

UNITED STATES PATENT OFFICE.

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FUEL.

1,261,645.

Specification of Letters Patent.

Patented Apr. 2, 1918.

No Drawing.

Application filed March 27, 1915. Serial No. 17,506.

To all whom it may concern:

Be it known that I, EDGAR ROUSE SUTCLIFFE, a subject of the King of Great Britain and Ireland, residing at Leigh, Lancashire, England, have invented certain new and useful Improvements Relating to Fuel, of which the following is a specification.

This invention relates to a process for the manufacture of coke or fuel from carbonaceous substances of the character of coal, namely coal, anthracite, coke and charcoal, and it has for its object to produce by a process of distillation, gasification or coking a fuel of the character of coke but having novel characteristics such as render it useful not only for purposes for which coke is usually employed, such as a fuel for blast furnaces and other metallurgical purposes, but also for purposes for which coke produced under the ordinary conditions of carbonization in gas works is not suitable, such for example, as a fuel for burning in open domestic grates, as a fuel for the manufacture of gas such as producer or water gas, as a fuel for use in slow combustion stoves, or for firing furnaces such as those of steam boilers and generally for purposes for which coal, anthracite, coke and charcoal are usually employed.

The invention has for its object to produce a coke of such a character that it burns freely although it contains but a small proportion of volatile matter, and to produce a coke that is hard and dense so that thus the product has particular advantages for general use as a fuel and for the special purposes indicated.

According to the invention such a fuel is produced from carbonaceous substances of the character of coal, namely coal, anthracite, coke or charcoal, and such a process is carried out by first reducing the raw material in a dry state to a very finely comminuted condition or flour, then compressing this substance in the manner hereinafter described into blocks, briquets or masses, and adding a solid and dry binder where the carbonaceous substance, for example, anthracite, coke or charcoal, has not itself the capacity of binding together upon compression, and then distilling, gasifying or coking the compressed blocks, briquets or masses at such a temperature and for such a time

as may be determined according to the character and purpose of the coke residue or the by-products of the process.

According to the invention moreover the raw material employed may be a mixture of coal with anthracite, coal with coke, or anthracite or coke with pitch where it is desired to secure a coke having the properties of anthracite or where a fuel is to be produced in the utilization of anthracite or coke, or where it is desired to produce dense compressed blocks which on being coked preserve their regular shape and are homogeneous and the mixture may be effected in the reduction to a finely divided condition or subsequently.

In carrying the invention into effect according to one modification in the employment of a coking coal, I reduce the raw material in a dry state to a very finely divided condition or flour and subject this raw material in the very finely divided condition to compression for the production of a solid block according to the method described in a pending application for patent, Serial No. 17,504 of Mar. 27, 1915; that is to say, by a process of compression in a hydraulic press or in a press of the hopper and plunger type or in any other suitable apparatus, the compression being effected under conditions that permit of the block laterally expanding under the stresses imposed in its production.

I then subject the blocks thus produced, to a process of distillation, gasification or coking in a coke oven or in a retort of any suitable kind, and I effect the distillation at such a temperature and for such a time as may be necessary according to the character of the product or by product desired or the content of volatile matter to be left in the residue; for example, I may carry out the distillation at from 400° to 1200° centigrade.

I may arrest the distillation at the particular stage necessary in order to retain in the coke to be produced the desired content of volatile matter.

In the use of an ordinary coking coal according to the process described a coke residue having a content of from two to three per cent. of volatile matter may be produced which has a good calorific value and is by reason of its special characteristics suitable for general use as a fuel. Such a fuel can

be burnt in an open grate with a considerable production of gas and flame free from smoke.

I find that the finely divided condition of the raw material is of great importance having regard to the burning quality and physical condition of the resulting coke and the effectiveness of the process of distillation, gasification or coking; and accordingly it is necessary to reduce the raw material to as fine a state of division as is convenient or practicable.

I have found that by reducing the raw material so that the whole passes through a sieve of 200 mesh, excellent results are secured but good results may be secured even if a proportion of the raw material employed is coarser than would pass through a 200 mesh.

In regard to the conditions of compression I have found that blocks produced from the very finely comminuted dry raw material in a press such as used for the production of ovoid briquets or bodies and briquets or bodies of other similar shapes and of small or large size give good results with raw material suitable for briquetting. It is, however, necessary that the blocks or bodies produced should be solid, free from cracks or laminations and not liable to disintegration. Such blocks may be produced according to the method described in the specification of the pending application Serial No. 17,504 aforesaid; for example, the blocks may be produced in a press of the hopper and plunger type and the finely comminuted and dry material may be compressed under conditions where the block or briquet is free to expand under the stresses imposed in its production which conditions are secured in the employment of a tapered mold tapering outwardly toward the discharge aperture in the mold.

In such a press, blocks may be produced by a single compression gradually increasing, which according to the size of the block produced may be varied from two to 10 tons per square inch. With a view, however, to secure a well compressed block without the use of a binder where coal is used as the raw material I may carry out the compression in distinct stages and move the briquet in the course of its compression toward the outlet end of the mold or during the interval between successive stages of compression.

Or again I may produce the blocks for coking or distillation by subjecting the very finely divided dry raw material to a preliminary compression in any suitable mold and then break up the blocks, nodules, cakes or flakes so produced into small pieces or bodies, as disclosed in my application Serial No. 17,505 filed simultaneously with the present one. Or compressed bodies of small size may be produced without the necessity of being broken up, and these may together be

subjected to further compression for the production of very hard and tough blocks or briquets of any desired size and shape according to the process the subject-matter of the application.

By subjecting the compressed very finely divided raw material in a dry state to further compression, or to further compression after being reduced to small pieces or bodies in the manner described, I am able to produce blocks for coking that are very hard and tough, and a coke that is dense and compact; but in general, in treating raw material capable of binding, or raw material such as anthracite, coke or charcoal, with which the use of a binder is required, blocks or bodies are produced without further compression that are in a condition suitable for coking to produce according to the invention a coke that is hard and dense and that is of especial advantage for use as a fuel.

In the production of a fuel in the utilization of anthracite and coal, I first roast the anthracite, and after reducing it dry to a finely divided condition I incorporate with it bituminous coal, coke, or pitch in a dry state, according to the character of the desired product and in the same finely divided condition. I have found that by subjecting the anthracite to a preliminary roast a greater quantity of anthracite can be mixed to produce a dense, homogeneous and free burning fuel than if the anthracite is used in its raw condition. I have found that in the use of the proportion of 80% of roasted anthracite and 70% of a steam coal an excellent product is produced by coking the compressed block formed from the mixture at a low temperature, that is, at a temperature of 500° C. The fuel produced is a dense block of regular form, less in size than that of the block from which it was produced, the fuel being hard and dense and suitable for burning in an open grate.

I have found that an excellent fuel can be produced according to the method described in the employment of 75% roasted anthracite, 15% steam coal, and 10% dry pitch; while furthermore, I have found that a useful fuel may be produced under the conditions of the process by the mixture with the roasted anthracite of 10% of dry pitch and that a useful fuel can also be produced according to the conditions of the process from ground coke with 10% of dry pitch.

In the use of coke for the purpose of the invention I have found that a mixture of two parts of a steam coal with one part of coke breeze gives good results according to the conditions of the process, a hard block of regular shape being produced, but the content of coke may be increased to 50% to produce a useful product.

In the production of coke for use in stoves

as a substitute for anthracite I have found that the harder and the denser the coke the better, and to secure this result the fine grinding of the dry raw materials is necessary as well as the intimate admixture of anthracite or coke with the bituminous coal or other dry binder employed. If in the use of anthracite a product is desired burning more like charcoal, a high percentage of roasted anthracite or of coke would give a fuel of the desired quality. Again, in the use of a coal having a low content of volatile matter I have been able to produce a hard and homogeneous coke of special utility for metallurgical purposes, or for use in blast furnaces, the coke having qualities resembling those of charcoal. Such a product I have found also useful as a substitute for anthracite.

It will be understood that any class of bituminous or semi-bituminous coal may be employed for incorporation with anthracite or coke or charcoal.

I prefer to wash and dry the raw material before subjecting it to treatment according to the process.

It will, however, be understood that the invention is not confined to the employment of the material for coking in the condition of briquets, as the compression of the very finely divided and preliminarily pressed raw material may be effected within the retorts or ovens, and in such event the further compression of the treated raw material, that is, the very finely divided and compressed raw material, in the condition of small spheres or other shaped pieces or bodies may be effected by means similar to that now usually employed for the compression of the charges for coke ovens or retorts. Or again, the compression may be effected in the retort or oven by tamping the very finely divided material, or the very finely divided material in the condition of small spheres or other shaped compressed pieces or bodies, or in molds or receptacles destined to be passed into the ovens or retorts, or the treated raw material, that is, the very finely divided material compressed into pieces or bodies, may be distilled, gasified or coked without being subjected to any further compression.

I claim:—

1. A method of producing a dense free burning coke from carbonaceous substances of the character of coal, consisting in reducing the raw material in the dry state to a condition of extreme fineness, then compressing the raw material without a liquid binder, to produce a hard stonelike block and coking the resulting product.

2. A method of producing a dense free burning coke from carbonaceous substances of the character of coal, consisting in reducing the raw material in a dry state to a con-

dition of extreme fineness, reducing a solid and dry binder in the dry state to a very finely divided condition, mixing the said raw material with the said binder, then compressing the raw material and binder in a dry state, to produce a hard stonelike block and coking the resulting product.

3. A method of producing a dense free burning coke from a carbonaceous substance of the character of coal having a substantial content of volatile hydrocarbons and such a carbonaceous substance having a low content of volatile hydrocarbons, consisting in reducing the respective carbonaceous substances in a dry state to a condition of extreme fineness, intimately mixing the said carbonaceous substances, then compressing the mixed and very finely divided raw material in the dry state, to produce a hard stonelike block and coking the resulting product.

4. A method of producing a dense free burning coke from carbonaceous substances of the character of coal having a low content of volatile hydrocarbons and a binder, consisting in reducing the raw material and binder in a dry state to a condition of extreme fineness, mixing the said raw material and binder, then compressing the mixed raw material and binder in the dry state, to produce a hard stonelike block and coking the resulting product.

5. A method of producing a dense free burning coke in the utilization of anthracite, consisting in roasting the anthracite and reducing the roasted anthracite and binder in a dry state to a condition of extreme fineness, mixing the said roasted anthracite and binder, then compressing the mixed mass in a dry state without the application of heat and without a liquid binder to produce a hard stonelike block and coking the resulting compressed product.

6. A method of producing a dense free burning coke in the utilization of anthracite, consisting in roasting the anthracite and reducing in a dry state the roasted anthracite and a carbonaceous substance of the character of coal having a substantial content of volatile hydrocarbons to a condition of extreme fineness, mixing the said anthracite and carbonaceous substance, then compressing the mixed mass in a dry state without the application of heat and without a liquid binder to produce a hard stonelike block and coking the resulting product.

7. A method of producing a dense free burning coke in the utilization of anthracite, consisting in roasting the anthracite, reducing the anthracite and a bituminous or semi-bituminous coal in a dry state to a condition of extreme fineness, mixing the said anthracite and bituminous or semi-bituminous coal in the dry state, then compressing the mixed mass without the application of heat and without a liquid binder to produce

a hard stonelike block and coking the product.

8. A new product of manufacture, a hard dense and free burning coke being the residue of the distillation of a carbonaceous substance of the character of coal in a dry and unheated condition of extreme fineness compressed without a liquid binder before distillation to produce a substance of a hard, dense and stonelike character, substantially as described.

9. A new product of manufacture, a hard, dense and free burning coke of regular shape, being a mixture of a very finely divided carbonaceous substance with another very finely divided carbonaceous substance having a substantial content of volatile hydrocarbons, the very finely divided mixture being densely and closely compacted and compressed in a dry state without the application of heat and without a liquid binder and from which mixture a considerable part

of the volatile hydrocarbons have been removed throughout by distillation, substantially as described.

10. A new product of manufacture, a hard, dense and free burning coke of regular shape being a mixture of very finely divided anthracite previously roasted with a very finely divided carbonaceous substance having a substantial content of volatile hydrocarbons, the very finely divided mixture being densely and closely compacted and compressed in a dry state without the application of heat and without a liquid binder, and from which mixture a considerable part of the volatile hydrocarbons have been removed throughout by distillation, substantially as described.

EDGAR ROUSE SUTCLIFFE.

Witnesses:

EWALD SIMPSON MOSELEY,
MALCOLM SMITHURST.