METHOD OF AGGLOMERATION


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When it is desired to produce the self agglomeration of pulverulent material with a view to obtaining agglomerated material adapted to be submitted to subsequent handling without any exaggerated crumbling away, it is generally necessary either to operate with the high agglomerating pressure of the magnitude of 1,500 kgs. per sq. cm. in the case of lignite or bituminous coal or else to resort to costly or objectionable binders such as pitch or cement.

These methods show the drawback of being comparatively costly which prevents them from being used when it is desired to agglomerate raw material of low value such as the pulverulent residue of bituminous schist or the like material.

For this reason, attempts have been generally to this day given up as concerns the use of such dust which leads to a waste reaching as high as 15 to 20% of the production of schist.

Our present invention has for its object to remove these drawbacks and to allow agglomeration through extremely cheap means requiring only very small plants, of dust of any kind and in particular of bituminous schist, lignite, coal and the like dust.

We have found that it was possible to obtain a satisfactory self agglomeration without any binder through a rapid compression at comparatively low pressures, provided the pulverulent material has been previously treated so that there remains in said material neither any superficially absorbed gases nor occluded gases at the moment of the agglomerating compression. It is chiefly the presence of such gases and in particular of absorbed gases even in small amounts which as a matter of fact prevents the agglomeration as these gases are compressed during the shaping and their expansion at the moment of the subsequent reduction in pressure leads to a disaggregation of the moulded products.

In accordance with our invention, the gases which are superficially absorbed or occluded inside the material before it is compressed for agglomeration, are removed by submitting the material to a uniform heating to a sufficient extent preferably in the presence of water or of steam. We inject for instance steam into the product until the whole mass is heated uniformly to a temperature approximating 90 or 100° C. We may also according to our invention heat the product in a moist state so as to bring it to the vicinity of 100° C.

The product to be compressed should however not be too moist at the moment of compression. The possible rate of moisture allowable depends moreover on the nature of the product. Moisture contents of 8% which are a hindrance to the agglomeration of certain salts such as ammonium chloride are still allowable in the case of lignite or fibrous material.

Furthermore, according to our invention, it has been found that better results are obtained when the pulverulent material such for instance as coal, lignite, bituminous schist, and the like is crushed so as to include grains of different sizes in proportions such that the interval between grains of similar size may be filled up in practice by finer grains without leaving any substantial empty space.

The product to be submitted to agglomeration should include for instance 25 to 30% of powder passing through a sieve of 200 mesh, per inch and a substantially equal proportion of grains passing between 50 and 200 mesh, the remainder being formed by grains having a diameter comprised between 0.5 and 3 mm.

It is however of no advantage to prosecute the crushing down to an extreme fineness, it has been in fact recognised that the extremely light particles or very light meal produce with much more difficulty compact agglomerates when it is desired to agglomerate them alone.

We have illustrated diagrammatically by way of example in accompanying drawing an arrangement for the practical execution of a method according to our invention and applicable in particular to the agglomeration of fines of bituminous schist with a view to their subsequent pyrogeneration in a furnace provided with a circulation of hot gases.

The fine grains passing through the 6 mm. mesh and consequently too fine to be admitted as such in the pyrogeneration furnace are fed through a conveyor belt 1 on to a vibrating sieve 2 provided with canvas showing 3 mm. meshes. The fractions which do not pass through said sieve and corresponding to about 25% of the fines flow out at 3 into a hopper out of which they pass into a hammer crusher 5 producing about 50% of a product underneath the 200 mesh size and only 25% of a product of the 80 mesh size.

This fine product is blown by a fan 9 into a hopper 10. The fines from the sieve 2 and hopper 8 forming about 75% of the total are disclosed herewith and also the fines fed by the hopper 10 which form about 25% of the total are fed respectively through the worm conveyors 11 and 12 to a mixer 13 adapted to heat and moisten the mixture and at the lower end of which there is
injected through a pipe steam the weight of which is about 5% of the weight of the fines being treated, which leaves the product treated at about 100 °C. This treated moistened product is then brought directly to a ball press which forms agglomerated cakes of tetrahedric shape weighing about twenty grams and which may be loaded directly into a pyrogenation furnace together with the raw calibrated bituminous schist.

It is important that the dust particles may be introduced into the ball press immediately after their treatment through steam so that they may not be aerated again.

The ball press used may be a press of any ordinary type producing pressures of the magnitude of only a few hundred kgs. per sq. cm.

Cylindrical agglomerates of 27 mm. prepared under such conditions and submitted to tests of resistance against crushing could bear pressures of 38 kgs. per sq. cm. They could be submitted without any difficulty to pyrogenation and after pyrogenation at 500 °C, they could be submitted to a pressure of 60 kgs. per sq. cm.

Obviously many modifications may be brought to the above described methods; in particular, it is possible to mix directly the dust with water and to heat it to the desired temperature so that the steam produced may excite the occluded gases.

Moreover our invention is by no means limited to the treatment of bituminous schist dust and it is applicable as well to the agglomeration of any dust including pulverulent lignite, coal, and even ammonium chloride etc.

What we claim is:

1. A method for agglomerating fines of bituminous schists, oil shales and the like oil-containing rocks, consisting in sizing the fines to form a mixture, containing no grains above 3 millimeters, removing the absorbed and occluded gases from said fines and submitting the mixture to a sudden pressure of the magnitude of not substantially above 100 kg. per sq. cm. at a temperature below 100 °C.

2. A method for agglomerating fines of bituminous schists, oil shales and the like oil-containing rocks, consisting in sizing the fines to form a mixture, containing no grains above 3 millimeters maintaining the moisture of said fines less than about 8%, injecting steam inside the mixture of fines for degasifying same and submitting the mixture to a sudden pressure of the magnitude of not substantially above 100 kg. per sq. cm. at a temperature below 100 °C.

3. A method for agglomerating fines of bituminous schists, oil shales and the like oil-containing rocks, consisting in sizing the fines mixing fines of different sizes to form a mixture showing only very reduced empty spaces, containing no grains above 3 millimeters maintaining the moisture of said fines less than about 8%, removing the absorbed and occluded gases from said fines and submitting the mixture to a low pressure of a few hundred kg. per sq. cm. at a temperature below 100 °C.

4. A method for agglomerating fines of bituminous schists, oil shales and the like oil-containing rocks, consisting in sizing the fines mixing fines of different size to form a mixture showing only very reduced empty spaces, containing no grains above 3 millimeters, mixing the fines with water, heating same for expelling the occluded and absorbed gases through the steam produced, and submitting the mixture to a sudden pressure of the magnitude of not substantially above 100 kg. per sq. cm. at a temperature below 100 °C.

5. A method for agglomerating fines of bituminous schists, oil shales and the like oil-containing rocks, consisting in sizing the fines mixing fines of different size to form a mixture showing only very reduced empty spaces, containing no grains above 3 millimeters maintaining the moisture of said fines less than about 8%, removing the absorbed and occluded gases from said fines and agglomerating the mixture in comparatively small-sized units through the rapid application of a low uniformly distributed pressure at a temperature below 100 °C.

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