

1. *Carbon residues* contain little volatile matter; occur largely in anthracites and hard steam coals, and in bituminous coals to a lesser amount.
2. *Resin bodies* contain very little hygroscopic moisture, melt and decompose between 300°C and 400°C; and below 500°C they yield soft coke; heated above 500°C they decompose rapidly, yielding hydrogen, hydrocarbon gases and hard coke.

These resin bodies and their derivatives, the humus bodies, are believed by many authorities to play a major part in the spontaneous combustion of coal. This matter will, however, only be touched upon here as it is dealt with at some length in another section.

There are two classes of these bodies (a) unsaponifiable by alkali, not oxidizable by warm air, and insoluble in pyridine; (b) soluble in pyridine, saponifiable by alkali, and oxidizable to humus bodies by warm air. These are the bodies upon which Parr worked, using phenol as a solvent. He says that they are oxygenated compounds which exist in coal and can be removed by phenol, and that they are unsaturated, and can take up oxygen. After distillation the distillates are equally active with respect to oxygen. They have definite melting points. The resin bodies are those whose presence decides the coking power of a coal; if too great a quantity is present the coke as it forms will swell and burst itself, just as sugar does when heated; if excessively resinous coals are to be coked they should, therefore, be mixed with some inert carbonaceous substance such as coke breeze.

The origin of these resin and humus bodies, and the part they play in spontaneous combustion is dealt with from the microscopical point of view by Lomax.¹

Fayol classes coals which are liable to heat in the following natural order: Lignite, Bituminous, and Anthracite. It can be readily understood that bituminous coals containing large quantities of easily attacked resin bodies are the ones which generally heat most readily; peaty lignites, and some lignites themselves, also heat readily, but this fact is of theoretical interest only as they contain so much oxygen, water, etc., that they keep very badly, and having a very low calorific value there is little commercial reason for storing them. On the other hand coals approximating to anthracite resemble carbon more and more in their stability when exposed to air.

Dennstedt and Bünz² ascribe increase of absorption of moisture by coal to the humic acids which are gradually formed as oxidation of the resin bodies proceeds. They state that the last products of the reaction are mainly humic acids, and the quantity of these acids present is, therefore, an indication of the heating tendency of a coal.

¹ Same reference as (A and B) on page 4.

² *Zeitschrift für ang. Chemie.* (1908), Vol. 35, pp. 1825-35.