

United States Patent [19]

Rokadia et al.

[11] 3,905,550

[45] Sept. 16, 1975

[54] AVOIDANCE OF SPATTERING IN THE
SUPPLY OF CONDUCTIVE LIQUIDS TO
CHARGED RESERVOIRS

3,761,941 9/1973 Robertson..... 239/15 X

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[22] Filed: June 6, 1974

[21] Appl. No.: 476,813

[57] ABSTRACT

[52] U.S. Cl. 239/15; 137/13

[51] Int. Cl.² B05B 5/02

[58] Field of Search 239/3, 15; 317/3, 2 R,
317/2 J; 137/1, 13

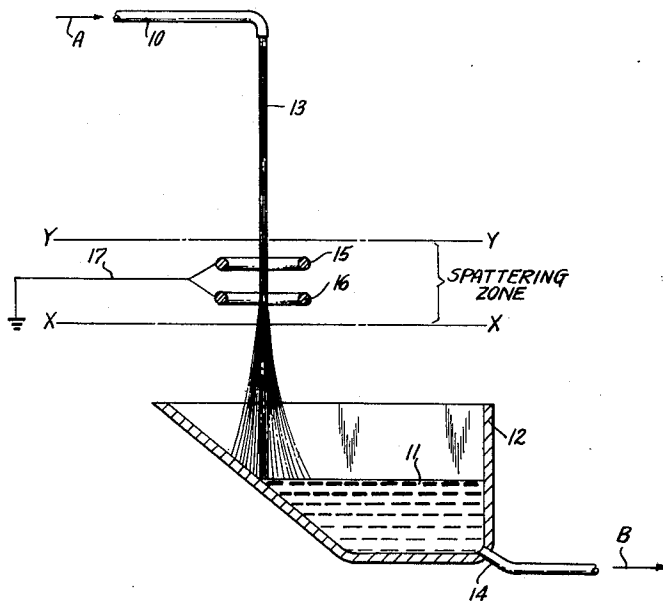
A grounded conductor is positioned around an unconfined column of uncharged conductive liquid entering an electrostatically charged reservoir of the liquid to dissipate the electrical field created by the charged reservoir in the vicinity of the column and thereby prevent the spattering of liquid which would otherwise occur.

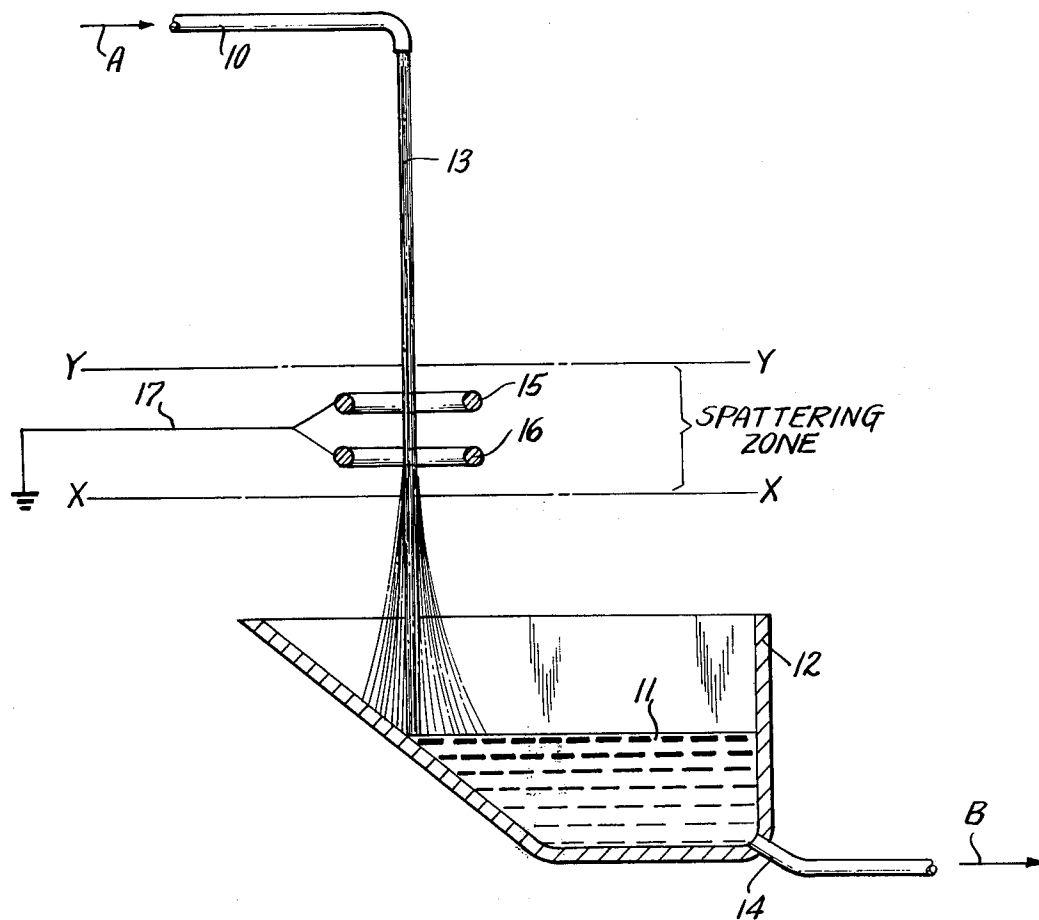
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10 Claims, 1 Drawing Figure





AVOIDANCE OF SPATTERING IN THE SUPPLY OF CONDUCTIVE LIQUIDS TO CHARGED RESERVOIRS

This invention relates to the electrostatic spraying of 5
conductive paints.

When conductive paints are electrostatically sprayed, the charge is conducted back through the paint to dissipate the needed charge and to create an obvious hazard. It is known to insulate the entire system, including the paint supply tank, but this is expensive, and the system cannot be safely approached and everything must be grounded before the supply tank can be refilled or changed.

To overcome this difficulty, Rokadia Application Ser. No. 403,364, filed Oct. 4, 1973, discloses employing an electrically isolated paint reservoir which is supplied by an unconfined column of conductive paint, it being found that the static charge which bleeds back from the atomizing head to the paint reservoir via the confined column of paint supplied thereto, is not transmitted through the unconfined column of paint which enters the reservoir.

In operating the Rokadia disclosure, particularly at higher voltages and in more humid atmospheres, it has been found that some of the paint in the unconfined column entering the charged paint reservoir sprays out laterally in all directions, creating a nuisance and wasting some of the paint. While this disadvantage could be tolerated, it would be better to eliminate it or minimize it, and this is the purpose of this invention.

It is first desired to point out that the problem is electrostatic, since there is no paint spattering when there is no electrostatic charge. Also, it is well known when paint is electrostatically charged, that the proximity of a grounded conductor will cause the electrostatically charged paint to atomize and move to the grounded conductor where it is electrostatically deposited on the conductor. Despite the fact that normal electrostatic atomization is assisted by the proximity of a grounded conductor, it has been found that the opposite occurs herein, the presence of a grounded conductor in the electrostatic spattering zone serving to minimize spattering from the unconfined column of conductive paint. Of course, the grounded conductor must be sufficiently elevated over the top of the charged paint reservoir as to avoid having the charge in the reservoir arc directly to the conductor.

More particularly, this invention positions at least one grounded conductor in the electrostatic spattering zone electrically proximate to a column of unconfined uncharged conductive liquid flowing into a charged reservoir. When the grounded conductor is above the arcing level and within about 4 inches of the column of liquid, it effectively reduces electrostatic spattering and this avoids unnecessary waste and aeration of the liquid, and it also obviates undesired coating of nearby objects. The conductor is preferably of annular shape and desirably completely surrounds the paint column and is usually a round ring, but this is not essential. Also, the conductor may extend for a distance along the length of the column, or it may be a narrow element, such as a ring, in which case several spaced rings are preferably used, these being spaced apart along the length of the column.

The conductive liquid is usually aqueous, and it is most frequently termed a paint, though emulsion bind-

ers and the like are also contemplated. Normally, the reservoir communicates with a charged spray head, but this invention is useful regardless of the ultimate purpose of the electrostatic equipment.

The electrostatic coaction may arise out of the fact that the unconfined paint column is uncharged as it enters the previously established electrostatic field above the charged paint reservoir, and the potential difference exists between the paint in the column and the field in the surrounding atmosphere. The grounded conductors dissipate the field in the surrounding atmosphere, and thus prevent undesired spattering.

It is also helpful to blow dry air around the descending unconfined column of paint to help prevent arcing from the sidewalls of the reservoir to the descending column of paint.

The invention will be more fully understood from the accompanying drawing which is diagrammatic.

In the drawing, conductive paint is supplied as indicated by arrow A through conduit 10 to a position several feet above a paint reservoir 11 in a container 12. The paint exiting from conduit 10 forms an unconfined column of paint 13 which falls into the container 12 to maintain the reservoir 11. Paint from reservoir 11 is pumped from outlet 14 to a charged spray head (not shown), the flow of paint being indicated by arrow B.

As will be understood, the electrostatic charge is conducted back from the spray head to the reservoir 11 through the paint, and this serves to charge the reservoir 11 to approximately the same level used in the electrostatic spray process.

Depending upon the conductivity of the atmosphere, the charged paint in the reservoir establishes a field around it which gets stronger as one approaches the reservoir. Below the level X—X, a grounded conductor will receive the charge on the reservoir rapidly, an electrical arc serving to instantly discharge the reservoir. Thus, any grounded conductor must be kept above the level X—X. Any spattering which occurs below the level X—X is easily contained within a reservoir of reasonable dimension.

Correspondingly, as the paint in the column 13 descends, it reaches the spattering level Y—Y, below which spattering may occur. Thus, there is a spattering zone between the levels X—X and Y—Y, and it is in this zone that conductors are placed to dissipate the charge in the field surrounding the column 13. Two conductive rings 15 and 16 are shown, these being grounded through electrical lead 17.

Each grounded conductor is placed in the electrostatic spattering zone electrically proximate to the unconfined column of uncharged paint. The grounded conductor must have an inside diameter greater than the diameter of the unconfined column to enable the column to fall through the hollow grounded conductor. The maximum effective diameter for the grounded conductor is dependent upon the distance of electrical proximity to the unconfined column. Changes in humidity or the charge level in the reservoir can affect the distance of electrical proximity. Normally, where the reservoir has a charge between 50,000 volts and 100,000 volts, the maximum effective diameter of the grounded conductor is about 8 inches. Under these conditions, the practical range of inside diameters for grounded conductors is from three inches to eight inches, with inside diameters between 4 inches and 6 inches being preferred.

To particularly illustrate the use of this invention, a water-based paint exits from a conduit and forms an unconfined column which falls into a reservoir having a charge estimated to be in the range of 80,000 to 100,000 volts (measured to be greater than 30,000 volts which is the upper limit of our meter). At 32 percent relative humidity, the arcing level extends to a height of 18 inches above the reservoir. Four grounded rings having a diameter of 4 1/2 inches were vertically spaced 3 1/2 inches from one another, with the ring nearest the paint level in the reservoir being 32 inches above the same. The grounded rings were made of hollow metal with inwardly pointing small holes to allow dry compressed air to be pumped into the space around the unconfined column of liquid. Under these conditions, there was a feedback of only five volts at 35 percent relative humidity which was not troublesome. Spattering was effectively contained.

If the grounded rings are spaced too far from one another, it is possible for some spattering to occur between the rings. At 100,000 volts, a ring spacing of about 3 1/2 inches effectively eliminates spattering. While the invention desires complete elimination of spattering, any reduction is advantageous.

With respect to the charge in the charged reservoir, electrostatic processing, such as the spraying of paints and binders, conventionally employs a high voltage in combination with low amperage, e.g., in excess of 1000 volts with a current measured in a small fraction of an ampere.

The unconfined column of conductive liquid is several feet in length, as pointed out in the prior copending application of Rokadia, Ser. No. 403,364, filed Oct. 4, 1973. The column is necessarily long enough to extend completely through the spattering zone and the arcing zone above the charged reservoir and serves to largely prevent the passage of the electrostatic charge back to the conduit means. The column is normally in free fall, but this is not essential since it can be pumped in through a pressure hose to move laterally as well as vertically.

**The column can be discontinuous, as when the liquid is supplied in spurts or as a spray.

The invention is defined in the claims which follow. We claim:

1. Apparatus for supplying uncharged electrically conductive liquid to an electrostatically charged electrically isolated reservoir thereof comprising, conduit means for supplying said liquid to said reservoir in the form of an unconfined column having a length which prevents the passage of an electrostatic charge back to said conduit means, an electrically isolated container positioned to receive said unconfined column of liquid to provide a reservoir of electrostatically charged liquid, said charged reservoir establishing an electrical field having an arcing level close to said reservoir and a spattering level further removed from said reservoir, said levels defining a spattering zone therebetween, said unconfined column of liquid passing through said field and through said spattering zone, and at least one grounded conductor surrounding said unconfined column and electrically proximate thereto within said spattering zone to dissipate the electrical field in said spattering zone in the vicinity of said unconfined column of liquid and thereby minimize loss of liquid from said unconfined column by spattering.

2. Apparatus as recited in claim 1 wherein said grounded conductor is annular shaped having an inter-

nal diameter greater than the diameter of said unconfined column and up to about 8 inches.

3. Apparatus as recited in claim 2 wherein there are a plurality of ring-shaped grounded conductors spaced apart along the length of said unconfined liquid column within said spattering zone.

4. Apparatus as recited in claim 2 wherein said grounded conductor has a diameter of from 3 to 8 inches.

5. Apparatus as recited in claim 4 wherein said grounded conductor has a diameter of from 4 to 6 inches.

6. Apparatus as recited in claim 1 wherein said reservoir is in communication with an electrostatically charged spray head.

7. Apparatus as recited in claim 1 wherein dry air is blown around the descending unconfined column of liquid, thereby avoiding arcing to the walls of the reservoir.

8. Electrostatic apparatus for spraying electrically conductive liquid comprising, conduit means for supplying said liquid to said reservoir in the form of an unconfined column having a length which prevents the passage of an electrostatic charge back to said conduit means, an electrically isolated container positioned to receive said unconfined column of liquid to provide a reservoir of electrostatically charged liquid, said charged reservoir establishing an electrical field having an arcing level close to said reservoir and a spattering level further removed from said reservoir, said levels defining a spattering zone therebetween, said unconfined column of liquid passing through said field and through said spattering zone, and at least one grounded conductor surrounding said unconfined column and electrically proximate thereto within said spattering zone to dissipate the electrical field in said spattering zone in the vicinity of said unconfined column of liquid and thereby minimize loss of liquid from said unconfined column by spattering, an electrostatically charged spray head for spraying said liquid and conduit means communicating between said reservoir and said spray head.

9. A method for supplying uncharged electrically conductive liquid to an electrically isolated electrostatically charged reservoir comprising: supplying said liquid to said reservoir in the form of an unconfined column through an intervening space having a length which prevents the passage of an electrostatic charge, said charged reservoir establishing an electrical field having an arcing level close to said reservoir and a spattering level further removed from said reservoir, the space between said levels defining a spattering zone, and dissipating the electrical field in said spattering zone in the vicinity of said unconfined column of liquid through at least one grounded conductor which is electrically proximate to said column of liquid to thereby minimize loss of liquid from said unconfined column by spattering.

10. A method for supplying uncharged electrically conductive liquid to an electrically isolated electrostatically charged reservoir comprising: supplying said liquid to said reservoir in the form of an unconfined column through an intervening space having a length which prevents the passage of an electrostatic charge, said charged reservoir establishing an electrical field having an arcing level close to said reservoir and a spattering level further removed from said reservoir, the

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space between said levels defining a spattering zone, and dissipating the electrical field in said spattering zone in the vicinity of said unconfined column of liquid through at least one grounded conductor which is electrically proximate to said column of liquid to thereby

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minimize loss of liquid from said unconfined column by spattering, each said grounded conductor being between 4 inches and 6 inches in diameter.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,905,550

DATED : Sept. 16, 1975

INVENTOR(S) : Abdullah M. Rokadia
Joseph E. Gaske

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 7, in the Assignee, "De Sota, Inc."
should read --DeSoto, Inc.--

Signed and Sealed this

twentieth Day of *April* 1976

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks