

[54] **ELECTROSTATIC FLUIDIZED BED**
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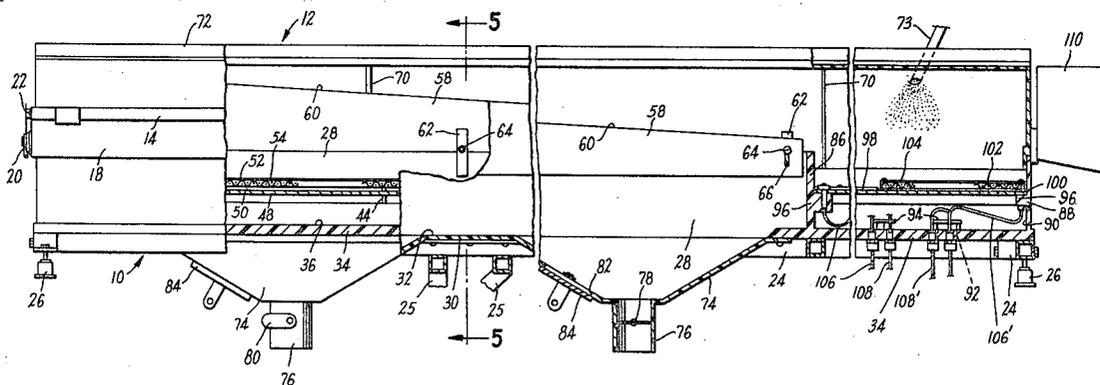
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 [58] Field of Search..... 117/DIG. 6, 93.4 R; 118/301, 406, DIG. 5, 634

[57] **ABSTRACT**

Objects are coated in electrostatic fluidized or fluidic bed apparatus which includes a mechanical barrier effectively interposed between the cloud of charged particles and the travel path for objects conveyed there-through. The barrier means includes an upstanding baffle having an edge portion configured to expose different vertical portions of the object as it is conveyed thereby. Generally, at the beginning of the travel path the lower portions of the objects will be masked by the baffle so as to promote deposition of the particles upon the upper surfaces initially. As it proceeds along the travel path, progressive exposure of the lower portions of the object will permit the complete and uniform coating thereof.

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23 Claims, 8 Drawing Figures



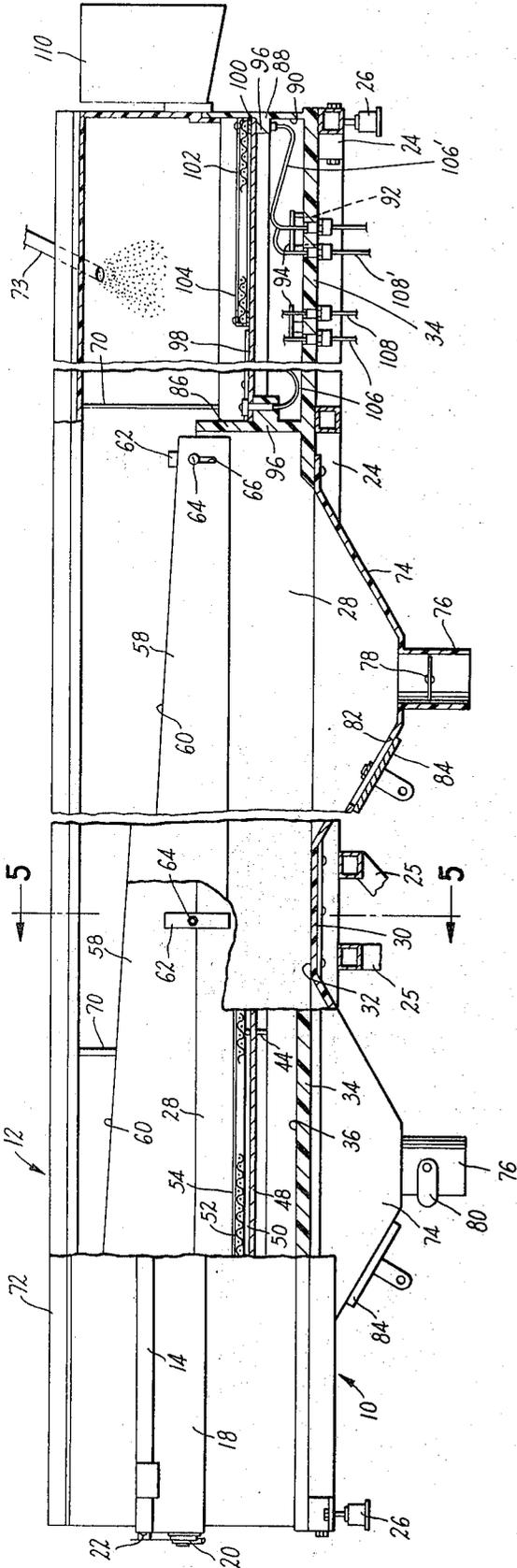


FIG. 1

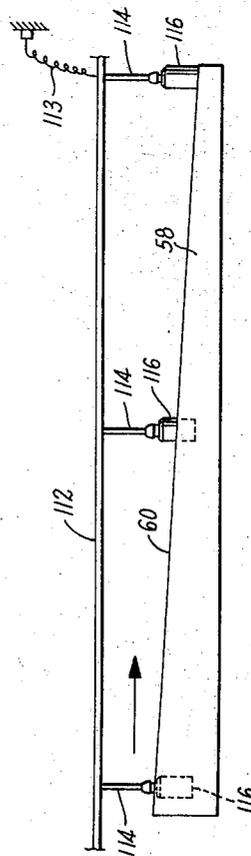


FIG. 2

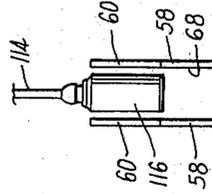


FIG. 3

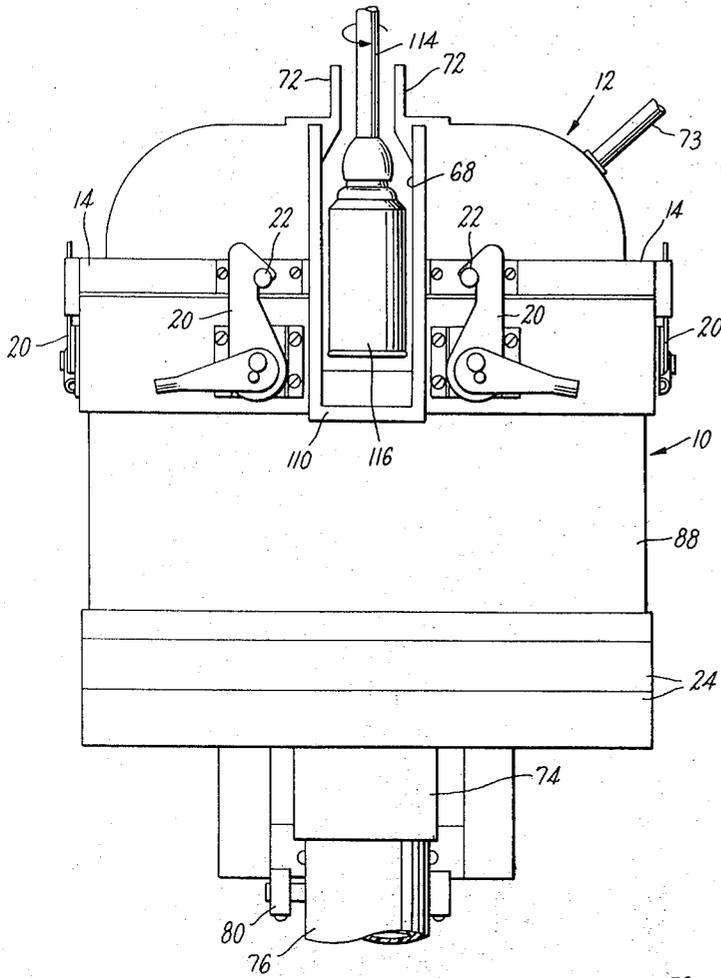


FIG. 4

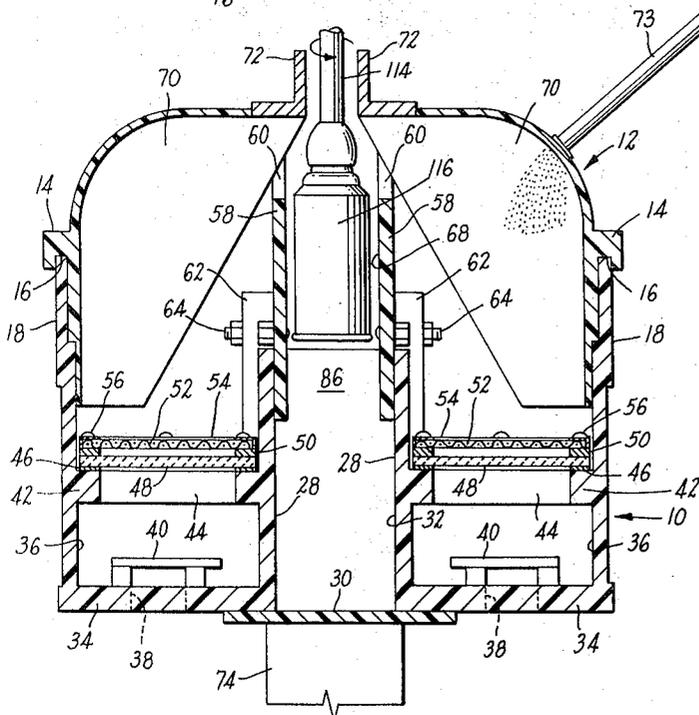


FIG. 5

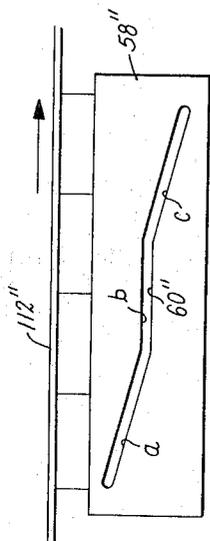


FIG. 8

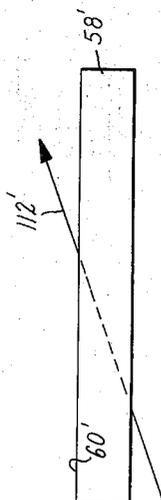


FIG. 7

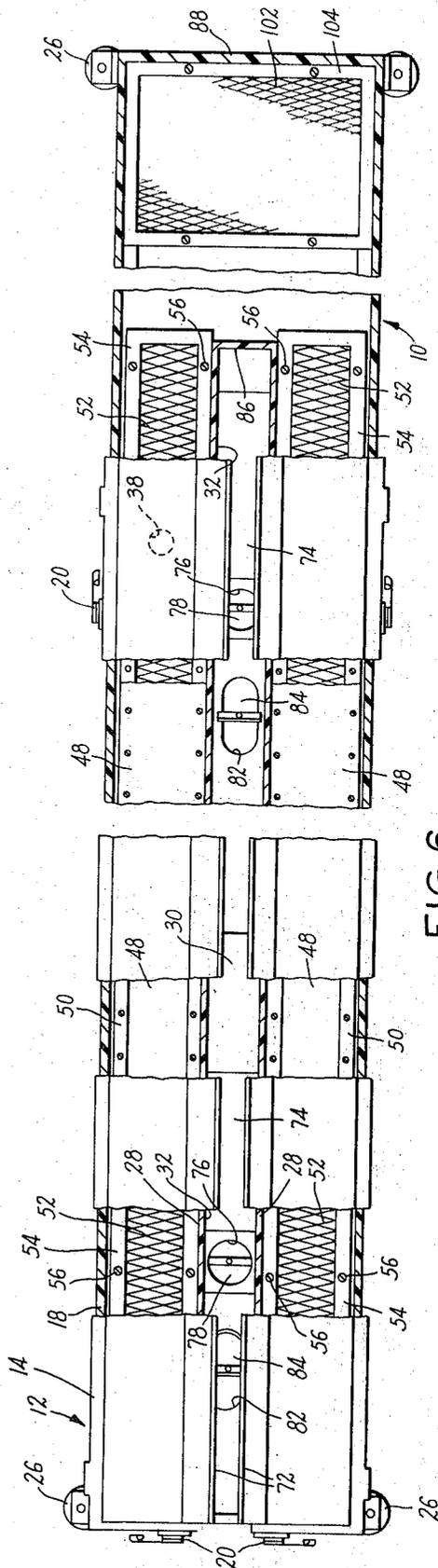


FIG. 6

ELECTROSTATIC FLUIDIZED BED**BACKGROUND OF THE INVENTION**

Apparatus and techniques have been disclosed in the prior art by which a variety of objects can be coated by the electrostatic deposition of particles thereon. One highly effective and convenient type of apparatus that is used for such coating consists fundamentally of a particle bed fluidizing device equipped with an electrode for producing an electrostatic charge on the particles. Exposure of the object to be coated to the cloud of charged particles so produced, while the former is maintained at an effectively opposite potential (normally grounded), will cause electrostatic attraction and adherence of the particles thereto. The object may then be heated or otherwise treated so as to fuse the particles into a unified surface coating, depending of course upon the nature of the particles and other factors.

Although such apparatus is used with a high degree of satisfaction for the coating of many different types of objects (such as continuous lengths of wire, tubing, and the like as well as individual objects which may be passed into or adjacent the cloud of particles), it is not fully satisfactory for the production of uniform coatings upon objects having an axial length which is greater than a certain value. This is due largely to the characteristic of such charged particles of seeking the shortest and most direct route to a surface for deposition. In other words, the charged particles will deposit upon the most accessible area of effectively opposite charge, and consequently objects which have surfaces at substantially different distances above the bed will acquire heavy deposits upon their lower portions while developing progressively thinner coatings on the upper surfaces. In addition, the absolute height to which any particle rises will have a finite value, which will depend upon the physical characteristics of the particle and the potential difference existing between it and the attracting body. The voltages necessary to charge particles sufficiently to cause them to rise to surfaces which are more than a given distance above the bed become prohibitive, from the standpoints of both safety and also satisfactory operation, as a result of which miscoating of the upper portions of many objects would frequently occur under practical operating conditions.

Accordingly, it is the principle object of the present invention to provide a novel electrostatic fluidized bed apparatus and system in which articles of significant axial length may be uniformly coated with charged particles from a cloud thereof.

It is also an object of the invention to provide such an apparatus and system which are highly efficient, safe, and convenient to operate, and which are at the same time relatively simple and inexpensive to produce.

SUMMARY OF THE INVENTION

It has now been found that the foregoing and related objects of the invention can be readily attained in apparatus comprising fluidized bed means, conveying means, and mechanical barrier means. The fluidized bed means includes at least a first electrode for producing a cloud of electrostatically charged particles, and the conveying means is adapted to transport an object along a travel path adjacent the fluidized bed means. The mechanical barrier means is effectively interposed

between the fluidized bed means and the travel path, and includes at least a first upstanding baffle which is spaced laterally to one side of the travel path and extends along at least a portion thereof. An edge portion of the baffle is located above the electrode of the fluidized bed, and is adapted to permit particles to pass thereacross from the bed to the travel path; it is configured for horizontal registration with different vertical portions of the object as it passes thereby along the travel path. As a result, particles from the bed may be charged effectively opposite to the object to be electrostatically coated in the apparatus, so as to effect electrostatic attraction therebetween. This effect, together with that of the baffle, causes particles to be deposited upon the different vertical portions of the object as such portions are exposed behind the baffle during passage of the object thereby.

Preferably, the edge portion of the baffle will be substantially rectilinear, and in one embodiment it may slope downwardly in the forward direction of the travel path, which is, in accordance therewith, substantially horizontally disposed. In another embodiment the edge portion may be substantially horizontal with the travel path of the object disposed at an angle thereto. The edge portion may have a complex configuration consisting, for example, of a number of rectilinear portions, and it may suitably be provided by the free upper edge of the baffle or by an elongated slot in the baffle extending generally in the direction of the travel path.

Most desirably, the barrier means includes a second upstanding baffle which is configured similarly to the first and is spaced laterally therefrom to the opposite side of the travel path. In such a case, the first and second baffles will be generally transversely aligned with the travel path therebetween, to thereby permit simultaneous coating of two sides of the object conveyed therealong. The travel path and the baffles will usually be substantially rectilinear and will extend generally parallel to one another. The conveying means will, in most instances, have means for mounting a multiplicity of objects thereon for sequential passage along the travel path, and the mounting means may beneficially be adapted to rotate each of the objects about a vertical axis during passage along the travel path.

The apparatus hereinbefore described may in addition include means in electrical connection with the conveyor for maintaining it at ground potential, with the mounting means being electrically conductive to effect grounding of objects mounted thereby. Preferably, the first-mentioned electrode of the apparatus will be substantially planar and disposed generally horizontally in the fluidized bed means. Most desirably, the fluidized bed means will include at least a second electrode which is electrically independent of the first electrode so as to permit first and second zones of different voltage to be established therein. In such a case, the first electrode may extend along the travel path portion to provide the first zone, and the second electrode may extend along a second portion of the path outwardly of the first portion to provide the second zone thereat. Such apparatus will be substantially free from obstructions between the second electrode and the second portion of the travel path, so as to facilitate the deposition of charged particles from the second zone upon a bottom portion of the object during passage thereover.

In operation, a multiplicity of objects will be sequentially passed along the travel path for coating. Most desirably, the travel path extends between two of such baffles, with a cloud of electrostatically charged particles being generated adjacent the outer side of each one thereof to simultaneously contact opposite sides of the object during passage therealong. The operation of the invention may include the step of generating at least a second cloud of particles possessing an electrostatic charge of substantially different magnitude than that of the particles of the first-mentioned cloud. It may also include the step of heating the object subsequent to the deposition of particles thereon, in which instance the particles will be of a heat-fusible material with the heating step thereby producing a fused coating thereof upon the object.

Objects of the invention are also attained with an electrostatic fluidized bed unit comprising a substantially closed container having a passageway for transport therethrough of objects depending thereinto. The container has at least a first plenum chamber which extends along one side of the passageway and has an inlet for pressurized air and an upwardly directed opening. A porous plate and an electrode span the opening, and a baffle is interposed between the plenum chamber and the passageway. An upper edge portion of the baffle is spaced above the electrode and is configured for horizontal registration with different vertical portions of the objects as they are passed thereby through the passageway along a predetermined path. Accordingly, a cloud of charged particles of a coating material may be generated above the porous plate and electrode of the plenum chamber, with the particles being electrostatically attracted and deposited upon the different vertical portions of objects charged effectively opposite thereto as such portions are exposed behind the baffle.

Preferably, the container of the fluidic unit has a second plenum chamber substantially identical to the first-mentioned plenum chamber and extending along the opposite side of the passageway therefrom. Such a unit will additionally include a second porous plate and an electrode spanning the opening of the second chamber, and it will also have a second barrier of substantially identical configuration to the first-mentioned barrier interposed between the second plenum chamber and the passageway. The unit will therefore be adapted to simultaneously coat opposite sides of the objects passed along the passageway with charged particles from clouds generated over both the first and second plenum chambers. Such a unit may in addition include a third plenum chamber located downstream along the travel path from the first and second plenum chambers. The third chamber will also have an upwardly directed opening with a third porous plate and a third electrode spanning thereacross. Such a unit will be substantially free from obstructions between the third electrode and the passageway so as to facilitate the deposition of charged particles from a cloud generated over the third plenum chamber upon bottom portions of objects during passage through the passageway. Preferably, the third electrode will be electrically independent from the first and second ones, and will be adapted for charging to a voltage lower than the voltages thereof. The container of the unit will most desirably have a pair of upstanding parallel interior walls defining in part the first and second plenum chambers and the passageway

therebetween, with the first and second baffles being mounted for vertical adjustment thereon.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary side elevational view in partial section of apparatus embodying the present invention;

FIG. 2 is a diagrammatical side elevational view of the conveyor and the exposed one of the pair of baffles employed in the apparatus of FIG. 1, drawn to a reduced scale and showing a number of cans being transported for electrostatic coating;

FIG. 3 is a right end view of the parts of the apparatus illustrated in FIG. 2 and drawn to a scale slightly enlarged therefrom;

FIG. 4 is a right end elevational view of the apparatus of FIG. 1 drawn to an enlarged scale;

FIG. 5 is a section view along line 5—5 in FIG. 1, drawn to the scale of FIG. 4;

FIG. 6 is a fragmentary plan view in partial section of the apparatus of FIG. 1;

FIG. 7 is a side elevational diagrammatical view of a different baffle and conveyor arrangement suitable for use in the apparatus of the invention; and

FIG. 8 is a view similar to FIG. 7 showing another type of baffle suitable for use herein.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Turning now in detail to FIGS. 1—6 of the appended drawings, therein illustrated is apparatus embodying the present invention and including an electrostatic fluidized bed unit comprised of a fluidic bed base and a cover therefor, generally designated by the numerals 10, 12 respectively. The cover 12 has a peripheral flange 14 with a downwardly opening channel 16 in which is received the upper edge of the sidewall 18 of the base 10. A number of hook locks 20 are spaced about the opening of the base 10, and cooperate with corresponding studs 22 on the flange 14 to lock the cover 12 thereto. The tubular elements 24, which provide a frame bed for the base 10, rest upon substructure elements 25; the fluidized bed unit is connected to the chassis by antivibration members 26, and means (not shown) is provided to vibrate the unit with the members 26 serving to prevent transmission of motion therefrom to the substructure.

As may best be seen in FIG. 5, the base 10 includes a pair of parallel upstanding interior walls 28 which cooperate with a base plate 30 to define a central trough 32 running along most of the length of the unit. The walls 28 also cooperate with the bottom walls 34 to define two elongated lateral plenum chambers 36, which are coextensive with the trough 32 and lie on opposite sides thereof. Air inlet ports 38 extend through the bottom walls 34 and have diffusion plates 40 positioned thereover, the latter serving to promote distribution along the length of the chambers 36 of air injected through the ports 38.

A peripheral flange 42 extends about each of the chambers 36 to provide support for a chamber-spanning porous plate 48 which is spaced thereon above the bottom wall 34. Interposed between the flanges 42 and the plates 48 are thin layers 46 of gasket material, and strut elements 44 extend across the flanges 42 to strengthen the base 10 and to provide additional support for the plates 48. The rectangular

frames 50 secure (such as by flat-headed screws) the porous plates 48, and also support the grid-type electrodes 52, which are substantially equal in area to the plates 48. The electrodes 52 are maintained in place by appropriate frames 54, which may be welded or otherwise secured thereto, the frames 54 being fastened to the flanges 42 by round-headed screws 56.

An elongated baffle 58 is secured to each of the interior walls 28 by cooperating clamps 62, which are tightened thereagainst by the nut and bolt fasteners 64 which pass through the walls 28 and through the elongated slots 66 in the baffles 58. As will be appreciated, the slots 66 enable adjustment of the height as well as the angular attitude of the baffles 58 with respect to the interior walls 28. Each of the baffles 58 has an upper edge 60 which slopes downwardly toward the outlet end of the unit, i.e., in a downstream direction; the edges are in substantial horizontal alignment, and the baffles 58 are parallel to thereby define a passageway 68 of uniform width along the full length of the baffles 58.

The cover 12 has a number of spaced reinforcing webs 70, and upstanding flanges 72 which extend along its entire length on either side of the passageway 68. The flanges 72 cooperate with an enclosure or cowling (not illustrated) which substantially surrounds the unit and has marginal edges abutting against the flanges 72 to prevent the entry of powder or debris therinto. A feed conduit 73 is attached to the cover 12 to provide means for furnishing powder to the unit from a reservoir or supply thereof (not shown), and means (also not shown) may be present within the unit for detecting the quantity of powder therein to automatically control the feed operation on a continuous basis. The bottom of the unit is furnished with two hoppers 74 which communicate with the central trough 32 and have conduits 76 extending downwardly therefrom. The conduits 76 are hooked into a vacuum system (not shown) to enable the withdrawal of excess powder which would otherwise tend to accumulate in the trough 32, and the butterfly disk 78 and operating mechanism 80 therefor, which are provided on each conduit 76, control the vacuum effect. Each hopper 74 has a cleanout opening 82 that is normally closed by a cover assembly 84, the principal purpose of which is to permit the ready removal of the articles, which may fall into the trough 32 from time to time during the coating operation.

As is most readily seen in FIGS. 1 and 6, a narrow end wall 86 lies transversely between the interior walls 28 adjacent the outer ends thereof and defines, in cooperation with the outer end wall 88 of the unit, a plenum chamber 90 extending across the width thereof. As in the case of the elongated plenum chambers 36, the plenum chamber 90 is provided with inlet ports 92 and diffusion plates 94 for the injection and distribution of air, and the peripheral flange 96, which projects inwardly from about the chamber 90, supports a porous plate 96, a peripheral frame 100, a grid 102, and a grid frame 104. Mounted through the bottom wall 36 beneath the plate 98 are cables for appropriate electrical interconnection, the cables 106, 106' providing high voltage to the grids 52 and 102, respectively (the grids 52 normally being maintained at a higher voltage than grid 102), and the cables 108, 108' being connected respectively (by means not shown) to the frame bed 24 and the flanges 72 to maintain them at ground potential.

Adjacent the outlet end of the unit and in communication with the passageway 86 is a channel extension 110, which serves to enable the controlled release of powder that may become trapped between adjacent articles, vacuum means being attached to the extension 110 for that purpose if so desired. As suggested in FIGS. 2 and 3, a conveyor 112, which is electrically grounded at 113, is disposed above the unit and has a multiplicity of mounting hangers 114 depending therefrom, each supporting a can 116 thereon for coating. The conveyor may be of any conventional design, and the hangers may desirably be electrically conductive and have magnetic coupling elements on the ends thereof to support the cans and maintain them at ground potential; of course, when different articles are to be coated in the unit other support means may be more suitable. As the arrow in FIG. 2 indicates, the conveyor 112 transports the cans 116 from left to right along a horizontal path through the passageway 68. Initially, the cans 116 are substantially entirely blocked or masked by the baffles 58; however, due to the slope of the upper edges 60, as the cans 116 proceed downstream progressively lower surface portions become horizontally aligned with the edges 60 and thereby exposed for powder contact behind the baffles 58.

Since, as has previously been pointed out, the lower portions of the cans 116 or other depending objects most readily attract the charged particles, considerably lower voltages are necessary to generate a cloud capable of producing a deposit thereon. The plenum chamber 90 and the porous plate 98 and electrode 102 associated therewith (which constitute a substantially independent cloud chamber or charged particle-generating effect) may therefore be used for this purpose, with the electrode 102 being charged to a substantially lower voltage to afford concomitant power economy and convenience of operation. As will be apparent, the cans 116 proceed on the conveyor 112 downstream through the passageway 68 between the baffles 58, over the electrode 102, and outwardly from the unit through the extension 110. They may then pass through sequential excess powder removal, heating and cooling stages, and preheating effects ahead of the fluidic bed unit may also be provided.

Although a preferred embodiment of the invention has been illustrated and described hereinbefore, it will be evident that many variations can be made in the apparatus without departure from the novel concept of the invention. One such alternative is depicted in FIG. 7 wherein a simple modification of the arrangement of the conveyor and baffles employed in the unit is shown. Thus, the baffle 58' is substantially the same as baffle 58 of the preceding figures, but has a free upper edge 60' which is substantially horizontally disposed. The conveyor 112' is comparable to the previously-described conveyor 112, but rather than extending horizontally is slightly inclined. As a result, objects depending from the conveyor 112' are progressively exposed behind the baffle 58' with virtually the same coating effect as is produced by the apparatus of the previous embodiment.

However, the embodiment of FIG. 7 affords the advantage of enabling the coating of objects of increased axial length in a direction generally perpendicular to the fluidized bed (extended dimensions parallel to the bed of course presenting little difficulty). Because the edge 60' is a uniform distance above the electrodes

(not illustrated, but horizontally disposed therebelow), and the objects pass from a position lower than the electrode location, the axial length that can be coated is not limited by the height to which the charged particles are capable of rising. As will be noted, this is not true of the apparatus of FIGS. 1 - 6 due to the parallel disposition of the travel path of the cans 116 and the electrodes 52; in such apparatus, it will not generally be feasible to coat objects having portions that are more than about 6-8 inches above the electrodes.

A second modification of the apparatus is shown in FIG. 8 wherein, rather than utilizing a free upper edge of the baffle to provide the edge portion across which the charged particles must pass, the baffle 58'' has a complex slot 60'' consisting of three rectilinear elements *a*, *b*, *c*, extending therein in the general direction of the travel path. The baffle 58'' cooperates with the conveyor 112'' to progressively expose lower portions of objects depending therefrom as they travel in the direction indicated by the arrow. It will be noted that the central element *b* of the slot 60'' is substantially horizontal, as a result of which no fresh surfaces of the objects will be exposed during passage thereby. An exposure of extended duration will thereby be afforded, as may be desirable in coating an object having a central portion which is somewhat inaccessible or on which a heavier coating is desired. From this sample illustration it will be appreciated that many variations in the configuration of the edge portion are possible to achieve a wide variety of coating effects, and it should be clear that, although continuous rectilinear edge portions have been illustrated, in some instances it may be desirable to utilize discontinuous edges or curvilinear portions to achieve the deposits desired.

Other variations in the apparatus are of course possible, and include the provision of different arrangements and greater or lesser numbers of electrodes, plenum chambers, etc., to generate different cloud chamber effects and to expose the objects to different conditions during passage along the travel path. Although not specifically discussed heretofore, it will be appreciated that a single-effect fluidized bed may be employed with the objects passing behind only one baffle interposed therebetween.

The materials of construction will be equally obvious to those skilled in the art, and need not be discussed in detail. However, perhaps it should be mentioned that the construction of the fluidized bed is desirably largely of a plastic or other dielectric material so as to prevent interference by the elements thereof with the efficient deposition of powder upon the objects. It might also be important to note that, although it is most desirable to maintain the objects at ground potential during deposition, they may be at other potentials as long as adequate attractive and adhesive forces are produced; moreover, electrical connections to the objects may be dispensed with entirely in some instances.

Virtually any powder which is conventionally used for electrostatic powder coating may be employed to provide the charged particles in accordance with the present invention. For example, resins such as polyvinyl chloride, polypropylene, polyethylene, epoxies, acrylics, polyesters, etc., may all be used successfully in accordance herewith. Among the myriad uses for the type of apparatus illustrated, the coating of aerosol and food and liquid packaging cans, tanks for fire extinguishers and gas storage, transformer housings, and

boxes of various types and configurations might be mentioned as exemplary.

Thus, it can be seen that the present invention provides a novel electrostatic fluidized bed apparatus and system in which articles of significant axial length may be uniformly coated with charged particles from a cloud thereof. The apparatus and system are highly efficient, safe, and convenient to operate and are, at the same time, relatively simple and inexpensive to produce. The invention also provides a novel method for the coating of such objects with charged particles produced in an electrostatic fluidized bed.

What is claimed is:

1. In apparatus for electrostatically coating an object, the combination comprising:
 - a. fluidized bed means including at least a first electrode for producing a cloud of electrostatically charged particles;
 - b. means for conveying at least the portion of an object to be coated along a travel path, which travel path is laterally adjacent said fluidized bed means; and
 - c. mechanical barrier means effectively interposed between said fluidized bed means and said travel path, and including at least a first upstanding baffle spaced laterally to one side of said travel path and extending along at least a portion thereof, said baffle having an elongated edge portion above said electrode of said fluidized bed across which particles may readily pass from said bed to said travel path, said conveyor means and baffle being so disposed relative to one another that said travel path traverses the imaginary, laterally-extending projection surface of said edge portion at a non-perpendicular angle thereto,
 - so that particles from said bed may be charged effectively opposite to the object to effect electrostatic attraction therebetween and deposition thereon, so as to develop a coating along an axis that is angularly displaced from the axis of said travel path as progressively lower vertical portions of the object horizontally register with said edge portion and thereby become exposed behind said baffle during passage of the object thereby.
2. The apparatus of claim 1 wherein said edge portion of said baffle is substantially rectilinear, and wherein said projection surface constitutes the laterally-extending plane thereof.
3. The apparatus of claim 2 wherein said edge portion slopes downwardly in the forward direction of said travel path and wherein said travel path is substantially horizontal.
4. The apparatus of claim 2 wherein said edge portion is substantially horizontal and wherein said travel path is disposed at an angle thereto.
5. The apparatus of claim 2 wherein said edge portion has a complex configuration consisting of a plurality of rectilinear elements that are angularly disposed with respect to one another.
6. The apparatus of claim 1 wherein said baffle has a free upper edge providing said edge portion.
7. The apparatus of claim 1 wherein said baffle has an elongated slot therein extending generally in the direction of said travel path and providing said edge portion thereof.
8. The apparatus of claim 1 wherein said barrier means includes a second upstanding baffle configured

similarly to said first baffle and spaced laterally therefrom to the opposite side of said travel path, said first and second baffles being generally transversely aligned with said travel path therebetween to permit simultaneous coating of two sides of the object conveyed therealong.

9. The apparatus of claim 8 wherein said travel path and baffles are substantially rectilinear and extend generally parallel to one another.

10. The apparatus of claim 1 wherein said conveying means has means for mounting a multiplicity of elongated objects thereon for sequential passage along said travel path with the axes thereof vertically disposed.

11. The apparatus of claim 10 wherein said mounting means of said conveying means is adapted to rotate each of the objects about a vertical axis during passage along said travel path.

12. The apparatus of claim 10 additionally including means in electrical connection with said conveying means for maintaining it at ground potential, said mounting means being electrically conductive to permit grounding of the objects mounted thereby.

13. The apparatus of claim 1 wherein said first electrode is substantially planar and is disposed generally horizontally in said fluidized bed means.

14. The apparatus of claim 1 wherein said fluidized bed means includes at least a second electrode which is electrically independent of said first electrode to permit first and second zones of different voltage to be established therein, said first electrode extending along said travel path portion to provide said first zone and said second electrode extending along a second portion of said path outwardly of said first portion to provide said second zone thereat, said apparatus being substantially free from obstructions between said second electrode and said second portion of said travel path to facilitate the deposition of charged particles from said second zone upon a bottom portion of the object during passage thereover.

15. In a system for electrostatically coating a multiplicity of objects transported sequentially along a predetermined path, an electrostatic fluidized bed unit comprising a substantially closed container having a passageway for transport therethrough of objects depending thereinto, and at least a first plenum chamber extending along one side of said passageway, said plenum chamber having an inlet for pressurized air and an upwardly directed opening, said unit also including a porous plate and an electrode spanning said opening, and a baffle interposed between said plenum chamber and said passageway, said baffle having an elongated upper edge portion spaced above said electrode and being so disposed that said passageway traverses the imaginary, laterally-extending projection surface of said edge portion at a non-perpendicular angle thereto, so that a cloud of charged particles of a coating material may be generated above said porous plate and electrode of said plenum chamber, and said particles may readily be electrostatically attracted and deposited upon progressively lower vertical portions of objects charged effectively opposite thereto, as such portions horizontally register with said edge portion and are thereby exposed behind said baffle during passage along said passageway.

16. The system of claim 15 wherein said container of said electrostatic fluidic unit has a second plenum chamber substantially identical to said first-mentioned

plenum chamber and extending along the opposite side of said passageway therefrom, said unit additionally including a second porous plate and electrode spanning the opening of said second chamber, and also having a second barrier of substantially identical configuration to said first-mentioned barrier interposed between said second plenum chamber and said passageway, said unit thereby being adapted to simultaneously coat opposite sides of the objects passed along said passageway with charged particles from clouds generated over both of said first and second plenum chambers.

17. The system of claim 16 wherein said container has a pair of upstanding parallel interior walls defining in part said first and second plenum chambers and said passageway therebetween, said first and second baffles being mounted for vertical adjustment upon said interior walls.

18. The system of claim 16 wherein said container of said electrostatic fluidic bed unit has a third plenum chamber downstream along said travel path from said first and second plenum chambers, said third chamber also having an upwardly directed opening with a third porous plate and a third electrode spanning thereacross, and said unit being substantially free from obstructions between said third electrode and said passageway, thereby facilitating the deposition of charged particles from a cloud generated over said third plenum chamber upon bottom portions of objects during passage through said passageway.

19. The system of claim 18 wherein said third electrode is electrically independent from said first and second electrodes, and is adapted for charging to a voltage lower than the voltages thereof.

20. In apparatus for electrostatically coating an object, the combination comprising:

- a. means for producing a cloud of electrostatically charged particles;
- b. means for conveying at least the portion of an object to be coated along a travel path, which travel path is laterally adjacent said cloud-producing means; and
- c. mechanical barrier means including at least a first generally upstanding baffle effectively interposed laterally between said cloud-producing means and said travel path;

said baffle having an elongated edge portion across which particles may readily pass from said cloud-producing means to said travel path, said conveyor means and baffle being so disposed relative to one another that said travel path traverses the imaginary, laterally-extending projection surface of said edge portion at a non-perpendicular angle thereto, so that particles of the cloud may be charged effectively opposite to the object to effect electrostatic attraction therebetween and deposition thereon, so as to develop a coating along an axis that is angularly displaced from the axis of said travel path as progressively lower vertical portions of the object horizontally register with said edge portion and thereby become exposed behind said baffle during passage of the object thereby.

21. The apparatus of claim 20 wherein said edge portion of said baffle is substantially rectilinear, and wherein said projection surface constitutes the laterally-extending plane thereof.

22. The apparatus of claim 20 wherein said conveying means has means for mounting a multiplicity of elongated objects thereon for sequential passage along said travel path with the axes thereof vertically disposed.

23. The apparatus of claim 20 wherein said cloud-producing means is a fluidized bed unit.