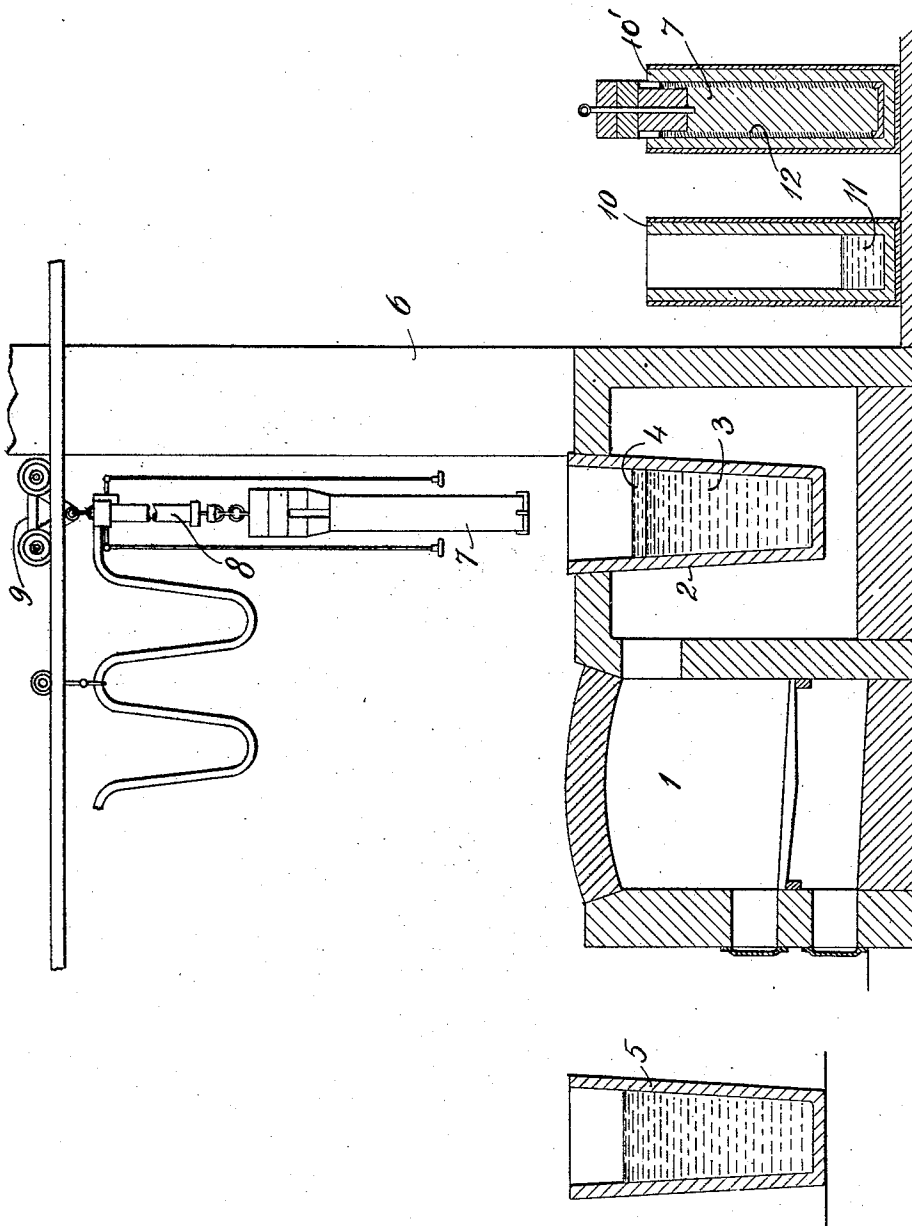


J. F. MONNOT.  
METHOD OF MAKING CLAD METALS.  
APPLICATION FILED APR. 2, 1910.

1,114,792.

Patented Oct. 27, 1914.



Witnesses:  
Max B. A. Doring  
Paul H. Frank

Inventor  
John F. Monnot  
By the Attorneys  
Marble & Bailey

# UNITED STATES PATENT OFFICE.

JOHN F. MONNOT, OF PARIS, FRANCE, ASSIGNOR TO DUPLEX METALS COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

## METHOD OF MAKING CLAD METALS.

1,114,792.

Specification of Letters Patent.

Patented Oct. 27, 1914.

Original application filed October 6, 1905, Serial No. 281,680. Divided and this application filed April 2, 1910. Serial No. 553,048.

*To all whom it may concern:*

Be it known that I, JOHN F. MONNOT, a citizen of the United States, residing at Paris, France, have invented certain Methods of Making Clad Metals, of which the following is a specification.

This invention relates to methods of making clad metals; and it comprises a process of producing clad metal wherein an iron or steel object is preliminarily cleaned, is then coated with an alkali solution to preserve a true metallic surface, is coated with a layer of melted metal and is then provided with a substantial coating of another metal through the intermediacy of the first named metallic coat; all as more fully hereinafter set forth and as claimed.

For many purposes in the art it is desirable to provide compound metal objects having a base of core of iron, steel or other ferrous metal firmly, permanently and metallurgically coated by a layer or coating of one of the high melting metals of the copper class or a metal comprising a metal of the copper class, such as brass, bronze and the like. Until recently, however, it has not been possible to produce coated metals of this nature in which the two metals are united by what is, or is equivalent to, a weld union; but such compound metals may be made by the process described and claimed in my application Sr. No. 281,680, filed Oct. 6, 1905 (Patent No. 971,136, Sept. 27, 1910) of which the present application is a division and in my Patent No. 853,716. The invention forming the basis of said patent and said prior application, is based upon the fact that while copper and like metals at the ordinary casting temperature display hardly any tendency to unite with metals of the iron class, such as iron, steel and alloy steels, yet by raising the temperature of the molten metal somewhat a tendency to unite appears. By contact of the iron or steel with superheated molten copper or supermolten copper the fluid metal readily wets the iron or steel and unites therewith to form a firm, permanent and indissoluble union. The iron or steel may, for instance, be dipped into supermolten copper under conditions precluding oxidation, such as the employment of a coating layer of flux, and then withdrawn, also under circumstances precluding oxidation, when it will be found covered with a firmly

united clinging film of copper or copper iron alloy. Against this film coating may be cast a substantial body of copper or other metal at a more convenient temperature to produce weld-clad metal. Copper clad steel so produced may be rolled, drawn, and otherwise worked like an integral body of either metal to any degree desired. The union so produced between the copper and steel is indissoluble by the action of cleaving tools, such as a cold chisel, heating and quenching, etc. In the said prior application Sr. No. 281,680, I have described sundry specific methods of performing the described process. In so securing a union between the two metals, it is necessary that they be presented to each other with clean metallic surfaces, a matter of some difficulty in practice. In the present invention, the iron or steel billet is best given a true metallic surface by sandblasting or pickling or both. The billet may, for instance, be first treated with a powerful sandblast which penetrates all of the small cavities containing oxid, etc., cleaning the same out thoroughly, taking off all scale, oxid, etc., and leaving a clean surface of the actual metal.

After sandblasting, the surface is absolutely metallic and is very sensitive to the action of corrosive influences. It may next be pickled to remove any trace of oxid formed during handling and treating, and then washed with hot water. In pickling, any of the usual acids may be employed. After the washing, it is next dipped into a neutralizing bath of an alkaline substance, such as a solution of potash, soda, borax, waterglass, etc. This neutralizing bath not only serves to remove any trace of acid which may have been left after the pickling process, but also has the further important function of protecting the true metallic surface. As is well known, solutions of alkaline materials exercise a specific protecting action upon bright iron and steel. Instead of dipping into the alkaline solution the billet after the pickling and washing operation or at any other suitable stage, may be painted with a suitable protecting coating such as a fusible indifferent paint, such as a mixture of waterglass and powdered aluminum. Waterglass is an alkaline substance exercising the usual alkaline protective action upon bright iron. Such a

paint applies both a coating of an alkaline substance and a coating of metal of useful properties in this relation. After receiving this alkaline dip or paint the billet will not  
 5 rust or oxidize under ordinary circumstances. The evaporation of the water in the film remaining on the surface of the billet after the removal of the billet from the neutralizing bath in dipping, leaves a crust of alkaline material behind on the billet which  
 10 acts as a protective coating substance. After this alkaline coating the billet may be handled freely without fear.

After producing the protected clean surface on the iron or steel object it is next to  
 15 be coated with a layer of melted coating metal of somewhat lower melting point. The coating metal should be lower melting so that the iron or steel body may be employed as a solid body; but as a matter of  
 20 fact, all the coating metals which are employed in the present invention, such as copper, silver, gold, brass and the cupriferos metals generally, although high melting,  
 25 have a melting point considerably below iron or steel. Instead of forming the superficial coating as above described, I may deposit a layer of the coating metal upon the surface of the core or base by electrical deposition,  
 30 precipitation, or any other convenient method, and may then heat the core so coated, under conditions such that oxidation is prevented, as for example in a neutral atmosphere, until the thin coating is  
 35 melted to the extremely thin liquid or super-molten condition and so is caused to enter into combination with the core or base. In the embodiment of the invention the coating process is performed in two stages.  
 40 The billet after having been cleaned and protected as described is film coated with a layer of copper by dipping it into a bath of molten copper. This molten copper should be at a temperature above its melting point,  
 45 and in a supermolten condition. As the billet passes downward beneath the surface of the fluid copper, the crust of alkaline material adhering to its surface, melts and forms a fluid molten layer above the copper. There  
 50 may be a layer of molten flux, preferably an alkaline flux, on top of the molten copper before the introduction of the alkali-coated billet therein. The billet should be maintained in contact with the molten copper  
 55 until the desired type of union is effected, something which generally requires but a few seconds. The temperature of the copper and the time of immersion can be regulated by observing the time and temperature  
 60 it will take to give a coating on the steel which after cooling cannot be stripped off with a cold chisel. As the billet carrying the film coating of copper passes upward through a layer of molten alkaline material  
 65 resting upon the copper, it picks up the ad-

hering coating of such material, which aids in preventing oxidation. Other auxiliary protecting means may be employed. Against this film coated surface may next  
 70 be cast a further body of copper or other coating metal, such as silver, gold, brass, bronze, etc., to produce a coating of substantial thickness. This second metal may be at a more convenient casting temperature since it will unite readily with the copper of the  
 75 filmed surface.

In the accompanying illustration I have shown more or less diagrammatically and in central vertical section, one form of apparatus for carrying out the described process.  
 80

In the drawing 1 designates a heating furnace, and 2 a crucible or similar vessel within said furnace and containing a deep body of molten coating metal 3, covered by  
 85 a protective coating of the flux 4.

5 designates the vessel containing an alkaline solution such as mentioned, in which the article to be coated is dipped before it is placed in the molten coating metal.  
 90

6 designates a stack for carrying away the waste gases from the furnace.

7 is a billet of iron or steel to be coated, carried by hoisting apparatus 8 and adapted to be moved from place to place by conveyer  
 95 means 9.

10 is a mold shown as containing a layer of molten flux 11.

In carrying out the process with the above described apparatus, the billet to be coated,  
 100 after its surface has been sand blasted or otherwise cleaned, and washed, is placed in the alkaline cleansing and neutralizing bath 5 and after cleansing is removed from such bath, and, after the drying upon its surface  
 105 of the film of alkaline solution remaining thereon, so that the alkaline coating above referred to has been formed on the surface of said billet, the billet is immersed through the flux 4 into the molten coating metal 3  
 110 beneath, and is allowed to remain in such molten metal until the desired union has taken place between the molten metal and the surface of the billet; the billet is then withdrawn, being now covered with a thin  
 115 film formed by the action of the molten metal upon its surface, and as said billet passes upward through the layer of the flux a film of such flux adheres to its surface, forming a protective coating by which the  
 120 delicate, newly formed metallic film coating is protected. This flux-coated filmed billet is now transported to the mold 10 and lowered therein, displacing the flux. Molten metal to form the final coating may then be  
 125 poured into the mold, or such molten metal may already be within the mold beneath the molten flux therein, in which case when the billet is immersed it displaces the flux and the molten metal, causing the latter to fill  
 130

the mold. This molten metal, which is of such a nature as to unite readily to the film coating formed on the billet, (this molten metal, within, or cast into, the mold 10 may be copper, brass, bronze, etc.,) then unites with the film coating as it solidifies. As the molten metal in the mold so contacts with the surface of the billet, it displaces the layer of flux on such surface, so that a clean surface of film-coating is exposed to contact with the molten metal. 10' designates another mold in which a billet has already been placed and surrounded by coating metal—the latter designated by numeral 12.

15 After the billet has been coated in the manner described, it may be rolled, drawn or otherwise reshaped as desired. This method is also applicable to the coating of bars as well as billets. The particular shape of the metal of the base is not material. The body of the coating metal may be copper, brass, bronze, aluminum or other metal or alloy.

What I claim is:—

25 1. The hereindescribed process of plating iron, steel and other metal with any desired metal or alloy, which consists in first cleaning the metal to be coated, coating with a covering of suitable alkali solution, coating 30 the same with a metal or alloy of a lower

fusing point, and then applying in molten form a metal that will unite with the last named metal.

2. The hereindescribed process of plating iron, steel and other metal with any desired metal or alloy, which consists in first cleaning the metal to be coated, coating with a suitable solution of alkali and coating the same with a metal or alloy of lower fusing point, applying a second metallic coating, and then applying in molten form, a metal that will unite with the last named metal.

3. The hereindescribed process of plating iron, steel and other metal with any desired metal or alloy, which consists in first cleaning the metal to be coated, coating with a covering of suitable alkali solution, coating the same with a metal or alloy of a lower fusing point by contacting the same with said lower fusing metal in a highly heated molten condition, and then applying in molten form a metal that will unite with the last named metal.

In testimony whereof I affix my signature in the presence of two witnesses.

JOHN F. MONNOT.

Witnesses:

JACK H. BAKER,  
HANSON C. COXE.