

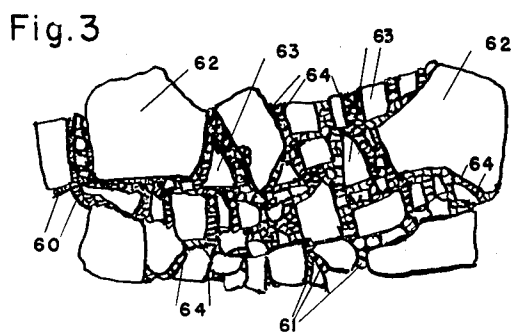
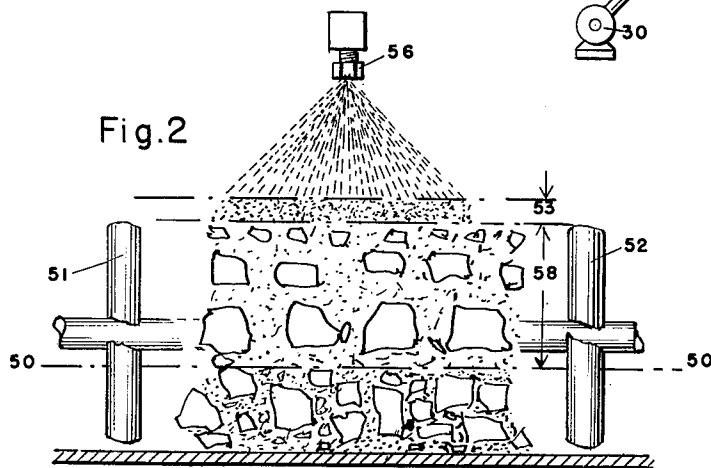
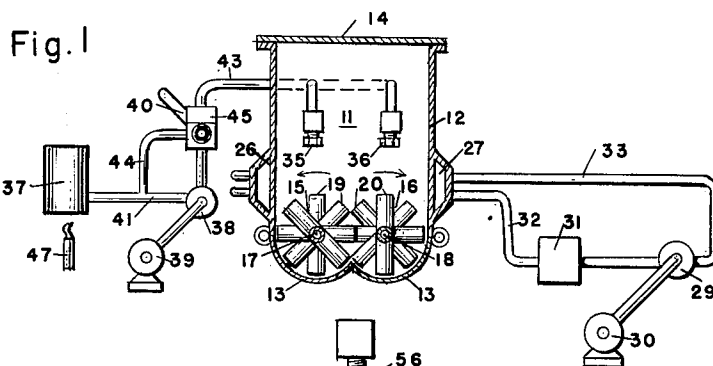
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METHOD OF PREPARING COATED PARTICLE COMPOSITIONS

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METHOD OF PREPARING COATED PARTICLE COMPOSITIONS

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In my earlier U. S. Patent No. 2,445,928, I have disclosed new methods of and apparatus for preparing in a gaseous medium pulverulent, non-coalescent compositions in which minute particles of a plastic are attached to minute particles of a solid.

The method and apparatus of this earlier patent 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 two layers of the mobile medium.

Into this zone there are projected particles of a solid of sufficiently small size, for instance so small that they pass a 200 mesh sieve, U. S. standard or sieve openings of 74 microns. From the other side minute globules of a liquid or liquefied plastic are directed into this zone as a spray or cone atomized under high liquid pressure. These minute globules of the plastic will collide with the minute particles of the solid held suspended in this zone, by the energy of the vortices, sufficiently long so that the particles of both constituents will adhere to each other at the impact and thus form a discontinuous dispersive system in air or other gaseous medium employed.

In the embodiment of an apparatus disclosed in my earlier patent, an impeller system for axial flow of the air or other gaseous medium is rotatably mounted in a vessel. The impeller system moves a column of air or other gaseous medium contained in the vessel and creates an axially extended sheet-like zone of the medium in vortex movement at the uncovered surface of the column, i. e. at the surface of the column which is not covered by the wall of the vessel. Simultaneously, the blades of the impeller project the particles of the solid assembled in the lower part of the vessel into said zone from one side. A liquid pressure nozzle system is disposed in the vessel at a distance from the zone and is directed towards this zone from the other side. This nozzle system projects an atomized spray of minute globules of liquid or liquefied plastic into this zone.

The minute particles of the solid assembled within reach of the impeller blades in the lower part of the chamber, when hit by the impeller blades and thus propelled by mechanical impulses, 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

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the minute particles of the solid to be subjected to the impact of the minute liquefied globules of the plastic, which strike this zone, for a time sufficiently long, to cause the particles of both constituents to be attached to each other.

The compositions thus obtained with the method and the apparatus disclosed in the said patent are dispersive systems in which both phases of the system, the solid and the plastic, are and remain discontinuous and after the termination of the process non-coalescent.

Either constituent, the solid or the plastic, may form the exterior phase of the dispersive system.

If the solid forms the exterior phase, particles 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.

If the dispersive system is to be produced in the form in which the plastic forms the exterior phase, I may apply such conditions, especially of temperature, or a solvent, or both, that surface tension and viscosity of the plastic are reduced sufficiently to cause the plastic to run out about the surfaces of the individual particles of the solid and coat them but insufficiently to cause coalescence.

At appropriate temperature conditions of the solid, of the plastic and of the operating space, the plastic which coats in minute layers the minute particles of the solid, will rapidly solidify sufficiently so that the dispersive system may in this state be handled and transported and even stored without the risk of coalescence.

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, if the plastic forms the exterior phase of the dispersive system, the cohesiveness of the plastic is to be activated, or, if the solid forms the exterior phase, the phases of the dispersive system are to be inverted with the activation of the cohesiveness. The activation of the cohesiveness, or the inversion of the phases, will be

effected by applying an appropriate agent such as heat or pressure, or both, to the dispersive system. A solvent may also be used as such an agent. With the application of one or more of these agents 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 particles of the solid, and will simultaneously become cohesive and thus present the viscous and plastic characteristics of the plastic; the dispersion is now "active" or the phases have been inverted, and the whole will coalesce and solidify.

Whereas thus in my earlier patent a certain phenomenon was utilized for the production of a composition in which minute particles of a solid and minute particles of a plastic were attached to one another as a discontinuous, non-coalescent dispersive system, it is the object of the present invention to utilize the phenomenon disclosed in my earlier patent for producing quasi-homogeneous non-continuous and non-coalescent compositions containing coarse or coarser particles of the solid coated with fine coatings of the plastic.

More particularly, it is an object of the invention to produce such non-continuous and non-coalescent systems containing coarser particles as well as minute particles of the solid combined with a soluble and liquefiable plastic.

In accordance with the invention, non-continuous and non-coalescing compositions are obtained from a mixture containing coarser particles and minute particles of a solid material and from a soluble liquefiable plastic by creating in air or another gaseous medium a sheet-like zone of said medium in vortex movement, projecting into this zone from one side, by mechanically transmitted energy, minute particles of the solid and suspending them therein. From the other side of the zone there is directed upon the zone under high liquid pressure an atomized spray of minute globules of the liquefied plastic. The minute particles of the solid and the minute globules of the plastic are thus caused to collide and to adhere to each other by the impact of the collision. Simultaneously, under the mechanically transmitted energy, the coarser particles are stirred and impelled towards the zone and sprayed and coated with the plastic.

For the purposes of this invention I may use as a coarse solid material any mineral stone material, or wood, or synthetic material, or glass or ceramics, or the like, of a particle size up to say $\frac{1}{2}$ or even $\frac{3}{4}$ of an inch. The minute particles of the solid may be of the same material as, or other material than, the coarser particles. They may be 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, diatomaceous 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, guaiac, gum resin, manilla, 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 atmosphere conditions; or oils which together with the solid are to form pastes or plastics.

By choosing the conditions properly which control the operation, such as the temperatures of the operating space, of the solid, and of the plastic, also with regard to the consistency or viscosity of the plastic, the plastic, on its contact with the surfaces of the particles of the solid, will, at least superficially, congeal or solidify. Ever according to these conditions, the minute particles of the solid at their impact with the minute globules of the plastic will dust and cover these globules so that the solid will form the exterior phase of the dispersive system. At the same time, through the greater heat contents of the coarser particles and their relatively smaller radiation—since the proportion, surface to volume, decreases with increasing size of the particles—the plastic will flow about and coat the coarser particles before congealing.

On the other hand, by appropriate control of the temperature, for instance by heating the dispersion vessel by means of temperature conditioning jackets, the minute globules of the plastic may be caused at the impact to flow about and coat the minute particles of the solid and congeal or solidify thereon without substantially coalescing whilst simultaneously the coarser particles are also coupled by the plastic in substantially non-coalescent coatings of minute thicknesses.

In both events, by proper choice of the relative quantities of solid and plastic and of the temperature conditions, surface coatings of such minuteness may be produced that transparent coatings will result.

The possibility opened by the method of this invention of producing a loose mass of coarse particles of a solid individually coated with extremely thin coatings of congealed or solidified plastic and of minute non-coalescent particles of the same or another solid severally attached to minute particles of the plastic, with the plastic in any case as the discontinuous phase, is of high importance in various industries.

The material when to be employed in the final structure is, as a rule, to be compressed into the shape of sheets, blocks, pavements, or any other moulded body. The particles, since their surfaces are generally non-cohesive, will then, under the compression slide against one another until the shape or form under compression is completely filled, the minute and finer particles of the solid

sliding into the interstices in and between the coarser particles; minute layers of the plastic being interposed between the solid particles.

When thereupon the compressed material is caused to coalesce by further application of pressure, or of heat, or of a solvent, or of several of them, the coatings and particles of the plastic will flow together within the interstices of and between the particles of the solid and form therein minute interfacial layers. By mixing coarser particles and finer and finest particles of the solid with one another and with the plastic in proper quantitative proportion, the interfacial layers formed by the plastic will be extremely fine and will thus oppose high capillary forces to any displacement of the parts, when in final position, under shear, thrust or other stress.

For further illustration of my invention, reference is now made to the accompanying drawings which form part of this specification and which are to be understood as explicative of the invention and not limitative of its scope.

In the drawings:

Fig. 1 is an elevational side view, partly in section of a dispersion apparatus for executing the method of the invention;

Fig. 2 indicates diagrammatically, the particles being shown not on scale, a momentary position of the particles of the solid during the operation period of the apparatus and distributed over the height of the apparatus in strata according to their sizes; and

Fig. 3 illustrates diagrammatically a portion of a compressed coalesced body, the particles likewise being shown on an exaggerated scale.

The apparatus as illustrated in Fig. 1 has been more fully described in my aforesaid earlier patent, to which description I may here refer.

The apparatus 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 19, 20, respectively, of which the blades of four wheels on each side are visible. The two impeller units may be driven by spur gears or by any other convenient drive, not shown on the drawing.

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 hollow spaces or channels or ducts at appropriate parts of the apparatus, such as the temperature conditioning pockets or jackets 26, 27, provided at the walls of the vessel 11. The temperature conditioning fluid may be supplied to the impeller system by pump 29, driven by motor 30, or by any other source of temperature conditioning fluid, over temperature conditioner 31—heater or cooler—pipe line 32, and may be withdrawn from the jackets through discharge pipes 33, or vice versa.

Similarly the shafts of the impeller system or the blades or both may be hollow and supplied with a temperature conditioning agent as described in my earlier patent.

In this manner, the temperature conditions of the impact dispersion process may be set and controlled, in accordance with atmospheric conditions, temperature of the particles of the solid supplied to the apparatus, temperature of the melted or otherwise liquefied plastic, the desired state of the final dispersive system, whether active or inactive, viz. whether the solid or the

plastic is to form the exterior phase of the dispersive system.

The blades of the impellers, as described in my earlier patent are set and shaped for axial flow of the gaseous medium—as a rule air—contained in the vessel 11. As described there in detail, vortex threads are being produced at the tips of the blades 19, 20, when such an impeller is rotated.

If the number of blades is large enough and the speed with which the impeller system rotates is high enough, it will be understood that these vortices emanating from the blade tips will cover the column of air propelled by the impeller system and will form a continuous sheet-like zone in vortex movement which will act as a separating surface or form a cover which separates the impeller space from the upper space of the chamber 11.

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 of a solid for a certain length of time, and I utilize this property of such a zone when projecting into it by means of the impeller blades the minute particles of the solid for holding them suspended in this zone sufficiently long to be exposed to the minute globules of the liquid or liquefied plastic which as an atomized spray or cone under high liquid pressure are directed from the other side upon this zone. The particles of both constituents will thus collide and at the impact be caused to adhere to each other.

The nozzle system includes nozzles 35, 36, a tank 37 for liquefied plastic spaced a short distance apart from the nozzle. A pump 38, driven by motor 39, and a cock 40 in close proximity to the nozzles are inserted into the feed line 41, 43, connecting the tank to the nozzles. Furthermore a bypass 44 with a pressure regulating flow control device, generally indicated at 45, is provided which connects delivery side with intake of the pump for opening the bypass when the cock is closed and vice versa. A heating device indicated at 47 is provided for keeping the liquefied plastic at the desired temperature and viscosity.

The nozzles 35, 36, are directed towards the 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 the sheet-like zone in vortex movement as described in full detail in my earlier patent.

The impeller system as illustrated consists of two reversely rotating units 15, 16, the drive in the present instance being so arranged, as the arrows illustrate, that the units are driven in opposite directions towards each other in the lower part of the vessel.

When the apparatus is to be put into operation, a batch of solid particles mixed in size will be filled into the lower part of the apparatus, for instance to the level 50—50 of the impeller space, part of which is schematically indicated in Fig. 2 between two impellers 51, 52, intermediate impellers being omitted from the drawing, and likewise the material in which impellers 51, 52 would actually work. The two impellers 51, 52 at the ends of the figure are shown merely for illustrating schematically the various levels in the distribution of the material over the height of the operating space.

When the impellers are revolving with a velocity sufficiently high, the movement of the

air contained in the vessel creates a zone in vortex movement, indicated, for the purpose of demonstration only, at 53. Into this zone the minute particles of the solid are projected and through the energy of the vortices in this zone held suspended therein. At the same time, a finely atomized spray cone of liquefied plastic, as schematically indicated at 55, is directed from the atomizer nozzle 56 upon this zone. Through the impact at their collision, minute particles of the solid and minute globules of the plastic will be attached to one another as set forth hereinabove.

The larger particles will be stirred and impelled towards the vortex zone, generally there will however be a certain distribution of the larger or coarser particles into strata in accordance with their sizes, as schematically indicated in zone 58 of Fig. 2.

During this movement, the coarser particles are coated, partly by direct contact with globules of the plastic which had penetrated through the vortex zone, partly by any surplus of plastic attached to the finer or finest particles. This plastic will flow on and about the surfaces of the coarser particles owing to the greater heat contents of these larger particles and their lower radiation.

In order to exemplify the method of the invention the following data may be given. It will be readily understood however that these data are given for the purpose of illustration only but not for limitation of the scope of the invention.

These data refer to the preparation of an asphaltic mortar or concrete for a pavement, however the compositions for other purposes or applications may be similarly chosen or otherwise as ever conditions require.

The sizes of the solid may be mixed, the contents of fines being of any proportion in the mixture down to 5% or less of the mixture. As a rule, the greater the proportion of larger particles, since the coating with the plastic is a surface reaction, the lower the contents of plastic in the composition need be.

Practical compositions for the afore stated pavements may be:

	Mix 1	Mix 2
	Per cent	Per cent
3/4" stone.....	38	70
sand.....	47	20
fines.....	10	6
residual asphalt penetration 200.....	5	4
	100	100

Laboratory analyses (screen) of other compositions:

	Mix 3	Mix 4
	Per cent	Per cent
retained on #4 sieve.....	34	
passing:		
#4.....	11	0.9
#10.....	16.5	28.3
#20.....	10.1	20.6
#40.....	8.6	15.8
#80.....	6.7	12.2
#200.....	10.3	16.3
asphalt.....	2.8	5.9
	100	100

The apparatus as shown on the drawing may be of a capacity of 1 1/2 cu. yd., for instance. Each batch supplied to the apparatus may be 3000 lb.

The impeller blades may be of a diameter of 33 in. to be driven at a speed of about 125 to 130 in./sec. at the blade tips.

The plastic employed for the purposes of the invention, in this instance a residual asphalt, may be of a wide range of viscosity. The penetration may be as low as 60 to 70, or as high as 200 or more. (The penetration numbers measure the penetration in tenths of millimeters of a penetrometer needle under a load of 100 gr. during five seconds at a temperature of 77° F.)

Soft asphalts may thus be used for the method of the invention.

The size of the minute globules, their velocity at the discharge from the nozzle, besides the type of the nozzles used, will depend upon the viscosity of the plastic, the temperature of the plastic and its pressure. The size of the globules at a given temperature and pressure will be greater for a plastic of higher viscosity, and, for a plastic with given viscosity characteristics, the size of the globules will increase with decreasing temperature or pressure. Furthermore, a decrease in viscosity or increase in temperature or pressure will increase the velocity of the globules.

By control of these characteristics, the quantity of the plastic deposited on the particles of the solid and correspondingly the thicknesses of the coatings may be controlled when the dispersive system is being activated. Smaller globules of high velocity, since they spread to a greater extent at the impact, will produce thinner films than those produced by larger, slower globules.

Temperatures may be as follows:

The aggregate may be heated to 225 to 250° F. in order to eliminate humidity. The plastic or, in the instance given, the asphalt of a penetration of 180 to 200, may be heated, within tank 47, to a temperature of 300° F. It is atomized under a liquid pressure of 275 to 300 lb./sq. in.

Through the atomization, the plastic, as it issues from the nozzles, is of a lower temperature than in the admission lines, not above 180° F. The system in the zone of vortex movement consisting of minute particles of the solid and minute globules of the plastic thus, so far, is to a certain extent in an equilibrium of temperature. By proper control of the temperature conditioning jackets 26, 27 of the apparatus, the state or condition of the phases of the dispersive system may now be easily controlled. Thus by supplying the jackets with cold water, the dispersive system will be obtained in the condition in which the solid forms the exterior phase, the globules of the plastic being covered or dusted with minute particles of the solid. Contrariwise, if the solid material is of an appropriate temperature or a warmer medium is circulated through the jackets, the plastic will form the exterior phase of the dispersive system. With intermediate temperatures, intermediate phase conditions will obtain, part of the dispersive system will be inactive, the solid forming the exterior phase, another part activated, the plastic forming the exterior phase.

The process is terminated when a predetermined quantity of the plastic had been atomized. When the material is being brought into final shape, the finer and minute particles of the solid with the particles of the plastic attached to them will on compression easily slide into the interstices in and between the coated coarser particles of the solid; and the plastic, when the material has coalesced, will form extremely fine interfacial binding layers highly resistant to any displacement.

Fig. 3 illustrates schematically, on an exaggerated scale, in a portion of a final structure, how on compression of the material the finer and minute particles, such as 60, 61, have slid into the interstices in and between the coarser particles (62, 63) and how the plastic 64, on coalescence, has formed minute interfacial binding layers. The voids between the coarser particles have substantially been filled with asphaltic mortar.

The quantitative relation between plastic and solid may vary to a wide extent and will depend upon the desired characteristics of the final structures. At any proportion of the solid and the plastic and in any of the two phase conditions, since the attaching of the plastic to the solid is a surface reaction, the finer particles of the solid will carry a much larger proportion of the plastic, for instance 25% of their weight, than the coarser particles.

For structures of higher plasticity the interfacial layers may be less fine, or the proportion of the plastic higher.

For structures of high stability, coarser, finer, and finest particles of the solid will be mixed with one another and with the plastic in such quantitative proportions that, when the material is coalescing, the plastic will bind together the particles of the solid in extremely fine binding layers. In asphaltic concrete compositions as exemplified above, a proportion of asphalt of less than 5% of the total will give excellent results when the proportions of the particles of the solid, viz. finest, fine and coarser, are properly chosen.

I claim:

1. The method of preparing a non-coalescent composition from a mixture containing coarser particles and minute particles of a solid material and from a plastic which includes the steps of creating in air or another gaseous medium a sheet-like zone of said medium in vortex movement, projecting into said zone from one side by mechanically transmitted energy minute particles of said solid and suspending them therein, liquefying said plastic and directing from the other side and under high liquid pressure an atomized spray of minute globules of said liquefied plastic upon said zone, thus causing said minute particles of the solid and said minute globules of said plastic to collide and to adhere to each other by the impact whilst simultaneously stirring under said mechanically transmitted energy said coarser particles and impelling them towards said zone and spraying and coating them with said plastic.

2. A method of manufacturing a bituminous paving mix comprising paving aggregate particles coated with bitumen binder wherein the bitumen in a liquefied condition is subjected to atomization in a gaseous medium in the form of minute adhesive particles dispersed in atomized condition in said gaseous medium and wherein the aggregate particles are projected into said gaseous medium containing the dispersed atomized adhesive bitumen particles and receive a coating of said adhesive bitumen by adherent deposition of said dispersed atomized bitumen particles thereon from said gaseous medium.

3. A method of manufacturing a bituminous paving mix according to claim 2 wherein a pulverulent filler material is dispersed in discrete particle form in said gaseous medium in interdispersed relation with said dispersed atomized adhesive bitumen particles and adherently re-

ceive part of said dispersed atomized bitumen thereon to form pulverulent filler-bitumen particles dispersed in said gaseous medium and wherein said pulverulent filler-bitumen particles are deposited from said gaseous medium on said aggregate particles in adherent relation to said coating.

4. In a method of making a pavement wherein paving aggregate particles are coated with a heat liquefied bitumen binder to form a workable mix that is thereafter distributed and consolidated in place on a road surface to form a pavement, the steps comprising heating the bitumen to a temperature at which it is freely fluid, atomizing the heat liquefied bitumen under a pressure of at least about 275 pounds per square inch into a gaseous medium and simultaneously agitating said aggregate particles to project same in essentially discrete and substantially completely surface-exposed condition into said gaseous medium and into the zone thereof into which said liquefied bitumen is atomized, said particles receiving said atomized liquefied bitumen as an adhesive coating distributed on the surface thereof while said particles are in said essentially discrete and substantially completely surface-exposed condition in said gaseous medium and being returned to intercontacting relation while maintained at a temperature at which the so coated particles provide a workable mix, the so coated aggregate particles thereafter being spread and consolidated to form the pavement.

5. In a batch method of mixing paving aggregate particles with a bitumen to form a paving mix, the steps comprising subjecting a batch of paving aggregate particles to mechanical agitation which projects uncoated particles in the batch upwardly in a discrete and substantially completely surface-exposed condition into gaseous atmosphere in the zone above the bulk of the particles in the batch, the particles so projected falling back into contacting relation with the other particles in the batch while additional particles are being projected into said zone, liquefying said bitumen to a freely fluid condition, reducing the liquefied bitumen to a finely atomized condition by atomization under the influence of high liquid pressure and directing the so atomized bitumen into said zone, said atomized bitumen being taken up by said aggregate particles while said aggregate particles are in said discrete and substantially completely surface-exposed condition as projected into said zone to form binder coatings thereon and with formation of a workable mass of the so-coated particles, discontinuing the further addition of bitumen to said so-coated particles and discontinuing the mechanical agitation of said aggregate particles substantially immediately upon discontinuing the further addition of the bitumen.

6. In a method of making a paving mix comprising a bitumen binder and aggregate containing both coarse particles and a pulverulent filler, the steps comprising subjecting a batch of the aggregate to mechanical agitation which projects uncoated particles in the batch upwardly in a discrete and substantially completely surface-exposed condition into gaseous medium in the zone above the bulk of the particles in the batch with the coarser particles so projected into said zone generally below the upper portion of said zone containing so projected pulverulent filler particles, atomizing the bitumen in liquefied freely fluid condition under the influence of high liquid pressure into said gaseous medium in

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minutely atomized condition and directing the so-atomized liquefied bitumen downwardly into said zone whereby part of the atomized bitumen in the form of said minute atomized particles adheres to pulverulent filler particles in said zone to form discrete filler-bitumen particles carried in said gaseous medium in said zone while simultaneously part of the so-atomized bitumen adheres to the coarser aggregate particles which are projected into said zone as an adherent adhesive coating, said pulverulent filler-bitumen particles carried in said gaseous medium becoming adherent to said coating of said coarser particles while said coarser particles are in discrete and substantially completely surface-exposed condition in said gaseous medium with formation on said coarser aggregate particles and in the manner recited of evenly distributed coatings consisting of said bitumen and said adherent pulverulent filler-bitumen particles and with ultimate formation of an adhesive but workable mix of the so-coated aggregate particles.

7. In the method of claim 6, the steps according to said claim wherein the mechanical agitation of said aggregate particles is carried on with production of vortex movement at least in the portion of said zone occupied by said pulverulent filler particles to assist in the suspension of said pulverulent filler particles therein.

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8. In a method of producing solid particles coated with a plastic, the steps comprising liquefying the plastic, atomizing the liquefied plastic into a gaseous medium in the form of minute adhesive particles dispersed in atomized condition in said gaseous medium and subjecting a body of said solid particles to mechanical agitation which projects said particles in discrete condition into said gaseous medium containing said dispersed atomized adhesive particles with return of said solid particles into intercontacting relation in said body, said solid particles receiving while in said so-projected and discrete condition an adhesive coating of said plastic by adherent deposition of said dispersed atomized adhesive plastic particles thereon from said gaseous medium and upon return to said intercontacting relation in said body forming a workable mass of the so-coated particles.

ALBERT SOMMER.

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