

air entering by each of the three intakes is reduced in the same proportion. If the ashpit door is closed the air admitted through the ashpit is reduced and increased through the other two intake openings.

Methods of control of draft conditions when burning oil or gas are noted in Chapter 11, Automatic Fuel Burning Equipment.

CLASSIFICATION OF COALS

The complex composition of coal makes it difficult to classify it into clear-cut types. Its chemical composition is some indication but coals having the same chemical analysis may have distinctly different burning characteristics. Users are mainly interested in the available heat per

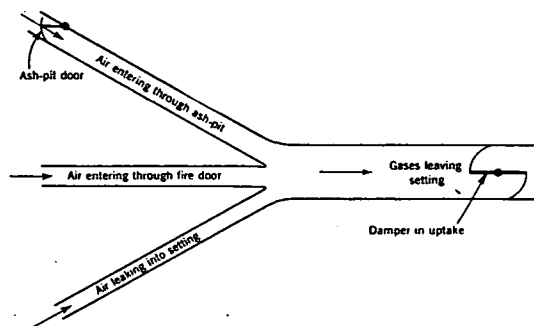


FIG. 4. CORRECT AND INCORRECT METHODS OF DRAFT REGULATION IN A HAND-FIRED FURNACE

pound of coal, in the handling and storing properties, and in the burning characteristics. A description of the relationship between the qualities of coals and these characteristics requires considerable space; a treatment applicable to heating boilers is given in *Bureau of Mines Bulletin 276*.

The classification of coals by rank involves several of the items indicated in a proximate analysis of the coal. This analysis determines the content of volatile matter, fixed carbon, ash and moisture. The calorific value and sulphur content are often reported with the proximate analysis. Volatile matter is the loss of weight when the coal sample is heated to 1732 F for 7 min. Fixed carbon is the difference from 100 per cent of the sum of other losses, not including sulphur. Ash is the incombustible impurity in the coal and has no heating value. Moisture is the inherent and extraneous water in the fuel.

A classification of coals is given in Table 5, and a brief description of the kinds of fuels is given in the following paragraphs, but it should be recognized that there are no distinct lines of demarcation between the kinds, and that they graduate into each other.

Anthracite is a clean, dense, hard coal which creates very little dust in handling. It is comparatively hard to ignite but it burns freely when well started. It is non-caking, it burns uniformly and smokelessly with a short flame, and it requires little attention to the fuel bed between firings. It is capable of giving a high efficiency in the common

types of hand-fired furnaces. A tabulation of the quality of the various anthracite sizes will be found in *Bureau of Mines Report of Investigations No. 3283*.

Semi-anthracite has a higher volatile content than anthracite, it is not as hard and ignites somewhat more easily; otherwise its properties are similar to those of anthracite.

Semi-bituminous coal is soft and friable, and fines and dust are created by handling it. It ignites somewhat slowly and burns with a medium length of flame. Its caking properties increase as the volatile matter increases, but the coke formed is relatively weak.

TABLE 5. CLASSIFICATION OF COALS BY RANK^a

Legend: F.C. = Fixed Carbon. V.M. = Volatile Matter. Btu = British thermal units.

CLASS	GROUP	LIMITS OF FIXED CARBON OR BTU MINERAL-MATTER-FREE BASIS	REQUISITE PHYSICAL PROPERTIES
I. Anthracite.....	1. Meta-anthracite.....	Dry F.C., 98 per cent or more (Dry V.M., 2 per cent or less)	Non-agglomerating ^b
	2. Anthracite.....	Dry F.C., 92 per cent or more and less than 98 per cent (Dry V.M., 8 per cent or less and more than 2 per cent)	
	3. Semi-anthracite.....	Dry F.C., 86 per cent or more and less than 92 per cent (Dry V.M., 14 per cent or less and more than 8 per cent)	
II. Bituminous.....	1. Low volatile bituminous coal.....	Dry F.C., 78 per cent or more and less than 86 per cent (Dry V.M., 22 per cent or less and more than 14 per cent)	Either agglomerating ^b or non-weathering ^c
	2. Medium volatile bituminous coal.....	Dry F.C., 69 per cent or more and less than 78 per cent (Dry V.M., 31 per cent or less and more than 22 per cent)	
	3. High volatile A bituminous coal.....	Dry F.C., less than 69 per cent (Dry V.M., more than 31 per cent); and moist ^d Btu, 14,000 ^e or more	
	4. High volatile B bituminous coal.....	Moist ^d Btu, 13,000 or more and less than 14,000 ^e	
	5. High volatile C bituminous coal.....	Moist Btu, 11,000 or more and less than 13,000 ^e	
III. Sub-bituminous.....	1. Sub-bituminous A coal.....	Moist Btu, 11,000 or more and less than 13,000 ^e	Both weathering and non-agglomerating ^b
	2. Sub-bituminous B coal.....	Moist Btu 9500 or more and less than 11,000 ^e	
	3. Sub-bituminous C coal.....	Moist Btu 8300 or more and less than 9500 ^e	
IV. Lignite.....	1. Lignite.....	Moist Btu less than 8300	Consolidated Unconsolidated
	2. Brown coal.....	Moist Btu less than 8300	

^aThis classification does not include a few coals which have unusual physical and chemical properties and which come within the limits of fixed carbon or Btu of the high-volatile bituminous and sub-bituminous ranks. All of these coals either contain less than 48 per cent dry, mineral-matter-free fixed carbon or have more than 15,500 moist, mineral-matter-free Btu.

^bIf agglomerating, classify in low-volatile group of the bituminous class.

^cMoist Btu refers to coal containing its natural bed moisture but not including visible water on the surface of the coal.

^dIt is recognized that there may be non-caking varieties in each group of the bituminous class.

^eCoals having 69 per cent or more fixed carbon on the dry, mineral-matter-free basis shall be classified according to fixed carbon, regardless of Btu.

^fThere are three varieties of coal in the High-volatile C bituminous coal group, namely, Variety 1, agglomerating and non-weathering; Variety 2, agglomerating and weathering; Variety 3, non-agglomerating and non-weathering.

Adapted from A.S.T.M. Standards, 1937, Supplement, p. 145, *American Society for Testing Materials*, Philadelphia.

Having only half the volatile matter content of the more abundant bituminous coals it can be burned with less production of smoke, and it is sometimes called *smokeless coal*.

The term *bituminous coal* covers a large range of coals and includes many types having distinctly different composition, properties, and burning characteristics. The coals range from the high-grade bituminous coals of the East to the poorer coals of the West. Their caking properties range from coals which completely melt, to those from which the volatiles and tars are distilled without change of form, so that they are classed as non-caking or free-burning. Most bituminous coals are strong and non-friable enough to