

# UNITED STATES PATENT OFFICE.

WALTER S. ROCKEY AND HILLIARY ELDRIDGE, OF NEW YORK, N. Y.

PROCESS OF EXPELLING GASES FROM METALS.

979,204.

Specification of Letters Patent.

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No Drawing.

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*To all whom it may concern:*

Be it known that we, WALTER S. ROCKEY and HILLIARY ELDRIDGE, citizens of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Processes of Expelling Gases from Metals, of which the following is a full, clear, and exact specification.

Our invention relates to the preparation of metals or their alloys for plating, welding or casting.

It particularly relates to the expulsion of absorbed or occluded gases, from metals or their alloys which gases, as is well known, are the principal cause of the forming of cavities in and the porosity of castings, and welds, and uncovered sections or spots on the surfaces of wares plated by hot processes.

The first step in the preparation of the metals or their alloys for the purposes specified above, is to thoroughly clean the metal or alloy which is to be fused, of all oxid or oxids. This is absolutely necessary, particularly so in the case of copper or an alloy of copper, for copper and its alloys possess the property of absorbing gases very freely when melted and in a liquid state. The reason in this connection for removing the oxid is that after the copper or its alloy is melted under a flux, the oxid is dissolved or mixed with the flux, and is disseminated throughout its mass. Should iron for example be now immersed through the flux and into the molten copper or copper alloy to be plated or welded, the oxygen of the copper oxid immediately combines with the iron, forming iron oxid and releasing atoms of copper, or if an alloy of copper and zinc is used, the copper is freed, iron oxid is formed, while the zinc of the alloy immediately attacks the iron oxid which has been formed, thus forming zinc oxid and freeing iron. Should a steel article be immersed instead of iron, these reactions are increased by the carbon of the steel assisting in the reduction of all the oxids which were present in the beginning, and have been formed afterward, and thereby evolving carbon monoxid gas. These reductions and combinations cause a continuous turmoil and bubbling in the mass and set up a high thermit temperature which always prevents good plating or welding, and it can readily be seen that to carry out the expulsion of gases from copper and its alloys as well as other metals which are

fused for the purpose of producing non-porous thoroughly covered platings or welds, and solid non-porous casting; that the first step to be taken to expel gases from metals would be to prevent the formation of as much gas as possible, so as to prevent any reabsorption of gases by the copper or its alloys or other metals after the contained gases have been expelled. This removal of the oxids can be done in various ways by alkalies or acids, but we preferably remove these oxids or foreign matter by abrasion, or by immersing the metal in a suitable cleaning flux, which we find are the only thorough methods for removing oxid or oxids or foreign matter from metals, as suboxids or other oxids always form again to a lesser degree after alkalies or acids are used.

A suitable non-gas containing flux, or a flux that will not generate gas when the metal to be treated is melted underneath the flux, or when the flux comes in contact with the metal that is immersed through said flux into the molted metal beneath said flux, while being plated or welded, such as the fluxes composed of boron trioxid, the constitutional water from which has been eliminated, which is melted in a suitable crucible, or other suitable melting device or receptacle; the metal or alloy which has been cleansed is then placed in the crucible, and sinks rapidly beneath the surface of the melted flux; the temperature is then regulated to just above the melting point of the metal or alloy; this temperature is maintained until the metal or alloy is thoroughly melted and liquid, the temperature is then lowered until the metal or alloy sets or becomes solid again; while the flux at this temperature remains liquid, and the metal on regaining its solid state, evolves its contained gases by molecular compression; these gases pass out of the metal or alloy and bubble upward through and out of the liquid flux. This operation should be repeated until all gases are eliminated which is denoted by the cessation of all bubbles in the flux. After the expulsion of these gases, the temperature is again raised to just above the melting point of the metal, or alloy and maintained until it is again fused and liquid. It is then ready for casting or may be used for plating other metals, and will be found to be non-porous and free of gases, for on account of being covered with and melted under this flux, it could not ab-



sorb any more gas after evolving its contained gases, it being a well known fact that the metals absorb gases in their melted state and evolve them when cooling to a solid state, therefore if melted under a protecting covering of non-gaseous flux that contains no gases, and then cooled until solid enough to evolve its contained gases, it would not be possible for the metal or alloy to absorb any more gases on account of said protection of said non-gaseous flux.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. The process of making copper or its alloys free of gases consisting in first heating a suitable flux containing boron trioxid to a molten state, then heating the metal being treated above its melting point beneath the said flux and then cooling said metal to a predetermined degree to cause the gases contained therein to be expelled therefrom into said flux.

2. The process of making metals or metal alloys free of gases consisting in repeatedly heating the metal above its melting point beneath the surface of a suitable flux and then cooling said metal to a predetermined degree to cause the gases contained therein to be expelled therefrom into said flux.

3. The process of making metals or metal alloys free of gases consisting in repeatedly heating the metal above its melting point beneath the surface of a suitable flux, and then cooling said metal to approximately its melting point to cause the gases contained therein to be expelled therefrom into and through said flux.

4. The process of making metals or metal alloys free of gases consisting in repeatedly heating the metal above its melting point beneath the surface of a suitable flux, and then cooling said metal to a solid condition to cause the gases contained therein to be expelled therefrom into and through said flux.

5. The process of making metals or metal

alloys free of gases consisting in first removing the oxids or foreign matter from the metal and then fusing the metal beneath the surface of a suitable flux, then cooling said metal to a predetermined degree, to cause the gases held therein to be expelled from said metal into and through said flux.

6. The process of first removing the oxids or foreign matter from copper or copper alloy, then fusing said metal and protecting the same beneath the surface of a flux of boron trioxid, and then solidifying the metal beneath the surface of said flux to cause the gases contained therein to be expelled therefrom into said flux.

7. The process of making copper or its alloys free of gas consisting in repeatedly heating the metal above its melting point beneath the surface of a flux of boron trioxid, and then cooling said metal to a predetermined degree to cause the gases contained therein to be expelled therefrom into said flux.

8. The process of making copper or its alloys free of gases consisting in repeatedly heating the metal above its melting point beneath a flux of boron trioxid, and then cooling said metal to approximately its melting point to cause the gases contained therein to be expelled therefrom into and through said flux.

9. The process of making copper or its alloys free of gases consisting in repeatedly heating the metal above its melting point beneath a flux of boron trioxid, and then cooling said metal to a solid condition to cause the gases contained therein to be expelled therefrom into and through said flux.

In testimony whereof, we affix our signatures, in presence of two witnesses, March 18th, 1910.

WALTER S. ROCKEY.  
HILLARY ELDRIDGE.

Witnesses:

G. SPINK,  
CATHERINE CAPUANO.