

[54] **ELECTROSTATIC SPRAYING APPARATUS FOR PULVERULENT MATERIAL**

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[58] Field of Search.....**239/15, 222.11, 224**

[56] **References Cited**

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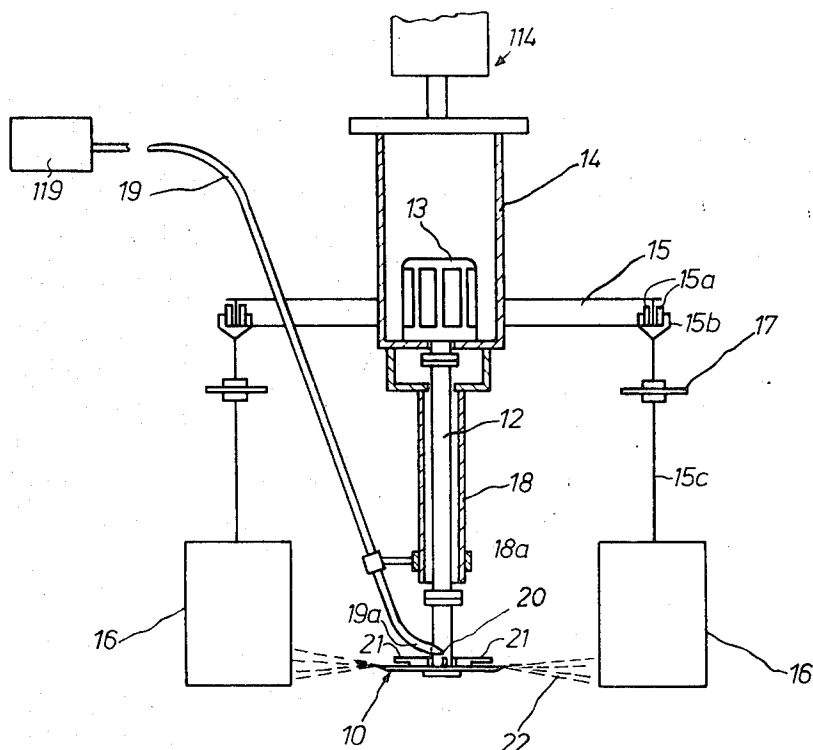
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## [57] ABSTRACT

An electrostatic spraying apparatus for applying powder to housings of refrigerators or the like has a disk-shaped sprayer which is rotated about a vertical axis and the upper surface of which receives a stream of powder through the slot-shaped orifice of a rigid or flexible conduit at an angle of 5°–35°. The upper surface of the sprayer carries radial agitating blades for air to thus reduce the speed of powder which creeps radially outwardly and is dispersed at the circular spraying edge of the sprayer. The orifice discharges the stream in the general direction of the spraying edge and is closely adjacent to the blades and to the periphery of the drive shaft for the sprayer.

**10 Claims, 2 Drawing Figures**



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3,735,924

Fig. 1

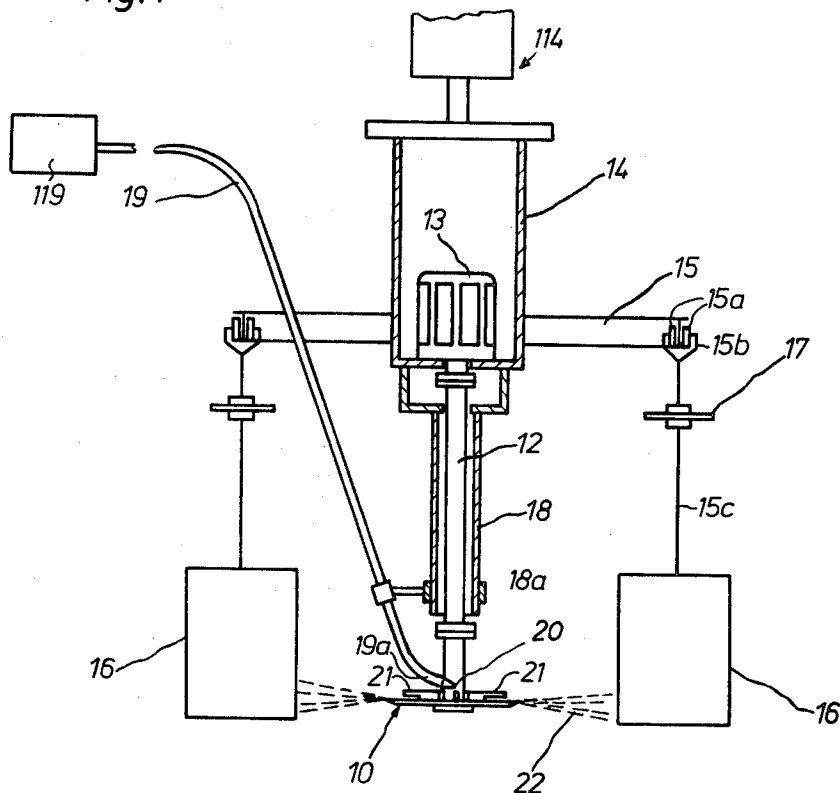
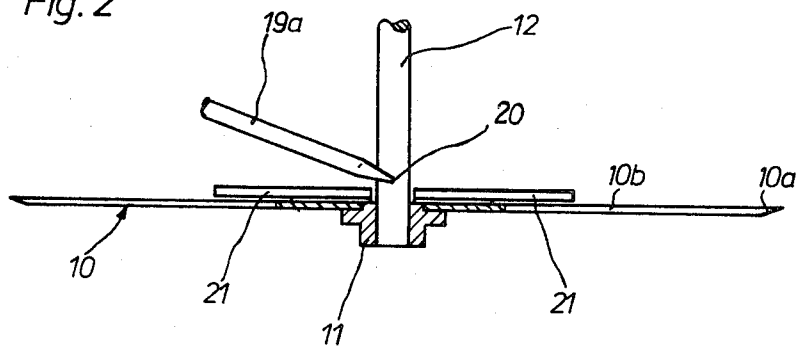


Fig. 2



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# ELECTROSTATIC SPRAYING APPARATUS FOR PULVERULENT MATERIAL

## BACKGROUND OF THE INVENTION

The present invention relates to apparatus for applying dispersed powder to housings of appliances (such as household refrigerators) or other types of articles. More particularly, the invention relates to improvements in electrostatic spraying apparatus of the class disclosed in my U.S. Pat. Nos. 3,358,931 and 3,478,962.

It is already known to employ in an electrostatic spraying apparatus one or more disk-shaped sprayers which are rotatable about vertical axes and receive liquid paint, lacquer or like coating material from a tube which is substantially normal and closely adjacent to the paint-receiving surface of the respective sprayer. Such spraying apparatus cannot be employed for satisfactory application of pulverulent coating material because the powder is likely to become sintered on the adjacent surface of the revolving sprayer and to thus clog the discharge end of the tube. Moreover, the material-distributing action of a smooth surface on the rotating disk-shaped sprayer is unsatisfactory when the material to be applied to housings of refrigerators or other types of articles is a powder, i.e., the uniformity of distribution of an air-powder mixture on a smooth rotating surface is rather low which affects the uniformity of distribution of pulverulent material on the articles.

It is also known to apply pulverulent coating material by resorting to various types of spray guns. Such guns are capable of uniformly distributing a powder; however, the rate of application of powder is rather low so that the coating of large housings or the like consumes much time or necessitates the use of several spray guns. Moreover, it was found that the powder-supplying channels of spray guns are likely to be clogged at frequent intervals.

## SUMMARY OF THE INVENTION

An object of the invention is to provide a novel and improved electrostatic spraying apparatus which is particularly suited for uniform distribution of pulverulent coating material to relatively large and bulky articles and wherein the means which feeds such material to the sprayer or sprayers is less likely to be clogged than in spray guns or other presently known apparatus.

Another object of the invention is to provide an electrostatic spraying apparatus wherein the sprayer or sprayers are mounted and configured in such a way that they are capable of insuring a highly satisfactory distribution of pulverulent material before such material leaves the spraying edge.

A further object of the invention is to provide a novel and improved device for feeding pulverulent coating material to one or more rotary sprayers in an electrostatic spraying apparatus for the housings of refrigerators or the like.

An additional object of the invention is to provide a simple, reliable and versatile spraying apparatus which can be used for the application of various types of pulverulent coating materials.

The invention is embodied in an electrostatic spraying apparatus which is particularly suited for applying dispersed pulverulent material to housings of refrigerators or other appliances. The apparatus comprises an

electric motor or another suitable prime mover having a substantially vertical rotary output member, at least one substantially disk-shaped sprayer mounted on and rotatable with the output member and having a preferably circular spraying edge remote from the axis of the output member and a powder-receiving surface (preferably the upper surface) extending from the spraying edge toward the periphery of the output member, a powder feeding device including rigid or flexible conduit means having at least one preferably slot-shaped orifice arranged to direct against the surface a stream of pulverulent material at an angle of not less than 5° and not more than 35°, and agitating means preferably comprising one or more radially extending blades provided on the powder-receiving surface to agitate the air in the region where the stream of paint impinges against such surface to thus reduce the likelihood of sintering and to promote the flow of powder toward the spraying edge.

That portion of the conduit means which is provided with the orifice is preferably tangential and closely adjacent to the periphery of the output member and also closely adjacent to the agitating means. The orifice preferably discharges powder in the general direction of the spraying edge on the sprayer.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved spraying 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 fragmentary partly elevational and partly central vertical sectional view of an electrostatic spraying apparatus which embodies the invention; and

FIG. 2 is an enlarged partly elevational and partly sectional view of a detail of the structure shown in FIG. 1.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1, there is shown an electrostatic spraying apparatus which is used for the application of pulverulent material to bulky articles 16, such as housings of household refrigerators or other types of appliances. The apparatus comprises at least one rotary disk-shaped sprayer 10 which is mounted at the lower end of and rotates with the vertical or nearly vertical output shaft 12 of a prime mover 13 here shown as an electric motor mounted in a housing or cage 14 which is movable up and down by a lifting device 114 so that the spray or mist 22 of pulverulent material which leaves the circular spraying edge 10a (see FIG. 2) of the sprayer 10 can be applied to the entire external peripheral surface of each article 16. The lifting device 114 may comprise a pneumatic or hydraulic cylinder and piston assembly actuated in synchronism with the conveyor which causes the articles 16 to orbit along an arcuate path about the spraying edge 10a of the rotating and axially moving sprayer 10. The latter is preferably removably secured to a suitably configured hub 11 of the output shaft 12. The conveyor for the articles 16 comprises a circular or loop-shaped track 15 for

pairs of roller followers 15a provided at the upper ends of carriages 15b which are caused to travel along the track by a driven chain or the like, not shown. Each carriage 15b has downwardly extending portion 15c which supports the respective article 16 and is provided with a suitable turning device 17 which turns the article while the latter travels about the sprayer 10. In this way, all sides of each article are coated uniformly while such articles travel from an article supplying to an article discharging station.

The housing 14 carries a downwardly extending sleeve 18 which consists of insulating material and spacedly surrounds the output shaft 12. The lower end portion of the sleeve 18 is provided with a clamp 18a for an intermediate portion of a powder supplying or feeding conduit 19. This conduit preferably consists at least in part of a suitable flexible material, such as polytetrafluorethylene, and constitutes a pneumatic conveyor wherein the powder is fed toward the horizontal upper surface 10b of the sprayer 10 in a gaseous carrier, such as air. The lower end portion 19a of the conduit 19 is provided with a preferably slot-shaped elongated orifice 20 which discharges a stream of pulverulent coating material against the surface 10b at an angle of between 5° and 35°, preferably at an angle of substantially 20°. The end portion 19a extends substantially tangentially of the adjacent peripheral surface on the output shaft 12 and is closely adjacent to such peripheral surface as well as to radially extending agitating or distributing ribs or blades 21 which are provided on the surface 10b of the sprayer 10. The orifice 20 preferably discharges the stream of pulverulent material in the general direction of the spraying edge 10a and is close to the agitating blades 21. The mist or spray 22 is caused to travel across an electrostatic field.

The agitating blades 21 perform the important function of producing air currents which reduce the speed of the stream of pulverulent material as the latter issues from the orifice 20 to thus control the speed at which the particles strike the surface 10b of the rotating sprayer 10. Such reduction in the speed of pulverulent material reduces the likelihood of sintering of powder on the sprayer 10 and the likelihood of clogging of the orifice 20 by the material which would accumulate on the sprayer in the event of sintering. Furthermore, the blades 21 produce air currents which flow substantially radially of the sprayer 10 toward the spraying edge 10a to thus promote the travel of pulverulent material toward the spraying edge which disperses the material to form the mist 22 which crosses the gap between the sprayer and the adjacent articles 16 in an electrostatic field. The radially outwardly oriented air currents which are produced by the blades 21 promote the action of the electrostatic field upon the dispersed particles of pulverulent material.

The details of the lifting device 114 form no part of the present invention. Such lifting device can be constructed and operated in a manner as disclosed in U.S. Pat. No. 2,894,485. The source of pulverulent material

is shown schematically at 119.

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 and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the claims.

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

1. In an electrostatic spraying apparatus, for applying dispersed powder to housings of household appliances or the like, a combination comprising a prime mover having a substantially vertical rotary output member; at least one substantially disk-shaped sprayer mounted on and rotatable with said output member, said sprayer having a spraying edge remote from the axis of said output member and a substantially plane upper surface extending from said spraying edge toward said axis; a powder feeding device including conduit means having at least one orifice arranged to direct against said surface a stream of powder at an angle of between 5° and 35°; and agitating means provided on said surface to agitate the air in the region of said surface to promote flow of powder toward said spraying edge and to prevent accumulation of powder on said surface.

2. A combination as defined in claim 1, wherein said conduit means is arranged to direct a stream of powder in a gaseous carrier into a zone adjacent to said upper surface.

3. A combination as defined in claim 1, wherein said surface is at least substantially normal to said axis.

4. A combination as defined in claim 1, wherein at least a portion of said conduit means consists of flexible material.

5. A combination as defined in claim 1, wherein said agitating means comprises a plurality of elongated blades extending substantially radially of said axis.

6. A combination as defined in claim 1, wherein said orifice is provided in an end portion of said conduit means which is substantially tangential to said output member.

7. A combination as defined in claim 6, wherein said orifice is closely adjacent to the periphery of said output member and to said agitating means and is arranged to direct said stream in the general direction of said spraying edge.

8. A combination as defined in claim 1, wherein said orifice is an elongated slot.

9. A combination as defined in claim 1, further comprising means for reciprocating said sprayer in the axial direction of said output member.

10. A combination as defined in claim 1, further comprising conveyor means for transporting articles to be sprayed along an arcuate path spacedly surrounding said spraying edge.

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