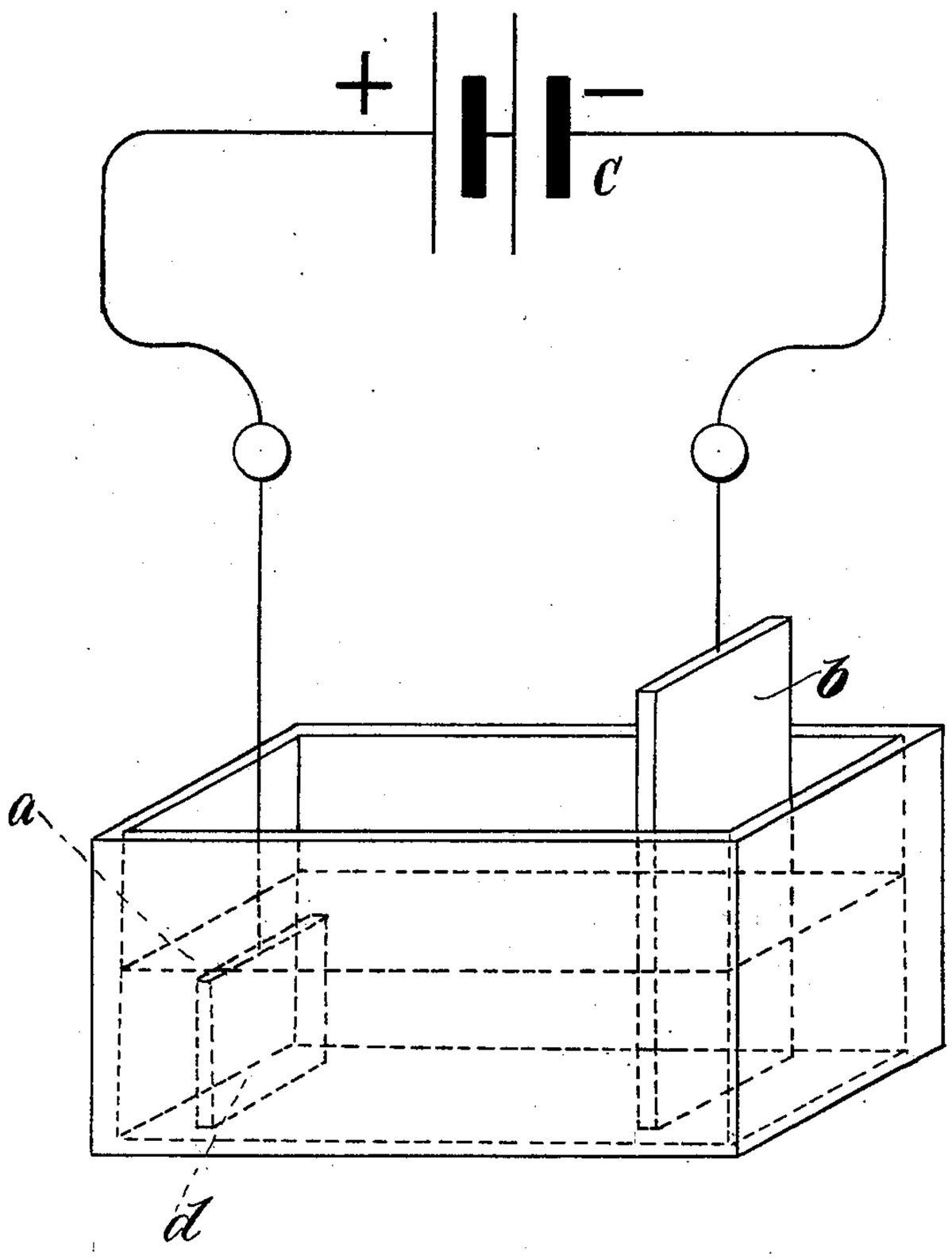
No. 621,084. Patented Mar. 14, 1899.

H. L. HOLLIS.

METHOD OF APPLYING PRESERVATIVE COATINGS TO OBJECTS OR STRUCTURES OF IRON OR STEEL.

(Application filed Apr. 20, 1898.)

(No Model.)



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UNITED STATES PATENT OFFICE.

HENRY L. HOLLIS, OF CHICAGO, ILLINOIS.

METHOD OF APPLYING PRESERVATIVE COATINGS TO OBJECTS OR STRUCTURES OF IRON OR STEEL.

SPECIFICATION forming part of Letters Patent No. 621,084, dated March 14, 1899.

Application filed April 20, 1898. Serial No. 678,233. (No specimens.)

To all whom it may concern:

Be it known that I, HENRY L. HOLLIS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Methods of Applying Preservative Coatings to Objects or Structures of Iron or Steel, (Case No. 3,) of which the following is a full, clear, concise, and exact description.

My invention relates to steel or other iron objects, and has for its purpose the provision of an improved method for treating the surfaces of iron objects subject to exposure to prevent the deterioration of the iron by rust formed thereon on account of dampness or deleterious atmospheric conditions.

As is well known, iron, and especially steel, readily corrodes when unprovided with a preservative coating, the rust being formed in scales or powder. Rust is a hydrated oxid of iron and readily conveys oxygen from the exterior to the unattacked portions of the iron, so that after rust has once been formed upon iron the iron continuously deteriorates unless the supply of oxygen should be cut off, as by painting. Moreover, the rust is not intimately united with the iron and readily becomes detached in the form of scales or powder, thus exposing the surface of the metal to attack.

My invention consists in an improved method of oxidizing iron in a manner to cause a firm physical union between the resulting oxid and the unchanged portion of iron beneath the oxid. Some of the various oxids of iron are well adapted for use as preservative coatings. If, therefore, such oxid is formed upon the surface of the iron in such a way as to maintain firm physical union therewith, so that it cannot be readily removed, then the iron beneath the coating of oxid will be thoroughly protected against further oxidation. Moreover, the union between the oxid and the iron is firmer when the oxid is formed "in place" than when it is applied by painting.

Heretofore mechanical processes have been employed for manufacturing Russia sheet-iron and planished sheet-iron. The product usually known as "Russia" sheet-iron has surfaces generally formed of a magnetic oxid of iron, which may be produced by hammering heated sheets of metal between which charcoal and water are placed. There are other steps in this mechanical process of treating sheet-iron which make the process expensive and tedious, since a very high degree of skill is required on the part of the workmen. Moreover, I am not aware that iron in other form than sheets can be treated by any mechanical process to produce the desired results. The process of my invention is simple and less expensive and does not require a high degree of skill in producing the product, and by means of my invention I am enabled to coat the iron with comparatively pure oxid. My invention relates to an improved method of manufacturing this product, and while primarily designed for the coating of sheet-iron iron or steel of other form may with advantage be treated by the process.

In practicing my invention I include the iron article to be treated in an electric circuit composed in part of a reagent, which furnishes alkaline conditions at the said article, the iron article through the agency of the electric current and the alkaline condition being coated with an iron oxid formed in place, oxidizing conditions being furnished at the iron article by means of my process. The resulting coating of iron oxid is so intimately united with the body portion of the treated article that the separation of the oxid from the article is under ordinary circumstances practically impossible.

In the preferred method of practicing my invention I employ an alkaline solution—as, for example, a solution of a caustic alkali—in which the iron article to be treated is immersed until satisfactorily coated, whereupon it is removed and the next article to be treated inserted in its place.

In practicing my invention I have connected each article to be treated as an anode in the electric circuit, any cathode suitable for the purpose being also connected in the circuit. Iron may advantageously be employed as the cathode, since it will not readily be attacked by the liberated cathion. The cathode should preferably in all cases be of such material that it will not readily be attacked by the solution chemically or electrolytically. The particular solution of caustic alkali that I have successfully employed in practice is caustic soda, (NaOH,) this solution being one

which will not appreciably dissolve iron, but which through the agency of the current serves to oxidize the article.

The apparatus for practicing the method is diagrammatically shown in the accompanying drawing, in which the bath *a*, containing the electrolyte, is provided with a suitable cathode *b*, connected with a negative terminal of a source of electricity *c*, whose positive terminal is connected with the iron that is to be treated, which thus constitutes the anode *d*. The iron object is temporarily inserted within the bath and temporarily connected with the source of electricity, the current being interrupted when the iron has been coated to the desired extent by removing the iron from the bath, whereupon another object may be treated in a similar manner. The character of the iron oxid formed in accordance with the process of my invention depends very largely upon the electrical condition of the circuit. An oxid of iron formed in the manner described is thus produced in place upon the iron object.

I have found that a satisfactory coating may be obtained with a variety of strengths of solution and current and degrees of temperature. I preferably, however, employ a caustic-soda solution with a specific gravity from 1.25 to 1.40, with a temperature from 50° to 115° centigrade and with a current of from .005 to .30 amperes per square inch of anode-surface. The product that I thus create when the oxids obtained are such that they would rust without such treatment, especially where the iron is in the form of sheets, may be subjected to an annealing temperature for several hours, the temperature being preferably between 800° and 1,400° Fahrenheit. The coating of oxidized iron may be changed by this heating to the magnetic oxid. The temperature should be such that the coating will not be caused to scale. The coating presents an ornamental appearance in addition to its function of preserving the iron and the union of the oxid is so intimate with the iron that in the case of sheet-iron it may be bent without in the least affecting the condition of the coating.

While I prefer the magnetic oxid of iron as a preservative coating, the other oxids may be employed with efficacy. The strength and temperature of the solution used may be varied and also the intensity as well as the quantity of the electric current employed. The quantity of electricity, and consequently the oxidizing effect, should be proportionate to the surface which is to be covered.

By a caustic or alkaline solution as used herein I mean a solution which is adapted to furnish alkaline conditions at the iron object while a current of electricity is passing through the iron object and solution.

I am aware that the use of a bath of distilled water in an electric circuit for securing a coating of oxid upon iron has been suggested. I do not claim a process in which distilled water is used.

I am aware of the process described in British Patent No. 8,712, dated June 16, 1887, to Johnson. The process of the said British patent is wholly different from the process herein described, since the iron is not formed into an oxid by electrolytic action, but the oxid is first formed upon the iron without the agency of electricity, electricity being merely employed to change the iron oxid from one form to another, the metallic iron being unexposed to the electrolyte.

While I have particularly specified the preferred manner of practicing my invention, I do not wish to be limited thereto nor to the ingredients employed.

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

1. The method of applying a preservative coating to iron objects, which consists in temporarily inserting the object to be treated in a solution of caustic alkali as an electrolyte, temporarily connecting said object as an anode with a source of electricity, passing an electric current from said source through the iron object and electrolyte, whereby oxidizing conditions will be furnished at the surface of the iron object and oxygen will there be united with the iron to form the protective coating, withdrawing the coated iron object from the solution, and subjecting the said object to an annealing temperature, substantially as described.

2. The method of applying a preservative coating to iron objects, which consists in temporarily inserting the object to be treated in a solution of caustic soda as an electrolyte, temporarily connecting said object as an anode with a source of electricity, passing an electric current from said source through the iron object and electrolyte, whereby oxidizing conditions are furnished at the surface of the iron object and oxygen will there be united with the iron to form the protective coating, and thereupon discontinuing the flow of current through the iron object, substantially as described.

3. The method of applying a preservative coating to iron objects, which consists in subjecting the iron object to be treated to an oxidizing reagent, passing a current of electricity from said object through the oxidizing reagent to furnish oxidizing conditions at the surface of the iron object and cause the union of oxygen with the iron, and subjecting the coated iron object to an annealing temperature, substantially as described.

4. The method of changing iron at the surface portions of iron objects to a protective coating of iron oxid, which consists in temporarily subjecting the iron object to be treated to caustic alkali and at the same time passing a current of electricity from said object through said caustic alkali to furnish oxi-

dizing conditions at the surface of the iron object and cause the union of oxygen with the iron, and thereupon discontinuing the flow of current through the iron object, substantially as described.

5. The method of changing iron at the surface portions of iron objects to a protective coating of iron oxid, which consists in temporarily subjecting the iron object to be treated to a solution furnishing alkaline conditions at the iron object and at the same time passing a current of electricity through said object and solution to furnish oxidizing conditions at the surface of the iron object and cause the union of the iron with the oxygen to form the desired protective coating, whereupon the current through the coated iron object is discontinued, substantially as described.

In witness whereof I hereunto subscribe my name this 18th day of April, A. D. 1898.

HENRY L. HOLLIS.

Witnesses:
CHARLES A. BROWN,
GEORGE L. CRAGG.