July 24, 1962 W. MÜSCHENBORN ET AL 3,045,818

PROCESS OF PREPARING SMALLS AND FINES OF COAL

Filed Sept. 24, 1959 3 Sheets-Sheet 1

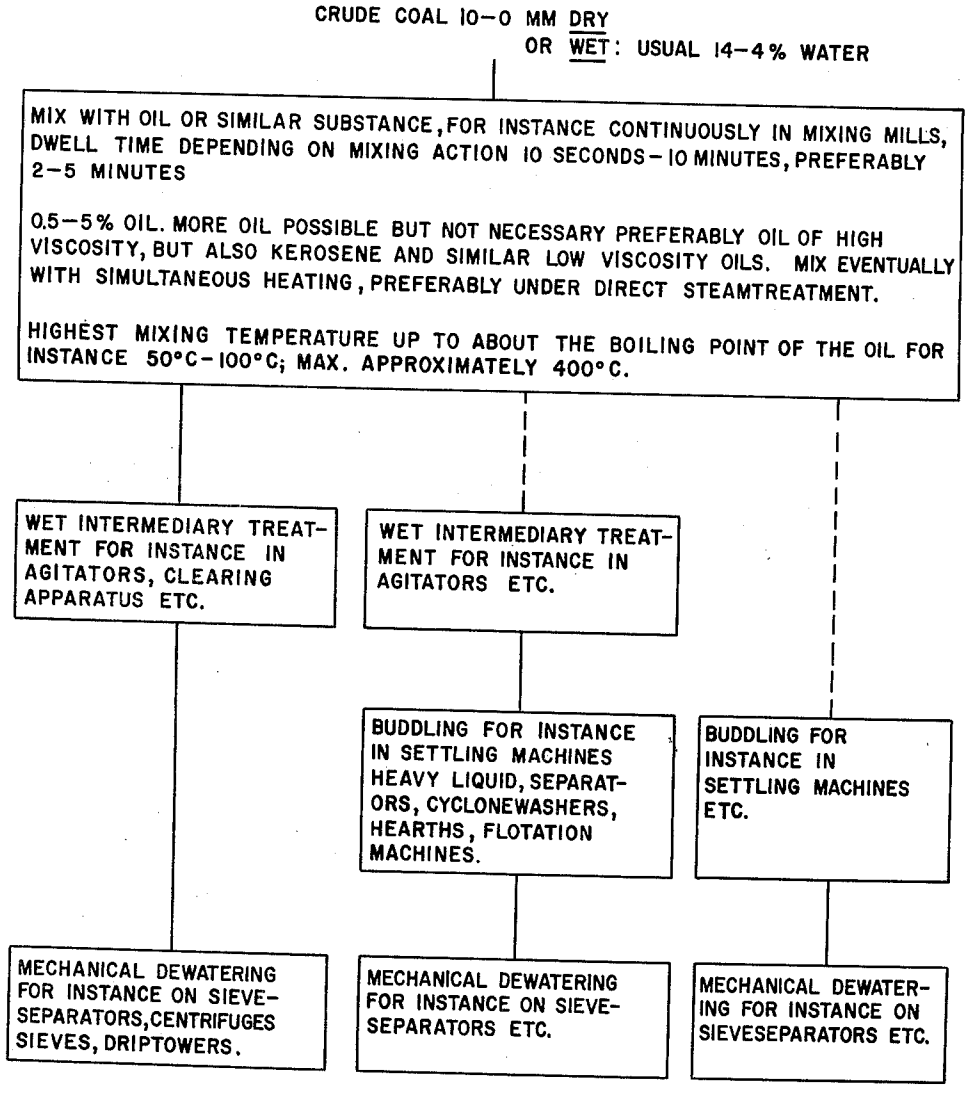

Fig. 1

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Filed Sept. 24, 1959 3 Sheets-Sheet 2

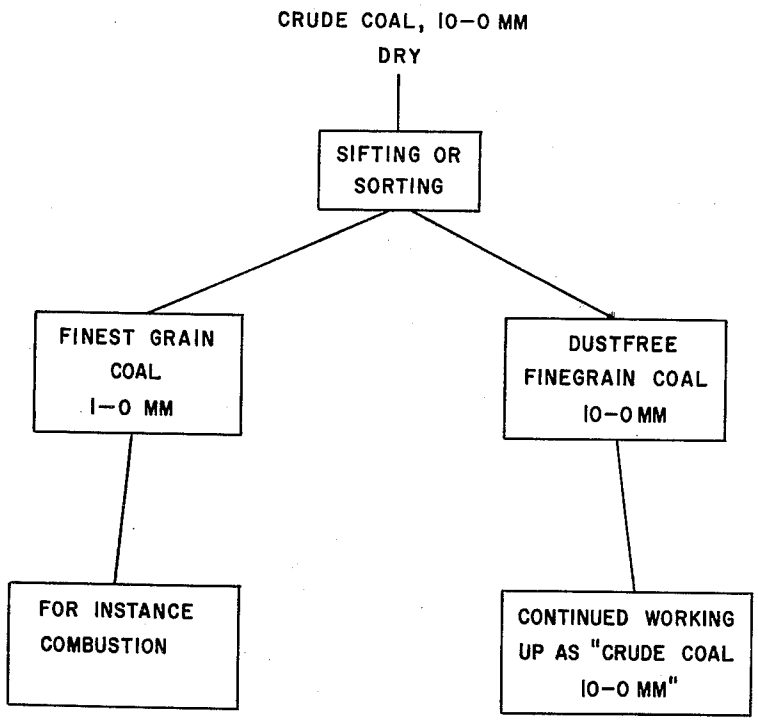

Fig. 2

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Filed Sept. 24, 1959 3 Sheets-Sheet 3

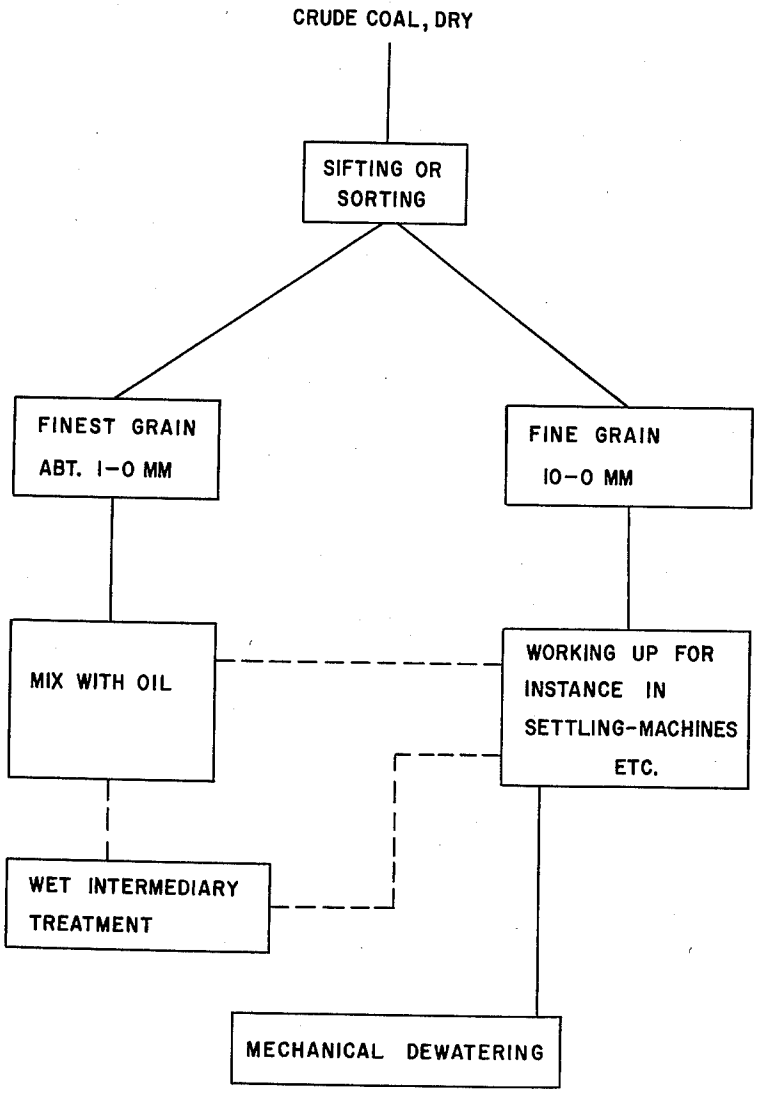

Fig. 3

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PROCESS OF PREPARING SMALLS AND FINES OF COAL

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It is known that the content of smalls and fines of the run-of-mine-coal is permanently increasing by the mechanization of the coal exploitation. Especially the grain content of fines possesses a relatively high ash content. Thereby it is rendered essentially difficult to admix the fines under 1 mm. to coking coals or briquetting coals. A preparation of the ash-containing very fine coal from the coal as mined is therefore imperative. If the very fine coal is to be remixed with coking coal or briquette coal, it must be de-ashed prior to such mixing. Presently used sifting methods are not effective for the separation of this very fine coal because of its high moisture content arising from present day methods of dust control by dampening so that dry sieving has to be supplemented by wet screening. The consequence of this development is a great increase of the mud yield of the washing treatment or a deterioration of the washing water, respectively, and in addition a deterioration of the preparation success and the dehydration of the smalls- and fines- types.

As it is known, for preparing finest muds the "Convertol-Process" is available which together with other processes, such as the flotation and the dehydration with chemical additions, would offset the disadvantageous results of this development of run-of-mine-coals techniques. Reference is hereby made to our prior U.S. patents directed to the "Convertol Process," Nos. 2,744,626; 2,769,537; 2,769,538; 2,781,904; 2,842,319 and 2,859,917.

It has now been found that when preparing smalls and fines which are separated, as it is known, from the run-of-mine-coals by screening or sifting, in the usual preparation machines, such as washing boxes, dense medium washers, cyclone-washers, concentrating tables, and similar machines, the sludge yield in the washing water can be already considerably reduced by making hydrophobic and agglomerating coal particles of the fine-grained raw coal content prior to being charged to these machines by a phase-inversion treatment with oil and/or similar reagents. In a first operating stage the raw fine coal (essentially the grain fraction of 10–0 mm.) is consequently thoroughly mixed together with reagents which have hydrophobic effects. By heating the mixing material, e.g. by direct steam, the mixing treatment and consequently the phase-inversion is favored. For this purpose the high-efficiency mixing apparatus are suitable. By this compulsory treatment the particles of fines agglutinate to greater particles or stick fast on greater coal particles. If now these coals are washed in a second operating stage in washing boxes, dense medium washers, cyclone-washers, or also concentrating tables, only the refuse and mainly the finest clay are wetted. The particles of fines are separated as greater ballings or adherent to the greater coal particles together with the concentrates (purified coal) and therefore do not join the washing-water-circulation. Thus the material of impurefines is already removed in the course of the preparation of fine grain. The apparatus requisite for the clearing of the washing water and the thickening and preparation of the slurries are also simplified. At the same time, the dehydration of the coal becomes considerably simpler, since the hydrophobic surfaces of the coal particles do no longer adsorb the water. The entire preparation process may be improved furthermore by connecting before the real washing process a wet intermediate treatment of the pretreated

coal in mixers, on wet screens or in a purification trommel or another similar apparatus. This treatment in mixing machines or similar machines will eventually do for reducing sufficiently the ash content, when the finely grained coal swims with oil upon the surface.

The method of operation according to the invention is explained in more detail in connection with the accompanying drawings.

In the drawings FIG. 1 is a flow sheet of an illustrative process embodying the principles of the invention and FIGS. 2 and 3 are flow sheets of alternative forms of the process of the invention. The values indicated therein are only standard figures, the scope of the invention is not, however, meant to be limited to these numbers.

According to the process of the present invention the preparation of wet unscreened coals, which can be no more sifted, is thus possible without a wet screening of the finest material (FIGURE 1). Dry raw coals can likewise be prepared either directly or after complete or partial sifting of the finest grain by the present process (FIGURE 2).

The process according to the present invention is also applicable for the preparation of dry fines poor in ashes which derive from the sifting process. It is known that it is uneconomical to subject dry dust to a wet preparation, since the decrease of the ash content has been bought by a high water content inside the concentrates. The process of the invention renders it possible to prevent from the first the wetting by water of the coal particles in the course of the wet preparation of dust, since the surfaces of the coal particles are made hydrophobic by the phase inversion with oil and the finest grains are agglutinated to coarser units. These coals treated by phase inversion are stirred with water, the fine clays thus being dispersed in the water and the coarser impurities being wetted with water.

The fines treated with oil may be directly charged—alone or together with the fine coal—to washing boxes or dense medium washers. The agglutination of the coal particles extends essentially the limit of the ability to be prepared of the fines in washing boxes. The alternatives of the preparation of the fines mentioned above are illustrated by FIGURE 3.

The concentrates can be definitely dehydrated in the usual dehydration devices, preferably in centrifuges, whereby the dehydration is carried out quicker and more thorough due to the oil-wetting than it is the case with coals wetted with water. For the rest, the coals prepared according to the present invention have an essentially increased bulk weight and thus render possible an increased throughput in coking chambers by being mixed with the rest of the coking coal.

Example I

A fine coal consisting of 22% of volatile matter, 11% of humidity, and 16.8% of ashes of the grain class of 6–0 mm. was thoroughly mixed with 2% of highly viscous fuel oil and the coal particles were thereby wetted with oil. Subsequently the thus treated material was stirred with water and charged to a washing box. Thereby 84% of the charged smalls were obtained with an ash content of 8.5%. The yield of sludge in the washing water was extremely low. The example makes it obvious that the raw coal still being very humid can be charged to the washing box without previously separating the finest grain.

Example II

Fines of 0.5–0 mm. consisting of an ash content of 18% were treated by phase inversion with 1% medium-weight fuel at 120° C. and for the purpose of preparation charged to the washing box together with ten times

the amount of a dusted-off raw fine coal. 85% of the oiled dust consisting of an ash content of 11% were absorbed by the coal during the washing process. 15% of the fines of 58% of ashes were again found in the refuse.

Example III

Fines under 1 mm. (45% of ashes) were treated with ¾% fuel, thoroughly mixed and prepared in a cyclone-washer together with eight times the amount of a fine coal (10 to 1 mm., 16% of ashes). The conglomerated particles of smalls were absorbed by the concentrate together with the smalls. The impure parts, such as carbonaceous slate, clays, pyrite, and spathic iron ore were easily separated together with the refuse on account of their higher specific weights. An intensive enrichment of the finest grain in the dense medium did not take place. The concentrate had an ash content of 6.8%, it contained 9% of finest material (81% of the content of finest grain) and an ash content of 11% only.

What we claim is:

1. In the production of small coals and fines the method which comprises thoroughly mixing dry-to-moist fine grained raw coal having not more than about 14% of moisture content and having a grain size up to about 10 mm. with an amount of oil effective to render the coal particles hydrophobic and to agglomerate them, and thereafter subjecting the thus treated fine coal to mechanical washing.

2. The method of claim 1 wherein the mixing of the fine coal with the oil is carried out at 50° to 400° C.

3. The method of claim 1 wherein the fines separated from run-of-mine coal by sieving are subject to the treatment with oil.

4. The method of claim 1 wherein the fines separated from run-of-mine coal by sieving are subjected to the treatment with oil and are then mixed with separated coarser particles in the mechanical washing operation.

References Cited in the file of this patent

UNITED STATES PATENTS

1,420,164	Trent	June 20, 1922
1,867,783	Trent	July 19, 1932
2,769,537	Reerink et al.	Nov. 6, 1956

FOREIGN PATENTS

250,039	Germany	Aug. 3, 1911
166,310	Australia	Aug. 23, 1952

OTHER REFERENCES

Colliery Engineering, March 1950, pages 109–112.