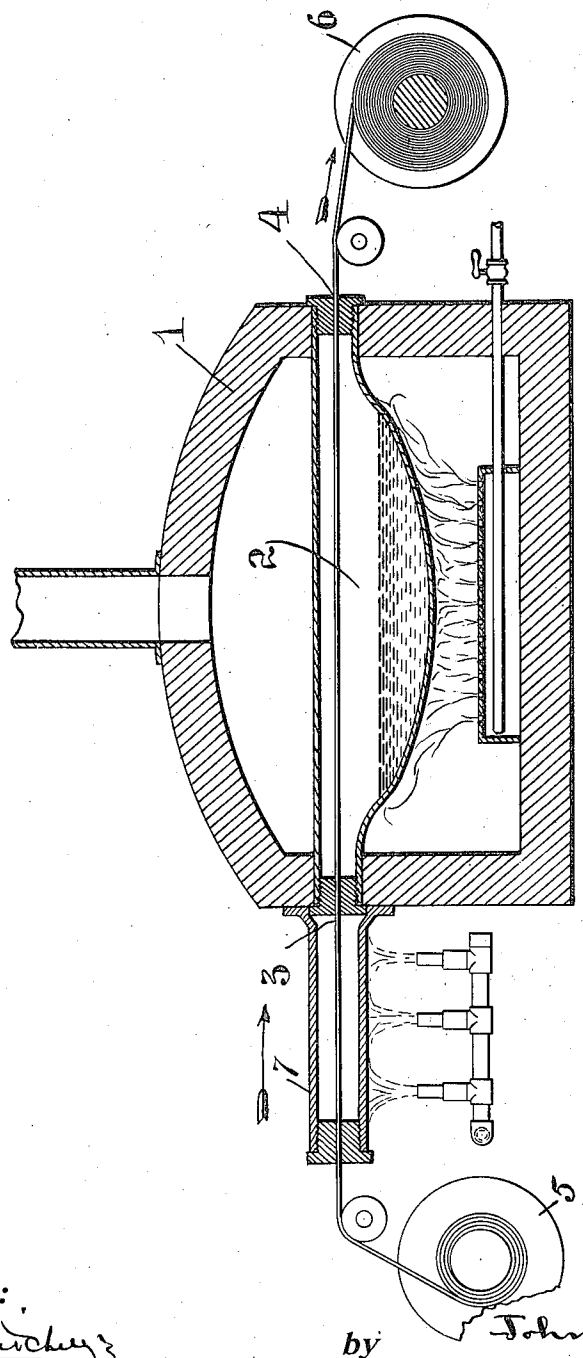
J. F. MONNOT.

ALLOY SURFACED METAL.

APPLICATION FILED JUNE 15, 1908.

1,156,169. Patented Oct. 12, 1915.




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# UNITED STATES PATENT OFFICE.

JOHN F. MONNOT, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO DUPLEX METALLIC COMPANY, A CORPORATION OF PENNSYLVANIA.

## ALLOY-SURFACED METAL.

1,156,169. Specification of Letters Patent. Patented Oct. 12, 1915.

Application filed June 15, 1908. Serial No. 438,680.

*To all whom it may concern:*

Be it known that I, JOHN F. MONNOT, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Alloy-Surfaced Metals; and I do hereby declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to alloy-surfaced metals; and it comprises an extended metal article comprising a ferrous metal base having a cohering, welded-on and coextended filmiform coating of an unlike pure metal, said coating being superficially alloyed with a third metal; all as more fully hereinafter set forth and as claimed.

In certain prior patents (Nos. 853,716, 893,932, etc.,) I have described and claimed processes of making compound metals, and particularly copper clad steel, in which a steel billet is provided with a welded on coating of copper or like high-melting metal and the billet is thereafter worked down, as by rolling and drawing, to wire or the like. The method of Patent No. 853,716 involves the use of high temperatures in producing the coating and while it may be used for making brass or bronze coated metal, brass and bronze do not well stand high temperatures without the use of some expedient. In these prior patents I have described an alternative method of making brass and bronze coated steel, in which the steel is first provided with a welded on film of copper against which brass or bronze is thereafter cast to produce a compound billet. Such compound billet may thereafter be worked down. In practice however it is often desirable to make compound articles having a steel base and a very thin film-like coating of brass or bronze; merely enough to give a tenuous superficial coating. But brass or bronze in many of their commercial forms do not extend well with steel at temperatures which are best adapted for steel work to an indefinite extent.

In the present invention, in lieu of giving a large billet a coating of brass or bronze and then drawing or otherwise extending to form a very thin-coated article, a large billet is given an initial coating of copper or other pure, indefinitely extensible metal welded thereto and the joined metals are then coextended to, or nearly to, the final dimensions desired. The welded-on thin coating of pure metal is then alloyed by a superficial treatment with an alloying metal. Further extension can then, and advantageously, be resorted to. The final product is a compound metal article comprising a core or layer of ferrous metal having welded thereto a compacted layer of a non-ferrous metal which is superficially converted into the desired alloy. The coextension in the described manner may be carried sufficiently far to produce the finished article which is to have the alloy surface, or, and preferably, the coextension may be discontinued at a point somewhat short of this, the alloying produced and then extension resumed to form the finished article. This allows an extension pass to be given after alloying, thereby compacting the alloyed coating in the manner described. The alloying opens up the metal and renders its surface more or less porous, and the extension pass is useful in closing this porosity.

After extending the ferrous metal carrying the welded-on pure metal coating to the desired extent, the coating is next alloyed with the desired alloying metal. This may be done in a number of ways. The alloying metal may be applied as a galvanic coating or a dipped coating, being, for instance, electroplated with zinc or tin, or dipped in melted tin or zinc. After applying the alloying metal, the whole mass may be heated to cause the alloying metal to sink into the surface of the coating and form an alloy therewith. Another and simple method is to expose the coextended joined metals to the vapors of the alloying metal, such as zinc or tin. These vapors will penetrate the coating metal and change it to the alloy desired for any desired degree of depth.

While, as stated, the finished article such as sheets, wires, rods and forms made therefrom by drawing, rolling, stamping, twisting, spinning and the like, can be given the desired finished form prior to alloying their surface, it is in general better, as stated, to carry the extension to a point somewhat short of forming the desired finished shape prior to alloying and resume extension thereafter. For instance in producing brassed articles, a copper-clad steel billet may be rolled down to sheets a gage or so thicker

than that finally desired, the surface brassed, the brassed sheet rolled down to its final gage and the desired articles made by stamping, spinning, etc.

In the present invention it is intended in many cases, as for example in the making of metal for paper fasteners, to carry the extension very far, producing mere filmiform coatings of copper upon the steel, such coatings being then alloyed.

If the finished form is to be produced prior to alloying, when the plate or wire has reached the desired ultimate gage, it is shaped or stamped into the desired forms. In stamping or cutting, the cutting edges of the tool employed may be of rounded or "obtunding" shape rather than have the usual V-shaped cutting edge, so as to sever the clad metal by a sort of comparatively slow pinching action rather than by a sharp cut, and thereby flow the softer copper over the exposed edge of the cut steel. If wire fasteners are to be produced, the clad metal billet is rolled or drawn to wire of the proper thinness, the wire may be cut in proper lengths by obtunding rather than true cutting tools, and these lengths bent into the desired form by suitable tools.

One of the advantages of this manner of operation where a partly extended sheet or wire is given the alloying treatment prior to final extension, is that the treatment may be made continuous, and, where the alloying is done by vaporous metal, the sheet or wire may be continuously passed into, through and out of a vapor chamber, the rate of passage being regulated so as to produce in the emerging metal the particular appearance desired.

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

In said drawing, 1 designates a suitable furnace and 2 a vapor chamber therein adapted to be heated by the heat of the furnace, said chamber adapted to contain molten zinc in its lower portion and having apertures 3 and 4 for the entry and exit, respectively, of the copper coated or other clad material to be treated. This material may be drawn from a reel 5 and wound upon another reel 6, being passed through the chamber 2 at such speed that every portion of the surface of the material is sufficiently impregnated by the vapors of molten zinc which fill said chamber. The effect of this impregnation is to convert the surface of the material into an alloy of zinc and of the coating metal of such material; that is to say, if such coating is copper, as assumed in the particular example described, such impregnation has the effect of converting the copper coating superficially at least, into brass. It is obvious that various other apparatus may be used for the same purpose and I do not limit myself to any particular apparatus.

It is in fact immaterial, in a broad sense, by what particular method the coating of copper or other metal on the ferrous base is produced, except that such coating shall be produced in such manner that coating and base are inseparably united.

Aluminum may be used in lieu of tin or zinc for giving a brass-like appearance to coppered steel surfaces produced in the manner described, but alumina not being reducible by carbon, the comminuted metal should be used, a mixture of oxid and charcoal not being suitable, as in the case of zinc or tin. And the temperature in the crucible must be much higher than with zinc or tin.

The paper fasteners stated are of course merely exemplificatory, since a myriad other complete articles may be made in the same manner, such articles ranging from the rods or tubing for bedsteads to lock parts, brass wire for general purposes, etc.

The initial coating of copper having been put on the ferrous metal in the molten state and having solidified from the molten state shares the property of liquids and set liquids of being poreless and in the co-extended article it is further compacted, so that the coating of such a clad metal article is absolutely impervious to liquids and gases, completely protecting the relatively corrodible metal beneath from rusting and corrosion, however thin it may be drawn in the co-extension. No pores are formed in the brassing or bronzing, so that the same is true of the brassed or bronzed complete article. In this respect therefore, such complete article possesses great advantages over the ordinary electroplated articles in which the coating is invariably porous and acts rather to facilitate corrosion of the underlying steel, by forming a galvanic couple therewith, than to prevent it.

By impregnating prior to the final pass, such final pass compacts and improves the alloy surface given in the impregnation.

It is of course necessary that the surface of the coated wire or other article treated shall be heated somewhat before the vapors of zinc or other metal can combine with the coating and produce the desired alloy instead of merely condensing thereon to form a superficial skin. To this end the furnace may be so designed that the wire or other material passing through it will be heated to the desired degree before it encounters any material portion of the metallic vapors, or the wire may be passed through the furnace at such rate that vapors which at first condense upon it are driven off, or the wire or the like may be heated externally. In

the apparatus shown I have shown the wire passing through a heating chamber 7 by which the wire is heated, before contact with the metallic vapors, to the desired degree.

What I claim is:—

1. As a new article of manufacture, a shaped article composed of a ferrous metal base having a filmiform, cohering welded-on, compacted and coextended coating of a non-ferrous metal, said coating being superficially alloyed with a third alloy-forming metal.

2. As a new article of manufacture, a shaped article composed of a ferrous metal base having a filmiform, cohering welded-on, compacted and coextended coating of copper, said coating being superficially alloyed with a third alloy-forming metal.

3. As a new article of manufacture, a shaped article composed of a ferrous metal base having a filmiform, cohering welded-on, compacted and coextended coating of copper, said coating being superficially alloyed with zinc.

4. As a new article of manufacture, a shaped article composed of a steel core having a filmiform, cohering, welded-on, compacted coating of a non-ferrous ductile metal of high melting point, said coating being impregnated and alloyed with a third alloy-forming metal.

5. As a new article of manufacture, a shaped article composed of a steel core having a filmiform, cohering, welded-on, compacted coating of copper, said coating being impregnated and alloyed with a third alloy-forming metal.

6. As a new article of manufacture, a shaped article composed of a steel core having a filmiform, cohering, welded-on, compacted coating of copper, said coating being impregnated and alloyed with zinc.

7. As a new article of manufacture, a compound metal article composed of a ferrous metal base having the major portion of its superficial area covered by a welded-on, cohering, filmiform, impervious and continuous coating of an unlike, non-ferrous, high melting ductile metal and the residue of its superficial area covered by metal drawn from said coating thereover; said coating metal being impregnated and alloyed with a third alloy-forming metal.

8. As a new article of manufacture, a compound metal article composed of a ferrous metal base having the major portion of its superficial area covered by a welded-on, cohering, filmiform, impervious and continuous coating of copper and the residue of its superficial area covered by metal drawn from said coating thereover; said coating metal being impregnated and alloyed with a third alloy-forming metal.

9. As a new article of manufacture, a compound metal article composed of a ferrous metal base having the major portion of its superficial area covered by a welded-on, cohering, filmiform, impervious and continuous coating of copper and the residue of its superficial area covered by metal drawn from said coating thereover; said copper being impregnated and alloyed with a third alloy forming metal.

10. As a new article of manufacture, a compound metal article composed of a ferrous metal base having the major portion of its superficial area covered by a welded-on, cohering, filmiform, impervious and continuous coating of copper and the residue of its superficial area covered by metal drawn from said coating thereover; said copper being impregnated and alloyed with zinc.

11. As a new article of manufacture a base of ferrous metal having a cohering welded-on layer of copper, said copper being superficially impregnated with zinc to form brass.

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

JOHN F. MONNOT.

Witnesses:

K. P. McELROY,

FRANK E. RAFFMAN.