United States Patent Office 2,744,626 Patented May 8, 1956

2,744,626

PROCESS FOR THE REMOVAL OF ASH AND WATER FROM RAW MATERIAL CONTAINING COAL

Wilhelm Reerink, Essen-Bredeney, Walter Müschenborn, Essen, and Erich Nötzold, Essen-Haarzopf, Germany

No Drawing. Application December 15, 1952, Serial No. 326,144

5 Claims. (Cl. 209—49)

The invention relates to a process for the removal of ash and water from raw material containing pit coal or brown coal and constitutes a further development of the process described in pending patent application Ser. No. 255,132 of the same applicants, in accordance with the underlying idea of which the raw material brought into very fine granular condition is intimately mixed with oil, tars, bituminous substances and the like until its particles are completely coated by said oily substances, and is simultaneously dispersed in water, whereafter the dispersion is mechanically separated into concentrate and water containing the waste substances, therewith simultaneously de-watering the concentrate.

The effect of this process primarily depends upon the replacement of the original coating of the surfaces of the coal particles with water as completely as possible by the coating with the oil and any reagents eventually employed besides. This result is very difficult to achieve, especially if the water content of the initial material is relatively high.

Even if the oil treatment is carried out with the aid of mixing devices or kneading pumps having an intensive action, completely satisfactory results are frequently not obtained, especially in the case of very fine material, for example if coal slurries with a high content of water have to be treated.

In accordance with the invention, this dependence of the success of the process upon the water content of the starting material is eliminated, and besides the entire performance thereof is simplified. The main feature of the invention consists therein, that the treatment with oil and the dispersion with water takes place simultaneously in one and the same device in such a manner that the slurry is subjected during the treatment to turbulence and/or preferably alternating energy actions, whereafter, in accordance with the process described in the prior application, it is separated into concentrate and waste water containing the waste substances, simultaneously de-watering the concentrate. This treatment is particularly effective if the energy actions to which the material is subjected in its passage through the oil-wetting and dispersing device is followed by an expansion under a sudden pressure reduction.

Preferably, this treatment is carried out continuously by producing the necessary energy and turbulence actions in the passage of the material through the apparatus in which the oil-wetting and dispersing treatment takes place, and in which the pulp mixed with oil and, if desired, reagents is for this purpose positively forced through narrow cross-sections by pressure or suction.

These requirements are met by suitably constructed homogenising machines provided with slots or nozzles, preferably spiral nozzles, and adapted to produce intensive turbulence, appropriately operating kneading mechanisms and the like. Practical experiences have shown that the best results in this respect are obtained by using so-called baffle-plate mills.

Such baffle-plate mills, as known in the art under the

name "Prall mills" and described in Colliery Engineering, Vol. 29, Oct. 1952, pgs. 433-434, consist of a rotating baffle plate and a stationary baffle plate, or two baffle plates rotating in opposite directions, between which an annular slot widening in the outward direction is formed along the periphery of the plates. A centrifugal wheel running between the two baffle plates in a direction opposite the direction of movement of the rotating baffle plate forces the material introduced between the plates, on the one hand against the baffle ribs provided on the plates, and on the other hand through the nozzle-like slot between the baffle plates, exerting thereby additional turbulence actions and/or shearing strains. As the material passes through the room between the baffle plates the distance between which narrows to the slot along the periphery of the plates, the necessary pressure actions are exerted thereon which are followed by the sudden expansion as the material leaves the slot.

The treatment in the baffle-plate mill can also take place with simultaneous forcing of air into the pulp, whereby a mass of creamy consistency is formed, which, as experiences have shown, can be separated in a particularly advantageous manner.

A further advantage of the use of a baffle plate mill within the process as a whole resides in that, if the slot-like aperture is made sufficiently narrow, it is possible to effect by means of the said mill a desirable reduction in size of the coarse waste particles, which can then readily be separated in the following stage of the process.

The success of the treatment in the baffle-plate mill is completely independent of the consistency or the water content of the material and it is possible therein to treat a material of any desired consistency ranging from a strewable condition to a thinly liquid condition, obtaining in every case the desired hydrophobation of the coal particles with simultaneous dispersion.

If the material to be treated contains relatively large quantities of comparatively coarser constituents, the efficiency of the whole process may be impaired owing to the fact that such coarser particles contained in the material, which in the course of the separation by means of a centrifugal screen do not pass the screen, are not carried away with the waste-containing residual water, and remain in the concentrate.

In order to avoid this danger and the disadvantages arising therefrom, which are encountered especially in cases where it is desired to produce coal of low ash content for briquetting, hydrogenation, low-temperature carbonisation or coking from low-grade coal slurries, and such concentrates are not mixed with low-ash concentrates from normal wet preparation processes in accordance with a further development of the invention between the oil treatment and dispersion on the one hand and the separation and de-watering on the other hand, an intermediate preparation treatment is interposed, by which the coarser impurities are separated off.

This intermediate preparation may be carried out by means of machines normally employed for this purpose, such as cyclones, hydraulic classifiers, "hydrodators," pneumatic or agitator flotation cells, ventilated vessels and oscillating jiggers, heavy liquid treatment or the like.

The concentrates of this intermediate treatment which are thus freed from the coarser wastes but still contain the very finely dispersed waste particles, can thereafter be satisfactorily separated from the very fine wastes by discharging them with the waste water, for example by means of the screening centrifuges which are preferably employed.

The preceding separation of the coarser waste constituents is of importance, not only from the viewpoint of a high degree of purity of the end products, but also from that of the output of the separating machines and with

regard to the life of the screening gazes of the centrifugal screens, which are otherwise very highly stressed by the coarser waste constituents.

Since in the case of such an intermediate treatment no account needs to be taken of the presence of coarser waste constituents in the initial material, as such coarse constituents are separated off by the intermediate treatment, the apparatus employed for the preliminary treatment, preferably baffle-plate mills, may eventually be more coarsely adjusted.

The de-watering and simultaneous separation of the very fine waste in the last stage of the process by means of centrifuges or filters may also be effected in a completely satisfactory manner if the intermediate dressing is effected by flotation, as is preferable, owing to the fact that all the coal particles are positively completely coated with the oil in the course of the preliminary treatment, while such a method of de-watering as experiences have shown, is not applicable, for example, to normal flotation concentrates.

Particular advantages are afforded by the new process for the production of concentrates to be subsequently briquetted, if for the hydrophobation treatment hydrocarbons of the type normally employed as binding agents for briquetting, such as tar, pitch or the like, are used, in which case suitably elevated temperatures may be employed in the preliminary stage having regard to the liquifying temperature of these bituminous substances. This can take place for example by introducing steam during the oil-wetting treatment and dispersion takes place.

The coal particles are thus ideally coated with the substances forming the binding agent in the subsequent briquetting, so that the concentrates produced by the new process can be briquetted even in the cold state and, if desired, without drying because the water contained therein does not wet the oil-coated coal particles.

The concentrates may either be briquetted as such or added as binding agents to a briquetting coal, which may be of larger grain size, whereby a further addition of binding agents is rendered completely unnecessary in some cases. Owing to the extremely fine grain size of the starting material, the quantity of binding agent necessary for the coating of the particles is relatively small.

The concentrates obtained by the new process can further be used with particular advantage for distillation, coking or subsequent hydrogenation.

The hydrophobation (coating with oily substances instead of water) of the surfaces if the constituents to be recovered, as hereinbefore described in its application to initial material containing coal, may also be applied to advantage to the treatment of other material to be dressed, for example ores. It has been found that ore particles for example can be coated with a film of oil in the same manner by a pressure treatment with oil and reagents and dispersed in water in the manner described, with the aid of the means described, and can be recovered as concentrate by a subsequent separating treatment.

We claim:

1. A process for removing ash and water from raw material containing fine-grain coal which comprises treating said raw material with a substance selected from the group consisting of oils, tars and bituminous substances, whereby the initial water films on the coal particles are replaced by films of said substance, while simultaneously dispersing the mixture in water, said simultaneous film replacement and water dispersion being carried out by subjecting the pulp to intensive turbulence by imparting thereto movements in opposite directions, at least one of said movements being rotary, then forcing said pulp to flow in radial direction in a constricted current, and finally separating the resulting dispersion into coal concentrate and waste water.

2. A process for removing ash and water from raw material containing fine-grain coal which comprises treating said raw material with a substance selected from the group consisting of oils, tars and bituminous substances, whereby the initial water films on the coal particles are replaced by films of said substance, while simultaneously dispersing the mixture in water, said simultaneous film replacement and water dispersion being carried out by subjecting the pulp to intensive turbulence by imparting thereto rotary movements in opposite directions, then forcing said pulp to flow in radial direction in a constricted current, and finally separating the resulting dispersion into coal concentrate and waste water.

3. A process for removing ash and water from raw material containing fine-grain coal which comprises treating said raw material with a substance selected from the group consisting of oils, tars and bituminous substances, whereby the initial water films on the coal particles are replaced by films of said substance, while simultaneously dispersing the mixture in water, said simultaneous film replacement and water dispersion being carried out by subjecting the pulp to intensive turbulence by imparting thereto rotary movement in opposite directions, forcing said pulp to flow in radial directions in a constricted current, then permitting said constricted current to expand, and finally separating the resulting dispersion into coal concentrate and waste water.

4. The process of claim 3 in which the oil and dispersion treatment is carried out at elevated temperature.

5. The process of claim 3 in which the oil and dispersion treatment is carried out under the action of steam.

References Cited in the file of this patent

UNITED STATES PATENTS

1,538,270	Collier	May 19, 1925
1,838,884	Trent	Dec. 29, 1931
1,867,783	Trent	July 19, 1932
1,995,603	Cunningham	Mar. 26, 1935
2,189,779	Daman	Feb. 13, 1940