

with unit stokers over the cost for a central fan system, particularly when only one boiler is operated for light load conditions.

The underfeed stoker particularly is suited for burning high volatile coals such as bituminous, semi-bituminous, sub-bituminous and the lignites. With low grades of fuel it is of course necessary to install a larger stoker than the size which is necessary to obtain the same capacity with the higher grades of fuel, such as are mined in the Eastern States. The size of coal preferred usually for underfeed forced draft stokers is $1\frac{1}{4}$ in. screenings, consisting of approximately equal portions of nut, pea and slack.

With the coking fuels a greater percentage of slack can be burned than with non-coking coals, but with the non-coking coals at least one-third of the screenings should be nut size. With the non-coking coal, such as Illinois and Indiana mines produce, too much slack makes the fuel bed dense and it is more difficult to force the air through it. The coarse sizes of coal such as lump and mine run are usually sold at a higher price per

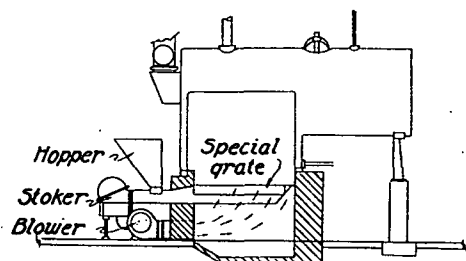


FIG. 3. A UNIT UNDERFEED STOKER

ton than screenings, and are more difficult to feed into the stoker. The coarser sizes of coal will not give as uniform a fuel bed nor as good combustion results as the screenings.

A horizontal feed stoker for service with small boilers has recently been developed. This type of stoker has some stationary and some movable grate sections, each made up of a number of small bars. These sections are inclined so that the movement of the fuel bed is forward and down the hill, though gravity plays no part in the advancement of the fuel.

Electric Motors and Controls

Constant speed motors are used on some of the smaller mechanical stoker installations. The fan and the stoker are operated at full speed and the motor is stopped and started according to the load demand. With this arrangement a magnetic switch is used and is controlled for automatic operation by a regulator which may be influenced by the steam pressure, the water temperature or by a thermostat set to maintain a certain room temperature in the building which is being heated.

With polyphase alternating current or with direct current, variable speed motors are much more desirable than constant speed motors. They are furnished with speed regulators and magnetic switches providing

overload and underload protection. The automatic control may be provided to start and stop the motor from an adjustable automatic regulator controlled to maintain any desired steam pressure, water temperature or room temperature. With the variable speed motor high speed is used for heavy load conditions and may be reduced automatically for light load conditions. The best combustion results thus are obtained and longer life for the stoker mechanism and more quiet operation of the fan is achieved.

Variable speed motors also may be controlled from hydraulically operated compensating automatic regulators. With this arrangement the speed of the motor is varied gradually according to the load demand. The speed regulator may be interlocked with the magnetic switch so that the automatic regulator will also start and stop the motor for extreme variations in the load. This hydraulic-electric regulation usually is superior to the start and stop type of control, but naturally is somewhat more costly.

Selection of Stokers

In recent years there have been put on the market a large number of different makes of stokers, and competent advice and judgment are required in selecting the equipment. Usually each plant has its own peculiar problems and requires study by a capable combustion engineer. In general the necessity for adequate height between grate and boiler surface and of combustion space within the firebox must be emphasized. It is especially important, when installing any mechanical stoker, that adequate instruments shall be furnished for indicating to the operator the exact conditions as to draft and air admixture, since without these the operation of the boiler may be exceedingly inefficient.

Pulverized Fuel

There are a number of very successful installations of pulverized coal burning plants in heating boilers, especially in the Central West. These are of the unit type, in which the pulverized coal is delivered immediately after grinding, with the proper amount of preheated air, into the furnace. With this apparatus, where the necessary furnace volume is obtainable, exceedingly high efficiencies without any smoke or fly ash, can be obtained. Each year witnesses improvement and simplification of the apparatus and a gain in the skill in designing and in operating pulverized fuel burning equipment. High ratings are obtainable and one of the great advantages of pulverized coal equipment is the fact that a boiler can be heated and made to deliver high output in an almost unbelievably short time.

With unit pulverizing machines especially there is apparently no more danger of coal dust explosions than there is with other types of coal handling machinery.

STORAGE SPACE FOR COAL

The storage space required for coal or coke is dependent upon the frequency of fuel purchases during the heating season, as well as upon the rate at which the fuel is burned.

In general, the size of the storage space can be determined on the basis of burning $3\frac{1}{2}$ tons of coal or coke per heating season per 100 sq. ft.