blower and is used to aid in the atomization of the fuel, the balance being induced by the natural draft through openings in the refractory hearth of the combustion chamber. These openings are usually arranged to conform to the shape of the flame from the burner so that the air comes in contact with burning fuel and is not permitted to escape unused through the boiler passages and up the stack. With other burners there is an air register, designed as part of the burner which admits the air by natural draft through adjustable vanes, giving a rotating motion to the air as it enters the combustion chamber about the atomizer. Some installations are provided with forced draft by connecting the air register to a duct from a fan blower.

There are many factors that should be taken into consideration when selecting burners for application to a particular installation. A good burner should be flexible in its adjustments, it should be easily adjusted over a considerable capacity range, it should be suitable for the lowest grade of oil that will be used, and its design should permit the shaping of the resulting flame from the burner so that the flame will fit the combustion chamber closely. A flame that does not properly fit the shape of the combustion chamber permits air to escape around the flame without mixing with the fuel and is therefore responsible for inefficient combustion results. If possible, it is best to use a single burner, rather than burners in multiple, wherever the shape of the flame can be adjusted to meet the combustion chamber requirements and the burner has sufficient capacity and flexibility to meet the variable loads imposed on the boiler. Single burners ordinarily meet the requirements of buildings such as schools, theatres, churches and apartments. For large office and commercial buildings the boilers are usually of such size as to require two or more burners per boiler in order to obtain the required flame application and flexibility of control.

Draft

There are several reasons why less draft is required with oil burning equipment than is necessary where coal is used as a fuel. The principle reasons are that the draft loss through the fuel bed and grate is eliminated, and as a general rule the stack temperatures are lower and the volume of gas less than with coal. For this reason the cross-sectional area of the stack may be smaller, some authorities say that it may be safely assumed as 60 per cent of the area that would be furnished for an equivalent coal fire boiler. In determining the height of the stack, care should be taken to design a stack that will give sufficient draft for the maximum requirements of the boiler and no more. It is therefore advisable to follow the recommendations of the boiler manufacturer and if possible the burner manufacturer should also be consulted so that the air register or parts can be designed correctly for the available draft, and in this way provide for sufficient air to develop the rating of the boiler in the combustion volume available.

Furnace

Under average conditions the combustion volume should be such that a release of 40,000 B.t.u. per cubic foot per hour would not be exceeded at 100 per cent of the boiler rating. This is not the maximum B.t.u. release possible but it is representative of good practice.

Where oil burning equipment is applied to existing coal burning boilers excess draft can be corrected by using a damper. It is also advisable in many cases to use baffles to provide for a longer flue travel and in fire-tube boilers it is good practice to insert retarders in the tubes which give the flue gases a spiral motion and keep them in contact with the surface of the tube.

Auxiliary Apparatus

Regardless of the type of burner used, the installation of the oil system, which includes the tank, heaters, strainers, pumps and piping, is important.

Tanks should be installed in accordance with the local rules for the storage of oil fuel, but in the absence of local regulations, it is suggested that the rules and regulations of the *National Board of Fire Underwriters* be followed. The size of the storage tank is often governed by the amount of space available but it is a question that should be given due consideration, taking into account the time required for delivery, the daily fuel requirements, also the price in various quantities. Where purchases are to be made by carloads it is advisable to have at least a 15,000 gal. tank.

While oil consumption cannot be checked by gaging the tank, an oil meter is the best means of readily determining fuel consumption. It is recommended, however, that each storage tank be equipped with a gage in order to have a constant check of the oil on hand.

A small heater is usually installed in the storage tank around the suction inlet. This heater is used to reduce the viscosity of the oil so that it can be readily pumped. The oil heaters are usually steam coils, but some local regulations require that this heating be done by hot water only. The oil is delivered from the pump to the supply line for the burners and is passed through larger heaters where the temperature is raised to a point that insures the viscosity being low enough for atomization. This temperature is variable for different oils but will usually be between 150 and 200 deg. fahr. It is important that oil be kept at a uniform temperature for satisfactory atomization. This is done by means of automatic temperature regulators which open and close the steam supply valve to the heater coils. From the heaters the oil is delivered as directly as possible to the burners for atomization.

As all fuel oils contain a certain amount of foreign matter in suspension, it is important that the oil line have large strainers with sufficient screen area to permit their being used for some period of time without the screens becoming clogged and preventing the flow of oil. The best practice calls for strainers in duplicate on the suction side of the pump and additional strainers, known as discharge oil strainers, on the delivery side of the pump. It is important that strainers be located where they are readily accessible for cleaning. For small commercial installations, the oil pumps are usually of the rotary type driven by electric motors and are sometimes incorporated into the design of the burner. For large installations, steam operated piston type pumps are commonly used. It is recommended that pumps and heaters be installed in duplicate. This is required by some local regulations where the boiler service is used in connection with the fire protection apparatus.

With the various types of burners that are being used, there have