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METHOD OF FORMING A BRIGHT METALLIC DEPOSIT ON THE SURFACE OF OBJECTS

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Fig. 1

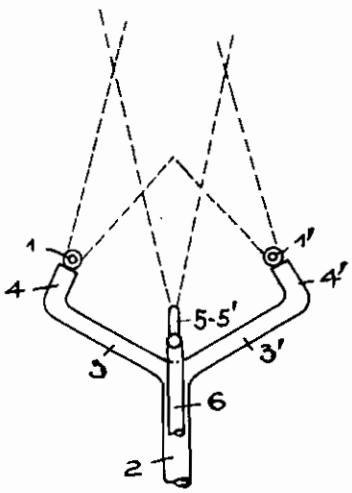


Fig. 2

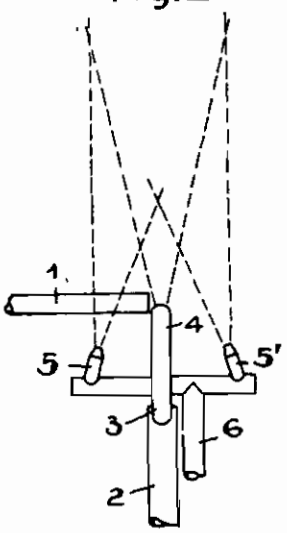


Fig. 3

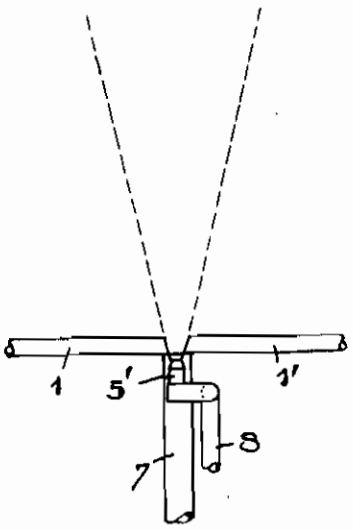


Fig. 4

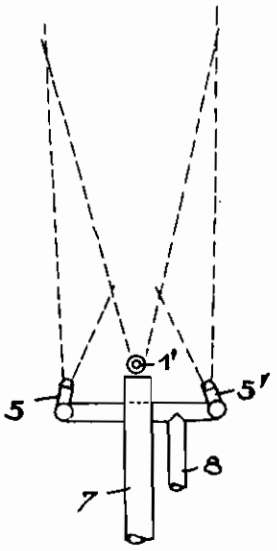
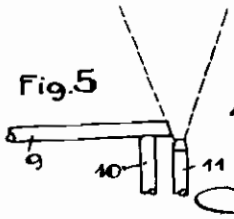


Fig. 5



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ALIEN PROPERTY CUSTODIAN

METHOD AND APPARATUS FOR FORMING A BRIGHT METALLIC DEPOSIT ON THE SURFACE OF OBJECTS

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In order to form a bright metallic deposit on the surface of glass or other materials through chemical methods, use is made, in a known manner, of a solution of a metallic salt from which the metal is precipitated in a finely divided state by the addition of a reducing solution, so as to be deposited on the surface of the object to be covered with a bright metallic deposit. The two solutions, that is to say the solution of metallic salt and the reducing solution, are kept separate and they are mixed together only a short time before they are to be used, because reduction, and consequently metal precipitation, take place immediately after this mixing of the two solutions with each other. The objects on which a bright metallic deposit is to be formed are immersed in the mixture of the solutions, or these objects are coated with this mixture of solutions or said mixture is atomized on the objects. In any case, it is clear that only a very small part of the metal present in the mixture of the solutions can be utilized for forming a bright metallic deposit, because the precipitation of the metal starts as soon as the two solutions have been mixed together and then it keeps going on in a continuous manner, being distributed in a uniform fashion throughout the mass of the mixed solutions, and only a small part of the metal thus precipitated can deposit on the object, whereas the remainder deposits on the bottom or on the walls of vessel containing the mixture. When use is made of atomizing devices, there is further produced, in the atomizing nozzles and in the feed conduits leading to said nozzles, an immediate clogging resulting from the depositing of metal, which also takes place therein, so that even after a short period of time it is necessary to proceed to a cleaning by dissolution of the deposited metal by means of acid, which is complicated and is a considerable delay to the operation.

The object of the present invention is to eliminate all these drawbacks, and also to obtain an improved adhesion of the bright metallic deposit on its support, in such manner that the risk of scaling off, a phenomenon which is particular frequent in the case of silver layers, is wholly eliminated.

The essential feature of the method according to the present invention lies in the fact that the solution of metallic salt, necessary for producing the bright metallic deposit on the objects, and the reducing solution are atomized separately but simultaneously and are caused, in this atomized state, to mix together and to act on the object to be coated with the bright metallic deposit. In order to facilitate the reduction of the metal and to obtain better adhesive qualities of the bright metallic deposit, the atomizing of the solutions, which are kept in distinct containers and are fed separately to the atomizing devices, is advantageously effected by means of steam or heated gases.

According to another feature of the present invention, in order further to accelerate the separation of the metal from the atomized mixture and the precipitation on the object to be coated with the bright metallic deposit, and also in order further to improve the adhesive qualities of this deposit, it is advantageous to introduce steam or heated gases, in particular gases having a reducing action, into the atomized mixture that is produced.

In order to carry out the method according to my invention, I preferably make use of an apparatus including two feed conduits, which are located at a small distance from each other, corresponding respectively to the solution of metallic salt and to the reducing solution, these conduits leading to two atomizing nozzles arranged to make an angle with each other. The atomizing nozzles are fed with steam or heated gases, preferably through a common conduit. The orifices of the feed conduits for the two respective solutions which serve to produce the bright metallic deposit can be located so close to each other that the simultaneous atomizing of these two solutions can be obtained by means of a single nozzle opening between said orifices and acting simultaneously on both of these solutions.

Other features of the present invention will result from the following detailed description of three specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a front elevational view of a first embodiment of the invention;

Fig. 2 is a side elevational view corresponding to Fig. 1;

Fig. 3 is a front elevational view of another embodiment of the invention;

Fig. 4 is a side elevational view corresponding to Fig. 3;

Fig. 5 is a side elevational view of another embodiment of the invention.

In the embodiment illustrated by Figs. 1 and 2 the apparatus includes feed conduits *1* and *1'*, located at a certain distance from each other and supplying, one the solution of the metallic salt,

and the other the reducing solution (these two solutions being preserved separately) and a nozzle 4, 4' corresponding to each of these conduits. Steam or heated gas is fed to these nozzles through a common conduit 2, which is divided into two branches 3, 3', leading respectively to the lateral nozzles 4, 4' in question. These nozzles 4, 4' are located at a small distance from the respective outlets of conduits 1, 1', in such manner that the steam or hot gases issuing from these nozzles, when flowing in front of these outlets of conduits 1, 1', suck out the solutions respectively fed by these conduits and disperse them in the atomized state in the form of cones. As a consequence of the angle made by the respective directions of nozzles 4, 4', the two atomization cones intersect each other at a distance from the outlets depending upon the values of said angle, so that the atomized solutions are mixed together. I introduce, into this atomized mixture, the object on which a bright metallic deposit is to be formed. The reduced metal is thus caused to precipitate on this object, in the form of a highly adhesive bright metallic deposit.

The apparatus is further provided with two lateral atomization nozzles 5, 5', which are also arranged at an angle to each other and which are fed with steam or a heated gas through the common conduit 6. The cones of dispersion of these nozzles 5, 5' are directed toward the atomized mixture in such manner that their jets mix with those of the coating (silvering) mixture, whereby precipitation of the metal on the object to be coated (silvered) with this metal is accelerated and the adhesion of the deposit to the support is further improved. In particular, this is the case when gases having a reducing action are fed through these supplementary nozzles 5 and 5'.

The embodiment illustrated by Figs. 3 and 4 corresponds to an analogous apparatus, in which, however, the two feed conduits 1 and 1', through which the metallic salt solution and the reducing solution, respectively, are fed, are arranged in such manner that their outlets are turned toward each other, at a small distance from each other. To these outlets corresponds a single atomizing nozzle 7, which simultaneously produces the atomizing of the two solutions and causes them to mix together.

The additional atomization nozzles 5, 5', which are still arranged laterally with respect to the atomization cone thus produced, and which are fed with steam or heated gas from conduit 8, serve, as in the apparatus above described, with reference to Figs. 1 and 2, to accelerate the reduction and precipitation of the metal and to improve the adhesive qualities of the bright metallic deposit.

Other changes may be brought in the manner of using the above described apparatus. For instance, the two feed conduits may be fed with the same metallic salt solution in case the reducing agent is carried by the gaseous fluid atomizing jet.

As above described, one of the features of the invention resides in the fact that the liquid solutions are atomized by means of jets of either steam or hot gases. It is obvious that the invention can be realized by atomizing by means of these jets a mixture of the two solutions containing the metallic salt and reducing agent.

The embodiment illustrated by Fig. 5 corresponds to an apparatus in which the metallic salt solution is fed through a feed conduit 9. To the outlet of this conduit is connected another feed conduit 10 through which is fed the reducing solution. 11 is an atomization nozzle through which steam or a hot gas, containing or not containing a reducing medium, is fed to produce the atomization of the liquids onto the surface of the object.

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