

Fig. 8 High-Pressure Atomizing Oil Burner

conditions. Two methods, atomization and vaporization, are employed for the preparation of the fuel oil for the combustion process. Air for combustion is supplied by a blower or by draft produced by the chimney. Ignition is accomplished by an electric spark, electric resistance wire, gas pilot flame, or oil pilot flame. Burners of different types operate with luminous or non-luminous flame. Operation may be intermittent or continuous with high-low flame.

Oil burners must be used with a sealed heat exchanger (warm air furnaces, boilers, water heaters, space heaters, etc.), and must have a proper venting system.

While most oil burners operate from automatic temperature-sensing controls, some of the simpler types are operated manually.

Classification of Burners

Domestic oil burners may be classified by type of design or operation into the following groups: pressure-atomizing or gun, rotary, and vaporizing or pot. These are further classified as mechanical draft, and natural draft.

Pressure Atomizing (Gun-Type) Burner

Gun-type burners are usually designed to burn No. 1 or 2 grade fuel oil. They may be divided into two classes: high-pressure and low-pressure atomization.

The high-pressure atomizing type, illustrated in Fig. 8, is characterized by an air tube, usually horizontal, with oil supply pipe centrally located in the tube and arranged so that a

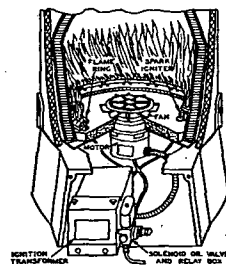


Fig. 9 Wall Flame Vertical Rotary Burner

spray of atomized oil is introduced at about 100 psi, and mixed in the combustion chamber with the air stream emerging from the air tube.

The oil rate can be changed by replacing the nozzle with one of different rating. Oil nozzles are precision devices for metering the oil and discharging the oil in a fine spray or mist. Small oil-rate changes can be made by adjustment of pump pressure. Good atomization is affected at pressures between 75 and 140 psig. Since the objective is to mix intimately the oil spray particles and air, a variety of baffles or mixing devices are employed in the air tube. The air velocity and direction is important in this mixing.

The oil pump can perform both as a suction pump (oil tank below burner), and a pressure pump for atomization.

A blower is used to supply the air for combustion. A damper or other adjustable means at the burner and a draft regulator maintain a proper air supply. Ignition is established by a high-voltage electric spark that may be operative

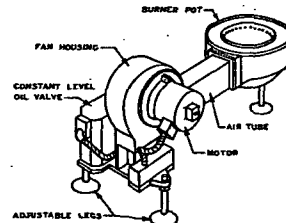


Fig. 10 Vaporizing Forced-Draft Pot-Type Burner

continuously while the burner is running, or just at the beginning of the running period. The burner operates on the intermittent on-off principle, and with a luminous flame.

The combustion process is completed in a chamber constructed of refractory material, or stainless steel, this being a part of the installation.

The low-pressure atomizing burner differs from the high-pressure type mainly by having means for supplying a mixture of oil and primary air to the burner nozzle. The air pressure before mixing and the pressure of the oil-air mixture at the nozzle vary with different makes of burners, but are in a low range of 1 to 15 psig for the air and 2 to 7 psig for the mixture, respectively. The various parts of the burner, except for oil and air mixing parts, are the same as shown in Fig. 8.

Rotary Burner

Most of the smaller rotary burners are of the vertical wall flame type (Fig. 9), and are used with No. 1 or 2 grade fuel oil. Oil is conveyed by gravity to the burner and is centrifugally thrown and mixed with air to a periphery ring of stainless steel or refractory material. A refractory hearth is used to prevent excessive heat loss below the burner and to prevent air leakage. Oil rate and air quantity can be adjusted to suit requirements.

The vertical rotary burners are further characterized by their installation within the ashpit of the boiler or furnace. Various types of ignition are utilized, gas and electric, either

Automatic Fuel Burning Equipment

spark or hot wire. The air for combustion is supplied partially by natural draft, and partially by fan effect of the central spinner element.

Vaporizing Burner

In the vaporizing burner, fuel oil is ignited (manually or electrically) and vaporized in a vessel or pot which is open at the top. Heat for vaporization is supplied by the combustion process. Openings in the side walls of the burner admit primary air which forms a rich mixture of air and oil vapors in the burner. Adjacent to the outlet opening, sufficient additional or secondary air is admitted to complete combustion. The openings for admitting air are arranged to obtain gradual and intimate mixing of air and oil vapor for combustion.

Fuel is fed by gravity from a constant level control valve, and the flow is either on (at rated capacity) or off (at pilot flow), according to the demand of the thermostat. However, the high fire can be reduced and the pilot fire can be increased to give almost any desired control characteristic within the range of the burner. The majority of vaporizing

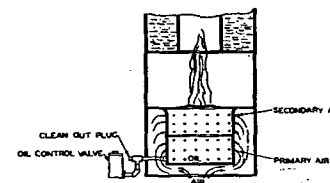


Fig. 11 Vaporizing Gravity Pot-Type Burner

burners are manufactured in sizes up to one gallon per hour input. Most vaporizing burners are limited to use with No. 1 fuel oil having a maximum end point of 625 F and a minimum API gravity of 35 deg.

A barometric draft regulator is required to maintain the recommended draft. A draft of not more than 0.06 in. of water column is recommended for most natural draft burners. When burners are equipped with mechanical forced draft, a slightly lower chimney draft can be used. A burner of this type is illustrated in Fig. 10. A gravity type is shown in Fig. 11.

Oil-Fired Boiler and Furnace Units

A number of types of specially designed oil-fired boiler-burner and furnace-burner units are available. Various locations of burners will be noted in such units; some having the combustion chamber and burner at the top, some at the bottom, and some at the center of the appliance. Typical combination units are shown in Figs. 12 and 13. The coordinated design of boiler (or furnace) and burner elements insures the optimum in operating characteristics, and the maintenance of balanced performance. This type of equipment usually has more heating surface, and better flue proportions and gas travel than conventional boilers or furnaces. Some of the better conversion installations, however, may equal the unit type in performance.

Operating Requirements for Oil Burners

The U. S. Department of Commerce, in conjunction with the oil burner and heating appliance industries, has estab-

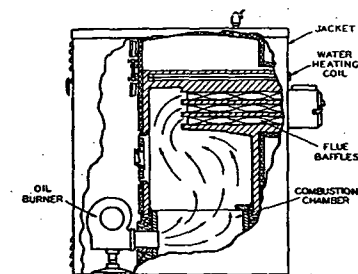


Fig. 12 Typical Boiler-Burner Unit

lished commercial standards for conversion burners and burner-appliance units which cover installation, construction and performance tests.

Combustion Process

Efficient combustion must produce a clean flame and use a relatively small excess of air, i.e., between 25 and 50 percent. This can be done only by vaporizing the oil quickly and completely, and mixing it vigorously with air in a combustion chamber hot enough to support the combustion. A vaporizing burner prepares the oil for combustion by transforming the liquid fuel to the gaseous state by the application of heat.

In an atomizing burner, the oil is mechanically separated into very fine particles so that the surface exposure of the liquid to the radiant heat of the combustion chamber is vastly increased and vaporization thereby promoted. The result is the ability to burn more and heavier oil within a given combustion space. Because the air enters the combustion chamber with the liquid fuel particles, mixing, vaporization, and burning occur all at once in the same space. This produces a luminous flame. A deficient amount of air is indicated by a dull red or dark orange flame with smoky tips.

An excessive supply of air may produce a brilliant white flame or a short ragged flame with incandescent sparks flashing through the combustion space. While extreme cases may be detected, it is not possible to distinguish, by eye, the effect of the finer adjustment which competent installation requires.

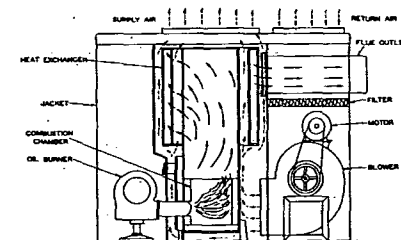


Fig. 13 Typical Oil-Fired Furnace Unit