

same for the best soft coals and anthracites. The Illinois coal near St. Louis is 80 per cent. in theory, but has rarely been found in practice to exceed 67 per cent. of the best coals.

Wood has about half the evaporative power of coal, and the usual comparison is to rate one cord, 128 cubic feet, equal to one ton of coal. The wood is supposed to be dry hard-wood or pitch-pine, and weighs about two tons. This is the practice of the master mechanics in this country in rating fuel in locomotives.

Indian corn has sometimes been burned and found when dry to be about equal to the same weight of wood. Corn-cobs have been found to be equal to one-third by weight of Illinois coal, or say one-fourth of good coal, or one-half of good wood by weight.

Incomplete combustion produces a very great loss, and this is best explained by a quotation from "Rankine's Steam Engine," page 270:

"The burning of carbon is always complete at first, that is, to say, one pound of carbon combines with two and two-thirds pounds of oxygen, and makes three and two-thirds pounds of carbonic acid, and although the carbon is solid immediately before the combustion, it passes during the combustion into the gaseous state, and the carbonic acid is gaseous, this terminates the process when the layer of carbon is not so thick can get direct access to all the solid carbon. The quantity of heat produced is 14,500 thermal units as already stated. But in other cases part of the solid carbon is not supplied directly with oxygen, but is first heated and then dissolved into the gaseous state by the hot carbonic acid gas from the other parts of the furnace. The third and two-thirds pounds of carbonic acid from one pound of carbon are capable of dissolving an additional pound of carbon, making four and two-thirds pounds of carbonic oxide gas, and the volume of this gas is double that of the carbonic acid gas which produces it.

"In this case the heat produced, instead of being that due to the complete combustion of one pound of carbon, equals heat units, 14,500, falls to the amount, due to the imperfect combustion of two pounds of carbon, or 2×4400 equals heat units 8,800, showing a loss of heat to the amount of 5,700 heat units, which disappears in volatilizing the second pound of carbon. Should the process stop there as it does in furnaces ill supplied with air, the waste of fuel is very great. But when the four and two-thirds pounds of carbonic oxide gas containing two pounds of carbon, is mixed with a sufficient