased, but slate content specified above shall not be exceeded in any event and the total maximum impurities shall not exceed those above specified.

charcoal. The lumps tend to break up in the fuel bed and pieces of char falling into the ashpit continue to burn. Very little smoke or soot is formed.

DUSTLESS TREATMENT OF COAL

The practice of treating the more friable coals to allay the dust they create is increasing. The coal is sprayed with various petroleum products, a solution of calcium chloride or a mixture of calcium and magnesium chlorides.

The coal is usually treated at the mine, but sometimes by the local distributor just before delivery. The salt solutions are 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. Oil for the dustless treatment of coal is also applied under high pressure, in concentrations of 1 to 8 qt. per ton of coal, depending upon the characteristics of the coal and oil.

Dustless treatments which are of such a corrosive nature that they may damage coal handling or burning equipment should not be used.

CLASSIFICATION OF COKES

Coke is produced by the distillation of the volatile matter from coal. The type of coke depends on the coal or mixture of coals used, the temperatures and time of distil-

lation and, to some extent, on the type of retort or oven; coke is also produced as a residue from the destructive distillation of oil.

High-temperature cokes: Coke as usually available is of the high-temperature type, and contains between 1 and 2 per cent volatile matter. High-temperature cokes are subdivided into *beehive coke* of which comparatively little is now sold for domestic use, *by-product coke*, which covers the greater part of the coke sold, and *gas-house coke*. The differences among these three cokes are relatively small; their denseness and hardness decrease and friability increases in the order named. In general, the lighter and more friable cokes ignite and burn the more easily.

Low-temperature cokes are produced at low coking temperatures, and only a portion of the volatile matter is distilled off. Cokes as made by various processes under development have contained from 10 to 15 per cent volatile matter. In general, these cokes ignite and burn more readily than high-temperature cokes. The properties of various low-temperature cokes may differ more than those of the various high-temperature cokes because of the differences in the quantities of volatile matter and because some may be light and others briquetted.

Petroleum cokes, which are obtained by coking the residue left from the distillation of petroleum, vary in the amount of volatile matter they contain, but all have the common property of a very low ash content, which necessitates the use of refractory pieces to protect the grates from being burned.

CLASSIFICATION OF FUEL OILS

Fuel oils are produced by distillation from crude petroleum after gasoline, naphtha, and other lighter products have been removed. Fuel oil is composed chemically of about 85 per cent carbon and 12 1/2 per cent hydrogen with small amounts of oxygen, nitrogen, and sulfur. Oils are classified according to their specific gravity, but specific gravity alone is not a sufficient index of the properties that are important for heating purposes. Other characteristics that must be considered in the choice of a fuel oil are the flash point, pour point, water and sediment content, carbon residue, ash, sulfur content, distillation temperatures, and viscosity.

The flash point and distillation characteristics are important relative to easy ignition and complete gasification of the oil in a burner. A low pour point and low water content are of interest in connection with the storage of the fuel in outdoor tanks, while a low viscosity permits easy passage through a small orifice. The sediment, carbon residue, and ash content should be low to prevent clogging of strainers and accumulation of unburned material in the burner. The sulfur content may be of importance because of the corrosive effect of sulfur compounds in the burner and heating appliance or in special commercial processes.

The Commercial Standard Specifications for Fuel Oils (CS 12-40) of the U. S. Department of Commerce are given in Table 4. These specifications conform to *American Society for Testing Materials Tentative Specifications for Fuel Oils D 396-38T*.

The relationship between the A.P.I. gravity of fuel oils and their calorific value is given in Table 5. Fuel oil grades No. 1, No. 2 and No. 3 only are used in domestic heating equipment. Grades No. 5 and No. 6 are used in commercial and industrial burners and usually require preheating.

CLASSIFICATION OF GAS

Gas is broadly classified as being either *natural* or *manufactured*. Natural gas is a mechanical mixture of several combustible and inert gases rather than a chemical compound. Manufactured gas as distributed is usually