

UNITED STATES PATENT OFFICE.

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PROCESS OF ELECTROLYTICALLY REMOVING SCALE AND PRODUCING IRON SULFATE.

No. 827,180.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CHARLES J. REED, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Processes of Electrolytically Removing Scale and Producing Iron Sulfate, of which the following is a specification.

Various electrolytic methods have been proposed for removing the oxid scale from iron sheets, rods, and wire. In some of these the iron article is made the anode in an electrolyte of acid or an acid salt. The scale is thus dissolved more rapidly than in the usual pickle bath; but the action is apt to be irregular, and solution of the iron invariably occurs. Furthermore, the gain in time is more than offset by the cost of the electric current. In other proposed methods the iron article is made the cathode in an electrolyte which is neutral, weakly acid, or alkaline—for example, a dilute solution of an alkali-metal salt, an acid, or an alkali. The removal of scale, however, is slow and irregular, spots of scale being frequently left at various points. Some of the scale is also loosened by the electrolytic hydrogen and drops into the bath. In neutral or alkaline solutions much of the scale is reduced to metallic iron, producing a rough irregular surface.

According to the present invention the iron article is made the cathode in an electrolyte consisting, preferably, of a strong aqueous solution of sulfuric acid. The scale is thereby reduced to a lower state of oxidation and electrolytically dissolved with the production of ferrous sulfate. An insoluble anode is employed, and sulfur dioxide is maintained in solution in the electrolyte, serving by its oxidation to both depolarize the anode and replenish the acid in solution.

In the preferred mode of procedure the electrolyte consists of an aqueous solution of sulfuric acid having a specific gravity of about 1.20, equivalent to an acid content of 27.1 per cent. The anode may be of lead and the current density at the cathode from forty to seventy amperes per square foot. The electrolyte is preferably maintained at a temperature of about 60° centigrade. The sulfur dioxide may be supplied directly to the electrolytic cell, as by allowing it to rise in bubbles along the anode, or the electrolyte may be circulated between the cell and a separate vessel, into which the gas is intro-

duced. A diaphragm-cell is preferably employed, the gas being supplied to the anode-compartment or anolyte to prevent its wasteful reduction to sulfur at the cathode. Under these conditions the reduction and solution of the scale on the cathode and the oxidation of the sulfur dioxide at the anode are rapid and continuous. By regulating the rate of supply of the gas the production of acid may be made to correspond with the rate of its consumption by the ferrous sulfate, the electrolyte thus being maintained at the proper concentration. In the case of a diaphragm-cell the concentration of the acid in the catholyte is maintained by diffusion and cataphoresis from the anolyte.

As the amount of iron sulfate in solution approaches saturation the electrolyte or catholyte is transferred to a shallow pan and allowed to cool. It is preferable to reduce its temperature to about 0° centigrade by the use of a suitable refrigerant. The iron sulfate crystallizes out, and the residual solution is returned to the electrolytic cell, preferably to the anode-compartment, no evaporation or further treatment being required to fit it for continued use as an electrolyte.

I claim—

1. The process of electrolytically dissolving iron-oxid scale from the surface of metal, which consists in passing an electric current to the metal, as cathode, in an electrolyte containing sulfuric acid and sulfur dioxide, as set forth.

2. The process of electrolytically dissolving iron-oxid scale from the surface of metal, which consists in passing an electric current to the metal, as cathode, in an electrolyte consisting of a strong aqueous solution of sulfuric acid impregnated with sulfur dioxide, as set forth.

3. The process of electrolytically dissolving iron-oxid scale from the surface of metal, which consists in passing to the metal as cathode, in an electrolyte consisting of a heated, strong aqueous solution of sulfuric acid impregnated with sulfur dioxide, an electric current of sufficient density to rapidly remove the scale, as set forth.

4. The process of electrolytically dissolving iron-oxid scale from the surface of metal, which consists in passing an electric current to the metal, as cathode, in an electrolyte containing sulfuric acid, and introducing sulfur dioxide into the electrolyte, as set forth.

5. The process of electrolytically dissolv-

ing iron-oxid scale from the surface of metal, which consists in passing an electric current to the metal, as cathode, in an electrolyte consisting of a strong aqueous solution of sulfuric acid, and introducing sulfur dioxid into the electrolyte, as set forth.

6. The process of electrolytically dissolving iron-oxid scale from the surface of metal, which consists in passing to the metal, as cathode, in an electrolyte consisting of a heated, strong aqueous solution of sulfuric acid, an electric current of sufficient density to rapidly remove the scale, and introducing sulfur dioxid into the electrolyte, as set forth.

7. The process of electrolytically dissolving iron-oxid scale from the surface of metal, which consists in passing an electric current to the metal, as cathode, in an electrolyte containing sulfuric acid and sulfur dioxid, and recovering the iron sulfate from the resulting solution, as set forth.

8. The process of electrolytically dissolving iron-oxid scale from the surface of metal, which consists in passing an electric current to the metal, as cathode, in an electrolyte containing sulfuric acid and sulfur dioxid, withdrawing the resulting solution, recovering the iron sulfate therein and returning the solution to the electrolytic cell, as set forth.

9. The process of electrolytically dissolving iron-oxid scale from the surface of metal, which consists in passing an electric current to the metal, as cathode, in an electrolyte containing sulfuric acid and sulfur dioxid, withdrawing and cooling the resulting solution, thereby precipitating the iron sulfate, and returning the residual solution to the electrolytic cell, as set forth.

10. The process of electrolytically dissolving iron-oxid scale from the surface of metal, which consists in interposing a diaphragm between a catholyte and anolyte containing sulfuric acid, passing an electric current to the metal, as cathode, and supplying sulfur dioxid to the anolyte, as set forth.

11. The process of electrolytically dissolving iron-oxid scale from the surface of metal, which consists in interposing a diaphragm between a catholyte and anolyte consisting of a strong aqueous solution of sulfuric acid, passing an electric current to the metal, as cathode, heating the electrolyte, and supplying sulfur dioxid to the anolyte, as set forth.

12. The process of electrolytically dissolving iron-oxid scale from the surface of metal, which consists in interposing a diaphragm between a catholyte and anolyte containing sulfuric acid, passing an electric current to the metal, as cathode, supplying sulfur dioxid to the anolyte, and circulating the electrolyte between the cell and a precipitating vessel, as set forth.

13. The process of electrolytically dissolving iron-oxid scale from the surface of metal, which consists in interposing a diaphragm between a catholyte and anolyte containing sulfuric acid, passing an electric current to the metal, as cathode, supplying sulfur dioxid to the anolyte, removing and cooling the catholyte, thereby precipitating the ferrous sulfate, and returning the residual solution to the anode-compartment, as set forth.

14. The process of electrolytically dissolving iron-oxid scale from the surface of metal, which consists in interposing a diaphragm between a catholyte and anolyte consisting of a strong aqueous solution of sulfuric acid, passing an electric current to the metal, as cathode, heating the electrolyte, supplying sulfur dioxid to the anolyte, removing and cooling the catholyte, thereby precipitating the ferrous sulfate, and returning the residual solution to the anode-compartment, as set forth.

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

CHARLES J. REED.

Witnesses:

JAY D. REED.

M. J. REED.