## STATIONARY GRATES

Stationary grates are installed on bearing bars, and not movable except as they are lifted out of the furnace for repair or replacement. Such grates are made in a large assortment of shapes, sizes, weights and have varying percentage of air openings. They may be air cooled or water cooled, for use under natural or mechanical draft and may be used with practically all kinds of hand fired fuels. Cleaning of fires must be done through firing doors. This makes it advisable for the grates to be at the firing door level. In cleaning fires, it is necessary to "wing" or jump the ashes over the live char.

## SHAKING GRATES

This type of grate is used where it is desired to accomplish the removal of the ash or fuel refuse by shaking, rocking, or a rolling motion of each grate bar unit. This operation can be performed at any time and under any fire condition and with any fuel which will not fall through the grate during the shaking process. It is essentially an open type grate with a large percentage of air opening and is used to best advantage under fuels that coke or bridge and that burn to a fine ash. Domestic sizes of anthracite, wood refuse, hogged fuel, bagasse, lignite, run-of-mine bituminous, etc., are types of fuels suitable for burning on shaking grates.

## DUMPING GRATES

The fine sizes of fuels such as the Buckwheat sizes of anthracite, mine or coal yard screenings, hard-wood sawdust and coke braize are burned to advantage on dumping grates. These fuels require keeping the fires level and adding fuel over the entire surface of the fire bed, continuing this procedure until cleaning time, i.e., until the mass of ashes and burning fuel reaches a thickness which prevents adequate supply or proper diffusion of air, or becomes too high for proper spreading.

Ash accumulation under such firing cannot well be removed by shaking for the reason that the fire bed becomes uneven in thickness and openings large enough to permit the ash to pass through would also allow unburned fuel to pass to the ashpit. This explains the difference between *shaking* and *dumping* grates.

Dumping grates are built in sections enabling the operator to push the unburned fuel off the ash bed to another section. The accumulated ash is then dumped into the ashpit and the live char from another section is pulled over onto the clean section of the grate. After this process has been continued until all of the ashes have been dumped, the live char should be allowed to burn down before covering with fresh fuel in order to prevent the formation of clinkers on the fresh fire. Where blowers are in use or the boiler is operating under strong natural draft, fuel should not be added to a freshly cleaned fire until the formation of ash on the surface of the grate has begun, for ash is a good diffuser of air and in addition protects the surface of the grates from overheating. The first firing should be thin and evenly spread over the entire fire bed and allowed to burn down after which successive firings can be made heavier.





This will form a formidable ash foundation after which it is practically impossible to form a hard clinker, even though fuels with very low fusing ash are used.

## MECHANICAL STOKERS

Three types of stokers are commonly used, namely chain-grate, under-feed and over-feed type. Their use permits a uniform fuel supply, efficient combustion, boiler operation at higher rating and the effectual meeting of peak loads. Either forced or induced draft is successful with chain grate stokers which are designed primarily for the use of bituminous coal particularly the free burning and clinkering types. Where forced draft is used, air is delivered at different pressures under the grate, the control being accomplished by dampers, to suit the grade of fuel and the firing rate. At the front the pressure will not exceed 2 in. water gage and will decrease toward the rear as the fuel bed gets thinner.

There are adaptations of self-feeding devices especially adaptable to the smaller heating plants which carry forced draft apparatus, controlled as outlined herein under forced draft. Some of these take the form of a hopper which feeds the coal through tuyeres and automatically brings the ash out of the ashpit. Others take the form of an under-feed type of stoker, which has a variable feed depending upon the heating requirements. There are adaptations of chain-grate stokers which emulate the more pretentious power type of units, all of which have their particular field for the kind of fuel to be burned and function as a labor saving device, but all in general follow principles as outlined in the foregoing treatise.

Over-feed stokers are adapted for all kinds of fuel and the angle of the grate bars will indicate whether bituminous, semi-bituminous, coking coal or the non-coking types are to be used.

Under-feed stokers are made in single or multiple units and will burn coking or non-coking varieties of coal equally well. In both cases either forced or induced draft may be used.

The important points to be observed in recommending and using stoker installations are:

1. Stokers in large plants used in conjunction with modern methods of coal storage and handling at their disposal show a considerable labor saving.
2. In small plants stokers are only advisable where the saving in fuel will be large or where the smoke question is a factor.
3. The upkeep cost of stokers generally exceeds that for hand fired furnaces.
4. The use of different fuels and a better efficiency is obtainable with mechanical stokers.

No stoker will handle every class of fuel satisfactorily so that in selecting a stoker the engineer should take into consideration the type best suited for the fuel and operating conditions. Relative to efficiency of combustion, other conditions being similar, there will be no appreciable difference with the different types of stokers provided that the proper type is used for the fuel to be burned and the operating conditions are fulfilled.