

Claims:

1. A method of forming pigment pseudoparticles from pigment particles comprising:
 - providing a hollow vessel having an inner cylindrical surface and containing pigment particles;
 - providing a plurality of paddles that extend inwardly from the inner cylindrical surface and that each have a concave segment;
 - passing a flow of gas through the inner cylindrical surface;
 - axially rotating the inner cylindrical surface, thereby causing the plurality of paddles to lift a portion of the pigment particles;
 - axially rotating the inner cylindrical surface, thereby causing the plurality of paddles to dispense the pigment particles of the dispensed portion being polarized by the gas and landing onto a pile of the pigment particles; and
 - axially rotating the inner cylindrical surface, thereby inducing a repeated avalanching of the polarized pigment particles that agglomerates the polarized pigment particles into pigment pseudoparticles.
2. The method of claim 1, wherein providing the plurality of paddles comprises providing the plurality of paddles positioned along the inner cylindrical surface in a helical formation.
3. The method of claim 1 or claim 2, comprising vibrating an inlet feed of the hollow vessel to deacrate the pigment particles.
4. A method of forming pigment pseudoparticles from pigment particles, comprising:
 - providing an inclined hollow vessel having an inner cylindrical surface, a higher inlet end and a lower outlet end;
 - providing a plurality of paddles extending inwardly from the inner cylindrical surface and positioned along the axial length of the inclined hollow vessel in a helical formation, wherein each paddle has a concave segment;
 - introducing the pigment particles into the inclined hollow vessel at the higher inlet end;
 - passing a flow of gas through the inclined hollow vessel in a direction toward the lower outlet end;

lifting the pigment particle with the paddles by axially rotating the cylindrical inner surface;

dispensing the pigment particles from the paddles by axially rotating the cylindrical inner surface, thereby allowing the pigment particles to fall through the flow towards a portion of the inner cylindrical surface nearer the outlet end while being polarized by the gas; and

nucleating the polarized pigment particles into pigment pseudoparticles by axially rotating the inner cylindrical surface.

5. The pigment pseudoparticles produced in accordance with the method of any one of claims 1 to 4.

6. An apparatus for forming pigment pseudoparticles from pigment particles, comprising:

a hollow vessel comprising an inner cylindrical surface, an inlet end, and an outlet end, wherein the hollow vessel is adapted to be positioned at an incline having the inlet end higher and the outlet end lower;

a gas within the hollow vessel; and

a plurality of scoops extending inwardly from the inner cylindrical surface and positioned along the axial length of the inner cylindrical surface.

7. The apparatus of claim 6, wherein the gas comprises a draft of air flowing in a direction from the inlet end towards the outlet end.
8. The apparatus of claim 6 or claim 7, comprising vibrating means for deaerating the pigment particles.
9. An apparatus for inducing electrostatic bonding and agglomeration of pigment particles, comprising:
 - a hollow vessel adapted to be rotated in an axial direction and having an inner cylindrical surface for containing the pigment particles;
 - a plurality of paddles, each of the plurality of paddles comprising an attachment end attached to the inner cylindrical surface, a dispenser end distal the attachment end, and a segment of paddle between the attachment end and the dispenser end, wherein the segment has concave curvature facing the axial direction;
 - a gas within the hollow vessel; and
 - a means for driving rotation of the hollow vessel.
10. The apparatus of claim 9, wherein the attachment end is at least one of being directly attached to the inner cylindrical surface and being attached to the inner cylindrical surface via an intermediate component.
11. The apparatus of claim 9 or claim 10, wherein the hollow vessel is modular.
12. The apparatus of any one of claims 9 to 11, comprising means for supporting the hollow vessel during rotation, and optionally the means for supporting the hollow vessel comprises trunnions.
13. The apparatus of any one of claims 9 to 12, wherein each of the plurality of paddles is spoon-shaped.
14. The apparatus of any one of claims 9 to 13, wherein a radius of curvature of the segment is equal to a linear distance measured from the attachment end to the

dispenser end, and optionally the dispenser end comprises convex curvature having a radius of curvature equal to half the width of the segment.

15. The apparatus of any one of claims 9 to 14, comprising means for deagglomerating the pigment particles.
16. The apparatus of any one of claims 9 to 15, comprising means for minimizing adhesion between the inner cylindrical surface and at least one of the pigment particles and polarized pigment particles.
17. The apparatus of claim 16, wherein the means for minimizing adhesion comprises strikers adapted to strike the hollow vessel thereby causing the hollow vessel to vibrate.
18. The apparatus of claim 17, comprising means for periodically actuating the strikers in association with rotation of the hollow vessel.
19. The apparatus of any one of claims 9 to 18, wherein the hollow vessel is inclined at an angle with respect to the horizontal, and optionally wherein the angle is no more than about twenty degrees, or the angle is greater than zero degrees and less than ten degrees.
20. The apparatus of any one of claims 9 to 19, comprising an inlet for receiving the pigment particles and an outlet for discharging agglomerated pigment particles, and optionally the inlet is higher than the outlet.
21. The apparatus of any one of claims 9 to 20, wherein the attachment end of each of the plurality of paddles is positioned along the inner cylindrical surface in a helical formation.
22. The apparatus of claim 21, wherein the plurality of paddles comprise at least one set of paddles, the attachment end of each paddle in a set being positioned along the inner cylindrical surface in a helical formation.
23. The apparatus of claim 22, wherein the plurality of paddles comprises a first set of paddles, a second set of paddles and a third set of paddles, wherein the attachment end of

each paddle in the first set is positioned along the inner cylindrical surface in a first helical formation, wherein the attachment end of each paddle in the second set is positioned along the inner cylindrical surface in a second helical formation, and wherein the attachment end of each paddle in the third set is positioned along the inner cylindrical surface in a third helical formation.

Claims:

1. A method of forming pigment pseudoparticles from pigment particles comprising:
providing a hollow vessel having an inner cylindrical surface and containing pigment particles;

providing a plurality of paddies that extend inwardly from the inner cylindrical surface and that each have a concave segment:

passing a flow of gas through the inner cylindrical surface;
axially rotating the inner cylindrical surface, thereby causing the plurality of paddles to lift a portion of the pigment particles;

axially rotating the inner cylindrical surface, thereby causing the plurality of paddles to dispense the pigment particles of the dispensed portion being polarized by the gas and landing onto a pile of the pigment particles; and

axially rotating the inner cylindrical surface, thereby inducing a repeated avalanching of the polarized pigment particles that agglomerates the polarized pigment particles into pigment pseudoparticles.

2. The method of claim 1, wherein providing the plurality of paddles comprises providing the plurality of paddles positioned along the inner cylindrical surface in a helical formation.

3. The method of claim 1 or claim 2, comprising vibrating an inlet feed of the hollow vessel to deaerate the pigment particles.

4. The method of claim 1, wherein the hollow vessel is an inclined hollow vessel having an inner cylindrical surface, a higher inlet end and a lower outlet end;

and the plurality of paddles are positioned along the axial length of the inclined hollow vessel in a helical formation;

and the introduction of the pigment particles into the inclined hollow vessel is at the higher inlet end;

and the wherein the gas flow through the inclined hollow vessel is in a direction

toward the lower outlet end;

and wherein the dispensing the pigment particles from the paddles fall through the flow towards a portion of the inner cylindrical surface nearer the outlet end while being polarized by the gas.

5. An apparatus for forming pigment pseudoparticles from pigment particles, comprising:

a hollow vessel comprising an inner cylindrical surface, an inlet end, and an outlet end, wherein the hollow vessel is adapted to be positioned at an incline having the inlet end higher and the outlet end lower;

a gas within the hollow vessel; and

a plurality of scoops extending inwardly from the inner cylindrical surface and positioned along the axial length of the inner cylindrical surface.

6. The apparatus of claim 5, wherein the gas comprises a draft of air flowing in a direction from the inlet end towards the outlet end.

7. The apparatus of claim 5 or claim 6, comprising vibrating means for deaerating the pigment particles.

8. An apparatus for inducing electrostatic bonding and agglomeration of pigment particles, comprising:

a hollow vessel adapted to be rotated in an axial direction and having an inner cylindrical surface for containing the pigment particles;

a plurality of paddles, each of the plurality of paddles comprising an attachment end attached to the inner cylindrical surface, a dispenser end distal the attachment end, and a segment of paddle between the attachment end and the dispenser end, wherein the segment has concave curvature facing the axial direction;

a gas within the hollow vessel; and

a means for driving rotation of the hollow vessel.

9. The apparatus of claim 8, wherein the attachment end is at least one of being directly attached to the inner cylindrical surface and being attached to the inner cylindrical surface via an intermediate component.
10. The apparatus of claim 8, or claim 9 wherein tire hollow vessel is modular.
11. The apparatus of any one of claims 8 to 10, comprising means for supporting the hollow vessel during rotation, and optionally the means for supporting the hollow vessel comprises trunnions.
12. The apparatus of any one of claims 8 to 11, wherein each of the plurality of paddles is spoon-shaped.
13. The apparatus of any one of claims 8 to 12, wherein a radius of curvature of the segment is equal to a linear distance measured from the attachment end to the dispenser end, and optionally the dispenser end comprises convex curvature having a radius of curvature equal to half the-width of the segment.
14. The apparatus of any one of claims 8 to 10, comprising means for deaerating the pigment particles.
15. The apparatus of any one of claims 8 to 14, comprising means for minimizing adhesion between the inner cylindrical surface-and at least one-of-the pigment particles and polarized pigment particles.
16. The apparatus of claim 15, wherein the means for minimizing adhesion comprises strikers adapted to strike the hollow vessel thereby causing the hollow vessel to vibrate.
17. The apparatus of claim 16, comprising means for periodically actuating the strikers in association with rotation of tire hollow vessel.

18. The apparatus of any one of claims 8 to 17, wherein the hollow vessel is inclined at an angle with respect to the horizontal, and optionally wherein the angle is no more than about twenty degrees, or the angle is greater than zero degrees and less than ten degrees.

19. The apparatus of any one of claims 8 to 18, comprising an inlet for receiving the pigment particles and an outlet for discharging agglomerated pigment particles, and optionally the inlet is higher than the outlet.

20. The apparatus of any one of claims 8 to 19, wherein the attachment end of each of the plurality of paddles is positioned along the inner cylindrical surface in a helical formation.

21. The apparatus of claim 20, wherein the plurality of paddles comprise at least one set of paddles, the attachment-end of each-paddle in a set being positioned along the inner cylindrical surface in a helical formation.

22. The apparatus of claim 21, wherein the plurality of paddles comprises a first set of paddles, a second set of paddles and a third set of paddles, wherein the attachment end of each paddle in the first set is positioned along the inner cylindrical surface in a first helical formation, wherein the attachment end of each paddle in the second set is positioned along the inner cylindrical surface in a second helical formation, and wherein the attachment end of each paddle in the third set is positioned along the inner cylindrical surface in a third helical formation.