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CARBONIZED BRIQUETTE AND ITS MANUFACTURE.

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My invention relates to carbonized briquettes and their manufacture, my aim being to produce a superior product, and to simplify and cheapen manufacture. While the invention is especially advantageous for the softer coals, yet it is also adaptable to anthracite, for example. In making briquettes, my preferred method is as follows:

Taking a non-coking and non-caking coal such as New River coal, for example, I grind it sufficiently for all to pass a screen of 40 meshes to the linear inch, say. The coal thus operated on may be mine run or screenings,—preferably the latter. I grind the coal in water or by what is known as the wet-grinding process, thus eliminating fire hazard. The resulting wet coal sludge is allowed to drain naturally by standing in a pile, and then mixed with binder while still wet. The amount of water retained by the ground coal after draining is determined, and the percentage of binder gauged on a dry basis, according to what is found by trial to give the best results with each particular coal treated. With New River coal, I use 8% by weight of binder and 92% dry weight of coal. For binder I may use an oil distillate of an asphalt base, such as asphaltum base petroleum distillate: e. g., Mexican oil distillate of 11° Bé. gives excellent results. Such a distillate is readily obtainable and low in price.

Adding the oil binder to the wet coal, I work and knead the two together until the mass is homogeneous. Oil has a physical affinity for coal or carbon, and displaces the water readily: accordingly, the water is easily forced out of the mass. The oil is more easily worked through and blended with the wetted coal than it would be with dry coal. Preferably, I employ a blending or mixing machine that will approximate or duplicate the action of a mortar and pestle. In practice, such a machine as a Simpson mixer or a wet pan with suspended mullers is satisfactory.

The mass of coal and oil may be formed into briquettes by either of two preferred methods: extrusion through a die, or pressing in a mold. Fairly high pressure is necessary. In either case, nearly all the water remaining in the mixture is expelled as the briquette is formed, so that not more than 10 or 12% is held by the formed briquette. When I use an extruding machine to form the briquettes, I prefer the plunger type, in order that as the water is expelled from the briquette it may leak back between the piston and the cylinder. As it is extruded, the column is cut off into convenient lengths. When I use a press, I prefer a mechanical or hydraulic one of the type that pushes the formed briquette through the mold. This forms an oil film on the surface of the briquette, which improves the appearance of the finished product.

While the formed briquettes may be dried or partially dried before retorting or carbonizing, yet I prefer to retort them without any special drying, thus allowing them to retain their moisture. This is because a certain amount of moisture improves the gas yield in carbonization. In charging the retort, I may mix the briquettes with carbonaceous material substantially free from volatile matter, such as pulverized (ground) charcoal or coke, preferably the former. This affords a non-oxidizing or reducing environment to protect the briquettes from oxidation during carbonization, and allows the necessary shrinkage to take place freely. As to the retort itself, the inclined type which allows gravity discharge and limits the weight on the briquettes is desirable. The retorts may be heated externally by burning the gas generated in the retorting process, or by the combustion of coal, or by any suitable means.

The temperature and time of retorting are important, being a means of controlling the shrinkage of the briquettes and the amount of volatile matter retained in them. By controlling the shrinkage, I am able to give the product a high apparent specific gravity, approaching that of anthracite. The volatile retained after low temperature retorting is substantial; i. e., some 10 to 12%, which is approximately the same as the volatile content of first quality anthracite. The fineness of grind of the original coal also has a bearing on the shrinkage, some coals requiring to be finer than others in order that the briquettes may attain maximum shrinkage and compactness. The temperature that I have com-

monly used in retorting is 500° C. (932° F.); and in "low temperature" carbonizing (as it is termed), I do not exceed 550° C. (1012° F.). In general, retorting should continue until no more gas will come off at the temperature employed: the time required for this depends on the type of coal, the size of the charge and its thickness as it lies against the retort wall through which the heat is transmitted to it, etc. High temperature carbonizing (expelling most or nearly all of the volatile) may be employed; but the briquettes thereby produced are not so satisfactory.

After retorting, the briquettes may be cooled to atmospheric (room) temperature under the protection of non-oxidizing gas. For this purpose, the products of combustion from the retort gas fires that heat the retorts may be used to preheat water, and thereby cooled below combustion temperature; they may then be employed as a cooling medium for the briquettes and their protective charcoal or coke. When thus cooled below combustion temperature in combustion gases, the briquettes retain a "slickened" looking surface, and the charcoal is preserved for reuse.

In this process of making briquettes from bituminous coal and oil binder, the oil holds the coal in shape while being prepared for retorting and give the desired retorting effect at the low temperatures indicated. The briquettes are hard, dense and cohesive; have a pleasing appearance; and closely resemble anthracite in density, in chemical constitution (proportions of fixed carbon, volatile matter, and ash), and in physical behavior on burning (retaining their shape without caking or running together).

The process can also be adapted and extended to the briquetting of anthracite, with suitable variation in the percentage of binder (anthracite requiring more binder than bituminous coal). The anthracite briquettes thus produced are superior to those of the prior art in both their appearance and their behavior in burning.

Having thus described my invention I claim:

1. The step in the preparation of oil-bonded pulverized coal for briquetting which comprises mixing wet-ground coal of predetermined moisture content with the oil binder, while wet, in approximately the proportions of nine parts of the former to one part of the latter.

2. The method of preparing oil-bonded coal for briquetting which comprises wet-grinding the coal, draining the ground coal to predetermined moisture content, and mixing it with the oil binder while, still wet, substantially in the proportions of ninety-two parts of the wet coal and eight parts of the oil binder.

3. The method of making briquettes which comprises wet-grinding coal and mixing it, while wet, with an oil binder; and after briquetting, retorting and carbonizing the briquettes in a non-oxidizing environment at a temperature sufficiently low to allow them to retain a substantial proportion of volatile matter.

4. The method of making briquettes which comprises wet-grinding coal and mixing it, while still wet, with an oil binder; forming the mixture into briquettes; and retorting and carbonizing the briquettes with carbonaceous material substantially free from volatile matter, at a temperature sufficiently low to allow them to retain a substantial proportion of volatile matter.

5. The method of making briquettes which comprises wet-grinding coal and mixing it, while still wet, with an oil binder; forming the mixture into briquettes; retorting and carbonizing the briquettes with carbonaceous material substantially free from volatile matter, at a temperature sufficiently low to allow them to retain a substantial proportion of volatile matter; and cooling the briquettes and said material with a non-oxidizing medium.

6. The method which comprises retorting and carbonizing oil-bonded coal briquettes containing not more than ten to twelve percent of water at a temperature sufficiently low to allow them to retain a substantial proportion of volatile matter.

7. The method which comprises retorting and carbonizing oil-bonded coal briquettes containing not more than ten to twelve percent of water in a protective non-oxidizing environment, at a temperature sufficiently low to allow them to retain a substantial proportion of volatile matter.

8. The method which comprises retorting and carbonizing oil-bonded coal briquettes while protected from oxidation by a covering of powdered carbonaceous material.

9. The method which comprises retorting and carbonizing oil-bonded coal briquettes at a temperature sufficiently low to allow them to retain a substantial proportion of volatile matter, and cooling the briquettes in a non-oxidizing gas.

10. The method which comprises retorting and carbonizing oil-bonded coal briquettes while protected from oxidation by a covering of powdered carbonaceous material, and cooling the briquettes and said material under the protection of a non-oxidizing gas.

11. A hard briquette of high specific gravity consisting of wet-ground coal and an oil binder with a water content of not more than ten to twelve percent carbonized at low temperature and retaining a substantial proportion of volatile matter; having a density approaching that of anthracite, and charac-

terized by a slickened appearance when cooled under non-oxidizing conditions after carbonization.

12. A hard, dense carbonized briquette composed of wet-ground bituminous coal and an oil binder with a water content of not more than ten to twelve percent, approximating anthracite coal in specific gravity; in proportions of fixed carbon, volatile matter, and ash, and in behavior during burning.

In testimony whereof, I have hereunto signed my name at Philadelphia, Pennsylvania, this 30th day of November, 1925.

SAMUEL FORMAN WALTON.