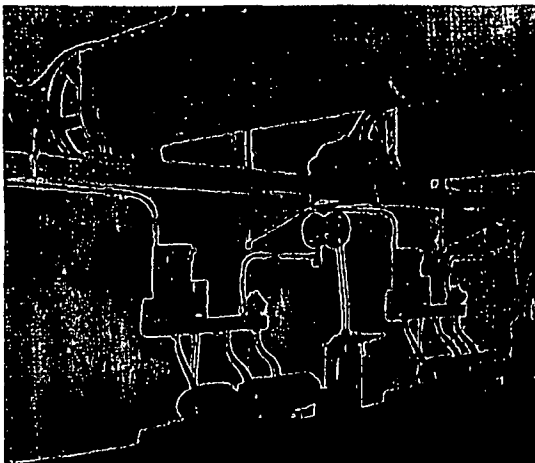




DRIVES AND CONTROLS placed in convenient location for cleaning and maintenance. Fuel-feed controllers stand alongside m-g sets, with the variable-speed motors above.

An overhead flight conveyor brings wood refuse to the boiler room. A tapered hopper connects the conveyors overhead to a horizontal, tapered feed screw driven by a variable-speed dc motor. From the feeder trough the fuel flows by gravity to the furnace top, to drop on the pile in the dutch-oven cell. Combustion is completed in the main furnace of the 3-drum bent-tube 7000-sq-ft Erie City 3-pass boilers.

As shown in the diagram, air is drawn from above the furnace top, under the firing deck and up the boiler front to a warm-air duct. Fresh air, from within the boiler house and from the roof, flows alongside the stack uptake to the same warm-air duct, which supplies the forced-draft fan with slightly preheated air.

Much of the control hookup follows essentially conventional practice. The boiler-outlet damper is regulated directly from furnace pressure. A steam-pressure controller operates the forced-draft-fan outlet damper, the fan being driven by a constant-speed motor. A fuel-feed controller actuates the generator rheostat of the typical Westinghouse Ward-Leonard variable-speed-drive system diagrammed above. This arrangement regulates the speed of the dc feed-screw motor, controlling rate of adding fuel to the pile.

The fuel-feed controller is primarily responsive to a steam-flow controller.

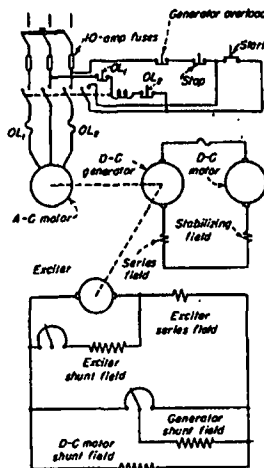
To compensate for differences in fuel conditions (relative amounts of sawdust, shavings and hogged fuel, percentage of moisture, etc) an additional secondary control to maintain desired air-fuel ratio seemed necessary.

Brilliance Control. For this purpose, a photoelectric cell in the boiler furnace rear wall measures brilliancy of the flame and gas stream leaving the dutch-oven furnace and, through an averaging relay, works with the steam-flow controller to adjust fuel feed. With this arrangement, an increase in brilliancy shows an excess of air and a need for more fuel, while a decrease in brilliancy indicates need for cutting down fuel feed.

In normal operation, increased steam demand is reflected quickly in an increase in forced-draft air. As steam flow changes, fuel feed is increased proportionately, with the brilliancy controller acting to correct any change in air-fuel ratio and to maintain combustion at maximum efficiency.

Rate of fuel feed is indicated on a dial at each feed controller; draft gages, steamflow-airflow meters and other boiler instruments are grouped on a panel on the firing deck (see photos and diagrams). Selector valves on the panel permit switching from automatic to manual control as desired.

Hand orat tests reveal that this control method automatically holds ex-

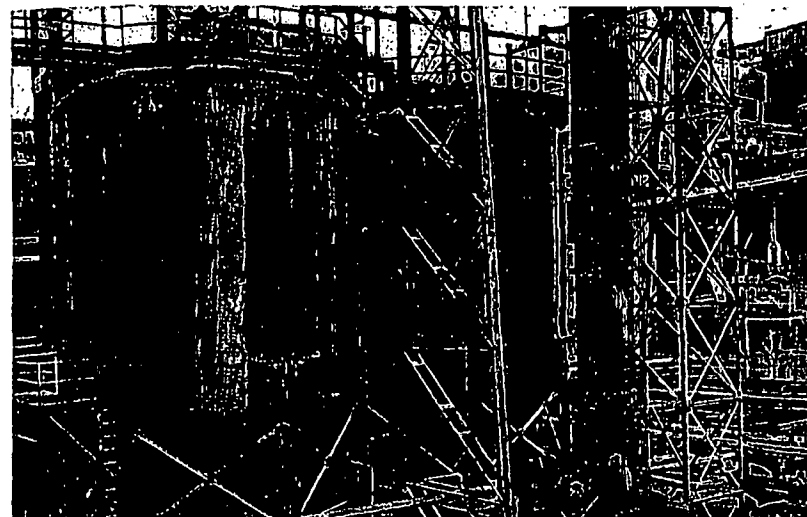


SCHEMATIC DIAGRAM shows electrical connections for the variable-speed drives

cess air within 2% plus or minus, at any rating from 20,000 to 60,000 lb of steam per hr. To do this, the brilliancy control regulates the height of the fuel pile on the grate, depending on the type of fuel being burned at any time, and maintains a clean fire, free from smoke. Gas analyses indicate approximately 22% excess air at high ratings and about 40% at low, with CO₂ at about 16-17% and no CO.

The steamflow-airflow meter was found to be an excellent operating index, correlating closely with the brilliancy values. For example, a deviation in excess air shown by the boiler meter also appears on the brilliancy-meter chart and is promptly corrected. When burning wet hogged fuel (approximately 55 to 65% moisture) the boiler meter shows about 10% lower steam flow than air flow because of the high loss represented by evaporation.

Successful Experience. Our experience indicates the brilliancy control to be of great help in compensating for varying fuel conditions and correcting the primary fuel-feed adjustment to maintain desired air-fuel ratio. The installation of automatic feeding, as a whole, has, in addition to conserving now-valuable wood-refuse fuel, made it easy to hold boiler output to desired levels. With hand firing the output could not be controlled closely and varied over a wide range.



1 First-stage is of sludge-blanket design. Second-stage silica reduction so it can be used when former is out for inspection. Phosphate treatment then goes to feed pump suction

Removal of Silica in a Sludge-Blanket Hot-Process Softener

By J D YODER, vice-president, The Permutit Co;
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Two years' experience using sludge, which accumulates in hot-process lime-soda softener, to give longer contact between magnesium hydroxide and water, better silica removal

silica contents of approximately 55 ppm. In view of this problem, it was decided to install a new type of hot-process softener recently developed by The Permutit Company. A 72,000-gph softener of this type was installed and put into operation in November, 1945, Fig. 1.

MORE CAPACITY REQUIRED

Prior to the installation of the new unit, makeup was treated by conventional hot lime-soda softeners. Nine years of operation with the old plant followed by two years of operation with the new plant have shown that the latter provides more efficient silica removal, as well as better hardness and

turbidity reduction in the effluent. Feedwater to the 430-psi boilers consists of 35 percent makeup, the remainder being condensate. The makeup was provided by one hot-process lime-soda softener of conventional design, Fig. 2, when the paper mill began operations. As the plant grew, similar units were installed until five with a total capacity of 52,000 gph were operating in parallel. Each softener had separate chemical-feeding equipment.

When increased feedwater demand called for still greater capacity, it was decided to install a 72,000-gph softener of the new sludge-blanket design. Although development of this type softener for silica removal was still in

► THE OUTSTANDING PROBLEM in the treatment of boiler water at the Savannah plant of the Union Bag & Paper Corporation has always been the removal of silica. The raw water, which is pumped from deep wells, has a