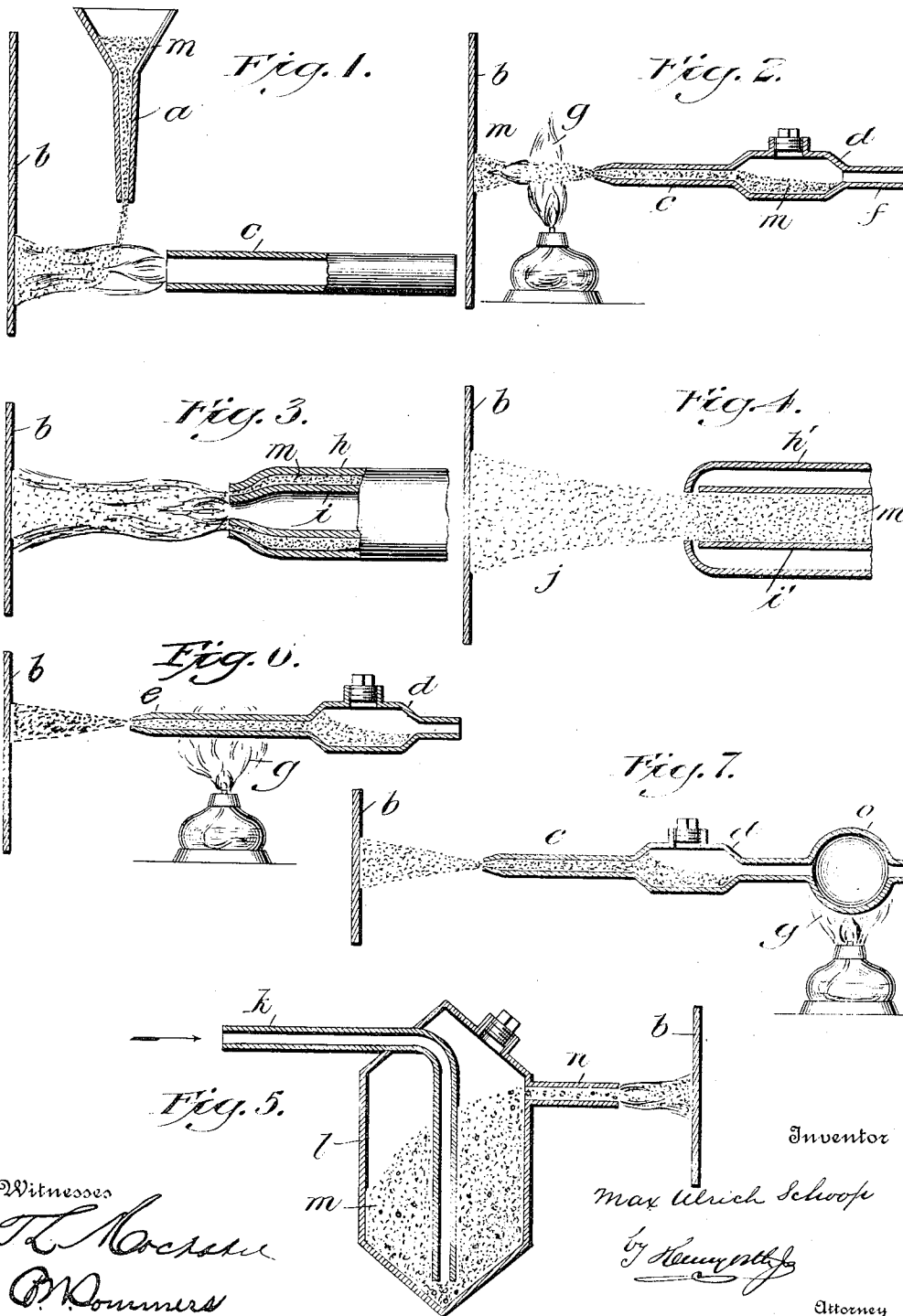


1,128,059.

Patented Feb. 9, 1915.



UNITED STATES PATENT OFFICE.

MAX ULRICH SCHOOP, OF HÖNGG, NEAR ZURICH, SWITZERLAND, ASSIGNOR, BY MESNE ASSIGNMENTS, TO METALS COATING COMPANY OF AMERICA, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

METHOD OF PLATING OR COATING WITH METALLIC COATINGS.

1,128,059.

Specification of Letters Patent.

Patented Feb. 9, 1915.

Application filed August 7, 1911. Serial No. 642,782.

To all whom it may concern:

Be it known that I, MAX ULRICH SCHOOP, a citizen of the Republic of Switzerland, residing at Höngg, near Zurich, Switzerland, have invented certain new and useful Improvements in Methods of Plating or Coating with a Metallic Coating; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to the method of plating or coating with a metallic coating, similar to electro-plating, by projecting small particles of the metal that is to form the coating, onto the object to be coated, as will hereinafter be more particularly described and claimed.

The present method of coating articles with metallic powder or bronzing them, requires that the article to be coated be prepared to receive the bronze either by coating it with a lac or paint, or by heating it to a high temperature, and it is impossible to use the latter method for combustible articles, such as those of paper, wood, cellulose, &c., as the heat would either destroy or deform their surfaces. Furthermore, such methods of coating do not form a continuous, homogeneous covering of a metallic nature for the articles, and for that reason they cannot be tooled, or otherwise subjected to mechanical action, and, moreover, the coating does not form a good protection against chemical action, or weathering. It is also not possible by these methods to reproduce special forms, such as the reproduction from matrices, especially when the latter are made of combustible substances, or substances that readily melt, as in the galvano-plastic art.

In my prior application, filed April 1, 1910, Serial No. 552800, the starting material or metal with which the coatings are made is melted and atomized, and requires a furnace or melting pot, so that the apparatus for carrying out the process is not readily transportable, and flexible or movable atomizing nozzles cannot be readily used.

Referring to the drawings in which like parts are similarly designated, Figure 1 is a diagrammatic sectional view illustrating means for carrying out the process. Fig. 2 is a like view when the metal particles are projected beyond the flame. Fig. 3 shows a combining nozzle. Figs. 4 and 5 are other forms thereof. Fig. 6 illustrates the heating of both metal powder and propelling gas. Fig. 7 illustrates the heating of the propelling gas only.

According to the present invention the starting material is not liquid metal, but metal oxid, metal powder or dust, which is projected upon the article to be coated.

For a better understanding of the invention it may be stated that if a lead ball is thrown against a stone plate it will be heated and mashed flat. If such a ball be given sufficient impetus, for example, if it be shot from a gun against a smooth hard plate, the heat generated by the impact will melt the lead, and the plate will be coated with a strongly adhering coating, not only at the point of impact but also over a considerable portion of the surrounding area, bordered by radiating lines of the lead. In a similar manner I impart to the metal particles a high speed so that the kinetic energy of the particles is partly converted into mechanical work and partly into heat, so that the particles weld together into a homogeneous sheet or coating. The size of the metal particles is dependent upon several factors; on the melting or welding temperature of the metal used as a coating, its density, and in general on its physical and chemical constants, also on the temperature and character of the impelling medium, as air, gas, steam, &c.

When using metals having a high melting point, it is desirable to warm or heat the metal powder in its container before projecting it onto the surface to be coated, or to use a heated propelling medium, or to heat the article that is to be coated, provided the nature of the article permits it, or I may use any of these means combined to effect the desired result when necessary.

In all the figures of drawing I have illustrated the use of heat, but the heating may be dispensed with when suitable.

In Fig. 1 the metal powder *m* streams down by gravity from a funnel-like hopper

a and is projected onto the surface *b* to be coated, by a combustible gas under pressure through a tube or burner *c* the gas being projected across the path of the metal particles *m*.

In Fig. 2 the metal particles are contained in the chamber *d* and are carried along or projected through the nozzle *e* communicating with chamber *d* by the propelling gas or air admitted to chamber *d* through pipe *f*. The metal particles pass through and beyond a flame *g* before becoming welded together on the surface *b*.

In Fig. 3 the metal particles and combustible propelling gas are mixed at the exit of two concentric nozzle elements *h* and *i*, the gas being supplied through the inner element *i* and the metal particles through the annular space between *h* and *i*.

In Fig. 4, the nozzle elements *h'* and *i'* are arranged to discharge metal through *i'* and gas through the annular chamber between *h'* and *i'*. In this instance the relation of the ends of the two elements *h'* and *i'* may be such that the stream or jet of metal particles is surrounded by a gaseous envelop *j* which, if ignited, produces a heated envelop.

Fig. 5 illustrates another form of apparatus, wherein carbon monoxid under pressure is supplied to a pipe *k* that terminates near the bottom of a closed container *l* in which the metal dust *m* is placed. The gas and metal particles issue from the container *z* through a pipe *n* and the gas is ignited.

In Fig. 6, which is similar to Fig. 2, the flame *g* is applied to the nozzle *e* to heat both gas and metal before leaving the device, while in Fig. 7 I have shown a heating chamber *o* for heating the propelling gas before it comes into contact with the metal.

Besides making use of the purely mechanical and thermal properties of the pressure medium or gas, I also avail myself of the chemical action of such gas, for example, its reducing property. This is advantageous because many base metals suitable for plating upon being reduced to powder have the surfaces of their particles more or less oxidized.

The propelling medium may be heated before or after it leaves the distributing nozzle, for example, I pass the jet of propelling medium and fine metal particles through a flame, Fig. 2, preferably but not necessarily a ring of flame, as in Fig. 4, which may or may not have a reducing action on the metallic powder. The powder may be blown by a combustible gas, and the jet of gas and metal powder ignited at the distributing nozzle, Figs. 1, 3, 4 and 5. Lead, nickel and iron are suitable for projection with air heated sufficient to impart redness to these metals. The metals may

also be heated sufficiently to render them plastic.

As already pointed out, and as confirmed by many experiments, it is not always necessary that the metal particles be in a liquid condition when they strike the object to be coated; in many cases they need be plastic, or be made plastic only to such an extent that little or no mechanical friction need be produced to cause them to weld.

According to the present process it is possible to produce coatings of alloys. The pulverulent metals or metal powders are mixed in the apparatus used for projecting it onto the surface to be coated, and the mixed powder is then blown on the surface, or several streams of different metals may be simultaneously projected onto the object. Substances other than metals or alloys, as coal dust, silica, corundum, may be mixed with the metallic or oxid powder that have a desirable effect on the coating.

In most cases it is desirable to produce either a very strongly adhering coating or else a coating readily separable from its base, having a bright metallic luster. This uniform bright metallic appearance is more readily obtained the greater the force with which the metallic particles are projected, and the more opportunity be given the metal particles to become plastic. This can be accomplished for example that a long stream of propelling gas is formed from the blowing device or otherwise and the metal particles coming into contact thereby or carried thereby are acted on chemically by the gases, or it may become heated thereby.

What I mean by chemical action is a gas that will combine with the metallic surface of the particles, such, for example, as oxygen, sulfur, sulfureted hydrogen and similar substances that will impart to the surface of the metal the darkened, mottled, or iridescent effect, variously termed in the plating art as oxidizing, bronzing, blazing, wash-streaking, Roman bronzing, &c., all of which give a peculiar pleasing, decorative effect.

In certain cases a better action is obtained and less dust results when the pressure medium, air or gas, after imparting to the metal particles sufficient speed, and after leaving the projecting nozzle is drawn out of its path or drawn away altogether by suction, while the metal particles, by reason of their inertia, proceed onto the surface to be coated. Large and heavy pieces to be coated are best subjected to the action of free jets. The strength of such a coating, whether permanent or separable, depends on the length of time the article is subjected to the action. In general a strongly adhering coating will be attained when the object to be coated is clean, and, in some cases,

heated. If separable coatings are to be made, as for printing blocks, seals, &c., the matrix is greased or oiled; or, if the matrix is of metal it is coated with a hot sulfur solution, or otherwise, to facilitate the removal of the metallic coating. The smoother the surface of the matrix, the more readily will the coating be separated.

Metallic coatings on polished or cut glass adhere by reason of the atmospheric pressure on their outer surface, and may be said to resemble in appearance the so-called photographic squeegee prints.

The hardness and density of the coatings corresponds to that of the metal used for making the coating, probably due to the intensive forging or hammering action of successive metal particles upon one another.

In some cases it is advisable to first coat the metal articles with a very thin coating of another metal to increase the adhesion, for example, iron or steel bodies may first be given a very thin coating of copper, as by washing with copper sulfate solution. This process is advantageous for strengthening separable coatings made by other processes, for example, electro-platings and the like.

This process is undoubtedly useful in many industries for coating with any desired metal, including aluminium, which cannot be plated galvanically. No bath is required, and the coatings can be rapidly made of any thickness on any object, irrespective of size, or of the material of which they are composed. Wood is preserved by such coatings, for example, telegraph or telephone poles, ship's bottoms; wood structures in the tropics are protected against the termite. Iron can be protected against rust, insulating surfaces may be provided with a conductive coating, as Leyden jars and other condensers. It may be stated that eggs, fruit and other edibles can be readily coated with an air tight coating of metal by this method.

Lead, lead-tin alloy, or other metals low in the scale of hardness, and in cold condition, may be blown by air under a pressure of 10 lbs. per square inch and upward. If the nature of the article to be coated permits, the metal particles may be heated to any temperature short of their melting point. Increase in pressure, and a high temperature increase the rapidity of the plating operation.

I claim—

1. The process of producing coherent metallic coatings, which consists in projecting finely-divided unmolten metal onto a surface by a gas with sufficient force to form a non-porous, homogeneous coating, the gas having a reducing action on the particles during the projection.

2. The process of producing coherent me-

tallic coatings, which consists in producing finely-divided unmolten heated metal onto a surface by a gas having a reducing action on the particles.

3. The process of producing coherent metallic coatings, which consists in projecting finely-divided unmolten metal on the surface to be coated by means of a combustible gas, the combined jet of metal particles and gas being ignited.

4. The process of producing coherent metallic coatings, which consists in projecting finely-divided, unmolten metal and metal oxid onto a surface to be coated with sufficient force to form a non-porous, homogeneous coating on said surface.

5. The process of producing coherent metallic coatings, which consists in projecting finely-divided unmolten metal and metal oxid onto a surface by a gas with sufficient force to produce a non-porous, homogeneous coating on said surface, the gas having a chemical action on the oxid.

6. The process of producing coherent metallic coatings, which consists in projecting finely-divided, unmolten metal and metal oxid in a heated state onto a surface to be coated by a reducing gas with sufficient force to form a non-porous, homogeneous coating.

7. The process of producing coherent metallic coatings, which consists in projecting finely-divided, unmolten metal and metal oxid in a heated state onto the surface to be coated by an ignited reducing gas with a sufficient force to form a non-porous, homogeneous coating.

8. The process of producing coherent metallic coatings, which consists in projecting finely-divided unmolten metal in a heated state onto a surface to be coated by a reducing gas with sufficient force to form a non-porous, homogeneous coating.

9. The process of producing coherent metallic coatings, which consists in projecting finely-divided unmolten metal in a heated state onto the surface to be coated by an ignited reducing gas with sufficient force to form a non-porous, homogeneous coating.

10. The process of producing coherent metallic coatings, which consists in projecting finely-divided metal and metal oxid mixed with a non-metallic powdered substance onto a surface to be coated with sufficient force to form a non-porous, homogeneous coating on said surface.

11. The process of producing coherent metallic coatings, which consists in projecting finely-divided metal and metal oxid mixed with a non-metallic powdered substance onto a surface to be coated by a heated gas with sufficient force to form a non-porous, homogeneous coating.

12. The process of producing coherent metallic coatings, which consists in projecting finely-divided metal and metal oxid

mixed with a non-metallic powdered substance onto a surface to be coated with sufficient force to form a non-porous, homogeneous coating by a gas having a chemical action on the metal oxid.

13. The process of producing coherent metallic coatings, which consists in projecting finely-divided metal and metal oxid mixed with a non-metallic powdered substance onto a surface to be coated by a reducing gas with sufficient force to form a non-porous, homogeneous coating.

14. The process of producing coherent metallic coatings, which consists in projecting finely-divided metal and metal oxid mixed with a non-metallic powdered substance

onto a surface to be coated by an ignited reducing gas with sufficient force to form a non-porous homogeneous coating.

15. The process of producing coherent metallic coatings, which consists in projecting finely-divided unmolten metal onto a surface by an ignited gas with sufficient force to form a non-porous, homogeneous coating.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

MAX ULRICH SCHOOP.

Witnesses:

WILH. REINHARD,
AUGUST RUEGG.

Correction in Letters Patent No. 1,128,059.

It is hereby certified that in Letters Patent No. 1,128,059, granted February 9, 1915, upon the application of Max Ulrich Schoop, of Hönegg, near Zurich, Switzerland, for an improvement in "Methods of Plating or Coating With Metallic Coatings," an error appears in the printed specification requiring correction as follows: Page 3, line 66, for the word "producing" read *projecting*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office

Signed and sealed this 16th day of March, A. D., 1915.

[SEAL.]

J. T. NEWTON,

Acting Commissioner of Patents.