

United States Patent Office.

JACOB G. WILLANS, OF BAYSWATER, ENGLAND.

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IMPROVEMENT IN PUDDLING IRON.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL TO WHOM IT MAY CONCERN:

Be it known that I, JACOB GEOGHEGAN WILLANS, of No. 9 St. Stephens Crescent, Bayswater, England, a subject of the Queen of Great Britain, am in possession of an invention for "Improvements in Puddling Iron, and in apparatus employed therein;" and I, the said JACOB GEOGHEGAN WILLANS, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, that is to say:

This invention has for its object improvements in puddling iron, and in apparatus employed therein, and relates, firstly, to dispensing with the rabbling of molten iron and cinder; secondly, to rendering the interior lining of revolving or reciprocating puddling furnaces better able to withstand the friction of the iron.

In order to carry out the first part of my invention, I have the cast iron, in a granulated or divided state, mixed with oxide of iron in a finer state of division, and I expose the mixture to a good red heat, but not so great as to fuse the metal or cinder, both of which should be kept in a friable state. After that the metal has become decarburetted to a great degree, it is removed into another place, where it is exposed to a higher heat until the cinder be fused, and any further decarburation, if necessary, accomplished. I prefer to take such metal, or mixture of metals as now used to make good malleable iron, and to granulate it by running a small stream out of a cupola furnace or coke refinery, or foundry ladle, on a horizontal disk attached to the spindle of a turbine in the centre of a wrought-iron tank about seven feet diameter and four and a half feet deep, covered over with movable iron top, the turbine worked by either water or steam to a speed of from fifteen hundred to two thousand per minute; the disk standing three feet high from the bottom, and an overflow to keep the surface of the water in the tank just below the under side of the disk, copious jets of cold water flowing down the entire interior circumference, by which the metallic particles thrown off from the disk by centrifugal force are cooled and remain separate. Jets of cold water should also be abundantly supplied to any other part of the tank if the operation be continued long enough to heat that part too highly. I prefer to use a wrought-iron disk three-sixteenths of an inch thick and fifteen inches diameter, allowing the stream of molten metal to descend perpendicularly, with as little fall as possible, upon a point in the surface of the disk three inches from its centre, and to have a half-inch jet of cold water thrown from above on the centre of the disk, also two or more jets of cold water thrown on the under side of the disk to keep it from being melted. A fire-clay tile disk, well hooped with iron, and fitted on a wrought-iron disk, will be found to answer, especially with white metal; but the water jets must not touch the tile. A high speed of the disk with a small supply of metal will be found most conducive to obtaining the smallest granules. The granules are afterwards sifted, and any that may exceed three-sixteenths of an inch in diameter are rejected. Instead of granulating the metal, it may be pulverized when heated a little below the melting point, and afterwards sifted; but I prefer to have it granulated. I then intermix with the granulated or divided cast iron one-fourth to one-third of cinder, in the state technically termed bull-dog, previously crushed to a somewhat finer state of division; but I do not confine myself to that proportion, and I place the mixture in a cylindrical flue or furnace made of wrought iron, and lined with closely fitting fire-brick of a tenacious and not friable description, the flue or furnace being previously heated to a good red heat, and having an oxidizing flame produced by a large supply of air before entering, and revolving, so as to produce continuous change of surface and points of contact in the charge. The heat must not be so great as to fuse or render the mixture pasty. After that all parts of the mixture have been exposed to a good red heat for about thirty minutes, the mixture may be removed in any convenient manner to the bed of an ordinary or puddling furnace, kept at the highest possible heat with a reducing or carbonizing flame, so that any of the metal particles oxidized may be reduced to the metallic state, also that the cinder be brought more or less to the same nature as before being calcined into bull-dog. As soon as the cinder becomes fused, also any apparent effervescence (or escape of gaseous matter) has ceased, the mixture may be balled in any convenient manner, and afterwards hammered and rolled, when the iron will be found malleable. The interior of the flue or heating furnace may be about seven feet in length, egg shaped, two feet eight inches in diameter in the centre, and eighteen inches at the extremities, placed horizontally, and charged with the mixture, but not in greater quantity than sufficient to form a bed about six inches thick in its deepest part, or the interior of the flue or heating furnace may be an even cylinder of two feet diameter, of any greater length up to ten feet,

placed in a slightly inclined position and fed continuously at its upper end, allowing it to revolve at such speed as would give each part of the mixture fully thirty minutes at a good red heat before its exit at the lower extremity. Access may be had to either kind of flue or heating furnace at the end distant from the fire, where the products of combustion are withdrawn into the chimney by a sliding door in the chimney, and the waste heat of puddling or balling furnace may be advantageously applied towards heating these cylindrical flues or heating furnaces. Although I prefer to conduct the two operations in separate heating chambers or furnaces, as above described, it is not essential that they should be so conducted, as, if the heating chamber or furnace be of large size, the two heats may be applied at different parts or ends of one heating chamber or furnace.

My invention relates, secondly, to the interior lining of revolving or reciprocating puddling furnaces in which the iron is brought to a fused or pasty state in contact with fused cinder. Heretofore a difficulty has arisen in such furnaces by the abrasion of the fire-proof lining, the granules or particles rubbed off by the friction of the iron getting intermixed with the cinder and worked up with the iron. Having discovered that the particles of such earthly fire-resisting minerals as are found native in rocks possess greater cohesion in their original structure than when crushed, tempered with water, and moulded, I dispense with crushing and moulding, by having the mineral made into such shaped blocks or forms as will fit closely together in that part of the furnace to which they are applied. I prefer to use the aluminous mineral named bauxite, which is found in France, also in the county of Antrim, Ireland, when the stones of it are fire-proof and sufficiently compact after being fired. Another is the silicate of alumina. Minerals that are fire-proof, such as many fire-clay rocks or beds of the coal measures, also some of the clay slates, bricks, or forms cut from these, should be thoroughly dried and very gradually brought up to a red heat; and where lamination or cleavage exists, they should be built in the furnace so as to expose the edge of the cleavage to the friction. Other silicates of alumina and silicates of magnesia will answer if sufficiently fire-proof and compact after being fired. Limestone and magnesia limestone, if found compact enough after burning, may then also be sawn into bricks for the purpose.

I would have it understood that I do not claim as part of my invention the means for granulating or dividing cast iron, nor the use of the cylinder or apparatus for heating the mixture as herein described; nor do I confine myself to any particular size of granule or proportion of cinder, or length of time for heating them together. I do claim the heating a mixture of cast iron and iron oxide, each being in a granulated or divided state at a heat below the fusing point of the cinder, and then removing the mixture into another furnace, (or it may be another part of the same furnace,) where it is subjected to a heat which melts the cinder and allows of the metal being collected together into puddle balls.

I would also have it understood that I do not claim as part of my invention the use of any of the above-mentioned minerals, as fettling, or for moulding bricks therefrom for puddling furnaces; but I do claim the lining of that part of revolving or reciprocating puddling furnaces which is exposed to the friction of the iron in the charge, whilst working with blocks or forms cut or shaped from the minerals above described.

J. G. WILLANS.

Witnesses:

G. F. WARREN, }
JOHN DEAN, } Both of No. 17 Gracechurch Street, London, E. C.