UNITED STATES PATENT OFFICE.

ASAHEL K. EATON, OF BROOKLYN, NEW YORK.

METHOD OF REMOVING SCALE OXID FROM THE SURFACE OF IRON OR STEEL.

SPECIFICATION forming part of Letters Patent No. 702,050, dated June 10, 1902.

Application filed September 10, 1900. Serial No. 29,547. (No specimens.)

To all whom it may concern:

Be it known that I, ASAHEL K. EATON, of the borough of Brooklyn, county of Kings, and State of New York, have invented a new and useful Method of Removing Scale Oxid from the Surface of Iron or Steel; and I hereby declare that the following is such a clear, full, and exact description of the same as will enable those skilled in the art to which my invention pertains to use or practice the same.

In the removal of "hammer-scale," as it is called, from the surface of hammered or rolled iron or steel it has been customary to use strong corrosive acids, such as sulfuric, hydrochloric, &c. These acids effect the desired result at the expense, largely, of the underlying pure metal. This is especially so in the treatment of the lighter articles of iron and steel, such as wire or thin plate. The acid acts injuriously by the dissolving of the metal and consequent loss thereof, and by molecular change of structure causes a brittleness and loss of that elasticity and toughness which the metal exhibited before treatment. I therefore sought for a substitute that would attack the oxid only, leaving the underlying pure metal intact. I finally reached a satisfactory solution of the problem, which I will here describe.

The scale oxid found upon the surface of all rolled or hammered iron or steel is represented by the chemical formulæ FeO and Fe_2O_3—that is to say, a mixture, varying in different cases, of the protoxid and sesquioxid of iron. It was desirable to find a compound which would readily dissolve these oxids without attacking the underlying surface. In effecting this it was necessary to devise a chemical combination which by first reducing the Fe_2O_3 to the protoxid made the whole scale easily soluble, with the qualification that the solution or combination should be entirely neutral to the metallic surface beneath.

The agents which I have found to be most efficacious in carrying out my process are solutions of sodium bisulfate and stannous chlorid. The simplest and most economical method of producing this mixture I have found to be as follows: I dissolve one hundred parts of sodium bisulfate in five hundred parts of water and to this add a solution of two parts stannous chlorid in three parts of water. The result of this combination is by double decomposition a fluid consisting mostly of dissolved sodium bisulfate and a small portion of stannous sulfate, which acts as a reducing agent of the more highly oxidized portions of the scale. Represented by chemical formulæ, the reaction resulting from the mixture of the sodium bisulfate and the stannous chlorid is—

$$n(NaHSO_4)+SnCl_2=(n-2)NaHSO_4+Na_2SO_4+SnSo_4+2HCl.$$

It is evident that the same proportion of tin in the form of stannous sulfate would, combined with sodium bisulfate, give a solution practically equivalent in its action to that above described; but this latter salt is difficult to obtain and would add considerably to the cost of the mixture.

The reactions that take place when the scale-covered iron or steel is treated according to my method are as follows: Tin in the form of a protosalt, being an excellent reducing agent, resolves the Fe_2O_3 constituent of the scale to FeO, thereby rendering the whole of the scale completely soluble in the extra acid constituent of the bi-acid salt. A desirable feature connected with this reaction is that while the solution of sodium bisulfate readily attacks the scale when thus reduced it has no perceptible affinity for the bared metal. In order to prove this, I removed the scale of some thin steel, dried and weighed the metal, and then for three days left it in the solution. It was then dried and weighed again, and I found no appreciable loss of weight.

The time required in a cold fresh solution for the removal of the scale is about half an hour. If the solution be heated, the time will be shortened to about five minutes. The cold solution after being weakened by use requires a relatively longer time or more or less heat to produce the same action in the same time. When the solution becomes weak, it may be improved by putting scraps of bright tin into the bath.

The same results could be obtained by the substitution of potassium bisulfate for the sodium salt; but the cost of this would be practically prohibitive.

The sodium bisulfate will by itself to a cer-

tain degree remove the oxid; but as it attacks readily the protoxid constituent only it is not sufficiently rapid in its action.

Having now described my invention, what I claim is—

1. The method herein described of removing hammer-scale from iron or steel, which consists in treating the same with an agent to reduce the more insoluble oxids of the scale to a soluble condition, and with a solvent for the resulting oxid which does not injuriously attack the underlying metal, as set forth.

2. The method herein described of removing hammer-scale from iron or steel, which consists in subjecting the same to the simultaneous action of a reducing agent for the higher oxids, and a solvent of the lower oxids, in the form of a mixture of the solutions of the two agents, as set forth.

3. The method herein described of removing hammer-scale from iron or steel, which consists in immersing the iron in a bath containing a reducing agent for the higher oxids, and sodium bisulfate, as set forth.

4. The method herein described of removing hammer-scale from iron or steel, which consists in treating the same with a bath containing in solution stannous sulfate and sodium bisulfate, as set forth.

5. The method herein described of removing hammer-scale from iron or steel, which consists in subjecting the scale-coated metal to the action of a bath containing sodium bisulfate, as set forth.

A. K. EATON.

Witnesses:
L. O. SHERWOOD,
H. M. EATON.