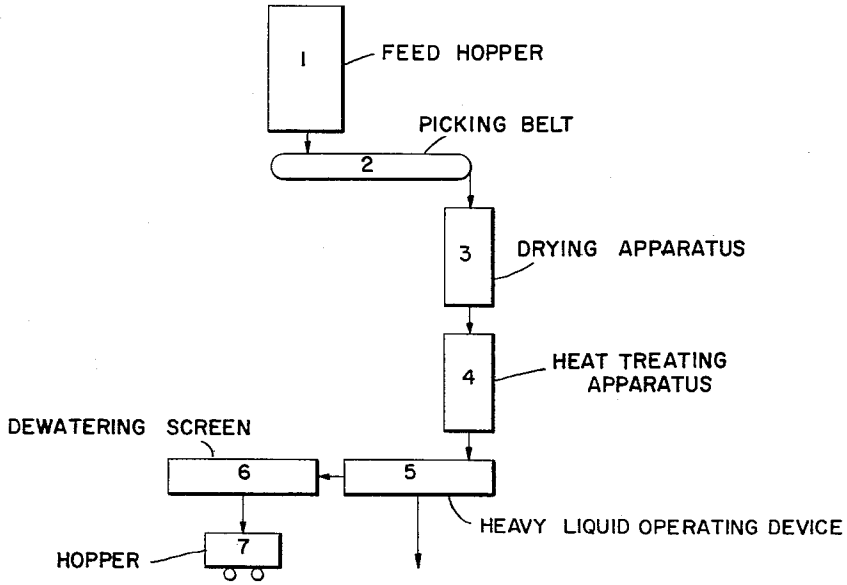
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METHOD OF PRODUCING A CARBONACEOUS PRODUCT FROM LOW GRADE COAL

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METHOD OF PRODUCING A CARBONACEOUS PRODUCT FROM LOW GRADE COAL

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The invention relates to a method of dressing coal-containing materials, more particularly materials containing a high percentage of ash or comprising coal which is intimately combined with unwanted substances.

The main object of the invention is to enable the efficient refining of low-grade coal-containing materials; these materials occur in extremely large quantities, notably as the geologically more recent coals rich in gas, for example lignite and brown coal in general.

The coal-containing materials with which the invention is concerned have a comparatively low specific weight, due to their low total percentage of mineral substance as compared with the volatile components and the bound water content. For example a ligneous brown coal may contain 15% pure rock material (with 80% residue on ignition), 20% bound water, 40% volatile hydrocarbons and a mere 25% of solid carbonaceous substance, and may despite its comparatively high ash content have a specific weight of only about 1.3. Moreover the particles of coal are intimately combined in the whole with the ash-containing material, there being hardly any free rock material.

Owing to the slight differences between the specific weights of the coal proper and the ash-containing material in a coal of this nature, the coal cannot be dressed by a normal washing process, for example in a settling tank, by trough washing, hearth washing or by heavy liquid treatment, despite the frequently considerable differences in the ash content of the individual pieces or grains or can be dressed at the most with an uneconomically low yield.

Furthermore the known fine-grain dressing processes, in particular the froth flotation or converter process, cannot be employed owing partly to the high cost of the fine disintegration required and partly to the unsatisfactory separation achieved by these processes; this latter disadvantage is consequence of the intimate combination of the coal proper with the ash-containing material, and the low specific weight.

For these reasons, the only economic way to use these coals, assuming that it was considered worth while to mine them in the first place, has heretofore been simply to burn them, for example in boilerhouses; even so they have been unsatisfactory owing to the high percentage of ash.

The invention provides a new method by which such coal-containing materials can be economically dressed. In accordance with the invention the raw coal or the like is subjected, either directly or after separation of the coarse impurities and preliminary disintergration as by crushing to a suitable granular size, to a coking operation by means of which the volatile constituents (which are recovered as such) and the water are expelled wholly or in part, whereupon the coked product is separated by one of the usual dressing processes into its components which are respectively poor in ash and rich in ash.

The coking operation is carried out at temperatures which are selected with regard to the granular size or granular condition of the coke to be produced: these temperatures may range between a temperature appropriate to a low-temperature coking or carbonising process and those temperatures which are usual in the production

of high-temperature coke. It is recognized in the industry that low temperature coking is carried on at a temperature of the order of 650° C. and high temperature coking is carried on at a temperature of the order of 1100° C.

The success of the new method is due to the expulsion from the coal, during the coking operation, of the bound water and volatile hydrocarbons and also changes in the mineral substances (carbonates, sulphides, etc.) in consequence of the action of heat; as a result the difference in the specific weights of the components of the coked product is much greater than the corresponding difference before coking.

The conversion of the coal proper into coke theoretically increases its specific weight but, particularly with raw materials having a high percentage of volatile constituents (with which the invention is primarily concerned), the coal particles become very porous; their apparent specific weight therefore becomes quite low.

As mentioned above the coking operation also effects a change in the ash-containing mineral substances; before the coking operation these substances have only a slightly greater specific weight than the coal proper but after coking they become, in effect, much heavier. This is due to chemical conversion on heating since the ash-containing mineral substances yield only very little water and gaseous matter.

The resulting differentiation in the specific weights of the components having the low and the high proportion of ash, enables them to be separated by a normal dressing treatment, e.g. the usual equal settling method or, particularly advantageously owing to greater discrimination, a heavy liquid treatment.

In the latter case it is desirable, before introduction of the material to be dressed into the separating liquid, to render the surface of the particles water-repellent, for example by a spray treatment with oil, and thus to prevent penetration of the heavy liquid into the pores of the particles. The oil used to render the surface of the particles water-repellant can be an oil of high viscosity such as a petroleum distillate having a viscosity of 100 S.U.S. at 210° F.

The differentiation in the specific weights of the coal and ash-containing substances which is obtained in the coking operation also results in considerable moderation in the final ash content when the method of the invention is applied to pre-washed coal; i.e. the same is coked and then again separated.

If the material resulting from the coking operation is lumpy the material is either separated directly after that operation or is first reduced by crushing to the granular size which is most favourable as regards the dressing process to be employed.

Generally speaking, however, the coking operation itself causes the material to break up into smaller pieces, which then merely require screening for separation of the finest grains.

As an example of the possibilities inherent in the new method it may be mentioned that on its application to raw coal having the composition set forth above and subsequent reduction in size of the coke produced to less than 10 mm. granular size, there was obtained by heavy liquid treatment at a specific separating weight of 1.35, from a granular size of 10 to 0.5 mm., a coke concentrate having 11% ash, with a yield of 60%. Heavy liquid treatment is well known in the art and can be for example tetrachlorocarbone. In any case it is a medium of higher density than water, and usually such medium is obtained by admixing to water a fine powdered heavy material, such for example as magnetite.

Apart from the main advantages of the new method there is also a further advantage in the avoidance of an exacting operation to reduce the particle size of the raw

coal prior to the dressing operation, as the requisite particle size reduction occurs either automatically on coking or can be performed easily on the very porous coke.

This advantage also makes the new process very suitable for the refining of raw coal in general, i.e., not only coal the nature of which renders its preparation subject to the difficulties referred to above.

The coke concentrate which is obtained as the final product of the method according to the invention, may either be used without further processing or may form the basic material for a further refining to form block coke, the coke concentrate being briquetted together with binding agents and coked again.

Reference to the schematic drawing will more clearly reveal the steps of the invention. In the drawing **1** is a feeding hopper; **2** is a picking belt; **3** is a drying apparatus; **4** is a heat treating apparatus, i.e., a furnace; **5** is a heavy liquid separation device; **6** is a dewatering screen; and **7** is a hopper.

An example of the method of this invention is as follows. A raw coal-containing material having a high content of volatile matter and water was fed into hopper **1**. The material was a Southern German lignite which consisted of alternating strips having varying volatile matter and ash contents. The average ash content was about 12%, the average volatile matter content was about 42%, and the average water content was about 35%. The total solids content was about 23% of which about 18% was clean coal. This coal-containing material could not be economically cleaned at all according to conventional separating processes. The material was fed from hopper **1** to the picking belt **2** and the rock pieces of bigger size were removed. The material was passed into the drying apparatus **3** and dried by heating to a temperature of about 120° C. The dried material was then passed into the furnace **4** and heated to about 600° C. As a result of the heat treatment, the material disintegrated into granular particles of relatively small grain size. The particles now being of different apparent specific gravities due to the previous treatment were subjected to a heavy liquid separation in the separation device **5**. The device contained tetrachlorcarbone as the heavy liquid medium. The particles were separated therein into a rich coke concentrate having a relatively low ash content and a waste portion high in ash content. The waste ash portion was discarded. The coke concentrate (product) was dewatered on the dewatering screen **6** and fed into hopper **7**.

We claim:

1. A method for producing a carbonaceous product of low ash content from low grade coal-containing material having a high ash content and a high proportion of volatile matter comprising disintegrating said material by coking, and subjecting said disintegrated material to a wet separation process to obtain a carbonaceous concentrate relatively low in ash content and a separated ash-rich component.

2. The method of claim 1 wherein said low grade coal-containing material is subjected to a crushing treatment prior to said coking step.

3. The method of claim 1 wherein said wet separation process is a heavy liquid separation process which involves the use of a heavy liquid.

4. A method of producing a carbonaceous product of low ash content from low grade coal-containing material having a high ash content and a high proportion of volatile matter comprising disintegrating said material by coking to produce a disintegrated, porous, coked material, treating said porous material with a water-repellant agent to thereby minimize water-penetration into the pores thereof, and subjecting said water-repellant material to a heavy-liquid separation operation which involves the use of a heavy liquid to obtain a carbonaceous concentrate relatively low in ash content and a separated ash-rich component.

5. The method of claim 4 wherein said porous coked material is crushed prior to the treatment thereof with the water-repellant agent.

6. The method of claim 4 wherein said water-repellant agent is oil and the oil is sprayed onto said porous coked material.

7. A method of producing a carbonaceous product of low ash content from low grade coal-containing material having a high ash content, a high proportion of volatile matter and coarse impurities comprising crushing said material and separating coarse impurities, disintegrating said crushed material by coking to produce a porous disintegrated coke, rendering said porous coked material water-repellant, and subjecting said water-repellant material to a heavy liquid separation operation which involves the use of a heavy liquid to obtain a coke concentrate relatively low in ash content and a separated ash-rich component.

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