The air requirements of oil and gas burners are discussed in Chapter 17, Automatic Fuel Burning Equipment.

DRAFT REQUIREMENTS

The draft required to effect a given rate of burning the fuel is dependent on the following factors:

1. Kind and size of fuel.
2. Grate area.
3. Thickness of fuel bed.
4. Type and amount of ash and clinker accumulation.
5. Amount of excess air present in the gases.
6. Resistance offered by the boiler passes to the flow of the gases.
7. Accumulation of soot in the passes.

Insufficient draft will necessitate additional manipulation of the fuel bed and more frequent cleanings to keep its resistance down. Insufficient

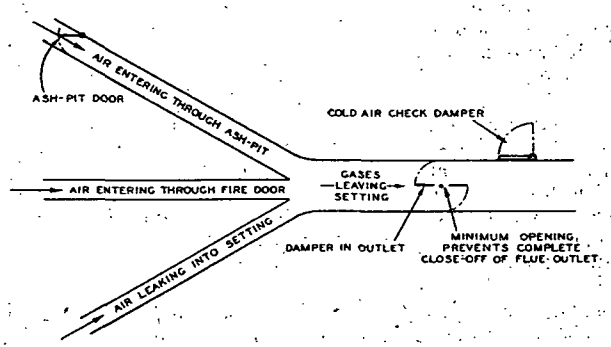

FIG. 3. CORRECT AND INCORRECT METHODS OF DRAFT REGULATION IN A HAND-FIRED FURNACE

draft also restricts the control that can be accomplished by adjustment of the dampers.

The quantity of excess air present has a marked effect on the draft required to produce a given rate of burning. If the excess is caused by holes in the fuel bed, or an extremely thin fuel bed, it is often possible to produce a higher rate of burning by increasing the thickness of the bed. The thickness of the fuel bed should not, however, be increased too much because the increased draft resistance will reduce the rate of primary air supply and the rate of burning.

For amount of draft required see Chapter 19, Chimneys and Draft Calculations.

DRAFT REGULATION

Because of the varying heating load demands present in most installations it is necessary to vary the rate of fuel burning. The maintenance of the proper air supply for the various rates of burning is accomplished by regulation of the drafts. Correct and incorrect methods of draft regulation are shown in Fig. 3. The air enters through the ashpit draft door, firing door, and by leaks in the setting, whereas the gases leave only through the outlet. By throttling the gases with the damper in the outlet all the air entering by each of the three intakes is reduced in the same proportion, thus maintaining about the same per cent of excess air. If inlet air is controlled by the ashpit draft door, the air admitted through the ashpit is reduced, while it is increased through the other two intake openings, resulting in an increase of excess air. A considerable increase in the efficiency of hand-fired furnaces and boilers can be realized by regulating the air supply with the damper in the outlet instead of the ashpit damper. Use of the ashpit damper is required, of course, for low rates of combustion. The cold air check damper is to be used only when chimney draft is excessive. It is normally closed unless closing of the outlet damper and ashpit damper is unable to control the rate of combustion.

Methods of control of draft conditions when burning oil or gas are noted in Chapter 17, Automatic Fuel Burning Equipment.

FURNACE VOLUME

The principal requirements for a *hand-fired furnace* are that it shall have enough grate area and correctly proportioned combustion space. The amount of grate area required is dependent upon the desired combustion rate.

The furnace volume is influenced by the kind of coal used. Bituminous coals, on account of their long-flaming characteristic, require more space in which to burn the gases of combustion completely than do the coals low in volatile matter. For burning high volatile coals provision should be made for mixing the combustible gases thoroughly, so that combustion is complete before the gases come in contact with the relatively cool heating surfaces. An abrupt change in the direction of flow tends to mix the gases of combustion more thoroughly. Anthracite requires comparatively little combustion space.

COMBUSTION OF GAS

The majority of gas burners utilized in central domestic heating plants are of the Bunsen type and operate with a non-luminous flame. In this type of burner part of the air required for combustion is mixed with the gas as primary air, the air and gas mixture being fed to the burner ports. Additional secondary air is introduced around the flame by draft inspiration. In the luminous flame burner, which is sometimes used, all of the air for combustion is brought in contact with the flame as secondary air. This secondary air should be brought into intimate contact with the gas.

Some makes of burners use radiants or refractories to convert some of the energy in the gas to radiant heat. The radiants also serve as baffles in directing the flow of the products of combustion.

The quantity of air given in Table 6 is that required for theoretical combustion, but with a properly designed and installed burner the excess air can be kept low. In order to insure freedom from carbon monoxide under conditions which may obtain in installations, it is customary to design gas burning appliances for a supply of 30 to 35 per cent of excess air. In individual installations in which flue gas analyses are made, the excess air is sometimes reduced to approximately 20 per cent. The division of the air into primary and secondary, is a matter of burner design, the pressure of gas available, and the type of flame desired.