

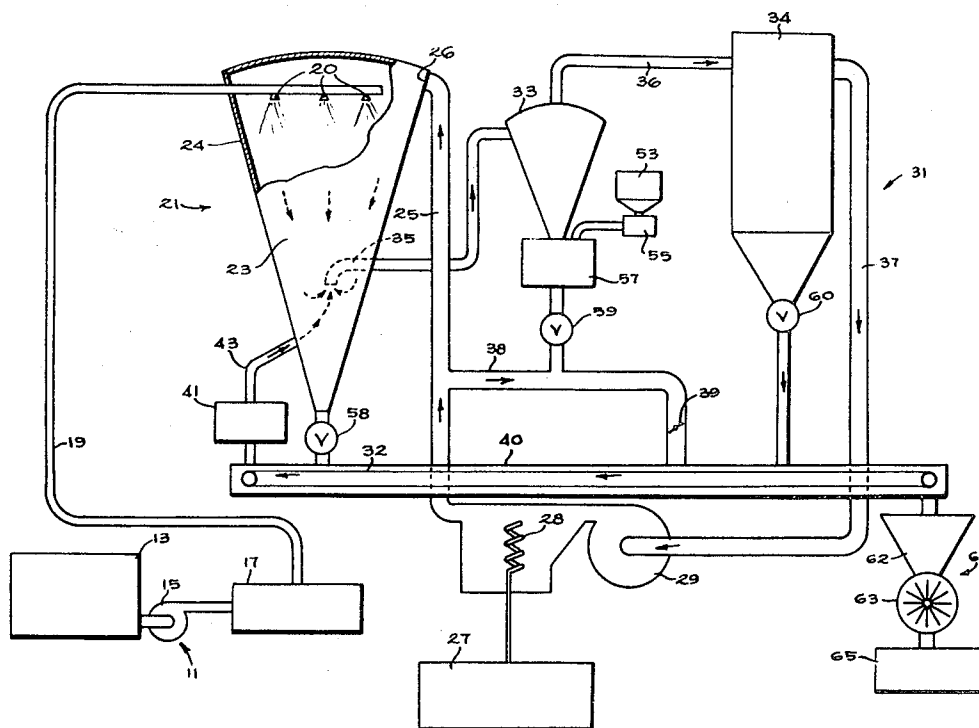
[72] Inventor **Russell W. Carnahan**
Deerfield, Ill.
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[73] Assignee **Kraftco Corp.**
New York, N.Y.

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Primary Examiner—Willie G. Abercrombie
Attorney—Anderson, Luedeka, Fitch, Even and Tabin

[54] **METHOD AND APPARATUS FOR MANUFACTURE OF PARTICULATE FATTY MATERIALS**
7 Claims, 1 Drawing Fig.

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228; 99/118, 118 P

ABSTRACT: A method and apparatus for providing a flowable particulate product from a fatty material having a melting point above ambient temperature is provided. The method includes the steps of establishing the fatty material in a melted state, spray chilling the melted fatty material to provide the particulate fatty material, providing a coarse blend of the fatty material and a flow-conditioning agent and subjecting the coarse blend to high-intensity impact mulling so as to texturize the coarse blend and provide a homogeneous blend of the flow-conditioning agent and the particulate fatty material. The steps of the method are performed substantially continuously and provide a flowable particulate fatty material which is not susceptible to melting or agglomerizing.



METHOD AND APPARATUS FOR MANUFACTURE OF PARTICULATE FATTY MATERIALS

The present invention relates generally to flowable, particulate materials and more particularly relates to a method and apparatus for providing flowable, particulate fatty materials.

Flowable particulate fatty materials are desirable for many industrial processes. In particular, edible fatty materials may be more easily incorporated into formulations for providing baked goods when the fatty materials are in a flowable, particulate form. It is known to provide fatty materials in particulate form by providing the fatty material in a melted state and thereafter spray chilling the fatty material to provide a particulate fatty material. However, spray chilled fatty materials have a tendency to lump and agglomerate after the particulate fatty material is packaged. In this connection, the fatty material tends to increase in temperature after being spray chilled due to heat of crystallization. The increase in temperature causes individual particles to coalesce or agglomerate and to cause lumping of the fatty material within a package.

It is known to add flow-conditioning agents to particulate fatty materials to improve their flowability and to prevent lumping. However, the flow-conditioning agent is usually added immediately after or during spray chilling and the tendency for the particles to increase in temperature after addition of the flow-conditioning agent is added causes the particles to agglomerate or lump even when the flow-conditioning agent is present. Accordingly, it has been necessary to break up the agglomerated lumps of fatty materials into particulate form by a secondary comminuting step at some time after the heat of crystallization has been completely evolved. This secondary comminution step is undesirable in that a further process step is added, which is uneconomical. It would be desirable to provide a method and apparatus for providing flowable, particulate fatty materials in a substantially continuous process wherein the particulate fatty materials do not have a tendency to reaggregate or form lumps.

Accordingly, it is the principal object of the present invention to provide flowable, particulate fatty materials. It is another object of the present invention to provide flowable, particulate fatty materials that do not have a tendency to reaggregate or form lumps. It is a further object of the present invention to provide flowable, particulate fatty materials by a process and apparatus that is substantially continuous.

These and other objects of the present invention will become more apparent from the following detailed disclosure and the accompanying drawing, wherein the single FIGURE is a flow chart of a system which may be used in the practice of the invention.

Generally, the present invention is directed to a method and apparatus for providing a flowable, particulate product from a fatty material having a melting point above ambient temperature. The method includes the steps of establishing the fatty material in a melted state, spray chilling the melted fatty material to provide a particulate fatty material, providing a coarse blend of the particulate fatty material and a flow-conditioning agent, and subjecting the coarse blend to high-intensity impact milling so as to texturize the coarse blend and to provide a homogeneous blend of the flow-conditioning agent and the particulate fatty material. The steps of the method are performed substantially continuously and provide a flowable, particulate fatty material which is not susceptible to melting or agglomeration.

A system which may be used in the practice of the invention is shown in the drawing. As seen in the drawing, the system comprises a feed system 11, a spray-chilling system 21, a collection system 31, a powder dispensing system 51 and a milling system 61.

The feed system 11 includes a feed tank 13, a feed pump 15, a high-pressure pump 17, conduit 19 and spray nozzles 20. The feed tank 13 is provided with heating means (not shown) to melt the fatty material and maintain the fatty material in a fluid state for distribution to the spray nozzles 20 by the high-pressure pump 17.

The spray-chilling system 21 includes a housing 24 which defines a spray chamber 23. The spray-chilling system 21 further includes a cold air duct 25 and cold air inlet 26. Incoming air is cooled by refrigeration means 27, which includes refrigerator coil 28. Air is continuously cycled through cold air duct 25 by means of blower 29.

The collection system 31 includes conveyor 32, cyclone collector 33 and a bag filter system 34. The spray chamber 23 is in communication with the cyclone 33 by the exhaust conduit 35. The cyclone 33 is in communication with the bag filter system 34 by conduit 36. Air which is exhausted from the bag filter system is returned to the spray chamber 23 through conduit 37 by means of the blower 29 and cold air duct 25. A cold air recycle conduit 38 is provided to convey the particulate solid material obtained from the outlet of cyclone collector 33 to the conveyor 32. A damper 39 is located within the conduit 38 to vary the airflow as desired.

The conveyor 32 is surrounded by a conveyor housing so as to contain the flow of air over the conveyor. Air is drawn from the cold air recycle conduit 38 through the conveyor housing 40 by means of exhaust fan 41 and into spray chamber 23 by conduit 43.

The powder-dispensing system 51 includes a powder hopper 53 and a powder feeder 55. A flow-conditioning agent is fed into the cyclone collection hopper 57 where the powder is mixed with the particulate solid material obtained from the cyclone 33. The location of the powder-dispensing system 51 is not critical and the powder-dispensing system may be located directly above the conveyor 32 at any point along its length.

Valves 58, 59 and 60 are used to control the flow of particulate solid material from the outlet of the spray chamber 23, cyclone 33 and bag filter system 34 respectively.

The milling system 61 comprises a hopper 62 which feeds a high-intensity impact mill 63. The high-intensity impact mill may be a hammermill or other suitable high-intensity-type impact mill. Upon exiting from the high-intensity impact mill 63 the powder is passed to packaging equipment 65.

In operation, a fatty material is melted and retained in feed tank 13. The fatty material is removed from feed tank 13 by means of pump 15 and is fed to high-pressure pump 17. The high-pressure pump 17 feeds the molten fatty material to spray nozzles 20. The molten fatty material is then sprayed in droplet form into spray chamber 23, where cool air from the cold air inlet duct 26 cools and congeals the fatty material to provide a particulate fatty material. The major amount of spray chilled, particulate fatty material is passed through valve 58 onto conveyor 32. Some fine particle size fatty material is entrained in the cold air and is carried by the cold air through the cold air exhaust duct 35 into cyclone 33. There, in cyclone collector 33 a major portion of the fine particle size fatty material is separated from the exhaust cold air and passed into the cyclone collector hopper 57.

The exhaust cold air exits from cyclone collector 33 through conduit 36 and the remaining fine particle size fatty material is removed from the exhaust air by means of the bag filter system 34. The exhaust cold air leaves the bag filter system 34 and is drawn by blower 29 into contact with the refrigeration coil 28, where the temperature of the exhaust air is reduced and the air is then passed through conduit 25 back to the spray chamber 23 through the cold air inlet 26.

A flow-conditioning agent is maintained in the powder hopper 53 and is fed by powder feeder 55 into the cyclone collector hopper 57 where the flow-conditioning agent is mixed with the output from cyclone collector 33. The mixture of fine-sized particulate fatty material and flow-conditioning agent is passed through valve 59 into the cold air recycle duct 38 and is carried through this duct by cold air which is obtained from cold air duct 25 to conveyor 32. The mixture of particulate fatty material and the flow-conditioning agent is then transferred onto the top of particulate fatty material which has been previously introduced onto the conveyor 32 to provide a coarse blend of flow-conditioning agent and particulate fatty material.

The cold air which carried the mixture of fine-sized particulate fatty material and flow-conditioning agent through the recycle cold air duct 38 is then caused to pass countercurrent to the conveyor 32 within the conveyor housing 40 by the exhaust fan 41. From there the cold air enters the spray chamber 23 through conduit 43. As the cold air from recycle conduit 38 passes over conveyor 32 it aids in further cooling the particulate fatty material on the conveyor.

The coarse blend is then transferred by the conveyor system to the high-impact mill 63. During passage of the coarse blend the output from the bag filter system is added to the total particulate material.

The high-intensity impact mill 63 acts to thoroughly disperse and blend the flow-conditioning agent with the particulate fatty material to provide a homogeneous mixture. The high-intensity impact mill, furthermore, texturizes the particulate fatty material and aids in dissipation of the heat of crystallization so that the particulate fatty material does not tend to reaggregate or lump after treatment with the high-impact mill. After treatment with the high-impact mill the particulate fatty material is packaged by suitable packaging equipment 65.

In this connection, the term "high-intensity impact mill" refers to a type of grinding mill which is usually used to effect grinding or comminution of materials by impact or attrition between lumps of the material and the elements of the mill. The mills contain a rotor shaft, which may be horizontal or vertical, to which are attached hammers or beaters. The hammers may be T-shaped elements, knives, bars, pins or rings, fixed or pivoted to the shaft or to disks fixed to the shaft. The rotor shaft is operated at high-rotational speeds of from about 500 r.p.m. to about 20,000 r.p.m. to provide the high-intensity effect.

The rotor runs in a housing, and a cylindrical screen usually encloses all or part of the rotor. The openings in the screen usually serve as an internal classifier. However, the high-intensity impact mill, as used in the method of the invention, does not effect particle size reduction so that the size of the openings in the screen are not critical and the mill may be operated with no screen. As previously indicated, the high-intensity impact mill is used to texturize the particulate fatty material and to provide a homogeneous dispersion of the fatty material and the flow-conditioning agent. Also, the high-intensity impact mill serves to dissipate the heat of crystallization of the particulate fatty material. The particle size distribution of the particulate fatty material after being treated in the high-intensity impact mill is substantially the same as before treatment.

The time lag after forming the fatty material into particles in spray chamber 23 and subjecting the coarse blend of particulate fatty material and flow-conditioning agent to high-intensity impact milling may be controlled by the speed of the conveyor 32. The time lag is preferably at least about 0.5 minutes to permit the partial evolution of the heat of crystallization. In this connection, if the time lag is less than about 0.5 minute, the particles of fatty material tend to agglomerate and form lumps after packaging. The lumps, however, are soft and may be easily broken by hand. When the high-speed impact milling is not used prior to packaging, the lumps that form are extremely hard and are very difficult to break into smaller pieces.

There is no particular upper limit to the time lag between forming the fatty material into particles and subjecting the coarse blend of fatty material and flow-conditioning agent to high-intensity impact milling. That is, the coarse blend may be stored and subjected to high-intensity impact milling at any convenient time. However, as previously indicated, the particulate fatty material tends to form hard lumps if packaged and stored without high-intensity impact milling. It is therefore preferred to subject the coarse blend of particulate fatty material and flow-conditioning agent to high-intensity impact milling in a continuous operation. Continuous operation also avoids an unnecessary packaging step. In a practical process the time lag before subjecting the coarse blend to high-intensity impact milling will be no more than about 30 minutes.

The method and system of the invention may be used with any particulate fatty material which has a melting point above ambient temperature. In this connection, it is preferred that the fatty material have a melting point of at least about 20° above ambient temperature, and it is particularly preferred that the fatty material have a melting point of at least 90° F. Fatty materials which may be treated by the method of the present invention include but are not limited to fatty acids, fatty acid esters of polyhydric alcohols and substituted fatty acid esters of polyhydric alcohols. In this connection, mono and di-substituted fatty acid glycerides may be treated, and esters of dicarboxylic acids and mono-acylated polyhydric alcohols may be processed by the method and system of the invention. The method and system of the invention have been particularly beneficial in the treatment of half esters of succinic acid and of a mono-acylated polyhydric alcohol or its salt. Such half esters are sometimes referred to as succinylated mono-glycerides. A particularly useful succinylated mono-glyceride is one wherein stearic acid forms the fatty acid residue of the compound, but myristic, palmitic and behenic acids may also be used as the fatty acid residue. The fatty acid residue should be substantially completely hydrogenated to provide the desired melting properties. Such succinylated mono-glyceride compounds are disclosed and described in U.S. Pat. No. 3,370,958.

The flow-conditioning agent may be any suitable flow-conditioning agent which has been approved for food use. In this connection, fine particle size magnesium aluminum silicates, referred to herein by the trade name Zeolox, fine particle size silica, referred to herein by the trade name Syloids, and fine particle size starch have been found suitable.

The process of the present invention is particularly suitable for providing particulate fatty materials having a particle size distribution such that at least about 20 percent of the particles will pass through a 100 mesh screen. Screen sizes as used herein refer to Tyler mesh designations. It is particularly difficult to provide fatty materials in particulate form with mesh sizes smaller than 100. As the particle size is reduced, the small particles tend to agglomerate more readily than do larger particles. Where a substantial amount of the fatty material is provided with a particle size above 100 mesh, the tendency of the particles to agglomerate is less severe. The process of the present invention, however, may be used to provide fatty materials having a particle size distribution such that at least 20 percent of the particles are less than 100 mesh.

The following example illustrates various features of the present invention, but is intended to in no way limit the scope of the invention, which is defined in the appended claims.

EXAMPLE

The method and apparatus of the invention is used to prepare a free-flowing particulate succinylated glycerol monostearate, hereinafter referred to as SMG. The SMG was melted and held in feed tank 13. The temperature of the SMG was maintained at 140° F. The melted SMG was supplied to the spray nozzles 20 at a pressure of 2,000 p.s.i.g. The spray nozzles had an orifice diameter of 0.052 inch. Cold air was introduced into the spray chamber at a temperature of 42° F. The cold air exited from the spray chamber through exhaust duct 35 at a temperature of 75° F. and the SMG particles were at a temperature of 72° F. after they had been spray chilled. The fines were removed from the exhaust air by means of the cyclone 33 and sufficient Zeolox was added to the fines to provide an overall level of Zeolox of about 2.0 percent by weight of the finished product.

The main output of particulate SMG from the spray chamber was transferred to a conveyor, and the output from the cyclone, which had been mixed with Zeolox, was added onto the main portion of the spray chilled SMG. The conveyor then transferred the coarse blend of SMG and Zeolox to a hammermill after a time lapse of 5 minutes. The hammermill had a screen with 1/8-inch diameter holes at the outlet and

was operated at a speed of 1,800 r.p.m. The product obtained from the hammermill was packaged immediately, and was stored for a period of one week. At this time, the product was examined, and it was determined that it was still free flowing and could be readily removed from the package.

The product had the following particle size analysis:

Tyler Mesh Size	Weight Percent
Percent on 40	0.7
Percent on 60	2.8
Percent on 80	3.8
Percent on 100	6.9
Percent on 140	29.6
Percent passing 140	54.8

The present invention and apparatus may be used to provide free-flowing particulate fatty materials in a substantially continuous process. The particulate fatty materials do not tend to reaggregate and do not tend to lump upon extended storage. The invention is particularly adapted to providing particulate fatty materials having a particle size distribution such that at least about 40 percent of the particulate fatty material will pass through a 100 mesh Tyler screen.

What is claimed is:

1. A method for providing a flowable, particulate product from fatty materials having a melting point above ambient temperature comprising, establishing the fatty material in a melted state, spray chilling the melted fatty material to provide a particulate fatty material, providing a coarse blend of said particulate fatty material and a flow-conditioning agent, and subjecting said coarse blend to high-intensity impact milling so as to texturize said coarse blend and to provide a

homogeneous blend of said flow-conditioning agent and said particulate fatty material, whereby a flowable particulate fatty material is provided which is not susceptible to lumping or agglomeration upon extended storage.

2. A method in accordance with claim 1 wherein said fatty material has a melting point of at least about 90° F.

3. A method in accordance with claim 1 wherein said flow-conditioning agent is selected from fine particle size magnesium aluminum silicate, silica, and starch.

4. A method in accordance with claim 1 wherein said high-intensity impact milling occurs more than about 0.5 minute after said melted fatty material is spray chilled to provide said particulate fatty material.

5. A system for providing flowable, particulate particles from fatty materials having a melting point above ambient temperature which system comprises means for establishing a fatty material in a melted state, means for spray chilling the melted fatty material to provide a particulate fatty material, means for providing a coarse blend of said particulate fatty material and a flow-conditioning agent, and means for subjecting said coarse blend to high-intensity impact milling so that to texturize said coarse blend and to provide a homogeneous blend of said flow-conditioning agent and said particulate fatty material, whereby a flowable particulate fatty material is provided which is not susceptible to lumping or agglomeration upon extended storage.

6. A system in accordance with claim 5 wherein said high-intensity impact milling means is a hammermill.

7. A system in accordance with claim 5 which further includes conveyor means for transporting said particulate fatty material from said spray-chilling means to said high-intensity impact milling means.

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