

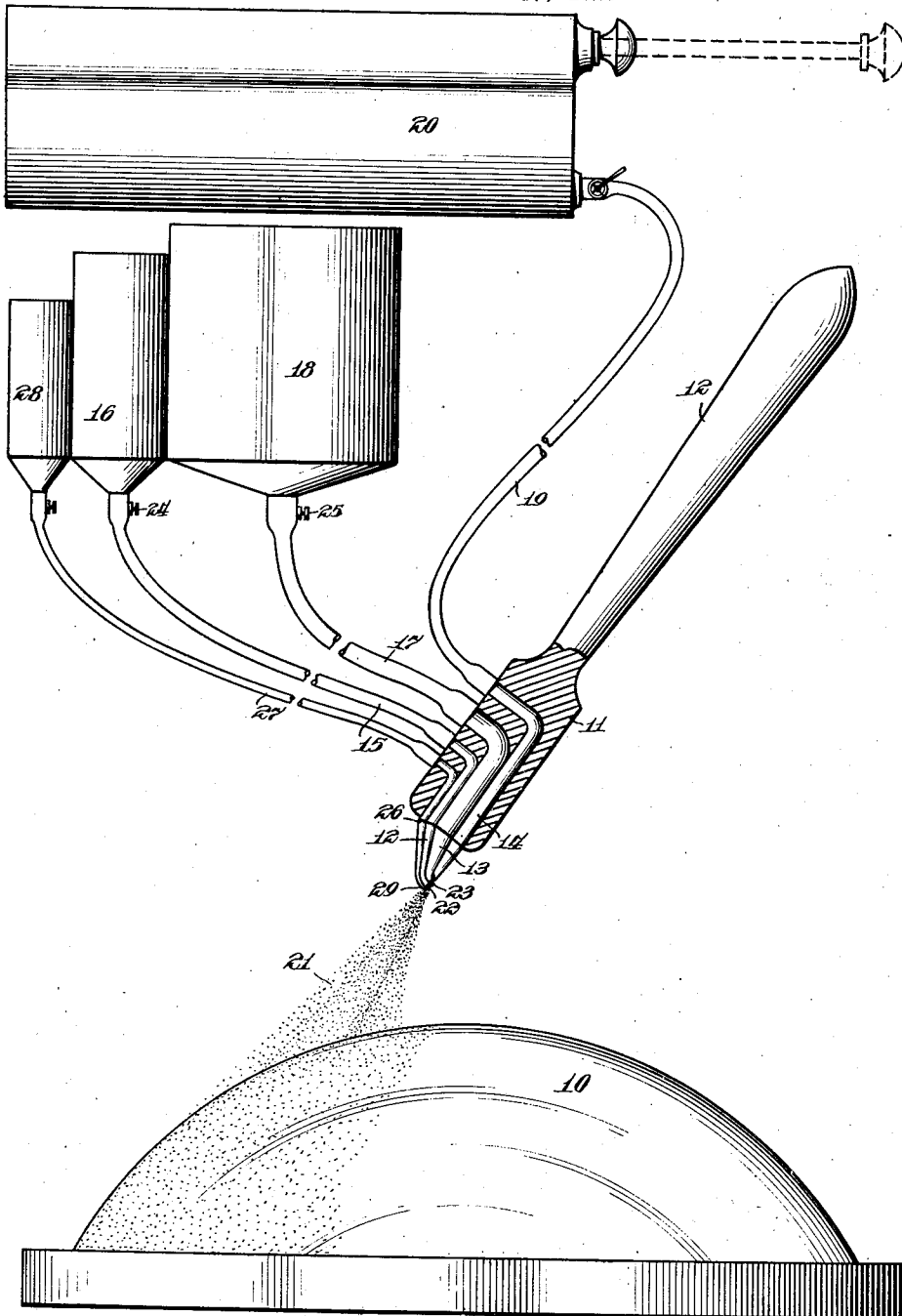
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B. BART

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METHOD OF FORMING REFLECTING SURFACES

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Inventor
Blasius Bart
By his Attorney
Warren S. Orton.

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UNITED STATES PATENT OFFICE.

BLASIUS BART, OF NEWARK, NEW JERSEY.

METHOD OF FORMING REFLECTING SURFACES.

Application filed June 10, 1920. Serial No. 387,974.

To all whom it may concern:

Be it known that I, BLASIUS BART, a citizen of the Republic of Switzerland, and resident of Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Methods of Forming Reflecting Surfaces, of which the following is a specification.

The invention relates in general to a method for depositing substances capable of reflecting light such as metallic silver on an object to be coated and the invention specifically relates to an improvement in the process of forming metallic silver reflectors.

It is the general practice in the art to which this invention relates to mix a solution of a silver salt, such as silver nitrate, with a reducing agent, such as Rochelle salt, and to flow the mixture over the object to be coated. This old method with the reagents in liquid bulk is wasteful in the amount of reagents used, provides coatings of unequal thickness, forms part of the layer of a different character from an adjacent part such as the formation of non-reflecting minute particles and is otherwise objectionable, particularly when attempts have been made to practice the same on a large commercial scale.

The primary object of the present invention is to attain a brilliant reflecting surface of uniform high lustre, simulating a highly polished silver surface and to attain this result with minimum loss of reagents, rapidly and in a manner susceptible of adoption for use on a large commercial scale and capable of being operated successfully by unskilled labor.

To attain this object I cause the reagents each to assume the form of a nebulous cloud of spaced apart, very fine particles, which floating particles will be caused to react chemically preferably but not necessarily while in the air and the metallic silver so formed is coevally deposited on the surface which is disposed to receive the nascently formed particles.

A further refinement of the invention contemplates an accurate and cautiously regulated control of the proportion of the reagents used during the initial depositing steps of the process and in a variation of these proportions during the subsequent progress of the depositing steps of the process. This feature of the invention is practiced by initially causing the particles in

the silver precipitating cloud to have a relatively larger percentage of silver present than would be indicated by the theoretically correct amount required by chemical calculation to effect the reducing action. This preponderance of silver forms an extremely brilliant surface layer and for reasons of economy in the use of silver is made extremely fine, in fact with no perceptible thickness. The proportion of silver solution to its reducing reagent is then caused to approach the true theoretical chemical reacting proportions, that is, in the illustration above referred to, the silver is present in a proportion of about one-third of the Rochelle salts solution present. It will be understood, however, that these proportions are merely suggestive of the particular example selected for illustration and obviously will vary under the conditions controlling processes of the type under discussion.

Another object of the invention is to provide a process which can be practiced more rapidly than can be effected with the methods now in general use, at the same time to feature economy in the use of the reagents and to attain a sensitive control over the character of the coating being formed.

I attain this object by observing certain refinements of procedure, such for instance, as the concentration of the solutions usually employed, the heating of the mould or object to be coated, the cautious directing of the precipitating cloud uniformly over the surface to be coated and the insuring of the completely formed initial layer of the coating before changing the proportions of the reagent for the succeeding layers.

In this disclosure reference is made to layers, but it is appreciated that there is but one integral coating which in the case of the reflectors selected for illustration is not more than one-twenty-fifth of a millimeter.

Various other objects and advantages of the invention will be in part obvious from the suggestions herein made relative to the improved process and from an inspection of the accompanying drawings showing the precipitating cloud, and in part will be more fully set forth in the following particular description of one practical method of practicing the invention and the invention also consists in certain new and novel combination of steps hereinafter set forth and claimed.

Referring to the accompanying drawings,

there is shown largely in diagrammatic outline a suggested form of apparatus for practicing the process featured in this disclosure.

In the drawings there is shown a convex, chemically clean and preferably highly polished glass mould 10. This showing is selected in order to feature the construction of a concaved reflector of the type disclosed in my copending application on reinforced reflectors Serial No. 387,975, filed June 10, 1920, for in such devices a high lustered surface is desired. It is understood that at the completion of the process there is a thin layer of metallic silver formed on the glass mould disclosed, after which the mould with the thin silver coating thereon is positioned in an electrolytic vat and a deposit of a strengthening material, such as copper, is formed on the rear side thereof, after which the copper backed silver coating is removed from the depositing vat.

In the drawings there is shown an atomizing tool 11 but it is to be understood that the tool illustrated is illustrated and hereinafter described simply to show a form of apparatus by means of which the method in one aspect of the same may be practiced. The tool is provided with some form of handle 12. The tool illustrated is of the four jet type selected in order to disclose the use of an additional reagent in the process, hereinafter more fully disclosed, but in general practice the tool will be equipped simply with three nozzles 12, 13 and 14 replaceable with nozzles having different discharge vents thereby to change the proportion of the reagents discharged per unit of time. The nozzle 12 communicates through a pipe connection 15 with a source of supply of a silver solution, herein indicated symbolically by a tank 16. Similarly the nozzle 13 is connected by means of a pipe connection 17 to a source of supply of a reducing agent, indicated symbolically by a tank 18. For the purpose of this disclosure it will be considered that there is present a solution of silver nitrate in the tank 16 and a solution of tartaric acid in the tank 18.

The nozzle 14 connects by means of a pipe 19 with a source of compressed gas, herein suggested as air, and represented by a compressed air tank 20.

The air nozzle discharge nozzle 14 defines the axis of the silver precipitating cloud 21 and the discharge vents 22 and 23 of the nozzles 12 and 13 respectively are extremely fine in discharging cross-section and discharge their contents one slightly in advance of the other and both at right angles to the direction of the air stream discharged from the nozzle 14.

The tanks 16 and 18 are provided, respectively, with main control valves 24 and 25 but the rate of discharge from the nozzles will depend primarily upon the flow

discharging capacity of the vents 22 and 23. In the device selected for illustration it is intended that the reducing agent be supplied in an amount three times greater than the amount of silver solution supplied per unit of time, and accordingly the vents 22 and 23 are cautiously designed to give this proportional rate of discharge.

With the parts in the position illustrated in the drawings the valve 25 is shut off slightly so as to give a slight preponderance of silver discharged compared to the theoretically defined amount of reducing agent as usually practiced in the flow method now in general use. With this slightly strong silver solution discharging in the form of fine mist rather than a rain of drops into the similar cloud of reducing reagent the tool is moved about until all parts of the surface of the mould is uniformly but slightly coated. After the initial coating is formed the valve 25 is fully opened and the operation is continued, the operator passing back and forth and across the mould until the desired thickness of silver coating is attained.

The best results are attained when the mould is heated and while any temperature above room temperature is suggested, a temperature of 70°-90° F. has been found to be most effective in forming devices of the type herein particularly described.

While the invention, as thus far described, is complete in itself, it is herein suggested that under some circumstances ammonium hydroxide may be added to the precipitating cloud. It is appreciated that any excess of ammonium hydroxide in the reaction, above outlined, would spoil the same, but addition of a very small amount of ammonium hydroxide is practiced with advantage when the mold is cold and has the effect of acting as a speeding reagent.

For this purpose there is disclosed in the drawings, an additional nozzle 26 which leads by means of a pipe 27 to a source of supply of ammonium hydroxide indicated by the tank 28. The nozzle 26 is provided with an extremely fine discharge vent 29 which points in the same direction as the vents 22 and 23 and adds a small spray of ammonium hydroxide to the reagents discharged by the vents 22 and 23.

It has been found upon analyzing the by-products flowing off the coated mould that there is very little silver present. As tartaric acid and ammonium-nitrate is relatively cheap the process features economy in the use of the expensive silver material. Further featuring economy, it is possible by practicing the method disclosed to effect an intensely brilliant but very thin coating to the face of the formed reflector and to back the extremely brilliant face with a very thin layer of silver which is not quite so brilliant. This

additional thickness is necessary in order to prevent dissolving in the subsequent electrolytic bath treatment but the coating can be made of uniform thickness, a result which is possible due to the fact that as a very small amount of the coating is deposited at any one time the operator has an opportunity to move the tool over another portion before an abnormally thick layer can form. It is understood that the operator comes back repeatedly over a previously coated part and in this way attains accurate control over the forming layer and with a little experience can readily gauge the thickness desired on the different parts of the coating.

The practicing of the process with the use of silver has been featured in this disclosure due largely to the fact that applicant's efforts have been connected with the development of silvered reflectors, but it is appreciated that the process is equally applicable, in the case of reflectors, to other light reflecting metals for instance platinum and gold and these metals are to be considered as the chemical equivalent of the silver recited in the following claims whenever such substitution of metals is permissible. Certain other metals, such as nickel and cobalt have been tried but do not give the satisfactory results above recited for silver. It is further suggested that the process can be practiced with certain alloys and metal mixtures and as one such mixture a combined gold-silver deposit has given a most beautiful reflecting surface.

Having thus described my invention, I claim:—

1. In the art of coating objects with a silver deposit, the process which consists in forming a cloud-like mist of small particles of a silver compound diffused into a similar cloud of small particles of a compound designed to react chemically on the silver compound to precipitate fine metallic silver and permitting the metallic silver particles so formed to deposit on the object to be coated.

2. In the art of coating objects with a silver deposit, the process which consists in intimately mixing a cloud of small, separated particles of a silver compound with a cloud of small particles of a substance capable of reacting with the silver compound particles to form fine particles of metallic silver and causing the metallic silver particles so formed to collect immediately on the object to be coated.

3. In the art of coating objects with a silver deposit, the process which consists in intimately mixing in air a cloud of small, separated particles of a silver solution, associated with said silver particles a cloud of particles of an agent capable of reducing the silver compound, said reducing agent being in close physical contact with the particles

of the silver compound, causing said particles of the silver solution and reducing agent to react chemically while passing through the air and immediately receiving the resulting metallic silver particles on the object to be coated.

4. In the art of coating objects with a silver deposit, the process which consists in intimately mixing while in the air a cloud of small, separated particles of a silver solution, a cloud of particles of an agent capable of reducing the silver compound to form metallic silver, said reducing agent while passing through the air being in close physical contact with the particles of the silver compound, causing said particles to react chemically while passing through the air and receiving the resulting metallic silver particles on the object to be coated while permitting the by-products formed to flow off the coated surface and thus leave the object coated with fine silver particles.

5. In the art of coating objects with a silver deposit, the process which consists in forming a cloud of fine particles comprising a silver compound and a reducing agent with the particles of the former present in a proportion of about one-third of the particles of the reducing agent and causing said cloud to pass through space for a relatively short distance to permit a brief reaction between the particles of the silver compound and the reducing agent and receiving the formed metallic silver particles on the object to be coated at the termination of the passage of the particles through the air.

6. In the art of coating objects with a silver deposit, the process which consists in forming a cloud of fine particles comprising a silver compound and a reducing agent with the particles of the former present in a proportion of about one-third of the particles of the reducing agent and causing said cloud to pass through space for a relatively short distance to permit a brief reaction between the particles of the silver compound and the reducing agent, receiving the formed metallic silver particles on the object to be coated at the termination of the passage of the particles through the air and causing a spray of a speeding reagent to commingle with the cloud.

7. In the art of coating objects with a silver deposit, the process which consists in forming in air a cloud of fine particles comprising a silver compound and a reducing agent, in which the silver compound is present initially in a proportion of more than one-third of the reducing agent and then reducing the proportion of the silver solution present until the particles of the silver is about one-third of the particles of the reducing agent, causing said cloud to pass through the air for a relatively short dis-

tance to permit a brief reaction between the particles of the silver compound and the reducing agent and receiving the formed metallic silver particles on the object to be coated at the termination of the passage of the particles through the air.

8. In the art of coating objects with silver, the process which consists in first spraying on the object a mist of a silver solution and a reducing agent, causing the reducing agent to react on the silver as the mist is deposited thereby to form a brilliant face layer to the coating and then reducing the percentage of the silver constituent in the spray until the proportion of silver to its reducing agent is approximately one to three thereby to form less brilliant portions to the part of the coating back of the face layer.

9. In the art of coating objects with metallic silver, the process which consists in causing a mist of fine particles of silver nitrate, tartaric acid and ammonium hydroxide to commingle in space and to fall on the object.

10. In the art of coating objects with metallic silver, the process which consists in causing a mist of fine particles of silver nitrate and tartaric acid to commingle in space and to fall on the object.

11. In the art of coating an object with silver, the process which consists in heating the object and while the object has a temperature greater than room temperature, causing a cloud of metallic silver particles to be formed in close proximity to the surface of the object to be coated and immediately permitting the freshly formed silver particles to fall gently as a cloud or mist onto said heated surface.

12. In the art of coating an object with silver, the process which consists in causing a cloud of finely divided particles of silver nitrate to mix with a cloud of a silver nitrate reducing agent in which mixture the silver is present in an amount approximately one-third of the amount of the reducing agent present and causing said cloud mixture to lay on the object to be coated.

13. In the art of coating an object with silver, the process which consists in causing a cloud of finely divided particles of silver nitrate to mix with a cloud of a silver nitrate

reducing agent in which mixture the silver is present in an amount approximately one-third of the amount of the reducing agent present, causing the particles of the silver nitrate and its reducing agent to come into such intimate physical and chemical relation that practically all of the silver present will be reduced to metallic silver and immediately receiving the metallic silver so formed on the object to be coated.

14. In the art of coating objects with metallic silver, the process which consists in forming metallic silver in such extremely fine particles that they will lazily float downwardly in air and immediately receiving the nascently formed silver particles on the surface to be coated.

15. In the art of coating the surface of an object with silver, the process which consists in causing a cloud of finely divided particles of silver nitrate to mix with a cloud of a silver nitrate reducing agent in which mixture the silver is present in an amount approximately one-third of the amount of the reducing agent present causing the cloud mixture to contact with the surface, said surface having a temperature greater than the temperature of the depositing silver particles.

16. In the art of preparing a coating for covering an object with silver, the process which includes the steps of causing a cloud of finely divided particles of silver nitrate to mix with a cloud of a silver nitrate reducing agent in which mixture the silver is present in an amount approximately one-third of the amount of the reducing agent present, said reducing reaction taking place in the presence of ammonium hydroxide.

17. In the art of coating objects with a light reflecting metal, the process which consists in forming the metal into a nebulous cloud of finely divided spaced apart particles, subjecting this metallic cloud to a similar cloud of a reagent capable of reacting chemically while in the air to reduce the metal in the cloud and causing the reduced metal promptly to lay on the article to be coated.

Signed at New York city, in the county of New York and State of New York, this 5th day of June, A. D. 1920.

BLASIUS BART.