

UNITED STATES PATENT OFFICE.

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METHOD OF CLEANING METAL CASTINGS.

SPECIFICATION forming part of Letters Patent No. 405,716, dated June 25, 1889.

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To all whom it may concern:

Be it known that I, JOSEPH H. POTTS, 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 Methods of Cleaning Metal Castings, of which the following is a specification.

My invention has relation, generally, to cleaning the surfaces of metal, and particularly to the removal of sand or foreign matter from the surfaces of iron or iron castings preparatory to japanning, galvanizing, plating, or otherwise treating the same.

In order to fully understand the importance of my invention it is necessary to refer to the methods and means heretofore employed for cleaning metal surfaces, to wit:

First, tumbling the castings in revolving drums. This is defective in that only parts of the castings are more or less cleaned, and with many classes of work it is objectionable for the reason that the sharpness of the corners and edges of the castings is more or less impaired and destroyed by the abrasion to which they are subject. It is impracticable to tumble large castings on account of weight and size, or thin brittle castings of white iron on account of breakage, or wire or sheet metal by reason of their shape. Therefore these classes of work are cleaned by pickling or immersing in a solution of sulphuric acid.

The acid process is objectionable for the reason that the acid does not act as a solvent for the foreign matter on the metal, but attacks and scales the metal and the foreign matter comes off with the scales; consequently the metal surfaces are more or less impaired and any cleaned parts are corroded or oxidized before the acid scales the uncleaned portions of the same sufficiently to admit of removal.

If the work subjected to the acid process is to be galvanized or otherwise coated with metal, it is further placed into a bath of muriatic acid to remove the oxide produced by the action of the sulphuric bath. All acid processes heretofore in use produce more or less oxidation of the metallic surface, which oxidation must be removed by manual labor or otherwise, and the defects of the above processes are so well known that the sand-

blast process has lately been resorted to for cleaning stove-castings in place of the acid-bath and tumbling processes.

It has long been known that metals differ greatly in the facility with which they can be coated with other metals. I have found that this difficulty is not inherent in the metal itself so much as it is due to the imperfect condition of the surface of the metal when prepared by processes heretofore in use, there being present in the pores of the metal minute quantities of foreign matter. Wrought-iron presents a surface comparatively free from porosity, and the oxide produced by the acid process is removed by scrubbing with sand and water. Therefore the tinning of it is readily performed; but it is impossible by the same means to perfectly remove the foreign matter from the porous surface of cast-iron; hence the difficulty in tinning or otherwise coating this metal.

I have discovered by practical use that hydrofluoric acid has valuable qualities which make it superior to all acids heretofore used for cleaning metallic surfaces. In addition to its action upon silicates, I find it is a powerful solvent of metallic oxides and that the heat of boiling water is sufficient to expel it from the pores of iron castings. Hence the tendency of cast metal to oxidize is not increased after an immersion in a solution of hydrofluoric acid, as is the case when it is subjected to the sulphuric-acid processes. I have also found that the addition of small quantities of hydrofluoric acid to a solution of sulphuric acid greatly increases its activity by loosening the silicates and tending to prevent the formation of the black oxide or renders the removal of it less difficult, and when added in like manner to a solution of muriatic acid its action is greatly improved when used as a bath to remove metallic oxides, especially from iron and nickel-plated surfaces.

My invention has for its object to avoid the above-described objections and defects incident to the sulphuric-acid and tumbling treatments, and so treat the castings or metals that all the burnt-in sand and other foreign matter is economically and readily dissolved or removed from the metal, and the surfaces are not attacked or oxidized, thus presenting clean metal throughout for any desired finish.

My invention accordingly consists of subjecting the castings or other metal articles to a bath or a solution of hydrofluoric acid and water, or combined with other acids, as hereinafter described in the specification, and pointed out in the claims.

I prefer to use a solution of hydrofluoric acid produced by placing water into the condenser equal to twice the weight of the sulphuric acid used in the retort. This reduces the strength of the acid produced and in like manner the danger and inconvenience in the handling of it.

To prepare the bath, I preferably take one part of the above solution of hydrofluoric acid and ten parts of cold water. The proportions, however, can be varied to suit the work; but pure acid must never be used, and care taken not to have the bath too strong, as the only correct way of cleaning metallic surfaces is to remove the foreign matter without attacking and destroying the metal. I accomplish this result by having the bath contain just sufficient acid to remove the oxide, if there be any, and correspondingly dissolve or loosen the silicates. Iron castings are kept in the bath until the silicate has the appearance of detached grains of sand, whereupon they are removed and placed into a bath of boiling water, quickly raised to this temperature and duly maintained thereat. After removal from the boiling-water bath they are quickly dried, whereupon the loose sand and other foreign matter is readily brushed off or otherwise mechanically removed, and the surface of the castings will be found to be clean throughout and perfect in their minutest outlines. The bath is kept in working order by small additions of the acid, and it is used until the density of it becomes so great that it will not readily wash from the work. The bath is then exhausted of its strength and thrown away. The detached foreign matter settles to the bottom of the bath and should be frequently removed, as its presence reduces the strength of the bath, and also prevents the acid acting upon portions of the work that become embedded in it. Other acid baths are often used hot; but a bath of hydrofluoric acid should be kept and used cold; otherwise the evaporation of a portion of its acid will cause loss of its strength. Mechanical means should be used to place into and remove the work from the bath, and in this manner protect the hands of the workman from the acid.

The directions herein given for practicing my invention are founded upon extensive and practical use, and while important that my directions should be observed in order to produce the best results, they may be varied without departing from the spirit of my invention.

The advantage of the foregoing-described

method is a clean metallic surface suitable for any desired finish, and this surface is produced by one operation and at less cost in time and labor.

Light castings and stove-work, which are produced with comparative clean surfaces, except at the "gates," at which place the sand and dirt are burned into the casting, can be perfectly cleaned by my invention, as it is well known it has heretofore been impossible by methods in use to entirely remove this foreign matter at the gates without detriment to other parts of the castings. So, too, it is well known that the preparing of hot-poured white-iron castings for coating with metal and other purposes is a most difficult operation, and the brittleness of the metal and liability to breakage render the tumbling process for such castings impracticable, and that to pickle them in a sulphuric-acid bath requires hours of immersion to loosen the thick scale covering such castings, and that when removed the metallic surface is more or less destroyed and covered with a black oxide, making it totally unfit to be coated with metal or even japanned. The expense of preparing the same in large quantities is considerable.

By means of my improvements the above-mentioned class of castings and many other difficult kinds of work are now prepared in large quantities and at small cost, and such results are not attainable except by means of my improvements.

What I claim is—

1. The method of removing sand and other foreign matter from metal castings without injury to their original or chilled surfaces, which consists in subjecting the castings to a bath of hydrofluoric acid and cold water and then to a bath of water, substantially as set forth.

2. The method of removing sand and other foreign matter from metal castings without destroying their original or chilled surfaces, which consists in subjecting the castings to a weak solution or bath of hydrofluoric acid and then to a bath of hot water, substantially as set forth.

3. The method of preparing the surfaces of metal castings for electro or other plating or coating, consisting in first subjecting the casting to a weak solution or bath of hydrofluoric acid and cold water to remove sand and foreign matter from the surfaces of the castings, and then subjecting them to a bath of hot water, substantially as set forth.

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

JOSEPH H. POTTS.

Witnesses:

JOHN RODGERS,
S. J. VAN STAVOREN.