PROCESS FOR PREPARING EXTREMELY LARGE CAKES OF COAL FOR COKING

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8 Claims. (Cl. 202—26)

This patent application is a continuation-in-part of my earlier patent application Serial No. 429,405, filed May 12, 1954, now abandoned for: “Process for Preparing Compressed Cake of Coal for Coking,” which patent application Serial No. 429,405 was a continuation-in-part of my earlier patent application Serial No. 329, 478, filed January 2, 1953, now abandoned, for: “Method of Carbonization,” and certain parts of the present application will be found in said earlier applications.

The coining of coals having a moisture content at the most equal to 4% by weight is rendered difficult when used in their original state due to the fact that it is impossible to obtain a cake for coining by the stamping of such coals in said original state. Coals of this type consist, on the one hand, of originally dry coals, such as coals directly supplied, without cleaning or water purifying, from American and some European mines and coals supplied after sorting and dry-purifying by some European mines, and, on the other hand, of dried coals previously treated with water, such as kiln-dried, centrifuge-dried and air-dried coals supplied by the greater number of European mines.

Up to the present, for preparing an extremely large cake of coal for coining from such coals having a low moisture content, the coal is previously moistened until it contains 9 to 10% of weight in moisture, whereby the cake has a relatively low density, the coining operation necessitates a relatively important carbonizing time and the carbonization by-products are of inferior quality. The main object of the present invention is to permit the charging of coke ovens by means of extremely large cakes of coal, approximating twenty tons, starting from a dry or dried coal, the forming of which could not be realized to date by stamping in its original state without moistening it.

For this purpose, the present invention provides a process according to which the coal to be utilized is a coal having a moisture content at the most equal to 4% by weight, said coal being pulverized and then being mixed with an emulsion containing by weight about 20% of water and about 80% of a mixture of viscous oily materials having a viscosity exceeding 300 seconds at 100° F. (Saybolt Universal). The amount of said emulsion which is added to a mass of pulverized coal is determined so that the total moisture content of the coated particles of said mass is at the most equal to about 5% by weight of said mass, such an emulsion acting as a bond by coating the particles of the pulverized coal. The coal particles thus coated are stamped for forming the extremely large cake approximating twenty tons to be used for carbonization.

Another object of the invention is to provide a reduction of the coining time for the cakes of the character described.

In the drawings, there is illustrated diagrammatically and by way of non-limitative example, a flow sheet of the sequence of steps in one mode of application of the process according to the invention, in the part A of said drawings, and, in the part B, the sequence of steps for carbonizing the coal cake obtained at the end of part A and for collecting the by-products of such a carbonization.

According to the invention, a mass of coal having a moisture content at the most equal to 4% by weight is previously pulverized by a grinder 1 or 1a then transferred to a mixer 2 connected to an emulsifier 3. Said emulsifier is fed with water from a water tank 4 and with a mixture of viscous oily materials having a viscosity exceeding 300 seconds at 100° F. (Saybolt Universal) contained within a tank 5, in such a manner that the resulting emulsion contains by weight about 20% of water and about 80% of said mixture. The thus obtained emulsion is fed to the mixer 2 so that the total moisture content of the mass of coated pulverized coal contained by said mixer is at the most equal to about 5% by weight of said mass. Therefore, 5% by weight is the greatest proportion of the coating emulsion to be used in a charge for coke preparation according to the present invention which corresponds to an amount of viscous oily material equal to about 4%. These percentages may vary slightly to take into account any changes that may normally occur in industrial operations.

Then the thus coated particles are transferred either directly or through a storage bin 6 to a stamping device 7. The extremely large cake of coal approximating twenty tons obtained under the action of said stamping device is conducted to the coke oven 8 where it is subjected to the coking operation or high temperature distillation.

Coals having a moisture content at the most equal to 4% by weight consist, on the one hand, of originally dry coals, such as coals directly supplied, without cleaning or water purifying, from the American and some European mines and coals supplied after sorting and dry-purifying by some European mines, and, on the other hand, of dried coals previously treated with water, such as kiln-dried, centrifuge-dried and air-dried coals supplied by the greater number of the European mines. The viscous oily materials of the character described comprise the residues obtained by the distillation of coal or natural organic products in liquid or viscous state, the residuum obtained at the end of the fractional distillation of benzenes obtained from the scrubbing of gas and light oils after extraction from the distillate of benzene, toluene, xylene and solvents, the resin of coumarones extracted from the latter residuum, all having separately or in admixture a viscosity exceeding 300 seconds at 100° F. (Saybolt Universal). The residues obtained by the distillation of coal or like organic products comprise high temperature raw tars deriving from high temperature carbonization of coal and oil and containing light, middle, and heavy oils and pitches, just as well as the fraction containing middle and heavy oils, primary tars with a high content of phenols, pitches, bitumens, resin and mineral oils.

The benzole may be obtained from procedures using dry or dried coals as well as coals other than dry or dried coals. The extraction of the resin or coumarone is immaterial to the invention and can be carried out in any known manner. Further, in the process according to the invention, there is no need to use a particular fraction of raw tars.

The percentage of water of the emulsion can neither be exceeded nor decreased without producing results which
are entirely different from those desired. In case the percentage of water is reduced, the emulsion obtained is too varying, and the coating of the pulverized coal by the emulsion is difficult. In case the percentage of water is increased, the water content of the coal after coating is increased too much whereby coking time is increased, whereas it is a secondary object of the invention to reduce such coking time. After coating of the coal particles, the emulsion acts as an adhesive or a bond for said particles which gives them a high degree of stability while substantially suppressing their mobility. Therefore, during the stamping step, the thus applied mechanical pressure reduces efficiently the distance between the particles which are brought close together as possible and adhere to one another. As a result the mass densities increases and ranges between 1,000 and 1,100 kg./cu m., i.e., between 62 and 68 lbs. per cu. ft. It is thus possible to obtain without moistening step extremely large cakes of dry or dried coals approximately twenty tons to be mounted, preferably laterally, in a coke oven.

Thus, by starting from dry and dried coals of the character described, an excellent cake firmness when loading the coke oven may be obtained whereby the physical conditions of furnace loading are improved. Simultaneously the carbonizing time is reduced by about 10%, and the bulk density of the cake is increased by 10 to 20% with respect to that of a conventional cake. This results in a significant cost reduction due to increased production of the furnace or coke set, and also in the production of by-products of higher qualities. For example, the material to form the coating film may conveniently be prepared from a mixture of viscous oily materials containing by weight, for instance, 10% of resin of coumarone or of the residuum of benzene fractional distillation and 90% of middle temperature raw tars. The proportions of resin of coumarone or similar products in the mixture may be varied between 5% and 50% by weight while the proportion of high temperature raw tars may be between 50 and 95% in weight.

What I claim is:

1. A method for preparing from coal having a moisture content at the most equal to about 4% by weight, an extremely large cake of coal approximating twenty tons to be inserted en masse into a coke oven, said method comprising: pulverizing said coal, preparing an emulsion containing by weight about 20% of water and about 80% of a mixture of viscous oily materials having a viscosity exceeding 300 seconds at 100° F. (Saybolt Universal), introducing said emulsion into the thusly pulverized coal for coating said coal, in a quantity such that the amount of viscous oily materials in said coal is equal to about 4% by weight whereby a bonding of the pulverized coal is obtained while the total moisture content of the coated coal is less than 5% by weight, and subsequently stamping the thus obtained product in order to obtain a pretreated cake of coal of high bulk density between about 62 to 68 lbs. per cu. ft.

2. A method according to claim 1, wherein the viscous oily materials are selected from the group consisting of:
   (1) the residue obtained by the distillation of coal; (2) the residue obtained by the distillation of natural organic products which are in liquid and viscous state; (3) the residuum remaining in a fractional distillation of benzene derived from scrubbing of gas oil and light oils after freeing the distillate from benzene, toluene, xylene and solvents, which residuum contains resin of coumarone; and (4) the resin of coumarone extracted from said last residuum.

3. A method according to claim 2, wherein the residue obtained by the distillation of coal is selected from the group consisting of:
   (1) high temperature raw tars derived from high temperature carbonization of coal and oil and containing light oils, middle oils, heavy oils and pitch; (2) the fraction of said high temperature raw tars remaining in a fractional distillation thereof and containing middle oils and heavy oils; (3) primary tars with a high content of phenols; (4) pitch; (5) bitumen; (6) resin; and (7) mineral oil.

4. A method according to claim 3, wherein the mixture of viscous oily materials comprises resin of coumarone as a first component and high temperature raw tars as a second component, the proportion of the total of coumarone and high temperature raw tars in the mixture being 5% and 50% by weight while that of the high temperature raw tars is between 50% and 95% by weight.

5. A method according to claim 3, wherein the mixture of viscous oily materials comprises the residuum of a fractional distillation of benzene after freeing the distillate from benzene, toluene, xylene and solvents, as a first component, and high temperature raw tars as a second component, the proportion of the residuum of a fractional distillation of benzene in the mixture being between 5% and 50% by weight while that of the high temperature raw tars is between 50% and 95% by weight.

6. A method for preparing from coal having a moisture content at the most equal to about 4% by weight, an extremely large cake of coal approximating twenty tons to be inserted en masse into a coke oven, said method comprising: pulverizing said coal, preparing an emulsion containing by weight about 20% of water and about 80% of a mixture of viscous oily materials having a viscosity exceeding 300 seconds at 100° F. (Saybolt Universal), introducing about 5% by weight of said emulsion into the thusly pulverized coal so that the amount of viscous oily materials in said coal is equal to about 4% by weight, for coating said coal to obtain the bonding of the pulverized coal, and subsequently stamping the thus obtained product in order to obtain a prefabricated cake of coal of high bulk density between about 62 and 68 lbs. per cu. ft.

7. A method for preparing from coal having a moisture content at the most equal to about 4% by weight, an extremely large cake of coal approximating twenty tons to be inserted en masse into a coke oven, said method comprising: pulverizing said coal, preparing an emulsion containing by weight about 20% of water and about 80% of a mixture of viscous oily materials comprising as a first component a material selected from the group consisting of coumarone resin and a residuum of a fractional distillation of benzene after freeing the distillate from benzene, toluene, xylene and solvents, and as a second component a high temperature raw tar; introducing said emulsion into the thusly pulverized coal for coating said coal, in a quantity such that the amount of viscous oily materials in said coal is equal to about 4% by weight whereby a bonding of the pulverized coal is obtained while the total moisture content of the coated coal is less than about 5% by weight; and subsequently stamping the thus obtained product in order to obtain a prefabricated cake of coal of high bulk density between about 62 and 68 lbs. per cu. ft.

8. A method for preparing from coal having a moisture content at the most equal to about 4% by weight, an extremely large cake of coal approximating twenty tons to be inserted en masse into a coke oven, said method comprising: pulverizing said coal, preparing an emulsion containing by weight about 20% of water and about 80% of a mixture of viscous oily materials comprising as a first component a material selected from the group consisting of coumarone resin and a residuum of a fractional distillation of benzene after freeing the distillate from benzene, toluene, xylene and solvents, and as a second component a high temperature raw tar; introducing said emulsion into the thusly pulverized coal for coating said coal, in a quantity such that the amount of viscous oily materials in said coal is equal to about 4% by weight whereby a bonding of the pulverized coal is obtained while the total moisture content of the coated coal is less than about 5% by weight; and subsequently stamping the thus obtained product in order to obtain a prefabricated cake of coal of high bulk density between about 62 and 68 lbs. per cu. ft.
duct to obtain a prefabricated cake of coal of high bulk density between about 62 and 68 lbs. per cu. ft.

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