

UNITED STATES PATENT OFFICE.

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CARBONACEOUS PRODUCT AND THE METHOD OF MAKING SAME.

1,420,754.

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No Drawing.

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To all whom it may concern:

Be it known that I, HUGH RODMAN, a citizen of the United States, and a resident of Edgewood, in the county of Allegheny and State of Pennsylvania, have made a new and useful invention in Carbonaceous Products and the Methods of Making Same, of which the following is a specification.

This invention relates to new carbonaceous products and to new and improved methods of utilizing the chemical qualities of a hitherto neglected coal, as distinguished from the well known properties of coal.

The method consists in bringing this coal into contact with chemical reagents, as will hereinafter be particularly described, and the hitherto neglected coal is what I shall call "rotted coal," lacking any well known term to call it, and which I will now describe.

The coal I have investigated most thoroughly is the Pittsburgh seam of coal in Western Pennsylvania and I will describe it especially, observing however that similar seams of coal in other parts of the country may have similar conditions existing. This Pittsburgh seam consists of about five feet of coal overlaid with about a foot of soft shale or clay which is overlaid with four or five feet of roof coal. The bottom five feet of coal is the well known commercial coal. It is taken out by any usual mining method and the foot of overlying shale is then pulled down or allowed to drop down. This leaves the roof coal as the permanent unmined roof of the mine, retained because it makes an excellent roof and also because it is a poor grade of coal, being generally intersected with many small clay and slate seams.

The Pittsburgh seam of coal slopes to the southwest, so that its northern and eastern edges lie in the tops of the hills while its southern and western edges are under the bottoms of the valleys. In the Pittsburgh region this results in the coal existing along the tops of the hills in the Oakmont district, while it exists under the valleys in the region about Monongahela City.

Wherever this coal exists under considerable cover, about fifteen or twenty feet, it is a hard compact, black coal which burns with the production of considerable smoke, makes the ordinary clinker and cokes to a firm coke under proper coking conditions. It carries two or three per cent of water

and is unaffected by ordinary chemical reagents, such as alkali hydrates. The top coal, also where the cover is sufficient, is a hard black coal having the characteristics just described, save that it carries so much slate and shale that it is never mined. When the coal vein has a slight cover only an entirely different condition exists. This different condition is most easily observed at the intersection of the coal vein with the surface of the hill, that is, where the coal comes to the surface, or outcrops. But, as shown further on, this different condition of the coal may also exist over large areas where the coal has only a slight cover, and the condition may also extend over large areas of the top coal, even where the underlying commercial coal is firm and has the characteristics of commercial coal. The coal at the outcrop of the ordinary drift mine, instead of being hard and black, is a soft, friable material having entirely different characteristics from the firm coal farther back under the hill. It is so friable it may easily be crushed or powdered in the fingers. It sometimes carries twenty to forty percent of moisture. It burns with difficulty, producing no smoke and without a trace of coking. When dried it is generally a yellowish brown color. When brought into contact with a solution of ammonia or sodium hydrate it goes into solution to the extent of possibly about sixty percent, producing an intensely black solution resembling tar. When charred under proper conditions it produces a material like charcoal.

It should be observed that this rotted coal is not a commercial product. Where drift mining is done it is of course necessary to drift through this soft rotted coal before the firm merchantable coal is reached, but the rotted coal is not a satisfactory fuel and is therefore thrown onto the dump along with the dirt and slate. Where coal is mined by stripping, the first cuts with the steam shovel are always thrown away with the cover dirt and the coal is not considered of value until the cover has become thick enough to insure hard, merchantable coal. The reason for this is that this rotted coal has been considered, if at all, as a fuel only, and it is not a satisfactory fuel for the reason that it is soft and friable, will not clinker or coke and carries such a large amount of moisture.

The extent to which the rotted condition exists under the hill depends upon the slope of the cover and possibly upon other conditions. It is, however, certain that the 5 rotted condition extends much farther back under shallow hills than under steep ones. Where the slope of the cover is very gentle the rotted condition may extend back fifty or a hundred feet from the outcrop, where- 10 as the rotted condition may not extend more than five or ten feet back from the outcrop upon a steep hillside. The completeness of the rotting of course decreases gradually from the outcrop to the place where 15 merchantable coal is encountered, as the drift is driven. The top coal, that which is always left as a cover or roof in ordinary underground mining, also exhibits the rotted condition at the outcrop, and the same con- 20 ditions seem to hold as with the lower coal, the extent of the rotted top coal depending upon the slope of the cover. It is, however, to be noted that where the coal exists under slight cover, especially under easily perme- 25 able cover, the top coal may be thoroughly rotted over the entire area, whereas the bottom coal may be firm and merchantable (as fuel) after passing the rotted rim (say fifty feet wide) at its outcrop. In other 30 words, where there is a permeable cover of may be ten feet there will usually be found a rotted top coal over the entire area, a rotted bottom coal extending inwardly along the seam twenty to one hundred feet 35 from the outcrop and a solid, merchantable coal within this rim of rotted coal. Possibly the whole description can be summed up by saying that this rotted coal is coal which has once been firm but has since dis- 40 integrated during very long exposures to conditions existing under low covers—but I do not wish to be understood as offering an explanation of its condition, but rather a description of that condition.

I have found that this rotted coal has the 45 unusual property of being easily soluble in ordinary alkalis, the degree of the solubility being dependent upon the alkali chosen and upon the thoroughness of the rotting. 50 As an example, it is possible to dissolve about sixty percent of the thoroughly rotted coal in a two per cent solution of sodium hydrate. That this is quite different from the action of ordinary, merchantable coal is 55 well known to those familiar with its characteristics. Ordinary coal is not soluble at all in weak alkalis and very slightly soluble in any ordinary reagent. The rotted coal is freely soluble in a number of chemical re- 60 agents, these generally being of an alkaline character. It is freely soluble in ammonia solutions and is also reactive with gaseous ammonia, forming a black material easily soluble in water.

65 The solution obtained by bringing rotted

coal into contact with weak alkali solutions is intensely black, except when very attenuated. It may be precipitated as a black material entirely soluble in water, by using an acid or salt reagent as precipitant. It may 70 be concentrated to a thick solution resembling tar or heavy molasses. It may be further concentrated and dried to a hard black glistening granular material looking like anthracite coal but entirely soluble in 75 water.

I believe the discovery of this soluble coal opens the way for development along a number of lines, as the material is easily 80 obtained in large quantities and at low cost.

It is, for instance, possible to use this rotted coal as a substitute for sulphuric acid in the fixing of ammonia, as now practiced in gas works. Experiments carried 85 on by me have demonstrated that the ammonia coming from the coal stills will react quantitatively with the rotted coal, held in suspension in water or in the dry, powdered condition, forming an ammonia- 90 coal compound which apparently should be better than the usual ammonia-sulphuric acid compound as a fertilizer;—this for the reason that the rotted coal, aside from the ammonia, is apparently a beneficial addition 95 to soil, whereas the acid of the acid-ammonia compound is harmful. Experiments are under way to determine the exact benefit to be derived from this ammonia-coal com- 100 pound as a fertilizer but these benefits will not be fully demonstrated for several years. Other uses for such a material will occur 100 to those familiar with the generation and handling of ammonia.

The solution of this rotted coal in weak 105 alkalis, say a two percent solution of sodium hydrate (commercial lye) may be concentrated to a syrupy condition resembling ordinary black strap molasses and used for such purposes as a binding material in 110 making foundry cores, etc., and for other similar work, as the cost of such a solution is much less than the cost of the equivalent amount of molasses.

The alkali solutions of this rotted coal 115 may be used, possibly, for the starting point in the manufacture of dyes, as it is obvious that since the rotted coal is in condition to respond to chemical attack, differing from ordinary coal, it may be possible to obtain dyes 120 more directly than by the usual process of first distilling the ordinary coal and then extracting certain chemically active substances from the condensed distillate. I have, in fact, made an excellent brown dye 125 by precipitating the soda-coal solution with a solution of iron sulphate, the soda-coal solution first being soaked into the cloth to be dyed. The color is apparently fast to light, acids and alkalis.

The rotted coal-alkali reaction may be the 130

starting point in the manufacture of printing inks. When the coal is attacked by the alkali, the portion not going into solution is reduced to an extremely fine silt and it is therefore possible to make a sort of black paste of very smooth quality by boiling the well rotted coal in weak alkali until there is obtained the desired consistency of the combined coal-alkali solution mixed with the undissolved silt.

Other uses for this alkali-coal compound and the reaction described will occur to those familiar with chemical engineering. So far as I know, this is the first observation made upon this unusual, and ordinarily waste, coal in the way of its chemical activity.

While I have described my invention and discovery in general terms and have specifically pointed out only a few of the products which result from employing processes herein described as a part of my invention, I desire it to be understood that I believe my invention and discovery to be of a generic nature, and that other processes and other materials, not herein specifically mentioned, may be employed in connection therewith without departing from its spirit and scope, as set forth by the appended claims.

What I claim is:

1. The method of producing a water soluble tar which consists in treating rotted coal with an alkaline reagent and in concentrating the solution so obtained.

2. The method of producing carbonaceous material which consists in dissolving rotted coal in an alkaline reagent, in continuing the action until a thick plastic mass is obtained and then in drying the plastic mass.

3. The method of producing an alkali soluble carbonaceous material which consists in dissolving rotted coal in an alkaline reagent

and in precipitating the solution so obtained with a chemical reagent.

4. The method of producing a soluble carbonaceous material which consists in dissolving rotted coal in an aqueous solution of an alkali hydrate, continuing the reaction until a thick plastic mass is obtained, and then in drying the product of the reaction.

5. The method of treating rotted coal which consists in subjecting it to the action of an aqueous solution of an alkali hydrate and treating the solution so obtained with a precipitant.

6. A method of treating rotted coal which consists in subjecting it to the action of ammonia.

7. A method of dissolving rotted coal which consists in treating it with ammonia and treating the product of the reaction with water.

8. The product obtained by treating rotted coal with an aqueous solution of an alkali hydrate, and in precipitating the solution so obtained with a chemical reagent.

9. The product obtained by treating rotted coal with an aqueous solution of an alkali hydrate and in concentrating the solution so obtained.

10. The product obtained by treating rotted coal with ammonia.

11. The product obtained by treating rotted coal with an aqueous solution of ammonia.

12. The method of fixing ammonia, which consists in subjecting it to rotted coal.

In testimony whereof, I have hereunto subscribed my name this Sept. 6th, 1917.

HUGH RODMAN.

Witnesses:

C. W. MCGHEE,
ANNA DOHERTY.