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METHOD OF CHANGING THE BULK DENSITY OF POWDERED MATERIALS

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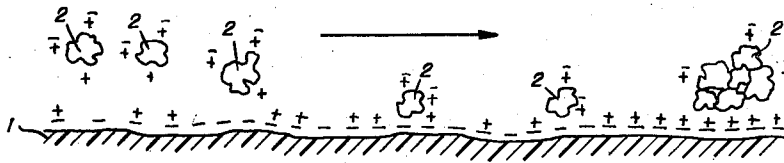


FIG. 1

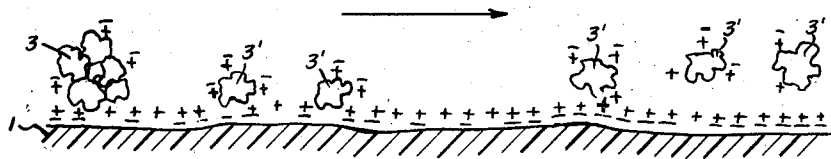


FIG. 2

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METHOD OF CHANGING THE BULK DENSITY OF POWDERED MATERIALS

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8 Claims. (Cl. 18—48)

Our invention relates to a method of changing the bulk density of powdered material or, in other words, a method of either agglomerating or dispersing powdered materials to improve their physical properties, facilitate their handling and increase their effectiveness in use.

One of the objects of our invention is to provide a simple method of agglomerating or densifying a powdered material so that it becomes dust-free and free-flowing; and another object is to provide a simple means of dispersing agglomerated particles of a powdered material.

Many powdered materials become charged with electricity during their production with the result that the separate particles, which carry electrostatic charges of the same polarity tend to repel each other.

Materials such, for example, as the oxides of zinc, lead, molybdenum, titanium, etc., resins, starches and most other commercial dusts are prepared and processed in a manner that imparts to the individual particles electrostatic charges. Commercial zinc oxide and molybdc oxide are examples of materials in which the particles have been found to carry a positive charge and which are deficient of electrons. These powders are low in density, dusty, and possess poor flowing properties. In a commercial method of agglomerating these powders which is in current use, water is employed to reduce the charge on the particles. This necessitates the subsequent drying of the product whereas, by our method, the agglomeration is effected with the product in dry condition and the costly drying operation is thus eliminated.

A graphic representation of the invention is seen in the accompanying drawing in which:

Fig. 1 shows diagrammatically the action in agglomerating particles.

Fig. 2 shows diagrammatically the action in dispersion of particles.

Depending, of course, on the particular powdered material to be treated, or the treatment desired, a selection is made of the material 1 over which the powdered material (or agglomerated material to be dispersed) is moved. This material is selected to have triboelectric characteristics such that movement of the material thereover will add or subtract the charges to change the net charge of the particles.

Broadly speaking, we accomplish our desirable results by subjecting the materials in dry condition to electrostatic induction by merely bringing them in contact with an appropriate dielectric medium 1, either to effect a charge or an increase in the charge carried by the particles, or a dissipation or a reduction of the charge carried by the particles, depending upon the results desired to be attained.

For example as seen in Fig. 1, a powdered material, the particles 2, 2, 2 which are electrostatically charged so that they repel each other, may be agglomerated by merely agitating it in contact with a dielectric medium 1 preferably capable of carrying a charge of a polarity opposite that of the charge on the powdered material and particles 2, 2, 2 agglomerate into compact masses 2'.

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In the following table there is set forth a triboelectric list or series in which each of the materials mentioned therein is more positive than any of the materials below it in the list. Thus, the greater the vertical distance between the materials in the list, the greater the electrostatic effect they will have upon each other.

Positive

Glass	Polyvinyl alcohol
10 Wool	Dacron
Nylon	Orlon
Viscose	Polyvinylchloride
Cotton	Dynel
Silk	Velon
15 Acetate	Polyethylene
Lucite	Teflon

Negative

In the case of powdered materials in which the particles carry positive electrostatic charges, the material may be subjected to the influence of a more negative dielectric medium which will bring about a reduction in the positive charge on the particles and thereby reduce or eliminate their repelling influence.

The static charge on particles of powder may also be reduced or dissipated by subjecting the powder to contact with an appropriate dielectric medium in the presence of an ionized atmosphere or an atmosphere having ionized particles therein.

As an example, the apparent density of a commercial sample of zinc oxide dust was determined to be 1.05 grams per cubic centimeter or 65.5 pounds per cubic foot. A similar density measurement of a commercial sample of molybdc oxide dust indicated a value of 0.26 gram per cubic centimeter or 16.7 pounds per cubic foot. After the dusts were placed in polyethylene bottles and the bottles with their contents rotated on a ball mill rack, the dusty character of the powders was eliminated and the powder transformed into free-flowing, spherically shaped aggregates of greatly increased density. The final apparent density of the zinc oxide was determined to be 2.04 grams per cubic centimeter or 127 pounds per cubic foot; and the final density of the molybdc oxide was determined to be 1.04 grams per cubic centimeter or 65.1 pounds per cubic foot.

Dispersion of agglomerated particles 3 may be effected by subjecting them as seen in Fig. 2, preferably with the aid of agitation or motion indicated by the arrow, to the influence of a charging medium 1, thereby creating a preponderance of similar charges on the individual particles 3', 3', 3' and causing them to repel each other or separate. Thus agglomerates of zinc oxide with an apparent density of 2.04 grams per cubic centimeter have been reduced to an apparent density of 1.05 grams per cubic centimeter by agitating them within the influence of a more positive dielectric medium, and preferably in contact therewith.

What we claim is:

1. That step in the method of agglomerating powdered material, the particles of which tend to repel each other by reason of electrostatic charges thereon, which comprises reducing said charges by subjecting said material to agitation in contact with a dielectric medium carrying an electrostatic charge of a polarity different from that of the charges on said particles.

2. The method set forth in claim 1 in which the agitation of said material is effected by rolling it in contact with said dielectric medium.

3. The method of agglomerating powdered material, the particles of which tend to repel each other by reason of electrostatic charges thereon, which comprises reducing said charges by agitating said material in contact

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with a dielectric medium carrying an electrostatic charge of a polarity different from that of the charges on said particles and in the presence of an ionized atmosphere.

4. The method set forth in claim 3 in which the agitation of said material is effected by rolling it in contact with said dielectric medium.

5. That step in the method of dispersion of agglomerated powdered material which comprises subjecting it to agitation in contact with a dielectric medium possessing the inherent capacity to provide an electrostatic charge of a polarity the same as that of the charges that hold the particles together.

6. The method set forth in claim 5 in which the agitation of said material is effected by rolling it in contact with said dielectric medium.

7. Those steps in the method of effecting a reduction in the bulk density of an agglomerated mass of powdered material which comprises dispersing the particles thereof by subjecting said mass to agitation while supported on a dielectric medium carrying an electrostatic

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charge of a polarity different from the electrostatic charges carried by said particles to reduce the electrostatic charges carried by said particles which tend to make them cohere.

8. A substantially spherical high density agglomerate formed throughout of powdered material secured together by electrostatic force.

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