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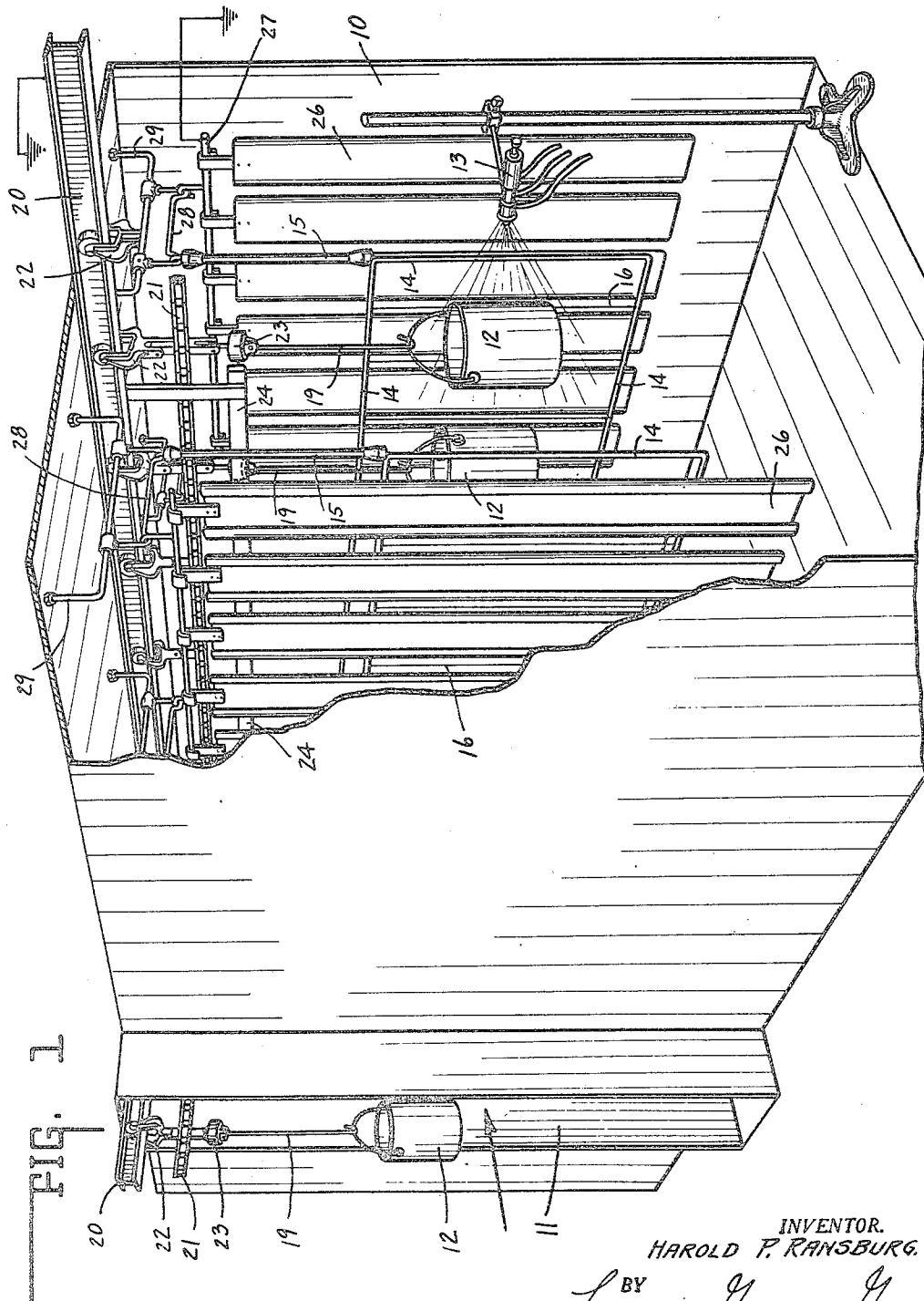
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APPARATUS FOR ELECTROSTATICALLY COATING ARTICLES

Filed Feb. 3, 1945

3 Sheets-Sheet 1



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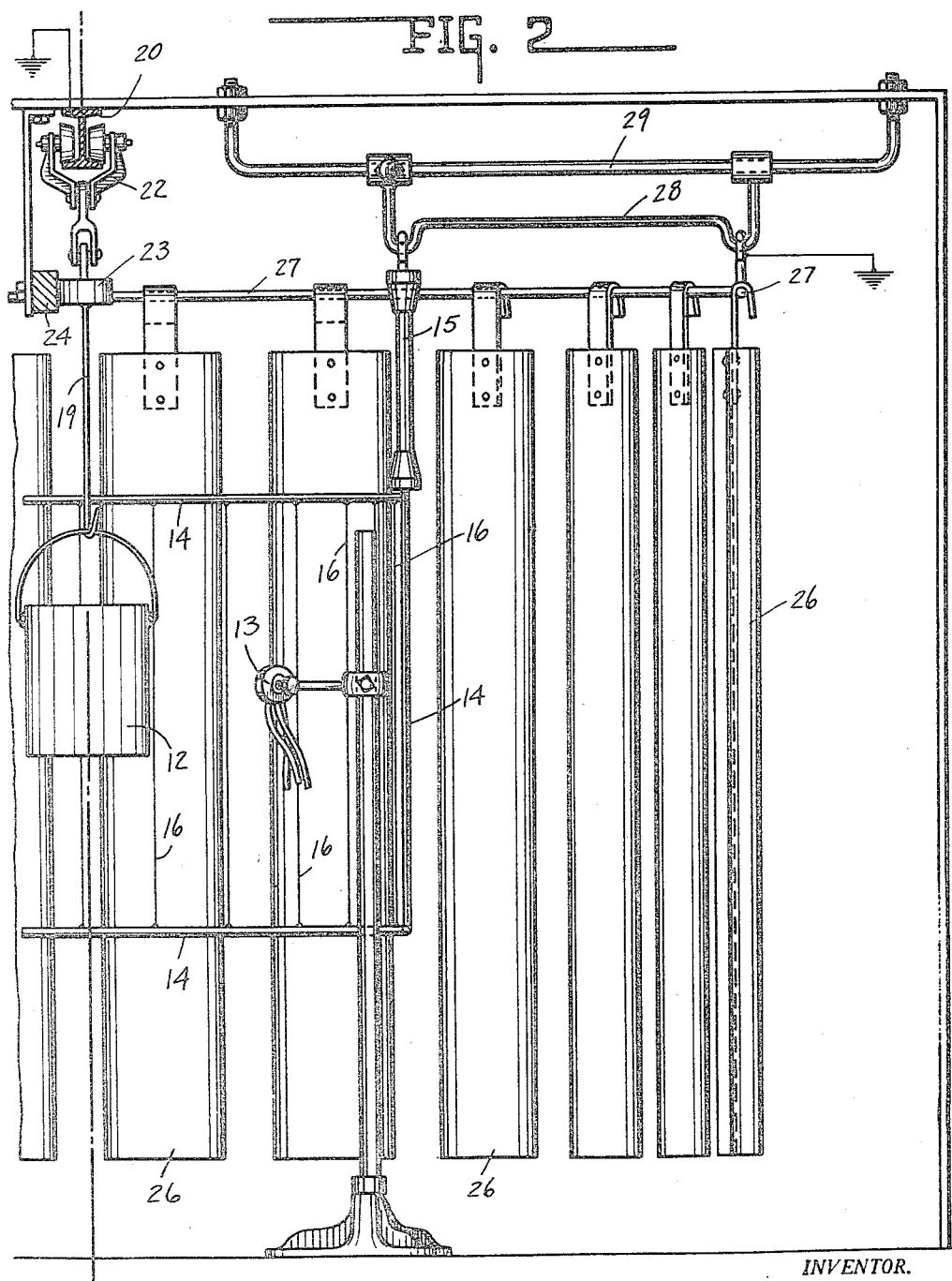
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FIG. 2



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APPARATUS FOR ELECTROSTATICALLY
COATING ARTICLES

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This invention relates to the coating of articles with a protective and decorative coating material, and particularly wherein the coating material is to be applied by electrostatic precipitation, as generally disclosed in Letters Patent of Pugh No. 1,855,869, granted April 26, 1932, and Letters Patent of Ransburg and Green, No. 2,334,648, granted November 16, 1943.

The apparatus herein disclosed is most desirable and advantageous when the coating material is a liquid, which when suitably atomized, tends to adhere securely to any object with which it comes in contact. The invention is directed to correcting one of the major deficiencies and objections to the electrostatic coating process as normally employed, in that it provides an effective apparatus for freeing the atmosphere which surrounds the spray area, of that small but highly objectionable percentage of charged particles of coating material which escape effective precipitation onto the article to be coated.

In the ideal electrostatic coating operation a finely divided coating material is carried into an electrostatic field established between an electrode system and the article to be coated at a rather slow velocity and in such a direction that the material will remain in the field long enough for complete precipitation to take place. But such ideal condition is never completely realized in actual practice. There are certain factors which preclude realization of this ideal because such factors individually or collectively cause some portion of the coating material to escape the intended action of the field. Since these factors are inherent in the method, one always finds a small percentage of the coating material leaving the spray booth at one point or another. This stray material coats and defaces objects, merchandise and adjacent equipment not intended to be coated. Furthermore, since the particles of stray material have passed through the field and have become charged, they will be attracted to objects to which uncharged particles would not normally be attracted.

My invention, therefore, provides means for substantially eliminating this objection. This means includes apparatus for establishing a second electrostatic field for the express purpose of electrically depositing those charged particles, which escape the intended coating operation, onto a collector surface such as removable plates which cannot be damaged. A suitable arrangement for accomplishing the invention is illustrated in the attached drawings.

The full nature of the invention will be under-

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stood from the accompanying drawings and the following description and claims:

Fig. 1 is a perspective view of an electrostatic spray installation with a portion of the spray booth broken away.

Fig. 2 is a vertical section taken through the right-hand side of the spray booth.

Fig. 3 is a schematic drawing showing a plan view of the spray booth and electrode system.

Fig. 4 is a sectional view of a non-conducting article to be coated.

In the drawings there is shown by way of illustration of the invention, an electrostatic spray booth 10 which is provided with an entrance opening indicated at 11 in the side wall thereof through which the articles 12 to be coated are conveyed into the booth. As shown, the spray booth is elongated and so arranged that the articles are conveyed longitudinally and centrally thereof, after entering through the entrance opening in the side wall, and toward the open exit end in which one or more spray guns 13 are mounted. Thus, after entering the booth through the entrance opening in the side wall they are conveyed in a curved path through a portion of their travel in the direction of the arrows as shown in Fig. 3.

For providing one terminal of the electrostatic field, there is mounted within the booth oppositely disposed discharge electrodes. Said discharge electrodes are shown herein as comprising one or more supporting frames 14 suspended from the top of the booth by the insulating hangers 15. Each frame carries a plurality of spaced fine electrode wires 16 arranged in vertical parallel relation and sufficiently far apart to avoid electrostatic interference with one another. The electrode frames and wires are electrically connected through a conductor 17 with one terminal of a source of high voltage indicated at 18. The other terminal of said source is grounded. The electrode frames 14 are supported in spaced relation to the path of travel of the articles 12 and are arranged to conform to the curved portion of the path of travel and extend toward the entrance opening 11 in the booth. This is best illustrated in the schematic drawing of Fig. 3.

The articles 12 to be coated are herein illustrated as comprising buckets suspended by hangers 19 from a mono-rail support 20 mounted in the top of the booth. They are conveyed through the booth and between the discharge electrodes by the conveyor chain 21 connected to the roller supporting brackets 22 carried by the mono-rail.

In coating certain articles, such as buckets, it is desirable to cause them to rotate as they pass through the spray booth, and this is accomplished by providing a swivel connection between the hangers 19 and brackets 22, which includes a roller 23 on said hanger arranged for frictional engagement with a track 24. Thus, as they are conveyed through the coating zone, they are slowly rotated.

For creating the electrostatic field of the coating zone, the conveyor and, therefore, the articles or their supports are grounded to provide a collecting electrode oppositely disposed relative to the discharge electrode. Thus, through the medium of the source of high voltage 18 there is created a high potential difference between the discharge electrode wires 16 and the articles which comprise the collecting electrode. Thus, an electrostatic field is created when the articles are conveyed past the discharge electrodes. The atomized coating material is introduced into this field through such a medium or agent as the spray guns 13.

Whereas there is illustrated herein a pair of spaced discharge electrodes 14, 16 between which the articles are conveyed, and wherein there is shown (Fig. 3) a pair of spaced spray guns 13 directing the coating material into the field along both sides of the path of travel of the articles, it is to be understood that in some installations, depending upon the character of the article, the discharge electrodes and spray guns may be arranged only on one side of the path of travel of the article.

As the atomized coating particles are introduced into the field, they are ionized by the corona discharge of the electrode 14, 16, and if their direction of movement, inertia and velocity are properly controlled and adjusted, they will be attracted to the grounded collecting electrode in the form of the articles 12 to be coated. However, it still remains that stray particles of coating material will escape the field of the coating zone and be lost so far as the coating of the articles is concerned. These particles will have passed through or near the discharge electrode and will, therefore, have become ionized so as to be attracted to and adhere upon surrounding structures and objects in the general neighborhood.

For the purpose of overcoming this objection and controlling the deposition of the stray particles, a second electrostatic field is provided. This second field is arranged adjacent to and outside of the first field of the coating zone, and is preferably of lesser intensity. For this purpose, a secondary collecting electrode surface is provided which is grounded and so spaced from the discharge electrode, on the opposite side thereof from the articles, to provide a second electrostatic field of less intensity. As the stray particles which have become ionized in passing through the coating field and discharge electrode escape to the outer or second field, they will become attracted to and deposited upon the secondary grounded collecting electrode.

In the form of the invention herein disclosed the walls of the spray booth 10 are of insulating material. Spaced from the walls there is provided a secondary collecting electrode surface in the form of a plurality of grounded collecting plates 26. Said plates may be arranged in alignment and hung from the supporting bars 27 by hooks to enable them to be conveniently removed for scraping or cleaning. The bars 27 may be car-

ried by a series of adjustable tie rods 28 adjustably mounted upon the brackets 29 depending from the top of the booth. As shown herein the tie rods 28 are provided with depressed portions at each end thereof, the bars 27 from which the plates 26 are hung being carried by the outer depression and the insulating hangers 15 by which the discharge electrodes are supported being carried by the inner depression. In this manner, the spacing of the plates 26 relative to the discharge electrode remains constant so as to maintain at all times the prescribed intensity of this field. However, the discharge electrode, together with the plates 26, may be adjusted in proper spaced relation to the near surface of the articles 12 to be coated, depending upon the size or diameter of the articles. Thus, as the size or diameter of the articles may be altered, the tie rods 28 may be moved back and forth on support 29 without changing the spaced relation of the collecting plates 26 with respect to the discharge electrode.

By providing the collector 26 in the form of a series of spaced plates 26, it may be more conveniently removed for cleaning or scraping than would otherwise be the case if it were of continuous construction. Also, by reason of the spacing of the plates, air may freely pass between and about them, carrying the stray particles of coating material so as to avoid any repelling air currents or turbulence such as would prevent such deposition of stray particles on their collecting surface. It is also desirable that the edges of the collecting plates be curved to prevent exposure of a sharp edge to the electrostatic forces which may concentrate the lines of force, such as to cause the stray particles of material to be re-ionized and repelled.

An exhaust fan 25 is provided at one end of the booth 10 and preferably directly opposite the guns 13 as shown in Fig. 3. The purpose of this exhaust fan is to cause air movement in the direction of the issuing streams from the guns 13, to facilitate the movement of air past the electrodes 14, 16 and 26 without creating repelling air currents or air turbulence.

By reason of the above arrangement, wherein two electrostatic fields are provided, one preferably of greater intensity for the coating zone and one preferably of lesser intensity to provide a stray particle collecting zone, there has been devised apparatus for controlling the material, such as to substantially eliminate the destructive and objectionable character thereof. Similarly, the reclaiming of the coating material electrostatically deposited upon the collecting plates, has been made more practical by arranging them for convenient removal, scraping or washing; or by other known means of reclamation, such as providing a water curtain to continuously cleanse and remove the deposited particles. Thus, the material may be reclaimed, and damage to surfaces in and about the premises, eliminated.

Whereas the article to be coated is shown and described herein as a bucket for illustrative purposes, it may be of any character comprising either conducting or non-conducting material. Thus, if it is of non-conducting material, an electrode element 12a having a connecting lead 19a is associated therewith as illustrated in Fig. 4. In either case the article, with or without the element 12a is to be herein considered as comprising the collecting electrode.

The invention claimed is:

1. Apparatus for electrostatically coating articles including a discharge electrode spaced from

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said articles, a collecting electrode having a surface spaced from said discharge electrode on the other side thereof from said articles, means for establishing a primary electrostatic field between said discharge electrode and articles and a secondary electrostatic field between said discharge electrode and collecting surface, and means for atomizing coating material into said primary field for electrostatic deposition on said articles, said secondary field acting to precipitate on to said collecting surface material escaping from said primary field into said secondary field.

2. Apparatus for electrostatically coating articles including a discharge electrode spaced from said articles, a collecting electrode comprising a plurality of spaced electrically connected plates arranged in series and in spaced relation to said discharge electrode on the opposite side thereof from said articles, means for establishing a primary electrostatic field between said discharge electrode and articles and a secondary electrostatic field between said discharge electrode and plates, and means for atomizing coating material into said primary field for electrostatic deposition on said articles, said secondary field acting to precipitate on to said plates material escaping from said primary field into said secondary field.

3. Apparatus for electrostatically coating articles including a discharge electrode, means for positioning the articles to be coated in spaced relation to said electrode, a collecting electrode having a surface spaced from said discharge electrode on the opposite side thereof from said articles, a source of high voltage having one terminal electrically connected with said discharge electrode and the other terminal electrically connected with the support for said articles and collecting electrode, said source establishing a primary electrostatic field between said discharge electrode and articles and a secondary electrostatic field between said discharge electrode and collecting electrode surface, and an atomizing means mounted to direct a spray of atomized coating material into said primary field for electrostatic deposition on said articles, whereby stray material escaping from said primary field into said secondary field will be electrostatically deposited on said collecting electrode surface.

4. Apparatus for electrostatically coating articles including a pair of discharge electrodes, means for conveying articles between said electrodes in spaced relation thereto, a series of collecting electrode plates removably supported in spaced relation to each of said discharge electrodes on the opposite sides thereof from said articles, a source of high voltage having one terminal electrically connected with said discharge electrode, and the other terminal electrically connected with said conveying means and electrode plates, said source establishing a primary electrostatic field between said articles and discharge electrodes and a secondary electrostatic field between said electrodes and their respective series of collecting electrode plates, and an atomizing means mounted to direct a spray of coating material into said primary field for electrostatic deposition on said articles, whereby stray material escaping from said primary field into said secondary field will be electrostatically deposited on said collecting plates.

5. Apparatus for electrostatically coating articles comprising a spray booth having top and side walls, a conveyor operatively mounted in said booth for conveying the articles to be coated

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therethrough, a plurality of tie rods adjustably supported by said booth for movement toward and away from the path of travel of the articles carried by said conveyor, a series of discharge electrode elements carried by said tie rods at one end thereof adjacent to the path of travel of said articles, collecting electrode plates carried by the opposite end of said tie rods respectively in fixed spaced relation to said discharge electrode elements and away from the path of travel of said articles, a source of high voltage having one terminal electrically connected with said discharge electrode elements and the other terminal electrically connected with said conveyor and collecting electrode plates to establish primary and secondary electrostatic fields therebetween respectively, and an atomizing agent mounted to direct a spray of atomized coating material into said primary field for electrostatic deposition on said articles, said secondary field causing electrostatic deposition of material escaping from the primary field into the secondary field upon said collecting plates.

6. Apparatus for electrostatically coating articles including a discharge electrode spaced from said articles, a collecting electrode comprising a plurality of spaced electrically connected plates arranged in series and in spaced relation to said discharge electrode on the opposite side thereof from said articles, means for establishing a primary electrostatic field between said discharge electrode and articles and a secondary electrostatic field between said discharge electrode and plates, each of said plates having a rearwardly and inwardly curved edge formed thereon in spaced parallel relation to the next adjacent plate, tie rods for removably supporting said plates at one end thereof and the discharge electrode at the other end thereof whereby said plates and discharge electrode will be maintained in fixed spaced relation, brackets for adjustably supporting said tie rods to permit adjustment of said discharge electrode and collecting plates toward and away from the path of travel of said articles to maintain their spaced relation from the surface of said articles to be coated, and means for atomizing a coating material into said primary field for electrostatic deposition upon the surfaces of said articles, said secondary field acting to electrostatically precipitate onto said plates stray material escaping from said primary field.

7. Apparatus for electrostatically coating articles including a discharge electrode, means for conveying said articles past said electrode in spaced relation thereto, a plurality of spaced collecting plates supported in spaced relation to said discharge electrode, a source of high voltage having one terminal electrically connected with said discharge electrode, and the other terminal electrically connected with said conveying means and plates, said source establishing a primary electrostatic field between said articles and discharge electrode and a secondary electrostatic field between said electrode and said collecting plates, an atomizing means mounted to direct a spray of coating material into said primary field for electrostatic deposition on said articles, whereby stray material escaping from said primary field into said secondary field will be electrostatically deposited on said collecting plates, and means for drawing air through said plates from adjacent said electrode.

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