UNITED STATES PATENT OFFICE.

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METHOD OF TREATING STEEL AND IRON PARTS.

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To all whom it may concern:

Be it known that I, JAMES SORENSON, a citizen of the United States, residing at Clintonville, county of Waupaca, and State of Wisconsin, have invented new and useful Improvements in Methods of Treating Steel and Iron Parts, of which the following is a specification.

My invention relates to improvements in methods in treating iron and steel parts for the removal of scale.

Heretofore, scale has been removed ordinarily after the metal has been heated for quenching or annealing purposes, and to facilitate such removal the parts are usually pickled in an acid solution and then subjected to sand blasting, grinding, filing or sand-papering operations. These methods are slow and especially so for the reason that much of the scale adheres to the metal with considerable tenacity and cannot be sufficiently loosely by any pickling process which will not impair or discolor the body of the metal.

My invention is based upon the discovery that by treating the metal parts with an acid solution either before heating them or while they are being heated, but before the blistering or sealing temperature has been attained, substantially all of the surface scale may be loosened or separated in such a manner that much of it will fall away when the parts are agitated or subjected to the action of an ordinary brush, and the remainder will be loosened so that it may be easily and quickly removed by a sand blast.

I have found that by subjecting the metal parts to a weak acid solution either in the form of a liquid or in the form of vapor or gas, the oxidized portions will be disintegrated in part at least. Probably such portions of the oxidized and unoxidized iron as are acted upon by the acid are converted into salts which have little adhesion and may be readily removed in both the old pickling process and in the new process forming the subject matter of this application. However, in the practice of my improved process, such acid as remains in contact with the material has its action greatly intensified by the heat, so that both its effect and the speed at which it acts are materially increased. The gases generated by the acid appear to act effectively when the parts are heated, to push the scale outwardly much more effectively than has heretofore been the case, and the scales will be broken at the margins to such an extent that they can be very easily removed. The action of the acid upon the surface of the metal undoubtedly also contributes toward the weakening of the scale whereby it may be more easily broken up and removed in the brushing and sand blasting operations.

It is, therefore, the object of my invention to provide an improved method for treating metal parts with liquid and heat in such a manner as to facilitate the removal of scale.

In carrying out my process, I may first immerse the parts to be heat treated in a weak acid solution, such for example, as a twenty-five per cent. by weight of hydrochloric acid to seventy-five per cent. of water. After the parts have been subjected to the action of this solution for about two minutes, they are placed directly into the furnace while wet and heated to the desired extent less than the melting point of the metal. After the annealing or quenching process has been completed, the parts are removed and allowed to cool with the desired rapidity as in any ordinary heat treating process. When cool, it will be found that a large percentage of the scale may be rubbed or brushed off and, in fact, that much of it will fall off if the parts are agitated or subjected to shock. The remainder may be almost wholly removed by simply passing the parts through an ordinary sand blast.

Instead of immersing the metal parts in an acid solution preparatory to heating them as above described, I may place them directly into the furnace and at any time before the final temperature has been attained, a small quantity of an acid solution having about twice the acid content as that above described may be thrown into the retort where it becomes immediately volatilized and attacks the surfaces of the parts from all sides with great rapidity. Where this course is followed, substantially the same results will be obtained when the metal reaches the sealing temperature above described as where the parts are first pickled for about two minutes and then put into the furnace while wet. In fact, I am satisfied from my experiments that where the metal parts are first pickled and then heated, a considerable portion of the acid reaction

upon the surface of the metal occurs after the parts have been placed in the furnace or retort and after their temperature has been raised to a considerable extent.

Where the acid solution is injected into the retort while the parts are being heated, I employ about one pint of a liquid solution containing fifty per cent. of hydrochloric acid and fifty per cent. of water for a retort having a capacity of twenty cubic feet, but I do not regard exact proportions as material, and my experiments have demonstrated that other acids may be substituted for hydrochloric acid. Any acid capable of rapidly disintegrating the iron oxid preparatory to subjecting the parts to a blistering or scaling temperature will be suitable for my purposes, for example, sulfuric acid may be used for this purpose. The proportions of acid to water as above given are mentioned merely as those which my tests have determined to be satisfactory both from the standpoint of economy and efficiency.

My experiments as thus far conducted indicate the probable formation of an oxygen excluding coating upon the surface of the iron or steel parts, thereby protecting the parts from further oxidation. Apparently this oxygen excluding coating consists of chlorid of iron formed by the action of the acid upon the oxid, or scale, and also by the action of the acid upon the metal itself. However, it is not essential to my process whether this result is attained or not. It is apparent that by following my process the scale is much more easily removed than heretofore and the metal surfaces are left bright and apparently clean after being subjected to the sand blast or equivalent abrading operation. This is the primary consideration.

The scale which is rapidly attacked by the acid, in my improved process, rapidly changes into a salt of the acid having a slight adhesive and cohesive action. Also, the change in volume which occurs when passing from the oxid to the salt of the acid tends to warp or buckle the scale and correspondingly tends to loosen such scale from attachment to the body portion of the material. This result has two effects,—(1) the loosening of the scale by this chemical change due to the resulting buckling, and (2) the weakening of the attachment of the scale which still adheres to the material thereby aiding in the ease with which the scale may be subsequently brushed off.

It will, of course, be understood that while I have referred to the acid material as a solution, it is not material whether it is applied to the metal in liquid or gaseous form. Even solids containing acid which can be vaporized by heat may be thrown into the furnace with the same effect as if initially injected in liquid or gaseous form.

I claim:

1. The method of treating scale bearing iron and steel parts for the removal of scale, consisting in subjecting the metal surfaces to the action of an acid and raising their temperature to the scaling point while acid is in contact with the material.

2. The method of treating scale bearing iron and steel parts, for the removal of scale, consisting in partially disintegrating the oxidized portions and subjecting the parts to heat while the oxidized portions are so disintegrating.

3. The method of treating iron and steel parts consisting in chemically weakening the adhesion of the oxidized portions, heating the parts while the weakening of the adhesion of the oxidized portions is in progress, and then removing the oxidized portions.

4. The method of treating iron and steel parts consisting in chemically weakening the adhesion of the oxidized portions, heating the parts with the adhesion so weakened, and then subjecting them to quenching and abrading operations.

5. The method of treating iron and steel parts for the removal of oxidized portions consisting in converting a portion of the oxidized metal into the salt of an acid to weaken the oxidized portions preparatory to quenching them, heating and quenching them, and then removing the scale therefrom.

6. The method of treating iron and steel parts for the removal of oxidized portions, consisting in interposing a protecting coating between the oxidized and unoxidized portions, and then heating the parts to a scaling temperature.

7. The method of treating partly oxidized iron and steel parts, consisting in treating the metal so as to form with the oxidized parts an oxygen excluding coating and subjecting the metal to heat while it is being so coated, to modify its characteristics as to hardness, malleability and ductibility.

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

JAMES SORENSON.

Witnesses:
H. B. DODGE,
B. S. DONLEY.