[22] Condensation of Moisture in Flues, by William R. Morgan (University of Illinois, *Engineering Experiment Station Circular* No. 22).

[23] Effect of Soot on Heat Transmission in Boilers (*U. S. Bureau of Mines Report of Investigation* No. 3272).

[24] Effect of Soot on the Rating of an Oil-Fired Heating Boiler (*National Bureau of Standards Report* BMS 54).

[25] Removal of Soot from Furnaces and Flues by the Use of Salts and Compounds, by P. Nicholls and C. W. Staples (*U. S. Bureau of Mines Bulletin* No. 360).

BIBLIOGRAPHY

Fuels and Their Combustion, by Haslam and Russell (McGraw-Hill Co., 1926).

Principles of Combustion in the Steam Boiler Furnace, by Arthur D. Pratt (Babcock and Wilcox Co.).

Smoke-Producing Tendencies in Coals of Various Ranks, by H. J. Rose and F. P. Lasseter (A.S.H.V.E. TRANSACTIONS, Vol. 45, 1939, p. 329).

Fundamentals of Combustion in Small Stokers, by C. A. Barnes (*Bituminous Coal Research, Inc., Technical Report* No. IV).

Hand-Firing of Bituminous Coal in the Home, by A. P. Kratz, J. R. Fellows, and J. C. Miles (*Illinois Engineering Experiment Station Circular* No. 46).

Classification and Selection of Illinois Coals, by G. H. Cady (*Illinois State Geological Survey Bulletin* No. 62).

Bituminous Coal Research, Inc.:

Technical Report VI, The Treatment of Coal with Oil and Other Petroleum Products, by J. M. Pilcher and R. A. Sherman.

Information Bulletin No. 4, Dustless Treatment of Coals with Materials Other Than Oil, by R. A. Sherman and G. W. Land.

Information Bulletin No. 6, Questions and Answers on the Use of Fuel Oil for Dustless Treatment.

Technical Report VII—Application of Overfire Air Jets, by R. B. Engdahl.

Bureau of Mines Publications:

Bulletin No. 97, Sampling and Analyzing Flue Gases, by Henry Kreisinger and F. K. Ovitz.

Report of Investigations (R. I. 2980), Coke as a Domestic Heating Fuel, by P. Nicholls and B. A. Landry.

Technical Paper No. 303, Value of Coke, Anthracite, and Bituminous Coal for Generating Steam in a Low-pressure Cast-Iron Boiler, by John Blizard, James Neil, and F. C. Houghten.

Bulletin 378, Effect of Preheat, and Distribution of Ash in Fuel Beds, by P. Nicholls.

Handbook, Questions and Answers for the Home Fireman (Revised), by J. F. Barkley.

Anthracite Industries Laboratories Publications:

Report 2015, Comparison of Sizes, Egg, Stove and Chestnut Anthracite.

Report 2018, Domestic Survey.

Report 2062, Utilization of Anthracite for Domestic Heating.

Report 2204, The Crater Method of Firing.

Report 2403, Anthracite Industries Manual.

Oil and Gas Publications:

Oil Fuels and Burners, by James A. Moyer (McGraw-Hill Co., 1937).

Industrial Gas Series, Combustion (*American Gas Association*).

Comfort Heating (*American Gas Association*).

Gaseous Fuels (*American Gas Association*, 1948).

Handbook of Oil Burning, by F. H. Faust and G. T. Kaufman (*Oil-Heat Institute of America*, 1951).

Formulas and Graphs for Representing the Interchangeability of Fuel Gases, by Elmer R. Weaver (*National Bureau of Standards Journal of Research*, 1951, *Research Paper* R.P. 2193).

CHAPTER 15

AUTOMATIC FUEL BURNING EQUIPMENT

Classification of Stokers, Combustion Process and Adjustments, Furnace Design, Rating; Classification of Oil Burners, Combustion Process, Combustion Chamber Design; Commercial and Industrial Oil Burners, Types of Burners; Oil Storage Tanks and Piping; Classification of Gas-Fired Heating Equipment, Combustion Process, Ratings; Sizing of Gas Piping, Fuel Burning Rates

AUTOMATIC mechanical equipment for the combustion of solid, liquid, and gaseous fuels is considered in this chapter.

MECHANICAL STOKERS

A mechanical stoker is a device that feeds a solid fuel into a combustion chamber, provides a supply of air for burning the fuel under automatic control and, in some cases, incorporates a means of removing the ash and refuse of combustion automatically. Coal can be burned more efficiently by a mechanical stoker than by hand firing because the stoker provides a uniform rate of fuel feed, better distribution in the fuel bed and positive control of the air supplied for combustion.

Classification of Stokers According to Capacity

Stokers may be classified according to their coal feeding rates. The following classification has been made by the *U. S. Department of Commerce*, in cooperation with the *Stoker Manufacturers Association*.

Class 1. Capacity under 61 lb of coal per hour.
Class 2. Capacity 61 to 100 lb of coal per hour.
Class 3. Capacity 101 to 300 lb of coal per hour.
Class 4. Capacity 300 to 1200 lb of coal per hour.
Class 5. Capacity 1200 lb of coal per hour and over.

Class 1 Stokers

These stokers are used primarily for home heating and are designed for quiet, automatic operation. Simple, trouble-free construction and attractive appearance are desirable characteristics of these small units.

A common stoker in this class (Fig. 1) consists essentially of a coal hopper, a screw for conveying the coal from the hopper to the retort, a fan which supplies the air for combustion, a transmission for driving the coal feed worm, and an electric motor for supplying power for coal feed and air supply.

Air for combustion is admitted to the fuel through tuyeres at the top of the retort which may be either round or rectangular. Stokers in this class are made for burning anthracite, bituminous, semi-bituminous, and lignite coals, and coke. The *U. S. Department of Commerce* has issued commercial standards for household anthracite stokers.[1]

Units are available in either the hopper type, as shown in Fig. 1, or in the bin-feed type as shown in Figs. 2 and 3. Some stokers, particularly those designed for use with anthracite, automatically remove ash from the ash pit and deposit it in an ash receptacle as shown in Fig. 3. Most