# More TECHNICAL BRIEFS

exciter in the Holtwood station. The total power required is 50 kw.; or 1.75 watts per square inch of screen bar area; of 7.5% of the power generated by the unit; or the equivalent of a 4% reduction in a total head of 60 feet. The heating is applied only when the temperature records indicate a possible ice run. The velocity at intake entrance is 2.0 ft./sec. *AIEE Paper No. 53-8.*

## Coal Gasification

**Pulverized Coal Combustion in a Water-Cooled Radiant Tube.** *By R A Sherman, C E Keinath, Battelle Memorial Institute; R T Sawyer, American Locomotive Co.*

Steam generators fired with pulverized coal are now designed for rates of heat liberation of the order of 20,000 Btu per hour per cubic foot of furnace volume or less. On the assumption of a 20 per cent excess air, of an average gas temperature in the furnace of 2500 F, and of a uniform gas flow over the entire cross-section of the furnace, the residence time of a particle in the furnace would be 2½ seconds. Because the gas does not flow uniformly through the entire cross-section, the velocity of travel is higher and the residence time is less than would be calculated. Inasmuch, however, as the residence time required for 98 per cent completeness of combustion of most high-volatile bituminous coals in the order of one-quarter of a second, it is obvious that large combustion chambers are not necessary to insure economically complete combustion.

The large volume, practically always surrounded by heat-absorbing surface, is provided to insure that the ash is cooled to a temperature low enough to avoid slagging and fouling of the boiler tubes. Such designs are highly satisfactory from the viewpoints both of efficiency of combustion and freedom from excessive slagging, particularly for large steam generators where space is not a particular premium.

Where, however, space is at a premium as, for example, on a locomotive, pulverized coal has not been successfully applied. All attempts of the early 1920's to apply pulverized coal to the steam locomotive encountered difficulty because of slagged ash in the firebox and on the flue sheet of the boiler.

Some years ago, under the sponsorship of Bituminous Coal Research, Inc, it was demonstrated that pulverized coal could be successfully burned without difficulty from slagging of ash at heat release rates of 400,000 Btu per cubic foot per hour. This was accomplished by firing the coal into a long tube of small diameter, which provided a large area of heat-absorbing surface per unit volume. The tubes used were alloy steel of 5-inch diameter and 10-foot length. The tubes, heated to 1700 F, were the heating elements in an experimental metallurgical annealing furnace. Such tubes, fired with natural gas or oil, are widely used for the heat-treatment of metals where it is important that the combustion products must not come into contact with the work. So it was a natural step to try it on coal.

This paper describes a series of combustion trials of pulverized coal in alloy-steel tubes from which the heat was absorbed by an outer, annularly spaced, water-cooled tube. Only one diameter of alloy tube, 5 in., in lengths of 10, 15 and 20 ft, was used for the trials. A highly volatile coal, pulverized to a fineness of 90 per cent through a 200 mesh screen, was fired into this tube at rates of 40 to 160 lb. per hr.

For the arrangement used, the fraction of the coal heat input absorbed by the water in the outer tube was only 20 to 40 per cent. Thus the particular arrangement used was not practical for a boiler. The interest in the tests lies in the fact that a coal whose ash softening and fluid temperatures were 2160 and 2220 F respectively, was burned at extremely high heat liberation rates without difficulty from slagging.

It appears possible that a tube of somewhat larger diameter would give a wall temperature high enough to have a satisfactorily low loss in unburned carbon yet not so high as to result in difficulty from slag formation. The possibility of application of this principle to the steam locomotive boiler [illegible] the research described. A design of locomotive incorporating these [illegible] presented in the paper. *ASME Paper No. 52-A-123.*

**Pulverized-Coal Gasification.** *By [illegible] Traenckner, Ruhrgas Aktiengesellschaft.*

After briefly reviewing the [illegible] of Germany's gas demand and [illegible] which makes it highly desirable [illegible] free larger amounts of coke-oven [illegible] by firing coke ovens with producer [illegible] the general program of research [illegible] development of the Ruhrgas A-G [illegible] explained.

Main efforts were directed to [illegible] the development of two gas producers using low-grade pulverized coal or dust obtained from the coal-cleaning operations. The first process, involving gasification of pulverized coal in a [illegible] tex-type system, with slagged ash removal, has reached the state of commercial applicability, and the results obtained exceed those of conventional producers gasifying coke.

The second process described in detail, the coal dust pulse-jet gasifier is in the experimental stage but already has shown promising results. Further work is in progress to improve operations and efficiencies.

So far only producer-gas tests using air blast have been mentioned. However, the same principles can be used in making synthesis gas or water gas by operating with oxygen-steam blast, and the results would be expected to be better because of the increase in concentration of the reactants. Tests with oxygen-steam blast are scheduled as soon as the producer-gas program approaches completion. Other processes are also under consideration at Ruhrgas and some are in or past the pilot-plant stage, including the high-pressure gasification of bituminous coal.

The problem of producing gaseous fuels and synthesis gas for a number of important industrial products such as ammonia, liquid fuel, rubber, chemicals, etc, using coal as a basic material, is of great interest throughout the world. Not only do many countries have adequate supply of this raw material, the deposits are mostly of such a magnitude that sufficient supply is ensured after other sources may be greatly depleted. *ASME Paper No. 52-A-102.*

(Continued on page 222)

### TO OBTAIN COMPLETE TEXT

*Material for these abstracts comes from the following sources unless otherwise stated. Order complete paper from source not* Power.

*American Society of Mechanical Engineers, annual meeting, Statler Hotel, New York, N. Y. Nov 30-Dec 5, 1952. Identified by initials ASME and obtainable through ASME, 29 W 39th St, New York 18, N. Y.*

*American Institute of Electrical Engineers, winter general meeting, Statler Hotel, New York, N. Y. Jan 19-23, 1953. Identified by initials AIEE and obtainable through AIEE, 33 W 39th St, New York 18, N. Y.*