

Charcoal Burning.

Charcoal was probably made in Ecclesall Woods in small quantities from an early date, but the heyday was in the 18th century, when charcoal was the fuel for iron-making. At that stage “coal” meant a product made from wood; there was charcoal, white coal, small coal. “Coal” as we know it was often called “sea-cole” because it was originally gathered on beaches where it weathered out. The different forms of wood product vary in how much carbon is concentrated in the end product: charcoal is almost pure carbon. Although the process of manufacture was always called charcoal burning, the trick was to heat the heap without air, so that the impurities vaporised and escaped, or were burnt, but the charcoal itself did not burn. A heap that was allowed air, or burnt vigorously, was a spoilt heap, with little charcoal produced.

There are many descriptions of the process. I have given here the process from and 19th-century encyclopaedia, when charcoal-burning was a current process.

“Charcoal”

Under the article CARBON are mentioned the chemical properties of charcoal; nothing further therefore remains to be described except the method of preparing the substance and a few other particulars intimately dependent on it.

Charcoal is prepared either by burning or distillation; of these the first is the simplest, most ancient, and usual method, on which account we shall begin with it.

The business of charcoal burning takes place during the whole of the summer months, and is for the most part carried on in the woods to save the expenses of carriage. Two or three families commonly unite for this purpose, dwelling in tents or temporary huts during the time in which they are thus employed for the convenience of being near their business. After they have felled the timber, and it is become sufficiently dry, the process of converting it into charcoal is begun by raising a plot of ground a little higher than the surrounding surface, and bringing it to a slightly convex form by beating it, and thus forming a hard, dry and solid floor. In the center of this area is placed a circle of sticks adjoining each other and composing a vertical hollow cylinder from three to four inches in diameter, and about six feet high. Round this interior cylinder are ranged successive concentric circles formed by truncheons from one to ten inches in diameter, care being taken that the truncheons in any one circle are of the same diameter, and that one built of the largest wood is always succeeded by one of the smallest wood, in order that there may be as few interstices as possible. The outermost circle is composed of brushwood. When the pile measures from twenty to thirty feet in diameter, it is sufficiently large; a coating is now laid on of turf, the grassy side next to the wood, and dry earth is heaped up around the bottom of the pile, and well armed in order to prevent the admission of air. Three or four screens formed of large hurdles well stuffed with brushwood, are also prepared in order to protect the pile from the violence of the wind. All the preparations being now completed, the pile is kindled by dropping lighted chips down the hollow cylinder in the center, which, in proportion as they are consumed, are supplied by others during the first three or four days, at the end of which period, the kindling of the pile is completed. The top of the cylinder is now closed, and a row of holes, each about two inches in diameter, is pierced at the base of the pile, by which the requisite quantity of air is supplied, and a passage is afforded for the smoke and vapours. When the smoke nearly ceases to issue from these holes, a second row is opened, about six or eight inches above the

first, which are now closed; in this manner the fire is conducted to the top of the pile in about a fortnight; at which time the pile is covered up with earth as accurately as possible, till the fire is completely extinguished. Those pieces that are found not to be sufficiently charred are called *brands*, and are employed as fuel for the next fire.

Although charcoal prepared by the above method is fully adequate to all the purposes of fuel to which this substance is applied, yet in the manufacture of gunpowder, and for some other uses, it is of essential importance to procure a charcoal of greater purity than common. This was formerly done by selecting the stems of willow, alder, and some other of the aquatic trees, and charring them in the usual manner, but with peculiar care. Of late, however, a considerable improvement in the preparation of the finer charcoal has taken place, by charring or distilling the wood in closed iron cylinders. For this purpose a large cylinder of cast iron fixed in masonry over a grate, and furnished at one end with a door capable of being accurately closed, and terminating at the other in a curved pipe, is filled with the chips of any kind of wood; the door being then closed, and a fire lighted in the grate, the empyreumatic acid and all the other volatile parts of the wood are driven off by the heat, which is increased until the contents of the cylinder are red hot. The fire is then withdrawn, the cylinder is allowed to cool, and a black shining and remarkably pure charcoal (in greater proportion also to the quantity of wood employed than by the usual way) is procured, admirably fitted for the use of the gunpowder makers, and apparently possessed of the same qualities from whatever kind of wood it is made.

The proportion of charcoal yielded by particular woods is liable to be so materially affected by the age, and the dryness of the wood, as to render it almost impossible to obtain any correct result in the great way. The following table, from experiments in the small way by Mr. Mushet, will, however, be found to be interesting, as all the woods before being charred were thoroughly dried and prepared, as nearly as possible in the same circumstances.

100 parts of			
Lignum vitae afforded	26.0	of charcoal	of a greyish colour resembling coak
Mahogany	25.4		tinged with brown, spongy and porous
Laburnum	24.5		velvet black, compact, very hard
Chesnut	23.2		glossy black, compact, firm
Oak	22.6		black, close, very firm
Holly	19.9		dull black, loose and bulky
Sycamore	19.7		fine black, bulky, moderately firm
Walnut	20.6		dull black, close, firm
Beech	19.9		dull black, spongy, firm
Norway pine	19.2		shining black, bulky, very soft
Elm	19.5		fine black, moderately firm
Sallow	18.4		velvet black, bulky, loose and soft
Ash	17.9		shining black, spongy, firm
Birch	17.4		velvet black, bulky, firm
Scottish pine	16.4		tinged with brown, moderately firm.

The author of the Rural Economy of the midland counties observes that, in making charcoal, men accustomed to the business cut and cord in wood in the winter, and burn in the summer season. The minutiae of the process of which are there, he says, these. The site, or hearth, being determined upon, the sward is pared off, and the sods laid on one side. The wood usually about the cord is then laid in a ring, somewhat wider than the intended hearth; beginning on the outer circumference of the ring with the smallest of the round-wood, laying the larger pieces of top-wood, and the cloven roots, or but-ends, towards the center. With these last, some of them nearly as large as bushel-blocks, they begin to make their pile,

leaving a sort of chimney in the middle, (a vertical aperture, from a foot to eighteen inches wide), and round this core of roots set up the top-wood, (which has previously been cut at the time of cording, in such a manner, that no forkedness or other awkward crookednesses are left; or, if not cut in this manner, or cut improperly, it is prepared by the colliers themselves, previous to laying it ready for setting), joining the blocks, or rather fitting them in, as close to each other as possible; placing the convex side of the logs outwards, forming the pile in the shape of an inverted bowl, nearly semiglobular. The pile being formed, it is covered over with sods, which are pointed, to keep in the heat the better, and the seams are filled up with fine pulverised mould. The chimney is now filled with short pieces of dry wood; near the top a live coal is put; over this one layer more of dry pieces; and upon these a close cap of sod is placed; nevertheless, this one coal, not larger than the fist, and excluded from the open air, is sufficient to set the whole pile on fire. As the pieces in the chimney burn away, they are replaced by fresh ones: thus feeding the fire with fresh fuel. Paired hurdles are placed on the windward side of the heap, to prevent the fire from acting partially.

When the fire begins to work itself out, at the outward skirts of the bottom of the pile, it is known that the coal is fully burnt, (or rather the wood sufficiently charred), which it will be, in a pile of ten cord, in fine dry weather, in seven or eight days. The fire, during the whole time, is carefully kept from breaking out, by throwing mould or ashes upon the weak parts: so that, though the fire passes through every part of the wood, little or none of the matter of heat escapes. It is observable, he says, that notwithstanding the intense heat, no part appears to be consumed; not the bark only, but even the moss upon it, comes out as entire as when it went in: the only apparent change is, in its being rendered friable and of a black colour. Wood that is charred, seems, he says, to be only very highly dried. It shrinks considerably during the process of charring; but there is no visible derangement of parts. One of the smaller pieces, which is not broken in the drawing, appears as entire when it comes out as when it went into the pile. The brittleness after charring, however, shows that the texture of the wood is altered by the action of the fire. As soon as the fire is out of the coal, on the outside of the heap, the workmen begin to draw; which is done by running a peel between the coal and the hearth, raising up the coal in such a manner as to let the mould and ashes of the sods fall through between the pieces, upon the inward parts, still full of fire. If this makes its appearance in any particular spot, a peel full of ashes is immediately thrown against it. Having got sufficiently near to the fire, the coals raised by the peel are raked off with long, wide-toothed, iron rakes; the teeth about a foot long, and standing about six inches a-part; the handle and head of wood, except a plate of iron on the back, with which the final coal is gathered together. No sieve, nor any rake with finer teeth than the above, is used. The coal being light, it is readily brought to the surface of the ashes and dirt; and, when there, is easily collected with the back of the rake. The side, thus drawn, being rounded up and secured with ashes, another, the coolest part, is secured in the same manner. The drawing is an infernal business; the men working among fire and heat enough to suffocate Satan himself. Such pieces as still retain fire, after they are drawn, are quenched with water; which the workmen have in plenty standing by them, in pails. If a large piece contain much fire, (which hides itself chiefly in the chinks of the large pieces), it is plunged bodily into the water. If the heap itself prove too refractory to be kept under by the ashes alone, a sufficient quantity of water is thrown upon it, to keep the fire under. Such large pieces as are suspicious are laid on one side, in order that those which take fire may be the more readily discovered. A waggon attends to take away the coal as fast as it is drawn: for, if it take fire, or get wet in the hands of the burners, it is at their risk; and, while in the waggon, it is at the risk of the waggoner. Every particle burnt is so much entire waste.

The quantity of ashes arising from a charcoal hearth, he says, is considerable. There were four cart loads taken up from two small hearths, and a load or two still remained.

The dust of charcoal has been found, by repeated experience, to be of great benefit to land, especially to such soils as are stiff and sour. It is to be used in the same manner as soot and wood-ashes. See ASHES and SOOT.

And the author quoted above observes, that charcoal ashes are in good esteem in the midland districts as a manure, particularly for turnips, and for fining grass land. They arise principally from the sods used in covering, but in part from the bits of coal which break off in raking it out of the ashes. There cannot be any doubt but that all the refuse of charred materials that become reduced into a powdery state during the process of drawing the coal, is highly beneficial, when applied on the more stiff and heavy sorts of land as a manure, as much advantage has been derived from it in the experience of different cultivators.

The microscope discovers a surprising number of pores in charcoal: they are disposed in order, and traverse it lengthways; so that there is no piece of charcoal, how long soever, but may be easily blown through. If a piece be broken pretty short, it may be seen through with a microscope. In a range the eighteenth part of an inch long, Dr. Hook reckoned one hundred and fifty pores; whence he concludes, that in a charcoal of an inch diameter, there are no less than five millions seven hundred and twenty-four thousand pores.

It is to this prodigious number of pores that the blackness of charcoal is owing: for the rays of light, striking on the charcoal, are received and absorbed in its pores, instead of being reflected; whence the body must of necessity appear black, blackness in a body being no more than a want of reflection.

Mathematical instrument makers, engravers, &c. find charcoal of great use to polish their brass and copper plates, after they have been rubbed clean with powdered pumice-stone. Mr. Boyle says, that the more curious burn it a second time, and quench it in a convenient fluid. Plates of horn are polishable the same way, and a gloss may be afterwards given with tripoly.

Charcoal and soot-black are the two most durable and useful blacks of the painter, and the varnish-maker. Those of the former kind are used both as pigments and pencils; and charcoal crayons prepared from the willow are preferred on account of their softness. See concerning them Lewis's *Commercium Phil. Techn.* p. 536.

Charcoal tinges glass in fusion yellow, reddish, &c. and by baking stains it yellow. See *ibid.* p. 628. See also his observations on the differences of different charcoals, &c. and of the manner of distinguishing between the vegetable and the animal, *ibid.* p. 336 and seq.

Charcoal was anciently used to distinguish the bounds of estates and inheritances; as being supposed incorruptible, when let very deep within the ground. In effect, it preserves itself so long, that there are many pieces found entire in the ancient tombs of the northern nations.

M. Dodart says, there is sometimes found charcoal made of corn, probably as old as the days of Caesar: he adds, that it has kept so well, that the wheat may be still distinguished from the rye; which he looks on as a proof of its incorruptibility." Rees' *Cyclopaedia*, 1820

There is no comparable description of the process of producing white coal (see Q-pits). The process, and the nature of the product, are not known, except that the white coal was not as pure carbon as charcoal, and burned less hot.

For interest, the same Encyclopaedia gives a description of the production of “small coal”.

Small Coal is a sort of charcoal, prepared from the spray and brushwood, stripped off from the branches of coppice wood, sometimes bound in bavins for that purpose, and sometimes prepared without binding.

The wood they dispose on a level floor, and, setting a portion of it on fire, they throw on more and more, as fast as it kindles; whence arises a sudden blaze, till all be burnt that was near the place. As soon as all the wood is thrown on, they cast water on the heap from a large dish or scoop; and thus keep plying the heap of glowing coals, which stops the fury of the fire, while, with a rake, they spread it open, and turn it with shovels till no more fire appears. When cold, the coals are put up into sacks for use. Small coal was formerly much more in use in London than it is at present. The siftings of charcoal are called charm by the London dealers.