

UNITED STATES PATENT OFFICE

JOHN R. CAIN, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO THE RICHARDSON COMPANY, OF LOCKLAND, OHIO, A CORPORATION OF OHIO

PROCESS OF FORMING IRON FOILS

No Drawing.

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My invention relates to a process of forming iron foils and other foils by electro-deposition of the desired metal upon a thin foil-like body of copper, followed by the removal
5 by electro-chemical means of the copper, leaving the iron foil or other metal intact.

The steps involving the deposition of iron or other metal on the copper, do not involve any particularly novel subject matter. In
10 dealing with iron, I will describe a preferred process for electro-deposition.

The process is particularly valuable in connection with the removal of the copper base from the metal foil deposited upon it, and
15 to this, my specification is particularly directed. In the value so far developed of my process, I refer particularly to the formation of iron foils, since to produce very thin foils of iron, is a problem in the arts, which has not
20 been satisfactorily solved, so far as I am advised, and in fine electrical equipment, the foils of electrolytic iron have a high value.

To describe a typical process, a sheet of copper foil or thin copper sheet material is
25 immersed in an electrolyte suitable to plate the required metal on the copper. In plating iron, I have employed a copper sheet of three thousandths thickness in a ferrous sulphate-sodium sulphate electrolyte, practically neutral and kept at around 95 to 100 degrees centigrade.

The copper sheet as cathode is suspended or supported in the bath so that to the minimum degree can the current cause plating on the
35 "back" of the copper cathode. As an anode I may employ ingot iron, particularly the brand known as "Armco" ingot iron, which is a commercially pure product. By using a spacing of around one inch, and continuing the plating at suitable current densities for
40 between six and ten minutes, I produce a film of iron on the cathode, without any substantial treeing. Agitation during plating, and a flow of electrolyte with a filter to remove precipitated substances is preferred.
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The copper cathode is cleaned and bright on the surface on which plating is to be done, and by a suitable placing in the bath, I am
50 able to avoid a coating of the back of the cathode with a high melting point wax, which

would otherwise be required, in order to give the best physical qualities to the iron. There are other methods of localizing electrolytic action, however, which I may employ, such as shields, or placing two cathodes back to back,
55 between two anodes.

In stripping, I employ a concentrated solution of alkaline cyanide, such as potassium or sodium cyanide or both, and preferably maintain the solution as hot as the original electrolyte. I pass a current of medium or low density through the plated copper sheet, as
an anode, and a suitable copper body as a cathode, and thus strip away the copper quite rapidly, leaving the iron intact. It is preferable to agitate the bath gently. If desired
60 the copper stripped from the cathode may be re-deposited on another finished article, e. g., on a copper foil, in order to thicken it.

In order to remove any spots of iron that
70 may have plated on the copper back of the plated body, I may coat the iron face with paraffin, dip the body into concentrated nitric acid, and thus eat away the iron deposits not protected by the paraffin. The
75 paraffin can be left on the iron side, and can be removed by dipping into hot water after the copper has been driven away from it.

I find that the face of the iron next to the copper is quite bright, and that the physical properties of the iron foil are good even without any annealing or cold rolling, although it will be best to follow the process
80 of producing the foil by suitable cold rolling.

If the original electrolyte is not hot while the plating is being done, the iron deposit will be brittle, which suggests itself as a mode of procedure in stripping the iron away from the copper by starting the plating
85 with the ferrous sulphate-sodium sulphate electrolyte cold, and thus obtaining a first deposit of brittle iron, followed by an electro-deposition while the electrolyte is hot. If the base metal used is not so soft as copper,
90 it should be possible to strip off the foil of iron mechanically, due to the non-adhesiveness of the brittle underneath coating thereof. I state this point without having
95 proven its value, as indicating one of the

aspects of my invention in the plating of iron onto suitable cathodes.

The practice of plating other metals on copper, whereof value in my invention, would have to be confined to those metals which would not strip away with the cyanide action.

I have not been able to effect a suitable process for removing a copper base from a product plated with iron, as described, by the use of acids as chemical reagents, without electric current, nor by the use of acid solutions or alkaline solutions, which suggest themselves from electro-plating practice. In the use of acid to dissolve a backing of copper from a protected iron deposit, the action is not subject to sufficient control to produce a good product.

In my product, the iron in particular is malleable, and of one very smooth, practically polished surface.

If it is desired to plate further iron on the removed foil of my process, it will usually be necessary to confine the additional plating to the smooth surface thereof, or else to cold roll the product so as to give two smooth surfaces.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

The process of producing iron foil which consists in electro-depositing iron upon a base of bright, clean copper, and then removing the copper electrolytically in a cyanide solution resulting in a foil having a polished appearance.

JOHN R. CAIN.

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