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Heinrichs

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[54] **COALESCING NOZZLE**

[75] Inventor: **Roland P. Heinrichs,** Lindenhurst, N.Y.

[73] Assignee: **Uniwave, Inc.,** Farmingdale, L.I., N.Y.

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[51] **Int. Cl.** **B05b 1/34**

[58] **Field of Search**.....239/337, 463, 487, 239/488, 489, 500, 501, 590, 590.3, 590.5, 467

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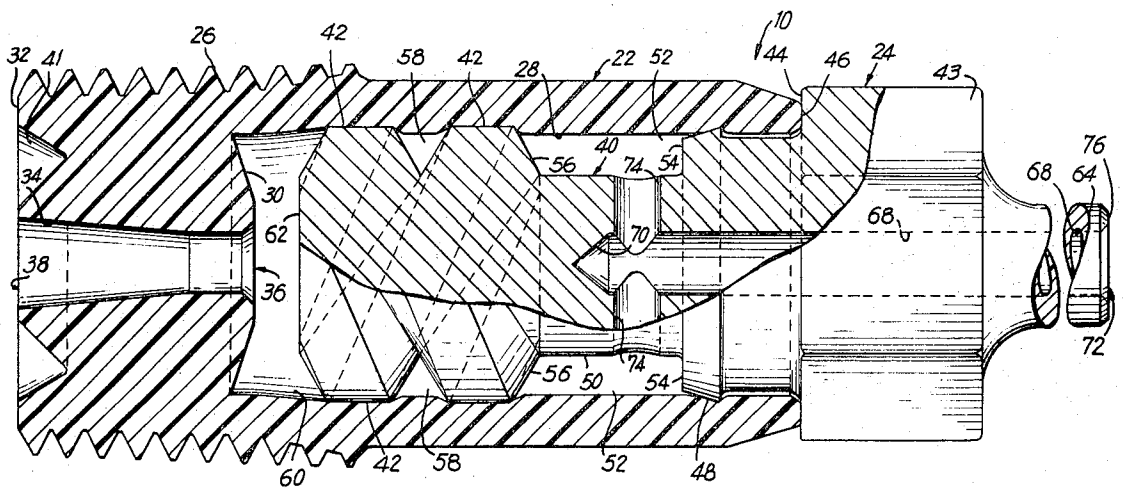
Primary Examiner—Robert S. Ward, Jr.

Attorney—Blum, Moscovitz, Friedman & Kaplan

[57] **ABSTRACT**

A coalescing nozzle having a body portion and a sleeve portion defining a circuitous path between inlet and outlet openings thereof for the coalescing of liquid particles as an aerosol passes therethrough. The circuitous path includes at least one region at which the aerosol impacts against a wall of said path and a region in which angular momentum is imparted to said fluid so that a liquid spray produced at said outlet consists substantially of droplets of a size tending not to remain in suspension in the ambient atmosphere.

32 Claims, 2 Drawing Figures



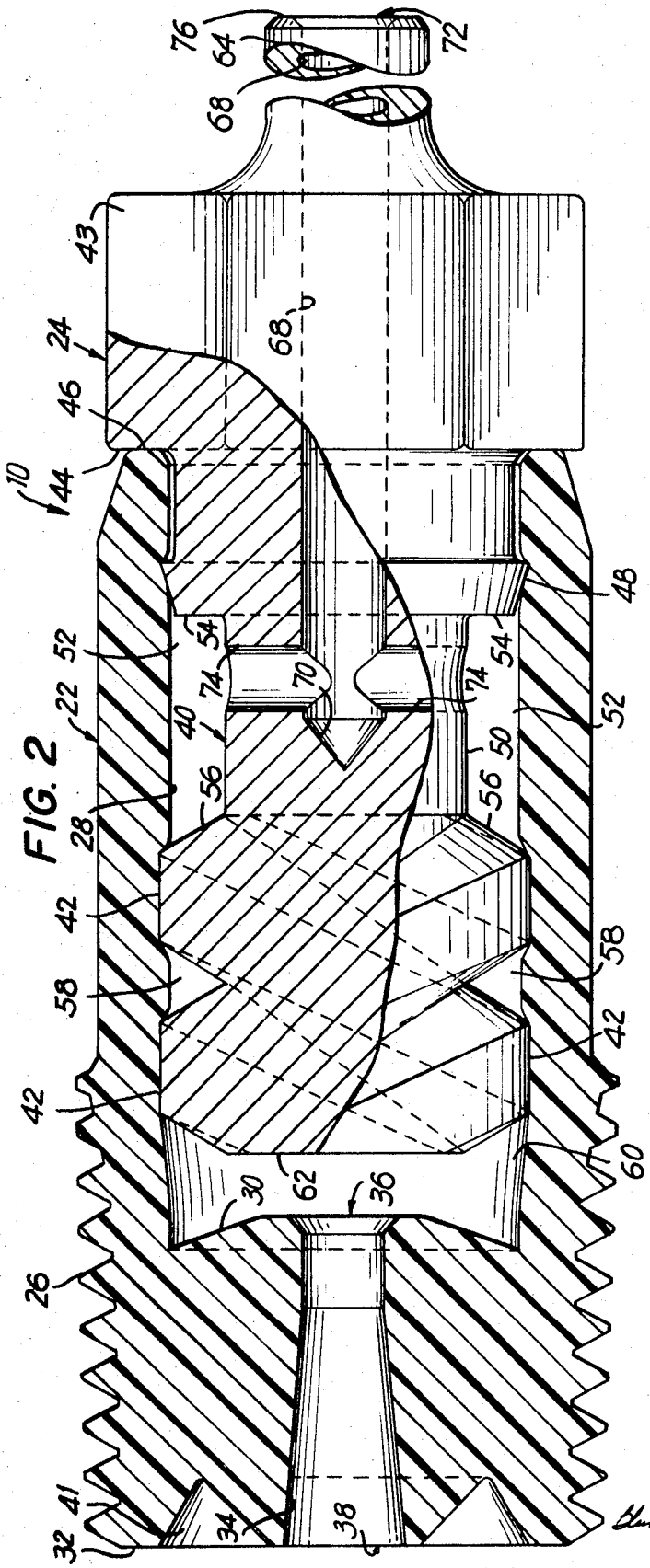


FIG. 2

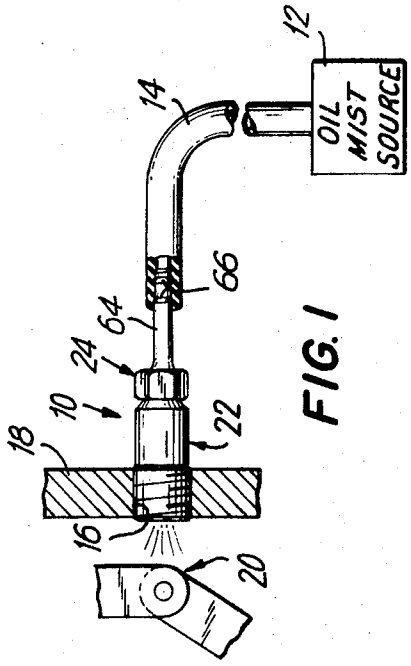


FIG. 1

INVENTOR.
ROLAND P. HEINRICHS
BY
Blum Moscovitz Friedman & Kaplan
ATTORNEYS

COALESCING NOZZLE

BACKGROUND OF THE INVENTION

This invention relates generally to a coalescing nozzle of the type useful in increasing the particle size of an aerosol passed therethrough. In particular, such coalescing nozzles are adapted for use with mist oil lubrication systems. In such lubrication systems, lubricating oil is suspended as an aerosol in a stream of air and is carried in this state through a tube or other enclosed channel to a remote location requiring continuous lubrication. The oil is generally placed in the aerosol state at a central oil mist source, each central oil mist source being connected to a plurality of transmitting tubes for the simultaneous and continuous lubrication of a plurality of locations on a single machine or group of machines.

The known mist oil lubrication systems, while producing satisfactory lubrication, have proved deficient in several respects. Thus, the parts to be lubricated are generally exposed to the air, or located in enclosed areas vented to the outside air. In the known systems, a portion of the oil mist is not deposited on the part to be lubricated, but rather, remains suspended in the air and passes into the ambient environment in the form of a stray fog. This stray oil fog reduces the amount of oil available for lubrication and causes an objectionable contamination of the ambient environment.

A further defect of the known mist oil lubrication systems is that some of the mist oil coalesces and drips from the nozzle or other outlet device of the mist oil conducting tube. Oil which drips in this manner is generally also unavailable for lubrication and causes undesirable lubricant accumulation on exposed machine surfaces, requiring frequent cleaning to prevent soiling of the articles being processed on the machines being lubricated. One frequent use of mist oil lubrication systems is in conjunction with knitting machinery, wherein the problem of soiling of the knitted goods by stray quantities of oil is of substantial practical importance.

By providing a coalescing nozzle which produces a liquid spray at its outlet opening consisting substantially of droplets of a size tending not to remain in suspension in air and of a flow characteristic which avoids dripping of the liquid, the foregoing defects in the known mist oil lubrication systems are avoided. Further, a coalescing nozzle for controlled coalescing of liquid particles in aerosols for applications other than mist oil lubrications is also provided.

SUMMARY OF THE INVENTION

Generally speaking, in accordance with the invention, a coalescing nozzle is provided having an inlet opening, an outlet opening and a circuitous path between said inlet and said outlet openings for the coalescing of liquid particles as an aerosol passes therethrough. The circuitous path includes at least one region at which said aerosol impacts against a wall of said path and a region in which angular momentum is imparted to the fluid so that a liquid spray is produced at said outlet consisting substantially of oil droplets of a size tending not to remain in suspension in ambient atmosphere.

The coalescing nozzle includes a body member and a sleeve member, said body member defining said inlet opening, said sleeve member defining said outlet opening and extending about at least a portion of said body member for defining segments of said circuitous path therebetween. At least a portion of the walls of said circuitous path are formed of a material of a surface tension less than the surface tension of the liquid of said aerosol. The walls of said circuitous path in the region of said outlet opening may be formed of said material, as well as a portion of said walls of said circuitous path in the region in which angular momentum is imparted to said fluid. Said sleeve member may be formed of said material of lessor surface tension.

The body portion may include an axial bore extending from said entrance opening, said entrance opening being of a cross-sectional area less than the inner cross-sectional area of the mist oil transporting tube. A transverse bore is formed in said body portion intersecting said axial bore and providing communication between said axial bore and a substantially annular cavity intermediate said body portion and said sleeve portion. The aerosol impacts against the base of said axial bore and against the peripheral wall of said annular chamber to effect the changes in direction necessary to follow said circuitous path and to effect coalescence.

The circuitous path of the coalescing nozzle according to the invention extends from said annular chamber along at least one helical channel defined between said sleeve and body members, in which region angular momentum is imparted to the fluid. The sleeve member is formed with an axial bore for receipt of the portion of said body member, and said helical channel terminates in an enlarged final coalescing cavity defined by the end of said body member and the base of said axial bore in said sleeve member. Said base of said axial bore is in the shape of a truncated cone projecting into said final coalescing chamber, said aerosol impacting against said conical base. Centrally located in said base wall of the axial bore of said sleeve member is the entrance opening to a diverging nozzle formed axially in said sleeve member and terminating in the outlet opening of the coalescing nozzle. A groove is formed on the end of the sleeve adjacent said outlet opening for supplying air to be drawn into the liquid spray flowing from said outlet opening to assist in the avoidance of nozzle dripping.

Accordingly, it is an object of this invention to provide a coalescing nozzle adapted to provide controlled coalescing of liquid particles in an aerosol to produce a liquid spray at the outlet consisting substantially of droplets of a size tending not to remain in suspension in the ambient atmosphere.

Another object of the invention is to provide a coalescing nozzle wherein the liquid does not drip from the outlet opening thereof, but rather, it confined to the liquid spray produced at said outlet opening.

Still another object of the invention is to provide a coalescing nozzle particularly adapted for use with mist oil lubrication systems and adapted to avoid the defects of stray fog and nozzle dripping in said systems.

Still other objects and advantages of the invention will in part be obvious and will in part be apparent from the specification.

The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts which will be exemplified in the constructions hereinafter set forth, and the scope of the invention will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWING

For a fuller understanding of the invention, reference is had to the following description taken in connection with the accompanying drawing, in which:

FIG. 1 is a partially schematic representation of a coalescing nozzle according to the invention connected to a mist oil lubricating system; and

FIG. 2 is a partially sectional view of the coalescing nozzle depicted in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, coalescing nozzle 10 according to the invention is depicted connected in an oil mist lubrication system. Said system includes an oil mist source 12 connected to nozzle 10 by means of a flexible mist transporting tube 14. Nozzle 10 is mounted within a threaded aperture 16 in a support 18 and positioned to direct an oil spray to the portion of the machine to be lubricated, illustrated by joint 20 in FIG. 1.

The oil mist source is adapted to produce an aerosol in which oil particles are suspended in the form of a small spherical bodies of between 1 and 5 micron in diameter. This aerosol mist is readily transported along tube 14 at a velocity of about 9m./sec. Particles of this size, would tend to remain suspended in the air if directed to joint 20, and would disperse and therefore would not be available for the lubrication function. However, the coalescing nozzle 10 is specifically adapted to coalesce the oil particles so as to produce oil particles of about 30–50 micron in diameter which are applied to a part such as joint 20 in the form of a spray. Particles of this range of sizes and larger cannot readily remain in suspension in free air, and hence will not contaminate the ambient atmosphere through the production of a mist fog in the region of joint 20.

Referring more particularly to FIG. 2, coalescing nozzle 10 consists of a sleeve member 22 preferably formed of a plastic material having surface tension characteristics more particularly discussed below, and a body member 24 preferably formed of a metal such as brass. One end of the peripheral surface of sleeve member 22 is formed with threads 26 which permit mounting of the coalescing nozzle 10 within the threaded aperture 16 in support 18, as shown in FIG. 1. This mounting arrangement is shown by way of example, and other mounting mechanisms may be utilized in conjunction with the coalescing nozzle according to the invention. A large bore 28 is formed axially in sleeve member 22. Bore 28 terminates in a transverse end wall 30 in the shape of a truncated cone projecting into said bore. Extending from bore end wall 30 to the end wall 32 of sleeve member 22 is a diverging axial bore 34. The diameter of the entrance opening 36 to said diverging axial bore is of a diameter less than the diameter of axial bore 28. Diverging bore 34 terminates in an opening 38 in end wall 32 which defines the outlet opening of coalescing nozzle 10. An annular groove 41 of substantially triangular cross-section is formed in end wall 32 concentric with outlet opening 38 and slightly radially spaced therefrom.

Body member 24 includes a sleeve engaging portion 40 dimensioned for receipt within axial bore 28 of said sleeve and for sealing engagement between the peripheral wall portions 42 thereof and the annular wall of said bore. Sleeve engaging portion 40 projects longitudinally from an enlarged portion 43 of said body member which defines a stop 44 against which end wall 46 of sleeve member 22 abuts to limit the insertion of sleeve engaging portion 40 within bore 28.

Sleeve engaging portion 40 is formed with an annular projection 48 spaced from stop 44 for sealing engagement with the annular wall of bore 28, and for cooperation with said wall to retain sleeve member 22 and body member 24 coupled together. The sleeve engaging portion is also formed with a region 50 of reduced diameter adjacent annular projection 48. Said region of reduced diameter defines an annular cavity 52 with the wall of bore 28. One end of said cavity is defined by the radially extending wall 54 interconnecting annular projection 28 and the region of reduced diameter 50. The other end of said cavity is defined by an inclined radially extending wall 56 which extends from the region of reduced diameter to the peripheral wall 42 which is in sealing engagement with the wall of bore 28. A pair of helical grooves 58 are formed in peripheral wall 42 and define helical channels extending from chamber 52 to the chamber 60 defined between end wall 62 of body member 24 and end wall 30 of bore 28. Helical grooves 58 are of a substantially V-shaped cross-section.

Projecting from the opposite side of enlarged portion 43 of the body member and axially aligned with the sleeve engaging portion thereof is mounting portion 64 which is dimensioned for receipt within mist oil transporting tube 14, as more particularly shown in FIG. 1. A pair of spaced annular projections 66 are formed in the outer surface of mounting portion 64 for engagement with tube 14 to insure retention of the coupling between said tube and the body member. The peripheral surface of enlarged portion 43 is provided with pairs of opposed flat longitudinally extending surfaces to permit gripping of the body portion by a wrench or the like.

Body portion 24 is formed with an axial bore 68 which extends through the mounting portion 64, the enlarged portion 43, and into the region 50 of reduced diameter of the sleeve engaging portion. Said bore terminates in a conical countersink 70. The inlet opening 72 of bore 68 is of a smaller diameter than the inner diameter of mist oil transporting tube 14. Axial bore 68 is cut by a transverse bore 74 at a point slightly spaced from countersink 70 in region 50 of reduced diameter. Transverse bore 74 provides a pair of paths for the transmission of aerosol from axial bore 68 to annular chamber 52.

The coalescing nozzle according to the invention relies principally on a series of impacts of the aerosol upon stationary walls in the path thereof to achieve primary coalescence. The collisions between particles thus produced tends to cause joining of the particles into larger particles due to the affinity of the molecules of oil to each other. The precise mechanism of coalescence will be discussed in conjunction with the

following detailed description of the operation of the coalescing nozzle according to the invention.

The aerosol generated in oil mist source **12** is unstable in nature, so that any controlled disturbance thereof acting on the aerosol will cause a separation of the aerosol into separate air and oil streams. Similarly, the turbulent operation of an air stream on an otherwise stable oil stream will tend to create small particles of oil which are entrained in the air stream to produce, once again, the aerosol. It is the latter principle which is utilized to generate the aerosol in the oil mist source.

While flow of the mist oil in transporting tube **14** is turbulent, such flow does result in some coalescence, principally affecting the larger particles of 4–5 micron in diameter. The coalesced oil particles form an oil film on the inner wall of tube **14** which is transported along said wall in the direction of nozzle **10** by the flow of the stream of uncoalesced aerosol, provided the total elevation difference between nozzle **10** and mist oil source **12** and the length of tube **14** is not too great. Under normal conditions, up to 40 percent of the oil particles can be expected to coalesce into the oil film traveling along the walls of tube **14**, depending on the actual length of the tube, its straightness, and the radii of any bends therein, among other factors. The partially coalesced stream engages body member **24** of nozzle **10** at the end wall **76** thereof which defines the inlet opening **72** to the circuitous path defined within nozzle **10** between inlet opening **72** and outlet opening **38**. The reduction in diameter between axial bore **68** and the inner diameter of tube **14** serves to increase the velocity of the stream within the axial bore **68**. The transition from tube **14** to axial bore **68** also results in the addition of kinetic energy to the particles, changing their momentum and resulting in additional coalescing.

The increase in the velocity of the flow insures coalescence as the result of the impact of the aerosol against countersink **70** as more particularly described below. The edge of inlet opening **72** is not sharp to minimize entrance contraction of the aerosol stream. A similar configuration is used for the edge of entrance opening **36** of diverging bore **34**.

The length of axial bore **68** is selected to assure sufficient directional alignment of the particles in the direction of flow. In one embodiment of the nozzle according to the invention, 0.8 inches of axial bore is sufficient for this result. After a short period of initial use, oil will accumulate in countersink **70** so as to present a surface substantially normal to the flow of aerosol in axial bore **68**. All but the smallest particles in the aerosol stream will strike the oil accumulated in countersink **70** with sufficient impact force to lose all of their velocity and to cling to the pool of oil at this point. At this stage, better than 90 percent of the oil has coalesced, while the progressively "dryer" aerosol contains only the original, as well as re-entrained particles of less than 2 micron in diameter. The aerosol stream will continue along the two branches of transverse bore **74** in equal flow quantities toward chamber **52**. The coalesced oil will be dragged along the walls of the transverse bore toward said chamber due to the friction between the aerosol stream and the oil film. Some small particles will be re-entrained into the aerosol due to the turbulent interaction between the aerosol flow and the oil film. The cross-sectional area of transverse bore **74** is uniform in size and preferably equal to one-half the cross-sectional area of axial bore **68**, so that the two branches of the transverse bore, together, have an area equal to the area of the axial bore.

After leaving transverse bore **74**, the aerosol stream impacts against the wall of bore **28** in sleeve member **22**, which impact results in further coalescing. More important, the impact force of the aerosol stream against the wall of bore **28** serves to force and hold the liquid oil against said wall of bore **28**. After a short period of use, oil will fill the cavity defined between transverse bore **74** and radial wall **54**.

As noted above, the material of sleeve member **22** is preferably selected for its surface tension characteristics, namely so as to have a surface tension less than that of oil.

This selection of material for the sleeve is based on the fact that where the surface tension of the material against which the oil film engages is greater than the surface tension of the oil, the oil will spread over the surface rather than contract within itself. This effect, called the wetting effect, is the result of the greater attraction between the oil molecules and the molecules of the material, than between the oil molecules themselves. This wetting effect results in a very thin oil film which has proved difficult to transport, i.e. push along the walls, through the operation of the flow of the aerosol stream thereby. Further, the turbulent nature of the aerosol stream, as noted above, results in the scraping off and re-entrainment of small particles from the thin film at the interface between the thin film and the stream of aerosol. On the other hand, where a material having a surface tension less than the surface tension of the liquid in the aerosol, in this case oil, the surface tension of the oil tends to produce a thicker, more resilient body of oil which can distort under the attack of the turbulent air stream to resist re-entrainment, while being readily displaced along the surface.

It has been found that some plastics, such as polypropylene, have a surface tension less than the surface tension of oil and by forming the sleeve member **22** of such a material, the material serves as the primary impact surface and the surface along which primary transport of the fluid particles occurs, after the initial stages of coalescence in mist oil transporting tube **14** and body member **24**.

Thus, the periphery of annular chamber **52**, which acts essentially as a plenum chamber, wherein the flow is redirected, is formed of low surface tension material, namely the wall of bore **28** of the sleeve member. As will be seen from the discussion below, the majority of the coalesced oil will, during the remaining portion of the fluid path, be forced against this wall, so as to take advantage of its surface properties.

The aerosol and coalescest oil flows out of annular chamber **52** through the pair of helical channels defined by grooves **58** of the body member and the wall of bore **28**. The helical channels serve as energy directors for the subsequent final coalescing process within chamber **60** into which they empty, as well as a region in which angular momentum is imparted to the fluid. The aerosol leaves the helical passages at a velocity having both axial and tangential vector components. The magnitude of the axial velocity component is sufficient so that, upon impact of the aerosol

stream on the conical end surface **30** of bore **28**, essentially total coalescence of all oil particles is achieved. This conical surface is also of the low surface tension material for proper oil film flow. The tangential component of the velocity of the aerosol provides the angular momentum to the liquid oil for the continuation of the flow process as discussed below. In one embodiment of the nozzle according to the invention, the lead angle of helix was 19°, and equal to the desired direction of the vectorial resultant of the axial and tangential components of the velocity.

Chamber **60** is specifically dimensioned and shaped to minimize re-entrainment of oil particles into the now practically dry air stream due to turbulence created by the striking of the air stream against end wall **30**. Specifically, said chamber is shaped so that each successive oil quantity leaving the helical channels will displace the preceding oil quantity on a decreasing spiral path towards the center of end wall **30**, and the entrance opening **36** to diverging bore **34**. The liquid oil retains sufficient angular velocity so that, when it joins the air stream in diverging tube **34**, the desired spray pattern is produced at outlet opening **38**.

Diverging tube **34** serves as a diverging nozzle with flow velocities within said nozzle at or below the speed of sound. The high air velocity is required to impart sufficient change of momentum upon the oil through friction to achieve the required exit velocity of the oil for the desired spray pattern, in this case a substantially conical pattern extending from outlet opening **38**. The angular velocity imparted to the oil in the helical channels, while reduced substantially by the time the oil reaches the nozzle, is still sufficient to force and hold the oil onto the nozzle surface so as to prevent material re-entrainment of oil particles into the air stream. The axial and tangential components of the velocity of the oil and air stream are such as to maintain the desired directionality of the flow of the oil within reasonable distances from the end of the nozzle, thereby insuring application of substantially all of the oil to the desired location.

The annular groove **41** is provided in order to insure that there is no dripping of oil from the outlet of the nozzle. This result is achieved by taking advantage of the fact that the static pressure in the air stream exiting from the nozzle is less than that of the surrounding still air at the nozzle outlet. The groove **41** serves as a lead in for the inrushing surrounding air drawn into the air stream due to the static pressure differential, which inrushing air tends to carry the oil off the surface of the nozzle and into the air stream. This result is enhanced by the low surface tension material used for the sleeve member which minimizes adhesion between the oil and the surface.

In this manner, both maximum coalescence and a substantially dripless output spray is produced. However, for some applications, a lower coalescing efficiency and some nozzle dripping can be tolerated. In such a case, the coalescing nozzle according to the invention can be produced with a sleeve formed of a material such as aluminum, brass or steel which would not have the above-described low surface tension properties. Further, if dripping is not a material consideration, the angular groove **40** can also be dispensed with.

The precise dimensions and orientation of the components of the nozzle according to the invention for practical application will depend on the specific air flow and the quality and quantity characteristics of the liquid. Accordingly, this coalescing nozzle according to the invention may be used for controlled coalescing of any liquid aerosol and is not limited to the mist oil lubrication embodiment shown in the drawing. Further the nozzle according to the invention may be used as an output nozzle for an aerosol having any colloidal substance suspended in a fluid medium such as a solid suspended in a liquid medium.

It will thus be seen that the objects set forth above, and those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above constructions without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. A coalescing nozzle comprising an inlet opening, an outlet opening, and means providing a circuitous path between said inlet and outlet openings for the coalescing of aerosol liquid particles as an aerosol passes therethrough, said circuitous path including at least a first region at which said aerosol impacts against a wall of said path to substantially change the direction of flow thereof and substantially coalesce said liquid particles, and a second region intermediate said first region and said outlet opening in which angular momentum is imparted to the fluid in said path to produce a liquid spray at said outlet, so that said liquid spray consists substantially of droplets of a size tending not to remain in suspension in the ambient atmosphere, at least a portion of the walls of said circuitous path being formed of a material of a surface tension less than the surface tension of the liquid of said aerosol.

2. A coalescing nozzle as recited in claim **1**, wherein said portion of the wall of said circuitous path of lessor surface tension is positioned so that coalesced oil is transported therealong in the region of said outlet opening.

3. A coalescing nozzle as recited in claim **1**, wherein at least a portion of the wall of the circuitous path of lesser surface tension defines the outer peripheral wall of said circuitous path in said second region in which angular momentum is imparted to said fluid.

4. A coalescing nozzle as recited in claim **1**, wherein said circuitous path includes a series of regions at which said aerosol impacts against the wall of said path.

5. A coalescing nozzle comprising an inlet opening, an outlet opening, and means providing a circuitous path between said inlet and outlet openings for the coalescing of aerosol liquid particles as an aerosol passes therethrough, said circuitous path including at least a first region at which said aerosol impacts against a wall of said path to substantially change the direction of flow thereof and substantially coalesce said liquid particles, said wall of said path against which said

aerosol impacts being aligned substantially normally to the direction of aerosol flow at said region of impact, and a second region intermediate said first region and said outlet opening in which angular momentum is imparted to the fluid in said path to produce a liquid spray at said outlet, so that said liquid spray consists substantially of droplets of a size tending not to remain in suspension in the ambient atmosphere.

6. A coalescing nozzle comprising an inlet opening, an outlet opening, and means providing a circuitous path between said inlet and outlet openings for the coalescing of aerosol liquid particles as an aerosol passes therethrough, said circuitous path including at least a first region at which said aerosol impacts against a wall of said path to substantially change the direction of flow thereof and substantially coalesce said liquid particles, a second region intermediate said first region and said outlet opening in which angular momentum is imparted to the fluid in said path to produce a liquid spray at said outlet, and a third region defining a diverging nozzle terminating at said outlet opening, so that said liquid spray consists substantially of droplets of a size tending not to remain in suspension in the ambient atmosphere.

7. A coalescing nozzle as recited in claim 6, wherein said second region in which angular momentum is imparted to said fluid is positioned relative to said outlet opening so that the coalesced liquid maintains a velocity having a tangential component at said outlet opening.

8. A coalescing nozzle comprising an inlet opening, an outlet opening, and means providing a circuitous path between said inlet and outlet openings for the coalescing of aerosol liquid particles as an aerosol passes therethrough, said circuitous path including at least a first region at which said aerosol impacts against a wall of said path to substantially change the direction of flow thereof and substantially coalesce said liquid particles, a second region intermediate said first region and said outlet opening in which angular momentum is imparted to the fluid in said path to produce a liquid spray at said outlet, so that said liquid spray consists substantially of droplets of a size tending not to remain in suspension in the ambient atmosphere, and an end surface through which said outlet opening extends, said end surface being provided with an annular groove substantially concentric with said outlet opening for providing a lead-in path for the ambient atmosphere to join the liquid spray at said outlet opening.

9. A coalescing nozzle as recited in claim 6, wherein said circuitous path includes a final chamber having an end wall, said region of said circuitous path in which angular momentum is imparted to said fluid being positioned to empty into the periphery of said final chamber so that the aerosol will impact against the end wall of said chamber, said end wall being formed with a central exit opening therethrough for the flow of fluid out of said chamber, said diverging nozzle extending between said exit opening and said outlet opening.

10. A coalescing nozzle as recited in claim 9, wherein said final chamber and region for imparting angular momentum to said fluid is adapted so that the coalesced liquid leaving said final chamber to said exit opening has a velocity having a tangential component.

11. A coalescing nozzle as recited in claim 10, wherein said final chamber end wall is formed in the shape of a truncated cone projecting into said final chamber.

12. A coalescing nozzle for an aerosol comprising a body member; and a sleeve member formed with an axial bore therein for receiving a portion of said body member in sealing engagement and formed of a material having a surface tension less than the surface tension of said liquid, said body and sleeve members being formed to define a circuitous path means therein between an inlet opening in an end wall of said body member and an outlet opening in an end wall of said sleeve member for coalescing aerosol liquid particles, at least a portion of said circuitous path means being defined between the walls of said axial bore in said sleeve member and the periphery of said portion of said body member received within said sleeve member axial bore, said sleeve and body members being formed so that said circuitous path means includes at least a first region at which said aerosol impacts against a wall of said path to substantially change the direction of flow thereof and substantially coalesce said liquid particles and a second region between said first region and said outlet opening in which angular momentum is imparted to the fluid to produce a liquid spray at said outlet opening.

13. A coalescing nozzle for an aerosol comprising a body member; and a sleeve member formed with an axial bore therein for receiving a portion of said body member in sealing engagement, said body and sleeve members being formed to define a circuitous path means therein between an inlet opening in an end wall of said body member and an outlet opening in an end wall of said sleeve member for coalescing aerosol liquid particles, at least a portion of said circuitous path means being defined between the walls of said axial bore in said sleeve member and the periphery of said portion of said body member received within said sleeve member axial bore, said sleeve and body members being formed so that said circuitous path means includes at least a first region at which said aerosol impacts against a wall of said path to substantially change the direction of flow thereof and substantially coalesce said liquid particles and a second region between said first region and said outlet opening in which an angular momentum is imparted to the fluid to produce a liquid spray at said outlet opening, said portion of said body member received within said axial bore of said sleeve member and said axial bore having respective facing spaced end walls and respective side walls at least portions of which are in sealing engagement, at least a portion of said circuitous path being formed intermediate portions of the respective side walls of said body member portion and the associated sleeve member axial bore, said body member being formed with a further portion of said circuitous path extending therethrough from said inlet opening to the side wall of said portion of said body member received within said axial bore for communication to said first-mentioned portion of said circuitous path.

14. A coalescing nozzle as recited in claim 13, wherein the respective side walls of said sleeve member axial bore and said body member portion received therein are formed with a helical channel therebetween

defining the region of said circuitous path in which angular momentum is imparted to said fluid, said helical channel emptying into a final chamber defined between the respective end walls of said sleeve member axial bore and said body member portion received therein.

15. A coalescing nozzle as recited in claim 14, wherein said helical channel is defined by a helical groove formed in the side wall of the portion of said body member received within said sleeve member axial bore.

16. A coalescing nozzle as recited in claim 14, wherein the respective side walls of the sleeve member axial bore and the portion of said body member received therein are formed with an annular chamber providing communication between the entrance of said helical channel and said further portion of said circuitous path in said body member providing communication with said inlet opening.

17. A coalescing nozzle as recited in claim 16, wherein said portion of said body member received within said sleeve member axial bore is formed with a region of reduced diameter defining said annular chamber.

18. A coalescing nozzle as recited in claim 16, wherein said body is formed so that the aerosol stream leaving said further portion of said circuitous path within said body portion impacts against said side wall of said sleeve portion axial bore to effect coalescence.

19. A coalescing nozzle as recited in claim 13, wherein said further portion of said circuitous path in said body member includes an axial bore extending from said inlet opening to an end wall, and a transverse bore passing through said body member axial bore and interconnecting said body member axial bore with said first-mentioned portion of said circuitous path intermediate the respective side walls of said sleeve member axial bore and the portion of said body member received therein.

20. A coalescing nozzle as recited in claim 13, wherein said sleeve member is formed with an axial diverging nozzle bore between the end wall of said axial bore of said sleeve member and said outlet opening, the diameter of said nozzle bore at said sleeve member axial bore end wall being less than the diameter of said final chamber.

21. A coalescing nozzle as recited in claim 19, wherein the portion of said body member including said inlet opening is dimensioned for receipt within an aerosol transporting tube, the diameter of the axial bore extending from said inlet opening into said body member being of a diameter less than the inner diameter of said aerosol transporting tube.

22. A coalescing nozzle as recited in claim 13, wherein said sleeve member is formed with an annular groove in the end wall thereof substantially concentric with said outlet opening for providing a lead in for the ambient atmosphere into said oil spray.

23. A coalescing nozzle for use in an oil aerosol lubrication system comprising an inlet opening, an outlet opening, and means providing a circuitous path between said inlet and outlet openings for the coalescing of aerosol oil particles as said aerosol passes therethrough, said circuitous path including at least a first region at which said aerosol impacts against a wall of said path to substantially change the direction of flow thereof and substantially coalesce said oil particles and a second region between said first region and said outlet opening in which angular momentum is imparted to the fluid to produce an oil spray at said outlet, at least a portion of said circuitous path in the region of said outlet opening and along which coalesced oil is transported being formed of a material having a surface tension less than the surface tension of oil.

24. A coalescing nozzle as recited in claim 23, wherein said portion of the wall of said circuitous path of lessor surface tension is formed of polypropylene.

25. A coalescing nozzle comprising an inlet opening, an outlet opening, and means providing a circuitous path between said inlet opening and outlet opening for the coalescing of aerosol liquid particles as an aerosol passes therethrough, at least a portion of said circuitous path in the region of said outlet opening and along which coalesced liquid is transported being formed of a material having a surface tension less than the surface tension of said liquid to assist in the maintenance of the liquid in the coalesced state for discharge as a spray consisting substantially of droplets of a size tending not to remain in suspension in the ambient atmosphere.

26. A coalescing nozzle comprising a body member; and a sleeve member formed with an axial bore therein for receiving a portion of said body member, said body and sleeve members being formed to define a circuitous path therein between an inlet opening in an end wall of said body member and an outlet opening in an end wall of said sleeve member adapted to coalesce liquid particles in said aerosol and to produce a liquid spray at said outlet opening, said sleeve member axial bore and the portion of said body member received therein having respective facing spaced end walls and respective side walls at least portions of which are in sealing engagement, said circuitous path including an axial bore formed in said body member and extending from said inlet opening to an end wall; a transverse bore in the portion of said body member received within said sleeve member axial bore and passing through said body member axial bore to the side wall of said body member portion; a region of said body member portion including the openings of said transverse bore in said side wall being of reduced diameter to define an annular chamber between the respective side walls of said body member portion; said body member portion side wall being formed with a helical groove defining with the corresponding side wall of said sleeve member axial bore a helical channel communicating between said annular chamber and a final chamber defined between the respective end walls of said sleeve member axial bore and said body member portion; and said sleeve member being formed with a diverging nozzle bore extending between the end wall of said sleeve member axial bore and said outlet opening, the opening into said nozzle bore in said sleeve member axial bore end wall being of a diameter less than the diameter of said final chamber.

27. A coalescing nozzle as recited in claim 26, wherein said sleeve member end wall is formed with an annular groove substantially concentric with said outlet opening for providing an intake path for the ambient atmosphere to join the liquid stream.

28. A coalescing nozzle as recited in claim 26, wherein said sleeve member is formed of a material

having a surface tension less than the surface tension of said liquid.

29. A coalescing nozzle as recited in claim 26, wherein the end of said body member including said inlet opening is dimensioned for receipt within an aerosol transmitting tube, said inlet opening being of a diameter less than the inner diameter of said tube.

30. A coalescing nozzle as recited in claim 26, and adapted for connection to an oil aerosol lubrication system, said sleeve member being formed of a material having a surface tension less than that of oil, said circuitous path being adapted to produce at said outlet an oil spray consisting substantially of droplets of a size tending not to remain in suspension in the ambient atmosphere.

31. A coalescing nozzle as recited in claim 26, wherein said sleeve member end wall is formed with an annular groove substantially concentric with said outlet opening for providing an intake path for the ambient atmosphere to join the liquid stream, and wherein said sleeve member axial bore end wall is formed at least in part in the shape of a truncated cone projecting into said final chamber and having said nozzle bore axially aligned therein.

32. A coalescing nozzle as recited in claim 31, wherein said sleeve member is formed of a material having a surface tension less than the surface tension of said liquid.

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