Cl 204

Published May 18, 1943

Serial No. 390,374

ALIEN PROPERTY CUSTODIAN

PROCESS FOR DRIVING OUT OCCLUSIONS OF GASES LIKE HYDROGEN FROM THE SURFACE LAYERS OF WORK-PIECES

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No Drawing. Application filed April 25, 1941

This invention relates to a process for driving out occlusions of gases like hydrogen from the surface layers of work-pieces in an electrolytic manner to increase the resistance to corrosion of such layers. The most important field of application of the process is the pretreatment of metals to be coated for subsequent electroplating so as to impart to the work a surface quality adapted for placing thereon metallic deposits of any kind and producing durable coatings of high corrosion resistance.

Owing to its great advantages compared with those obtainable by the application of the formerly usually employed mechanical or chemical cleaning treatments, the electrochemical treatment of metallic work-pieces for the purpose of removing foreign external impurities, the oxidic surface films and foreign matter embedded in the surface layers in the course of production, particularly for preparing the surface for the subsequent provision of a deposit, has been more and more adopted of late.

Electrolytic refining or cleaning processes in which the metal objects to be treated are used either as cathode or as anode in an electrolytic bath are in particular widely employed.

Of these processes the anodic treatment is especially effective and, above all, applicable where it is necessary to neutralize, as for subsequent electroplating, the hydrogen found in the surface layers of a work, which enters the metal, or is not oxidized, during the cathodic cleaning as well as for instance during pickling in an acid solution.

The known processes of the latter class are, however, open to the objection that their application involves partial dissolution of the metal treated and redeposition of the dissolved metal in oxidic form on the surface of the work, which implicates an undesirable loss of material and necessitates also subsequent treatment of the work in a mechanical or chemical manner to remove again these oxides. The known process failed, moreover, even if the current was allowed to act for a long time, to remove with sufficient penetrative effect the foreign constituents of the metal, especially carbides, etc. embedded between the crystallites of the metal structure, though this foreign matter is also a cause for the manifestation of corrosion in the metal coating.

The invention avoids the drawbacks of the hitherto known anodic treating methods and provides a process which insures complete liberation of the surface of a work not only from all oxide films but also from the carbides, etc. embedded in the body of the metal, as well as full oxidation of the hydrogen contained in the pores of the metal.

The invention is based on the knowledge that the process of the dissolution of the metal and of the reoxidation thereof does not occur immediately after current is applied to the bath containing the work serving as anode, but sets in, depending on the nature of the alkaline or neutral, though not acid, bath, a certain time after the current has begun to act. The gas reactions, on the other hand, i. e. the oxidation of the hydrogen and the conversion of the carbides, etc. whose presence directly at the surface of a work subsequently to be coated is highly detrimental and absolutely prevents for instance the production of deposits free from pores in electroplating commence as soon as the current begins to act.

In view of these facts the invention proposes to operate the bath in which the work, previously preferably cathodically treated to effect decreasing and removal of the surface oxide films, is used as anode by current impulses occuring at interval the duration of which and of the impulses is adapted to the peculiar nature of the metal and of the electrolyte in such manner that the reactions leading to the formation of an oxidic deposit of the metal on the work do not set in as yet.

The duration of each current action differs therefore and, depending on circumstances, may last up to 60 seconds, though it is much shorter as a rule and may amount to less than one second. The actions of the current are continued until it is apparent that all oxidizable constituents, besides the metal treated, are completely oxidized at the surface. This can be well observed with the naked eye. For example, during the first current impulses islands- and band-like regions appear on a test piece, which are irregularly distributed over the entire surface and on which a particularly strong gas development can be noticed. After a certain number of impulses these at first clearly contrasting regions disappear, and the gas development proceeds uniformly over the entire area. At this moment no oxidizable constituents are present any more.

The new process is preferably carried out with the aid of a switch connected in the circuit for automatically cutting off and interrupting the current for adjustable periods.

When the above-mentioned condition has been reached, the current is shut off, the work taken out and rinsed and may then for instance be directly electroplated.

Experiments have shown that electroplating produces a metal layer of highest quality, which is not only completely free from pores and pitting, but which is distinguished also by an extraordinary adhesiveness to the basic metal.

The layer produced is, moreover, much more non-corrodible than a layer obtained in the usual manner.

At a comparison test 20 sheets were cathodically decreased in the customary way and then anodically treated uninterruptedly for 30 seconds. After this time the test sheet did not show any visible coat. The current was then cut off, and the sheets were rinsed and nickelplated for 30 minutes.

The sheets were subjected to the usual corrosion test by boiling in distilled water, that is, they were boiled for four minutes and then allowed to stand four hours in their boiling water. The subsequent count of rusty places yielded 1,486 points.

A second series of 20 sheets was treated in the same manner with the difference, however, that during the anodic treatment the current was applied only for one second whereupon the current supply was interrupted for another second. The sheets remained in the anodic bath for 30 seconds, but only 15 current impulses lasting one second each were applied, so that the total current action amounted to 15 seconds.

The corrosion test of these sheets, which were also immediately nickelplated for 30 minutes, disclosed only 176 rusty places, or only one-ninth of the number of such places found during the first test.

The application and effect of the new process have been described above with a view to employing it as a pretreating process for subsequent electroplating. The range of uses of the new process is, however, not limited hereto, but is far more general. The new process can be advantageously applied in all cases where occlusions of gas, particularly hydrogen, have to be driven out of the surface layers of work-pieces. It may serve for instance for after-treating already produced metal coatings to considerably increase their resistance to corrosion, or for giving intermediate treatment when electroplating several superposed metal layers of the same or different kind, as for instance for dehydrating a nickel layer prior to final chrome-plating.

At any rate, the invention is not restricted to the embodiments and possibilities of application described, but may be varied in many ways without deviating from its fundamental idea.

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