UNITED STATES PATENT OFFICE.

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PROCESS OF MANUFACTURING CRUCIBLE CAST-STEEL.

SPECIFICATION forming part of Letters Patent No. 283,141, dated August 14, 1883.

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To all whom it may concern:

Be it known that I, JACOB REESE, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a certain new and useful Improvement in Processes for the Manufacture of Crucible Cast-Steel; and I do hereby declare the following to be a full, clear, and exact description thereof.

Crucible cast-steel has heretofore been manufactured from blister-steel or wrought-iron, or iron and steel scrap. The crucibles, or "pots," as they are called, are made of German clay and plumbago, and generally hold about ninety pounds of scrap metal.

The object of my invention is to produce an improved quality of crucible cast-steel at a reduced cost.

My invention consists in the hereinafter-described process for attaining said object.

In the practice of my invention I blow non-phosphoritic molten iron with an air-blast in a silicious-lined converter until the silicon and carbon are eliminated. The metal is then, minus the slag, poured into crucibles which have been previously heated, and having therein such chemicals, flux, or manganese metal as may be required for the production of the grade of steel desired. When the pots are thus filled the lids are put on, and they are placed in the melting-furnace and subjected to the usual treatment after melting. When the steel has thus been subjected to the dead melt, the pots are withdrawn and the metal poured into ingot-molds.

In the practice of this invention, when phosphoritic metal is used, he molten metal may be desiliconized and decarburized, as before described, and then, minus the silicious slag, poured into a basic-lined vessel, and, in the presence of basic additions, therein subjected to an overblow until the phosphorus is oxidized to phosphoric acid and held in the slag as a phosphate. The metal should then, minus the phosphoritic slag, be poured into hot crucibles placed in the furnace and subjected to the refining and dead-melt period, after which the crucibles may be withdrawn and the metal poured into ingot-molds; or the phosphoritic metal may be run direct into a basic-lined vessel and therein blown until the silicon and carbon are eliminated, and the blow then continued, in the presence of a highly basic slag, until the phosphorus is oxidized, and thus removed from the metal and held in the slag as a phosphate. The desiliconized, decarburized, and dephosphorized metal thus made may then be poured into the hot crucibles and subjected to the treatment before described; but in either case great care should be taken to exclude both the silicious and the phosphoritic slag from the crucibles.

The time required to produce a heat by this process will not exceed one hour, as the pots are hot and the metal is in a highly fluid condition; and, taking the ordinary-sized pots, in which ninety pounds is the utmost that can now be packed in them, by my method of charging them with metal in a fluid state I am enabled to put into each crucible one hundred and twenty-five pounds.

In the practice of my invention the chemicals, flux, and manganesic additions are carefully weighed and kept in cans ready for use, and immediately after the crucible is emptied the contents of one of these cans is placed in it and the molten metal then poured in until the vessel is sufficiently filled. The charged pot is then placed in the furnace and treated as before described. In no case should the pots be permitted to get cold until they are worn out, and in case the molten metal is not ready for a fresh charge the pots should be returned to the furnace immediately after pouring, in order that they may be kept in a hot condition, ready for the next charge, as the cooling and reheating of crucibles is very destructive to them, and often cause the pots to crack and permit their contents to flow out into the furnace, which is not only a loss of pots and metal, but the metal getting into the gas-ports obstructs the proper working of the furnace.

In the practice of my invention, in works where thirty five-pot melting-furnaces are used, I employ a five-ton converter, and by making two blows per hour I am enabled to produce with such a plant two hundred net tons of crucible cast-steel ingots per day of twenty hours, leaving ample time for repairs, while in the present crucible practice not more than thirty-five net tons can be produced per day from five thirty-pot melting-furnaces.

In the practice of the old process of pro-

ducing crucible cast steel, by charging scrap and pieces of steel while cold into the pots, a considerable amount of oxides and dirt is admixed with the charge, as the metal is all more or less oxidized on its surface, and carries with it a considerable amount of dirt. When the metal is melted it only fills the pot two-thirds full. The oxides and dirt float upon the surface of the metal, which, with the fluxing materials, forms a fusible and very destructive slag, which decomposes the pot at the slag horizon, thus cutting a ring or annular groove around the inside of the pot about one-third the distance from the top of the pot to its bottom. In my process the dirt is entirely avoided, and by deoxidizing the molten metal previous to its being poured out of the converter oxides are also excluded from the crucibles, and they are charged with a pure iron in a fluid state, and thus the destruction of the pots from the action of the slag will be almost, if not entirely, avoided.

By the old process, in which the metal is melted in the pots, it is exceedingly costly to produce homogeneous steel, low in carbon, for boiler-plate, as it requires a very high and continuous temperature to melt a charge which is principally of wrought-iron; but in my improved process I melt cast-iron, which is easily fused, and convert it into fluid desiliconized and decarburized iron, and by charging the pots with that quality I am enabled to produce soft or homogeneous steel as cheap as any other grade.

The advantages of this invention are, first, the metal may thus be placed within the crucibles at less cost per ton than by the old method of charging cold material into cold pots; second, a series of pots may be charged with a metal of absolute uniform quality; third, the cost of fuel for melting and refining in the pots will be reduced eighty-five per cent., because 5.88 times the metal, with the same fuel, will be produced by my process as is now produced by the method of charging cold material into cold pots; fourth, the cost of crucibles will be reduced fully fifty per cent., as they may be used double the number of heats, owing to the short time they remain in the furnace, and by reason of keeping them continuously hot; fifth, the cost of plant per ton of ingots produced will be largely reduced, even after taking into consideration the Bessemer additions; sixth, a better and more uniform quality of steel can be produced, because a uniform quality of metal is charged into the pots, and for this reason a uniform treatment can be given to it and a uniform duration of the dead melt secured; seventh, scrap may be utilized to much better advantage, as by the old practice the scrap must be sheared or broken into small pieces, so as to be closely packed in the pots, while in my improved process the unsheared scrap may be thrown into the converter and therein melted in the act of blowing; eighth, by excluding the dirt and oxides from the crucible the life of the pot is extended and a better quality of steel may be produced; ninth, by charging decarburized iron in a molten state into the crucible soft or homogeneous steel may be produced at no greater cost than that which is highly carburized.

I wish it distinctly understood that I do not in this application claim any part of the process or processes described by which the cast-iron is converted in the Bessemer vessel as distinct and separate from its further treatment, as set forth; but when such treatment is supplemented with a further treatment in crucibles it becomes a part of this invention.

I am aware that it is not broadly new to charge molten metal into previously-heated crucibles for the purpose of producing steel. This therefore I do not claim; but

What I do claim is—

1. The process herein described for producing crucible cast-steel, which consists, first, in desiliconizing and decarburizing iron; second, in charging said molten iron into crucibles containing deoxidizing, fluxing, and steel-producing agents; and, third, in subjecting said iron, while contained in said crucibles, to a dead melt, substantially in the manner and for the purposes described.

2. The process herein described for the production of homogeneous steel, which consists, essentially, first, in desiliconizing, decarburizing, and dephosphorizing cast-iron; second, in charging the molten metal into previously-heated crucibles containing deoxidizing, fluxing, and recarburizing agents; and, third, in subjecting the metal to a dead melt, substantially in the manner and for the purposes described.

JAGOB REESE.

Witnesses:
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