UNITED STATES PATENT OFFICE.

PETER DE VILLIERS, OF ST. LEONARD-ON-SEA, ENGLAND.

PROCESS OF APPLYING ALLOYS TO STEEL.

SPECIFICATION forming part of Letters Patent No. 265,221, dated September 26, 1882.

Application filed September 3, 1881. Renewed September 1, 1882. (No specimens.) Patented in England August 20, 1880, No. 3,394; in Canada April 13, 1881, No. 12,620; in Belgium April 15, 1881, No. 54,221; in Italy April 16, 1881, and in France April 19, 1881, No. 141,254.

To all whom it may concern:

Be it known that I, PETER DE VILLIERS, of St. Leonard-on-Sea, England, doctor of medicine, have invented a new and useful improved process for applying alloys to steel or other metal with or without a silver or other coating or covering, (for which I have obtained a patent in Great Britain, No. 3,394, bearing date 20th August, 1880; in France, bearing date 19th April, 1881, No. 141,254; in Belgium, bearing date 15th April, 1881, No. 54,221; in Italy, bearing date 16th April, 1881, and also in Canada, bearing date 13th April, 1881, No. 12,620,) of which the following is a specification.

My invention relates to a process for applying an inoxidizable alloy to steel, iron, or other metal or alloy, which may be afterward coated or covered with silver or other metal, or left without such a coating or covering, as may be desired.

The said invention is chiefly designed for applying to knives and other articles the inoxidizable alloy forming the subject-matter of Letters Patent granted to me since the filing of the present application, and bearing date November 29, 1881, No. 250,326. In the specification of the said former patent I have stated that when tin is suitably combined with lead and silver in the proportions therein specified an alloy is produced which will not only strongly adhere to iron and steel, but will impregnate these metals when they have been properly prepared to receive the alloy, and I have given the proportions in which these metals should be mixed in such alloy.

In practicing my present invention I proceed as follows—that is to say: The tin is first melted, and when a brilliant whiteness of the surface of this metal indicates its thorough fusion the lead is added in a granular state, and the mixture is slowly stirred, preferably with a rod of very dry fir-wood. The silver, separately melted, is then added to and mixed in like manner with the compound. At this moment the fire under the melting-pot or crucible containing the alloy must be quickly increased till the surface of the metal has a slight yellow tinge. It is then rapidly stirred and run into molds to form ingots.

When I have the choice between iron or steel for the manufacture of any article to be treated with my improved alloy I take the purest steel used for manufacturing purposes. One very important use of my invention is its application to table-cutlery. For this purpose I proceed as follows: The blade is immersed in a bath of a solution of muriatic or sulphuric acid in the following proportions, by weight, viz: one hundred (100) parts of distilled water or filtered rain-water, and from one (1) to ten (10) parts, by weight, of muriatic acid or of sulphuric acid. The blade must remain in this bath for a longer or shorter time, according to its thickness, in order that it may be slowly and thoroughly penetrated by the same, this result being indicated by the appearance of spots on the surface of the metal. Instead of the acid solution, I may use aqua-fortis, the time of immersion in this case being very short. When the blade is withdrawn from the bath it must immediately be plunged into pure water, to be quickly and completely washed, and then it is wiped and dried as rapidly as possible with a piece of old linen, soft leather, or a very dry sponge. It is then subjected for about five minutes to a dry heat in a furnace or oven heated to 70° or 80° centigrade. It is then withdrawn and again wiped.

The preceding operations have for their object the preparation of the iron or steel for impregnation with the alloy, the result being that the said iron or steel is roughened or provided with a rugged surface, as though filled with a large number of small cavities, the structure of the surface being as though the pores of the metal were enlarged or distended. In iron, unless this metal is of excellent quality, the roughened or rugged surface or the size of the pores is variable, and sometimes there are defective parts, which make the subsequent operations difficult. In steel the roughened or rugged surface is substantially uniform, and the subsequent operations are effected with but little difficulty, and for this reason I prefer to employ steel in carrying out my invention.

The knife-blade or other article, after its preparation as above described, is immersed in a metallic bath composed of the alloy made according to one or the other of the formulas

given in the said former specification. The ingots are melted over a moderate fire in a crucible or pot formed of plumbago or refractory clay, and not in an iron vessel, as particles of the iron would mix with the alloy and render the same liable to oxidize in the open air, thus impairing the appearance of the impregnated knife-blade or other article. The iron or steel, previous to immersion in the metallic bath or alloy, must be heated to a temperature of 50° or 60° centigrade. The bath must be perfectly liquid, and is stirred with a dry rod of fir-wood or poplar, and the surface of the molten alloy must present a fine silver-white color, which is obtained by slow fusion and by stirring only when the whole of the mass is liquefied. If these precautions are observed, the alloy will fill the before-mentioned distended pores or the roughened or rugged surface of the metal in an effective manner, and provide an efficient union between the metal and the alloy coating. The length of time that the metal to be coated is subjected to the acid solution or bath will depend upon the dimensions of the article being treated. For example, the metal used for making an ordinary knife-blade or similar thin object will be subjected to the acid solution or bath for about five minutes, while a piece of steel, say, one-eighth of an inch thick will be subjected to the acid solution or bath for about ten minutes. When withdrawn from the metallic bath the blade or other article of iron or steel is at once immersed in cold water, or is otherwise properly treated to harden or temper it or to restore its temper, as required. If left in the cold water for too long a time, the metal sometimes becomes brittle; but carefulness on the part of the operator will prevent any difficulty of this kind. The blade or other article, having been wiped and dried without the application of heat, is polished in any suitable manner. It will then have the whiteness and luster of silver, and will have a ring or sound analogous to that of the latter metal, and may be considered inoxidizable under ordinary atmospheric conditions; but by the further treatment hereinafter described these articles can be rendered thoroughly proof against oxidation or corrosion by ordinary acids—such as vinegar, lemon, or other fruit acids or pickles—so that when used in contact with the same, or with fish, fatty matters, or culinary preparations of any kind, or with potable liquids or the like, they will not impart flavor nor taste thereto, nor will the taste or smell of any of these substances adhere to such articles. To attain these results, I take the blades or other articles that have been prepared and subjected to the alloy, as above described, and rub the same gently with an amalgam which I compound as follows, viz: mercury, sixty (60) parts; tin, thirty-nine (39) parts; silver, one (1) part—one hundred (100) parts, by weight. I make this amalgam as follows—that is to say, I first melt the tin, and when the same is rendered properly liquid pulverized silver is thrown upon its surface and melts somewhat rapidly. The whole is then stirred by means of a very dry rod of fir-wood, and the mercury is added gradually with continual stirring. The mixture is then allowed to cool in an earthenware vessel. It is then reheated over a moderate fire without stirring. This operation of reheating is repeated three or four times. The amalgam is then ready, and has to be kept in a close vessel and protected from light. The polished articles must be lightly rubbed with this amalgam by means of a soft cotton cloth or other suitable material previously impregnated with a solution containing one (1) part of nitrate of potassa (saltpeter) in one hundred (100) parts of filtered water, by weight. This cloth is to be used only when thoroughly dry, and rendered supple by rubbing it between the hands. When once permeated by the amalgam it will serve for an indefinite time.

The above-described successive operations result in the incorporation or union with the iron or steel, first, of the metals of the alloy, and then of the amalgam. The following proceedings complete and render practically perfect the series of combinations whereby an article or object to which my invention is applied has the various metals thereof as intimately and inseparably united as in any true alloy. The articles of iron or steel prepared up to this point—that is to say, by the application of the amalgam—are finished by electro-deposition or otherwise, with a coating or covering of silver, which is combined or incorporated by the aid of the amalgam with the substance of the article itself and the alloy with which the same is impregnated, and thereby my invention differs from the processes hitherto known, which only cause a simple superposition of the silver or other coating metal upon the surface of the metal covered thereby.

If the final coating or covering of the knife-blade or other article is to be of gold, I prefer to apply this metal by electro deposition upon the surface of the silver.

In cases where it is desirable to economize the process above described I make an alloy of tin and lead without the silver, in the proportion of about ninety (90) parts of tin and ten (10) parts of lead, and immerse in it the iron or steel in the manner above described, and then apply the amalgam and the silver coating or covering; but I do not think the result in this case will be so satisfactory as when the alloy used consists of silver, lead, and tin in the proportions set forth in the said specification. Furthermore, as I am aware that many persons strongly object to the use of any articles in whose manufacture the slightest particle of mercury has been used, I may modify my invention by substituting for the application of the amalgam the following treatment—that is to say, I immerse the articles after they have been impregnated with the aforesaid alloy in a bath composed of cyanide of potassium, six (6) parts; bisulphide of soda, two (2) parts; and carbonate of soda, eight (8) parts,

by weight, dissolved in water, preferably rain-water, to which I add protochloride of zinc, two (2) parts, and acetate of copper, one (1) part, by weight, also dissolved in rain-water, but in only about one-quarter of the quantity or volume of the first-named solution.

The objects or articles prepared as above described, but not treated by the amalgam, are placed in the said bath, which is connected with a strong electric battery, and will rapidly acquire a beautiful white but not shining appearance. They should not remain in the said bath more than a few minutes. Immediately after being removed from the bath they should be carefully dried and placed in a bath of pure silver, and finished as above described.

I may apply my invention not only to iron and steel, but also to bronze, German silver, and other metals and alloys which are capable of resisting the heat required for the divers operations above described, and I thereby increase the hardness and sonorousness of such metals.

I have hereinabove chiefly described my invention as applied to knife-blades; but I wish it clearly understood that other objects or articles can be treated in the same manner with great advantage. The said invention is applicable to household utensils used for culinary or other purposes wherein inoxidability is desirable; likewise to a great number of objects or articles used in the arts and manufactures.

My process is inexpensive, and the difference in price between any articles or objects manufactured in the best manner by any processes hitherto known and similar articles or objects produced or finished by my said process is in favor of the latter. The articles prepared by my process do not require the frequent or severe rubbing or polishing which in the case of ordinary table cutlery and other articles necessitates a considerable expenditure of time and labor and soon renders knives or other articles subjected thereto unfit for use, whereas a knife treated according to my process will be kept clean and bright by simple washing with warm water and without the use of a knife-board or a cleaning or polishing machine, and such knives may be sharpened in the usual manner, and will keep their edge like pure steel.

It will thus be obvious that by my invention table-cutlery and other articles are rendered practically imperishable with ordinary care, and will retain the appearance and brilliancy of polished silver.

Having thus described my invention, what I claim is—

1. The process herein described of coating metal, which consists in roughening the surface of the articles to be coated by acids and heat, as set forth, again heating the metal, and then subjecting the metal thus prepared to the action of a molten bath of an alloy of lead, tin, and silver which fills the roughened surface of the metal, all substantially in the manner and for the purposes set forth.

2. The process herein described of coating metal, which consists in roughening the surface of the articles to be coated by acid and heat, as set forth, again heating the metal, subjecting it to the action of a molten bath of an alloy of lead, tin, and silver, applying a secondary coating of amalgam, and then electroplating the same with silver, substantially in the manner and for the purposes set forth.

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