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ELECTROSTATIC COATING APPARATUS

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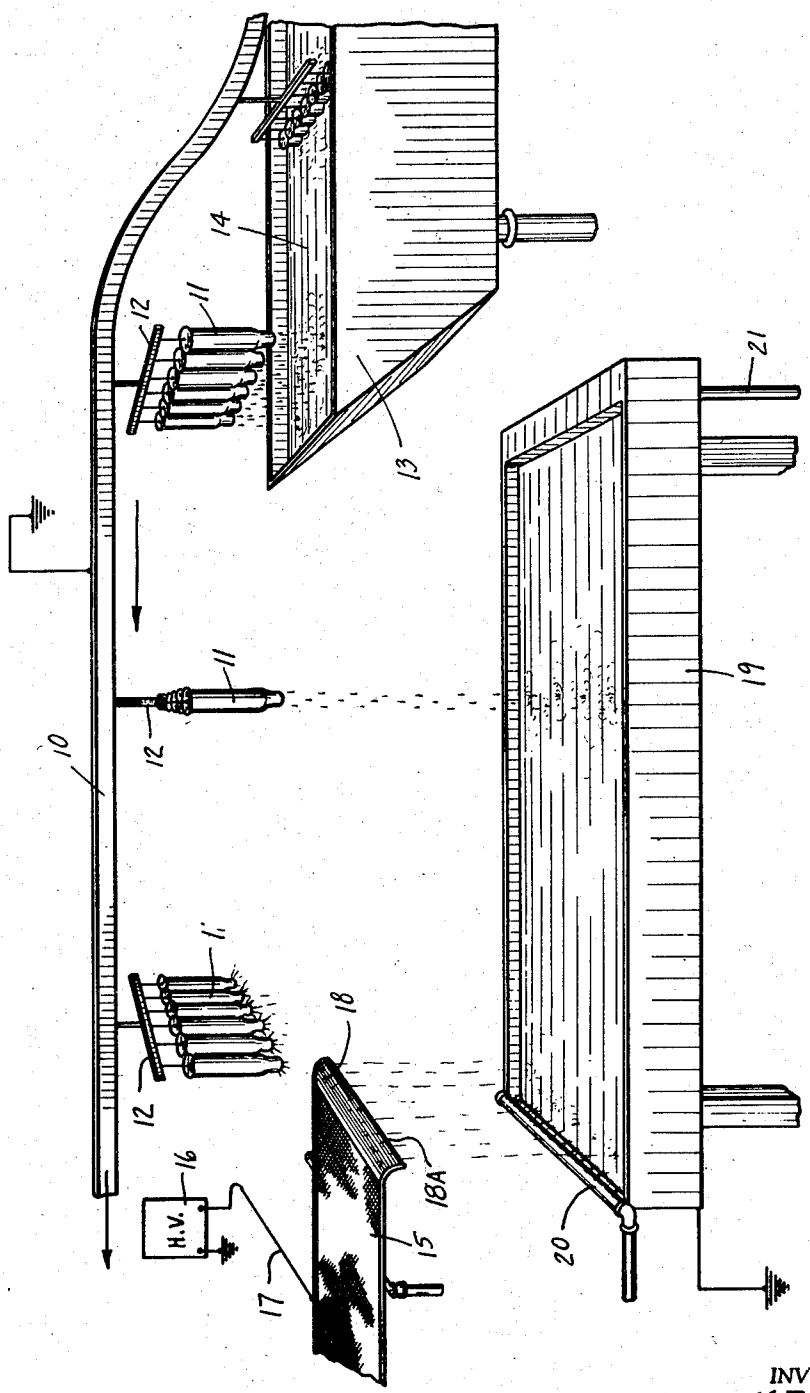

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ELECTROSTATIC COATING APPARATUS

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This invention relates to an apparatus for coating articles in an electrostatic field wherein said articles are first dipped in a bath of coating material and then passed through an electrostatic field for removing excess coating and tear drops, reference being had to Letters Patent No. 2,359,476, granted on an application of Charles K. Gravley, October 3, 1944, entitled "Electrostatic method and apparatus."

In the application of paint, lacquer or other coating materials by the dip process, the excess material which invariably remains at the drain-off point after substantial flow has ceased, has always been a problem which has seriously limited wide spread application of this most efficient coating method. The accumulations which remain at the drain off points are referred to as "tears." In accordance with the above patent, a process and apparatus is disclosed which accomplishes the removal of this excess material and leaves the finish on the article smooth and complete. This removal is accomplished by so arranging the apparatus as to cause the dipped articles to pass at the correct time through an electrostatic field, wherein an electric force is applied to all parts of the article which tends to pull it toward a spaced electrode charged at high voltage. If the article is rigidly held and the excess coating material is sufficiently liquid, it will be pulled off of the article, leaving a coating that is smooth and free from tear drops or similar excess material. This removal of excess material is herein referred to as "detearing."

Heretofore the attracting high voltage electrode has been spaced to one side of the article. However, it has been found advantageous in applying this method to numerous articles to place the electrode below the article so as to combine the attractive force of the electrode with the force of gravity. This arrangement, however, immediately gives rise to difficulties in that the drippings build up and accumulate on the electrode in repeated use of the process, such as occurs in large scale production. Although the build-up of the material on the electrode does not affect its electrostatic efficiency, it becomes unsightly and not good practice, and involves considerable effort and loss of time in periodically cleaning and removing its accumulation of drippings. However, more important, if the accumulation of the leading edge of the electrode becomes excessive, and if the material remains liquid for any length of time, it will have a tendency to re-detear back onto the finished work.

It is, therefore, one of the objects of this invention to provide means for materially reducing the build-up of coating on the electrode and the re-detearing thereof back onto the work. In any electrostatic detearing operation the detearing action will always take place from points, edges, or sections of small radius. Because electrodes, as used heretofore, have been designed with a relatively sharp leading edge, material which accumulates on this edge will, if it remains fluid, eventually present an excess which may be deteared back on to the work. In order to prevent this action, the leading edge of the electrode, in the present invention, is attached to a downwardly curved smooth surfaced apron of a radius which is relatively large compared to the work being treated.

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Another feature of the invention resides in the provision of a drip tank extending under the apron into which the liquid or drippings are directed, said drippings being carried away by a constant flow of water in the drip tank. Said drip tank may also be utilized to carry away and dispose of drippings from the article as it passes from the dipping tank.

A further feature of the invention resides in the provision of a drip receiving structure interposed between the detearing electrode and the dip tank, and which extends below and in spaced relation to their adjacent edges. By means of such structure fire hazards are avoided in that there will be no continuity of inflammable material leading from the detearing electrode to the dip tank. Furthermore, this structure is preferably grounded so that it will act through electrostatic forces to detear excess material from the detearing electrode.

The full nature of the invention will be understood from the accompanying drawing and the following description and claims.

The drawing is a perspective view of the apparatus illustrating the invention.

In the drawing there is shown an overhead conveyor track 10 for continuously conveying a group of articles 11 to be coated. Said articles are, for purpose of illustration, herein shown as shell cases to which a coating of varnish is to be applied. The articles are carried in groups by a supporting hanger 12 carried by a suitable conveyor along the track 10.

A dip tank 13 is provided for containing a bath of coating material 14 into which the articles are submerged and removed by a dip in the overhead conveyor track 10, said articles being moved in the path indicated by the arrows. Spaced from the dip tank along the line of travel of the arti-

cles there is provided an underlying electrode 15 supported in spaced horizontal relation to the line of travel of the articles so that the articles are caused to pass thereover following their travel through a predetermined space between the leading edge of the electrode and the dip tank.

A source of high voltage indicated at 16 has one terminal thereof grounded and the other terminal connected to the electrode 15 by the lead wire 17. The overhead track is grounded and is electrically connected with the articles through the hangers 12. Thus, the articles are grounded to one side of the source of high voltage and the electrode 15 is at a high potential in respect thereto, such as to create an electrostatic field therebetween. The resultant field thus established causes an increased force, over that of gravity, on the residual droplets or excess coating, such as to draw them from the articles. This action takes place as the articles approach the leading edge of the electrode, and hence the major portion of the excess material and droplets is withdrawn from the articles toward said leading edge.

To prevent a build-up of the removed coating material on the leading edge of the electrode, such as may cause a re-detearing action or fire hazard, a drip apron 18 is provided. Said drip apron comprises the leading edge of the electrode, that portion thereof which receives the greater amount of removed material. To prevent the material building up on the drip apron, it is provided with a smooth downwardly curved surface, such as to cause the liquid material to rapidly drain therefrom as it is received and thereby prevent it from building up. Upon draining by gravity to the lower edge 18A of the apron, the material will then detear to the drip tank 19 which is the more convenient of the two adjacent grounded objects, rather than back to the coated articles. This rounded surface also is designed so that it presents a surface of sufficiently large radius to preclude detearing of the wet material back onto the work. The balance of the electrode may be in the form of a large mesh screen, as illustrated.

Below the plane of the electrode 15 and extending along the path of travel of the articles from the dip tank to the electrode, there is provided a drip tank 19 containing a water bath which flows through said tank from an inlet pipe 20 to an outlet pipe 21. By means of this drip tank spanning the space through which the articles travel before reaching the apron of the electrode, provision is made for receiving and carrying away the intermediate drippings, as well as the dripping from the apron.

From the foregoing it will be apparent by means of this apparatus that the electrostatic force may be combined with the force of gravity to withdraw downwardly the excess material from the articles. This is made possible by the disposition of the electrode, its structure and the provision for draining its leading edge.

The invention claimed is:

1. Apparatus for coating articles comprising means for applying a liquid coating material to the surface thereof, means operable to convey said articles through space to permit drainage of said coating by force of gravity, a horizontally disposed electrode mounted to extend below and in spaced relation to the path of travel of said articles, means for providing an electrostatic force between said articles and said electrode capable of establishing an electric force exerted in the same direction as the force of gravity and in addition thereto for drawing excess liquid coating material downwardly from said articles, and a downwardly curved drip apron extending along the leading edge of said electrode to initially receive said withdrawn excess of material and permit it to freely flow therefrom.

2. Apparatus for coating articles comprising a dip tank containing a bath of coating material, a conveyor operable to submerge said articles in said bath and thereafter convey them beyond said tank, a horizontally disposed electrode spaced from said tank extending below and in spaced relation to the path of travel of said articles, means for providing an electrostatic force between said electrode and articles capable of drawing excess liquid coating material downwardly therefrom, and a downwardly curved drip apron extending along the leading edge of said electrode for initially receiving said excess material and provide a draining medium therefor.

3. Apparatus for coating articles comprising a dip tank containing a bath of coating material, a conveyor operable to submerge said articles in said bath and thereafter convey them beyond said tank, a horizontally disposed electrode spaced from said tank extending below and in spaced relation to the path of travel of said articles, means for providing an electrostatic force between said electrode and articles capable of drawing excess liquid coating material downwardly therefrom, and a water containing drip tank extending between said dip tank and electrode for receiving and disposing of excess coating drawn from said articles during their passage therebetween.

4. Apparatus for coating articles comprising a dip tank containing a bath of coating material, a conveyor operable to submerge said articles in said bath and thereafter convey them beyond said tank, a horizontally disposed electrode spaced from said tank extending below and in spaced relation to the path of travel of said articles, means for providing an electrostatic force between said electrode and articles capable of drawing excess liquid coating material downwardly therefrom, a downwardly curved drip apron extending along the leading edge of said electrode for initially receiving said excess material and provide a draining medium therefor, and a water containing drip tank extending between said dip tank and electrode for receiving and disposing of excess liquid drawn from said articles during their passage therebetween and from said apron.

5. Apparatus for coating the surface of an article comprising means for applying a liquid coating to said surface, means operable to support the coated article in spaced relation to a receiver positioned to receive excess coating material therefrom, a detearing electrode located between said article and receiver, said electrode having a curved surface presented toward said article and terminating in an edge portion presented toward said receiver, and means for creating a high potential difference between said electrode and article and between said electrode and receiver, whereby excess material will be deteared from the article to said electrode and from said electrode to the receiver.

6. Apparatus for removing excess liquid coating material from an article comprising means for conveying the article through space to permit draining of said excess material, a detearing electrode extending adjacent to but spaced from the

ath of article-travel, the leading edge of said electrode being directed away from such path, and means for establishing an electrostatic field between said article and said electrode for removing excess liquid coating material from said article.

7. Apparatus for removing excess liquid coating material from an article comprising means for conveying the article through space to permit draining of said excess material, a detearing electrode extending adjacent to but spaced from the path of article-travel, the leading edge portion of said electrode being curved in a radius greater than the radius of that portion of the article from which coating material is deteared, and means for establishing an electrostatic field between said article and said electrode for removing excess liquid coating material from said article.

8. Apparatus for removing excess liquid coating material from an article comprising means for conveying the article through space to permit draining of said excess material, a detearing electrode extending adjacent to but spaced from the path of article-travel, a portion of said electrode being located below the lowest extremity of the article and extending away from such path, and means for establishing an electrostatic field between said article and electrode.

9. Apparatus for coating an article comprising means for applying a liquid coating to the surface thereof, means for conveying the coated article over a predetermined path to permit draining of excess coating material from it, a detearing electrode mounted in spaced relation to such path, a receiver disposed below said electrode to receive excess material which has left the article, and means for maintaining a high potential difference between said electrode and article and between said electrode and receiver, said electrode being so arranged relative to said receiver and article that the electrical forces therebetween will combine with the forces of gravity to detear accumulated excess material from said article to said electrode and from said electrode to said receiver.

10. Apparatus for removing excess liquid material from the surface of an article, comprising means for moving the article over a predetermined path, a detearing electrode the leading edge portion of which is curved away from such path, and means for establishing between said article and said electrode an electrostatic field to move excess material from said article to said detearing electrode.

11. Apparatus for removing excess liquid material from the surface of an article, comprising means for conveying said article along a predetermined path to permit draining of said excess material, a receiver arranged below said means to receive excess material which has left the article, means for removing the material from the surface of said receiver, a detearing electrode placed beneath said path and above said receiver, and means to electrostatically charge said electrode to a high potential with respect to said article and said receiver.

12. In a coating apparatus, means for applying an excess of liquid coating material to an article, a detearing electrode spaced from said means, a conveyor for conveying an article over a predetermined path extending through said coating means and above said electrode, a receiver disposed beneath the path of article travel and between said coating means and electrode to receive coating material draining from the article, said receiver extending beneath at least the leading edge of said electrode, and means for electrically charging said electrode to create electrostatic fields between the electrode and article and between the electrode and receiver.

13. In electrostatic detearing apparatus, a detearing electrode having a portion which slopes generally downwardly to an edge, a support for an article to be deteared, a receiver beneath said edge, and means for maintaining a potential difference between said electrode and an article on said support and between said electrode and said receiver, whereby excess coating material on said article will be deteared to said electrode and coating material gravitating to the edge of said downwardly sloping electrode portion will be deteared therefrom to the receiver.

14. The invention set forth in claim 13 with the addition that said electrode is generally horizontal, said article support being a conveyor for conveying the article over said electrode, and said downwardly sloping electrode portion being at the leading edge of the electrode.

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