

United States Patent

LeJeune

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[54] **PROCESS AND APPARATUS FOR SUSPENDING PARTICLES IN A LIQUID**

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162/380, 259/7

[51] **Int. Cl.** **B01d 46/00**

[58] **Field of Search** 55/1, 36, 55, 159, 189-193,
55/430-431, 466; 19/66 A, 66 B, 66 CC, 66 R, 66
T, 156, 156.1-156.4; 264/121; 162/380; 259/7, 8;
8/156

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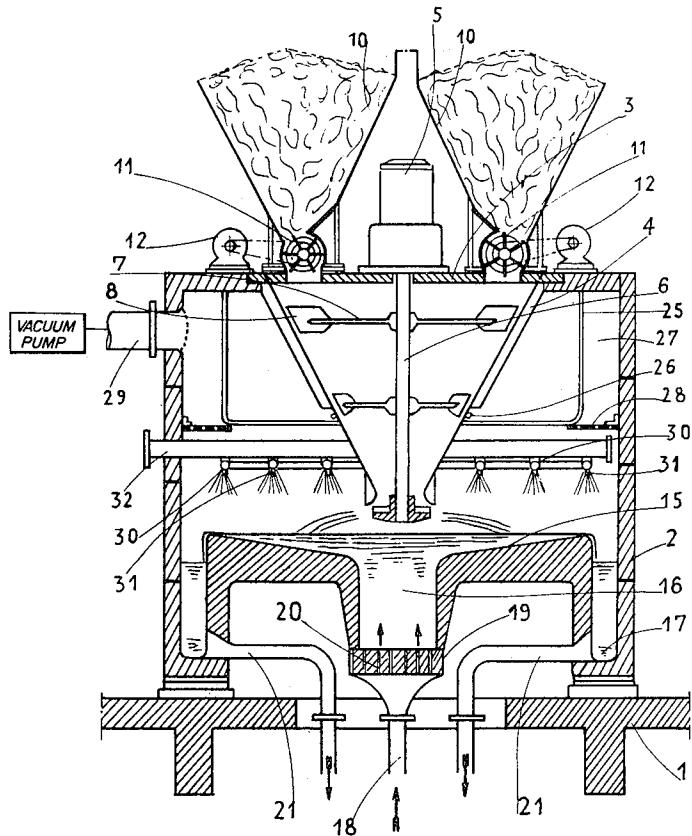
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[57]

ABSTRACT

Particles to be suspended in a liquid are fed into an enclosure maintained at less than atmospheric pressure. In the enclosure the particles are subjected to mixing and then centrifuging to assist the vacuum in removal of air from the particles. The particles leaving the centrifuge are subjected to liquid jets to assist in removal of air and the particles then fall onto a layer of the suspending liquid and thereafter in homogeneous suspension in the liquid leave the enclosure.

5 Claims, 2 Drawing Figures

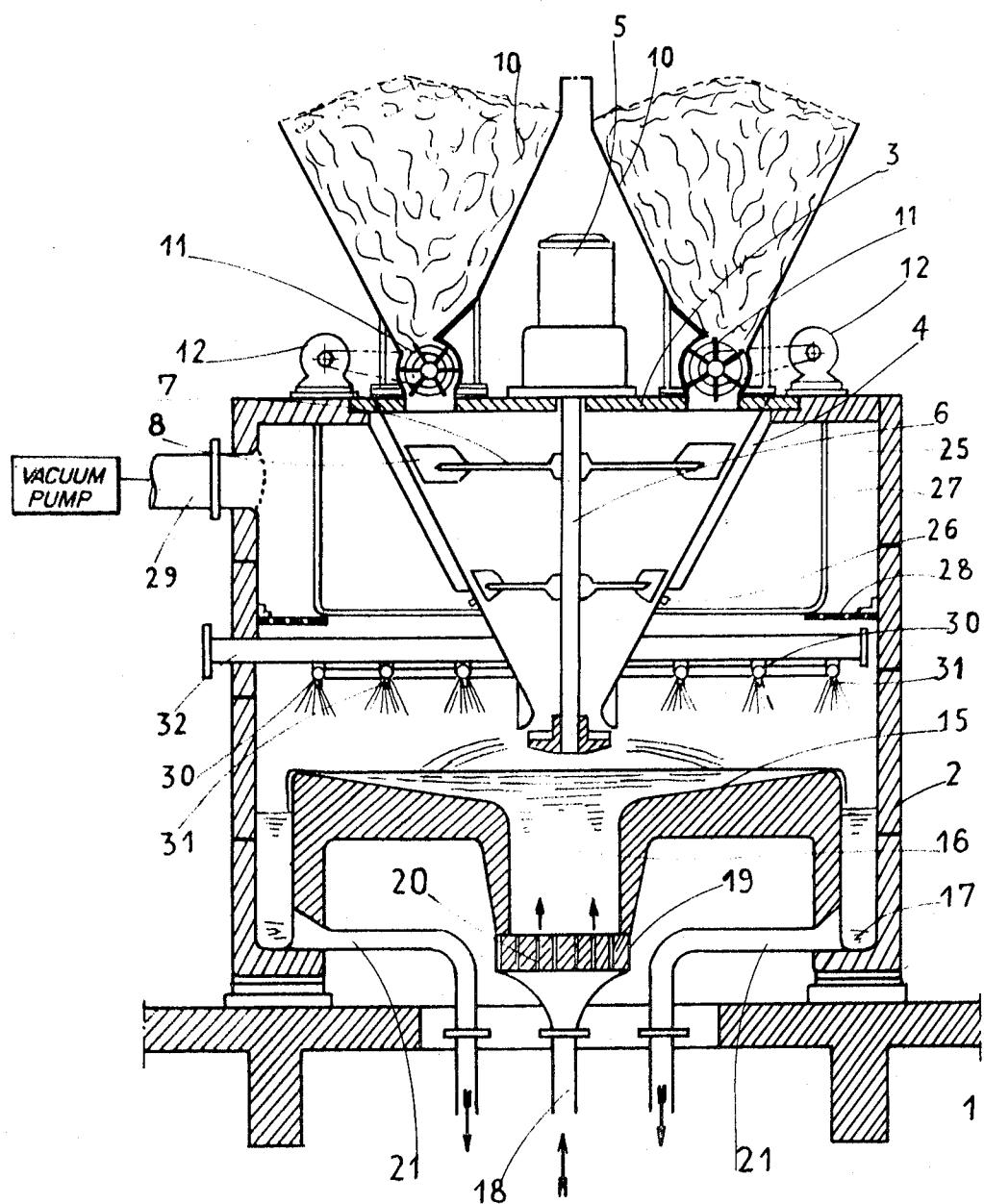


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FIG :1

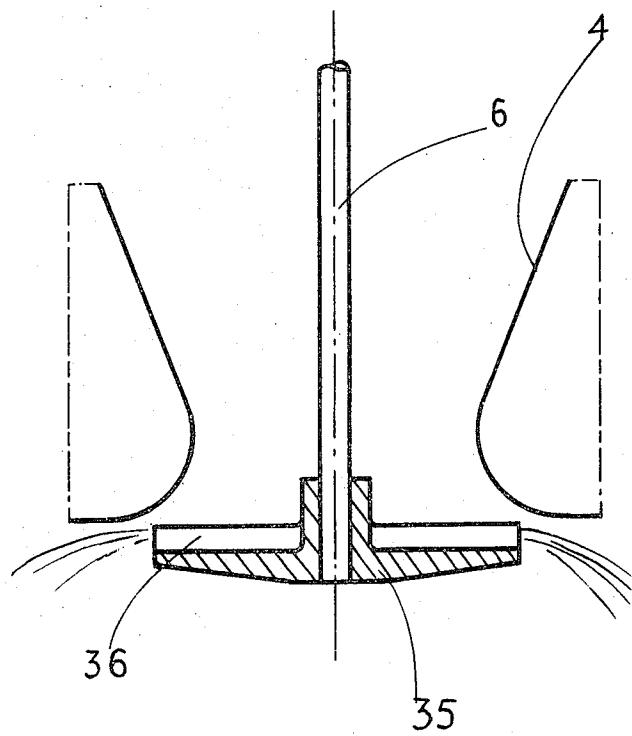


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FIG :2



PROCESS AND APPARATUS FOR SUSPENDING PARTICLES IN A LIQUID

BACKGROUND OF THE INVENTION

The present invention relates to a process for forming a homogeneous suspension of particles in a liquid and apparatus for carrying out the process. The present invention relates more particularly, for example, to providing aqueous suspensions of cellulosic fibers or textile fibers for feeding machines for the continuous manufacture of paper or non-woven textiles.

Generally speaking, granular or fibrous particles to be suspended in a liquid are obtained from natural or synthetic product by known procedures to provide the desired granulometry or length characteristics of the fibers.

These procedures are usually carried out under normal atmospheric pressure and, even if the procedures are carried out in a humid atmosphere, the particles are almost always dried to facilitate transportation. It follows that even the smallest crack or orifice, however small, in a granular particle is filled with air or the fibers of fibrous material include packets filled with air at normal atmospheric pressure since nothing has occurred to remove the air.

When the particles are placed in contact with the suspension liquid, the phenomenon of superficial tension, the value of which depends upon the material of the particle and that of the liquid, prevents the liquid from taking the place of the air in the interstices and from completely covering the particle. Numerous air bubbles thus remain attached to the particles which hinders a homogeneous suspension and favors agglomeration of the particles. The air bubbles give the particles a different apparent density depending upon the relative amount of the gases retained by the particles.

SUMMARY OF THE INVENTION

The present invention corrects these inconveniences and facilitates the elimination of gas intimately associated with the particles. In accordance with the present invention, the particles are stirred in an enclosure maintained at a sub-atmospheric pressure and then, while within the enclosure, the particles are projected onto the surface of a moving layer of the suspension liquid.

Further in accordance with the present invention, apparatus is provided for carrying out this process comprising an airtight enclosure connected to a vacuum pump, feed apparatus for the particles located outside of the enclosure and including an airtight distributor passing through the wall of the enclosure, a storage bin disposed within the enclosure beneath the distributor for the particles, an agitator for the particles including at its lower end a rotating distributor or centrifuge, a receiver having a large opening within the enclosure beneath the distributor or centrifuge and concentric with the bin, the receiver having at least one feed tuyere for the suspension liquid and at least one tuyere for removal of the liquid-particle suspension.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described with reference to the accompanying drawings that show a preferred embodiment thereof as an illustrative example. In the accompanying drawings, in which like reference characters indicate like part,

FIG. 1 is an axial sectional view of a preferred embodiment of apparatus in accordance with the invention for placing textile fibers in suspension in water; and

FIG. 2 is an axial sectional view in enlarged detail of the lower part of the bin shown in FIG. 1.

DESCRIPTION OF PREFERRED EMBODIMENT

As seen in FIG. 1, the apparatus is mounted on base 1 and includes an airtight enclosure 2, preferably cylindrical, closed at its upper end by cover 3. A truncated conical bin 4 is mounted beneath cover 3 in enclosure 2.

A motor with reduction gear 5 is mounted on cover 3 and has a vertical drive shaft 6 passing through bin 4. Horizontal radial arms 7 are mounted on shaft 6 and have paddles 8 at their extremities to agitate the material in the bin.

5 Cover 3 also mounts bins 10 in which is stored in dry state the fibers to be placed in suspension. Rotating distributor 11, mounted at the bottoms of bins 10 and driven by variable speed motors 12, provide airtight connections between bins 10 and the interior of enclosure 2.

10 In the lower part of enclosure 2 is mounted a wide mouthed basin 15 having a deep central part 16 and the boundaries of the basin form a deep annular outlet 17.

Feed tuyere 18 is connected to the central part 16 through a distributor made of a thick plate 19 provided with numerous vertical cylindrical openings 20. Annular outlet 17 is connected to evacuation tuyeres 21.

15 A caisson 25 within enclosure 2 and surrounding bin 4 has an opening in its lower surface which is completely closed by bin 4 and by an airtight joint 26. Caisson 25 provides within enclosure 2 an annular space 27 closed at its lower portion by a perforated annular wall 28. Space 27 is connected to a vacuum pump by a duct 29.

20 Within enclosure 2 and slightly above the bottom of bin 4 are three concentric headers 31 comprising jets directed downwardly. The headers 30 are provided with liquid under pressure by duct 32 passing through the wall of enclosure 2.

With reference to FIG. 2, shaft 6 of the agitator carries at its 30 lower end rotating disc 35 disposed slightly below the lower open end of bin 4 and disc 35 has radial lands 36.

25 In this embodiment of the present invention, the interior of enclosure 2 is maintained at less than atmospheric pressure on the order of 0.05 to 0.2 bars by the vacuum pump connected to duct 29. Caisson 25 decreases the interior volume of enclosure 2 subject to vacuum.

30 The fibers stored in the bins 10 are introduced into bin 4 in controlled amounts by the motors 12. The fibers introduced in bin 4 are thus suddenly subjected to a vacuum which dilates the volumes of air enclosed at normal pressure in the fibers causing the adherence of the air to the fibers to become unstable. The mechanical action of the agitator in bin 4 then facilitates the freeing of the air particles. The particles are again subjected to a mechanical action under a sub-atmospheric pressure freeing the air therein when they are centrifuged by the disc or turbine 35 and, again, by the shock of the liquid particles projected by the pulverizers 31.

35 The fibers therefore arrive in contact with the suspension liquid without air particles adhering thereto and their dispersion in the suspension liquid is homogeneous.

40 The difference in level between the evacuation tuyeres 21 and the surface of the suspension of liquid and fibers in annular outlet 17 equalizes the difference in pressure between the interior and the exterior of enclosure 2.

45 It should be understood that the present invention is not limited to the preferred embodiment described above by way of example and that the present concept broadly includes variations in details of the described structure. Introduction of the fibers into the apparatus can be by any suitable apparatus providing a seal at the enclosure and the construction of the agitator could differ from that described.

50 Further, the liquid in headers 30 is not necessarily the same liquid as the suspension liquid and may be, regardless of the suspension liquid, water, water vapor, a softening agent, and may be at a different temperature from that of the liquid introduced by duct 18.

What I claim is:

1. Apparatus for suspending particles in a liquid comprising 50 a substantially airtight enclosure, means for drawing a partial vacuum within said enclosure, feed apparatus for the particles exterior of said enclosure, distributing means between said feed apparatus and said enclosure passing through the wall of said enclosure and providing an air seal between said enclosure and said feed apparatus, a bin disposed within said enclosure.

sure beneath said distributing means, an agitator in said bin, a rotating distributor at the lower end of said agitator outside said bin, a wide mouth receiver within said enclosure and spaced from and beneath said rotating distributor concentric with said bin, at least one feed tuyere means for supplying suspension liquid to said receiver and at least one evacuation tuyere for the particle-liquid suspension flowing from said receiver.

2. Apparatus as described in claim 1, including at least one header for pulverizing fluid within said enclosure above said rotating distributor and concentric with said bin, the pulverizing fluid being directed toward the surface of said receiver from said header.

3. Apparatus as described in claim 1, said agitator within said bin having a vertical rotating shaft and horizontally rotating paddles within said bin supported by said shaft.

4. Apparatus as described in claim 3, said rotating distributor outside said bin being a centrifugal turbine with horizontal rotor mounted on the lower end of said shaft.

5. Apparatus as described in claim 1, said receiver including a wide mouth basin, said feed tuyere discharging through the center of said basin and a peripheral gutter concentric with said basin receiving liquid-particle suspension overflow therefrom said evacuation tuyere opening into said gutter.

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