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METHOD OF PRODUCING ELECTROFORMS

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1 Claim. (Cl. 117—47)

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This invention relates to a method of producing electro-forms, such as electro-type plates.

A method of preparing replicas by an electroforming process in common use is to prepare a mould in wax from the original, and to render the wax mould electrically conducting by intimately depositing on the surface a coating of graphite, so that a metallic shell can be deposited thereon electrolytically. The deposition of graphite and the attendant preparation of the surface of the wax mould by brushing and polishing the graphited surface, is a process which is dirty and is attended by discomfort to the operator. In addition the electrolytic deposition of the metal on such a conducting surface is, because of the limited electrical conductivity of the graphite film, a relatively slow process; and uniform deposition of the metal is not always obtained.

The object of our invention is to provide a conducting surface to the wax by depositing, by purely chemical means, a layer of silver thereon. Such a silver film acts as an efficient conducting surface on which an electrolytic deposition of metal may be made in a space of time appreciably less than by the conventional graphite method above described, and the deposition of the metal also takes place in a more even and more easily controlled manner.

The deposition of silver by chemical means on conventional surfaces such as glass, metal and other surfaces which are easily wetted by aqueous solutions, is normally carried out by well known commercial processes, but the deposition of silver on surfaces such as wax which are not wetted by aqueous solutions is a matter of difficulty.

We are aware of methods in which surfaces of all kinds which can be easily wetted are treated with a solution of stannous chloride in order to aid the deposition of a film of silver.

We are also aware of methods of producing wetted films on hydrophobic surfaces by the use in various ways of stannous salt solutions, e. g., the patent to Walker 2,303,871, but these methods are invariably time consuming and frequently laborious.

We have discovered that the wetting of hydrophobic surfaces by metallic salt solutions is due to the deposition on the said surfaces of a wetted film of a basic metal compound due to the coagulation of a positively charged sol of the said compound. We also find that the deposition of this wetted film is greatly accelerated by the addition to the metallic salt solution of a wetting agent.

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According to the present invention, a hydrophobic surface is treated with a wetting agent and a solution of a metallic salt having the property that when mixed with the chosen wetting agent it will rapidly deposit a permanent wetted film of basic metal compound on the said surface. The wetting agent is preferably added to the metallic salt solution and the nature and amount of wetting agent and the composition of the metallic salt solution are so chosen as to give a mixture which will rapidly deposit a permanent wetted film of basic metal compound on a hydrophobic surface but is sufficiently stable to permit storage for an appreciable time. The presence of the wetting agent also facilitates the initial wetting of the hydrophobic surface by the salt solution. When a stannous salt is used the film of basic compound deposited, in addition to providing a wetted surface, further assists in the deposition, by chemical means, of a film of conducting material such as silver, by producing, when brought into contact with a silver solution, metallic silver nuclei which promote the rapid subsequent growth of a continuous metal film.

As an example we use an aqueous solution containing stannous chloride (of concentration 0.2 molar) and hydrochloric acid (approximately 1 molar) to which has been added 1% by weight of the sodium salt of an alkylated naphthalene sulphonate. The total time taken by this solution to form a wetted film on wax is about 30 seconds.

Although it is preferred to employ an aqueous solution containing stannous chloride, when the material to be treated is wax, solutions of salts of other metals such as iron, aluminium, chromium and zinc, to which a suitable wetting agent has been added, may be employed to render the surface wettable.

Although the use of a wax mould in the above mentioned treatment is specifically stated, the invention is also applicable to other materials (e. g. certain plastic materials) which show a resistance to deposition of a silver film by reason of their resistance to wetting by aqueous solutions. We find that pretreatment with the above described metallic solutions to which a wetting agent has been added materially renders such surfaces easily receptive of a film of silver.

In the application of the above solutions to the surfaces already described, we can use any of the following methods—dipping, brushing or spraying.

In the subsequent deposition of a film of silver

on the treated surfaces described, we can attain this deposition by the use of a conventional solution such as is used in many commercial processes but we find that our pretreatment allows us to use new and non-conventional methods of silver deposition. Thus we find that our pretreatment surface will accept a solution of silver nitrate to which has been added colloidal agents, these serving to give a more even silver film, as first treatment and that this silver solution will be retained by the surface until it can be reduced chemically to metallic silver in a second bath. Such a method of using a silver bath and a subsequent reducing bath effects a considerable saving of silver salts. In methods heretofore commonly employed in which ammoniacal silver salts and reducing agents are used, there is appreciable instability of the complex silver solution due both to the action of light and to the reactive nature of the constituents. We mention the use of a silver bath and of a reducing bath which implies treatment by dipping but we also find that application of such solutions by spraying methods and by brushing methods are successful.

A typical method of treatment according to our invention is as follows:

1. A mould in wax or in a plastic material which is not readily wetted is first made from the article to be reproduced.

2. The mould is treated with the following aqueous solution, 0.2 molar stannous chloride, 1.0 molar in hydrochloric acid and containing 1% of the sodium salt of an alkylated naphthalene sulphonate.

3. The mould is washed under running water.

4. The mould is treated with an aqueous solution containing 1% silver nitrate and gelatin not exceeding 2%.

5. The mould is then immediately, without washing, treated with a solution of a suitable reducing agent, such suitability being governed by the rate of reduction required. For example, we prefer to use an aqueous solution containing

0.8% pyrogallol. Steps 4 and 5 may be repeated if required in order to obtain a silver film of suitable thickness.

6. The mould is then washed with water and is ready for subsequent treatment in an electrolytic depositing bath.

What we claim is:

In a method of producing non-adherent deposits useful as electroforms, the steps of subjecting a wax mould having a surface which is not readily wetted by aqueous solutions to treatment by an aqueous solution of an alkylated naphthalene sulphonate as a wetting agent and stannous chloride, and in which the wax mould, after treatment with the aqueous solution and metallic salt, receives a deposit of a layer of silver.

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