July 12, 1938. L. R. BEYNEN ET AL 2,123,297

PROCESS OF PREPARING PERFORATED METAL ARTICLES

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Fig. 1.

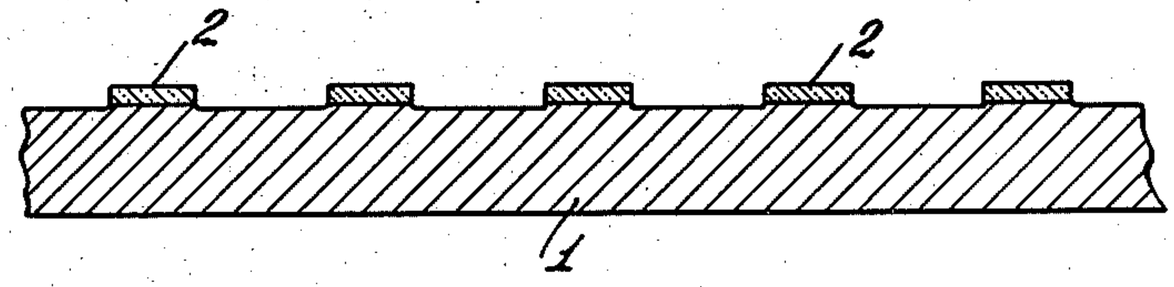


Fig. 2.

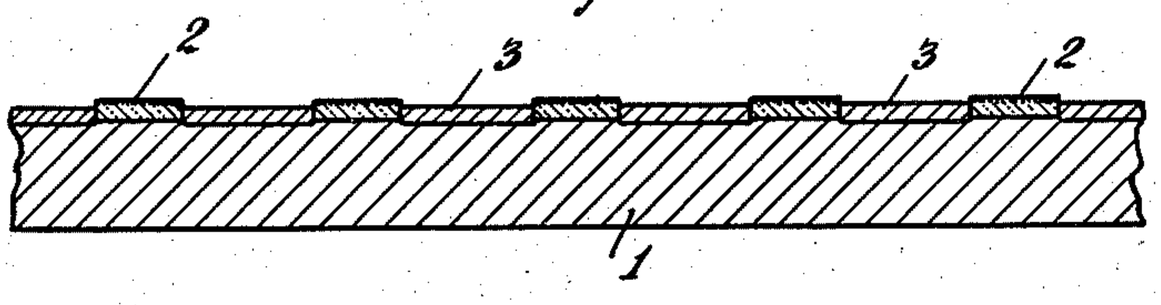


Fig. 3.

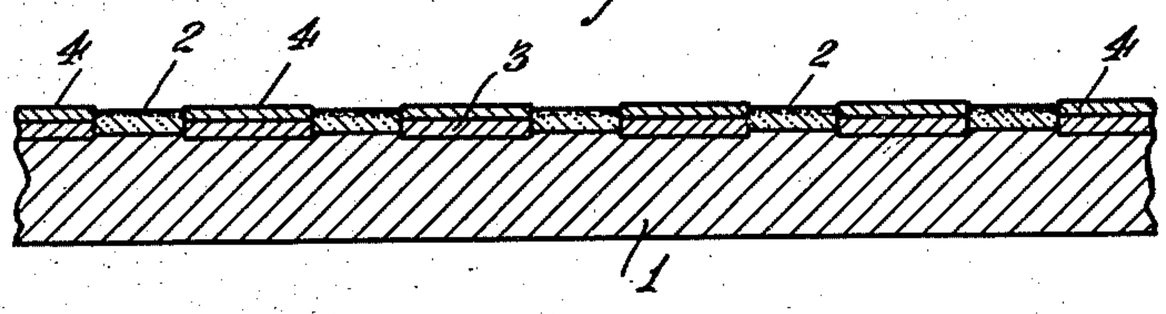
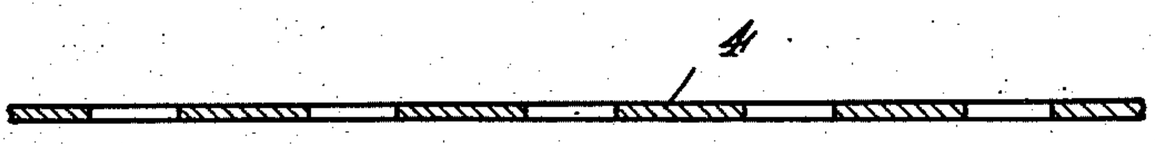


Fig. 4.



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PROCESS OF PREPARING PERFORATED METAL ARTICLES

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4 Claims. (Cl. 204—6)

For the manufacture of perforated metal articles by means of galvanoplasty it has already been proposed to use a master plate the surface of which comprises portions that are electrically conducting and portions that are electrically non-conducting. In making such a plate it has been proposed to employ as a starting material a copper plate acting as a cathode, in which plate small cups were formed by means of photo engraving. These cups are filled with insulating varnish, after which the copper plate is placed in a nickel bath. The nickel layer which is then formed is allowed to grow until the little elements of insulating material at the edges of the cups are overhung by the nickel.

One of the drawbacks of this method is in the first place that the cups cannot be refilled with insulating material, as this is prevented by the overhanging edges of the nickel deposit. This not only nullifies the practical value of the process, but it also renders impossible mass production in factories, especially for the manufacture of sieves which require a great number of equal and uniform perforations. If the master plate after it has been finished proves to have cups that are not or not sufficiently filled with insulating material, the product will be useless.

Another drawback of this known method is that the metal article obtained by electrodeposition or electroforming on the master plate thus formed, will deviate considerably from the desired form, since the said deposit will deviate around the openings from the plane of the article and follow the curved line of the nickel deposit around the edges of the cups. This fact alone limits the use of the said method.

The present invention has for its purpose to improve these conditions and to provide a master plate for the manufacture of sieves and other perforated metal articles which is free of the said drawbacks, produces better sieves and renders possible mass production in factories. By perforated metal articles are meant those articles that are provided with perforations or recesses of any given form and dimensions extending through the entire thickness of the material.

A master plate according to the invention likewise has a surface comprising electrically conducting portions and electrically non-conducting portions, and which is to be used as a carrier for sieves or other perforated metal articles to be formed thereon and is characterized by the fact that the non-conducting portions are surrounded by lead or a lead alloy, mercury amalgam or some other material the surface of which in a moistened, resp. dry or other condition has the property to repel the insulating material or its carrier which is to be applied to the non-conducting portions, or to form them.

This in the first place has the great advantage that it is now possible to improve at all times the insulating portions of the surface by a refill of insulating material. This may be done in a very simple manner by applying, e. g. by means of rollers, fatty printing ink (German: "Federfarbe") which will adhere to the portions to be insulated, but will not adhere to the electrically conducting portions of the surface, since these portions are either naturally fat-repelling (mercury amalgam) or rendered fat-repellent to the insulating material or its carrier either by moistening with e. g. water (surface of lead or a lead alloy or material having a similar or an equivalent surface) or by treatment by some other agent.

The portions which are retaining the fatty ink or similar material may now be dusted with asphalt or some other material which after melting or burning or some other treatment will constitute the desired insulated portions on which no deposits of the copper, nickel or other material for the sieves will be formed.

The invention therefore is not limited to any given material as it is based on the novel idea that it is possible to fill or to replenish the insulation cups when the plate is treated with an insulating material or a preparatory material that will retain the insulating material which does not adhere to the electrically conducting material, which material may be pre-treated (e. g. moistened) for this purpose.

According to the invention there may be formed on the carrier constituting the carrier for the portions having insulated surfaces and for the portions having electrically conducting surfaces, first a high relief design of insulating substance or insulating substance-containing material, and subsequently between the insulating portions a layer of electrically-conducting material as a carrier for the articles to be formed. The carrier which may be of copper may be slightly etched after the formation of the high-relief design layer and prior to the application of the conducting layer around the parts of this design layer.

After the application of the electrically conducting layer the said design layer may be partly or almost entirely removed, e. g. with the aid of hot lye, and the cups may be filled with fatty ink (the so-called "Federfarbe") and with asphalt, resin, copal resin, copal varnish or some other insulating material, owing to the above mentioned properties of the conducting layer.

The conducting layer may be obtained either by electrodeposition, or by cathodic atomization or in some other manner.

The sieves or other perforated metal articles may be formed on the master plate in different ways e. g. by electroforming, or by cathodic atomization depending on the nature of the material of which they are going to consist and of the purpose which they are to serve.

It has been found in practice that both the layer comprising the portions which are to form the electrically-conducting surface, and the material for the sieve may be obtained in a satisfactory and advantageous manner electrolytically.

According to the invention the conducting portion of the master plate preferably consists of the surface of lead or of a lead alloy which has the property of taking and retaining water without preliminary graining i. e. in a smooth condition, and when moist to repel fatty ink and similar fatty material. A surface of this nature may be obtained e. g. by applying on a smooth ungrained copper plate a deposit of lead, either by electrodeposition by spraying or by cathodic atomization.

The application of the present invention to the making of sieves may be still further explained with the aid of an example.

A smooth, polished copper plate 1—vide Fig. 1—which has been covered with a light-sensitive layer is exposed to light through a screen in such a way that round, square or otherwise shaped light points are formed on the emulsion and that corresponding hardened spots are formed. The said layer is then developed and completely finished, so that after washing and drying of the same raised points 2 remain on the plate which may be burned into the plate to make them adhere better.

Between the design elements 2 which in the present example have the shape of points, the polished metal surface of the plate 1 lies exposed and this surface is very slightly etched. Subsequently a thin layer of lead 3 is formed by electrodeposition on the smooth conducting portion, the design elements in their quality of insulating points preventing the deposition on the places covered by them.

The layer of lead 3—vide Fig. 3—consequently will form a thin metal network corresponding to the desired appearance of the sieves that are to be produced.

The plate is then cleaned with sulphuric acid or/and other means, moistened with water which adheres to the smooth lead surface and fatty ink is then applied to the plate by means of rollers, the said fatty ink adhering to the design elements 2, but not to the water retaining surface of the layer of lead 3. The plate is then dusted with asphalt powder as a strengthening insulation material, which powder is held by the fatty-ink retaining parts, the remaining powder being removed. The asphalt which remains on the plate is melted. This treatment may be repeated once or more, according to desired height and strength of the insulating points.

The master plate thus obtained comprises smooth, electrically conducting portions 3 and non-conducting portions 2, on which conducting portions the sieves 4 may be deposited in the desired thickness and then removed—vide Fig. 4. If desired, a fresh supply may be added to the insulation cups or the insulation may be strengthened or renewed after a certain number of sieves or other perforated articles have been made.

As a variation on the above it is also possible according to the invention, after the layer of lead or similar conducting layer has been applied—but not before that time—to remove the hardened emulsion—formerly sensitive layer—still present by means of heated lye or in some other manner, after which the fatty ink will adhere better; if desired after having cleaned the plate with sulphuric acid or some other means. The plate may also be treated with a tincture and other means, before the fatty ink is applied to the plate.

Instead of the fatty ink (German: "Federfarbe") repeatedly mentioned here, any other material is suitable that will form insulating spots, resp. that adheres to those places where the insulating material is to be applied and that, at the same time will not adhere to the electrically conducting portions. As stated above, the repulsive power of the conducting portions may be intensified by moistening the same with water or a strongly diluted acid, for which purpose said portions have been made water-retaining. The invention however is not restricted to the use of moistened plates.

Before making the article by electroforming, spraying, cathodic atomization or other electrodepositing methods, the plate may be treated with known or other agents in order to facilitate the removal of the article after it is made.

Modifications and improvements are possible within the scope of the present invention. Said invention not only comprises the process of making a master plate of the kind described above, but also covers the master plate itself, and the manufacture of sieves or other perforated, more especially, but not exclusively thin metal articles.

We claim:

1. The process of making perforated articles by electro-deposition which comprises placing a design on a metal base plate by means of an electrically insulated light-sensitive emulsion, hardening the emulsion form said design, etching the plate in the areas other than covered by said design, depositing an amalgam on said etched areas, cleaning said plate with an acid, coating said plate with fatty ink, the latter adhering only to the hardened design, dusting said plate with asphalt powder which adheres only to said fatty ink, cleaning the non-adherent ink and powder, melting and hardening said asphalt, electrically depositing a metal on said plate, and stripping off said metal in the form of a perforated article.

2. The process of making perforated articles comprising the steps of electrically depositing a metal on the conducting portions of a master plate having electrically conducting fatty printing ink repellent surface portions and electrically non-conducting surface portions composed of non-conductive material superposed on fatty printing ink retaining portions, and stripping off said metal in order to obtain a perforated article.

3. The process of claim 2, which comprises depositing said metal around a layer of non-conductive material which extends above said repellent surface portions.

4. The process of claim 2, which further comprises coating the master plate with fatty ink, fixing asphalt to said fatty ink retaining portions to repair damaged portions of the same, electrically depositing a layer of metal on said plate, and stripping off said metal in the form of a perforated article.

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