Oct. 14, 1969 N. M. ZUPAN ET AL 3,472,204

ELECTROSTATIC COATING APPARATUS

Filed June 14, 1968

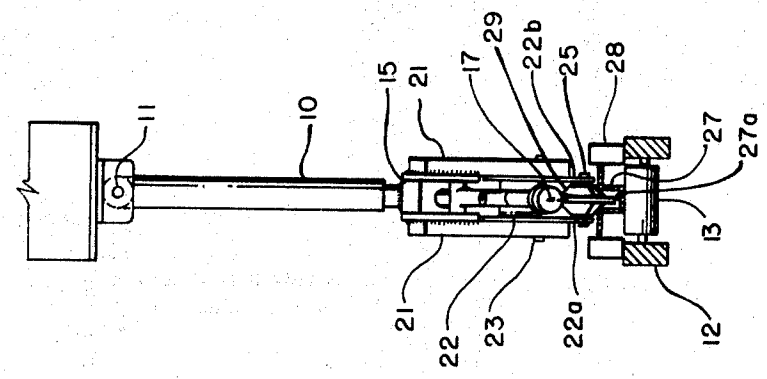


Fig. 2

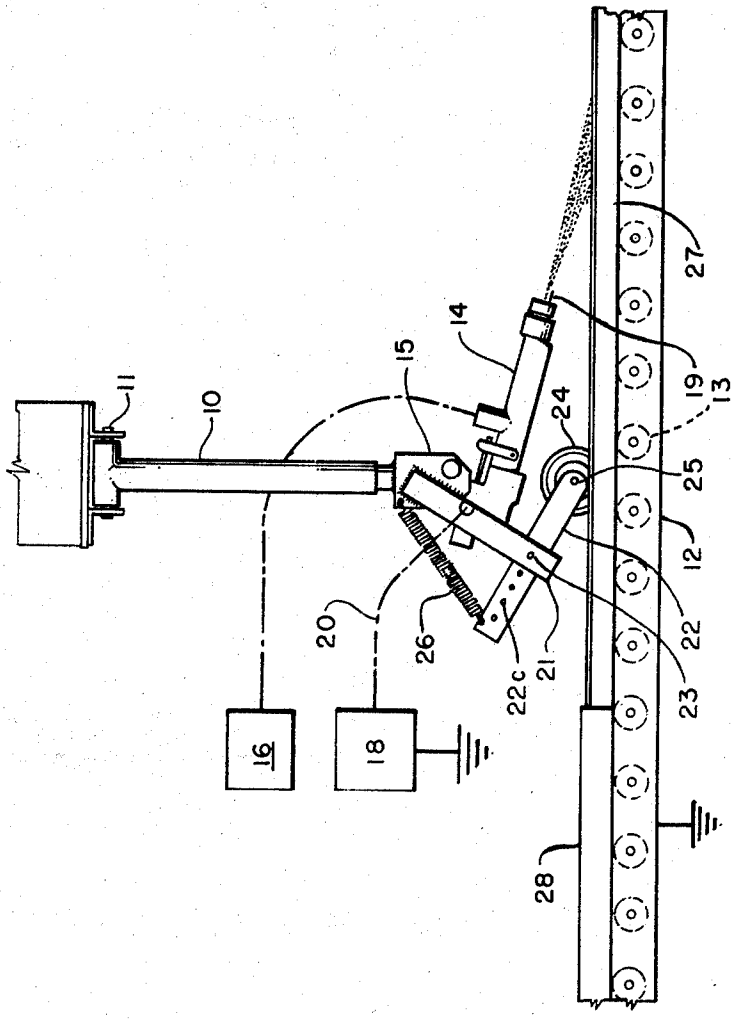


Fig. 1

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United States Patent Office 3,472,204
Patented Oct. 14, 1969

3,472,204

ELECTROSTATIC COATING APPARATUS

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Continuation-in-part of application Ser. No. 470,152, July 7, 1965. This application June 14, 1968, Ser. No. 761,357

Int. Cl. B05b 5/08, 13/04

U.S. Cl. 118—631 6 Claims

ABSTRACT OF THE DISCLOSURE

The apparatus of this invention is directed toward coating channeled articles and other articles having depressions, recesses or other irregularities and comprises a spray gun for projecting a spray of coating material particles along a predetermined axis, conveyor for moving one or more channeled articles through the spray and a supporting structure for the spray gun. The spray gun may be mounted at an acute angle with respect to the conveyor. The spray gun supporting structure includes means to intercept the channel of the article and to align it with the spray axis. It also includes means which is movable from an equilibrium position and biased to return to that position and is adapted to keep the article out of contact with stationary objects as it moves through the spray. The gun support structure may include means to permit pivotal movement so that movement of the spray gun and the intercepting means is transverse to the conveyor movement. The spray gun may be a hydrostatic-electrostatic gun of the type shown and described in U.S. Letters Patent 3,169,883.

This is a continuation-in-part of application Ser. No. 470,152, filed July 7, 1965, now abandoned.

This invention relates to an apparatus for electrostatically coating articles, particularly channeled or grooved articles.

Electrostatically spray coating articles of manufacture is a well known and widely practiced art in which charged coating material particles are deposited on an oppositely charged article. However, electrostatically coating some articles presents difficulties because of the particular shape or configuration of the article. For example, articles of manufacture having deep grooves or deeply channeled sections, such as ceiling joists and deeply corrugated metal roof decking, are more difficult to coat electrostatically than those which are flat or have only shallow indentations. Unless the charged coating material particles are given a strong mechanical push in the direction of the channel, such as may ocur when the coating material is atomized by hydraulic pressure, compressed air or other mechanical means, the electrostatic attraction between the charged particles and the top portion of the side walls of a deep channel will result in satisfactory deposition of coating material on the top portion, but little or no deposition of coating material near the bottom of the channel.

Electrostatic coating methods in which atomization is effected by interaction with air, such as by compressed air or hydraulic pressure, impart a substantial directional mechanical momentum to the charged coating material particles so that if properly directed they may be deposited uniformly in the depths of a channel, thus in part at least overcoming the electrostatic attraction to the upper sides of the channel. Because of the directional nature of the projected spray, however, alignment between the axis of the spray pattern and the axis of the channel is critical if satisfactory deposition in the channel is to be achieved. Misalignment of these axes will result in non-uniform

deposition in the channel. Long narrow articles are likely to move about considerably while being carried along on a conveyor into and through a coating zone. Although guide rails along the conveyor may somewhat confine article movement, especially movement from side to side, they cannot prevent such movement and at the same time permit longitudinal movement along the conveyor. If the channeled articles are to be coated rapidly, the guide rails must be so spaced that the articles are free to move. Where the spraying device is hand held by an operator, the operator can generally direct the spray accurately toward the article and into any channels or depressions therein, even though the article may move somewhat erratically. Where the spraying device is to be operated automatically, however, the possibility of such erratic movement of the article requires the provision of means to assure that the spray is properly directed toward the article and toward any channel therein.

One embodiment of this invention includes an electrostatic spray gun in which coating material is supplied at a very high pressure to a small elongated orifice to be projected therefrom into a thin fan-shaped film at very high velocity to be atomized by interaction with air and in which the atomized coating material is charged by a slim elongated electrode adjacent said orifice. The electrostatic spray gun is mounted on a movable support with the spray axis oriented at an acute angle to the conveyor which carries the articles. The movable support is arranged to have an equilibrium position that will position the channeled articles intermediate guide rails of a conveyor. Upon being struck by the misaligned channel of an article, the support will transiently move laterally to intercept the channel of the article. The support will return to its equilibrium position with the article. By means connected to the support, the channel of the article and the axis of the projected spray are aligned, and alignment is maintained while the conveyor moves the channeled article through the projected spray. The alignment means is, of course, adjustable so that it may accommodate different sizes and various types of channeled articles.

Various features and advantages will be apparent from the description and drawings in which:

FIG. 1 is a side elevational view of one form of apparatus embodying this invention; and FIG. 2 is an end elevational view of the apparatus shown in FIG. 1.

Referring now to FIG. 1, a support **10** pivotally mounted at **11** is positioned opposite a conveyor **12** which includes a series of power-driven rollers **13**. A hydraulic-electrostatic spray gun **14**, which may be of a type described in U. S. Patent 3,169,883, is adjustably supported from support **10** by mounting bracket **15**. Coating material is supplied to spray gun **14** by means of hydraulic pump **16** at appropriate pressures. The coating material is emitted through a small elongated orifice **17** (shown in FIG. 2), formed into an expanding fan-like spray which is directed generally along the axis of the spray gun. High voltage is brought to the spray gun from high voltage source **18** through high voltage cable **20** which passes through the insulating body of the gun to a slender elongated electrode **19** positioned closely adjacent but spaced from orifice **17** so as to charge the spray particles. Typically, such an electrostatic spray gun incorporates a resistor of several hundred megohms between the electrode and the high voltage source, and the high voltage source has an output voltage of about 60 kilovolts.

Mounting bracket **15** orients spray gun **14** so that the axis of direction of emission of the charged spray particles lies at an acute angle with respect to the plane of the conveyor. Two bars **21** are mounted on support **10** and carry centrally between them a fork-like member **22** having legs **22*a*** and **22*b***. Fork-like member **22** is aligned with the

axis of the spray gun and is rotatable about a shaft **23** which extends between bars **21**. A series of points **22***c* are provided about which the fork-like member may rotate to accommodate different articles. A guiding roller **24** is journaled on a shaft **25** between legs **22***a* and **22***b*. Guiding roller **24** has a tapered periphery **29** which will fit in the channel of the articles and by bearing on the sides of the channel will align the channel and the axis of the spray emitted from the spray gun **14**. At the rear end of member **22**, biasing means, such as spring **26**, supported from support **10**, provides sufficient pressure to cause the periphery **29** of guiding roller **24** to maintain contact with the channel of the article **27**. Elements **10**, **15**, **21**, **22**, **23**, **24**, and **25** make up the supporting structure of the spray gun. Various sizes and shapes of rollers can be used, depending on the particular article being coated.

Pivot mounting **11** is centered above the conveyor **12** and between guide rails **28**. The spray gun **14** and its supporting structure including the article guiding roller **24**, hang in an equilibrium position that is centered between the guide rails and is free to swing transversely of the direction of article movement.

In operation a channeled article, such as a hat-section ceiling joist **27**, is moved horizontally along conveyor **12** from left to right as shown in FIG. 1. Guide rails **28** guide the article **27** so that the channel may be engaged by guiding roller **24**. If the channel of the article is not aligned with the guiding roller **24**, pivot mounting **11** will permit the support to swing, transiently moving the guiding roller **24** and the spray gun laterally to intercept the article. The pendulum action of the spray gun and its supporting structure bias it to return to its equilibrium position and to move the article to a position out of contact with the stationary guide rails of the conveyor, permitting articles to be rapidly conveyed through the coating zone. By means of spring **26**, sufficient pressure is exerted on fork **22** to maintain guiding roller **24** in contact with the channel **27***a* in article **27**. As the article is moved along the conveyor and through the coating zone at the intersection of the atomized spray and the conveyor, alignment is automatically maintained between the axis of the channel **27***a* in article **27** and the axis of the direction of the spray emitted from the spray gun **14**. Where a plurality of such articles are to be coated, they may be conveyed end to end through the coating zone so that the guiding roller will bridge the interface between the ends. Typical coating material such as red oxide primer thinned to 20 seconds, Zahn 2 with xylol is supplied at 920 pounds per square inch fluid pressure to an orifice having an area equivalent that of a circle .015 of an inch in diameter and forming an expanding fan-like spray having an included angle of 15°. The orifice is positioned approximately three inches from the top surface of the hat-shaped section and the spray was projected downwardly at an angle of 20° with respect to horizontal. Approximately 12 to 15 inches exist between the point of guidance and the coating zone. This hat-shaped section had a channel 2½ inches wide and 1¾ inches deep. With the hat-shaped section carried through the coating zone at the rate of 125 feet per minute a uniform coating of ½ mil of primer was achieved on the entire surface of the channel even though the center line of the channel wobbled about 1½ inches.

Channeled articles of varying heights may also be coated by mounting the support **10** on a reciprocator whose vertical position is controlled by the height of the channeled article being presented to the coating zone.

Although the invention is described and shown with a source of spray in which atomization is effected by using very high fluid supply pressures and a small orifice, it is apparent that the invention is equally advantageous with a source of spray in which atomization is effected by using compressed air.

We claim:

1. Apparatus for coating channeled articles comprising, a spray gun to project a spray of coating material particles along an axis, a conveyor to move channeled articles through said spray, and a supporting structure for said spray gun including means to intercept the channel of the article and to align it with the axis of the spray, said supporting structure being movable from an equilibrium position and biased to return to that position and to keep the article out of contact with stationary objects as it moves through the spray.

2. Apparatus for electrostatically coating an article with a channel, comprising a pivotable support, an electrostatic spray gun mounted on the support and having an elongated orifice and a charging electrode adjacent to said orifice, means for supplying coating material to said orifice at very high pressures, means for charging said electrode, a conveyor to move the article past said spray gun, a guiding roller mounted on the support aligned with the axis of the spray gun, and shaped to engage the channel of the article to maintain the alignment between the channel and the axis of the spray gun as the article moves past the spray gun, said pivotable support permitting movement of the spray gun and guiding roller transverse to the conveyor movement.

3. Apparatus as set forth in claim 2 wherein said atomizer is mounted at an acute angle with respect to the conveyor.

4. Apparatus for electrostatically coating a channeled article, comprising a pivot, a support movably carried by said pivot, an electrostatic spray gun for mechanically atomizing coating material mounted to said support, a pair of bars mounted to said support, a fork-like member rotatable about a shaft extending between said bars, a guiding roller journaled between the legs of said fork-like member and having a periphery shaped to engage the channel of said article, and bias means acting on said fork-like member to maintain the engagement of the guiding roller with the channel of the article.

5. Apparatus as set forth in claim 4 wherein a conveyor supports the article and moves it horizontally past the spray gun, the pivot permits the support to swing transversely to the direction of article movement and the fork-like member includes a series of points about which it is rotatable to permit accommodation of different articles.

6. Apparatus for electrostatically coating a channeled article comprising, an atomizer to atomize and mechanically impart a momentum to a spray of coating material, an electrode to charge the spray and create an electrostatic depositing field, a conveyor to move the channeled articles through the charged spray, and means aligned with the axis of the spray to maintain the alignment of the axis of the channel with the axis of the spray during deposition of the spray.

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U.S. Cl. X.R.

117—93.4, 96; 118—307