

## UNITED STATES PATENT OFFICE

1,935,520

SILVER - COPPER ALLOY MIRROR AND  
METHOD OF PRODUCING SILVER-COPPER  
ALLOY FILM

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No Drawing. Application November 21, 1930  
Serial No. 497,339

8 Claims. (Cl. 91—68.3)

This invention relates to the manufacture of mirrors and the like and more particularly to an improved method of depositing a silver copper alloy upon the surface to be treated whereby to utilize the alloy so deposited as the reflecting medium.

Experiments in the art to which this invention relates have shown that an alloy of silver copper produces a reflecting medium of maximum reflecting efficiency. Those skilled in the art have long been cognizant of the fact that mirrors the reflecting surfaces of which are composed solely of silver are readily subject to deterioration and that it is therefore necessary to carefully protect the silver reflecting films against the deleterious effects of moisture, gases and other such elements generally present in the atmosphere. It is furthermore well known that silver mirrors have a somewhat yellow cast tending to distort the images appearing in the mirror. The use of copper in combination with silver not only eliminates the presence of this undesirable yellow cast but also renders the reflecting medium more stable at the same time that it retards the tendency for the silver to readily combine with those elements which ordinarily cause spoilage of the mirror.

Heretofore and prior to this invention it has been exceedingly difficult and impracticable, if not entirely impossible, to deposit upon glass or other such surface to be treated a reflecting medium composed of a silver copper alloy. It is among the objects of the present invention to provide a simple and effective method of depositing a silver copper alloy out of solution upon a surface to be treated whereby to obtain a reflecting medium of maximum efficiency.

A further object of the invention is to provide a method of coating a glass surface with a silver copper alloy whereby there is produced a reflecting medium which is capable of reflecting objects in their proper proportion and perspective and in their true color.

Still another object of the invention is to provide a practical method of depositing a silver copper alloy upon a glass surface or the like without the necessity for employing expensive equipment.

Other objects of the invention include the production of a film or coating of metallic silver and metallic copper so combined as to form a uniform and homogeneous film such as is essential to the efficient reflection and transmission of light rays. Still other objects of the invention will appear more fully hereinafter.

While the invention is described herein as re-

lating more particularly to the manufacture of glass mirrors it is to be understood that the hereinafter disclosed method or process of depositing silver and copper out of a single solution may be employed to good advantage in any case where it is desired to apply a silver copper alloy to articles other than mirrors and which might be constructed not only of glass but of ceramic or other such material.

In carrying out the present invention, four primary solutions are first prepared as follows:—

## Solution No. 1

In a suitable glass or earthenware container, preferably one that is capable of withstanding considerable heat without breaking, is placed 16 ozs. of silver nitrate. To this silver nitrate is added 11 ozs. of ammonia (26°), the ammonia being added slowly to prevent possible explosion and being stirred to insure complete dissolution of the silver nitrate in the ammonia. When all of the silver nitrate has been dissolved, 16 ozs. of distilled water is added to the silver nitrate-ammonia solution, the solution being then cooled and filtered. To the filtered solution is added an additional 144 ozs. of distilled water.

## Solution No. 2

|                                |         |
|--------------------------------|---------|
| Copper sulphate (crystal)..... | 1 lb.   |
| Distilled water.....           | 64 ozs. |

This solution No. 2 is filtered and the filtered solution placed in a dark bottle where it is kept until used.

## Solution No. 3

In a suitable glass or porcelain container is placed 64 ozs. of distilled water to which is added two pounds of crystalline Rochelle salts. This salt solution is heated to the boiling point at which time 1 oz. of silver nitrate dissolved in 4 ozs. of distilled water is added. The Rochelle salt solution and the silver nitrate solution are then thoroughly mixed together after which the solution is again heated to the boiling point at which time 4 ozs. of solution No. 2 is added. After the addition of solution No. 2 the solution is again boiled for at least ten minutes whereupon it is cooled and filtered. This filtered solution No. 3 is then placed in a dark bottle in which it is kept ready for use.

## Solution No. 4

|                             |         |
|-----------------------------|---------|
| Powdered tartaric acid..... | 1 lb.   |
| Distilled water.....        | 48 ozs. |

This solution No. 4 should be allowed to stand

for at least one week after which it is filtered clear.

The final solution which is to be used upon the glass surface to be treated is prepared as follows:—

|                      |         |
|----------------------|---------|
| Distilled water..... | 64 oz.  |
| Solution No. 1.....  | 2 oz.   |
| Solution No. 3.....  | 2 oz.   |
| Solution No. 4.....  | 3 drams |

Attention is here directed to the fact that in preparing this final solution, the solutions are added to the distilled water in the order given above and that solution No. 4 is not added until after solution No. 1 and solution No. 3 have been thoroughly mixed together. Increasing the amount of solution No. 4 which is added to the final solution will slow up its action.

Before mixing together the numbered solutions in order to obtain the final solution, the glass or other surface to be coated is initially block polished or hand rubbed with rouge, after which it is well brushed with water. Following this water brushing operation, a weak solution of tin chloride is applied to the surface to be treated preferably by means of a felt block or bristle brush. The surface is then rinsed well with water and lightly brushed.

The glass so treated is then placed in a horizontal plane and accurately leveled with wedges, the surface to be coated being uppermost. Following the application of the tin chloride solution the surface to be treated must be kept wet until the final solution has been applied thereto. As much of the final solution is poured upon the leveled surface as the latter will hold without the solution running over the edges.

In a relatively short time (about 15 minutes) the first coating of silver copper alloy will have deposited out of the final solution and upon the glass. Thereupon the excess or undeposited solution is removed from the glass surface, preferably with a piece of chamois, the surface being then well brushed to obtain a clean metallic surface for a second coating. A second application of the final solution is then made. In about 10 minutes a second coating or film of silver copper alloy will have deposited out of solution upon the first coating, this second coating being also well brushed and then dried with the chamois. When the deposited film of metal shows no dark spots indicating the presence of moisture, a coating of shellac is applied and when this coating of shellac is thoroughly dry it is covered with a coating of paint.

The shellac for coating the silver copper alloy is preferably prepared by dissolving one pound of arsenic free shellac in 96 ozs. of methanol or special denatured alcohol.

In some instances it may be desired to apply only a single coating of the silver copper alloy to the surface to be treated. In such instance the best results are obtained by decreasing the amount of distilled water in the final solution to 32 ozs. It will be understood of course that other changes may be made from time to time without departing from the essential spirit or general principles of the invention and it is accordingly intended to claim the same broadly as well as specifically as indicated by the appended claims.

What is claimed as new and useful is:—

1. A method of producing a silver copper alloy film upon a glass body or the like which consists in dissolving silver nitrate in an aqueous solution of

ammonia, in dissolving an aqueous solution of copper sulphate and an additional quantity of silver nitrate in an aqueous solution of Rochelle salts, in dissolving tartaric acid in water, and in adding the resultant solutions in the order named to a quantity of water, the final solution so obtained being poured upon the body to be treated.

2. A method of producing a silver copper alloy film upon a glass body or the like which consists in pouring upon said body an aqueous solution of silver nitrate dissolved in ammonia to which has been added, first an aqueous solution of copper sulphate, silver nitrate and Rochelle salts, and, second, an aqueous solution of tartaric acid.

3. A method of depositing a silver copper alloy upon a glass body or the like to form a metallic film thereon which consists first in preparing a solution of silver nitrate dissolved in ammonia; which solution is rendered aqueous and then filtered; secondly, in preparing an aqueous solution of Rochelle salts to which an additional solution of silver nitrate is added plus a solution of copper sulphate; thirdly, in preparing an aqueous solution of tartaric acid; and in finally adding to a quantity of water said first, second and third solutions in the order named:

4. A method of depositing upon a glass body or the like a silver copper alloy in the form of a metallic film which consists in applying to said body a film-forming liquid consisting of an aqueous solution of silver nitrate dissolved in ammonia, of a salt solution in which aqueous solutions of silver nitrate and copper sulphate are dissolved, and of an aqueous solution of tartaric acid, said solutions being added to a quantity of water in the order named.

5. A method of depositing upon a glass body or the like a silver copper alloy in the form of a metallic film which consists in pouring upon said body a film-forming liquid consisting of a primary aqueous silver nitrate-ammonia solution, of a primary Rochelle salt solution in which aqueous solutions of silver nitrate and copper sulphate are dissolved, the silver nitrate solution being added to the salt solution after the latter is brought to its boiling point and the copper sulphate solution being subsequently added to the said salt solution after the latter is brought a second time to its boiling point, and of a primary aqueous solution of tartaric acid, the several primary solutions being each filtered and separately added to a quantity of water in the order named.

6. A method of depositing upon a glass body or the like a silver copper alloy in the form of a metallic film which consists in brushing the surface of the body to be treated with water, applying a solution of tin chloride thereto, in pouring upon the wet tin chlorided surface a film-forming liquid containing aqueous solutions of silver nitrate dissolved in ammonia, silver nitrate and copper sulphate dissolved in a Rochelle salt solution, and tartaric acid, and in removing the excess or undeposited liquid from the surface undergoing treatment.

7. A method of depositing upon a glass body or the like a silver copper alloy in the form of a metallic film which consists in brushing the surface of the body to be treated with water, applying a solution of tin chloride thereto, in pouring upon the wet tin chlorided surface a film-forming liquid containing aqueous solutions of silver nitrate dissolved in ammonia, silver nitrate and copper sulphate dissolved in a Rochelle salt solution, and tartaric acid, in removing the excess or

undeposited liquid from the surface undergoing treatment, and in subsequently coating the deposited film of silver copper alloy with shellac.

8. A method of producing a silver copper alloy film upon a glass body or the like which consists in dissolving silver nitrate in an aqueous solution of ammonia, in dissolving an aqueous solution of

copper sulphate and an additional quantity of silver nitrate in an aqueous solution of a reducing agent, in dissolving tartaric acid in water, and in adding the resultant solutions in the order named to a quantity of water, the final solution so obtained being poured upon the body to be treated.

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| 10 | 85  |
| 15 | 90  |
| 20 | 95  |
| 25 | 100 |
| 30 | 105 |
| 35 | 110 |
| 40 | 115 |
| 45 | 120 |
| 50 | 125 |
| 55 | 130 |
| 60 | 135 |
| 65 | 140 |
| 70 | 145 |
| 75 | 150 |