monly used in sizing the stoker, but this factor may be increased at times due to unusual conditions.

Controls

The heat delivery from the stoker of the smallest household type to the largest industrial unit can be accurately regulated with fully automatic controls. The smaller heating applications are normally controlled by a thermostat placed in the building to be heated. Limit controls are supplied to prevent excessive temperature or pressure being developed in the furnace or boiler and refueling controls are used to maintain ignition during periods of low heat demand. Automatic low water cut-outs are recommended for use with all automatically-fired steam boilers. (See Chapter 34.)

DOMESTIC OIL BURNERS

An oil burner is a mechanical device for producing heat automatically and safely from liquid fuels. This heat is produced in the furnace or firepot of hot water or steam boilers or warm air furnaces and is absorbed by the boiler, and thus made available for distribution to the house through the heating system.

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 (continuous ignition) or just at the beginning of operation (intermittent ignition).
     - (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 at fixed firing rate for period determined by load demand.
   - *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.

A trade classification of domestic oil burners consists of the following general types: (*a*) gun or pressure atomizing, (*b*) rotary, and (*c*) pot or

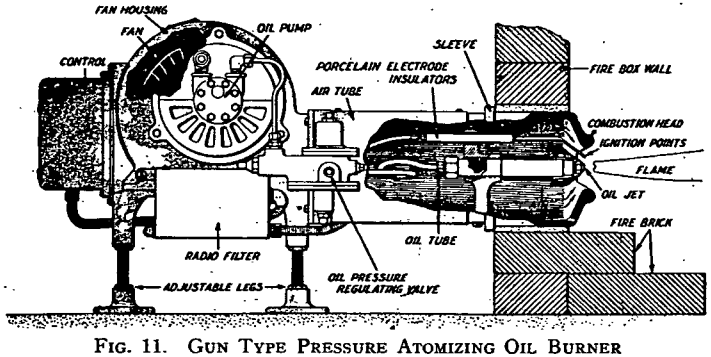

FIG. 11. GUN TYPE PRESSURE ATOMIZING OIL BURNER

vaporizing. These are further classified as mechanical draft and natural draft based on method used to supply the air for combustion.

The gun type, illustrated in Fig. 11, is characterized by an air tube, usually horizontal, with oil supply pipe centrally located in the tube and arranged so that a spray of atomized oil is introduced and mixed in the combustion chamber with the air stream emerging from the air tube. A variety of patented shapes are employed at the end of the air tube to influence the direction and speed of the air and thus the effectiveness of the mixing process.

The most distinguishing feature of vertical rotary burners is the principle of flame application. These burners are of two general types: the center flame and wall flame. In the former type (Fig. 12), the oil is atomized by being thrown from the rim of a revolving disc or cup and the flame burns in suspension with a characteristic yellow color. Combustion is supported by means of a bowl-shaped chamber or hearth. The wall flame burner (Fig. 13) differs in that combustion takes place in a ring of refractory material, which is placed around the hearth. These types of burners are further characterized by their installation within the ash pit of the boiler or furnace.