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METHOD OF COATING ARTICLES BY CATHODE DISINTEGRATION

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2 Sheets-Sheet 1

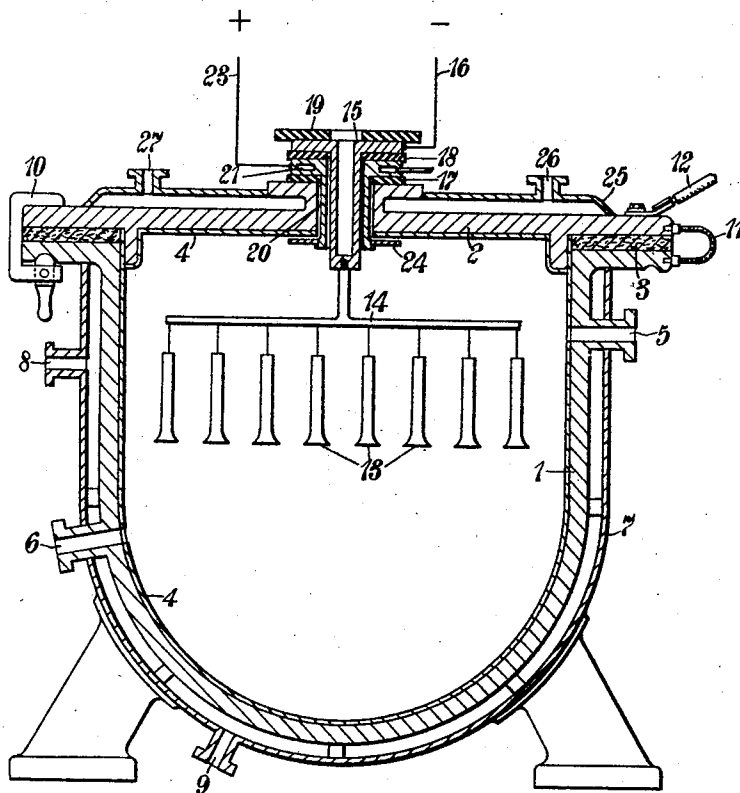


Fig. 1.

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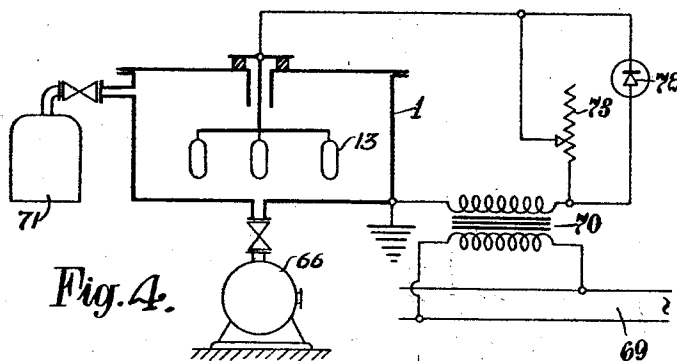
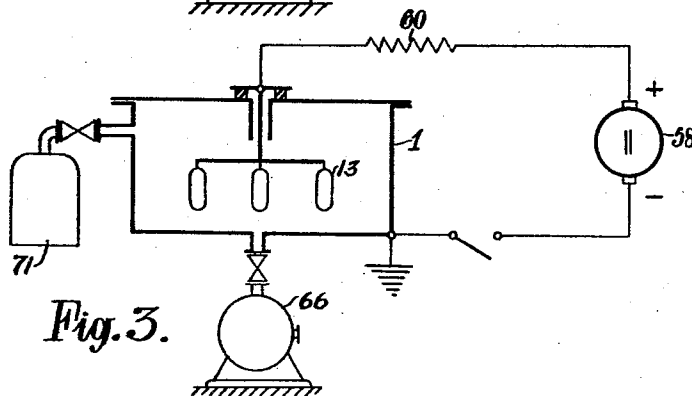
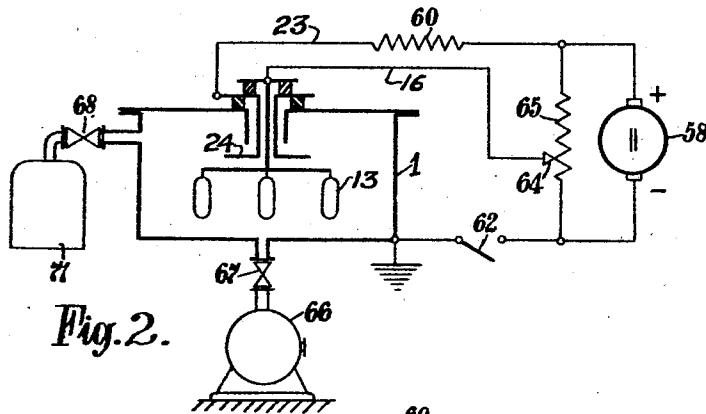
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METHOD OF COATING ARTICLES BY CATHODE DISINTEGRATION

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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METHOD OF COATING ARTICLES BY
CATHODE DISINTEGRATIONBernhard Berghaus, Berlin-Lankwitz, and Wil-
helm Burkhardt, Berlin-Grünwald, Germany;
said Burkhardt assignor to said BerghausApplication July 14, 1938, Serial No. 219,293
In Germany August 14, 1937

4 Claims. (Cl. 204—192)

The present invention relates to a method of coating articles by means of particles disintegrated from a cathode.

It is known to coat metal articles by cathode disintegration, mainly by the disintegration of wires, bands or metal sheets, by means of an electric discharge, at pressures which are characteristic for the cathode disintegration. The disintegrated particles are spread uniformly in all directions and, in addition to being deposited on the articles, they are deposited also on the walls of the vessel and on the other constructional parts lying in the interior of the vessel. Only a comparatively small portion of the disintegrated material is deposited on the surface of the article to be coated, the remainder, deposited on the inner walls of the vessel and on the other parts being lost as regards further disintegration. The recovery of this material, more especially in the case of expensive materials such as silver, gold, platinum, rhodium, and the like, entails considerable expenditure and work. The object of the present invention is to avoid these disadvantages.

The invention relates to a method of coating articles by cathode disintegration, wherein the coating of the articles is effected in a cathode disintegration chamber, the whole inner surface of which is constructed and connected as a cathode. The article is secured on a conductor introduced in an insulated manner into the disintegration chamber, and is subjected therein to coating from all directions.

The particles disintegrated from the cathode impinge either on the articles and the suspension devices or on the wall of the vessel, where they take again part in the disintegration.

The cathode material deposited on the suspension devices, which are constructed in an easily removable manner and preferably consist of the material to be disintegrated, can be easily recovered.

The anode voltage may be applied to the articles to be coated. Preferably, however, the articles may be so connected as to carry a negative voltage with respect to the anode, and be surrounded by a glow fringe. In this case a second conductor may be introduced in an insulated manner, provided with a replaceable disc-shaped electrode connected as an anode, which may consist of the material to be disintegrated.

The output on the surface of the articles per square centimeter is smaller than the load on the cathode to be disintegrated. The load itself is dependent upon the material of which the article

to be coated consists. When use is made of alternating current voltage for the disintegration, the source of alternating current voltage is connected preferably with the one terminal to the articles to be coated, and with the other terminal to the cathode to be disintegrated. Any desired frequency of alternating current voltage, even high frequency currents, such as are produced by thermionic tube generators, may be used. In order to reduce the load on the articles with respect to that on the cathode to be disintegrated, regulating means, such as electric valves and resistances, are inserted in the connection from the transformer to the articles. In this way it is attained that the adjusted full output is supplied to the cathode, while the output on the articles can be reduced through the resistance.

Before the beginning of the disintegration of the cathode material, in the case of direct current, the article is first subjected to a preliminary disintegration, whereby it is attained that the material to be provided thereon will adhere especially firmly. In the case of alternating current disintegration the load on the article is higher than with respect to that on the cathode to be disintegrated, so that the surface of the articles is again cleaned before the coating thereof. Thereupon the disintegration conditions are so adjusted that material is deposited on the articles. According to the material to be disintegrated, the vessel may be made solid of the cathode material, such as iron, copper, nickel, magnesium, aluminum and the like, but, in the case of expensive materials, such as silver, gold, platinum, rhodium, or of materials which have not sufficient strength, such as cadmium, tin, zinc, or materials the shape of which cannot be changed, or only with difficulty changed, such as beryllium, chromium, titanium, molybdenum, tantalum, tungsten, the disintegration vessel may be coated with these materials on its inner wall.

In the case of disintegration of materials up to a fusing point of about 1100° C., the material to be disintegrated may also be fused on the bottom of the vessel by heating with glow current and be disintegrated from the melt. The reduced pressures for the disintegration may be adjusted to lie between 10 and 0.001 and preferably between 1.5 and 0.1 millimeters of mercury.

The invention will be more clearly understood by reference to the attached drawings and the following detailed description wherein apparatus

for carrying the method into practice is disclosed.

In the drawings:

Fig. 1 is a sectional view of cathode disintegrating apparatus which surrounds the articles to be coated.

Figure 2 is a diagram of electric connections,

Figure 3 is another diagram of electric connections, and

Figure 4 is a third diagram of connections.

Referring to Figure 1 which illustrates a section through cathode disintegration apparatus, the whole of the inner surface of the housing 1 forms a cathode which surrounds the articles to be coated. The housing is closed in a vacuum-tight manner by a cover 2 and a seal 3. The whole inner space of the apparatus, that is to say, the cover as well as the vessel, is coated with material 4 to be disintegrated, which may consist of any desired metal, metal alloy or metalloid. The vacuum pump is connected to the connecting pipe 5, while the pipe connection 6 serves for the introduction of a neutral, reducing gas, such as hydrogen, nitrogen or the like. The vessel is surrounded by a jacket 7 to which a cooling medium, for instance water or oil, is supplied by the pipe connection 8. The cooling medium is discharged through the pipe connection 9. The cover is secured to the vessel by clamps 10 and may be conductively connected to the vessel through the removable conductor 11. The negative voltage is supplied by the cable 12 which is secured to the cover.

The articles 13 to be coated are, for instance, suspended on a frame 14, which is secured to the lead-in conductor 15, connected through the cable 16, for instance, to direct current voltage. Rings of insulating and sealing material are indicated at 17, 18 and 19, and a metallic screening sleeve 20 is provided, the hollow flange 21 of which is clamped onto the cover by means of screws which, for the sake of clearness, have not been shown. The positive voltage is supplied to the screening sleeve through the cable 23. The screening sleeve 20 may be provided at its end with an anode 24 which may for instance be disc-shaped.

Also the cover of the vessel is provided with a jacket 25 to which the cooling medium is supplied by the pipe 26 and the cooling medium is discharged through a pipe connection 27.

There is shown in Figure 2 a diagram of connections which is, for instance, used in the installation according to Fig. 1. The source of direct current high voltage 58 is connected with the positive terminal thereof to the anode 24 over a resistance 60 and the negative terminal is connected over the switch 62 to the wall of the cathode disintegration housing 1. The articles 13 are connected to a sliding contact 64 of a resistance 65, which is connected in parallel with the source of direct current voltage. The vacuum pump is represented at 66 and is connected over the valve 67 with the disintegration chamber, and a hydrogen flask 71 is connected over the valve 68 with the disintegration chamber.

The diagram of connections according to Figure 3 differs from the diagram of connections according to Fig. 2 in that the articles 13 carry the positive voltage and are connected over the resistance 60 to the positive terminal of the source of voltage 58.

The arrangement shown in Fig. 4 includes the

use of an alternating current source 69 for carrying out the coating process. A transformer 70 is connected to the supply line 69 and one terminal of the secondary of this transformer is connected to the housing 1. The other terminal of the secondary winding of the transformer is connected to the articles 13 within the housing 1 through a rectifier 72. An adjustable resistor 73 is arranged in parallel circuit relation with respect to the rectifier. The rectifier prevents the passage of current therethrough during one cycle so that the load of the disintegrating current can be regulated by the shunt resistor 73.

While the invention has been described in connection with specific types of apparatus it will be appreciated that the coating method can be carried out with other structural arrangements and by following various method steps. Such changes may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

What we claim is:

1. The method of coating an article which comprises, surrounding the article to be coated with a housing having an inner surface formed of metallic material adapted to provide the coating for the article, sealing the housing, adjusting the pressure within the housing to support cathode disintegration therein, and electrically disintegrating particles from all points along the inner surface of said housing onto said article whereby the entire surface of the article is simultaneously coated.

2. The method of coating articles, which comprises, surrounding the articles to be coated with a housing having an inner surface formed of metallic material adapted to provide the coating for the articles, sealing the housing, adjusting the pressure within the housing to a range between 10 and 0.001 millimeters of mercury, and electrically disintegrating particles from all portions of the inner surface of said housing onto the articles whereby all surfaces of the articles are simultaneously coated.

3. The method of coating articles which comprises, supporting the articles within a sealed housing having the inner surface completely covered with a metal adapted to form the coating of the articles, adjusting the pressure within the housing to support cathode disintegration of the inner surface of the housing, electrically disintegrating metal particles from all points of the inner surface of the housing whereby some of the particles impinge onto the articles and other particles engage the inner surface of the housing for further disintegration.

4. The method of coating an article which comprises, supporting the article within a sealed housing having the inner surface formed of a metallic material for the coating and which completely surrounds the article, adjusting the pressure within the housing to support cathode disintegration of the inner surface of the housing, impressing a direct current voltage across the housing and an electrode within the housing with the housing connected negatively with respect to said electrode to disintegrate particles from all points of the inner surface of the housing onto the article, and impressing a voltage across said electrode and said article with the article connected negatively with respect to said electrode.

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