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B. BERGHAUS ET AL

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METHOD OF COATING METALLIC ARTICLES

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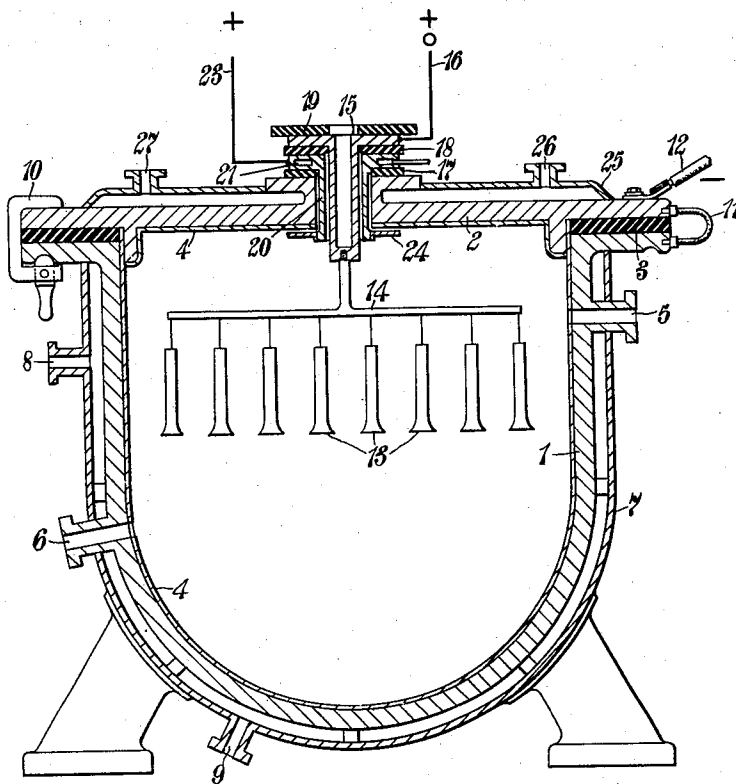


Fig. 1.

B. Berghaus
W. Burkhardt
Inventors

By: Glascock Downing & Seebold
Attys.

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METHOD OF COATING METALLIC ARTICLES

Bernhard Berghaus, Berlin-Lankwitz, and Wilhelm Burkhardt, Berlin-Grünwald, Germany;
said Burkhardt assignor to said Berghaus

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2 Claims. (Cl. 204—192)

This invention relates to a method of metallizing metallic articles by means of cathode disintegration, which is distinguished by the feature that the cathode to be disintegrated is cooled and such an energy input is applied that the article to be metallized acquires a temperature of at least 300° C. The input on the cathode may further advantageously be chosen so high that there is alloy formation between the metal, or metal alloy, disintegrated on and the foundation material. Very advantageously the cathode may surround on all sides the article to be coated with disintegrated metal. The input at the cathode may be raised by increasing the voltage and by suitably regulating the gas pressure which prevails in the cathode disintegration chamber. The cathode disintegration may be effected at pressures between about 10 and 0.01 millimeters of mercury or less.

The raised energy input may also be applied to the cathode only when the article is already coated with a metal layer by the cathode disintegration. Advantageously an input energy of at least 1 watt per square centimetre is applied to a cathode surrounding the articles to be coated on all sides for example. It is then advisable to operate the cathode surrounding the articles on all sides at least with a voltage of 600 volts. The article to be metallized is either arranged neutral and insulated in the cathode disintegration chamber, or it is connected as anode. When a cathode is disintegrated, the greatest part of the electric power expended therefor is converted into heat and in fact chiefly at the cathode, for example in the case of normal glow covering, that is to say a normal gas discharge, almost 100%. With increasing load, there is an output distribution such that a part of the energy is liberated in the gas space or on the article to be coated and heats it up. According to the shape and the cathode material used, a definite temperature can be imparted to the article to be coated if the load on the cathode is correspondingly chosen. The most favourable arrangement is obtained, for example, when the cathode surrounds the article to be coated so that energy is supplied to it from all sides for heating purposes. The temperature may be measured by means of thermocouples or by means of pyrometers.

By this arrangement, absolutely firmly adherent and compact layers are obtained of very fine crystal structure and of any desired thickness. By means of the blending an inseparable unit is produced. For example in coating a copper article with silver in hydrogen as a discharge

gas, the disintegrating output of the cathode surrounding the article on all sides was so chosen that the article first assumed a temperature of about 950°. A degassing and cleaning of the surface of the article took place as a result. After five minutes the temperature was lowered to 800°, when the silver disintegrated on as a result immediately formed an alloy with the copper. The fusion point of this alloy lies at 798° C. After about half an hour a sufficiently thick layer of the alloy silver/copper has formed, on which pure silver was disintegrated at a temperature of 600° C. During the disintegrating of pure silver the temperature was slowly lowered to 400° C. After about three hours' total treatment time a copper article uniformly coated with silver is obtained which in ground section reveals an intermediate zone of the silver/copper alloy. This layer is no longer removable in itself, but forms a unit with the foundation material. The temperatures and times mentioned in the example are to be varied according to the effect desired. If the process is performed below 800° C., then only a diffusion in of the silver takes place. These layers are likewise mechanically inseparably united with the foundation material. For all other combinations the temperatures and times are to be chosen corresponding to the known binary system. Furthermore, combinations are also possible with one and more intermediate layers, the metals in the individual intermediate layers being brought to alloy formation or to diffusion by suitable temperature conditions. When the cathode surrounds the article on all sides the heating action on the same is greater the lower the vacuum is adjusted and the amount disintegrated is dependent on the energy applied to the cathode, and it is advantageous, when dealing with low temperatures, to work at high pressures, of 2 to 3 millimeters of mercury, and more, in order to be able to apply a sufficiently great disintegration power, and when very high temperatures come into question, to work at low pressures in order not to have to apply excessively high inputs to the cathode. The cathode is in order advantageously cooled in order in the case of high outputs so that the material will be able to withstand the mechanical stress, and the outer pressure of the atmosphere. The process is particularly advantageous for the building up very valuable constructional parts which have become unusable owing to excessive wear. The material lost by wear can in this way be readily replaced without changing the unitary nature of the foundation body.

In the accompanying drawing one constructional example of the invention is schematically shown in some detail, the drawing showing a sectional elevation through cathode disintegration apparatus with a cathode surrounding the article to be metallised on all sides.

The total inner surface of the cathode disintegration chamber forms a cathode which surrounds on all sides the articles to be coated, 1 is the housing which is capable of being closed in a vacuum-tight manner by means of a cover 2 with employment of a seal 3. The whole interior space of the apparatus, that is to say both the cover and the housing, is coated with the material 4 to be disintegrated, which may consist of any desired metal, a metal alloy or a metalloid. The vacuum pump (not shown) is connected to the pipe 5, and the pipe connection 6 serves for supplying a neutral, reducing gas, such as hydrogen, nitrogen or the like. The vessel is surrounded by a cooling jacket 7, to which the cooling medium, such as water or oil, can be supplied through the pipe connection 8. The cooling medium is led off through the pipe connection 9. The cover is fastened to the housing by clamps 10 and may be brought into conductive connection with the housing by means of the removable conductor 11. The negative voltage is supplied by the current cable 12 which is secured to the cover.

The articles 13 to be coated by disintegration are suspended for example on a frame 14 which is fastened to the lead-in conductor 15, which is connected by means of the cable 16 for example with the positive pole of the disintegration voltage, but may also be neutral. 17, 18 and 19 are rings of insulating and sealing material and 20 is the metallic screening sleeve. The sleeve 20 is provided with a hollow flange 21 which can be cooled and these elements can be pressed on to the cover by means of screws which for the sake of clearness are not shown. The positive voltage is supplied to the screening sleeve through the cable 23, but it may also be neutral if the

articles form the anode. The screening sleeve may carry at its end a plate-shaped anode 24. The cover of the vessel also is provided with a cooling jacket 25, to which the cooling medium can be supplied through the pipe connection 26 and can be led off through the pipe connection 27.

We claim:

1. The method of coating metal articles by cathode disintegration which comprises, arranging the articles within a housing formed of a metal to provide the coating, insulating the articles with respect to the housing, sealing the housing, adjusting the pressure within the housing to support cathode disintegration therein, impressing a voltage across the articles and the housing to create a glow discharge within the housing and disintegrate metal particles from the housing onto the articles, adjusting the voltage to such a value with respect to the pressure within the housing so as to liberate heat adjacent and around the articles so as to heat the articles to at least 300° centigrade.

2. The method of coating metal articles by cathode disintegration which comprises, supporting the articles to be coated within a housing having the inner surface thereof formed of metal to provide the coating for the articles, insulating the articles with respect to the housing, sealing the housing, impressing a voltage across the articles and the housing to create a glow discharge within the housing and disintegrate metal particles from the inner surface of the housing onto the articles, adjusting the voltage to such a value and further adjusting the pressure within the housing to such a value that the energy of the discharge amounts to at least 1 watt per square centimeter of the inner surface of the housing so as to liberate sufficient heat adjacent and around the articles to heat the articles to at least 300° centigrade.

**BERNHARD BERGHAUS.
WILHELM BURKHARDT.**