

UNITED STATES PATENT OFFICE

SEBASTIAN ZIANI DE FERRANTI, OF HOLLINWOOD, ENGLAND, ASSIGNOR TO FERRANTI, LIMITED, OF HOLLINWOOD, ENGLAND

PROTECTION OF METALS

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This invention relates to the protection of metals and has particular reference to the rotors and contacts of mercury bath electricity meters, in which connection it will be described hereinafter as applied by way of example.

In mercury bath electricity meters a rotor disc is usually provided, which carries the current to be measured and acts as the braking means, the disc being immersed in mercury. It is practically essential that copper should be used to constitute the disc so as to impart high conductivity thereto and enable the desired eddy currents to circulate in the copper for braking purposes. The surface of the disc is not protected from attack by the mercury but is purposely amalgamated to make sure that the mercury is in actual contact with the copper all over. The disadvantage of this arrangement is that amalgamation continues for as long as the meter remains in use and a thickening of the copper disc results with consequent diminution of its conductivity owing to the permeation of the mercury into each surface exposed. On account of these disadvantages, some years ago it was common practice to plate the discs with platinum so as to prevent the mercury attacking the body of the disc. The edge of the disc was, however, left clear of platinum and was amalgamated so that the current to be measured could freely enter by this path. The platinum plating was, however, found to be porous, and as the mercury penetrated it and also penetrated beneath the plating at the amalgamated edge, the plating became detached from the disc, fouling the disc and so stopping the meter. In order to overcome porosity of the plating and to endeavor to make it more permanent, the discs were varnished or enamelled over the plating. This, however, did not prove effective.

The object of the present invention is to provide protection for metals against attack by mercury.

Platinum is found to be highly suitable to constitute the protective coating in the case of mercury bath electricity meter discs and contacts because it possesses but low electrical contact resistance to mercury and al-

though it is possible to deposit mercury upon platinum by electrolytic action platinum is very highly resistant to attack by mercury in the absence of such action, i. e. under the condition obtaining in mercury bath electricity meters.

The effect of the process in accordance with the present invention is that the external surface is formed of, say, platinum grading into, say, a platinum-copper alloy, which platinum copper alloy in turn grades into, say, the pure copper of the article. It is essential that the atmosphere in which the process is performed should be suitable, that is to say, that it should not attack either the platinum or the copper. It is also essential that the heating should not be rapid enough to separate the coating from the disc and that the time for which the disc is kept at the alloying temperature should also be long enough to effect the alloying process without carrying this so far that the coating is absorbed into the body of the copper, that is it is essential that there should be a platinum coating on the outside in contact with the mercury.

In carrying the invention into effect in one form as applied to a copper disc and contacts used in a mercury bath electricity meter, I coat the contacts and the whole of the disc with platinum by any convenient process and slowly raise the disc and contacts to red heat in an atmosphere which does not react chemically with either the platinum or the copper. Under these conditions the platinum and copper become alloyed together in the region of their surface of contact and it is no longer possible to strip off the platinum coating. If the annealing process which performs this alloying were continued too long the whole of the platinum would become alloyed with the whole of the copper. Thus it is important that the temperature be maintained only for so long as will ensure achievement of alloying to the desired depth.

In the operation of the meter it is found that platinum in connection with mercury makes good contact, that is to say, there is good contact conductivity between mercury and platinum—a most important feature in

connection with mercury bath electricity meters. The conductivity of the disc itself is retained in so far as the protecting coating of platinum and platinum-copper alloy is very thin and so does not detract appreciably from the conductivity of the disc. It is essential that the coating of the disc should be non-magnetic, otherwise the operation of the meter would be interfered with.

In one particular example I electroplated with platinum a two inch diameter copper disc or about 30 mils thickness and then heated it in an atmosphere of CO_2 of a temperature of 700°C . The disc was heated up slowly to prevent the coating from coming away from the copper, e. g. on account of occluded hydrogen in the copper, 6 minutes being allowed in this example. The disc was retained at 700°C . for 8 minutes and was then allowed to cool in the same atmosphere of CO_2 . Tests with the aid of a microscope revealed an alloying together of the platinum and copper to an appreciable depth in the region of the surface separating the one from the other, and tests in boiling mercurous nitrate showed great resistance to attack and no tendency for the platinum to strip off.

In some cases I may subject the metal treated in accordance with the present invention to a subsequent pressing or planishing operation in order to harden the article after the annealing process to which it has been subjected and to render compact the external surface of the coating.

It is possible to use atmospheres of gas other than CO_2 in some cases, e. g. where electrolytic copper (which has not been melted after production) be used it is possible to employ an atmosphere of hydrogen, since this does not react chemically with either the platinum or the copper.

The process may also be carried out in a vacuum.

It is possible that an additional metal may be applied between the "base" and the coating, provided that all three individual metals are so mutually alloyed, each to its neighbor, that perfect adherence is secured.

It is to be understood that the coating may be applied to the metal to be protected by any available coating process, the essential feature of the invention being the heat treatment of the coated metal so as to effect alloying to the required depth between the coating and the metal to be protected in the region of the surface separating the one from the other.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. A method of protecting the rotor of a mercury bath electricity meter from amalgamation with mercury, which consists in applying a coating of platinum to the rotor, heating it slowly to a temperature of about

700°C . in an atmosphere which is inert with respect to platinum and to the metal constituting the rotor, maintaining the temperature for sufficient length of time to produce the desired depth of alloying and then while still in the said atmosphere allowing the rotor to cool.

2. A method of protecting a copper rotor of the mercury bath electricity meter from amalgamation with mercury, which consists in applying to the copper a coating of platinum, heating it slowly to a temperature of about 700°C . in an atmosphere which is inert with respect to platinum and copper, maintaining the temperature for sufficient time to produce the desired depth of alloying and then allowing the rotor to cool while still in the said inert atmosphere.

In testimony whereof I have signed my name to this specification.

SEBASTIAN ZIANI DE FERRANTI.