UNITED STATES PATENT OFFICE.

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METHOD OF RENDERING POROUS METALS DENSE.

986,519. Specification of Letters Patent. Patented Mar. 14, 1911.

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To all whom it may concern:

Be it known that I, CHARLES E. SWETT, a citizen of the United States, and resident of Providence, in the county of Providence and State of Rhode Island, have invented new and useful Improvements in Methods of Rendering Porous Metals Dense, of which the following is a specification.

This invention relates to a new art or method of treating a body or mass of porous, spongy or discrete metal to render the same more dense, and consists in applying to such mass a compound of the metal in a fluid state, in such manner that said compound of the metal will enter the porosities of the metal mass being treated, after which said metallic compound is reduced to the metal state in place in the porosities. This filling of the porosities with the metallic compound, and reduction, may be repeated as many times as necessary or desirable according to the degree of density required, and finally results in a solid, dense and homogeneous mass of metal which was originally porous or spongy.

It happens in the course of the manufacture of articles of silver or other metals, especially when certain processes are used, that the metal body, or some part thereof, is porous, and therefore not acceptable as a marketable commodity. For example, suppose an article, or an ornamentation in relief upon an article, be formed in the desired shape out of a plastic or fluid mass consisting wholly or chiefly of a reducible compound of a metal, such as the bromid, chlorid, iodid, fluorid or nitrate of silver, or of copper, or any of the reducible salts of a metal, and the mass or body so formed be then reduced to metal by any appropriate method of reduction, it will be found that the mass in its reduced state will be more or less porous or spongy.

To render such mass or body of porous metal more dense and solid is the chief object of the present invention. This is accomplished by applying to the mass or body of porous metal a compound of like metal in a fluid state, and thereafter reducing the fluid metallic compound to metal in place within the porosities. The porosities of the metal mass will absorb or "imbibe" the metallic compound, which has been rendered fluid by solution in an appropriate solvent or by heat. The reduction of the compound of the metal within the porosities may be effected by any means appropriate to the particular material being used. After one such treatment of filling the porosities and reducing as aforesaid, the object will probably still be somewhat porous, and I therefore recommend repeating the treatment, by filling the residual porosities and reducing, as many times as may be necessary to secure a practically dense metal.

To give a specific illustration of the method hereinbefore generally set forth, suppose a porous body of silver, in the form of a silver ornamentation in relief on a piece of silverware, is to be treated to render the same dense. I apply to such porous body a fluid compound of silver, such as a strong solution of silver nitrate, or melted silver chlorid, by washing or immersing the porous silver body in said fluid compound of silver. The fluid compound is absorbed by and soaks into the porosities, assisted by capillary attraction. I then reduce the compound to metal in place in the pores, by any well known and appropriate method of reduction. If silver nitrate in solution has been used, the reduction may be accomplished by heat. If melted silver chlorid has been used the reduction may be accomplished by electrolytic reduction, or by chemical reduction, in any manner well known to those skilled in the art. Should greater density be required than results from one application and reduction of the fluid compound, the treatment may be repeated until the pores are for all practical purposes filled.

While the foregoing exemplification of the invention is sufficiently characteristic admirably to illustrate the nature and principle of the invention, it will be understood that the invention is by no means limited to the manufacture or ornamentation of silverware, nor to any specific use, but is applicable to the treatment of porous metals generally, to render the same more dense, and such general application is contemplated by the claims.

I claim:

1. The method of treating a mass of porous or spongy metal to render the same more dense, which consists in filling the pores of said mass with a reducible compound of the metal in a fluid state, and thereafter reducing said compound to metal in said pores.

2. The method of treating a mass of po-

rous or spongy metal to render the same more dense, which consists in filling the pores of said mass with a reducible compound of the metal in a fluid state, and thereafter reducing said compound to metal in said pores, and thereafter repeating the filling of the residual pores with a reducible compound of the metal, and reducing the same in the pores, until the mass so treated attains the desired density.

Signed by me at Providence this 6th day of May, 1908.

CHARLES E. SWETT.

Witnesses:

EMMETT GINLEY,

WASHINGTON R. PRESCOTT.