

these accumulated when the trees and shrubs grew that bore them, and formed in the first place, no doubt, beds of peat which have since been subjected to an ever-increasing pressure of accumulating strata above them, compressing the shedding of a forest into a thickness of probably a few inches of coal, and which have been acted upon by the internal heat of the earth, which has caused them to part to a varying degree with some of their component gases. By submitting very thin slices of coal to a strong light under the microscope it may be ascertained whether it has been formed from conifers, horse tails, club mosses, or ferns, or whether it consists of the sheddings of all, or as in some instances, of spores.

Ques. How many kinds of coal are there, and to what is due the variety?

Ans. Three, namely, Lignite, bituminous anthracite. The character of the coal has been determined by the facilities for the escape of the gases contained in the mass. A stagnant pool containing a large amount of vegetable matter, when stirred will show bubbles of gas rising to the surface from the mud below. This gas is known as marsh fire, or light carburetted hydrogen, and gases rise to the igneous fatus which hovers about marshy land. The vegetable mud is undergoing decomposition, and as there is not strata to confine it the gases escape and the breaking up of the tissues of the vegetation goes on swiftly. The chemical changes which have taken place in transforming seeds or flowers or trees to coal is not yet well understood. All we know is that under certain circumstances one kind of coal is formed, while under other conditions other kinds have been produced. In some cases the process has resulted in the production of large quantities of mineral oils, such as petroleum. Mineral trees similar to our pine trees were the chief factors in the making of mineral oils. The gradually increasing heat met with, the deeper in the ground we sink, has been the cause of a slow but continuous distillation. Whilst the oil so distilled has found its way to the surface in the shape of mineral oil springs, or has accumulated in troughs, in the strata, and which flows when tapped. All the oils have had a common origin; they are accumulations of ancient vegetation which has undergone chemical change under certain conditions. In the lignite and brown coal this change has been less complete than in the others. The following table shows the changes coal passes through in its transition from wood to anthracite:

	Weight	Specific	Carbon	Hydro.	Ox. & Nit.
	in lb.	Gravity			
Wood average,	30 lbs.	0.50	50.29	6.09	43.62
Peat "	50 "	0.85	60.85	5.89	33.23
Lignite "	20 "	1.04	67.13	5.59	26.98
Brown "	75 "	1.15	82.92	5.40	21.58
Bituminous "	80 "	1.30	83.48	5.34	11.18
Anthra. "	90 "	1.50	95.35	2.47	2.18

The conversion of vegetable matter into peat and ordinary coal, and then into anthracite, is brought about by a diminution in the quantity of hydrogen, oxygen and nitrogen, and an increase in the residual carbon. The gradual increase in weight is mainly due to compression during and after the transformation process. Lignite is of later formation, it has low heating power, and leaves much ash. Brown coal resembles Lignite, but is older and contains more carbon. Bituminous coals are misnamed, as they contain no bitumen. This coal burns freely, and gives off considerable smoke. Anthracite is most highly mineralized of all coals, and burns slowly without smoke.

Everywhere, says an eminent historian, there is a class of men who cling with tenacity to what ever is established, and who, even when convinced by overpowering reasons that innovation would be beneficial, consent to it with misgivings, and forebodings. We also find everywhere, he continues, another class of men, sanguine in hope, bold in speculation, always pressing forward, quick to discern the imperfections of whatever exists, disposed to think lightly of improvements, and disinclined to attend credit for being an imposed to give every change credit for being an improvement. "In the sentiments of both classes," concludes the writer of history, "there is something to approve, but of both the best specimens will be found not far from the common frontier. The extreme section of one consists of bigoted doctards, the extreme section of the other consists of shallow and reckless empirics." Perhaps this old classification of the electorate may fairly be applied to the divisions in public opinion upon the power question and kindred issues. There are on the one hand the arrogant corporation partisans who would give the great consuming classes no consideration whatever; on the other are the eager crowd ready to confiscate property and rob shareholders. Between the two extremes stand those moderates who believe in the administration of public utilities for the benefit of the public but who in order to obtain that desirable end would resort only to fair and honorable methods. To confiscation they prefer purchase on a basis of equitable arbitration.

THE WONDERS OF COAL.

Has it ever occurred to you, says a writer in the Pall Mall Magazine, that the vanilla which many a favorite dish of yours is flavored, is made from coal tar? Will you believe that most of the dyes which have stained the fabrics of your clothes, that the naphtha and benzine which your tailor uses in removing stains, and that even the sweetest perfumes, are all of them derivations of coal? It was once said by a scientist, cleverer and more imaginative than most of his kind, that coal is "buried sunshine." Something of the enormous extent of ancient coal forming jungles may be conceived when it is said that our present forests would produce only two or three inches of coal, if they, too, were subjected to a carbonizing process. The magicians who have wrought wonders with coal are the gas-maker and the chemist. It coal is burnt in the open air, heat is produced and nothing left but a little ash. Burn it in a closer vessel, however, and marvelous changes occur. In the first place, coal-gas is produced, and chemically treated, is supplied to every city home. Furthermore, ammonia is obtained, important in modern agriculture because by its means plants can be artificially supplied with the nitrogen they need. Then, again, asphalt is produced, much used in road-making, although the gas retort is not the chief source of its supply. Lastly, a black, noisome ooze is collected which goes by the name of "coal-tar." It is this which, at the touch of the modern chemist's wand, is transformed into the most widely different substances imaginable. The wonders of coal-tar do not cease here. It is a palette of gorgeous colors, a medicine chest of potent drugs, a whole arsenal of terrible ex-solvents, a vial of delicious flavors, and a garden of perfumes—the most protean, variegated substance in the world.