

burners, it is customary to preheat the oil between the tank and the burner. Preheating when delivering from tank car, or truck is often required in cold weather. As with pressure atomizing burners, a refractory combustion chamber, built within the boiler furnace, is a part of the installation.

Vaporizing Burners

This type burner transforms the oil into a combustible vapor by the application of heat from a plate, or cracking chamber. The class may be subdivided into burners supplying combustion air mechanically, and those utilizing the natural chimney draft. Vaporizing pot-type burners are restricted to the use of the lighter distillates.

These burners are designed for continuous or intermittent operation, with manual ignition, and the rate of burning is controlled by a metering valve. Flame may be luminous or non-luminous, dependent upon adjustment. A burner of this type is illustrated in Fig. 16.

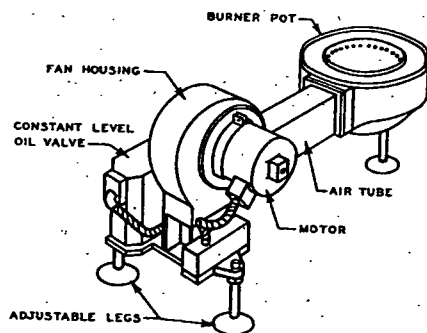


FIG. 16. VAPORIZING POT-TYPE BURNER

Vaporizing burners of the natural draft type are used as the firing device in integral space heaters, water heaters, or furnace units. Only those with full mechanical draft are suitable for conversion installation.

Oil-Fired Boiler and Furnace Units

Boilers and furnaces especially designed for oil burners are available. This type of equipment usually has more heating surface, better flue proportions and gas travel, than conventional boilers or furnaces. Some of the better conversion installations, however, equal the unit type in performance.

Operating Requirements for Mechanical Draft Oil Burners

The U. S. Department of Commerce in conjunction with the oil burner industry has established commercial standards for automatic mechanical draft oil burners for domestic installations which cover installation requirements and performance tests⁶.

⁶Automatic Mechanical Draft Oil Burners Designed for Domestic Installations (U. S. Department of Commerce, National Bureau of Standards, Commercial Standard No. CS75-42). Flue Connected Oil Burning Space Heaters Equipped with Vaporizing Pot Type Burners (U. S. Department of Commerce, National Bureau of Standards, Commercial Standard No. CS101-43). Warm-Air Furnaces Equipped with Vaporizing Pot-Type Oil Burners (U. S. Department of Commerce, National Bureau of Standards, Commercial Standard No. CS(E)104-43).

Combustion Process

Efficient combustion must produce a clean flame and use a relatively small excess of air, *i.e.*, between 25 and 50 per cent. 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. This is accomplished before the oil vapor mixes with air to any extent and if the air and oil vapor temperatures are high and the fire pot hot, a clear blue flame is produced.

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 proceeds quickly. 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.

Combustion Adjustments

The present-day oil burner with mechanical oil and air supply, properly installed and equipped with an automatic draft regulator, is capable of maintaining efficient combustion for an appreciable period following the initial adjustments of oil and air. Eventually certain changes may occur, however, that will cause the per cent of excess air to decrease below allowable limits. A decrease in air supply while the oil delivery remains constant or an increase in oil delivery while the air supply remains constant will make the mixture of oil and air too rich for clean combustion. The more efficient the adjustment the more critical it will be. The oil and air supply rates must remain constant.

The following factors may influence the oil delivery rate: (1) changes in oil viscosity due to temperature change or variations in grade of oil delivered, (2) erosion of atomizing nozzle, (3) fluctuations in by-pass relief pressures, and (4) possible variations in methods of atomization. Any change due to partial stoppage of oil delivery will increase the proportion of excess air. This will result in less heat, reduced economy and possibly a complete interruption of service.

The following factors may influence the air supply: (1) changes in combustion draft due to a variety of causes (*i.e.*, changes in chimney draft because of weather changes, seasonal changes, back drafts, failure or inadequacy of automatic draft regulator, use of chimney for other purposes, possible stoppage of the chimney and changes in draft resistance of boiler due to partial stoppage of the flues), and (2) changes in air inlet adjustments at the fan.

Air leakage into the boiler or furnace setting should be reduced to a minimum. The amount of air leakage will be determined by the draft in the combustion chamber. It is important that this draft should be reduced as low as is consistent with the proper disposal of the gases of