

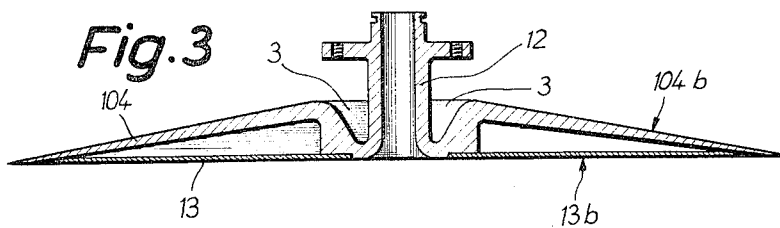
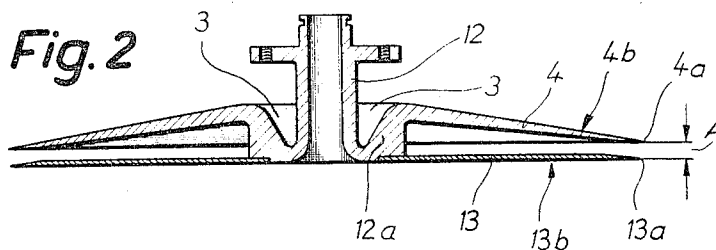
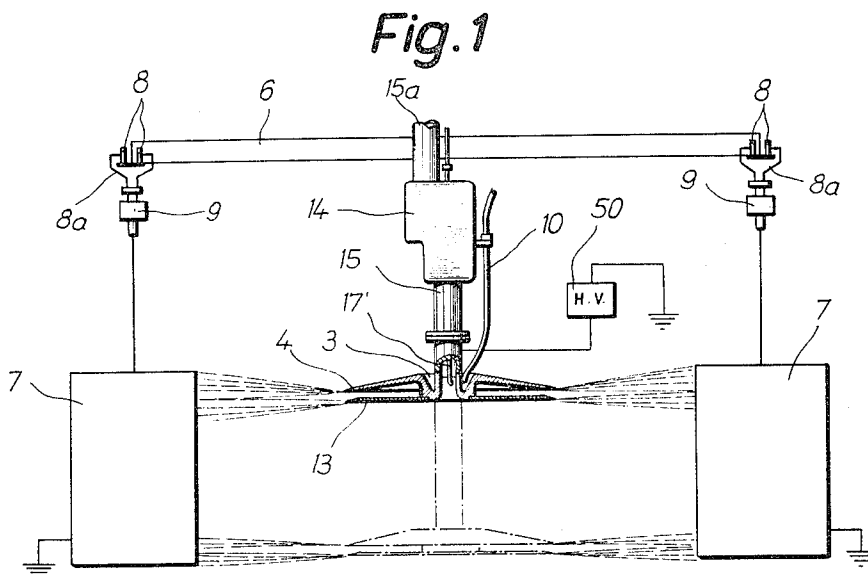
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ELECTROSTATIC PAINTING APPARATUS

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1

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ELECTROSTATIC PAINTING APPARATUS
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Continuation-in-part of application Ser. No. 472,650,
July 16, 1965, now Patent No. 3,358,971, dated
Dec. 19, 1967. This application June 12, 1967,
Ser. No. 645,300

Claims priority, application Germany, Oct. 4, 1966,
B 89,190

The portion of the term of the patent subsequent to
Dec. 19, 1984, has been disclaimed
Int. Cl. B05b 5/08

U.S. Cl. 239—15

10 Claims

ABSTRACT OF THE DISCLOSURE

An atomizer array for use in electrostatic painting apparatus. Includes two annular sprayers which are rotated about a common vertical axis and whose spraying edges may but need not be spaced axially from each other. The annular surfaces which deliver paint to the respective spraying edges converge radially outwardly so that the distance between the radially outermost portions of such surfaces is less than between the radially innermost portions.

CROSS-REFERENCE TO RELATED APPLICATION

The present application is a continuation in part of my copending application Ser. No. 472,650 filed July 16, 1965 and entitled "Painting Apparatus" now patent No. 3,358,931 granted December 19, 1967.

BACKGROUND OF THE INVENTION

The present invention relates to improvements in electrostatic painting apparatus, and more particularly to an improved multiple-head atomizer array for use in such painting apparatus.

My aforementioned copending application Ser. No. 472,650 discloses a painting apparatus wherein the atomizer array comprises two or more substantially disk-shaped atomizer heads or sprayers which are disposed in axially spaced parallel planes. One annular surface of each sprayer receives paint from one of a series of separate sources, or each such surface may receive the same type of paint. The paint creeps radially outwardly toward the edges of the respective sprayers to form a mist or spray of finely atomized particles which can be applied to the surfaces of travelling articles.

An electrostatic painting apparatus with two or more atomizing heads or sprayers is further disclosed in U.S. Patent No. 2,894,485. In this apparatus, the atomizing heads rotate about parallel axes and their annular surfaces resemble conical frusta of identical taper.

It is an important object of my invention to provide an atomizer array which can be used in electrostatic painting apparatus to improve the operation of such apparatus, particularly as regards the uniformity of the spray produced by a plurality of atomizing heads.

Another object of the invention is to provide an atomizer array which can blend a plurality of different paints with greater uniformity than was possible heretofore, and wherein electrostatic charging of atomized particles is of advantage not only because it promotes travel of particles toward the articles or commodities to be painted but also because it promotes the blending of different types of paint.

A further object of the invention is to provide a simple, compact and relatively inexpensive atomizer array whose heads may be installed and/or removed as a unit and which

2

can be installed, with minor alterations, in certain presently known electrostatic painting apparatus.

An additional object of the invention is to provide an electrostatic painting apparatus which can be converted for spraying of different types of liquids, not only as regards the color but also as regards the consistency of such substances.

SUMMARY OF THE INVENTION

Briefly outlined, one feature of my invention resides in the provision of an electrostatic painting apparatus for spraying paint, particularly for applying lacquer to travelling housings of household refrigerators or like commodities. The painting apparatus comprises an atomizer array which includes coaxial upper and lower sprayers or atomizer heads respectively provided with circular atomizing edges and radially outwardly converging annular surfaces which are surrounded by the respective spraying edges, separate feeds for supplying paint to the surfaces of the upper and lower sprayers, and drive means for rotating the sprayer, preferably about a vertical axis.

Convergence of the annular surfaces can be achieved by placing one of the surfaces into a horizontal plane and by imparting to the other surface the shape of a cone, or by resorting to two conical surfaces.

The spraying edges may be spaced from each other in the axial direction of the sprayers or the two edges may abut against each other to discharge a single annular spray of paint in response to rotation of the sprayers. The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved painting apparatus itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic side elevational view of an electrostatic painting apparatus which embodies one form of my invention, the atomizer array being shown in axial section;

FIG. 2 is an enlarged axial sectional view of the atomizer array which forms part of the apparatus shown in FIG. 1; and

FIG. 3 is an axial section through a modified atomizer array wherein the spraying edges of the two sprayers abut against each other to form a single annular spray.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1, there is shown an electrostatic painting apparatus which includes a novel atomizer array including a plurality of coaxial atomizer heads or sprayers. In the illustrated embodiment, the array comprises only two coaxial sprayers 4 and 13 best shown in FIG. 2. The drive for rotating the sprayers about a common vertical axis includes a vertical tube 12 whose upper end is provided with a flange bolted to the lower end of a tubular output shaft 15 forming part of a variable-speed transmission 14. The input shaft 15a of the transmission 14 is driven by a motor, not shown. The entire drive is reciprocable up and down to move the sprayers 4, 13 of the atomizer array between the solid-line and broken-line positions of FIG. 1. The reciprocating unit is of known design and is not shown in the drawings. Reference may be had, for example, to the aforementioned Patent No. 2,894,485.

In the embodiment of FIGS. 1 and 2, the tube 12 is integrally connected with the upper sprayer 4 by means of an annular receptacle 12a which is formed with an annular chamber 3. The deepest portion of the cham-

ber 3 is immediately adjacent to the external surface of the tube 12 and the depth of this chamber at least equals but may exceed 10 mm.

The circular spraying edge 4a of the upper sprayer 4 surrounds an annular surface 4b at the upper side of this sprayer, and the radially innermost portion of the surface 4b merges gradually into the surface surrounding the chamber 3. It will be seen that the surface 4b slopes downwardly and outwardly toward the spraying edge 4a and resembles the frustum of a cone. The lower sprayer 13 resembles a flat disk or washer and is preferably detachably connected to the tube 12. The annular surface 13b at the underside of the sprayer 13 is surrounded by a circular spraying edge 13a which is axially spaced from the spraying edge 4a by a distance A. It was found that the distance A need not exceed 20 mm. and is preferably less.

An important feature of my invention is seen to reside in that the annular surfaces 4b and 13b converge in a direction radially outwardly, i.e., away from their common vertical axis so that the distance A is less than the distance between the radially innermost portions of such surfaces. This can be achieved by resorting to sprayers with conical surfaces which taper in the same direction or in opposite directions, or by using a plane surface and a conical surface.

The painting apparatus further comprises separate feeds for supplying paint to the surfaces 4b and 13b. The first feed includes a hose or pipe 10 which is supported by the housing of the transmission 14 and whose outlet discharges paint (e.g., lacquer) into a radially innermost portion of the channel 3 which is remotest from the annular surface 4b. The second feed includes a pipe 17' which extends through the shaft 15 and has a nozzle discharging paint against the internal surface of the tube 12 adjacent to the annular surface 13b. Such paint flows along the internal surface of the tube 12 and creeps along the surface 13b in response to rotation of the pipe 12 to be atomized at the edge 13a and to form a mist or spray directed toward the articles 7 which orbit about the shaft 15.

The apparatus of FIG. 1 comprises a suitable conveyor which circulates the articles 7 about the atomizer array. This conveyor comprises a circular track 6 for rollers 8 provided on carriages 8a. Each carriage 8a supports an article 7 (e.g., the housing of a household refrigerator which is to be provided with a coat of lacquer), and each such carriage further comprises a suitable turning device 9 which changes the angular position of the respective article, either intermittently or continuously, while the article travels beneath the track 6. In this way, the sprayers 4 and 13 can coat all sides of the articles 7. The exact construction of the prime mover which causes the carriages 8a to travel along the track 6 and of the turning devices 9 forms no part of my present invention.

The spraying or coating operation is preferably carried out in an electrostatic field. The sprayers 4, 13 are connected to one pole of a source 50 of high-voltage D-C current and the articles 7 are connected to the other pole, for example, to the ground.

FIG. 3 shows a modified atomizer array wherein the inclination of the annular surface 104b on the upper sprayer or atomizer head 104 is more pronounced than in FIG. 2. Furthermore, the lower sprayer 13 is nearer to the sprayer 104 so that their spraying edges abut against each other. Thus, the array of FIG. 3 can be said to have a single spraying edge which receives paint from two surfaces 104b, 13b. If desired, the annular surface 13b may taper radially outwardly and upwardly so that each of the surfaces 104b, 13b resembles a cone. For example, the inclination of the surface 104b may be in the range of about 10 degrees and the inclination of the surface 13b may be about 5 degrees. The sprayers 104, 13 can be made of one piece.

It is clear that the underside of the upper sprayer 4

or 104 need not be inclined downwardly and outwardly, as long as the surfaces 4b, 13b, or 104b, 13b converge in a direction toward the spraying edges.

An important advantage of my atomizer array with outwardly converging annular liquid-conveying surfaces is that the two sprays can be intimately mixed with each other, especially if the spraying edges actually abut against each other in a manner as shown in FIG. 3. Each of the sprayers may atomize a different type of paint, or the pipes 10, 17' may furnish the same type and color of liquid material, such as lacquer or the like. The intermixing of both sprays is very satisfactory irrespective of whether the spraying edges are in actual contact with each other or define between themselves a gap. It was found that the atomizer array of my invention can be used with advantage for simultaneous application of two types of liquid coats which must be intimately mixed with each other prior to reaching the surfaces of the articles. Moreover, the entire array may be removed or reinstalled in a single operation because the two sprayers are preferably rigidly secured to each other. The apparatus may be furnished with a set of two or more atomizer arrays, for example, with the arrays shown in FIGS. 2 and 3.

Electrostatic charging of atomized particles also contributes to an improved mixing effect. Since the sprayers 4, 13 or 104, 13 are connected to the same pole of the source 50, the particles leaving the spraying edges first repel each other and are caused to mix at an optimum distance from the sprayers.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of my contribution to the art.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

I claim:

1. Electrostatic painting apparatus for spraying atomized paint, particularly for applying lacquer to housings of refrigerators or other types of articles, comprising an atomizers array which includes discrete coaxial upper and lower sprayers respectively provided with pronounced first and second circular atomizing edges and substantially radially outwardly converging first and second outer annular surfaces surrounded by the respective edges; first and second feeds for respectively supplying paint to said first and second outer annular surfaces, respectively; and drive means for rotating said sprayers.

2. Painting apparatus as defined in claim 1, wherein said drive means includes a tube coaxial with and surrounded by said sprayers and a receptacle provided on said tube within said upper sprayer, said receptacle having an annular chamber and said first annular surface being located at the upper side of said upper sprayer to receive a film of paint from said chamber in response to rotation of said receptacle with said tube, said first feed having an outlet arranged to discharge paint into that portion of said chamber which is remotest from said first annular surface.

3. Painting apparatus as defined in claim 2, wherein the depth of said chamber, as considered in the axial direction of said sprayers, at least equals 10 mm.

4. Painting apparatus as defined in claim 2, wherein said second annular surface is provided at the underside of said lower sprayer and said second feed includes a portion extending through said tube to supply paint to said second annular surface.

5. Painting apparatus as defined in claim 1, wherein said spraying edges are spaced from each other in the axial direction of said sprayers and wherein the distance between said spraying edges at most equals 20 mm.

6. Painting apparatus as defined in claim 1, wherein said spraying edges are immediately adjacent to each other.

7. Painting apparatus as defined in claim 1, wherein

5

said sprayers are rotatable about a vertical axis and wherein one of said annular surfaces is located in a horizontal plane, the other annular surface being of conical shape.

8. Painting apparatus as defined in claim 1, wherein the diameters of said spraying edges are substantially identical and wherein one of said sprayers is separably supported by the other sprayer. 5

9. Painting apparatus as defined in claim 1, wherein said drive means is arranged to rotate said sprayers about a vertical axis and at the same speed, and wherein said first annular surface slopes downwardly toward said first spraying edge. 10

10. Painting apparatus as defined in claim 1, wherein a portion of said drive means is integral with one of said 15 sprayers.

6

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10 EVERETT W. KIRBY, Primary Examiner

U.S. Cl. X.R.

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