under the ignition area as under the rest of the grate, while others have a divided air chamber using the full air pressure under the ignition area and a reduced air pressure under the remainder of the grate. These stokers vary in size from approximately 5 ft square to a maximum of 8½ ft square.

Class 4 Stokers, Large Commercial

These stokers are usually of the underfeed type with multiple retorts and either side cleaning or rear cleaning. In the side cleaning type there may be as many as three retorts in the furnace, and the stoker functions in the same manner as has been described for the single retort. These stokers are usually limited in length to approximately 8½ ft while the width may be as great as 10½ ft. In the rear cleaning stokers the number of retorts and the dimensions of the furnace are practically unlimited.

DOMESTIC OIL BURNERS

The number of combinations of the characteristic elements of domestic oil burners is rather large and accounts for the variety of burners found in actual practice. Domestic oil burners may be classified as follows:

1. AIR SUPPLY FOR COMBUSTION
   - *a. Atmospheric*—by natural chimney draft.
   - *b. Mechanical*—electric-motor-driven fan or blower.
   - *c. Combination of (a) and (b)*—primary air supply by fan or blower and secondary air supply by natural chimney draft.
2. METHOD OF OIL PREPARATION
   - *a. Vaporizing*—oil distills on hot surface or in hot cracking chamber.
   - *b. Atomizing*—oil broken up into minute globules.
     - (1) Centrifugal—by means of rotating cup or disc.
     - (2) Pressure—by means of forcing oil under pressure through a small nozzle or orifice.
     - (3) Air or steam—by high velocity air or steam jet in a special type of nozzle.
     - (4) Combination air and pressure—by air entrained with oil under pressure and forced through a nozzle.
   - *c. Combination of (a) and (b).*
3. TYPE OF FLAME
   - *a. Luminous*—a relatively bright flame. An orange-colored flame is usually best if no smoke is present.
   - *b. Non-luminous*—Bunsen-type flame (*i.e.*, blue flame).
4. METHODS OF IGNITION
   - *a. Electric.*
     - (1) Spark—by transformer producing high-voltage sparks. Usually shielded to avoid radio interference. May take place continuously while the burner is operating or just at the beginning of operation.
     - (2) Resistance—by means of hot wires or plates.
   - *b. Gas.*
     - (1) Continuous—pilot light of constant size.
     - (2) Expanding—size of pilot light expanded temporarily at the beginning of burner operation.

   - *c. Combination*—electric sparks light the gas and the gas flame ignites the oil.
   - *d. Manual*—by manually-operated gas torch for continuously operating burners.
5. MANNER OF OPERATION
   - *a. On and off*—burner operates only a portion of the time (intermittent).
   - *b. High and low*—burner operates continuously but varies from a high to a low flame.
   - *c. Graduated*—burner operates continuously but flame is graduated according to needs by regulating both air and oil supply.

Air and Oil Supply

The object of regulating the air and oil supplies is to obtain a complete mixture of the proper quantities of oil and air so the fire will be clean and efficient. Proper and dependable ignition also depends upon the ability of the burner to produce consistent fuel-air mixtures. The type and shape of flame depend largely upon the methods of air and oil supply employed.

It should be pointed out that this mixture burns in a space called the furnace, which is lined with refractory bricks or other heat-resistant substances for the purpose of maintaining that space at a high temperature so that the oil and air may completely unite and burn. Excessive cooling before combustion is completed stops the combustion process and causes soot. The furnace is in some instances a valuable auxiliary in assisting in the actual mixture of oil and air and in modifying the flame shape, besides its primary function of maintaining high temperatures. The size and shape of furnace required are important, especially where the dimensions of the space into which the burner is to be placed are already fixed.

Atomization

The purpose of atomization is greatly to increase the surface area of a given quantity of oil in order to accelerate the change from the liquid state (in which oil cannot burn) to the gaseous or vaporous state, in which state it is one of the elementary fuels, gaseous hydrocarbon. This conversion is largely accomplished through the action of radiant heat energy upon the flying globules of oil, and the tremendously increased surface provided aids gasification.

Air for Combustion

Air for combustion usually is supplied by a motor-driven fan, several types being in common use. Electric motors varying from 1/20 hp to ⅓ hp are used and are started and stopped by the control mechanism. In most cases, they are direct-coupled to the fan as well as to a gear or lobe pump for drawing the oil from the storage tank, and in some cases, to a pump for forcing the oil through the nozzle.

All of the air required for combustion can be supplied by the blower, or else only the *primary* air can be supplied under pressure and provision made so that the remainder will be drawn into the combustion chamber by the natural draft developed by the chimney or by an injector-like action of the primary air. In any event there should be definite control of the quantity of air as well as of the rate of oil supply. Some method of