

As more coal is fed from below the mass of coke continues to grow forming a *coke tree*, *plug* or *spar* as it is variously designated. After a period of time, dependent upon the strength of the coke formed, pieces of the *coke tree* break off and fall upon the hearth surrounding the retort or within the retort itself where they are burned.

While part of the ash fuses into particles at the surface of the coke as it is released, most of it is freed in unfused flakes or grains. The greater part of this unfused ash remains on the hearth or dead plates although a part may be expelled from the furnace with the gases.

The ash layer becomes thicker with time and that near the retort, being exposed to temperatures which are high enough at times, fuses into a clinker. The temperature attained in the fuel bed, the chemical composition and homogeneity of the ash, and the time of heating are factors which govern the degree of fusion.

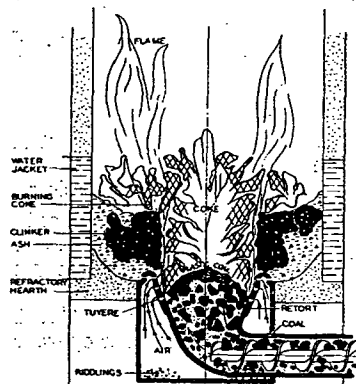


FIG. 8. CROSS-SECTION OF FUEL BED WITH WEAKLY COKING COAL

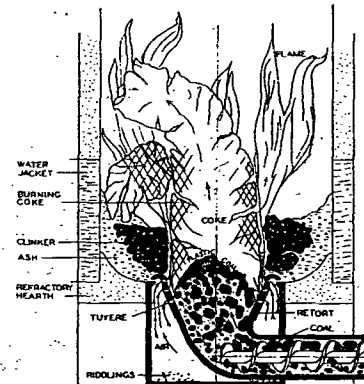


FIG. 9. CROSS-SECTION OF FUEL BED WITH STRONGLY COKING COAL

Bituminous coal stokers of the Class 1 type operate on the principle of the removal of ash as clinker and clinker tongs are provided to facilitate this purpose. Typical representations of underfeed bituminous stoker fuel beds are shown in Figs. 8 and 9.

The appearance of such fuel beds is very ragged at times, and large masses of coke build up, surrounded by blowholes with intense white flame indicating the presence of excess air. There is a natural tendency for users to disturb the fuel bed and make it conform to the conventional representation or ideal fuel bed. Such attention should not be required, as usually the fuel bed tends to correct its own faults as the cycles of plasticity, coke *tree* formation and ash fusion recur.

There are a number of factors which materially affect the rate and type of combustion obtained in stoker usage, the most important of these being: the type and design of stoker, the type and characteristics of the fuel, the method of stoker installation and the method of stoker operation.

Furnace Design

The burning of the fuel on the grate or in the retort will be influenced directly by the stoker design. The burning of the volatile gases above the fuel bed is a matter of furnace design. Proper care should be taken to provide furnaces sufficiently liberal in volume and with the grates or retorts at a sufficient distance from the heating surface to permit proper combustion of the gases. Smoke and low efficiency will result if the furnace is too small to permit proper mixing of the gases and completion of combustion.

TABLE 1. RECOMMENDED SETTING HEIGHTS FOR HEATING BOILERS EQUIPPED WITH MECHANICAL STOKERS^a

Firebox Boilers									
Actual Load ^b	2500	5000	7500	10000	12500	15000	20000	25000	30000
A	18"	18"	20"	20"	22"	22"	24"	24"	24"
B	42"	48"	54"	60"	66"	72"	78"	84"	84"

A = Distance from bottom of Water Leg to floor.

B = Distance from Crown Sheet to bottom of Water Leg.

COMPACT WELDED BOILERS									
Actual Load ^b	2500	5000	7500	10000	12500	15000	20000	25000	30000
A	18"	18"	20"	20"	22"	22"	24"	24"	24"
B	30"	33"	36"	42"	45"	48"	54"	60"	60"

A = Distance from bottom of Water Leg to floor.

B = Distance from Crown Sheet to bottom of Water Leg.

H. R. T. BOILERS											
Hp	50	75	100	125	150	175	200	225	250	275	300
A	5'-0"	5'-6"	6'-0"	6'-6"	7'-0"	7'-0"	7'-6"	8'-0"	8'-6"	9'-0"	9'-0"

A = Distance from bottom of shell to floor.

Hp = Installed horsepower.

In the case of the Firebox or Compact Welded type boilers the desired setting height can be obtained by combining A and B dimensions. The load ratings shown for this class of boilers are actual developed loads in square feet of equivalent cast-iron steam radiation and are not manufacturers' ratings.

The setting heights given for H. R. T. boilers may be used for developed loads up to 50 per cent above normal rating.

^aFrom Data prepared by the *Midwest Stoker Association*.

^bExpressed as steam radiation, 1 sq ft = 240 Btu.

The standards that have been most universally adopted for the proportioning of furnaces for bituminous coal stokers are those of the *Midwest Stoker Association* and the *Steel Heating Boiler Institute*. See Chapter 13.

Table 1 gives recommended setting heights for heating boilers equipped with mechanical stokers using bituminous coal.

Furnace volume is not an important item in anthracite stoker installations. Due care should be exercised for both anthracite and bituminous stokers to prevent intense heat application on the metal surfaces of the combustion chamber. The installation of a baffle or adjustment in setting height of the stoker may be desirable in some cases.