

The Illinois coal has rarely been the best coals. of coal, and the feet, equal to dry hard-wood is the practice rating fuel in.

found when dry d. Corn-cobs right of Illinois f of good wood

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t first, that is two and two-thirds carbon is solid during the combustion is gaseous, carbon is not carbon. The its as already carbon is not ed and then onic acid gas rd and two- of carbon are on, making as, and the ic acid gas

ng that due on, equals e imperfect equals heat t of 5,700 ond pound es in fur- ery great. c oxide gas sufficient,

"supply of fresh air, it burns with a blue flame combining
"with an additional two and two-thirds pounds of oxygen,
"making seven and one-third pounds of carbonic acid gas, and
"giving additional heat of double the amount due to the combustion of one and one-third pounds of carbonic oxide. That
"is to say, $10,100 \times 2$ equals heat units, 20,200. To which
"add the heat produced by the imperfect combustion of two
"pounds of carbon 8,800.

There is obtained the heat due to the complete combustion of two pounds of carbon $2 \times 14,500$ heat equals units 29,000.

With coal that has little flame, a thin fire, with exactly the right draft, has been found to give the best results, producing exactly the effects in the first part of the quotation.

It may be doubted if such a bad state of affairs is often found in a boiler furnace of the present day as indicated in the middle of the quotation, though a tendency to an insufficient supply of air may exist in internally fired boilers, such as locomotives, if there is a very thick fire and no air admitted about the grate; and, although not approaching remotely the case where no carbonic acid is produced, some of the carbonic oxide may pass off unburned, in such cases the admission of air about the fuel will be found beneficial.

In all soft coals there are found compounds of carbon and hydrogen known as hydro-carbons, which must also pass into the gaseous condition before being burned. "If these hydro-carbons, such as pitch, tar, naphtha, etc., are mixed on first issuing from the coal with a large quantity of air, these inflammable gases are completely burned with a transparent blue flame, producing carbonic acid and steam, but if raised to a red heat before being mixed with air enough, then disengage carbon in fine powder and the higher the temperature the more carbon they disengage. If this disengaged carbon is cooled below the temperature of ignition before "coming in contact with oxygen it constitutes while floating in gas smoke," and when deposited on solid bodies is soot.

But if this disengaged "carbon is maintained at the temperature of ignition, and supplied with oxygen sufficient for its combustion, it burns while floating in the inflammable gas with a red, yellow or white flame. The flame from fuel is the larger the more slowly its combustion is effected," and with the colors of flame given above as the combustion of smoke is less or more complete. An example of this is found in the use of common illuminating gas when burned with a "Bunsen" or a common burner. The chilling of the gaseous hydro-carbons, which are driven off from the solid pieces of coal by