grate, Fig. 1, p. 128, consisting of a short step-grate mounted at stoker hopper before the traveling grate, proved successful. Compressed-air jets impinging on coal retained on the step grates stimulated ignition. Crushed run-of-mine coal, 47 to 49% moisture, burns at grate ratings up to 400,000 Btu per sq ft per hr with this important proviso—size segregation is watched carefully. *WPC, Paper No.* 15, *Section C2.*

Furnaces for Special Fuels, *by Otto de Lorenzi, Combustion Engineering Co, Inc.* Waste products from many manufacturing processes are potential low-cost substitute fuels, for instance, byproducts from pulp manufacture. Most important of these byproducts are (1) wood refuse from the wood room (2) spent alkaline liquors from chemical digestion processes.

Wood refuse, particularly bark, requires dewatering by roll or reciprocating press to bring its water content down from 80 to 65%. If the pressed bark and other wood refuse are hogged, a more favorable size develops that allows a more uniform feed and a better combustion. Pre-heated air provides further drying.

Most widely used furnace for burning wet wood refuse is the dutch oven. *Adaptations of this incinerator have* been made for building a dutch-oven flat-grate steam generator. From this point a sloping-grate design, followed by a secondary furnace for auxiliary fuels, has been developed. Large units sectionalize furnaces with the dutch oven as a primary furnace and a large watercooled secondary furnace, Fig. 2, where pulverized coal may be burned with wood refuse, or alone.

Spent alkaline liquors, arising from the soda or sulphate process of extracting intercellular matter from wood fiber, are burned in recovery units. These units burn organic matter in the furnace and recover inorganic chemicals by (1) fusing to form a smelt in the furnace and (2) collecting any inorganic chemicals carried off with furnace gas. *WPC, Paper No.* 6, *Sec. C2.*

Deposits on External Heating Surfaces of Boiler Systems, *by H E Crossley, Fuel Research Station, Dept of Scientific and Industrial Research, London, England.* Troubles resulting from formation of deposits on external heating surfaces have increased considerably. High-temperature deposits on boiler and superheater tubes occur in three forms: (1) fused, consisting of sintered flyash only (2) bonded, consisting of flyash particles in a matrix composed mainly of alkali salts (3) phosphatic, consisting of masses of phosphate formed by the action on flyash of furnace-released phosphate compounds. Economizer deposits are aggregates of sulphate and phosphate formed from constituents of flyash and called (1) sulphatic with less than 10% phosphate (2) phosphatic with 10% and over phosphate. Air-heater deposits consist of sulphates, derived from flyash, and free sulphuric acid.

Investigations at British power plants indicate a correlation between amount of alkali chlorides in the coal and the severity of boiler deposits. A similar correlation exists between sulphur in coal and air-heater troubles. Neither correlation applies with pulverized-fuel firing.

Sulphur trioxide in flue gas develops this way. Sulphur dioxide is partly oxidized to trioxide in an aerated flame of carbon monoxide. Oxidation is inhibited by methane and various other substances, including volatile organic matter from coal. Large-scale trials showed that burning liquid fuel in the combustion chamber of a stoker-fired boiler alleviated trouble from deposits. *WPC, Paper No.* 3, *Sec C2.*

Spreader Stoker in the U. S. A., *by Royce L Beers, U. S. National Committee, Fuel Economy Conference.* Recent years have seen development of spreader-stoker firing of bituminous and lignite coals within the U. S. Installations run up to unit sizes of 250,000 lb per hr of steam.

Spreader firing embraces a wide range of coals; from lignite of 6700 Btu per lb, 40% moisture, to bituminous of 14,000 Btu per lb.

Feeders are generally of the mechanical rotating-type with automatic metering of coal feed. Small and medium size installations are of stationary- and dumping-type grates; larger ones, continuous-cleaning grates.

Load change response is rapid. Flexibility compares with oil. Best results come from automatic controls. Furnace volume is large so heat release is kept under 35,000 Btu per cu ft per hr. *WPC, Paper No.* 8, *Sec C*

HOW TO OBTAIN COMPLETE TEXT

Material appearing in this month's briefs comes from one of these three sources:

World Power Conference at The Hague in Sept. Papers are identified by the initials *WPC* and the paper No. Supply is limited at the present but will be available in the future.

National Conference on Industrial Hydraulics, Oct 16, 17, 1947. Papers are identified by initials *NCIH.* They are available from the Armour Research Foundation, Technology Center, 35 W 33rd St, Chicago 16, Ill.

American Society of Mechanical Engineers, fall meeting, Salt Lake City, Utah. Sept 1-4, 1947. Papers are identified by initials ASME and paper No. Available while supply lasts at American Society of Mechanical Engineers, 29 W 39th St, New York, N. Y.

HYDRAULICS

Development of Hydraulic Seals. *W. F. Hagerty, University of Michigan.* Describes a method of sealing a rotating shaft against leakage caused by axial pressure. Essential features of this method of sealing are given, and the theory of viscous-fluid flow in an annulus formed by concentric rotating cylinders is outlined. Test made on several sizes of seals verify the theory. *NCIH paper.*

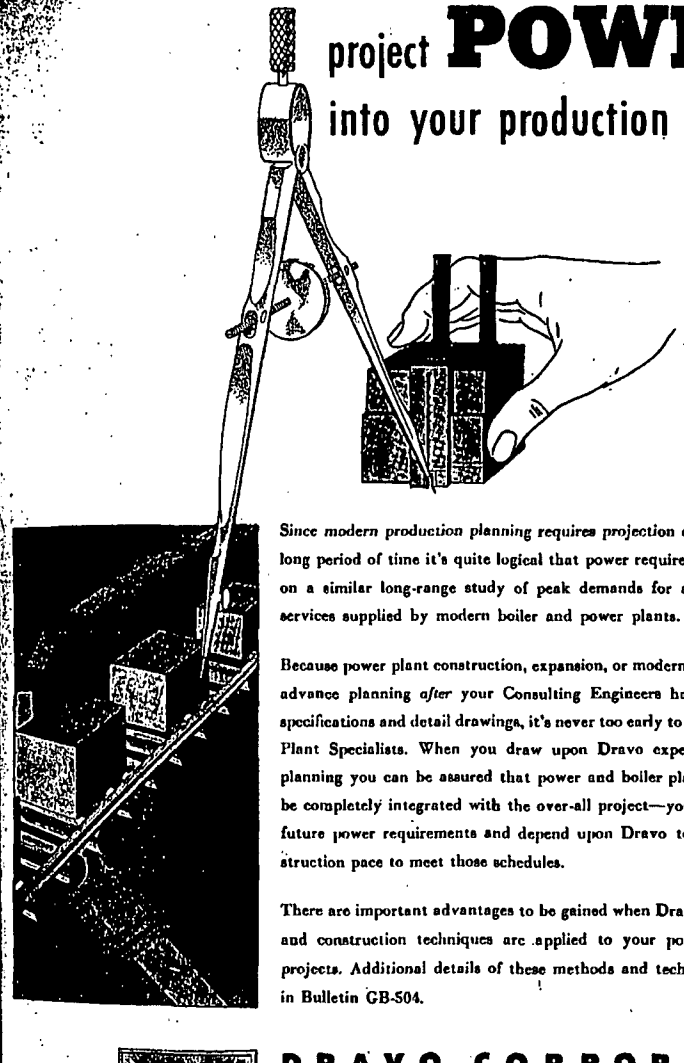
Temporary Installation of Shasta Turbines at Grand Coulee, *by H. H. Sloan, U. S. Bureau of Reclamation.* To supply power for war industries, two 103,000 hp hydraulic turbines, designed for Shasta power plant on the Sacramento River in California, were installed early in 1942 in Grand Coulee plant on the Columbia River in Washington. At the rated head of 330 ft. discharge of Shasta units equaled 3200 cfs at full gate, compared to Grand Coulee units, full-gate discharge of 4500 cfs. Grand Coulee draft tubes are, therefore, about 40% larger than those for Shasta.

Records show that the two Shasta units performed well in their temporary setting and supplied over 3 billion kwh. They rated at 75,000 kw, were loaded to 84,000 kw continuously, and when a little extra peak power was needed each unit operated up to 92,500 kw.

These units were returned to Shasta during 1945 and 46. The biggest job in their removal was taking out the temporary concrete that supported the generators and embedded the turbine casings. About 6500 cu yd of concrete were removed. Most of it was broken out in large blocks, some weighing 8 tons. *ASME Paper No.* 47-F-7.

(*Continued on page* 134)

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