

# UNITED STATES PATENT OFFICE.

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## PROCESS FOR MAKING COMPOUND METALLIC ARTICLES.

1,171,856.

Specification of Letters Patent.

Patented Feb. 15, 1916.

No Drawing.

Application filed April 9, 1913. Serial No. 759,931.

*To all whom it may concern:*

Be it known that I, IRVING LANGMUIR, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in a Process for Making Compound Metallic Articles, of which the following is a specification.

The present invention comprises as a new manufacture metallic articles, such as plates, wire and the like, consisting partly of a metal of the iron group, particularly steel and an integrally joined coating of a malleable alloy of copper and aluminum. These articles combine the mechanical strength of iron or steel with the non-corrodibility, and attractive appearance of the alloy.

Because of the surface film of oxid forming on both the metal to be coated and the coating metal they cannot be integrally joined or welded by simply heating them in contact with each other, or even rolling, or hammering them in contact with each other. My invention includes a process whereby an intimate metallic union is secured.

As will be pointed out in the appended claims my invention includes a process, whereby the aluminum bronze is brought into contact with the iron or other metal to be coated in a reducing environment in the presence of a flux, such as cryolite, in which aluminum oxid is soluble.

In carrying my invention into effect the sheet, billet or coil of metal to be coated is placed in a mold of inert material such as graphite. The cryolite is then placed in a powdered state upon the metal to be coated or at the bottom of the mold and the strips or granules of bronze containing about 92 parts copper and 8 parts aluminum are placed around the metal to be coated. The mold containing the metals thus assembled is then heated in carbon monoxid or hydrogen to a temperature of 1000 to 1050° C. to melt the bronze which under these conditions spreads over the surface of the metal to be coated and forms intimate metallic union. Carbon monoxid in one respect is to be preferred as the presence of a little oxygen does not act as it does in the case of hydrogen to decompose the cryolite. The heating may also take place in a vacuum furnace of the type described in U. S. Patent No. 785,535. The residual atmosphere of carbon monoxid in the furnace is sufficient

to reduce the film on the surface of the iron, or other metal to be coated and also to promote the required mobility of the copper alloy to cause it to completely wet the surface of the iron. When the granules of the copper aluminum alloy are thus melted upon a sheet of iron or steel which has been previously wet by the cryolite flux, the alloy immediately spreads out in a uniform layer which upon cooling appears to be intimately welded or united to the iron or steel. When the cryolite flux is not present the alloy gathers in globules on the surface of the iron and upon cooling is found not to adhere.

The articles to be coated and cryolite flux may also be placed in a mold, and the aluminum bronze cast about them, preferably while the mold is preheated. The articles to be coated may also be dipped into the molten alloy in a reducing atmosphere, the cryolite flux in this case being maintained on the surface of the alloy in a molten state, so that the article dipped first passes through the flux. The composite metal bodies thus produced may then be further reduced in section as by rolling, swaging, drawing and the like without changing the relative proportion of cross-section of the respective metals and without disturbing the adherence of the alloy. It is to be understood that metals other than iron, such as nickel, manganese, or ferro-alloys may be similarly plated.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. The process of coating a metal of the iron group with an alloy of copper and aluminum which consists in bringing said alloy in contact with the metal to be coated in a reducing environment and in the presence of a cryolite flux, at a temperature sufficient to melt said alloy but not substantially higher.

2. The process of integrally joining iron and an alloy of copper and aluminum which consists in bringing said alloy into contact with the iron in the presence of hydrogen and molten flux having a solvent action on oxid of aluminum, at a temperature not substantially higher than necessary to secure fluidity of said alloy.

3. The process which consists in bringing an alloy of copper and aluminum into contact with steel in the presence of a reducing

gas and a cryolite flux, at a temperature not substantially in excess of the melting point of said alloy, thereby effecting a homogeneous metallic union with said alloy and  
5 the steel and then reducing the section of the resulting compound article by mechanical working.

In witness whereof, I have hereunto set my hand this 7th day of April, 1913.

IRVING LANGMUIR.

Witnesses:

BENJAMIN B. HULL,  
HELEN ORFORD.