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PROCESS OF SPHERULIZING FUSIBLE PULVERIZABLE FILLER MATERIALS

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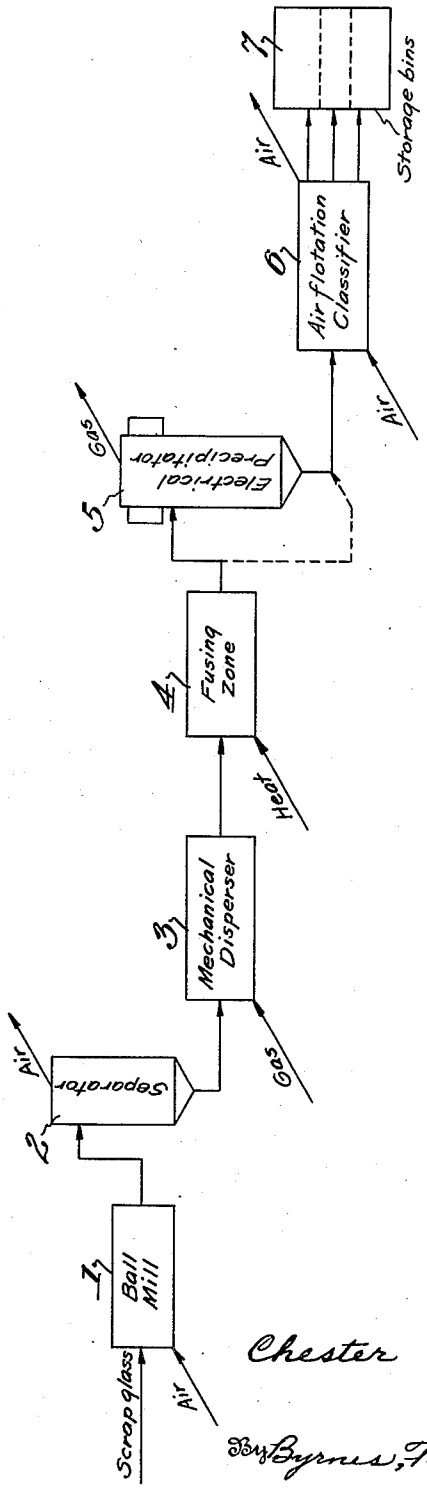

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PROCESS OF SPHERULIZING FUSIBLE PULVERIZABLE FILLER MATERIALS

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8 Claims. (Cl. 49—84)

The present invention relates to the provision of spherulized fillers, and resides more particularly in an improved process of spherulizing fusible pulverizable filler materials.

It heretofore has been proposed to reduce glass (or similarly fusible material) to granules by a process which consisted essentially in subjecting pulverized glass to the influence of heat while in motion by dropping the pulverized glass, in a stream, into the path of a more or less horizontal jet of burning gas, whereby to exert upon the pulverized glass a disseminative action and simultaneously a fusing action. It was found, however, that the practically uncontrollable disseminative action of the flame was insufficient positively to disperse the individual particles of powdered glass, and that the resulting product contained substantial amounts of irregularly shaped particles, and of aggregated particles superficially fused together in what may be called "clover leaf" form. In cases where regularity of shape, and uniformity of size, of the resulting particles was of major or even material consideration, such products were objectionable if not unusable; the task of separating the irregularly shaped from the regularly shaped particles while possible is not commercially feasible.

An object of the present invention is the provision of a process of spherulization in which the individual particles of the pulverized material to be spherulized are positively dispersed (not merely subjected to a disseminative influence) and are maintained in such dispersed condition during their passage through a heating zone of fusing temperature. The invention has for another object the provision of a process yielding directly spherulized product consisting of particles of fusible pulverizable materials of substantially uniform size and of true spherical form.

The above, and other, objects are afforded by the process of the present invention, which consists essentially in dispersing pulverized fusible material in a dispersing vehicle prior to the introduction of said material into a heating zone of fusing temperature and moving the vehicle and the material dispersed therein into and through such a heating zone. By the expedient of insuring positive dispersion of the individual particles of pulverized material before they are subjected to a fusing heat I am able to prevent irregular fusion of the particles and to prevent the formation of fused aggregated masses (that is, the hereinbefore-mentioned "clover leaves"), or, in other words, to insure the production of uniformly spherical particles of substantially uniform size.

The above described process may be effected in one or another of several specifically different manners. Thus (1) I have found that it can be effected by suspending the pulverized fusible material to be spherulized in a body of fuel oil or other combustible liquid (e. g., kerosene, gasoline, alcohol, or the like) and burning the mixture with air in a liquid fuel burner of known type (e. g., the oil burner commonly used in chemical arts for providing high temperature heating gases). In this connection I have found it is not only possible but also preferable to use the combustible fluid in the form of an aqueous emulsion thereof, whereby to aid the flowing of the mixture in known manner. The expansion occasioned by the vaporization of the combustible liquid and by the heating of the resulting vapor to ignition temperature in the burner results in a thorough dispersion of the suspended pulverized material.

The hereinbefore-described process also may be effected by (2) introducing the pulverized material into the current of combustion-supporting gas, or into the current of combustible gas, or both, of a gas burner in which combustion-supporting gas is fed to the burner under superatmospheric pressure (e. g., a blast type gas burner). According to this embodiment of the invention the mere suspension of the pulverized material occasioned by its introduction into the current of gas is converted into a positive dispersion of the individual particles thereof during the interval in which the supporting gas is heated by the blast flame from about room temperature to the ignition temperature by the enormous expansion of the gas during said interval.

In carrying out the process in accordance with the embodiment just described, I may effect the suspension of the pulverized material undergoing the spherulization treatment in the gas (be it air, oxygen, or combustible gas) by passing the gas, under predetermined superatmospheric pressure, upwardly through a column of the pulverized material and leading the gas from said column to said burner.

Another embodiment of the invention consists (3) in mechanically dispersing the pulverized fusible material to be spherulized in a gas (e. g., air) and moving the gas and the material so dispersed therein into and through a heating zone maintained at or above the fusing temperature of the material undergoing the treatment. Such heating zone may consist of a tube or other conduit, or of any suitably shaped chamber, to which heat from any suitable source is supplied in effective amounts. Thus, I may pass the gas with the pulverized material dispersed therein through a tube to which heat in sufficient amount is supplied by means of electric resistance elements, or of highly heated combustion gases, or the like. Or, I may mechanically disperse the pulverized material in the combustion-supporting gas, or in the combustible gas, or both, of a blast type gas burner, in which event there is attained

a double dispersion effect, in that there is added to the original mechanical dispersion the hereinbefore-mentioned dispersive effect of the very rapid and extensive expansion of the gas during the interval in which the gas is heated from, say, room temperature to the ignition temperature.

Before carrying out the actual spherulization by any of the above-described embodiments of the invention I may, and preferably do, roughly grade the pulverized fusible material; whereby to provide a starting material which is to some extent uniform in magnitude of particle size and is at least roughly of the size desired in the resulting product (it being, of course, understood that the spherulization inevitably reduces the apparent size of the particles somewhat). Such rough grading may be accomplished by appropriate screening of the pulverized raw material.

The product of the spherulization process is separated from suspending air or other gas, either before or after final grading, e. g., by passing the mixture of gas and spherulized particles through an electrical precipitator, or "multiclone" separator, or equivalent means for separating fine particles of solid from a suspending gas.

The product of the spherulization treatment may be graded according to relative particle size, whereby to separate it into a plurality of fractions of different particle size: this finish grading may be effected by application of the conventional means—e. g., air flotation method—of grading fine particles.

I have found that this process is applicable to any pulverizable fusible filler material, be it glass, silica, Portland cement, diatomaceous earth, volcanic ash, or the like. I have prepared such spherulized materials having particle sizes ranging from one micron in diameter upwardly through the classifications known in the art as "300 mesh", "200 mesh", "100 mesh" and larger.

The invention will be described more particularly, and with reference to the accompanying drawing, in which the single figure is a schematic representation of a plant adapted to carry out the third of the three embodiments of the process hereinbefore described in the making of glass spherules.

In the drawing:

1 represents a ball mill equipped to expel therefrom pulverized material of desired fineness; in a current of gas passed through said mill under superatmospheric pressure; 2 is a device for separating gas from fine solid particles; 3 is a mechanical disperser of conventional type; 4 is a heating chamber; 5 represents a device for separating gas from suspended fine solid particles; 6 is an air flotation classifier of known type; while 7 represents an assembly of storage bins for classified product; the several units of equipment being connected in series by appropriate means for advancing fine solid particles.

In operation; scrap glass is fed into the ball mill 1, is there pulverized to appropriate size (e. g., 150 mesh) and is removed therefrom by a current of air in which it is carried into the separator 2 and there thrown out of the suspension in air. The pulverized material is then delivered into the mechanical disperser 3 where it is subjected to a thorough dispersive treatment by the action of whirling jets of gas (air) moving under high velocity. The resulting current of dispersed particles and gas is directly led through the chamber 4 wherein the particles and gas are raised to and maintained for a brief but sufficient period at a temperature at least equal to the fusing temperature of the glass by heat indirectly supplied thereto from highly heated gaseous products of combustion, whereupon the said current is removed from the chamber 4 and either passed through the electrical precipitator 5 and the solids separated therefrom thence to the classifier 6, or else directly to the latter. In the latter the sperulized particles are graded according to size into a plurality of fractions which fractions are transferred to appropriate spaces in the storage bins 7. The so-classified product consists of a portion having individual particle size of about 200 mesh, and portions having particle sizes typified by "300 mesh", 10 microns, 5 microns, and 1 micron or less, diameters.

I claim:

1. In the process of producing granules of fusible material involving the operations of pulverizing the material, introducing the so-pulverized material into a zone of heating while in motion and removing the resulting heated product from the zone of heating while still in motion, the improvement which consists in dispersing the individual particles of the pulverized material in a fluid dispersing medium and introducing the resulting dispersion into a heating zone of fusing temperature.

2. The improved process defined in claim 1, characterized in that the pulverized material is dispersed in a combustible fluid which latter thereupon is burned with a combustion-supporting gas in a fluid fuel burner.

3. The improved process defined in claim 1, characterized in that the pulverized material is suspended in a gas of the group consisting of combustible gas and combustion-supporting gas, that the said gas is fed into a blast lamp under superatmospheric pressure, along with another gas of the said group and there mixed with the latter, whereupon the mixture is caused to burn at the orifice of said lamp.

4. The improved process defined in claim 1, characterized in that the pulverized material is mechanically dispersed in a current of gas whereupon the resulting current of so-dispersed material and gas is led into and through a heating zone maintained at a temperature at least equal to the fusing temperature of the material.

5. Process which comprises pulverizing a pulverizable fusible material to a suspendable particle size, mechanically dispersing the so-pulverized material in a current of air, leading the resulting current of dispersed material and air into and through a chamber maintained at a temperature above the fusing temperature of the material, and separating the resulting spherulized particles from suspending air.

6. The improved process defined in claim 1, characterized in that the pulverized material is glass.

7. The improved process defined in claim 1, characterized in that the pulverized material is silica.

8. The improved process defined in claim 1, characterized in that the pulverized material is volcanic ash.

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