



HUGE HOGGED-FUEL PILES standing next to industrial and thermal generating plants are common sight in our North

To Burn Wood Efficiently Choose Properly Designed Combustion Chamber

Waste wood's value varies from a nuisance, to be gotten rid of as cheaply as possible, to a salable commodity in high demand. To make best use of heating values, wood-fed furnaces must be engineered as carefully as those burning other fuels

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► LUMBER MILLS, remote from industrial and residential areas, generally find their waste wood an operating liability. They can't locate a market, so must expend effort and money to get rid of the waste. Generally they use conveyors and refuse burners to dispose of it. This requires not only investment in equipment, but also labor to run and maintain it.

Most mills, however, use steam to run engine drives, "shot guns" for log carriage propulsion, log kickers or hoisting cylinders, dry kilns, glue pots, plywood presses, and also electrical generating, distribution and application equipment.

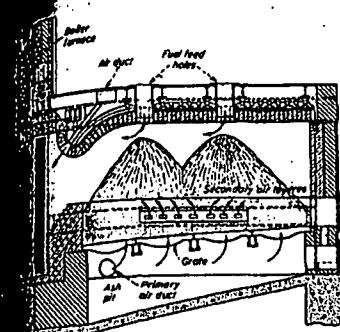
Lumber and paper mills use their wood wastes to fuel this apparatus. If the waste has a market value, it becomes especially important to burn it with maximum combustion efficiency, so a return can be realized from hogged-fuel sales.

Dutch ovens are universally used for furnaces burning wood in steam boilers, see drawings p 91. They must be carefully designed to do a proper burning job. Dutch-oven layout controls the size of boiler, wood bin and auxiliaries. Usual combustion principles govern design of these dutch ovens taking into account, of course, the special charac-

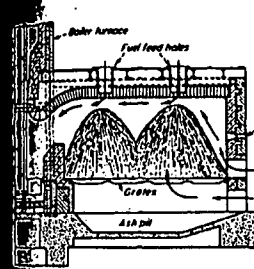
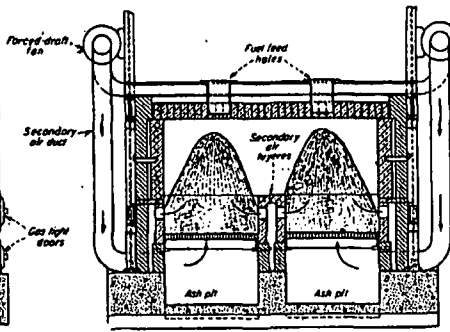
teristics of wood as a fuel, especially high moisture content.

Measures. Wood waste is usually on a volume basis, one unit occupies 200 cu ft. One unit is assumed to weigh 4500 lb. Actual weight, however, depends on entrained moisture, kind of tree the waste comes from, consistency of the waste. This practice shows "primitiveness" of waste-wood fuel industry and the need for classification.

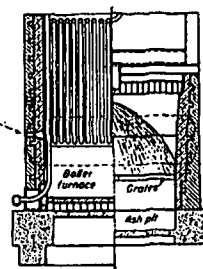
Wood refuse may consist of sawdust, shavings, broken-up trimmings, bark, defective lumber pieces, sugar dust, or any combination of these. It contains carbon, hydrogen and moisture



MODERN GAS-DUTCH OVEN controls air supply to meet steam demand, uses forced draft for undergrate air and overfire excess air. About 85% of air flows in above grate to complete combustion. Air blast insures turbulence



CONVENTIONAL DUTCH-OVEN furnace has minimum control of air flow for combustion. Hogged fuel drops on grates from overhead bin through fuel feed holes in top



typical analysis of the ash by weight:

Silica, SiO ₂	33.70%
Alumina, Al ₂ O ₃	2.21%
Lime, CaO	24.30%
Magnesia, MgO	7.30%
Iron, Fe ₂ O ₃	4.22%
Phosphorous, P ₂ O ₅	5.44%
Titanium, TiO ₂	0.01%
Manganese, Mn ₂ O ₃	0.54%
Copper oxide, CuO	0.87%
Sulfur trioxide, SO ₃	2.90%
Soda, Na ₂ O	5.40%
Potash, K ₂ O	8.87%
Nitrogen, N	0.03%
Moisture	4.21%

Vaporization of moisture in the waste wood and gasification of volatile matter absorbs appreciable amounts of heat energy, Table II. These must be taken into account when designing a dutch oven. For high moisture contents around 65%, use of fuel dryers and air preheaters offers appreciable economies.

Waste wood stored for prolonged periods loses heating value from a form of low-temperature spontaneous combustion, called an isothermic reaction. If the storage pile is heated, the volatile matter progressively disappears by distillation, whether air is present or not to burn it.

In the furnace, the fixed carbon component of waste woods burns as fast as oxygen comes in contact with it. Fixed carbon on the fuel-pile surface burns to CO₂. Fixed carbon within the pile burns to CO. CO₂ generated at the pile surface reduces to CO if it comes in contact with hot carbon before cooling. As fixed carbon burns, the ash deposits and falls through the grate, or is carried up

to all fuels. Particle size varies from minute specks of sander dust to pieces of large as 2x2x6 in. coming from the "hog."

Characteristics. From a steam-raising standpoint the different woods may be graded as follows:

Western hemlock poor
Western fir good
Western pine good
Western spruce fair

California redwood poor
Moisture content is the most variable component of wood-refuse fuels. For approximations in furnace design, the following constants may be used:

Heating value, dry, 9000 Btu per lb
One unit weighs 4500 lb
Fixed carbon, as received 10%
Volatile matter, as received 40%
Ash, as received 0.5%
Moisture, as received 50%

Detailed analyses for specific woods are given in Table I. Principal characteristics of waste-wood fuels are high moisture content, high volatile content, high oxygen content, low ash.

Typical flue-gas analysis when burning Western fir shows CO₂ of 12.5%. While the wood ash is minute compared to most fuels, the constituents it contains are large in number. Here is a