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PROCESS FOR APPLYING METALLIC COATINGS TO POROUS BASES.

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To all whom it may concern:

Be it known that I, KURT RIPPER, a citizen of the Republic of Austria, residing at Vienna, Austria, have invented certain new and useful Improvements in a Process for Applying Metallic Coatings to Porous Bases, of which the following is a specification.

This invention relates to a process of applying metallic coatings to porous bases.

It has long been desired in the art, to apply firmly adherent metallic coatings free from pores to porous articles by electro-deposition. By this means the respective materials are to be protected from the attacks of liquids, atmospheric influences and gases. The electro-plating of such articles, however is met with considerable difficulty, because both the alteration of the porous surface during the deposition of the metallic coating, as well as also the irregular adhesion of the metallic coating to the base, and finally the small stability of a metallic coating of such thinness, must be taken into account.

In order to render the non-metallic surfaces electrically conductive, it is known that preferably graphite is employed. For this purpose for example finely ground and washed crude natural graphite is treated first with sulphuric acid, and thereupon with concentrated soda lye in autoclaves under pressure. According to Schössel (Musspratt, Enzyklopädisches Handbuch der Technik, 4th edition, volume 4, page 1569) finely ground graphite is pre-treated in a similar manner with hydrochloric acid and alkali. However even these known purifying processes do not produce graphites for rendering porous materials conductive which fulfil the requirements of the art of electro-deposition, neither does the use of synthetic graphite furnish good results. It was hitherto unknown to what reasons this uncertain and irregular action of the graphite-coating methods generally used for this purpose is attributable. Nevertheless it is an established fact that the metal forms firmly adherent deposits at only those portions of the porous surface which have been rendered to all intents and purposes absolutely equally conductive to the electric current. If the current during the electrolytic process anywhere encounters a resistance which is not uniform, then the metal no longer deposits entirely evenly on the base. For this purpose it has been recommended to render the graphite coating—which as a rule is applied mechanically by hand or by means of a brush—more adherent by the use of adhesives or the like. In practice however this measure is completely useless, since although the adhesive causes the graphite powder to adhere, yet it does not ensure even coating of the graphite to the base. Consequently during the electrolytic treatment hollow spaces are formed in the metallic coating which fall off already when slightly pressed by the hand, so that the coating by no means answers its desired purpose.

As a result of very exhaustive experiments it has now been found that the suitability of electrically conductive substances for rendering conductive, porous non-metallic bases is essentially dependent on the size of the particles of these substances bearing a suitable relation to the size of the hollow spaces (i. e., the pores) of the porous base. It is assumed that this fact is attributable to the capillary action of the porous bases. There are, however, sizes of particles which even when using coarsely porous bases no longer give corresponding (satisfying) results. This is the size of particles of more than 3 microns (1 micron is 0.001 millimetre). Thus the ineffectiveness of the hitherto usual graphite-coating methods is explained since as is well known by mechanical disintegration and washing it is hardly possible to produce particles of a size less than 10 microns.

The required degree of dispersion for the desired purpose may be produced according to the present invention with the aid of the known mechanical means for the production of colloidal suspensions (beating mills, turbo-mixers, or the like) or by chemical methods such as are used for example, in the production of copper bronze. It is also possible to employ a combination of mechanical and chemical means. The colloidal suspensions of graphite have a particle size of less than 0.1 micron, the size of the particles of the above mentioned copper bronze was found to be 0.5 to 1 micron.

A colloidal suspension of graphite, preferably to be employed for the purpose aimed at by the present invention, may be prepared by dispersing chemically produced graphite, which had been mechanically triturated as

far as possible, by means of tannic acid and ammonia till it assumes the colloidal state. Graphite thus treated is nowadays brought on the market under the name of "defloccu-lated Acheson graphite". The coarser particles may be removed therefrom by filtration, for which filtering materials or filtering candles may be used, the pores of which do not exceed a certain size. Colloidal metals may be prepared by the methods known in colloid chemistry, for instance by reducing the respective salt solutions. By very careful operations one may even succeed to obtain a powder of copper sufficiently fine by reducing a solution of copper-sulphate by means of zinc dust.

It is of no importance in what manner the dispersion is produced, the only essential is that the size of the particles is smaller than 3 microns. If dispersions of this character are employed, the conductive coatings can be applied without any difficulty to preliminarily treated porous nonconductors in very uniform and firmly adherent layers, the electro-plating being effected thereupon uniformly and in an excellent manner.

The current conductor need not be applied immediately to the porous bases, inasmuch as a thin layer of lacquer may be applied as a first coating. This is often desirable in order to protect the porous material from being attacked by the electroplating liquor. When operating in this manner the desired effect is produced even when the varnish coating has entirely clogged the pores. This peculiar phenomenon may be explained by the action of the high pressure of precipitation in the electrolytic bath. The layer of varnish is pressed into the porous substance and the small particles of the current conductor arrive in the same way to the surface of the porous base as if they had been applied without preliminary varnishing of the article.

For carrying out the process, a wooden object for example is preliminarily treated with a paraffin or retene mass, thereupon provided with a thin varnish coating and a colloidal suspension of graphite is applied to this base by gentle rubbing. A completely uniform and smooth coating of metallic lustre is immediately produced which adheres with extraordinary firmness and can only be removed with difficulty by mechanical means. On being immersed into the electrolytic bath the piece of wood which has been rendered conductive is coated with a firmly adherent smooth coating of the corresponding metal. It is of particular importance that the growth (closure) of the metallic coating takes place the more rapidly the smaller the size of the particles of graphite or other disperse conductive material.

In the same way also other porous bodies, for example leather, concrete, cardboard, fabrics, as well as pressed materials of any kind may be coated with a dense, firmly adherent metal.

Coatings produced by the present method essentially differ from those hitherto made. The latter are only adhering to metals, but are not firmly adhering to porous softer materials. In contradistinction thereto by the present method even one single, perfectly plane and small surface of a wooden object may be electroplated without any fear of the metallic layer coming off. This astonishing new effect is in first instance due to the fact that the sufficiently small particles of the conductive substance are by the deposition pressure of the electrolytic bath driven deep into the porous base and that consequently a kind of impregnation of the latter takes place.

What I claim is:

1. A process for applying metallic coatings to non-metallic porous objects, which process consists of rendering the surfaces to be coated conductive by means of conductive substances in such a degree of dispersion, that the particles thereof are of smaller size than the pores of the base, and thereafter effecting the galvanization.

2. The process for applying metallic coatings to non-metallic porous objects, which process consists of rendering the surfaces to be coated conductive by means of conductive substances in such a degree of dispersion, that the size of their particles does not exceed 3 microns, and thereafter effecting the galvanization.

3. The process for applying metallic coatings to non-metallic porous objects, which process consists of rendering the surfaces to be coated conductive by means of colloidal suspensions of conductive substances, and thereafter effecting the galvanization.

4. The process for applying metallic coatings to non-metallic porous objects, which process consists of rendering the surfaces to be coated conductive by means of colloidal suspensions of graphite, and thereafter effecting the galvanization.

5. The process for applying metallic coatings to non-metallic porous objects, which process consists of rendering the surfaces to be coated conductive by means of colloidal suspensions of graphite, the particles of which have a size of less than 0.1 microns, and thereafter effecting the galvanization.

6. The process for applying metallic coatings to non-metallic porous objects, which consists of first coating the porous base with a layer adapted to protect the porous material from being attacked by the galvanic bath, then rendering the surfaces conductive by applying thereto conductive substances in such a degree of dispersion, that the size of their particles does not exceed 3 microns and thereafter effecting the galvanization.

7. The process for applying metallic coatings to non-metallic porous objects, which consists of first coating the porous base with a layer adapted to protect the porous material from being attacked by the galvanic bath, then rendering the surfaces conductive by applying thereto colloidal suspensions of conductive substances, and thereafter effecting the galvanization.

8. The process for applying metallic coatings to non-metallic porous objects, which consists of first coating the porous base with a layer adapted to protect the porous material from being attacked by the galvanic bath, then rendering the surfaces conductive by applying thereto colloidal suspensions of graphite, and thereafter effecting the galvanization.

9. The process for applying metallic coatings to non-metallic porous objects, which consists of first coating the porous base with a layer of a wax-like mass, then rendering the surfaces conductive by applying thereto conductive substances the size of the particles of which does not exceed 3 microns, and finally effecting the galvanization.

10. The process for applying metallic coatings to wooden objects, which consists of preliminary treating them with a wax-like mass, coating them with a thin layer of varnish, then rendering the surfaces conductive by applying thereto conductive substances the size of the particles of which does not exceed 3 microns, and finally effecting the galvanization.

11. The process for applying metallic coatings to wooden objects, which consists of preliminarily treating them with a wax-like mass, coating them with a thin layer of varnish, then rendering the surfaces conductive by applying thereto colloidal suspensions of conductive substances, and finally effecting the galvanization.

12. The process for applying metallic coatings to wooden objects, which consists of preliminarily treating them with a wax-like mass, coating them with a thin layer of varnish, then rendering the surfaces conductive by applying thereto colloidal suspensions of graphite, and finally effecting the galvanization.

13. The process of applying metallic coatings to a wooden object which consists of preliminarily treating the said base with paraffin, then coating it with a thin layer of varnish, rendering the surfaces to be coated conductive by gently rubbing a colloidal suspension of graphite thereon and finally immersing the piece thus prepared into the galvanic bath.

In testimony whereof I have affixed my signature.

KURT RIPPER.