

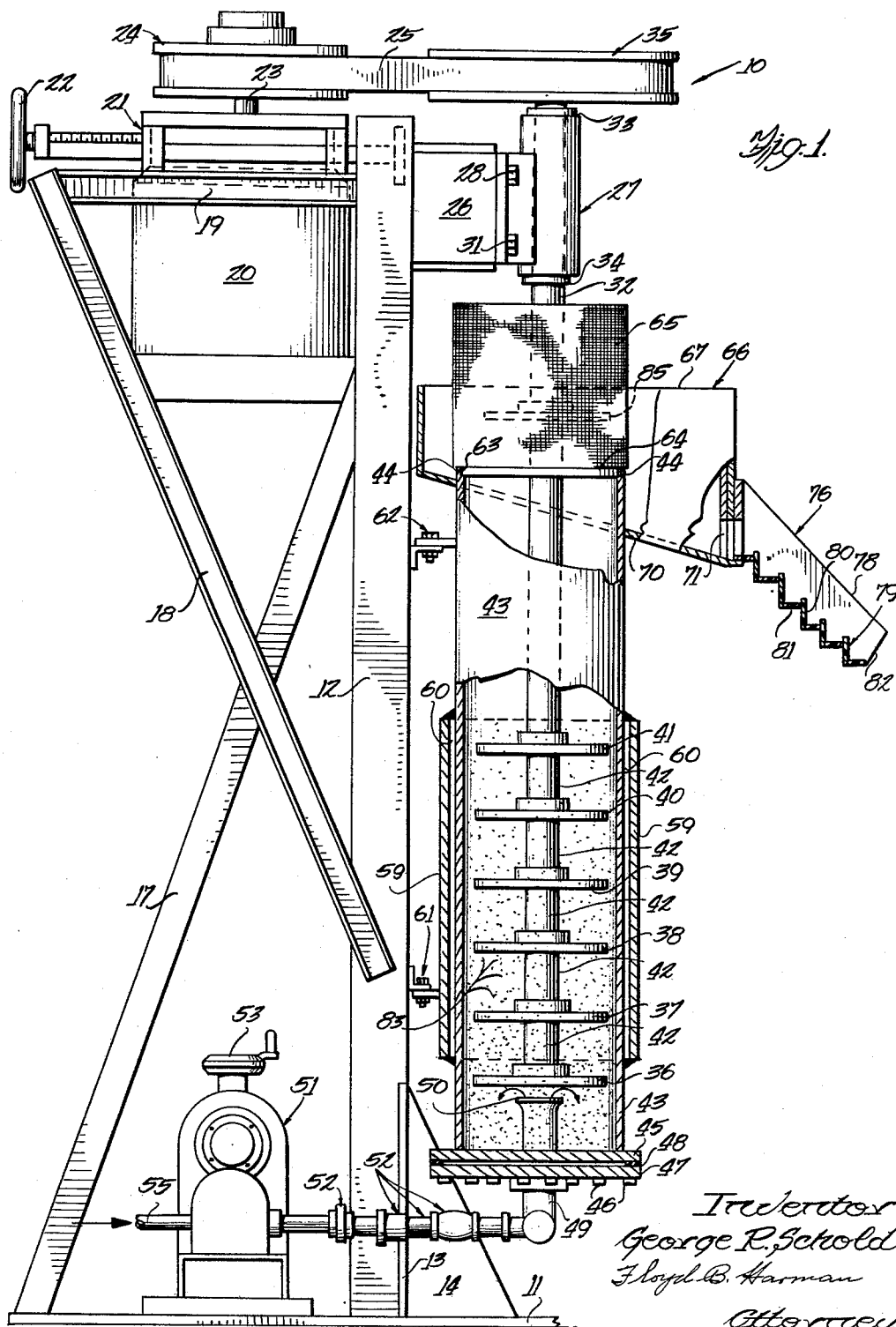
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DIVIDED SOLID PARTICLES IN A VEHICLE

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2 Sheets-Sheet 1



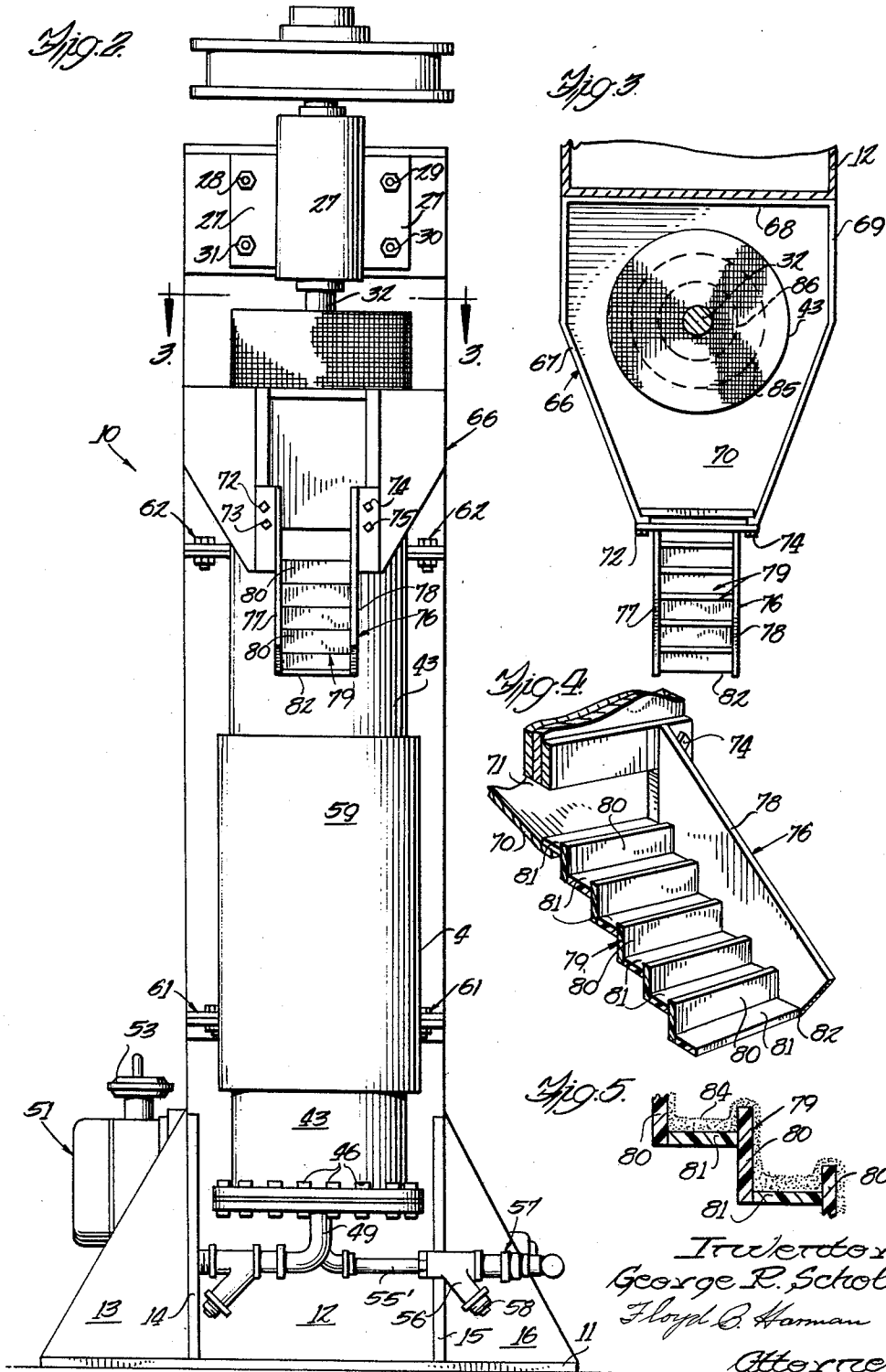
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Inventor
George R. Schold
Floyd C. Harman
Attorney

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APPARATUS AND METHOD FOR DISPERSING FINELY DIVIDED SOLID PARTICLES IN A VEHICLE

George R. Schold, 8818 W. 93rd Place, Oak Lawn, Ill.
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This invention relates to apparatus for uniformly dispersing finely divided particles in a liquid vehicle. More in particular this invention relates to apparatus for dispersing finely divided particles in a liquid vehicle wherein the dispersing agent is in the form of granulated particles of magnetically susceptible material and magnetic means for separating the dispersing agent from the dispersed particles and vehicle therefor.

In the manufacture of paints, enamels, oils containing a solid additive such as graphite, pigmented inks and the like, the solid material to be introduced into a liquid vehicle is usually in a finely divided form sometimes having a particle size as low as one micron. These solid particles are substantially insoluble and inert with respect to the vehicle. When such material in the dry form is first introduced into a selected liquid vehicle the particles tend to form lumps which are agglomerations of particles surrounded by a film of the vehicle. Thus the particles within the film of a lump remain dry and do not readily disperse uniformly in the vehicle. Perhaps this phenomena is due to the surface tension of the vehicle being of such magnitude to inhibit dispersion. One mechanical means commonly used to break up the agglomerated particles is to pass the fluid mixture through conventional roller mills. These roller mills consist of a pair of highly machined and polished power driven metal rollers in line contact with each other under strong force. The fluid mixture passes between the rollers and the pressure of the line contact therebetween mechanically crushes the agglomerated particles thus dispersing the individual particles of the agglomerates into the vehicle. The difficulties with this apparatus are that the rate of dispersion is slow, at least one operator must always be in attendance as damage to the rollers occurs if the mill is allowed to operate when the fluid mixture supply fails, the power consumption is high, and lastly the cost of such mills is extremely high and maintenance is expensive. The present invention overcomes these disadvantages as will be evident later herein.

Accordingly it is a prime object of the present invention to provide a dispersing apparatus which disperses non-magnetic susceptible insoluble solid particles uniformly into a liquid vehicle continuously without contaminating the product with the dispersing agent.

A further important object of this invention is to provide a dispersing apparatus according to the preceding object wherein the dispersing agent is in the form of granulated magnetically susceptible particles.

Still another object of this invention is to provide a dispersing apparatus according to the preceding objects wherein means are provided for magnetically removing substantially all particles of dispersing agent which otherwise would contaminate the product.

A yet further object of this invention is to provide a dispersing apparatus according to the preceding objects at low manufacturing cost, low maintenance cost, low power requirement, and does not require the constant attendance by an operator.

Another important object of this invention is to provide a method for dispersing solid particles in a liquid vehicle with a dispersing agent in particulate form and separating said agent from the resulting liquid dispersion product.

These and other desirable and important objects inherent in and encompassed by the invention will be more

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readily understood from the ensuing description of a preferred embodiment, the appended claims and the annexed drawings wherein:

FIGURE 1 is a side view, partly in section and partly broken away illustrating the general arrangement of the dispersing apparatus of this invention.

FIGURE 2 is a front view of the dispersing apparatus of FIGURE 1 showing details not too apparent from FIGURE 1.

FIGURE 3 is a plan view, partly in section and partly broken away, taken on line 3-3 of FIGURE 2 illustrating the means for removing particles of the dispersing agent from the fluid mixture after completion of the dispersing operation but before discharging of the final product.

FIGURE 4 is an enlarged perspective view, partly in section and partly broken away, of the magnetic means for removing particles of the dispersing agent from the dispersed fluid mixture prior to discharge as a final product, and

FIGURE 5 is an enlarged front sectional view, partly in section and partly broken away, of a portion of the magnetic means for removing particles of the dispersing agent from the dispersed fluid mixture illustrating the position of the entrapped particles of the agent.

Referring now to the drawings the numeral 10 in FIGURES 1 and 2 indicates generally the dispersing apparatus comprising this invention. The apparatus 10 is provided with a supporting base plate 11 securing, as by welding, a vertical column 12 which may conveniently be in the form of a channel beam. Reinforcing plates 13, 14, 15 and 16 each welded to the column 12 and base plate 11 are employed to secure further the column 12 rigidly with the plate 11. In order to secure the upper end portion of the column 12 a pair of parallel spaced angle irons, one of which is shown at 17 in FIGURE 1, are welded to the base plate 11 and the upper end portion of the column 12 as shown.

Welded to the lower portion of the column 12 and extending upwardly and rearwardly is a pair of parallel spaced angularly disposed channel beams one of which is shown at 18 in FIGURE 1. Also welded to the upper end portion of the column 12 is a pair of parallel spaced horizontal channel beams one of which is shown at 19 in FIGURE 1. The outer ends of these horizontal channel beams are respectively welded to the upper ends of the angularly disposed channel beams as evident from FIGURE 1. Thus the elements 11 to 19 inclusive as described form a rigid stationery supporting structure or frame.

Mounted on the horizontal beams is a power means in the form of an electric motor 20. The motor 20 is provided with a conventional sliding support 21 which permits the motor 20 to be adjustably moved forwardly or rearwardly by rotation of the hand wheel 22. Secured to the motor shaft 23 is a conventional V-belt pulley 24 of the type having its effective diameter variably adjustable. Thus by adjusting the pulley 24 the peripheral speed of its V-belt 25 can be varied widely. From this it can be readily appreciated that the purpose of the adjustable sliding support 21 for the motor 20 is to attain proper tension of the V-belt 25 for the entire belt speed range of the adjustable pulley 24.

Secured, as by welding, to the forward side of the column 12 is a forwardly extending bearing support 26. Mounted on the support 26 is a bearing member 27 and secured thereto rigidly by bolts 28, 29, 30 and 31 as best shown in FIGURES 1 and 2. The bearing member 27 is of conventional construction for supporting rotatably a vertically disposed agitator shaft 32. Axial movement of the shaft 32 is prevented by any conventional means such as collars 33 and 34 secured thereto. Secured to

the upper end of the shaft 32 is a conventional V-belt pulley 35 in alignment with the pulley 24 and V-belt 25. Thus the motor 20 is in drive relation with the agitator shaft 32.

As shown in FIGURE 1 there is a plurality of agitator discs, six of which are illustrated at 36, 37, 38, 39, 40 and 41 all constrained for rotation with the agitator shaft 32. Conveniently the discs 36—41 are constrained to the shaft 32 by conventional keys 42 disposed in a complementary groove in the shaft 32. The keys 42 protrude radially from the shaft 32 between each pair of discs 36—41 as they serve to assist in agitation.

The construction of the discs 36—41 is of hard steel preferably of the wear-resistant type. Each disc is circular shaped with an upwardly extending hub portion for increasing the shear area of its key 42. The surface characteristics of the discs 36—41 are that of ordinary rough machining.

Surrounding the discs 36—41 in an upwardly extending agitator tube 43 having an upper end terminating at 44 as seen best in FIGURE 1. The lower end of the tube 43 is provided with an annular flange 45. Secured to the flange 45 by bolts 46 is a closure plate 47 with an annular shaped sealing ring 48 therebetween for preventing leakage of fluid therethrough. Centrally disposed in the closure plate 47 and extending therethrough is a fluid mixture inlet pipe 49 having a flared orifice 50 for discharging undispersed fluid mixture into the lower end of the tube 43. The inlet pipe 49 communicates with the discharge side of a motor driven variable displacement fluid pump 51 through conventional pipe fittings generally indicated at 52. The pump 51 is of conventional construction and the hand wheel 53 is illustrative of the displacement control therefor. The conduit 55 from the inlet side of the pump 51 leads to the source (not shown) of fluid mixture of agglomerated particles in a liquid vehicle to which the apparatus 10 is to disperse.

Referring to FIGURE 2 it will be seen that the pipe 49 is provided with a branch conduit 55' having a drain fitting 56 and a valve 57. Thus to drain the tube 43 the plug 58 is removed from the fitting 56. The valve 57 is connected to a source of fluid pressure (not shown) for the purpose of cleaning and flushing out the pipe 49 of solid particles which might settle therein during shut-down periods of the apparatus 10.

It is sometimes necessary to control the temperature of the fluid mixture within the tube 43. For example when first starting the fluid may be cold and hence quite viscous which would impose an unnecessary load on the motor 20. At other times it may be necessary to dissipate heat from the fluid in the tube 43. For these reasons a portion of the tube 43 is surrounded with a jacket 59 welded at the top and bottom to the tube 43 as best shown in FIGURE 1. The cylindrical space or volume 60 between the inner surface of the jacket 59 and outer surface of the tube 43 is conventionally charged with circulating heat control media through suitable inlet and outlet passages (not shown) as may be required. For example steam under pressure or hot water may be used for heating and cold water may be used for cooling. The jacket 59 may be secured to the column 12 by welded lugs and bolts indicated at 61. Likewise the upper end portion of the tube 43 may similarly be secured to the column 12 as by welded lugs and bolts indicated at 62.

The upper end 44 of the tube 43 is provided with an inner peripheral recess 63 adapted to receive slidably an annular ring 64 in support relation. Rigidly connected to the upper side of the ring 64 is a cylindrically shaped filter screen 65 extending upwardly nearing the lower end of the bearing member 27 as best shown in FIGURE 1. The openings in the screen (mesh) should be small but yet sufficiently large to permit the vehicle with its dispersed particles to flow therethrough readily and without

overflow through the top thereof. A 40 mesh screen has been found satisfactory for most purposes.

Sealed, as by brazing or welding, to the outer surface of the upper portion of the tube 43 is a fluid collector generally indicated at 66. The collector 66 surrounds the upper end 44 of the tube 43 as well as the cylindrical filter screen 65. It will be observed that the vertical sides 67, 68 and 69 (FIGURE 3) of the collector 66 are disposed at an appreciable distance from the filter screen 65. The bottom or floor 70, in sealing relation with the tube 43 and sides 67, 68 and 69, is sloped in a forward direction as may be evident from FIGURE 1. From this it is apparent that fluid moving upwardly in the tube 43 passes through the openings in the filter screen 65 and drains to the sloping floor 70 of the collector 66.

The forward portion of the collector 66 is provided with a large opening or gate 71 for discharging by gravity liquid fluid mixture collected in the collector 66. Rigidly connected to the forward portion of the collector 66, as by bolts 72, 73, 74 and 75 is a sloping discharge trough indicated generally at 76. The trough 76 comprises a pair of sides 77 and 78 sealingly secured to fluid turbulence inciting bottom 79. The bottom 79 of the trough 76 in some respect resembles a staircase as may be evident from the drawings particularly FIGURE 4.

Referring to FIGURE 5 the bottom 79 of the trough 76 is formed by a plurality of permanent magnets, the risers or vertical magnets designated by the numeral 80 and the horizontal or step magnets by the numeral 81 all connected together to form a rigid structure. Electromagnetic means may similarly be employed if desired. The upper end of each riser 80 should be of one polarity (e.g. north) and the forward ends of the steps should be of the opposite polarity (e.g. south). As seen best in FIGURE 5 the upper ends of the risers 80 should extend above the upper surface of the next ascending step to form a sill or perhaps a weir. From this it will be apparent that when fluid mixture from the collector 69 passes through the gate 71 it cascades with considerable turbulence over the upper edges of each riser 80 as the fluid mixture makes its way downward to its discharge point 82. From the discharge point 82 the fluid dispersed mixture (final product) is conducted to a suitable receiver (not shown) by any conventional means.

The dispersing agent, shown as dots 83 within the lower portion of the tube 43, is in the form of small particles of hard, magnetically susceptible material such as steel, iron and the like which are attracted under the influence of magnetism. This is an essential feature as otherwise the trough 76 will not function as intended. The particle size of the dispersing agent may vary from 10 to 160 mesh. A more preferred range of particle size of the dispersing agent which performed excellently is 20 to 60 mesh.

The general shape of the particles of the dispersing agent is very important. Spherically shaped steel shot, for example, will function to disperse the aforementioned agglomerated particles in the fluid mixture but the rate of satisfactory dispersion is unnecessarily slow. Perhaps this is due to the contact between two dispersing agent particles is limited to a point. It was found that if the particles of the dispersing agent were irregularly shaped preferably having at least one flat surface the efficiency and effectiveness of the agent was greatly enhanced as evidenced by increased rate of dispersion. Perhaps this is due to surface-to-surface contact of the particles of the agent instead of point to point contact as in the case of spheres. Perhaps the ideal form of particles of the agent would be cubical or rectangular shape as this would provide maximum surface-to-surface contact but a source of such particles is speculative. Steel particles of irregular shape may be produced by impinging steel shot at high velocity with the aid of compressed air against a

hard, rough surface such as that of a rasp or file, and

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then riddle the resulting mass to obtain the desired mesh range size.

The dispersing agent above described should of course be clean and free of foreign matter particularly of the type that is not attracted by a magnetic field.

Having now described the construction of the dispersing apparatus of this invention, the operation thereof will now be discussed.

Operation

The magnetically susceptible dispersing agent 83 is first charged into the tube 43 through the opening at the upper end of the filter screen 65 to a depth approximately at the upper end of the jacket 59. In many instances a lesser amount of dispersing agent will suffice. The jacket 59 in most cases may be charged with steam if desired, but is not always absolutely necessary. A fluid mixture comprising the selected vehicle, such as oil, with agglomerated particles of undispersed solids therein (e.g. a pigment) enters the pump 51. The pump 51 controls the rate of flow of such fluid mixture into the inlet pipe 50. At this time the motor 20 is energized thereby rotating the agitator discs 36—41. Since the linear speed of the particles near the shaft 32 is low the keys 42 assist in agitation in those regions. The fluid mixture having agglomerated solid particles is pumped continuously through the orifice 50 at the bottom of the tube 43. As the fluid mixture is thus forced upwardly agglomerated lumps of solid particles are physically engaged by the agitating particles of the dispersing agent which effectively destroys the agglomerates and disperses the individual particles of solids (e.g. pigment) into the fluid vehicle. Eventually the fluid mixture with its solid particles (e.g. pigment) enters the low agitation zone in the tube 43 above the top or uppermost agitating disc 41. In the low agitating zone the larger particles of dispersing agent, being of high density, move downwardly under the force of gravity.

At this point it is mentioned that the action of the dispersing agent is not principally that of grinding for there is no appreciable evidence that the solid particles of the fluid mixture (e.g. pigment) are reduced in size. However the action of the dispersing agent probably results in some abrading and hence grinding. This is substantiated by the fact that some of the dispersing agent becomes finely divided, sometimes referred to in the trade as "fines." For purposes herein the term "fines" is defined as particles of dispersing agent sufficiently small that they are carried in suspension in the liquid vehicle either without agitation or with very low agitation. Hence the fluid mixture with its dispersed particles of solids (e.g. pigment) in the low agitation zone in the tube 43 may contain dispersing agent "fines."

As the fluid mixture progresses upwardly through the low agitation zones of the tube 43 it eventually reaches the filter screen 65. The fluid mixture passes through the screen 65 which removes any larger particles of solids (e.g. dirt and other foreign matter) and flows downwardly along the outer periphery thereof into the collector 66.

At this point it is mentioned that an upper agitating disc 85 similarly constructed as the discs 36—41 is mounted on the shaft 32 within the screen 65. The disc 85 is of course constrained for rotation with the shaft 32. The purpose of the disc 85 is to engage the fluid mixture if the level thereof rises sufficiently within the screen 65. The disc 85 then imparts radial movement to the fluid mixture to increase the flow pressure through the screen 85. Normally the fluid level does not rise sufficiently to engage the disc 85.

The dispersed fluid mixture in the collector 66 flows by gravity along the sloped floor 70 and thence through the gate 71. The fluid mixture then cascades downwardly through the trough 76 with considerable turbulence. As the fluid mixture proceeds downwardly in the trough 76 to the discharge point 82 the plurality of magnets 80 and

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81 attract the particles of dispersing agent "fines" which were suspended in and carried over by the fluid vehicle. FIGURE 5 illustrates these dispersing agent fines adhering to the magnets 80 and 81. When the magnets 80 and 81 have an appreciable build-up of dispersing agent fines the fluid flow is terminated and the adhered fines physically removed. Compressed air directed into the trough by hose effectively cleans the magnets 80 and 81 quickly and the fluid flow may then be restarted.

The final product flowing through the discharge point 82 of the trough 76 is found to consist of the vehicle with its finely divided solid particles (e.g. pigment) completely dispersed therein and devoid of all or substantially all evidence of traces of dispersing agent therein.

Unlike the roller mills previously described the apparatus of this invention is not damaged if permitted to continue operating after failure of delivery of the fluid mixture from the pump 51. Thus the constant attendance of an operator is not required. The operator is merely required to examine occasionally the amount of fines adhered in the trough 76, temperature, rate of flow, etc. Furthermore the cost of constructing the apparatus 10 is but a small fraction of that for a roller mill above described having equal production capacity as only one highly machined component (bearing assembly 27) is required.

Having thus described a preferred embodiment of the invention it can now be seen that the objects of the invention have been fully achieved and it must be understood that changes and modifications may be made which do not depart from the spirit of the invention nor from the scope thereof as defined in the appended claims.

What is claimed is:

1. The method of individually dispersing finely divided substantially insoluble particles held in agglomerated form by a liquid vehicle as a fluid mixture consisting of the steps of introducing a magnetically susceptible dispersing agent in particulate form and agitating the resulting mass until said agglomerates have disintegrated, and thereafter subjecting the resulting fluid dispersion product to a magnetic field to remove particles of said agent carried by said vehicle.

2. The method of individually dispersing finely divided substantially insoluble particles held in agglomerated form by a liquid vehicle as a fluid mixture consisting of the steps of introducing a magnetically susceptible dispersing agent in particulate form and agitating the resulting mass until said agglomerates have disintegrated, reducing the agitation rate to separate by gravity the major portion of said agent, and thereafter subject the resulting fluid dispersion product to at least one magnetized surface in contact relation to remove remaining particles of said agent carried by said vehicle.

3. The method of individually dispersing finely divided substantially insoluble particles held in agglomerated form by a liquid vehicle as a fluid mixture consisting of the steps of introducing a magnetically susceptible dispersing agent in particulate form and agitating the resulting mass until said agglomerates have disintegrated, filtering the resulting fluid mass to remove a major portion of said agent, and thereafter subject the resulting fluid dispersion product to at least one magnetized surface in contact relation to remove remaining particles of said agent carried by said vehicle.

4. An apparatus for individually dispersing finely divided substantially insoluble solid particles held in agglomerated form carried in suspension by a liquid vehicle as a fluid mixture comprising, in combination, a frame, a tube, secured to said frame having one end thereof elevated, power driven agitating means disposed in said tube, a magnetically susceptible dispersing agent in particulate form disposed in said tube in engaging relation with said agitating means, a fluid collector disposed on the upper end portion of said tube having fluid discharge means connected thereto, said discharge means having a

magnetic field positioned for removing particles of said agent from said vehicle, fluid mixture inlet means disposed at the lower end of said tube, and means for introducing said fluid mixture under pressure to move said fluid mixture into said tube through said inlet means and discharge the resulting liquid dispersion product through said collector and the magnetic field of said discharge means.

5. An apparatus for individually dispersing finely divided substantially insoluble solid particles held in agglomerated form carried in suspension by a liquid vehicle as a fluid mixture comprising, in combination, a frame, a tube secured to said frame having one end thereof elevated, power driven agitating means disposed in said tube, a magnetically susceptible dispersing agent in particulate form disposed in said tube in engaging relation with said agitating means, said dispersing agent having a particle size in the range of 10 to 160 mesh, a fluid collector disposed on the upper end portion of said tube having fluid discharge means connected thereto, said discharge means having a magnetic field positioned for removing particles of said agent from said vehicle, fluid mixture inlet means disposed at the lower end of said tube, and means for introducing said fluid mixture under pressure to move said fluid mixture into said tube through said inlet means and discharge the resulting liquid dispersion product through said collector and the magnetic field of said discharge means.

6. An apparatus for individually dispersing finely divided substantially insoluble solid particles held in agglomerated form carried in suspension by a liquid vehicle as a fluid mixture comprising, in combination, a frame, a tube secured to said frame having one end thereof elevated, power driven agitating means disposed in said tube, a granulated magnetically susceptible dispersing agent in particulate form disposed in said tube in engaging relation with said agitating means, said particles of said agent being of irregular shape, a fluid collector disposed on the upper end portion of said tube having fluid discharge means connected thereto, said discharge means having a magnetic field positioned for removing particles of said agent from said vehicle, fluid mixture inlet means disposed at the lower end of said tube, and means for introducing said fluid mixture under pressure to move said fluid mixture into said tube through said inlet means and discharge the resulting liquid dispersion product through said collector and the magnetic field of said discharge means.

7. An apparatus for individually dispersing finely divided substantially insoluble solid particles held in agglomerated form carried in suspension by a liquid vehicle as a fluid mixture comprising, in combination, a frame, a tube secured to said frame having one end thereof elevated, power driven agitating means disposed in said tube, a granulated magnetically susceptible dispersing agent in particulate form disposed in said tube in engaging relation with said agitating means, said particle of said dispersing agent being of irregular shape and having sizes in the range of 10 to 160 mesh, a fluid collector disposed on the upper end portion of said tube having fluid discharge means connected thereto, said discharge means having a magnetic field positioned for removing particles of said agent from said vehicle, fluid mixture inlet means for introducing said fluid mixture under pressure to move said fluid mixture through said inlet means into said tube and discharge the resulting liquid product through said collector and the magnetic field of said discharge means.

8. An apparatus for individually dispersing finely divided substantially insoluble solid particles held in agglomerated form carried in suspension by a liquid vehicle as a fluid mixture comprising, in combination, a frame, a tube secured to said frame having one end thereof elevated, power driven agitating means disposed in said tube, a granulated magnetically susceptible dispersing agent in particulate form disposed in said tube in en-

gaging relation with said agitating means, said particles of said dispersing agent being of irregular shape and having sizes in the range of 10 to 160 mesh, a fluid collector disposed on the upper end portion of said tube, a downwardly sloping trough having its upper end communicatively connected to said collector, said trough having a magnetized floor for removing particles of said agent from said vehicle, fluid mixture inlet means for introducing said fluid mixture under pressure to move said fluid mixture through said inlet means into said tube and discharge the resulting liquid dispersion product through said collector and said trough.

9. An apparatus for individually dispersing finely divided substantially insoluble solid particles held in agglomerated form carried in suspension by a liquid vehicle as a fluid mixture comprising, in combination, a frame, a tube secured to said frame having one end thereof elevated, power driven agitating means disposed in said tube, a granulated magnetically susceptible dispersing agent in particulate form disposed in said tube in engaging relation with said agitating means, said particles of said dispersing agent being of irregular shape and having sizes in the range of 10 to 160 mesh, a fluid filter disposed at the upper end of said tube and in fluid communication therewith, a fluid collector disposed on the upper end portion of said tube in fluid receiving relation with said filter, a downwardly sloping trough having its upper end communicatively connected to said collector, said trough having a magnetized floor for removing particles of said agent from said vehicle, fluid mixture inlet means for introducing said fluid mixture under pressure to move said fluid mixture through said inlet means into said tube and filter and discharge the resulting liquid dispersion product through said collector and said trough.

10. An apparatus for individually dispersing finely divided substantially insoluble solid particles held in agglomerated form carried in suspension by a liquid vehicle as a fluid mixture comprising, in combination, a frame, a tube secured to said frame having one end thereof elevated, a jacket surrounding at least a portion of said tube having a fluid passage for conducting a fluid temperature controlling media in heat exchange relation with said tube, power driven agitating means disposed in said tube, a granulated magnetically susceptible dispersing agent in particulate form disposed in said tube in engaging relation with said agitating means, said particles of said dispersing agent being of irregular shape and having sizes in the range of 10 to 160 mesh, a fluid collector disposed on the upper end portion of said tube, a downwardly sloping trough having its upper end communicatively connected to said collector, said trough having a magnetized floor for removing particles of said agent from said vehicle, fluid mixture inlet means for introducing said fluid mixture under pressure to move said fluid mixture through said inlet means into said tube and discharge the resulting liquid dispersion product through said collector and said trough.

11. An apparatus for individually dispersing finely divided substantially insoluble solid particles held in agglomerated form carried in suspension by a liquid vehicle as a fluid mixture comprising, in combination, a frame, a tube secured to said frame having one end thereof elevated, a jacket surrounding at least a portion of said tube having a fluid passage for conducting a fluid temperature controlling media in heat exchange relation with said tube, power driven agitating means disposed in said tube, a granulated magnetically susceptible dispersing agent in particulate form disposed in said tube in engaging relation with said agitating means, said particles of said dispersing agent being of irregular shape and having sizes in the range of 10 to 160 mesh, a fluid filter disposed on the upper end of said tube and in fluid communication therewith, a fluid collector disposed on the upper end portion of said tube in fluid receiving relation with said filter, a downwardly sloping trough having its upper end com-

municatively connected to said collector, said trough having a magnetized floor for removing particles of said agent from said vehicle, fluid mixture inlet means for introducing said fluid mixture under pressure to move said fluid mixture through said inlet means into said tube and filter, and discharge the resulting liquid dispersion product through said collector and said trough.

12. An apparatus for individually dispersing finely divided substantially insoluble solid particles held in agglomerated form carried in suspension by a liquid vehicle as a fluid mixture comprising, in combination, a frame, a tube secured to said frame having one end thereof elevated, power driven agitating means disposed in said tube, a granulated magnetically susceptible dispersing agent in particulate form disposed in said tube in engaging relation with said agitating means, said particles of said dispersing agent being of irregular shape and having sizes in the range of 10 to 160 mesh, a fluid collector disposed on the upper end portion of said tube, a downwardly sloping trough having its upper end communicatively connected to said collector, said trough having a floor comprising of a plurality of horizontal steps and vertical risers in alternate relation for inciting turbulence by repeated cascading of fluid flowing downwardly on said floor, said steps and risers being magnetized for removing particles of said agent from said vehicle, fluid mixture inlet means for introducing said fluid mixture through said inlet means into said tube and discharge the resulting liquid dispersion product through said collector and said trough.

13. An apparatus for individually dispersing finely divided substantially insoluble solid particles held in agglomerated form carried in suspension by a liquid vehicle

as a fluid mixture comprising, in combination, a frame, a tube secured to said frame having one end thereof elevated, power driven agitating means disposed in said tube, a granulated magnetically susceptible dispersing agent in particulate form disposed in said tube in engaging relation with said agitating means, said particles of said dispersing agent being of irregular shape and having sizes in the range of 20 to 60 mesh, a jacket surrounding at least a portion of said tube having a fluid passage for conducting a fluid temperature controlling media in heat exchange relation with said tube, a fluid filter disposed on the upper end of said tube and in fluid communication therewith, a fluid collector disposed on the upper end portion of said tube in fluid receiving relation with said filter, a downwardly sloping trough having its upper end communicatively connected to said collector, said trough having a floor comprising a plurality of horizontal steps and vertical risers in alternate relation for inciting turbulence by repeated cascading of fluid flowing downwardly on said floor, said steps and risers being magnetized for removing particles of said agent from said vehicle, fluid mixture inlet means for introducing said fluid mixture through said inlet means into said tube and filter and discharge the resulting liquid dispersion product through said collector and trough.

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