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# ALIEN PROPERTY CUSTODIAN

## AGGLOMERATED BODIES OF CARBONACEOUS MATERIAL AND PROCESSES FOR MAKING THE SAME

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Tars, pitches, bitumen, asphaltum or similar products are generally used as binding agents for the manufacture of agglomerated bodies of carbonaceous material. These substances have to be used in important quantities—up to 25 or 35% in case of wood charcoal—in order that the agglomerated bodies obtained will have a sufficient mechanical resistance when handled industrially; these binding agents, beside their use in high proportions have the disadvantage to destroy the porous structure of the carbonaceous material, especially in the case of charcoal, and give rise, during the combustion, to the distillation of very inconvenient tarry products, as it is well known, in almost all applications.

To avoid these disadvantages, it has already been proposed to agglomerate charcoal powder by means of solutions of molasses, dextrin, starch, lignosulphonates, sugar etc, but the agglomerated bodies thus obtained have the disadvantage to be of a weak density, even if an important proportion of the binding agent solution is used; besides, in that last case, a prolonged drying is necessary on account of the great quantity of water to be evaporated; finally, the evaporation of the water gives rise to the formation of pores which conduce themselves to decrease the density of the agglomerated body.

It has also been proposed to treat wood charcoal powder with water or aqueous solutions, by adding for instance wetting products; to mould the mass obtained, as much as possible without pressure, and to dry the products thus formed. But the low mechanical resistance of such agglomerated bodies does not permit to transport them in bulk and makes their use little advantageous.

At the knowledge of the Inventors, none of the above mentioned processes have ever been used commercially.

Now, we have found according to the present invention, that it was possible to obtain agglomerated bodies of carbonaceous material having a considerable commercial value by moulding under pressure a mixture of powders of carbonaceous material, of water, of a cold-binding agent, of a hot-binding agent and of a wetting and dispersing agent, preferably non-foaming or little foaming.

By "powders of carbonaceous material", it has to be understood pulverulent material containing a very important proportion of carbon, such as powder of charcoal, powder of coke, of coal or of vegetable matters, of powder of gas coke or metallurgical coke, or any other powders of simi-

lar matters, i. e., fine powders of anthracite or close burning coal, and pulverulent graphite having a lamellar structure or not. Generally very fine carbonaceous powders will be used, although it is likewise possible to use mixtures of powders of various thicknesses, especially mixtures of comparatively coarse powders and fine powders with, eventually powders of a medium thickness.

By "cold-binding agent", it has to be understood a product which is capable, when in aqueous solution or emulsion, to stick together, at low temperature, the particles of carbonaceous material. Will answer to such conditions, for instance: the dextrin, the glues, the gums, the casein or the natural or synthetic resins.

By "hot-binding agent", it should be understood a product capable of being converted into caramel or coke at a high temperature and which is therefore apt to unite together the particles of carbonaceous material by means of a kind of coke net work; products answering to these conditions are i. e., the monoses, the polyoses, the sugars, the molasses, the raw products, soluble or not in water, coming from the hydrolysis of the wood.

By "Wetting and dispersing agent, preferably nonfoaming or little foaming", it has to be understood a product which facilitates the mutual dispersion of the solid material and of the water, but preferably giving not rise to the formation of inconvenient foam; such products are i. e., the products of condensation and sulphonation of aromatic hydrocarbons and of their derivatives with the aldehydes, the alkoyl and aralkoylnaphtalene sulphonates, the residual lies of sulphite cellulose, the sulphonated derivatives of the fatty bodies, the esters of fatty acids, the products of the sulphonation of the residues of the distillation of the benzaldehyde, the products soluble in water resulting from the action of the ethylene oxide on bodies insoluble in water and containing a reactive hydrogen, as well as substances of a vegetable origin having wetting and dispersing properties, such as the licorice, the products of hydrolysis of albuminoids, the lies resulting from the treatment of ligneous substances by sulphites or bisulphites, and even, should the case happen, of the substances of vegetable origin having, in addition to dispersing properties, an appreciable foaming power, i. e. the saponin.

By "lies resulting from the treatment of ligneous substances by sulphites or bisulphites", it has to be understood that this expression covers, in a general way, all products or residues of the various fabrications of cellulose under the condition

that they contain lignosulphonic acids and that they have a pH above 6.8 (or brought to this value) in order to avoid a rapid deterioration of the machines and tools used during the various phases of the agglomeration.

Non-foaming dispersing agents are preferably used, according to the present invention, in order to avoid the necessity of taking particular measures, at the moment of the agglomeration, for expelling out of the agglomerated body, the air bubbles formed by the foam.

To form agglomerated bodies, according to the invention, the powder of carbonaceous material and an aqueous solution of the cold-binding agent, of the hot-binding agent and of the wetting and dispersing agent are mixed together. It is advantageous to determine the proportion of solution in the mixture, with respect to the quantity of carbonaceous material powder, so that the mixture initially offers the consistence of a moist mass, or even of a comparatively dry paste. The proportions of aqueous solutions, or especially of water, with respect to the other constituting substances of the mixture, are to be determined in each case by preable experiments, with, as object, to obtain the desired density for the agglomerated body with an as low as possible pressure, and to reduce at a minimum the quantity of water which is to be evaporated. Good results and even very good results are generally obtained with a proportion of 8% of water with respect to the total weight of the mixture.

Instead of carbonaceous powder of a single kind only, it is possible to introduce into the mixture, carbonaceous powders of various kinds, i. e. of coal, of vegetable wastes, of lignite, and it is also possible to introduce into the mixture a small proportion of preserving agent, in order to protect the organic material against putrefaction during the making, or metallic salts capable to act as catalysers, in view to satisfy to the different cases which can be encountered or to improve the properties of the finished agglomerated bodies. A particularly advantageous solution of the manufacture of agglomerated bodies of carbonaceous substances consists, according to the present invention, to agglomerate an intimate mixture of charcoal, i. e. in the proportion of one third ( $\frac{1}{3}$ ) and close burning coal or anthracite in the proportion of two thirds ( $\frac{2}{3}$ ). In such an agglomerated body the charcoal facilitates considerably the lighting and the combustion, and decreases the total percentage of ashes with respect to that given by the mineral coal itself.

The so obtained mass is moulded by compression in the hot or in the cold; the higher the density desired, the higher will also be the pressure put into working. The moulded products are then dried and eventually baked, in order to convert into caramel or coke the binding agent. By using a heated press, or, as in the case of the making of lignite briquettes, by effecting the compression with a displacement of the agglomerated body in the mould insuring a sufficient production of calories, it is possible to suppress the cold-binding agent, taking care that the temperature to which the agglomerated body is submitted during the compression should be high enough, i. e. from 400 to 450° C., to convert into caramel or coke the hot-binding agent, which permits, in this case, to partially and even totally suppress the cold-binding agent.

Another possibility, according to the inven-

tion, is to use a mixture of substances composing at the same time the cold-binding agent and the hot-binding agent, instead of two various substances composing one the cold-binding agent, the other the hot-binding agent; such is the case especially of the sugars as well as of the hydrolysed wood, the latter containing simultaneously dextrin and glucose.

The non-foaming dispersing agents do not require normally special precautions during the agglomeration and are consequently put into working in an easier, and in the whole, less expensive way. The foaming dispersing agents may necessitate on the contrary the use of a compression apparatus permitting the evacuation of the air out of the agglomerate during the moulding.

Whatever the manner used to make the agglomerated bodies, it is possible, if desired, to polish them or to coat them with a waterproofing layer by means of a varnish or of a paraffin solution. Besides, the polishing can also be the result of an action exercised during the compression on the outer surfaces of the agglomerated body. Such processes of polishing are well known as such; it is therefore unuseful to describe them more clearly.

The agglomerated bodies obtained according to the invention, have the following properties amongst others: a very high content of carbonaceous material, an excellent mechanical resistance, a high density, a very regular burning without disintegration and which subsists in the open air without flame or fumes if the compression is not particularly high and if a sufficient proportion of coal of an easy burning, i. e. powder of charcoal, is contained in the agglomerated body. These properties give a very special value to such agglomerated bodies for their use in metallurgy, in industrial or house heating apparatuses and in stable or mobile gas producers. Moreover, when they are prepared starting from charcoal, they can, on account of their important adsorption capacities, be used for all applications of active coal: bleaching, purification, cleansing, fixation of certain gases in a gas mixture.

The following are examples of a few concrete cases of the manufacture of agglomerated bodies according to the invention. The volume of the agglomerated bodies can be whatever and correspond for instance, to the pieces of natural, treated or artificial combustibles presently used for the various considered applications. In these examples the parts by volume are taken so that in the case of the water, one part by weight is equal to one part by volume.

#### Example 1

1000 parts by weight of coal powder passing through a sieve of 80 meshes, were introduced by kneading in 80 parts by volume of an aqueous solution containing 20 parts by weight of dextrin, 20 parts by weight of molasses, 4% of the sodium salt of a sulphonated condensation product of naphthalene with formol, for instance of Diaster-sol NDS.

The mixture was allowed to rest during a few hours, then it has been moulded in the cold, under a pressure of 100 to 250 Kgs per cm<sup>2</sup> and the agglomerated bodies thus obtained have been dried at 120° C.

#### Example 2

1000 parts by weight of charcoal powder passing through a sieve of 120 meshes, were mixed with 80 parts by volume of an aqueous solution

containing 10 parts by weight of molasses, 10 parts by weight of dextrin and 2% by weight of butylnaphthalene-sodium-sulphonate. The mixture was moulded in the cold under a pressure of 500 Kgs per cm<sup>2</sup> and the agglomerated bodies thus obtained were dried at 120° C.

#### Example 3

1000 parts by weight of charcoal powder passing through a sieve of 80 meshes were mixed intimately with 160 parts by volume of an aqueous solution containing 40 parts by weight of dextrin, 40 parts by weight of molasses, 8 parts by weight of isopropynaphthalene-sodium-sulphonate. The mixture was moulded in the cold under a pressure of 100 Kgs per cm<sup>2</sup>, the agglomerated bodies thus obtained were dried at 120° C and baked at a temperature of about 450° C.

#### Example 4

1000 parts by weight of metallurgical coke were crushed in pieces or dust and the powder obtained was mixed, as in above example 1, with 100 parts by volume of an aqueous solution containing 25 parts by weight of dextrin, 25 parts by weight of molasses, 5 parts by weight of the sodium salt of a sulphonated condensation product of naphthaline with formol, for instance of Diasterol NDS. The mixture thus obtained was introduced in a slubbing machine capable to compress at 100 Kgs per cm<sup>2</sup>. Agglomerated bodies of a density of 1.5 keeping their shape and their hardness at high temperatures and capable to be used with advantage in metallurgy, were so obtained.

#### Example 5

500 parts by weight of gas coke on the one hand and 500 parts by weight of charcoal on the other hand were crushed; the two powders obtained were mixed with 150 parts in volume of an aqueous solution containing 35 parts by weight of dextrin, 35 parts by weight of molasses, 7 parts by weight of the sodium salt of a sulphonated concentration product of naphthaline with formol, for instance of Diasterosol NDS. The mixture was moulded in the cold under a pressure of 100 Kgs per cm<sup>2</sup>; the agglomerated bodies thus obtained were dried at 120° C. and baked at 450° C. Agglomerated bodies of a density of 1.20 burning completely in the open air were obtained.

#### Example 6

1000 parts by weight of charcoal powder were crushed, and the powder obtained was mixed, as in example 1, with 150 parts by volume of an aqueous solution containing 35 parts by weight of dextrin, 35 parts by weight of molasses, 7 parts by weight of a condensation product of cetyl alcohol with 18 molecules of ethylene oxide. After the mixture had been intimately mixed it has been moulded in the cold under a pressure of 100 Kgs per cm<sup>2</sup>, and the agglomerated bodies obtained were dried at 120° C.

#### Example 7

1000 parts by weight of charcoal powder passing through a sieve of 80 meshes were gradually introduced, by kneading, in 150 parts by volume of an aqueous solution in the following manner: by one of the well known processes, natural graphite was transformed in graphite acid which was washed, dried and heated in a closed vessel at a temperature of about 800 to 1000° C. The graphite swelled and occupied a volume which

was about twenty six times larger than before heating. Once the swelling terminated, the graphite was compressed into lozenges under a pressure of 50 to 1000 Kgs per cm<sup>2</sup> and these lozenges were heated at a temperature of about 500° C which caused a new swelling of much less intensity. The volume of the lozenges increased from one to three time its initial value while the lozenges were disintegrated in a certain measure but remained agglomerated with a tendency to again take their former foliated structure. The so treated lozenges were finally crushed again, by means of an easy crushing operation.

100 parts by weight of the graphite obtained as said above were mixed with 5 parts by volume of an aqueous solution containing, per litre:

	Grams
Dextrin .....	150
Molasses .....	400
The sodium salt of a sulphonated condensation product of naphthalene with formol...	50

The mixture was moulded under pressures varying between 25 and 1000 Kgs per cm<sup>2</sup>, according to the wanted hardness, and the agglomerated bodies were heated to a temperature between 400 and 600° C. in a time of about 20 minutes. The so obtained agglomerated bodies were submitted to a second baking, in a bath of boiling pitch at 400-500° C.

Graphite agglomerated bodies appeared as being containing by weight, 40 parts of dextrin, 40 parts of molasses and 8 parts of sodium ligno-sulphonate. The mixture obtained was moulded in the cold under a pressure of 100 Kgs per cm<sup>2</sup> and the agglomerated bodies obtained were dried at 120° C.

#### Example 8

In the process described in Example 6, the 7 parts by weight of the condensation product of cetyl alcohol with 18 molecules of ethylene oxide were replaced by 7 parts by weight of butylnaphthalene-sodium-sulphonate, or by 7 parts by weight, of sulphonated lauric alcohol, or by 7 parts by weight, of sulphonated ricinate of butyl; or by 7 parts, by weight, of the sulphonation product of the residue of the distillation of benzaldehyde; or by 7 parts, by weight, of the product as in Example 1.

#### Example 9

1000 parts by weight of Tonkin anthracite were crushed and mixed progressively, by kneading, with 80 parts in volume of an aqueous solution containing, per litre:

	Grams
Dextrin .....	250
Molasses .....	250
A condensation product of cetyl alcohol with 18 molecules of ethylene oxide.....	70

After intimate mixing, the substance was moulded in the cold under a pressure of 300 Kgs per cm<sup>2</sup>. The agglomerated bodies were dried at 120° C. Their density approached 1.4.

#### Example 10

Graphite in a divided state was first prepared fit for the production of electrodes, retorts, muffles, crucibles, and other manufactured articles of which graphite forms a part.

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