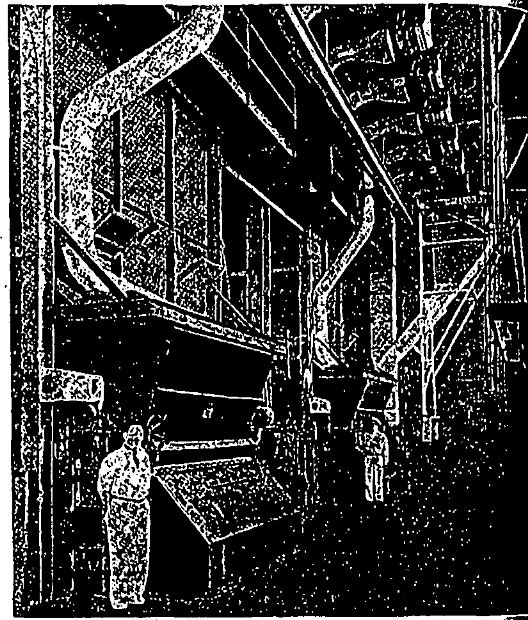
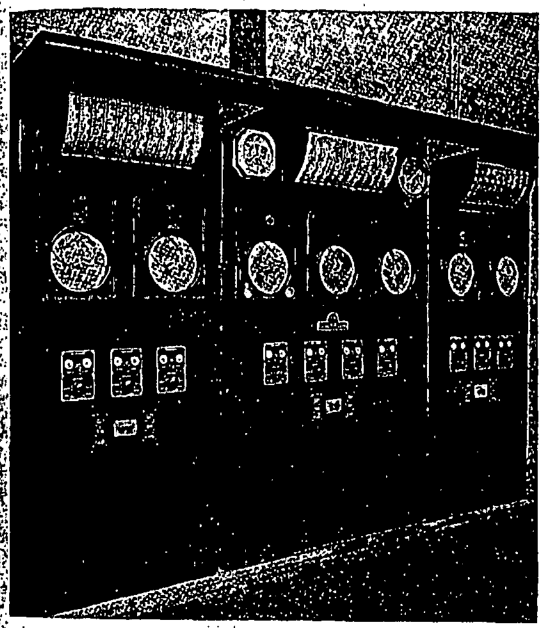
Expanded plant with chain-grate stokers burns lignite having 35% moisture and only 7000 Btu. Monthly boiler and furnace efficiency is 76%. Furnaces have special water-cooled arches and use overfire air from nine horizontal nozzles above the front arch

By G E GIBSON, Chief Engineer
Canada Packers, Ltd
St. Boniface, Manitoba



COAL DUST IS ELIMINATED from the boiler room by an exhaust duct along bunker bottom with intakes to each coal gate and along each stoker hopper. That's why operators wear white suits even though fine, dusty coal is distributed by a weigh larry



METERS AND CONTROL. Each boiler has automatic combustion control, and all three controls are tied into a master regulator which coordinates the operation of all boilers. Meters guide operators in maintaining high boiler performance at all times

Burns Bug-Dust Lignite At Efficiencies to 79%

▶ MEAT PACKING, like many other industries, expanded greatly during the war. The millions leading strenuous lives in the armed forces and in labor's ranks needed more and more body-building food. Moreover, canned and dehydrated meats and new packing-house byproducts were developed along with an enormous and growing output of fats for glycerin and soap. As every plant was pushed to maximum production, requirements of steam, power, air and refrigeration also increased.

Canada Packers' St. Boniface plant, one of the largest packing houses in western Canada, soon faced serious problems because power-house equipment could not meet growing demands. During the lean 1930's one 6000-kw electric-steam generator met practically all requirements. This unit was originally installed to use off-peak power, available at low rates. Two venerable B&W straight-tube boilers, in semi-retirement after nearly 50 years, were used only during the busy fall season.

New Steam Generator. By 1940 it was obvious this equipment would not meet demands, so plans were made to add to the steam-generating capacity. In 1941 a new generator, rated 36,000 lb per hr, 130 psi, saturated, was installed in an extension to the boiler room. Surveys showed that the cheapest fuel available was Souris bug-dust, a lignite averaging 7½% ash, 33 to 35% moisture, 7000 Btu per lb. This high-moisture fuel is burned on a traveling-grate stoker. Furnace construction is conventional with a long ignition arch and refractory walls.

This generator has forced- and induced-draft fans, economizer, air heater, automatic combustion control. A new 160-ft cast-concrete stack was erected, large enough to take care of expansion that was foreseen even then.

This unit gave excellent service, often at severe overloads, as expansion taxed boiler capacity to the utmost. Meanwhile, rapid expansion in the twin cities of Winnipeg and St. Boniface added a problem. The electric utility no longer had excess power at peak periods, and warned that the electric-steam generator could operate during off-peaks only.

Two Additional Units. Early in 1946 we surveyed steam requirement. Peak load had reached 98,000 lb per hour with averages of 70,000 in the busy season. We therefore decided to scrap the two old straight-tube boilers and install two units of about the size of the new boiler. Duplicates were considered, but experience suggested certain improvements. Refractory maintenance costs had been high under the heavy loads carried. Also, the long pipelines through the expanding plant made superheat advisable. Accordingly, we requested the designers to incorporate waterwalls, watercooled arches and superheaters in the new units.

The designers, in turn, proposed a new furnace to provide rear-arch firing for lignite and a more open furnace throat. This design was developed for greater fuel versatility so other coals than lignite could be burned, if there should be delays in coal fields or transportation.

Demolition of the old boilers started March 1, 1946. The old boiler house was extended and its roof raised to conform to the newer section. Erection of the new boilers started the first week in May. The first unit was ready for trials by Sept 3.

Trial Runs. First trial runs, while satisfactory in many respects, revealed some flaws in gas circulation. Gases stratified in the furnace and shot straight up to the first pass, bypassing the rear furnace tube bank. Flyash carryover, always a problem with lignite bug dust, was excessive. After making tests and studies of gas circulation we applied a blast or blanket of overfire air through a row of nozzles above the front arch.

Air at static pressure of about 11 in. wg is supplied by a high-head fan through a duct, and introduced into the furnace by nine nozzles between the front-wall tubes. This air sweeps the flame toward back of furnace above the rear arch, causing increased turbulence and a longer flame travel. This equipment increases boiler and furnace efficiency nearly 5%.

At the same time, flyash carryover was greatly reduced. Finally, automatic combustion control of the overfire air, correlating air volume to the boiler load, was worked out and applied.

As far as I know, this is the first application of overfire air jets to this type installation. The highly satisfactory results exceeded expectations.

In rear-arch firing, as now practiced in these furnaces, main air supply from the forced-draft fans enters the furnace well toward the grate's rear. Main flame, deflected forward by the long rear arch, crosses the furnace from back to front at an angle and strikes the bull-nosed front arch. Radiant heat from this flame dries and ignites incoming fuel. Deflected by the front arch and the blast of air above it, the flame passes back across the furnace again, toward the rear-tube bank, where a baffle turns it forward and upward once more to the first pass. Thus gas travel forms a rough "Z," giving plenty of room for thorough gas mixture and complete combustion.

A test run on a bituminous coal of totally different characteristics from lignite showed this furnace will burn it with fairly good results if necessary.

Each new boiler consists of an upper drum 54 in. dia x 10 ft long, a 36-in. mud drum 11 ft long, with 198—2½-in. and 121—3¼-in. steam-generating tubes, giving a total heating surface of 5072 sq ft including waterwalls. Water is supplied to sidewalls and front-arch tubes by 7½-in. square headers. Rear arch is cooled by extending the front two rows of rear tubes forward and downward around the arch, then back to a rear waterwall header on top of back wall.

Furnace has a volume of 1680 cu ft, and coal is burned on a traveling-grate stoker with 140 sq ft effective grate area.

Automatic combustion control regulates forced- and induced-draft dampers and stoker speed. Meters record steam pressure, feed temperature, gas temperature in each boiler, economizer and air-heater outlet, and air-temperature as well as steamflow airflow relationship for each unit.

An integrator on each boiler records steam production. Twelve-point draft gages show draft pressure at the air-heater outlet, stoker-wind-boxes, furnace-uptake, economizer, and air pressure in and out of air heater. Pushbutton controls for induced- and forced-draft fan and stoker motors are mounted on the meter panel.

Modern Equipment. All boiler-room equipment is as modern as possible with emphasis on dependability, maintenance of service and flexibility to meet widely varying demands without sacrifice in efficiency.

Coal is received in gondola cars on a spur track in front of the boiler room. Dumped directly into either of two grated track hoppers, it is elevated by continuous-flow conveyors into overhead bunkers running the length of the room in front of the boilers. These bunkers hold 220 tons, enough for 48-hr operation under heavy demand. An electrically driven 2-ton weigh larry takes coal from any bunker gate and delivers it to any of the three boilers.

Ashes fall from rear of traveling