be installed to add water to the boiler to maintain a safe level, instead of stopping the burner. Either or both should form part of a first-class installation.

Again, with either steam or water systems, the burner control can be inter-wired with a thermostatic device having its temperature element introduced into the boiler near the top, its function being to limit the maximum temperature of water or pressure of steam so the burner will be shut off before dangerous temperatures or pressures are reached. Windows of the room in which the thermostat is located are sometimes opened to *air out* the house in the morning, and if they are not closed promptly, the burner will operate continuously and possibly develop temperature and pressure conditions that might be detrimental to the boiler. This is where the safety device can be used to offset the carelessness of the human being.

Safety controls have been developed for intermittent burners to guard against failure of ignition and in some instances against momentary flame failures. In general regulatory devices are well developed and dependable. Otherwise the domestic oil burner probably would not have been possible.

For further information on temperature control with oil burners, see Chapter 14.

Boilers for Domestic Oil Burners[2]

Boilers used with domestic installations may be those designed for solid fuel or those designed for liquid fuel. The latter are coming to the fore with great rapidity as they usually have greatly increased secondary surface. Many are of copper or steel tube design. Increased efficiencies of 5 per cent to 15 per cent are often obtainable with boilers designed especially for liquid fuel.

It is possible to go to extremes in providing secondary surfaces sufficient to reduce flue temperatures to the order of 250 F to 300 F, with the result that the added resistance through the flues may necessitate the use of a booster fan to insure sufficient draft. It is difficult to obtain satisfactory efficiencies with boilers having little or no secondary surfaces, where the hot products of combustion pass almost immediately from the combustion chamber to the flue; in fact a high efficiency is unlikely with any fuel under such conditions, and the intermittent burner is especially at a disadvantage because of its characteristic development of heat at a high rate while it is operating.

It is essential that the flame produced by an oil burner, especially where it is strongly luminous, be kept from contact with the water-backed surfaces of the combustion chamber, and to this end bricking or its equivalent must be provided in most cases. Where a burner fires through the ash pit, doorframe bricking must protect the unbacked surfaces of the ash pit. The same fire bricking constitutes the actual combustion chamber for the burner flame, and materially increases the combustion volume for a given boiler.

[2]For additional information on this subject, refer to Study of Performance Characteristics of Oil Burners and Low-Pressure Heating Boilers, by L. E. Seeley and E. J. Tavanlar (A.S.H.V.E. TRANSACTIONS, Vol. 37, 1931).

Installation

The intelligence and care with which a burner is installed largely determines the satisfaction that will result from its operation. Two plans for the installation of burners are in general use. In the first, the dealer makes all installations. In the other, sales agencies function only to make sales, and the installation for as many as twenty such sales offices is done by a centrally located installation force, usually factory controlled.

Some burners are adjusted for oil rate by means of a blind needle valve that can only be operated with a special wrench; others, by changing the size of the orifice; others, by a combination of orifice size and pressure. In any event, changes in the firing rate, involving careful air and draft adjustment to match the oil rate, should be made by only a trained man,

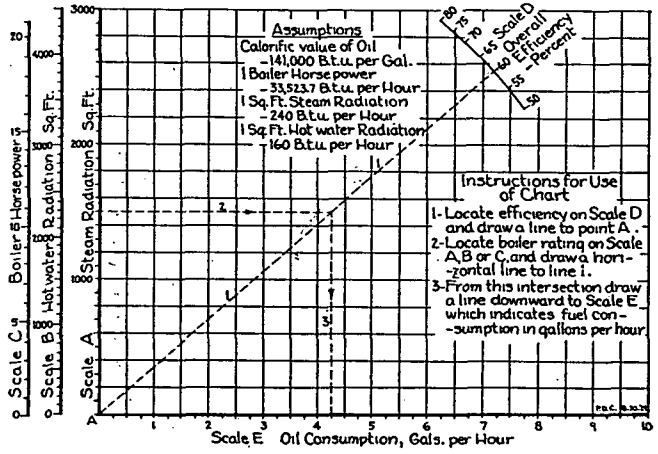

FIG. 1. FULL LOAD RATE OF OIL CONSUMPTION FOR HEATING BOILERS

preferably with the aid of an Orsat test set so that the degree of combustion efficiency can be determined. It is practically impossible to set a burner flame by eye, although that has been general practice in the past. The industry is turning to the Orsat and, as a result, more domestic burners are operating at from 9 per cent to 12 per cent CO_2, representing a higher efficiency combustion than at 5 per cent to 8 per cent, as frequently is the case where the burner is adjusted by eye.

Air for Combustion

It is essential that the basement, or at least that portion used as a boiler room, be open to the outside air, in order that sufficient air be available for combustion. Frequently a case of poor operation will be found where a test with a draft gage made by inserting the tube through the keyhole of the outer door will show that there is a partial vacuum in the basement when the burner is running, all of the combustion air coming through the keyhole and minute cracks. A simple remedy is to cut an inch from the bottom of the outer door.