

July 27, 1948.

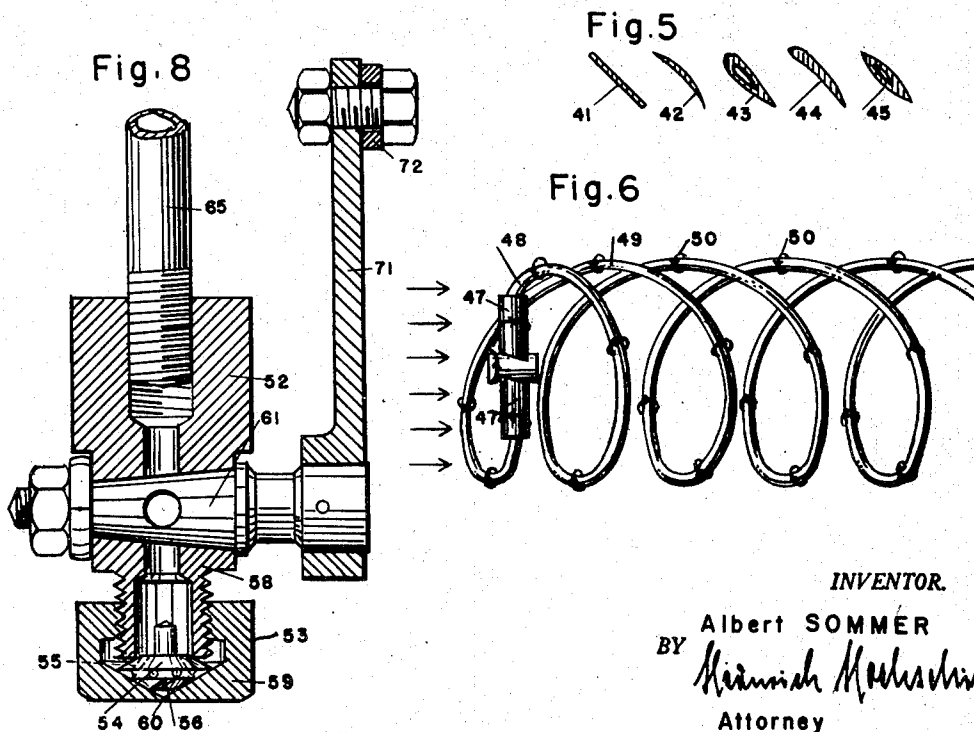
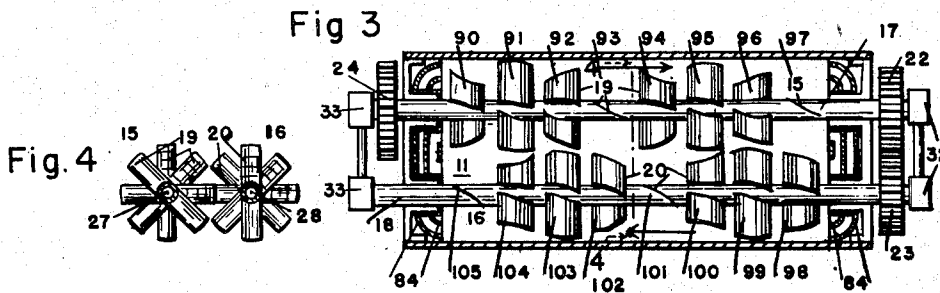
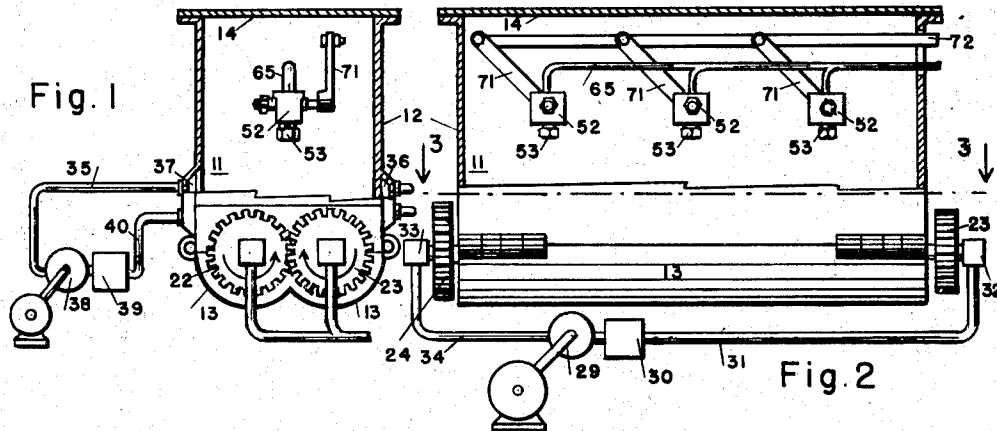
A. SOMMER

2,445,928

METHOD AND APPARATUS FOR PREPARING IN A GASEOUS
MEDIUM PULVERULENT NON-COALESCENT DISPERSIONS

Filed June 6, 1944

2 Sheets-Sheet 1



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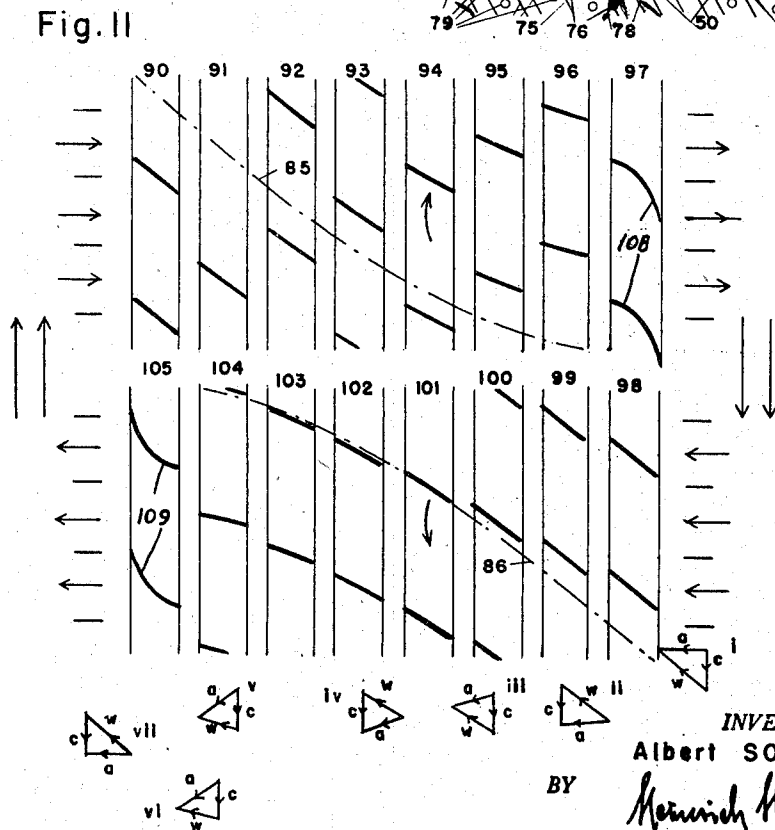
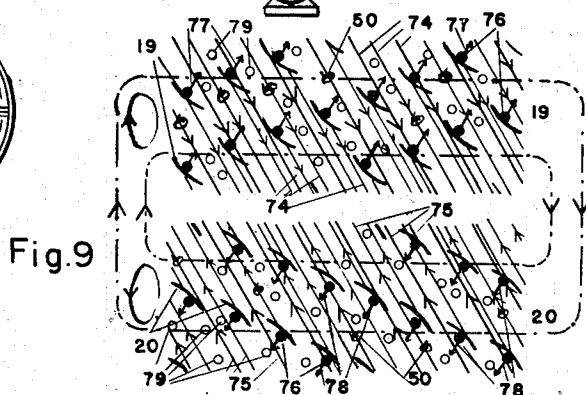
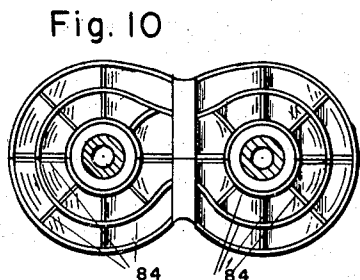
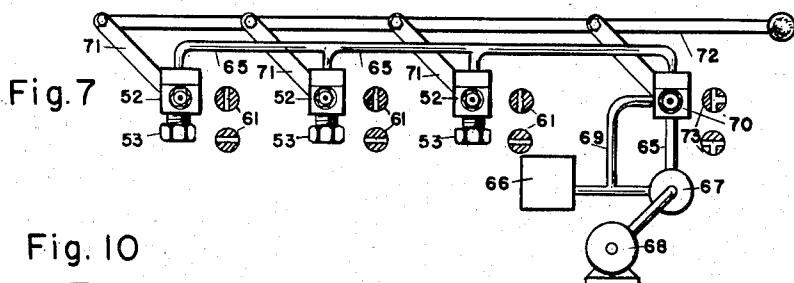
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Filed June 6, 1944

2 Sheets-Sheet 2



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2,445,928

METHOD AND APPARATUS FOR PREPARING
IN A GASEOUS MEDIUM PULVERULENT
NONCOALESCENT DISPERSIONS

Albert Sommer, New York, N. Y.

Application June 6, 1944, Serial No. 538,924

16 Claims. (Cl. 259—6)

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This invention relates to new methods of and apparatus for preparing in a gaseous medium pulverulent, non-coalescent dispersions in which minute particles of a plastic are attached to minute particles of a solid.

When preparing such dispersions, as I have disclosed in my earlier patents, 2,125,860 and Re. 20,119, both, particles of the solid and of the liquefied binder or plastic may be carried by and suspended in currents of air or another gaseous medium and caused while being dispersed in the gaseous medium to collide and to adhere to each other by impact.

Whereas in my earlier disclosures the energy for propelling and suspending the minute particles of both constituents and for causing them to collide is transmitted to the particles from and by the flowing gaseous medium, it is a primary object of this invention to transmit part of this energy at least to the particles of the solid by mechanical means, and to combine mechanically transmitted energy—impulses—and aerodynamically transmitted energy for obtaining a highly homogeneous dispersion.

More particularly it is an object of this invention to make use of the phenomenon that between two layers of differing velocities of a mobile, in the present instance gaseous medium, a sheet-like zone may be created which is in vortex movement. This zone, for certain aspects, acts as a separating wall between the layers of the mobile medium.

I have made the surprising discovery that if into this zone particles of sufficiently small size are projected, for example of a solid of a size that 70% of these particles pass a 200 mesh sieve, U. S. standard or of a diameter of 74 microns, the particles or units will be retained or kept suspended or afloat within this zone sufficiently long so as to be caused to collide with particles of a plastic likewise of sufficiently small size and projected into this zone. The units of the solid and the particles of the plastic will then adhere to each other by impact and thus form a discontinuous dispersion of these constituents in air or another gaseous medium.

It is therefore a primary object of the invention to utilize this faculty of a sheet-like zone in vortex movement of retaining and keeping afloat minute particles, and thus to enable two constituents to combine as a dispersion.

It is a further object of this invention to create this sheet-like zone in vortex movement at the surface, particularly free surface, of a column of the gaseous medium moved along its axis.

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Furthermore, the invention has for its object appropriate methods of producing these sheet-like zones in vortex movement and apparatus for executing these methods and for preparing the aforesaid dispersions.

An object of the invention thus is an apparatus for making dispersions of the aforesaid type in which the sheet-like zones in vortex movement are produced by means of a propeller or impeller system for axial flow of the medium with which the propeller or impeller is in energy exchange. This impeller system when driven will move the medium as a body in a column along its axis. If the velocity with which the impeller system rotates is sufficiently high, vortex threads will permanently form at the tips of the rotating impeller blades and will move along with the column. Since the impeller rotates these vortex threads which are steadily produced will form helicoids which cover the free surface of the flowing medium and thus form a separating layer or sheet-like zone in vortex movement between the column and the outer medium bordering the column.

It is a further object of this invention to arrange above and directed towards said zone in vortex movement a pressure-operated nozzle system which atomizes to minute particles liquefied plastic and project these minute particles upon said zone.

It is a further object of this invention to utilize simultaneously the impeller system for propelling by mechanical impulses the minute units of the solid assembled within reach of the impeller blades in the lower part of the chamber within which the impeller system is operated. These units when hit by the impeller blades will not follow strictly the path of the moving column but, owing to the pitch of the impeller blades, to the inertness of the units and to gravity, will describe a helical path which brings them into the aforesaid separating zone in vortex movement. The vortices owing to the high rotating energy inherent to them, will retain the minute units for a time sufficient to subject them to the impact of the minute liquefied particles of the plastic which strike this zone in vortex movement. The units of the solid and the particles of the plastic will then be attached to each other.

Since the column proceeds through the space in which the nozzle or nozzle system is active, and with the column the separating sheet-like zone in vortex movement, an extraordinarily homogeneous combination of the particles of both constituents in the dispersion will result.

In a further development of the invention the column of air or other gaseous medium is circulated within the vessel wherein the impeller is operated. This amounts to a considerable reduction of the volume of air necessitated for the dispersion process of this invention in comparison with my earlier process in which the units of the solid as well as the particles of the liquefied plastic are being dispersed by air or another gaseous medium. The size of the apparatus, the time necessitated for the making of a certain quantity of the dispersion, and consequently the costs of the process will be greatly reduced.

The term "solid" as used in this specification and in the claims is intended to include finely comminuted or subdivided, for instance wet-ground, or mechanically or electrically precipitated, dusts of any type, as used for instance as fillers in the building arts or in the arts of making plastics, such as mineral dusts—e. g. hydraulic cement, limestone, chert, flint, trap rock, dolomite, marble, quartz, granite, or other siliceous or calcareous dusts; carbon dust, dust of calcium carbonate, calcium sulphate, gypsum, zinc oxide or other metal oxides or sulphides; talc, kaolin, china clay, mica, asbestos fines, distomaceous earths, pumice; fiber material, such as cotton, wool, silk, cellulose flock, paper, wood, lignin, cork flour, saw dust or other natural or synthetic fiber material; furthermore pigments, or other mineral or synthetic coloring material, or the like.

The term "plastic" as used herein is intended to include: (1) fusible and soluble bitumen, such as asphalts, either native asphalts, or residuals originating from petroleum; tar and pitches, such as coal tar pitch, bone pitch, pressure still pitch, or other fusible and soluble pitches; asphaltites, and mixtures thereof; (2) any thermoplastic resin, i. e. any organic, plastic material capable of being rendered cohesive by application of heat or solvents or both and, in its cohesive condition, being capable of binding together the particles of the solid; synthetic resins as well as natural resins showing this property, such as rosin, Vinsol resin, shellac, also extended shellac and shellac substitute, furthermore copal, dammar, mastic, gualac, gum resin, manila, sandarac, kauri, or the like, and mixture of thermoplastic resins; (3) the drying fatty oils, e. g. linseed oil, or other oils which harden by oxidation or polymerization under artificial or atmospheric conditions; or oils which together with the solid are to form pastes or plastics.

The dispersion process is to be conducted under conditions that both phases of the dispersion, the solid and the plastic, are and remain discontinuous and after termination of the process non-coalescent.

When withdrawn from the dispersion apparatus, the exterior phase of the dispersion may either be formed by the solid or by the plastic.

If the solid forms the exterior phase, units of the solid cover the particles of the plastic and the mixture represents a dispersive system in which the entire mass retains the pulverulent condition of the solid, and the apparent physical characteristics of the mass are those of its external phase, namely the solid. In this stage, therefore, the cohesiveness of the particles is suspended. The plastic is in an "inactive" condition.

When the dispersion is to be employed for the final structure—for building purposes of any kind or type, such as flooring, insulating, and roofing material, wall coverings, road structures,

paving, paving blocks, surfacings, or for molded bodies of any type—with this ultimate use of the dispersion or prior thereto the cohesiveness of the plastic is to be excited or revived. For this purpose the phases of the dispersion are to be inverted. This inversion of the phases will be effected by applying heat or a solvent or both to the dispersion. With this application of heat or a solvent or both to the dispersive system, the viscosity and surface tension of the particles of the plastic will drop considerably. The particles of the plastic will now wet and envelop the units of the solid, and will simultaneously become cohesive and thus present the viscous and plastic characteristics of the plastic; the dispersion is now "active" and the phases have been inverted.

I may also produce the dispersion in the form in which the plastic forms the exterior phase, in this case by inverting the phases already in the dispersion chamber. To this purpose I apply to the dispersion which first is formed with the solid as the exterior phase, moderate liquefying conditions, heat or a solvent, or both, however to an extent only that surface tension and viscosity of the plastic are reduced and the plastic will run out about the surfaces of the individual particles of the solid and coat them but insufficient to cause coalescence. In order that the dispersion may in this state be handled and stored without the risk of coalescence, a protective liquid may be applied to the surfaces of the particles of the dispersion while the dispersion is dispersed or is being dispersed, by agitation for instance, in air or another gaseous medium and before it can settle and conglomerate. Preferably this protective liquid, such as water or alcohol in aqueous dilution or any other liquid immiscible with the plastic, will be applied to the dispersion in a separate chamber joining, or in proximity to, the processing chamber.

In order to produce the dispersion in either state—the exterior phase being formed by the solid or by the plastic—the invention provides for temperature conditioning means in the apparatus, as will be specifically described hereinafter, for cooling or holding cool the solid when the solid is to be the exterior phase, and for raising the temperature to, or keeping the temperature at, a desired level for inverting the phases.

Other objects of the invention will become apparent as this specification proceeds.

An embodiment of the invention will now be described and illustrated by way of example in and by the accompanying drawings which form part of this specification and which are to be understood explicative of the invention and not limitative of its scope. Other embodiments incorporating the broad principle underlying my invention are feasible without departing from the spirit and ambit of my appended claims.

In the drawings:

Figs. 1 and 2 respectively show a side view and front view, part of the upper side wall and front wall, respectively, being cut off, of an embodiment of an apparatus of the invention;

Fig. 3 is a plan view taken along section line 3—3 of Fig. 2;

Fig. 4 is a side view of the impeller system along line 4—4 of Fig. 3;

Fig. 5 illustrates various profiles of impeller blades;

Fig. 6 shows diagrammatically and in perspective the formation of vortex threads at the tips of rotating impeller blades;

Fig. 7 illustrates in detail a nozzle system for

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dispersing liquefied plastic within the apparatus shown in Figs. 1 to 4;

Fig. 8 shows on an enlarged scale a longitudinal section of a single nozzle with cock and control lever;

Fig. 9 is a diagram of the movements of the various media in the zone above the impeller system;

Fig. 10 is a side view of a stationary guiding system for directing the current of gaseous medium from one impeller unit to the other; and

Fig. 11 illustrates diagrammatically a development into a plane of an embodiment of a blade system.

In all figures, like parts have been designated by like characters.

In the drawings, I have illustrated the invention rather diagrammatically and, in favor of clearness of representation I have omitted from the showing details of the structure, of the drive and control or in short various elements which are not essential for the explanation and illustration of my invention.

The apparatus as shown on the drawings comprises a vessel or chamber 11 with side walls 12, tiltable bottom flaps 13, and lid 14. Within the vessel, there is rotatably mounted an impeller system, in this instance two reversely rotating impeller units 15, 16, each comprising a shaft 17, 18 and sets of wheels or sections 90 to 97 and 98 to 105 with blades 19, 20, respectively. The two impeller units may be driven by meshing spur gears 22, 23 and by gear 24 by any convenient drive, not shown on the drawings.

The shafts may be hollow as indicated at 27, 28, Fig. 4, and, if desired, the blades likewise may be hollow, as indicated in blades 43 and 45 of Fig. 5. A temperature conditioning medium, a heating or a cooling fluid, steam, air, water, oil, brine, or any other heat supplying or withdrawing fluid may be conducted through these hollow spaces or channels or ducts. This temperature conditioning fluid may be supplied to the impeller system by pump or other source 29 of temperature conditioning fluid over temperature conditioner 30—heater or cooler—pipe line 31, supply boxes 32, and may be withdrawn from the shafts 17, 18 through discharge boxes 33 and pipes 34, or vice versa.

In this manner, the temperature conditions of the impact dispersion process may be set and controlled, in accordance with atmospheric conditions, temperature of the units of the solid supplied to the apparatus, temperature of the melted or otherwise liquefied plastic, the desired state of the final dispersion, whether active or inactive, viz. whether the solid or the plastic is to form the exterior phase of the dispersion. Similarly, temperature conditioning pockets 36, 37 may be provided at the walls of the vessel 11 which may likewise be fed from source 29 and conditioner 30 or from a separate pump or source 38 and conditioner 39 over pipe lines 35 and 40 as shown in Fig. 1.

The blades of the impellers are set and shaped for axial flow of the gaseous medium—as a rule air—contained in chamber 11. Their profile may be of any type, it may be, as Fig. 5 exemplifies, straight, profile 41; arcuate, 42; of streamline contour, symmetrical, 43, or asymmetrical, 44; or lenticularly thickened, 45, as well known per se for pumps and turbines for axial flow, or propellers.

When such a propeller or impeller is rotated, vortex threads 48, 49 are being produced at the

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tips of the blades 47 as I have diagrammatically illustrated in Fig. 6. These vortex threads, rotating in themselves about their longitudinal extension, as I have indicated by circular arrows 50, form helices since they rotate with the impeller blades and are carried along in the direction of flow by the column of air or other gaseous medium moved by the propeller or impeller.

Similar vortex threads or helices will be formed at the hub ends of the blades, they, however, need not be considered here, as they are not essential for the invention.

If the number of blades is large enough and the speed with which the propeller or impeller system rotates is high enough, it will be understood that these helices emanating from the blade tips will fully envelop and cover the column and will form a continuous sheet-like zone in vortex movement which, comparable to a tube, will act as a separating surface.

Whereas the production of the zone in vortex movement in the lower part of the apparatus will be disturbed by the pulverulent solid which is assembled there and by the walls which as to their shape follow the contour of the space described or swept by the impeller, the upper part of this zone may freely develop and will form a cover which separates the impeller space from the upper space of the chamber.

I have now made the surprising discovery that this cover or zone in vortex movement is utilizable for my dispersion process. By creating such a cover or zone in vortex movement, I am able to retain and suspend in this cover or zone in vortex movement minute particles for a certain length of time, and I may utilize this property of such a zone for projecting into it minute units of a solid and holding these units suspended in this zone sufficiently long to be exposed to the particles of the liquid or liquefied plastic which strike this zone, the units of the solid and particles of the plastic thus colliding and being caused to adhere to each other by impact.

For executing this process, I have arranged, in accordance with the invention, above said zone in vortex movement a pressure operated nozzle system. This nozzle system comprises a nozzle or a number of nozzles 52, 53 directed towards said zone in vortex movement and disposed at a distance therefrom so that the cones of atomized plastic dispersed by the nozzle or nozzles substantially cover said sheet-like zone in vortex movement.

In the embodiment of a nozzle system as shown in Figs. 7 and 8, the nozzles may be provided with a head 53 of any conventional or convenient type consisting in the embodiment illustrated of nozzle disc 54 with feed ducts 55, spray ducts 56 seated between throat of nozzle body 58 and nozzle cap 59 provided with atomizer opening 60.

Nozzle body 58 is provided with a cock 61 for cutting off sharply the flow of the liquefied plastic when the dispersing process is to be interrupted. Nozzles 52 are supplied through feed line 65 from a source, e. g. heated tank 66, disposed as close as possible to the nozzle in order that any adverse change of the liquefied plastic under the high pressure used—for example 225–250 lb.—will be avoided.

Pump 67, driven for example by motor 68, is inserted into feed line 65, and a bypass 69 controlled by valve or cock 70 connects delivery side to intake side of the pump. Cocks 61 and 70 are controlled together, for example by hand by

means of a lever system 71, 72, or by means of any other automatic or semiautomatic means as known in the art. Instead of cock 70, I may also employ a spring loaded valve controlled by the pressure in feed-line 65, as is known.

At the side of the nozzles, I have illustrated in Fig. 7 the appertaining open and closed positions of the cock cones 61 and 73, respectively.

In the embodiment illustrated, I have shown the impeller system as consisting of two reversely rotating units 19 and 20, the drive in the present instance being arranged as the arrows of Fig. 1 illustrate that the units are driven in opposite directions towards each other in the lower part of the vessel.

In this way, the particles of the solid assembled in this lower part of the vessel 11 will be projected by the revolving blades into the middle part of the covering zone and of the atomization cones. Other arrangements, however, are feasible, for example one impeller unit may be provided in the dispersion chamber 11.

The arrangement of two reversely rotating impeller units, however, is particularly valuable, if in accordance with a further development of my invention, the blades 19, 20 of the two units are set on their respective shafts so as within the dispersion chamber to circulate the column of air or other gaseous medium along one shaft 17 in one direction and along the other shaft 18 in the other direction.

The various movements of the various elements and the various media may be represented as to their general character as illustrated in the diagram of Fig. 9. This representation, which does not claim to be exact as to the directions and magnitudes of the various movements, is only for the purpose of illustration and shows a projection of the blades 19 and 20 and of the various movements into a common plane representing the separating zone in vortex movement. The paths in which the vortex threads travel are illustrated by arrows 74 and 75, respectively. In addition to this travelling movement, the threads revolve about their longitudinal axes, as indicated in Figs. 6 and 9 by the circular arrows 50.

The units of the solid represented by black circles 76 will be propelled in directions generally indicated by arrows 77 and 78, respectively; they will partake to some extent in the revolving movement of the vortex threads and travel along the separating zone in a movement resulting from the component movements in the directions of the arrows 74 and 77, and 75 and 78, respectively. The particles of the plastic represented by white circles 79 arrive in the separating zone with a velocity substantially perpendicular thereto, a movement which will be checked in this zone, and these units will then collide with the particles of the solid. The units of the solid and the particles of the plastic while thus being suspended in air or another gaseous medium will now adhere to each other by impact.

Owing to these movements, combined and relatively to each other, an extremely homogeneous composition will be obtained in the dispersion.

Stationary guiding means, such as guide blades or vanes 84 schematically illustrated in Figs. 3 and 10 may be provided at both ends of the impeller system for guiding the column of gaseous medium moved by this impeller system from one impeller unit to the other and back again. Such guiding blades or vanes will reduce the impact losses when directing the flow of the gaseous medium from one side of the chamber to the other.

However, if these losses are negligible or may be neglected, these guiding means may be dispensed with.

As Figs. 3 and 9 show, each impeller unit is illustrated as comprising a multiple of sections or wheels, in the example illustrated eight, 90 to 97 and 98 to 105, respectively, each section or wheel of two blades, and the blades of consecutive sections displaced with regard to one another at 45°. The number of blades in one section, and the angle of displacement are arbitrary, any other numbers, as ever appears useful or convenient may be chosen.

The blades of all of the sections or wheels may be of the same shape. If, however, it might be desirable to reduce disturbances and impact losses of the flowing medium at the blade edges of each subsequent wheel, the blades, as to their shapes may also follow generally, not necessarily exactly, a common contour 85, 86, respectively, as wheels 90 to 96 and 98 to 104 of Fig. 11 rather diagrammatically indicate.

As a whole, the impeller system illustrated on the drawings, Figs. 3 and 4, and also 9, operates as a pump, i. e. rotatory energy supplied by the impeller shafts is converted in energy of flow.

At the bottom of Fig. 11, I have shown velocity triangles i to v representing the general character of the velocity conditions prevailing respectively at the entering and leaving edges of wheels 98 and 101, and at the leaving edge of wheel 104. The circumferential velocity of the wheels is designated by c , the relative velocity with regard to and along the blades is designated by w , and the resultant absolute velocity by a .

In section 98, the absolute velocity a with which the fluid leaves the wheel shows, as triangle ii illustrates a peripheral component if compared with the absolute velocity a at the entering edge, triangle i, where the fluid is assumed to enter in an axial direction. This peripheral component increases with each subsequent wheel, triangle v representing the velocity conditions at the leaving edge of wheel 104.

This peripheral component with which the medium leaves the sections of an impeller unit may be undesirable at the end of the unit as it may disturb an orderly flow of the medium without loss from one impeller unit to the other.

Through a further development of the invention, I may compensate the deviation of the absolute velocity from the axial direction by reverting the energy transformation and providing one or more sections or wheels, intermediate or end wheels, where the flowing energy is reconverted into rotary energy, or, in other words, where the blades are set and shaped for turbine action.

Sections or wheels 97 and 105 of Fig. 11 illustrate diagrammatically such blades, 108 and 109 respectively shaped for turbine effect. Triangles vi and vii respectively illustrate for the entering edge and the leaving edge of section or wheel 105 how by this means the peripheral component with which the medium would otherwise leave the impeller unit may be eliminated. The flowing column of the gaseous medium will now leave the end wheel of the impeller unit in an axial direction and may flow to the entrance wheel of the other impeller unit without guiding means or guided by means of a simple guide vane system such as illustrated in Fig. 10.

This change from pump effect to turbine effect is without influence upon the formation of the sheet-like zone in vortex movement since sense

of rotation and direction of flow remain unchanged.

The methods and apparatus as described are valuable also when several, or mixtures of, pulverulent or comminuted solids are to be combined in a dispersion together with a plastic common to them, for example when the pulverulent dispersion is to include the various agents of a subsequent chemical reaction such as a metal ore with a reducing agent, or when the pulverulent dispersion is to include physical components of differing character for a structure, such as a fiber material and a powder.

What I claim as my invention is:

1. An apparatus for preparing a pulverulent, non-coalescent composition of minute units of a solid and minute particles of a plastic attached to one another by impact, said apparatus including a vessel having rotatably mounted therein an impeller system for axial flow and a pressure operated nozzle system, said apparatus further including a drive for said impeller system; said impeller system for moving gaseous medium contained in said vessel as a body in a column, said impeller system having blades shaped, and said drive adapted to drive said blades at a speed sufficiently high so as to create an axially extended sheet-like zone of said medium in vortex movement at the uncovered surface of said column, said blades further adapted to project said units of the solid assembled in said vessel into said zone from the one side, said nozzle system directed towards said zone and disposed at a distance therefrom so as to project from the other side liquefied particles of said plastic into said zone, for causing said units and said particles to collide, whilst, by means of the vortices in said sheet-like zone, they are held suspended in said zone sufficiently long to adhere to one another at the impact as a dispersion without coalescing.

2. An apparatus for preparing a pulverulent, non-coalescent composition of minute units of a solid and minute particles of a plastic attached to one another by impact, said apparatus including in combination, a vessel, an impeller comprising a shaft rotatably mounted in said vessel and blades for axial flow mounted on said shaft, driving means for rotating said shaft; said vessel shaped to provide space for, and said impeller blades for causing an axial flow of, gaseous medium contained in said vessel as a body in a column, the bottom of said vessel adapted as to its shape to follow the lower contour of the space described by said impeller said blades shaped, and said driving means adapted to rotate said shaft and said blades at a speed sufficiently high to create an axially extended sheet-like zone of said medium in vortex movement, said sheet-like zone bordering the upper surface of said impeller space, said blades adapted to project units of said solid assembled in the lower part of said vessel into said sheet-like zone from below and suspending them therein; said apparatus further including at least one nozzle, a feed line adapted to feed said nozzle with liquefied plastic; and means for submitting said liquefied plastic in said feed line and said nozzle to high pressure; said nozzle being disposed at a distance from and above said sheet-like zone and adapted to project minute particles of said plastic into said sheet-like zone from above, for thus causing said units and said particles to collide whilst, by means of the vortices in said sheet-like zone, they are held suspended in said zone sufficiently long to adhere

to one another at the impact as a dispersion without coalescing.

3. An apparatus as set forth in claim 2 wherein said impeller is provided as a pair of reversely rotating impeller units arranged parallel and close to each other, said driving means adapted to drive said impeller units in opposite directions, said blades further shaped and set on the respective of their shafts so as to circulate said column within said vessel, along one of said shafts in one direction and along the other of said shafts in the other direction.

4. An apparatus as set forth in claim 2 wherein temperature conditioning means are provided for governing the state of the phases in said dispersion.

5. An apparatus as set forth in claim 1, said impeller system having allotted thereto stationary guide blades mounted in said vessel opposite the end sections of said impeller, said guide blades adapted to guide circulation within said vessel of said body of gaseous medium moved by said impeller system.

6. An apparatus for preparing a pulverulent, non-coalescent composition of minute units of a solid and minute particles of a plastic attached to one another by impact, said apparatus including a vessel having rotatably mounted therein at least one impeller unit for axial flow and a pressure operated nozzle system, said apparatus further including a drive for said impeller unit, said impeller unit for moving gaseous medium contained in said vessel as a body in a column, said impeller unit having blades shaped, and said drive being adapted to drive said blades at a speed sufficiently high so as to create an axially extended sheet-like zone of said medium in vortex movement above said column and bordering it, said blades further adapted to project said units of the solid assembled in said vessel into said zone from the one side, said nozzle system directed towards said zone and disposed at a distance therefrom so as to project from the other side liquefied particles of said plastic into said zone for causing units of said solid and particles of said plastic to collide whilst, by means of the vortices in said sheet-like zone, they are held suspended in said zone sufficiently long to adhere to one another at the impact as a dispersion without coalescing; said impeller unit comprising a plurality of wheels in axial alignment, the blades of at least some of said wheels shaped so as generally to follow a common contour.

7. An apparatus for preparing a pulverulent, non-coalescent composition of minute units of a solid and minute particles of a plastic attached to one another by impact, said apparatus including a vessel having rotatably mounted therein at least one impeller unit for axial flow and a pressure operated nozzle system, said apparatus further including a drive for said impeller unit, said impeller unit for moving gaseous medium contained in said vessel as a body in a column, said impeller unit having blades shaped, and said drive adapted to drive said blades at a speed sufficiently high so as to create an axially extended sheet-like zone in vortex movement at the free surface of said column, said blades further adapted to project said units of the solid assembled in said vessel into said zone from the one side, said nozzle system directed towards said zone and disposed at a distance therefrom so as to project from the other side liquefied particles of said plastic into said zone for causing units of said solid and particles of said plastic to collide

whilst, by means of the vortices in said sheet-like zone, they are held suspended in said zone sufficiently long to adhere to one another at the impact as a dispersion without coalescing; said impeller unit comprising a plurality of wheels in axial alignment, the blades of some of the wheels shaped and disposed for converting rotatory energy supplied by said impeller into energy of flow and at least the blades of another of said wheels for reconverting energy of flow into rotatory energy.

8. The method of preparing a pulverulent, non-coalescent composition of minute units of a solid and minute particles of a plastic attached to one another by impact, which includes moving a gaseous medium as a body in a column having a free surface and at a velocity sufficiently high to produce at said free surface a sheet-like zone of said medium in vortex movement, projecting into said zone, from a direction transversely thereof, by mechanically transmitted energy minute units of said solid and under liquid pressure minute liquefied particles of said plastic, thus causing them to collide whilst, by means of the vortices in said zone, they are held suspended in said zone sufficiently long to adhere to one another at the impact as a dispersion without coalescing.

9. The method of preparing a pulverulent, non-coalescent composition of minute units of a solid and minute particles of a plastic attached to one another by impact, which includes moving a gaseous medium as a body in a column having a free surface and causing said body to progress in the direction of the axis of said column, the velocity of said movement being sufficiently high to produce at said free surface a sheet-like zone of said medium in vortex movement partaking in said progressing motion, projecting into said zone, from a direction transversely thereof, by mechanically transmitted energy minute units of said solid and under liquid pressure minute liquefied particles of said plastic, thus causing them to collide whilst, by means of the vortices in said zone, they are held suspended in said zone sufficiently long to adhere to one another at the impact as a dispersion without coalescing.

10. The method of preparing a pulverulent, non-coalescent composition of minute units of a solid and minute particles of a plastic attached to one another by impact, which includes moving a gaseous medium as a body in a column having a free surface and causing said body to progress in circulatory movement in the direction of the axis of said column, the velocity of said movement being sufficiently high to produce at said free surface a sheet-like zone of medium in vortex movement partaking in said progressing motion, projecting into said zone, from a direction transversely thereof, by mechanically transmitted energy minute units of said solid and under liquid pressure minute liquefied particles of said plastic, thus causing them to collide whilst, by means of the vortices in said zone, they are held suspended in said zone sufficiently long to adhere to one another at the impact as a dispersion without coalescing.

11. The method of preparing a pulverulent, non-coalescent composition of minute units of a solid and minute particles of a plastic attached to one another by impact, which includes moving a gaseous medium as a body in a column having a free surface and at a velocity sufficiently high to produce at said free surface a sheet-like zone of said medium in vortex movement, projecting into said zone, from a direction transversely there-

of, by mechanically transmitted energy minute units of said solid and under liquid pressure minute liquefied particles of said plastic, thus causing them to collide whilst, by means of aerodynamic energy transmitted through the movement of said body to, and carried by, the vortices of said zone, said units and said particles are held suspended in said zone sufficiently long to adhere to one another at the impact as a dispersion without coalescing.

12. An apparatus for preparing a pulverulent, non-coalescent composition of minute units of a solid and minute particles of a plastic attached to one another by impact, said apparatus including a vessel, means for moving in one part of said vessel gaseous medium, contained in said vessel, as a body in a column having a free surface towards another part of said vessel and at a velocity sufficiently high to produce at said free surface a sheet-like zone of said medium in vortex movement, means for projecting from one of its sides into said zone mechanically minute units of said solid; a pressure operated nozzle system including at least one nozzle, a tank for liquefied plastic spaced a short distance apart from said nozzle, a feed-line connecting said nozzle to said tank, a pump inserted into said feed-line, a drive for said pump, a cock in said feed-line and in close proximity to said nozzle, a bypass connecting delivery side to intake side of said pump, and a flow control means in said bypass adapted to open said bypass when said cock is closed and vice versa; said nozzle directed towards said sheet-like zone and disposed at a distance therefrom so as to project into said zone from the other of its sides liquefied particles of said plastic; for thus causing units of said solid and particles of said plastic to collide whilst, by means of the vortices in said zone, they are held suspended in said zone sufficiently long to adhere to one another at the impact as a dispersion without coalescing.

13. In an apparatus for preparing a pulverulent, non-coalescent composition of minute units of a solid and minute particles of a plastic attached to one another by impact, a vessel, means for moving in one part of said vessel gaseous medium, contained in said vessel, as a body in a column having a free surface towards another part of said vessel and at a velocity sufficiently high to produce at said free surface a sheet-like zone of said medium in vortex movement, means for projecting separately into said zone mechanically minute units of said solid and under liquid pressure minute liquefied particles of said plastic, for causing them to collide whilst, by means of the vortices in said zone, they are held suspended sufficiently long to adhere to one another at the impact as a dispersion without coalescing.

14. In an apparatus for preparing a pulverulent, non-coalescent composition of minute units of a solid and minute particles of a plastic attached to one another by impact, a vessel, means for moving in one part of said vessel gaseous medium, contained in said vessel, as a body in a column having a free surface towards another part of said vessel and for causing said body to progress in the direction of the axis of said column, at a velocity sufficiently high to produce at said free surface a sheet-like zone of said medium in vortex movement partaking in said progressing motion; means for projecting into said zone from different directions mechanically minute units of said solid and under liquid pressure minute liquefied particles of said plastic, for causing them to

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collide whilst, by means of the vortices in said zone, they are held suspended sufficiently long to adhere to one another at the impact as a dispersion without coalescing.

15. In an apparatus for producing a pulverulent, non-coalescing composition of minute units of a solid and minute particles of a plastic attached to one another by impact, a vessel, means for moving in one part of said vessel gaseous medium, contained in said vessel, as a body in a column having a free surface towards another part of said vessel and for causing said body to circulate in said first part of the vessel and to progress therein in the direction of the axis of said column at a velocity sufficiently high to produce at said free surface a sheet-like zone of said medium in vortex movement partaking in said progressing motion; projecting means, one of said projecting means for projecting into said zone, from a direction transversely thereof, mechanically minute units of said solid, another of said projecting means for projecting into said zone, from another direction likewise transversely of said zone, under liquid pressure liquefied particles of said plastic for causing said units and said particles to collide whilst, by means of the vortices in said zone, they are held suspended sufficiently long to adhere to one another at the impact as a dispersion without coalescing.

16. In an apparatus for preparing a pulverulent, non-coalescent composition of minute units of a solid and minute particles of a plastic attached to one another by impact, a vessel, means

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for moving in one part of said vessel gaseous medium, contained in said vessel, as a body in a column having a free surface towards another part of said vessel and at a velocity sufficiently high to produce at said free surface a sheet-like zone of said medium in vortex movement, means for projecting separately into said zone mechanically minute units of said solid and under liquid pressure liquefied particles of said plastic for causing said units and said particles to collide whilst, by means of the aerodynamic energy transmitted through the movement of said body to, and carried by, the vortices of said zone, said units and said particles are held suspended sufficiently long to adhere to one another at the impact as a dispersion without coalescing.

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