

Title of the Invention: Dispersion method and dispersing apparatus

BACKGROUND OF THE INVENTION

(1) Technical Field of the Invention

The present invention relates to a dispersion method and a dispersing apparatus by which a material to be treated is finely ground and dispersed by using a dispersing medium, and more particularly to a dispersion method and a dispersing apparatus which are characterized by supplying the material to be treated and the dispersing medium and by cleaning the apparatus after dispersion treatment.

(2) Background Information

For the production of various products such as coating materials, printing ink, pigments and magnetic materials, medium-dispersing apparatuses of various types have been employed. In the medium-dispersing apparatuses, to a mixture of a dispersing medium and a material to be treated, motion is given by an agitating means disposed in a dispersing chamber, and the material to be treated is finely ground by pulverization, shearing action and grinding action generated between the media, to disperse the material in a liquid. If such an apparatus is designed so that adequate treatment time may be obtained for efficient dispersion, the dispersing chamber tends to be large and can not be applied to the production of small amount.

Further, the dispersing chamber is formed in vertical type or a horizontal type, and an exclusive liquid-feeding pump is required to feed the material to be treated into the dispersing chamber. This is because that when usual liquid-

feeding pump is used, if the dispersing medium flows out of the dispersing chamber and enters into the pump, the pump tends to undergo a jamming accident, and if an outflow-preventing mechanism is provided, this site is hardly cleaned after the dispersion treatment, resulting in causes of troubles.

Besides, prior to the dispersion treatment, it is required to charge a predetermined amount of the dispersing medium uniformly into the dispersing chamber. However, this charging operation is troublesome, for example, depending on the structure of the dispersing apparatus, the charging operation is necessarily divided into several times, resulting in a long charging time and sometimes poor operability.

In the cleaning operation after completion of the dispersion treatment or at the time of changing the kinds of materials, the dispersing chamber and production lines have to be cleaned, and the medium has to be taken out of the dispersing chamber for cleaning. The operation for taking out (discharge) the dispersing medium is not readily carried out. Further, solid or liquid stains adhere to even corner portions of pipelines of the production line, whereby cleaning is hardly completed and a large amount of a cleaning liquid is required. Accordingly, the kind of products which can be treated by one medium-dispersing machine is fixed, and the range of application by one machine is restricted.

A dispersing apparatus has been known which utilizes a rotary disc type dispersing machine for dispersion-treating a small amount of a material to be treated without using

conventional dispersing chamber and pump, thereby causing no jamming of the dispersing medium. (Japanese Unexamined Patent Publication No. 7-116488). In this dispersing machine, the material to be treated is sucked into a dispersing chamber with rotation of the disc. However, problems as happened in the conventional technics have sometimes occurred with respect to the points such as the charge of the dispersing medium, the discharge during the cleaning, or the cleaning of pipelines.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a dispersion method, which uses a dispersing apparatus for generating a sucking action with the rotation of a disc like a rotary disc type dispersing machine, wherein during the dispersion of a material in a liquid by means of a dispersing medium, the dispersing medium can readily be charged, and after completion of the dispersion treatment, discharge of the dispersing medium and cleaning of pipelines can effectively be conducted; and a dispersing apparatus.

The present invention provides a dispersion method which comprises sucking a liquid containing a material to be treated and a dispersing medium, stored in a tank, into a dispersing chamber by sucking action generated by rotation of a disc which is disposed in the dispersing chamber; constraining the dispersing medium within the dispersing chamber by means of a medium-separating means; dispersing the material in the liquid by moving the dispersing medium by the rotation of the disc; discharging the dispersed liquid through the discharge outlet while separating the dispersing medium from the dispersed liquid

by means of the medium-separating means which is disposed at the discharge outlet side of the dispersing chamber; circulating the dispersed liquid to the tank through a pipeline which communicates from the discharge outlet to the tank; and after dispersion treatment, cleaning the tank, dispersing chamber and pipeline by permitting the dispersing medium to flow out of the dispersing chamber through the discharge outlet, and to circulate together with a cleaning liquid through the tank, dispersing chamber and pipeline.

The present invention also provides a dispersing apparatus which comprises a dispersing chamber having a disc; a sucking inlet through which a liquid containing a material to be treated and a dispersing medium are sucked into the dispersing chamber by rotation of the disc; a discharge outlet; and a medium-separating means for separating the dispersing medium from the dispersed liquid, disposed at the side of the discharge outlet of the discharging chamber, wherein the dispersing medium may be discharged in such a manner that the dispersing medium does not pass through the medium-separating means.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a layout diagram illustrating the basic construction of the dispersing apparatus according to the present invention.

Fig. 2 is a sectional view showing the embodiment of a dispersing apparatus according to the present invention.

Fig. 3 is an enlarged cross-sectional view of the

discharge outlet portion of the dispersing apparatus shown⁵ in Fig. 2.

Fig. 4 is an enlarged vertical-sectional view of the discharge outlet portion of the dispersing apparatus shown in Fig. 3.

Figs. 5(A) and 5(B) show other embodiments of the discharge outlet portion of the dispersing apparatus according to the present invention. Fig. 5(A) is a view illustrating the case where a dispersed liquid is discharged through a medium-separating means. Fig. 5(B) is a view illustrating the case where a dispersing medium is discharged.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A tank 1 for storing a liquid containing a material to be treated such as a slurry and a dispersing medium, is preferably provided with an agitating blade 2 for stirring and mixing the contents of the tank as shown in the drawing, and a pipeline 3 disposed at the lower portion of the tank is connected to a sucking inlet 6 of a dispersing apparatus through a valve 4.

The dispersing apparatus 5 has a structure basically the same as the rotary disc type dispersing apparatus as described in the above-mentioned Japanese Unexamined Patent Publication No. 7-116488, and comprises a plurality of discs 8a, 8b, 8c disposed within a dispersing chamber 7 of a substantially cylindrical shape, each of the discs being disposed with a certain distance, wherein a hole 10 is formed at the center portion of each of the discs 8a, 8b at the side of the sucking inlet 6 which opens at the center

portion of a side plate 9, and connecting members 8d disposed at several portions around the hole 10 connect the discs 8a, 8b, 8c. Further, the disc 8c is connected to an actuating shaft 11 and rotated by a motor 12 to rotate the discs entirely, and the liquid which is in contact with the surface of the disc is thereby made to flow in a circumferential direction by the action such as friction or centrifugal force to generate a sucking action, whereby the liquid to be treated is sucked into the dispersing chamber through the sucking inlet 6. A dispersing medium 13 such as glass beads, ceramics beads or steel balls, is charged in a predetermined amount into the tank 1, and sucked into the dispersing chamber through the sucking inlet 6 as disc rotates. The supply of the dispersing medium may be supplemented without stopping the operation of the dispersing apparatus.

In the dispersing chamber 7, the dispersing medium 13 is given a motion by means of the discs 8a, 8b, 8c. In this time, the distance between the respective discs and the distance between each disc and the inner wall of the dispersing chamber is suitably maintained so that no jam or break is occurred for the dispersing medium.

At the inner side of the discharge outlet 14 for discharging the dispersed liquid from the dispersing chamber 7, a medium-separating means for separating the dispersed liquid from the dispersing medium is formed. In the embodiments as shown in Figs. 1 to 4, the medium-separating means is detachably disposed to the dispersing chamber so that the medium-separating means may be attached to the dispersing chamber during dispersion treatment, and may be

detached from the dispersing chamber during cleaning after completion of the dispersion treatment. Instead of the embodiments as shown in Figs. 1 to 4, the medium-separating means may be movably disposed between an operation position and a non-operation position within the dispersing chamber, or as described below, a flow path for permitting the dispersing medium to flow, may be disposed separately, to open and shut the flow path.

As the medium-separating means, a suitable separating means of e.g. a screen system, a cassette screen system or a gap separator system, may be used. Figs. 3 and 4 show an embodiment of the medium-separating means of a screen system, wherein a filter 15 having e.g. a slit, pores or a net, through which the dispersed liquid is permitted to pass and the dispersing medium is not permitted to pass, is formed in a shape along the inner surface of the dispersing chamber 7, and is held by a holding frame 16 which is detachably engaged with a discharge outlet 14 of a substantially square shape in cross-section. A stay 17 is fixed to the substantially center portion of the holding frame 16, a connection rod 19 is fitted with a screw to a securing portion 18 disposed on the stay 17, and a securing frame 20 is fixed to other end of the connection rod 19. The securing frame 20 is detachably fitted to receiving grooves 21, 21 formed at the opening end of the discharge outlet 14, and the holding frame 16 is thereby held within the discharge outlet 14.

At the opening end of the discharge outlet 14, is mounted a cover plate 24 which has, on its lower surface, a seal 23 and small projections 22, 22 which fit to the

receiving grooves 21. 21 and press the securing frame 20. The cover plate 24 is fastened to a fastening screw 27 of a clamp 26 which is hinged by a hinge 25 to the dispersing chamber 7. The cover plate 24 is provided with a discharge pipeline 28. The dispersed liquid discharged from the discharge outlet 14 is discharged through the discharge pipeline 28, and pass through a pipeline 29 detachably connected to the discharge pipeline 28 and circulated to the tank 1.

In the state as shown in the drawings, when the cover plate 24 is detached by operating the clamp, and then the securing frame 20 or the like is taken away from the discharge outlet 14, the medium-separating means will be detached to permit the dispersing medium to flow out of the chamber. To attach the medium-separating means, the cover plate 24 is detached by operating the clamp and the medium-separating means may be attached to the discharge outlet, thereby permitting the dispersed liquid alone to flow out of the chamber while separating the dispersing medium.

Figs. 5(A) and 5(B) show views illustrating an embodiment wherein a medium-separating means is fixedly disposed. At a part of the discharge outlet 14, a filter 30 having e. g. slits, a net or pores, through which the dispersed liquid is permitted to pass and the dispersing medium is not permitted to pass, is formed along the inner surface of the dispersing chamber. A flow path 31 wherein the dispersing medium flows is formed at the side portion of the filter 30, and an open-and-shut means for opening or shutting the flow path 31 is disposed. In the drawings, the open-and-shut means is a plate 32 slidably disposed in front of the

filter 30 and the flow path 31, and if the flow path 31 is shut by the plate 32, the dispersed liquid is discharged through the filter 30 as shown in Fig. 5(A), by which the dispersing medium in the dispersing chamber is prevented from flowing out, and if the plate 32 is moved to shut the flow path 31, the dispersing medium is made to flow out (Fig. 5(B)).

The terminal end of the pipeline 29 opens toward the tank 1, and against the terminal end, a collecting filter 33 having e.g. slits, a net or pores formed, is provided so that a cleaning liquid can be permitted to flow, but the dispersing medium can be collected. When the dispersing medium is circulated, the collecting filter 33 is taken away from the position against the terminal end of the pipeline 29, and when the dispersing medium is collected, the collecting filter 33 is set at the position against the terminal end of the pipeline 29 as shown in Fig. 1.

The liquid containing a material to be treated and the dispersing medium 13 is charged into the tank 1 and then the dispersing apparatus 5 is actuated. The liquid to be treated and the dispersing medium are sucked into the dispersing chamber 7 through the pipeline 3, and then, the material is dispersed in the liquid by the dispersing medium which moves by the rotation of the discs 8a, 8b, 8c. The dispersed liquid is discharged from the discharge outlet 14 and returned to the tank 1 through the pipeline 29, though the dispersing medium remains in the dispersing chamber by means of the medium-separating means. By the circulation system along the line through the dispersing chamber and the like as described above, the material to be

treated is dispersion-treated to a predetermined level and will be taken out through a pipeline not shown in the drawings from the tank 1.

After completion of the dispersion treatment, the dispersing apparatus is stopped, and the liquid remaining in the dispersing chamber 7 or the pipeline 29 is taken out from a plug valve 34 disposed on the side plate 9, and then the medium-separating means is taken away from the discharge outlet or the flow path 31 for permitting the dispersing medium to flow is opened, and the line is arranged again, a cleaning liquid is charged into tank 1 and the dispersing apparatus 5 is operated. Then, the dispersing medium in the dispersing chamber 7 is discharged from the dispersing chamber together with the cleaning liquid sucked in the dispersing chamber, circulated in the line, by which the dispersing medium is itself cleaned, and at the same time, by permitting the dispersing medium to flow all the corners of the tank, dispersing chamber, pipeline and the like, stains or the like adhered to every corner portions of the line can be removed by cleaning. After completion of cleaning, the collecting filter 33 is set at the position against the terminal end of the pipeline 29, to collect only the dispersing medium within the filter.

According to the the present invention, the dispersion method comprises sucking a liquid containing a material to be treated and a dispersing medium stored in a tank through a sucking inlet into a dispersing chamber by sucking action generated by rotation of a disc which is disposed in the dispersing chamber; constraining the dispersion medium within the dispersing chamber by a medium-separating means;

dispersing the material in the liquid by moving the dispersing medium; discharging the dispersed liquid through a discharge outlet while separating the dispersing medium from the dispersed liquid by means of the medium-separating means; circulating the dispersed liquid to the tank through a pipeline which communicates from the discharge outlet to the tank; and after completion of dispersion treatment, cleaning the tank, dispersing chamber and pipeline by permitting the dispersing medium to flow out of the dispersing chamber through the discharge outlet, and to circulate together with a cleaning liquid through the tank, dispersing chamber and pipeline, by which even if the dispersing medium is not charged into the dispersing chamber at first, the dispersing medium can be sucked into the dispersing chamber by the sucking action generated by the disc, whereby the charging operation of the discharging medium can readily be conducted.

Further, by the structure wherein after the completion of the dispersion treatment, the dispersing medium is permitted to flow from the discharge outlet of the dispersing chamber and to circulate through the tank and the dispersing chamber by means of pipelines, the dispersing medium can simply be taken out (discharge) of the dispersing chamber and the dispersing medium is circulated in the line together with the cleaning liquid, whereby the dispersing medium itself is cleaned and solid or liquid stains adhered to the inside of the tank or the dispersing chamber, or corner portions of the pipelines in which the liquid flows, can be completely removed by cleaning, and further it is easy to change the types or colors of

products such as a coating material, and it is possible to apply such method or apparatus to a small amount of production of various kinds.

What is claimed is:

1. A dispersion method which comprises sucking a liquid containing a material to be treated and a dispersing medium, stored in a tank, through a sucking inlet into a dispersing chamber by sucking action generated by rotation of a disc which is disposed in the dispersing chamber; constraining the dispersing medium within the dispersing chamber by means of a medium-separating means; dispersing the material in the liquid by moving the dispersing medium by the rotation of the disc; discharging the dispersed liquid through a discharge outlet while separating the dispersing medium from the dispersed liquid by means of the medium-separating means; circulating the dispersed liquid to the tank through a pipeline which communicates from the discharge outlet to the tank; and after completion of dispersion treatment, cleaning the tank, dispersing chamber and pipeline by permitting the dispersing medium to flow out of the dispersing chamber through the discharge outlet, and to circulate together with a cleaning liquid through the tank, dispersing chamber and pipeline.

2. A dispersing apparatus which comprises a dispersing chamber; a disc disposed in the dispersing chamber for generating sucking action by rotation; a sucking inlet for sucking a liquid containing a material to be treated and a dispersing medium into the dispersing chamber by the sucking action; a discharge outlet for discharging the material dispersed in the liquid by movement of the dispersing medium; and a medium-separating means for separating the dispersing medium from the dispersed liquid.



disposed at the inner side of the discharge outlet, wherein the dispersing medium may be selectively discharged through the discharge outlet in such a manner that the dispersing medium does not pass through the medium-separating means.

3. The dispersing apparatus according to Claim 2, wherein the medium-separating means is disposed in a detachable fashion at the inner side of the discharge outlet.

4. The dispersing apparatus according to Claim 3, wherein the medium-separating means comprises a filter through which the dispersed liquid is permitted to pass and the dispersing medium is not permitted to pass, and a holding frame for holding the filter, wherein the holding frame is disposed in a detachable fashion at an end of the discharge outlet.

5. The dispersing apparatus according to Claim 4, wherein the filter is located along the inner face of the dispersing chamber when the holding frame is disposed at the end of the discharge outlet.

6. The dispersing apparatus according to Claim 2, which further comprises a flow path through which the dispersing medium is permitted to pass and an open-and-shut means for opening and shutting the flow path, at the inner side of the discharge outlet.

