Sept. 25, 1956 J. W. JUVINALL 2,764,125

ELECTROSTATIC ATOMIZING AND COATING APPARATUS

Filed Feb. 14, 1952

4 Sheets-Sheet 1

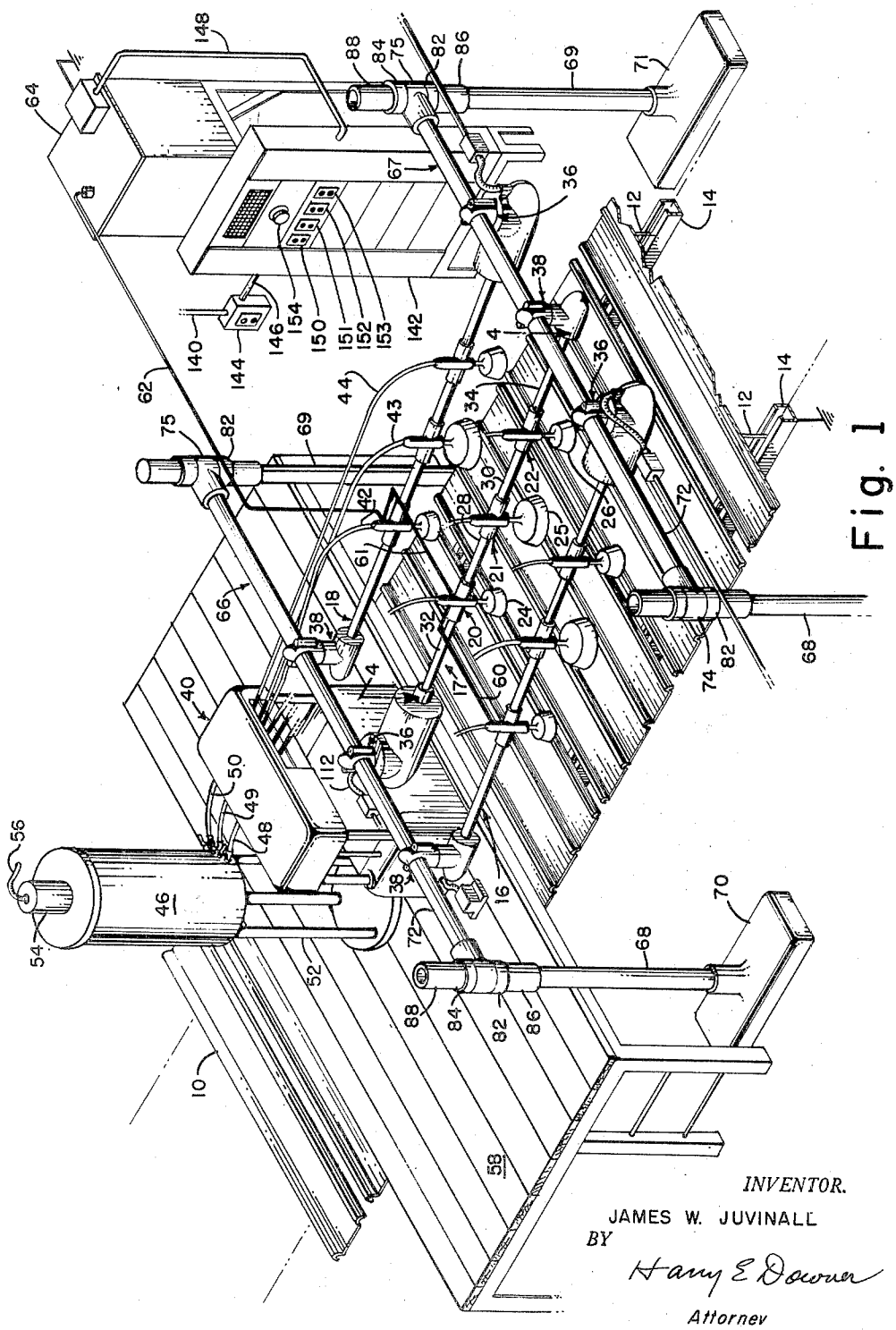

Fig. 1

INVENTOR.

JAMES W. JUVINALL

BY

Harry E. Downer

Attorney

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Filed Feb. 14, 1952 4 Sheets-Sheet 2

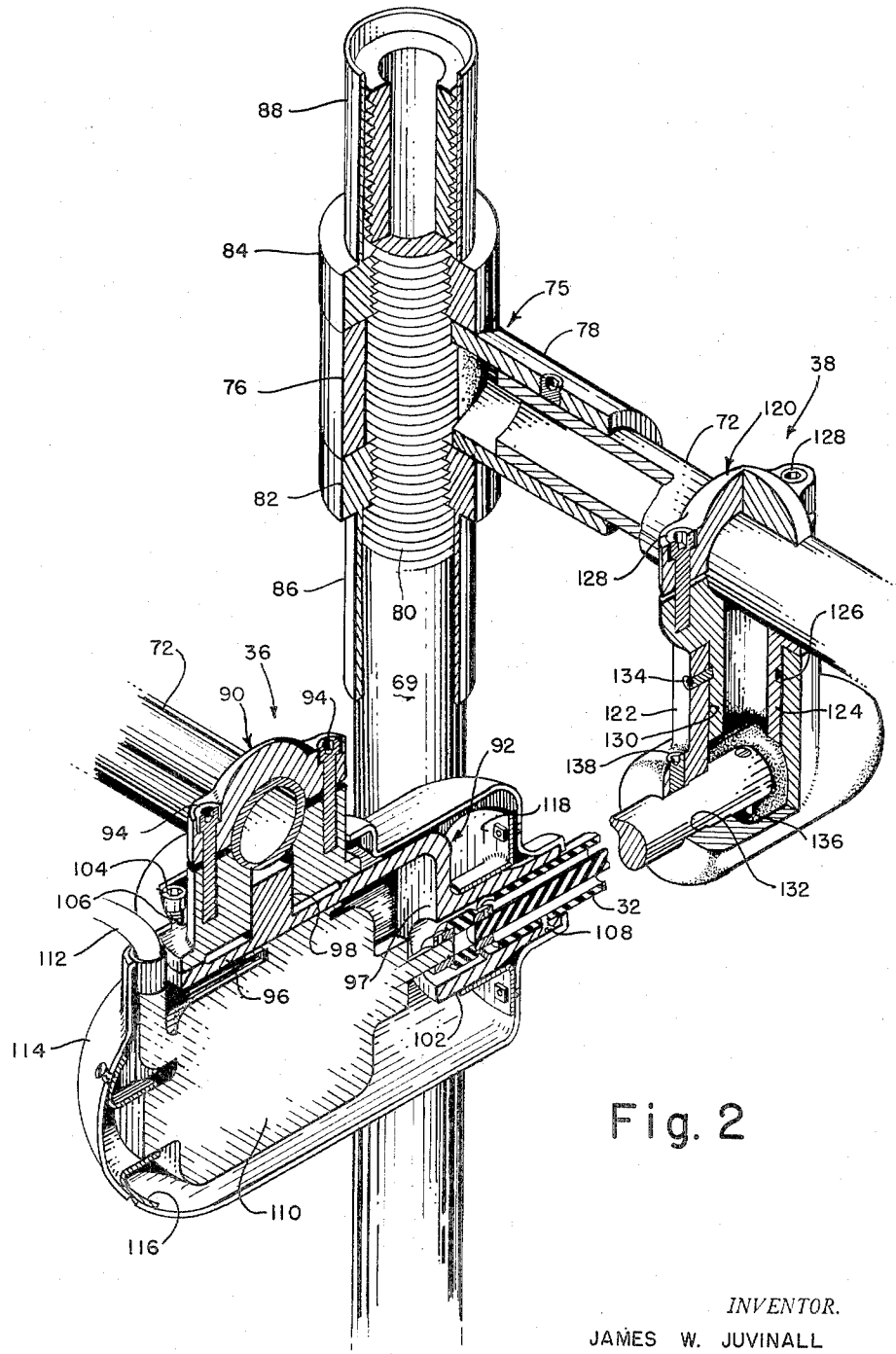

Fig. 2

INVENTOR.
JAMES W. JUVINALL
BY
Harry E Downer
Attorney

Sept. 25, 1956 J. W. JUVINALL 2,764,125

ELECTROSTATIC ATOMIZING AND COATING APPARATUS

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4 Sheets-Sheet 3

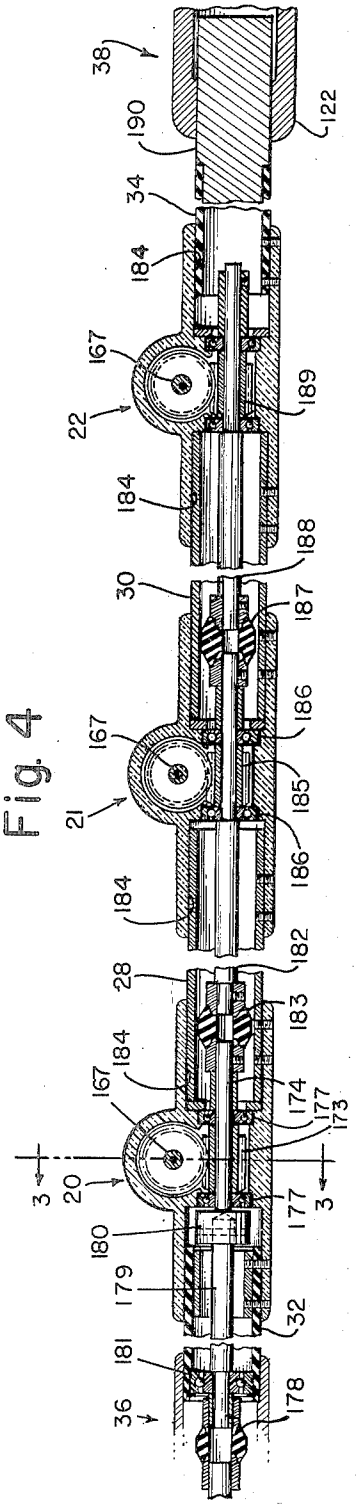

Fig. 4

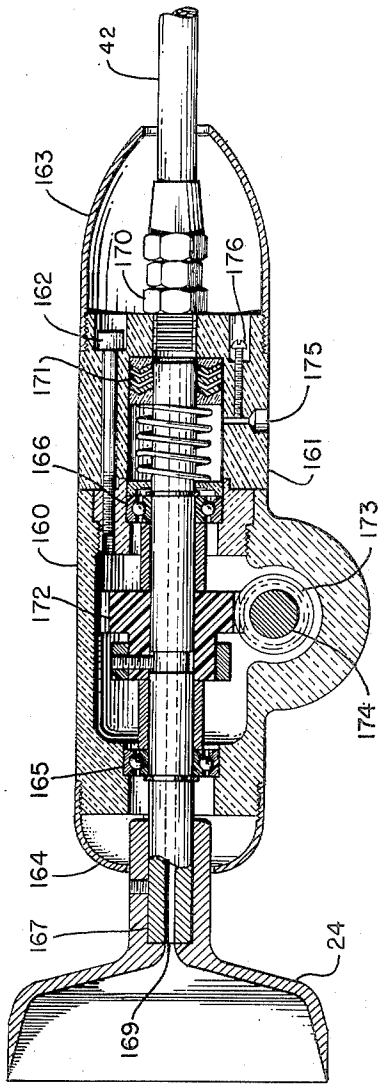

Fig. 3

INVENTOR.
JAMES W. JUVINALL
BY
Harry E Downer
Attorney

Sept. 25, 1956 J. W. JUVINALL 2,764,125

ELECTROSTATIC ATOMIZING AND COATING APPARATUS

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4 Sheets-Sheet 4

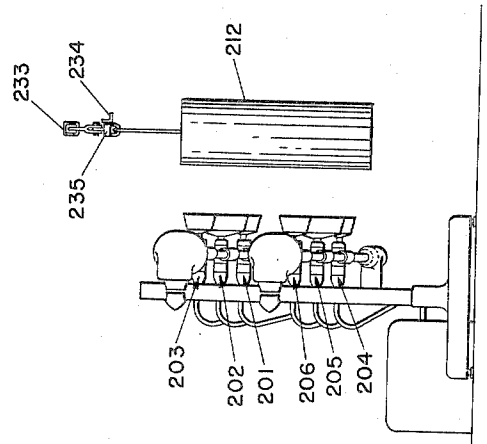

Fig. 7

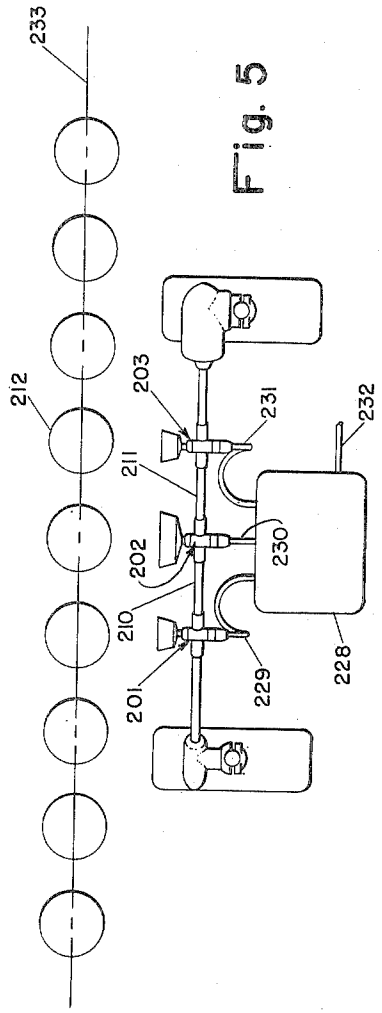

Fig. 5

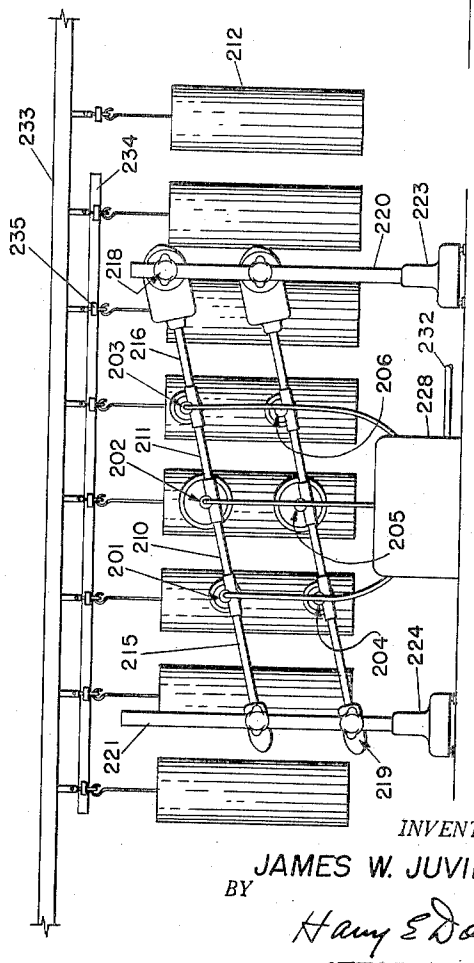

Fig. 6

INVENTOR.
JAMES W. JUVINALL
BY
Harry E Downer
ATTORNEY

United States Patent Office 2,764,125
Patented Sept. 25, 1956

2,764,125

ELECTROSTATIC ATOMIZING AND COATING APPARATUS

James W. Juvinall, Indianapolis, Ind., assignor to Ransburg Electro-Coating Corp., a corporation of Indiana

Application February 14, 1952, Serial No. 271,625

19 Claims. (Cl. 118—313)

This invention relates to apparatus for spray-coating articles. More particularly it is directed to the adjustment of one or more atomizing heads of such apparatus for obtaining desired coating material distribution on articles to be coated and to the adjustment of the atomizers of coating apparatus when an electric field is established over the surface of the article to aid in the precipitation of coating material.

In the coating art the problem of obtaining a desired coating material distribution over the surface of an article to be coated has been a major one which can only be solved after the atomizers of the apparatus are readily adjustable to all positions with respect to the surface being coated and are easily fixed in any position to which they can be adjusted. This is particularly true where the surface being coated is extended and the number of atomizers is large.

More recently it has been found desirable to utilize electrostatic fields in cooperation with coating apparatus wherever possible because of high coating efficiences obtained by such apparatus. However, the problem of coatting material distribution and the adjustment of atomizers also exists in this case.

That form of such coating apparatus which yields the highest coating efficiences includes one or more discharge devices which are maintained at high voltage. Such device may comprise a discharge member such as a bell having the form generally of a hollow cone and which may be mounted in series for rotation about the principal axis of the cone. Suitable apparatus may be provided for mounting the bell opposite an object having a surface to be coated. Simultaneously with the rotation of the bell, coating material may be injected through an orifice at the apex of the bell, the coating material flows in the form of a film over the inner surface of the bell to its outer periphery from where it is atomized in the form of a spray. The electrostatic field that exists between the discharge member and the surface to be coated effects the deposition of the spray on the article. When a stationary flat sheet of material to be coated is disposed opposite to such bell, a spray pattern is precipitated thereon which is in the form of an annulus or doughnut devoid of coating material at its center. When the flat sheet is moved with respect to the atomizing head, the pattern of this form produces on the surface a coated area of non-uniform film thickness whereby there is a thick band of coating material at either edge and a relatively thin band of coating material in the center.

Due to the non-uniform material distribution obtained from such single bell type atomizers, their utilization in some instances have been restricted notwithstanding the high coating efficiencies which can be obtained through the use of apparatus incorporating such atomizers.

To supplement the deficiencies of such single heads, additional heads are used in overlapping relationship to each other and in this way large areas can be uniformly coated. Such combining of many bell-type atomizers requires free movement of such atomizers relative to the surface being coated and accurate control over the positions of such atomizers when they are in final or combined position.

Accordingly it is the principal object of this invention to provide novel coating apparatus for coating surfaces of extended area more uniformly and with high efficiency.

Another object of this invention is to provide novel electrostatic coating apparatus adapted to form a coating of desired distribution.

Still another object of this invention is to provide in an electrostatic coating apparatus using a plurality of atomizers a supporting mechanism providing ready adjustment of those atomizers with respect to each other and with respect to a surface to be coated and permitting the sprays from the plurality of atomizers to be combined to obtain a coating of desired distribution on the surface to be coated.

A further object of the present invention is to provide a novel, multiple atomizer coating apparatus which is simply and conveniently adjusted to permit coating article surfaces which vary in dimension and shape from run to run and also which is of rigid construction and is adapted to remain in a predetermined adjusted condition from run to run.

Still a further object of this invention is to provide, in an electrostatic coating apparatus using a plurality of rotating atomizing heads, electrically insulated driving connections adapted to permit the driving of said heads from a single electrically grounded motor.

A still further object of this invention is to provide electrostatic coating apparatus in which the electrostatic atomizing head or heads are electrically insulated from ground and to which electrically conducting coating materials may be fed without electrically grounding the atomizing head or heads.

A still further object of this invention is to provide novel means for supporting a plurality of multiple head atomizing units which permit coincident adjustment of the atomizing units and also separate adjustment of each such unit relative to the surface being coated.

In accordance with one feature of this invention there is provided an atomizing unit comprising a support, a plurality of discharge devices rotatably mounted on the support, and driving mechanism connected to each of the discharge devices for rotating such devices.

In accordance with another feature of this invention there is provided an atomizing apparatus comprising a stand, a support mounted on the stand, one or more rotating atomizing heads mounted on the support and adjustable connections between the stand and support for providing adjustment of the atomizing heads.

In accordance with another feature of this invention, there is provided an apparatus for coating a surface of an article comprising a stand adjacent the article to be coated, one or more atomizing units each of which includes one or more discharge devices, and adjustable connections between the units and the stand to permit uniform adjustment of the discharge device or devices relative to the surface being coated.

For a better understanding of the invention, together with other and further objects thereof, reference is made to the following description, taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is an isometric view of a multiple head electrostatic coating apparatus illustrating one embodiment of my invention.

Figure 2 is an enlarged isometric view partly in section of a portion of the apparatus shown in Figure 1 illustrating the adjusting mechanism for an atomizing unit.

Figure 3 is a cross-sectional view taken on line 3—3 of Figure 4 with certain parts omitted.

Figure 4 is a cross-section taken on line 4—4 of Figure 1 with certain parts omitted.

Figure 5 is a top plan view of a multiple head electrostatic coating apparatus illustrating another embodiment of my invention.

Figure 6 is a side elevation view of the apparatus illustrated in Figure 5.

Figure 7 is an end view of the apparatus illustrated in Figure 5.

While one form of atomizing unit and two forms of apparatus for adjustably supporting one or more atomizing units are illustrated in the drawings and will be described hereafter as providing a coating of desired distribution on a surface, it will be understood that these are representative embodiments only. It will also be understood that forms of atomizing units other than the particular atomizing unit shown may be utilized, that the atomizing unit may comprise more or less than the three atomizing heads shown, and that forms of adjustable supporting apparatus other than the particular adjustable supporting apparatus shown may be utilized; and it is to be understood that no limitations are to be implied from such specific description as is now provided.

Referring to the drawings, particularly to Figure 1 thereof, there is provided in accordance with one embodiment of my invention a plurality of articles **10** supported on supports **12** for movement over a predetermined path past coating apparatus by means of a conveyor **14**.

The coating apparatus comprises a plurality of atomizing units, **16**, **17** and **18**. Each atomizing unit comprises three atomizers **20**, **21** and **22**, which include atomizing heads or discharge devices **24**, **25** and **26**, respectively, in the form of rotatable bells. As illustrated, the bells **24** and **26** may be of a smaller size than the bells **25**. The size of the bells may be selected so that when they are properly adjusted relative to each other and the articles being coated a coating pattern will be provided for obtaining a coating of uniform thickness on the articles being coated. The bell portions of these atomizers is being claimed in the copending U. S. application Serial No. 229,247, filed May 24, 1951.

Atomizers **20**, **21** and **22** are connected together structurally by means of electrically conductive shaft housings **28** and **30**. For supporting the atomizers and housings of each atomizing unit and insulating them from ground, shaft housings **32** and **34** at least partially of electrically insulating material, are connected to the atomizers **20** and **22**, respectively, and supports or connectors **36** and **38**, respectively. Thus, there is provided an electrically insulated multiple head atomizing unit.

For supplying coating material such as paint, enamel, and the like to the atomizing heads of each unit **16**, **17** and **18**, there is provided a pump **40** which conveniently may be insulated from ground and which may be connected to each head by a separate pipe. For the sake of simplicity only pipes **42**, **43**, and **44** connecting the heads **20**, **21** and **22**, respectively of atomizing unit **18** with pump **40** are shown. The pump **40** is supplied with coating material from container **46** by means of pipes **48**, **49** and **50**. If desired, the container **46** may be insulated from ground by means of legs **52** made of electrically insulating material. The container **46** may be provided with an air driven agitator **54** for mixing the coating material. The agitator may be energized by means of air from hose **56**. Both container **46** and pump unit **40** may conveniently be supported on platform **58**, which bridges the conveyor **14**.

The bells of each of the atomizing units **16**, **17** and **18** are maintained at an electrical potential, for example 90,000 volts, by means of conductors **60**, **61** and **62**, which are connected to one terminal of high voltage pack **64** while the other terminal of the high voltage pack as well as the articles **10**, through the conveyor **14**, are electrically grounded as indicated. Thus a high voltage electrostatic field is established between the bells of each of the atomizing units **16**, **17** and **18** and the articles **10**.

For connecting the atomizing units **16**, **17** and **18** to permit their adjustment in a plane parallel to the path of article movement as well as normal thereto, there are provided frames **66** and **67** which bridge the conveyor **14** at spaced locations along its path of movement. Each frame comprises a pair of standards **68** and **69** mounted on bases **70** and **71**, respectively, and a tube slidably connected to the standards **68** and **69** by brackets **74** and **75**, respectively.

Referring to Figure 2, the bracket **75** comprises tubular section **76** slidably mounted on the standard **69** and a socket **78** for receiving one end of the tube **72**. In order to adjustably move bracket **75** and the tube **72** connected thereto along the standard **69**, the upper portion of the standard **69** is threaded as shown at **80**. Adjustable member or nut **82** is threadedly mounted on the standard **69** below the bracket **75**. A stabilizing nut **84** is provided above sleeve **76** and threaded on threads **80**. By withdrawing nut **84** and rotating the adjustable nut **82** the bracket may be adjusted upwardly or downwardly along the standard **69** in any desired position. This results in adjusting the atomizing units **17**, **18**, and **19** toward and away from the articles **10** on the conveyor. By rotating the stabilizing nut **84** into engagement with the bracket **75**, it functions to hold the bracket **75** rigid relative to the standard **69**. The adjustable and stabilizing nuts **82** and **84** may be provided with shields **86** and **88**, respectively, to maintain the threaded portion **80** of the standard **69** in a clean condition.

The supports **36** and **38** of each atomizing unit are connected to the tubes **72** of the frames **66** and **67** and permit adjustment of each atomizing unit in a plane parallel to the path of movement of the articles **10**. Referring to Figure 2, the support or connector **36** for adjustably supporting atomizing unit **17** comprises clamp **90** and angle member **92**. The clamp **90** is mounted on the tube **72** of frame **66** for adjustable movement along the tube **72** and is adapted to be fixed in any desired position by the screws **94**. The angle member **92** comprises sections **96** and **97** which are at an angle to each other. Section **96** is provided with pin **98**, and section **97** is provided with socket **102**. The angle member **92** is connected to the clamp **90** by screw **104** which extends through arcuate opening **106** in the lower portion of the clamp. This connection permits pivoting the angle member **92** about the axis of the pin **98** for any desired adjustment and also permits fixing the angle member **92** relative to the clamp by tightening screw **104** after the proper adjustments have been made. The socket **102** supports the housing **32** of the atomizing unit **17**, which is fixed in the socket by screw **108**. A motor **110** is affixed to the section **96** in a suitable manner and functions to drive the bells of the atomizing unit **17** in a manner to be described in greater detail hereafter. The motor **110** is connected to a source of power (not shown) by means of conductor **112**. The connector **36** and the motor **110** are enclosed by a housing **114** which has smooth contours and preferably is of electrically insulating material. The housing **114** is supported on the motor **110** and the socket **102** by means of mounting sleeves **116** and **118**, respectively.

The adjustable connector **38** comprises clamp **120** and swivel member **122**, both of which are formed to present a smooth uniform contour to reduce to a minimum any field reducing effect these parts may have on the atomizing field at the discharge devices and to facilitate in keeping these parts clean. Clamp **120** is provided at its lower end with a tubular section **124** in the outer peripheral wall of which there is formed annular groove **126**. This clamp is mounted on the tube **72** of frame **67** for adjustable movement along the tube **72** and is adapted to be fixed in any desired position by the screws **128**. The swivel member **122** is provided with sockets **130** and **132** formed perpendicular to each other and is

swivelly mounted on the clamp **120** by screw **134**, which connects sockets **130** and the tubular section **124** and is adapted to move in the groove **126**. After the swivel member **122** is adjusted as desired, it may be fixed in this position by tightening the screw **134**. The socket **132** slidably supports the member **34** of the atomizing unit **17**. Screw **136** is provided on the end of the member **34** to prevent it from slipping out of the socket **132** during adjustment. After adjustment of the atomizing unit **17** relative to the swivel member **122** is accomplished, the member **34** is fixed in position relative to the socket **132** by means of screw **138**.

Referring again to Figure 1, the electrical power for energizing the high voltage pack **64**, the bell motors **110**, the pump unit **40**, and the conveyor **14** is supplied from a source (not shown) by means of conductor **140** which is connected to a control panel **142** through master switch **144** and conductor **146**. The control panel distributes the electrical power to the high voltage pack **64** by means of conductor **148**. The connection of the control panel **142** to the bell motors **110**, pump unit **40**, and to the conveyor **14** are not shown. The switches **150**, **151**, **152** and **153** on the control panel function to energize and deenergize the high voltage pack, the bell motors, the pump unit, and the conveyor, respectively. Also the control panel may be provided with a control knob **154** for varying the voltage of the discharge devices of each of the atomizing units **16**, **17** and **18**.

Referring to Figure 3 of the drawings, each of the atomizers **20**, **21** and **22** of each atomizing unit is substantially identical in construction. Therefore, atomizer **20** will be described as typical. The atomizer includes a gear housing **160**, a seal housing **161** bolted thereto by means of a suitable bolt **162**, a rear end cover **163**, and a front end cover **164**. Covers **163** and **164** are formed to present a smooth, uniform contour to reduce to a minimum any concentration of electrostatic field on these parts. Within the gear housing **160** there are provided bearings **165** and **166** for rotatably supporting the drive shaft **167** upon which the bell **24** may be suitably mounted on the front end thereof.

Shaft **167** is provided with a passage **169** for supplying paint or other coating material to the interior surface of the bell **24**. For coupling the passage **169** to one of the pipes, such, for example, as the pipe **42**, there is provided a coupling member **170** which may be threaded or otherwise attached to the seal housing **161**. For sealing the shaft so that coating material will not leak from the space between coupling **170** and the end of shaft **167**, there are provided a plurality of chevron seals **171**. In this manner the coating material may be piped into a rotating shaft without danger of leakage.

For driving the shaft **167** there is fixed thereto a helical gear **172** which is adapted to mesh with a pinion gear **173** fixed on a drive shaft **174**. Shaft **174** is rotatably supported in a manner that will be described subsequently.

For permitting electrical connection of the assembly to the voltage pack **64** there is provided a plug receiving aperture **175** and a set screw **176** for engaging the plug to retain it within the aperture. Since all of the atomizers on one atomizing unit are connected electrically by housing **28** and **30** only a single electrical connection to a single atomizer is necessary.

Referring to Figure 4 of the drawings, it will be noted the shaft **174**, mounted in bearings **177**, may be driven from the motor **110** within the housing **114** by means of a coupling **178** connected to the motor and to a shaft **179** made of insulating material and extending from the motor coupling to the coupling **180** within housing **160**. Shaft **179** may be rotatably mounted by means of bearing **181** which is in turn mounted within the insulating housing **32**. Thus the motor **110** may drive shaft **174** through shaft **179**. Shaft **174** is in turn coupled to shaft **182** by means of a flexible coupling **183**. The electrically conducting shaft housing **28** in the form of a metallic cylinder extends from the atomizer **20** to the atomizer **21**.

Shaft **182** extends along the axis of the housing **28** from the coupling **183** to atomizer **21** whereby there is a driving connection between atomizers **20** and **21**. Each of the atomizers is formed to provide sockets **184** for receiving the ends of shaft housings **28**, **30**, **32** and **34** whereby the atomizers may be supported by the housings.

Atomizer **21** comprises substantially the same structure as atomizer **20**, shaft **182** having attached thereto a helical gear **185** and being supported by means of bearings **186**. Gear **185** corresponds to gear **173** of atomizer **20**. Shaft **182** extends through the assembly to the flexible coupling **187** which may be attached to another drive shaft **188**. Shaft **188** extends through the electrically conductive housing **30** to the atomizer **22** and terminates therein. The shaft **188** is provided with helical gear **189** which corresponds to gears **173** and **185**, for driving bell **26**. The atomizer **22** is similar to the atomizers **20** and **21** except that it is connected to the swiveled end member **122** by means of the insulating housing **34**. Housing **34** terminates in a metallic end shaft **190** which may be arranged to slide inwardly and outwardly with respect to member **122** as previously explained whereby the entire assembly of atomizers **20**, **21** and **22** may be adjusted in a horizontal plane.

In operation the tubes **72** are adjusted so that the atomizers **20**, **21** and **22** of each atomizing unit are spaced the proper distance from the surface of the articles **10** on the conveyor **14**. Then the connectors **36** and **38** of each atomizing unit connected to the horizontal tubular members **72** are adjustably spaced along these tubes and are adjustably pivoted about their axes so that the bells are properly positioned relative to each other so that the patterns from all the bells are interlaced to obtain a uniform coating on the articles to be coated. Thereafter, the voltage pack **64**, bell motors **110**, and the pump unit **40** are energized by actuating the switches **150**, **151** and **152**, respectively. With the coating apparatus in operation, the conveyor **14** is energized by actuating switch **153** for moving articles past the bells of the coating apparatus for being coated thereby.

In the embodiment of the invention just described, coatings of commercially satisfactory quality have been obtained on sheet metal siding sections 68 inches long when the following specifications were followed; the sheets were arranged on the conveyor moving 15 feet per minute so that their 68 inch dimensions were transverse to their direction of travel; each atomizing unit was provided with two outside bells 4 inches in diameter and an intermediate bell 6 inches in diameter; the three atomizing units were adjusted into positions so that the discharge edges of each bell were coplanar and at a distance of 13 inches from the sheets, the bells on each atomizing unit were spaced so that the axes of adjacent bells were 18 inches apart, the axes of the smaller bells of each atomizing unit were offset 3½ inches from the axis of the larger bell in opposite directions transversely of the path of sheet travel and the axes of the larger bells of adjacent atomizing units were spaced 22½ inches from each other and the axis of the larger bell of the central atomizing unit was spaced 34 inches from the opposite sheet edges arranged parallel to the path of sheet movement; a D. C. potential difference having an average value of 90,000 volts was maintained between the bells and the sheets; the heads were rotated at approximately 900 R. P. M.; and a modified urea formaldehyde olive drab enamel (20 sec. viscosity on a No. 2 Zahn cup at 75 degrees F.) was supplied to each of the smaller bells at a rate of 60 cc. per minute and to the larger bell at the rate of 90 cc. per minute.

Another embodiment of my invention is illustrated in Figures 5, 6 and 7 of the drawings where there is shown an electrostatic coating apparatus comprising a plurality of atomizers **201**, **202**, **203**, **204**, **205** and **206** including

discharge devices in the form of rotatable bells. As illustrated, atomizers **201**, **203**, **204** and **206** may have bells of smaller size than atomizers **202** and **205**. The sizes of the bells may be selected to provide a coating pattern such that a coating of uniform thickness may be produced on an article to be coated. The atomizers and bells just referred to are similar in construction to the atomizers and bells of the apparatus described in connection with Figures 1–4.

Atomizers **201**, **202**, **203** are connected together structurally and supported by means of electrically conductive shaft housings **210** and **211**. Atomizers **204**, **205** and **206** are structurally connected together by similar housings. A source of high voltage may be connected to the structure of one or more of the atomizers and to the object to be coated. Thus, a high voltage electrostatic field may be created between the bells and the articles **212** to be coated for precipitating atomized coating material from the periphery of the bells to the surfaces of the articles to be coated. For supporting the atomizers and housings and insulating them from ground, the shaft housings **215** and **216** of insulating material are connected to the atomizers **201** and **203**, respectively, housing **215** extending into a socket within a swivel support or connector **218** and housing **216** extending into a socket within a swivel support or connector **219**. The connectors **218** and **219** may be of similar construction to connectors **36** and **38**, respectively, described above in connection with Figures 1 and 2. Thus there is provided an electrically insulated, multiple head atomizing unit.

For movably or tiltably supporting each atomizing unit so that it may be moved in a vertical plane and adjusted at various angles with respect to the horizontal, there are provided a pair of columns **220** and **221** mounted on bases **223** and **224**. Each atomizing unit is connected to these columns by the swivel clamping connectors **218** and **219**. By moving these swiveled clamping connectors **218** and **219** upwardly or downwardly on columns **220** and **221** the angle to the horizontal of the atomizing units may be adjusted in whatever fashion may be necessary to obtain a coating of uniform thickness on the articles **212**.

For supplying paint to the atomizers **201**, **202** and **203** there is provided a pump **228** which may be connected to atomizers **201**, **202** and **203** by means of pipes **229**, **230** and **231**, respectively. Pump **228** may be connected to a source of coating material (not shown) such as paint, enamel or the like by means of a pipe **232**. The atomizers **204**, **205**, and **206** may likewise be connected to the pump **228**, as will be obvious to those skilled in the art.

In utilizing the apparatus illustrated in Figures 5, 6 and 7 there may be provided a conveyor **233** adapted movably to support a plurality of the articles **212**, such as the cylinders shown, adjacent the electrostatic apparatus described above. The most desirable positions of the atomizers **201**, **202**, **203**, **204**, **205** and **206** may be determined by moving the swivel connectors **218** and **219** upwardly or downwardly until they are in such a position that a coating of desired distribution is applied to the surfaces of the articles. Suitable means may be provided for slowly rotating the articles **212** as they move past the electrostatic coating apparatus such as by rack bar **234** engageable by pulley **235** on the article supports.

In operation, after high voltage is applied to the atomizers the motors supported on connectors **218** may be energized thereby to rotate the bells of atomizers **201–206**. Upon the energization of the pump **228** coating material flows from the pipes **229**, **230** and **231** to feed coating material to the rotating bells of each atomizing unit. As the bells rotate the coating material spreads over the inner surface thereof and is atomized from the front edge and electrostatically precipitated on the surface to be coated.

It will be readily understood from the foregoing description that there are provided by this invention structures for supporting a plurality of atomizing bell units in relatively fixed relation to one another, and which also permit adjustment in a horizontal plane, a vertical plane and toward and away from the surfaces to be coated. Thus, these structures are adapted readily to combine the patterns from a plurality of atomizing units into an integrated single pattern which has the desirable distribution of thickness and area desired. It will also be understood that apparatus is provided in accordance with this invention for driving a plurality of atomizing bells from a single motor. Furthermore, these adjustment and driving features permit insulation from ground, even though high voltages are used in the coating process.

While there has been described what is at present considered the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

I claim:

1. An atomizing unit comprising a plurality of atomizers each of which includes a casing, an atomizing head rotatably mounted on said casing and mechanism within said casing for driving said head; a supporting structure for said atomizers comprising electrically conductive shaft housings joined to and between the casings of said atomizers for supporting and electrically interconnecting them, and end shaft housings at least partially of electrically insulating material connected to the outer atomizers for providing electrical isolation of said atomizers; and drive mechanism comprising interconnected shafts within said conductive housings and connecting said driving mechanisms within said atomizers, an end shaft at least partially of electrically insulating material within one of said end housings and drivingly connected to one of said conductive shafts, and a motor connected to said end shaft.

2. An atomizing unit comprising a plurality of atomizers, each of which includes a casing, an atomizing head rotatably mounted on said casing, a rotatable shaft mounted within said casing and connected to said head for rotating it, and gear mechanism for driving said shaft; a supporting structure for said atomizers comprising electrically conductive shaft housings joined to and between the casings of said atomizers for supporting and electrically interconnecting them, and end shaft housings at least partially of electrically insulating material connected to the outer atomizers for providing electrical isolation of said atomizers; and drive mechanism comprising interconnected electrically conductive shafts within said conductive housings and connecting the gear mechanisms within said atomizers, an end shaft of electrically insulating material within one of said end housings and drivingly connected to one of said conductive shafts, and a motor connected to said end shaft.

3. An atomizing apparatus comprising a frame including a pair of spaced apart cross members; a plurality of atomizing units each of said units including a support, an atomizing head rotatably mounted on said support, and a shaft rotatably mounted on said support and operatively connected to drive said atomizing head; a motor connected to each shaft for driving said shaft; and a pair of adjustable connectors for connecting opposite ends of each of said supports to said cross members, one connector associated with each atomizing unit having a motor support member for the motor associated therewith, each motor and its corresponding support member being arranged in staggered relation along said cross members.

4. An electrostatic apparatus comprising a pair of spaced parallel columns; an atomizing unit including a support comprising electrically insulating portions connected by an electrically conductive portion, and a plurality of spaced atomizers having rotating heads mounted on said conductive portion; adjustable means connecting said support to said columns to permit angular adjustment of said support and said heads as a unit; and head driving

means supportingly associated with said support and drivingly connected to said heads.

5. An electrostatic apparatus comprising a pair of spaced parallel columns; an atomizing unit including a housing extending between said columns and comprising of electrically insulating end portions connected by an electrically conductive portion, a plurality of spaced atomizers having rotating heads mounted on said conductive portion, and a shaft rotatably mounted within said housing and connected to said heads for rotating them; means for tiltably supporting one end of said unit comprising a socket for receiving one end of said housing, and adjustable means for pivotally connecting said socket to one of said columns; and means for tiltably supporting the other end of said unit comprising a motor, a support member therefor, said support member including a socket for receiving one end of said shaft for connection to said motor and the other end of said shaft housing respectively, and means for pivotally connecting said support member to said other column.

6. An electrostatic appaartus comprising a pair of spaced vertical columns; an atomizing unit including a housing extending between said columns and comprising of electrically insulating end portions connected by an electrically conductive portion, a plurality of spaced atomizers having rotating heads mounted on said conductive portion, and a shaft rotatably mounted within said housing and connected to said heads for rotating them; means for tiltably supporting one end of said unit comprising a socket for receiving one end of said housing, a swivel connected thereto and a clamp connecting said swivel to one of said columns; and means for tiltably supporting the other end of said unit comprising a motor, a support member therefor, said support member including a socket for receiving one end of said shaft for connection to said motor and the other end of said shaft housing respectively, a swivel connected to said supporting member and a clamp for connecting said swivel to said other column.

7. An electrostatic apparatus comprising a frame including a member; an atomizing unit including a support and a plurality of spaced atomizers each having discharge portions mounted on said support; a connector secured to the atomizing unit support, and adjusting means for securing the connector to said frame member in any one of a plurality of positions to permit angular adjustment of said discharge portions as a unit in a predetermined plane.

8. The invention set forth in claim 7 with the addition that said frame also includes a column, said frame member includes a tubular portion whereby it is slidably mounted on said column and an adjustable member movably mounted on said column and being in engagement with said frame member for adjusting said discharge portions relative to said predetermined plane.

9. Apparatus for electrostatically coating an article comprising a frame including a column and a member slidably mounted on said column, said frame being adjacent the article to be coated; a plurality of atomizing units, each of said units comprising a support and an atomizer having a discharge portion mounted on said support; a separate connector for connecting each of said atomizing unit supports to said slidable member for holding said atomizing units in spaced relation to each other; and an adjustable member movably mounted on said column for moving said slidable member to adjust said discharge portions relative to the surface of the article to be coated.

10. An atomizer comprising a housing having aligned sockets on opposite sides for reception of tubular members by which the atomizer may be supportingly connected to adjacent similar atomizers, a shaft section rotatably mounted in said housing and having end portions projecting into said sockets, a head spindle rotatably supported in said housing, gearing operatively interconnecting said spindle and said shaft section, and an atomizing head connected to said spindle for being driven thereby.

11. An atomizing unit comprising a plurality of atomizers, each of which comprises a supporting structure, a shaft section rotatably mounted on said structure, a head spindle rotatably mounted on said structure, gearing operatively interconnecting said spindle and said shaft section, and an atomizing head connected to said spindle for being driven thereby; means for supportingly interconnecting said atomizers with their respective shaft sections in alignment; coupling means drivingly interconnecting the shaft sections of adjacent atomizers, and motor means connected to one of said shaft sections to rotate all of said interconnected shaft sections.

12. An atomizing unit as set forth in claim 11 with the addition that said means for supportingly interconnecting adjacent atomizers comprises a tubular member and provisions on the supporting structures telescopically associated with the ends of said members, said coupling means comprising a shaft disposed in said tubular member.

13. Atomizing apparatus comprising a plurality of atomizers, each having a housing with oppositely disposed aligned sockets for reception of tubular members by which the atomizers may be supportingly connected to adjacent similar atomizers, a shaft section rotatably mounted in said housing, end portions of said shaft section projecting into said sockets, a head spindle rotatably supported in said housing, gearing operatively interconnecting said spindle and said shaft section, and an atomizing head connected to said spindle for being driven thereby; means including electrically conductive tubular members received in said sockets for supportingly and electrically interconnecting said atomizers with their respective shaft sections in alignment; coupling means drivingly interconnecting the shaft sections of adjacent atomizers; spaced supports; and additional tubular members of insulating material received in the sockets of the end atomizers and connected to said supports.

14. An atomizing apparatus comprising a plurality of atomizing units, each atomizing unit comprising a plurality of atomizers each having a housing with oppositely disposed aligned sockets for reception of tubular members by which the atomizers may be supportingly connected to adjacent similar atomizers, a shaft section rotatably mounted in said housing and having end portions projecting into said sockets, a head spindle rotatably supported in said housing and offset from said shaft section, gearing operatively connecting said head spindle and said shaft section, and an atomizing head secured to one end of said spindle for being driven thereby, said shaft having an axial passage extending through it and communicating with the interior of the head at one end of the shaft, means for supplying liquid to be atomized to the opposite end of said passage, means including electrically conductive tubular members received in said sockets for supportably interconnecting said atomizers with their respective shaft sections in alignment, coupling means drivingly interconnecting the shaft sections of adjacent atomizers, an additional shaft section of insulating material connected to the shaft section of one of the end atomizers, and a motor connected to said additional shaft section; a pair of spaced parallel supports; a pair of connectors for connecting each of said atomizing units to said parallel supports, each of said connectors comprising a first portion slidable on its associated support and a second portion swiveled to said first portion on an axis perpendicular to said support and adapted to support the associated atomizing unit, the motor of said atomizing unit being supported on the second portion of one of said connectors; a pair of columns for supporting each of said parallel supports; means for slidably mounting said supports on said columns; and means including a nut threadedly mounted on each of said columns for adjusting said support relative to said columns.

15. An atomizing apparatus comprising a frame which includes a support member; an atomizing unit including a support, an atomizer having a rotatable head mounted on said atomizing unit support, and a shaft rotatably

mounted on said support and connected to drive said rotatable head; a motor connected for driving said shaft; a connector rigidly connected to said atomizing unit support, means supportedly connecting said connector and support member, said means being adjustable to permit relative movement of the atomizing unit support and said support member, a housing of electrically insulating material for enclosing at least a portion of said connector and the motor supported thereby, and means for supporting said housing in spaced relation from said connector and said motor except at points of support.

16. Apparatus for electrostatically coating an article comprising a frame including a support member adjacent to the article to be coated, said frame support member having a threaded portion; an atomizing unit including an atomizer having a discharge portion; means for supporting said atomizing unit on said frame for holding said discharge portion in spaced relation from the article to be coated, said means including a member connected to said atomizing unit and slidably mounted on the frame support member; a nut threadably mounted on the threaded portion of the frame support member and having a shield for enclosing the exposed portion of said threaded portion, said nut being in engagement with said slidable member for adjusting the distance between said discharge portion and the surface of the article being coated.

17. The invention set forth in claim 16 with the addition of said nut engaging said slidable member on one side thereof and of a second nut threadedly mounted on said threaded portion for engaging said slidable member on the opposite side to said first nut for maintaining the slidable member and the atomizing unit connected thereto in a rigid adjusted condition.

18. An atomizing apparatus comprising an atomizing unit including an elongated tubular support and a plurality of atomizing heads rotatably mounted on said tubular support; a drive shaft extending through said tubular support; means connecting the drive shaft to each of said heads to rotate the same; a pair of spaced parallel columns; means on each end of said tubular support for connecting said tubular support at its ends to said columns for adjustment to any one of a plurality of positions; a motor connected to said shaft for rotating the same; means for maintaining each of said heads at a high electrical potential, and means insulating said columns from the electrical potential applied to said heads.

19. The atomizing apparatus of claim 18 including a conveyor for conveying a plurality of articles, said columns being positioned generally equidistant from the path of article movement and in which column-position the tubular support in any one of said adjustable positions lies in a plane generally parallel to, but spaced from, the path of article movement.

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