

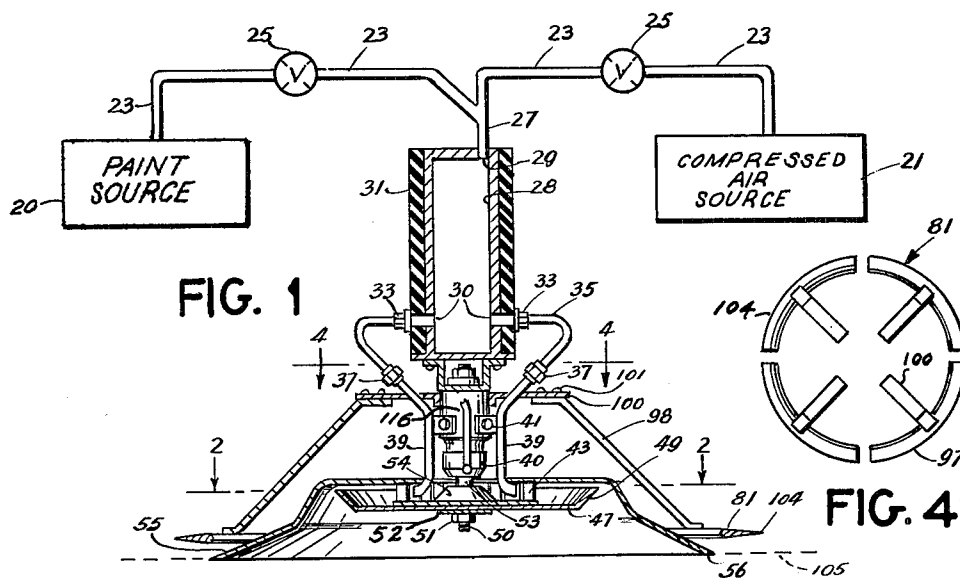
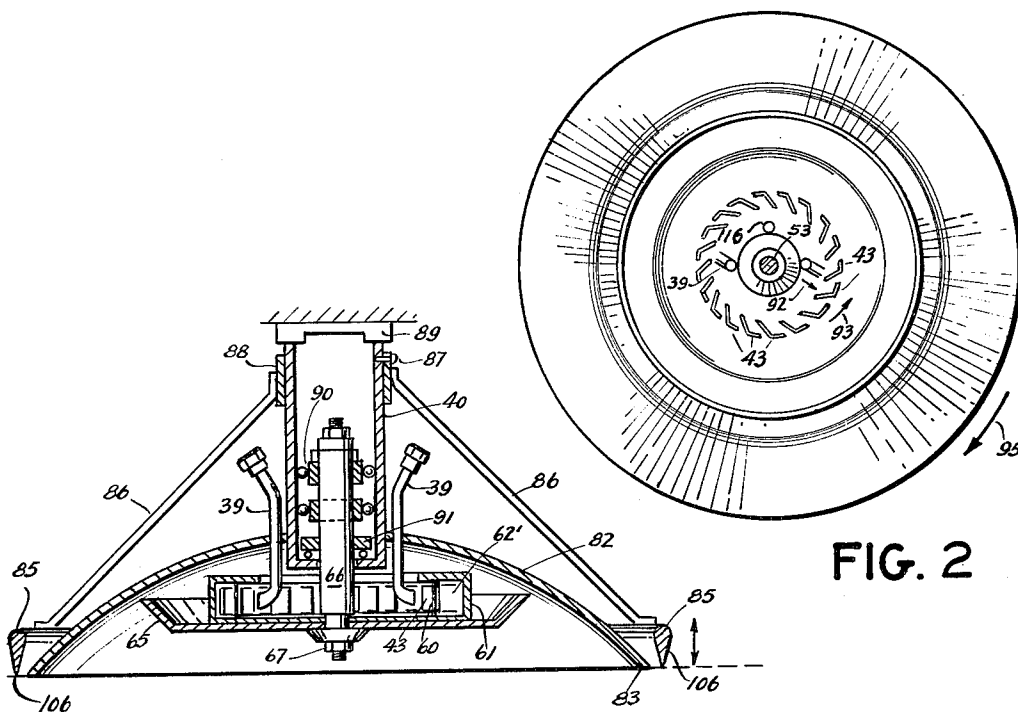
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COATING MATERIAL MOTIVE AGENT ATOMIZER HEAD

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COATING MATERIAL MOTIVE AGENT
ATOMIZER HEAD

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The present invention relates to apparatus for depositing fluid coating material on an object and includes a vaned rotor which drives a circular atomizer member, a preatomized mixture of compressed air and coating material being directed through the rotor blades to cause rotation of the atomizer member.

Further, the invention contemplates, and it is an object thereof to provide a novel atomizer arrangement of the rotary type, wherein the fluid motive agent may be the coating material per se, either in liquid or powdered form.

A further object or feature of the invention is the provision of an atomizer head having rotary blades to be impinged by a fluid motive agent at a selective predetermined speed, and wherein the motive agent embraces the coating material per se in effective spray particles to be ultimately deposited onto the surface of an object.

Another feature or advantage of the invention is the provision of a mixing or preatomizing chamber for the coating material, wherein the liquid coating material is preatomized and supplied as the motive agent of the rotary or movable atomizer head, which atomizer head again may atomize or distribute and disperse the coating material to be ejected from the rotary atomizer head.

A further object is to provide a mixing chamber for combining a fluid under pressure and a liquid coating material for preatomizing or initially atomizing coating material by pneumatic force, which atomized material is to be sequentially used as an operating or motive agent and then collected and again atomized for deposition onto an object to be coated.

A further advantage or benefit of the invention is to provide electrode means, which are adjustable and positionable, to be used in conjunction with an electrostatic head or for independently electrostatically charging the material to be dispensed, to facilitate dispersion, and deposition, if desirable, of the particles after leaving the atomizer head.

Other objects, advantages or benefits of the invention may be or may become apparent to those skilled in the art from a perusal of the specification and drawings presented herewith.

The present invention in one form contemplates a novel rotary atomizer head, which may be used in conjunction with spraying generally or for coating an article or item with oil, paint, or powder material and by employing the coating material in either solid or liquid form to be embraced in a pressure system for impinging the blade of the rotary atomizer, so that the coating material, in fluid form, becomes the motive agent for rotating the atomizer per se at selective speeds. The operation is done by premixing the air and the oil, or paint, in such a way that the paint is vaporized, and then the vaporized material, still under pressure, is directed against the rotary blades of the atomizer head per se for rotating the atomizer head to provide centrifugal atomization of the collected preatomized coating material, so that it may be again atomized centrifugally from the force produced by the movement of the fluid coating material in a jet stream form as the motive agent for the atomizer head.

Further, the invention provides in another form a rotary atomizer in conjunction with a stationary receiver atomizer head, with the coating material being distributed therearound and pneumatically driven to the peripheral

edge of said stationary receiver atomizer head to be pneumatically atomized or projected in particle form and simultaneously electrostatically dispersed and pneumatically pattern-controlled.

The foregoing and other objects and advantages of the invention will appear more fully hereinafter from a consideration of the detailed description which follows, taken together with the accompanying drawings, wherein several embodiments of the invention are illustrated. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description, and are not to be construed as defining the limits of the invention.

In the drawings:

FIG. 1 is a sectional view partially shown in schematic form of an atomizer head of the invention used in conjunction with a preatomizing aspect of the invention;

FIG. 2 is a sectional plan view taken along lines 2-2 of FIG. 1, showing the relative position of the atomizer, the rotor blades of the atomizer, the feed tubes for the motive agent, and at least one independent feed tube for coating material;

FIG. 3 is a sectional view in elevation similar to FIG. 1, showing a modified embodiment of the invention; and

FIG. 4 is a top view taken substantially along lines 4-4 of FIG. 1, showing the circular electrode, which may be sectional.

Referring to the drawings, and more particularly to FIG. 1, there is shown a compressor air source and a paint source 20 and 21, respectively in block form, connected by communicating tubes, such as 23, and two fluid medium control valves, such as 25, into one form of a mixing section of tubing 27, connected into an enlarged mixing chamber or atomizing chamber 28, having a cylindrical side wall and a top and bottom closure portion, so that after the paint and air under pressure has been mixed in the mixing section 27 to provide a vapor of the atomized paint or other liquid material in the air under pressure, the vapor is fed through the port 29 into the larger mixing chamber 28, which latter chamber may be of any configuration suitable for receiving and developing the atomized coating material. An electrically insulative supporting structure 31 is shown in one form as a sleeve of insulating material fitted over the outside surface of the mixing chamber or preatomizing chamber 28. Ports 30 are formed in the mixing chamber 28 and the cylindrical insulating supporting structure 31, and have a pair of couplings, such as 33, on opposite sides thereof, which are fed into tubes 35 connected to couplings 37, which couplings 37 combine the tubes 35 with the jet tubes 39. The jet tubes 39 are secured onto the body 40 by means of brackets and screws 41 and have the lower end, which is opened, disposed and positionally directed toward the rotor blades 43. An inner centrifugal atomizer 47 is round in shape, and has an inclined edge terminating in a peripheral edge 49. The atomizer may have any peripheral edge configuration desired and may be disposed in a variety of planes, for the various edge portions which will vary with the material utilized. The inner atomizer 47 and the rotor portion having the blades 43, are held onto the outer portion of a threaded stem 50 by a nut 51 and a washer 52 and a collet 54 with one surface on the inner bladed rotor on the atomizer 47, in conjunction therewith. The outer centrifugal atomizer 55 terminates in an annular peripheral edge 56. The outer atomizer is secured to a flange of the rotor having the blades 43, by welding or screws in a conventional manner, so that the inner atomizer, shown in disc form, the outer atomizer and the rotor and blades are a composite unit removably secured onto the shaft

53, which shaft is mounted for rotational movement, in the body 40.

In FIG. 3, which is a modification having a double set of rotor blades, there is shown an inner blade rotor 60 having blades 43, and an outer blade rotor 61 having outer blades 62, with the number of blades in the outer rotor being the same as the number of blades on the inner rotor and with the respective blades of the outer and inner rotor being aligned for maximum efficiency, to receive sequentially the jet flow or fluid flow of coating material from the jet tubes, such as 39, so that the inner centrifugal atomizer, such as 65, which is secured on the shaft 66 by the nut 67, holds the parts in fixed relation with one another, so that they all rotate along with the centrifugal atomizer 65. The jet tubes 39 are connected by further tubes such as tubes 35 of FIG. 1 to a preatomizing chamber (not shown).

In FIG. 1, the inner atomizer may be made of either a conducting or nonconducting material, and the outer atomizer, having the peripheral edge 56, may also be constructed either of insulating or noninsulating material. In either event, either one or the other, or both, may be made of metallic portions or have provided means for charging the particleized coating material, or in the absence of any metallic means contacting and charging the coating material, an external electrode 85, such as that shown in FIG. 3, or 81, such as that shown in FIG. 1, or a comparable device or electrode, may be used for charging the coating material after it is ultimately atomized centrifugally, or atomized and emitted pneumatically, as would be the case in FIG. 3 with the stationary receiver atomizer head 82 under influence of the motive agent, at least in part.

In FIG. 3, the stationary receiver atomizer head may be metal, but in one version, it is made of insulating material and terminates in a peripheral edge 83, which may or may not be sharp, with said stationary receiver atomizer head 82 being secured to the body 40 in any convenient manner, such as an L-shaped bracket or clamping means, secured to the body member and the receiver atomizer head 82 by screws, pins, or the like.

In one form shown, an electrode 85 has four braces 86 having one end thereof secured equidistantly about the top edge and to said electrode 85. The braces 86 are secured conveniently to a sliding cylindrical sleeve 88, which is movably attached by screws 87 and slides on the outside of the body 40, which body 40, in FIG. 3, is shown having a cap or clamp 89 for assisting in holding the sleeve 88 in a fixed position on the body 40.

In FIG. 3, the shaft 66 is longitudinally and laterally held rotatably within the body 40 by any arrangement of bearings, such as the shaft-centering ball bearing assemblies 90, including the thrust bearing 91, for holding the shaft centrally relative to the centrifugal atomizer 65 and the stationary receiver atomizer head 82.

In FIG. 2, it will be seen that the blade carrier is shown relative to the rotor and rotor blades 43, so that when the jets 39 are fed by the atomized or other fluid motive agent, it leaves the jet in the direction of the arrow 92, to impinge the vents or blades of the rotor and be driven therethrough and thence projected outwardly in the direction of the arrow 93, so that the rotor is turned on its shaft 53 in the direction of the arrow 95.

In FIG. 4, the electrode 81 is shown as being in four segments, such as 97, each of which is connected to a supporting brace 98, and having one end of each secured by screws or welding to the electrode portion, such as 97, and the opposite end of said braces, each being bent to engage one of the brackets 100. There will be one bracket 100 extending outwardly from the side of the housing 40 for each brace 98, and with elongated slots in said bracket to slidably receive screws, such as 101, so that each of the electrode sectors, may be moved inwardly or outwardly. The sectors may be brought together

so that their adjacent edges will be contiguous to form a complete circle or annular electrode having the sharp corona edge 104. It will be noted that the sharp corona edge is directed with its cross-sectional axis generally in the radial spray plane 105 of the atomizer edge, so that the material, which is projected radially normally, will have the particles charged to facilitate movement of the atomized coating material in substantially the same radial direction as projected or emitted from the atomizing edge to charge and facilitate deposition electrostatically of the atomized or projected particles of fluid material.

In FIG. 3, the annular edge 106 from the annular electrode is directed so that it is substantially axially of the shaft 66, so that as the coating material is received on the inner surface of the stationary receiver atomizer head 82, which may be of conducting material but preferably may be of nonconducting material, is dispersed outwardly, preferably by a combination of pneumatic, centrifugal, and/or motive agent force after it has been centrifugally projected onto the inner surface of the atomizer head 82, the particles will be charged to urge the coating material substantially axially or, in the same general direction as moved pneumatically and as emitted from the inner surface of the stationary atomizer head 82. While pneumatic force is used, it may also be a hydraulic force of the motive agent in any form.

While pneumatic pressure is used for atomizing material, we have also successfully used hydraulic pressure to provide high velocity jet streams of coating material, which coating material impinges and acts as a motive agent for the bladed atomizer head.

While FIG. 1 shows two feed tubes 39 for feeding the vaporized coating material under pressure to act as a motive agent for the centrifugal atomizer, the same two feed tubes 39 shown in FIG. 3 without any external connection thereto, may have one feed tube 39 connected to pressurized air source and the other one may be connected to the mass liquid coating material source, which coating material may be sprayed or forcibly ejected against the rotor blades independently of the pressurized air, which may also be used as a motive agent for the atomizer. With the latter arrangement, the device may operate with two different fluid motive means. This distinguishes from the arrangement mentioned hereinbefore, wherein the mass of liquid material and the air under pressure fed from sources 21 and 20, respectively, are combined in pressure chamber, such as 27 and 28, which also acts as a distributing means and as multiple outlets for the vaporized coating material under pressure.

In FIGS. 1 and 2, feed tube 116 is shown. With this arrangement, a single feed tube 116 may be utilized for feeding the mass liquid coating material, and the two feed tubes 39 may be used exclusively for pressurized air as the motive agent. Feed tube 116 would be connected to a source of supply, such as 21, and used as an independent coating material feeding arrangement.

From the foregoing, it will be seen that the motive agent may be either a preatomized or vaporized mixture of coating material and a gas, such as air, or with a mass liquid coating material under pressure as a motive agent, or a gaseous motive agent may be used independently of the feed of the mass liquid coating material to be vaporized.

When the coating material is vaporized, as in FIG. 3, the centrifugally atomized material is dispensed against the stationary non-metallic shell or disc 82 to break the velocity of the atomized coating material and changes the direction of the atomized and projected coating material to conform to that of the contour of the deflector.

With the arrangement shown in FIG. 1, the disc 55, which is represented as metal in one form, may be of nonconducting material or semiconducting material. In the event of the disc 55 being of nonconducting material, then some external means for charging the atomized material would be employed. However, if the disc 55 is

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made of a partially conducting material or material having a partially conducting surface or high resistance surface, then the coating material may be charged in atomized form by the atomizer having metallic parts directly or indirectly coupled to a source of voltage. While a source of voltage is not specifically shown, it is to be understood that the electrodes, such as 81 or 85, are directly connected with a voltage source in a conventional manner, or the atomizer head may have metallic parts, such as the shaft, rotor, or atomizer 47 or parts thereof being made of a conducting material.

In FIG. 1, there are two atomizing chambers, wherein the air rushing past the column of paint from the compressed paint source is of sufficient length to cause the air to atomize the paint prior to being blown into the main chamber, to which is coupled the coupling 33. The couplings 33 of the tubes 35 are shown spaced up from the bottom of the mixing chamber 28. However, in actual practice, the tube 35 is coupled preferably to the very bottom of the mixing chamber, so that any condensation or restoration of the atomized material to a mass of paint will be avoided. When the tubes are at the bottom as they are in normal practice, the mixing chamber arrangement permits the atomized coating material to be blown directly outwardly from the tubes 35 for impingement against the rotor vanes or blades 43.

While the invention is described in detail as employing preatomization based on a pneumatic arrangement, it is to be understood that airless spraying may be employed wherein the liquid coating material may be subjected to a pressure between 2000 and 5000 p.s.i. With this latter arrangement, the hydraulic or airless spray will be utilized in the preatomizing arrangement and then used to drive the centrifugal atomizer in one form, or may be sprayed hydraulically into the preatomization chamber and then fed out through an outlet orifice having a controlled pattern and rate of flow as determined, at least in part, by the characteristics of the output port of the nozzle.

While the annular electrode has a sharp edge, and the disc also is shown as having a sharp edge, the invention is not limited thereto. The corona edge of the disc or electrode may be slightly curved or may be completely circular in cross-section, since any form of charging electrode may be used. The sharp edge being demonstrated is one form having improved efficiency. It is also to be understood that needles or projections may be used, and may employ a carrier electrode, whether it be annular or shaped otherwise.

In both FIGS. 1 and 3, the discs 55 and 82 respectively, may be insulated so that a metallic charging element of the rotary portion of the device may be used as a charging electrode and disposed within the physical confines of the insulated atomizer head. Where the insulated atomizer head is used, the electrode, such as 85, may be moved above or below the plane of the peripheral discharge edge, or may be eliminated entirely, with the coating material particles being electrostatically charged from a charged electrode or element, such as 61 and 65, to form a part of the rotor.

While the chamber 28 is shown in FIG. 1, it is to be understood that this particular chamber may be eliminated entirely and just the tube-chamber 27 may be employed for coupling to either one or both of the tubes 35. Further, the output of the tube-chamber 27 may be coupled to one tube 35 to provide a motive agent, and the other tube 35 may be coupled directly only to the compressed air source 21 with a valve control, so that the compressed air source may supplement the motive agent force to provide increased speed or better control of the rotary element to improve the centrifugal atomization resulting from operation of the rotary device.

In one form of the invention, there is pre-atomization, followed by accelerated atomization, and thereafter centrifugal atomization, and thereafter either further centrifugal atomization or motive agent atomization, as in

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FIG. 3. Accordingly, there is in both FIGS. 1 and 3, shown apparatus for atomization of the coating material four times before it becomes deposited on the article. Accordingly, the multiple atomization, which is actually quadruple atomization, creates a definite certainty that the coating material has been atomized a sufficient number of times to avoid any possibility of having slugs or large particles emitted from the ultimate atomizing surface.

The speed of rotation and the degree of atomization is dependent upon the pressure and volume of the coating material impinging the vanes inside the rotary disc.

Concerning the matter of accelerated atomization, this is a phase developed by the inventor so that the coating material in passing the blades 43 must of necessity be moved at the same r.p.m. or rotary speed as the coating material when it leaves the edge of the centrifugal atomizer. Without the accelerators, the coating material will frequently slide or skid completely over the surface of the disc and be projected without having sufficient rotary motion. Accordingly, it is desirable to have the coating material move at a rotational speed substantially the same as the rotational speed of the peripheral edge to improve centrifugal atomization.

While several embodiments of the invention have been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. Various changes may also be made in the design and arrangement of the parts without departing from the spirit and scope of the invention as the same will now be understood by those skilled in the art.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A spraying device comprising: a source of fluid material to be sprayed; a source of air under pressure; supporting means; a circular extending atomizer member mounted for free rotation about an axis passing through its center, said atomizer member being supported by said supporting means and having an obliquely inclined free peripheral edge portion; an annular rotor member connected to said atomizer member for rotation therewith, said rotor member being disposed interiorly of said free edge portion concentrically with said atomizer member, said rotor member comprising a regularly arranged series of angularly spaced blades the inner and outer ends of which terminate at radially spaced imaginary cylindrical surfaces coaxial with said axis, each of said blades having at least a portion which is inclined with respect to a radial plane passing through said axis and the particular blade, the inclination being uniform for all of said blades; preatomizing means connected to said sources for combining said fluid material and said compressed air to form an atomized mixture thereof; conduit means extending between said preatomizing means and a location within said rotor member, said conduit means directing said mixture outwardly of said rotor member between the blades of said rotor member and over said atomizer member to drive said rotor and atomizer members as a unit; and generally annular electrode means located concentrically with said axis beyond the periphery of said atomizer member for electrostatically guiding the atomized material which has passed over said free edge portion.

2. A spraying device according to claim 1, wherein said axis is vertical and in which said obliquely inclined free edge portion of said atomizer member is upwardly and outwardly inclined, said device further comprising an inverted circular dish-shaped member extending over said rotor member and atomizer member concentrically therewith, said inverted member having a downwardly and outwardly inclined periphery, said inverted member receiving material from said atomizer member, said electrode means being located exteriorly of said inverted member.

3. A spraying device according to claim 2, wherein said inverted member is connected for rotation as a unit with said atomizer and rotor members.

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4. A spraying device according to claim 2, wherein said inverted member is supported separately and spaced from said atomizer and rotor members.

5. A spraying device according to claim 1 wherein said electrode means is segmented, said device further comprising individually adjustable supporting means for each segment.

6. A spraying device according to claim 1, wherein said electrode means has a sharp corona edge for enhancing said guiding of said atomized material.

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