

manufactured gas. Most states have legislation which controls the distribution of gas and fixes a minimum limit to its heat content. The gross or higher calorific value usually ranges between 520 and 545 Btu per cubic foot, with an average of 535. A given heat value may be maintained and yet leave considerable latitude in the composition of the gas so that as distributed the composition is not necessarily the same in different districts, nor at successive times in the same district. There are limits to the variation allowable, because the specific gravity of the gas depends on its

TABLE 3. REPRESENTATIVE PROPERTIES OF GASEOUS FUELS, BASED ON GAS AT 60 F AND 30 IN. HG..

GAS	BTU PER CU FT		SPECIFIC GRAVITY, AIR = 1.00	AIR REQUIRED FOR COMBUSTION, (Cu Ft)	PRODUCTS OF COMBUSTION				THEORETICAL FLAME TEMPERATURE, (DEG FAHR)
	High (Gross)	Low (Net)			Cubic Feet			ULTIMATE CO ₂ -DRY BASIS	
					CO ₂	H ₂ O	Total with N ₂		
Natural gas—Mid-Continental	967	873	0.57	9.17	0.97	1.92	10.2	11.7	3580
Natural gas—Ohio	1130	1025	0.65	10.70	1.17	2.16	11.8	12.1	3600
Natural gas—Pennsylvania	1232	1120	0.71	11.70	1.30	2.29	12.9	12.3	3620
Retort coal gas	575	510	0.42	5.00	0.50	1.21	5.7	11.2	3665
Coke oven gas	588	521	0.42	5.19	0.51	1.25	5.9	11.0	3660
Carburetted water gas	536	496	0.65	4.37	0.74	0.75	5.0	17.2	3815
Blue water gas	308	281	0.53	2.26	0.46	0.51	2.8	22.3	3800
Anthracite producer gas	134	124	0.85	1.05	0.33	0.19	1.9	19.0	3000
Bituminous producer gas	150	140	0.86	1.24	0.35	0.19	2.0	19.0	3160
Oil gas	575	510	0.35	4.91	0.47	1.21	5.6	10.7	3725

composition, and too great a change in the specific gravity necessitates a change in the adjustment of the burners of small appliances.

Table 3 shows that a large proportion of the products of combustion when gas is burned, may consist of water vapor, and that the greater the proportion of water vapor, the lower the maximum attainable CO₂ by gas analysis. The table also shows that a low calorific value does not necessarily mean a low flame temperature since, for example, natural gas has a theoretical flame temperature of 3600 F and blue water gas of 3800 F, although it has a calorific value less than one-third that of natural gas.

The quantity of air given in Table 3 is that required for theoretical combustion, but with a properly designed and installed burner, the excess air can be kept low. The division of the air into primary and secondary is a matter of burner design and the pressure of gas available, and also of the type of flame desired.

Chapter 28

AUTOMATIC FUEL BURNING EQUIPMENT

Stokers, Residential Stokers, Apartment House Stokers, Commercial Stokers, Domestic Oil Burners, Air and Oil Supply, Atomization, Type of Flame, Ignition, Boilers for Domestic Oil Burners, Commercial Oil Burners, Gas-Fired Appliances, Gas Boilers, Warm Air Furnaces, Space Heaters, Conversion Burners, Gas Appliances, Installation Features

LABOR saving, automatic, mechanical equipment for the efficient combustion of coal, oil, and gas is considered in this chapter.

MECHANICAL STOKERS

Assuming the same intelligence in handling the fire, coal can be burned more efficiently on a mechanical stoker than on any kind of hand-fired grate. This does not necessarily mean that a stoker installation may be more economical, because the amount of coal burned may be so small or the cost of the installation so high that the savings with stokers may not be sufficient to pay for the investment. The operation of burning coal involves uniformity in stoking, proper distribution over the fuel bed, admission of air as required to all parts of the fuel bed, and disposal of the ash. The handling of the volatile gas is largely a matter of furnace design but since this gas forms a considerable portion of the heating value of the coal, it may also be said that the proper handling of this gas is a function of firing. All mechanical stokers must provide means of taking care of these several functions in order fully to serve their purpose.

Classifications of Stokers

Stokers may be divided into four types according to their construction and operation, namely, (1) overfeed flat grate, (2) overfeed inclined grate, (3) underfeed side cleaning type, and (4) underfeed rear cleaning type. They may also be classified according to their uses. The following classification has been adopted by the U. S. Department of Commerce:

- Class 1. Residential (Capacity less than 100 lb coal per hour).
- Class 2. Apartment houses and small commercial heating jobs (Capacity 100 to 200 lb coal per hour).
- Class 3. General commercial heating and small high pressure steam plants (Capacity 200 to 300 lb coal per hour).
- Class 4. Large commercial and high pressure steam plants (Capacity over 300 lb per hour).

Overfeed Flat Grate Stokers

This type is represented by the various chain grate stokers. These