UNITED STATES PATENT OFFICE.

CHARLES C. McCARTEY, OF KNOXVILLE, TENNESSEE.

IMPROVEMENT IN PROCESSES OF PRODUCING WROUGHT-IRON AND STEEL FROM COLD-SHORT PIG.

Specification forming part of Letters Patent No. **191,698**, dated June 5, 1877; application filed May 28, 1877.

To all whom it may concern:

Be it known that I, CHARLES C. McCARTEY, of Knoxville, in the county of Knox and State of Tennessee, have invented certain new and useful Improvements in Process of Making Iron and Steel, of which the following is a specification:

The object of this invention is to make either wrought-iron or steel from cold-short or phosphorus pig-iron, alone or mixed with other iron.

The invention consists of treating the cold-short pig-iron with a definite dose of manganese, or compound containing manganese, and an alkaline carbonate, such as soda-ash and carbonate of soda, the dose of chemicals being proportioned to the amount of phosphorus contained in the iron, and the heat and time of treatment being regulated so as to produce either iron or steel, as desired, and also so as to produce different qualities of steel as wanted.

The following description will enable others to carry out the invention.

As a good example to illustrate in a practical way the invention, I give the complete method of producing from what is known as Mayville or Iron Ridge pig-metal, good bar iron or steel. The analysis of this metal shows it to contain about 2.63 per cent. of phosphorus, and it is quite cold-short, and would require much skill if treated in the ordinary manner of puddling or boiling to produce any bar-iron, and good iron cannot be produced at all.

The work may be conducted in the ordinary puddling or boiling furnace with a fix or felting of pulverized magnetic oxide of iron. This magnetic oxide is very free from phosphorus, and, therefore, the amount of phosphorus in the pig-metal will not be increased. Upon the hearth is placed the usual bed of slag, roll or hammer scale, and wrought-iron scrap, as commonly used in puddling. Upon this is placed the charge of pig-metal to be treated, which is melted in the usual way upon the hearth of the furnace. As soon as it is melted, for every three hundred pounds of melted cast-iron I add three pounds of black oxide of manganese, three-fourths of a pound of carbonate of soda, and one-fourth pound of soda-ash, these chemicals being pulverized and well mixed together. The damper is kept well open, so as to run up to near a white heat, which will cause the impurities of the iron to separate and unite with the chemicals, and be washed off with the slag. When the iron has "come to nature," and the ball formed by the usual manipulation, it is to be taken out and put through the squeezer or other compacting device, and next drawn into muck-bar.

The operation of forming the puddle-ball may be completed in, say, an hour to an hour and fifteen minutes in the ordinary puddling-furnace, the best results being obtained by taking out the ball as soon as it has sufficient consistency to be handled, further heating having a tendency to cause the phosphorus to return to the iron. The muck-bar is next cut into fagots, piled, reheated in a heating-furnace, and drawn or rolled into any form required, and will be a good article of merchantable iron, free from shortness, either hot or cold.

When the final result is to be steel, steely iron, or homogeneous metal, the treatment is to be varied as follows, using the same metal and chemicals as before: The heating is kept up till the charge begins to show signs of coming to nature—that is, when it begins to grain or curdle. The chemicals are then added, and the damper closed, so as to prevent the further decarbonization of the pig-metal. The puddler should then work the charge with the bar, taking care to keep the mass well covered with the slag, so as to prevent as much as possible the contact of the oxygen with the iron. When the whole mass has come to nature, and the metal is uniform beneath the slag, and separated therefrom, the muck-ball is formed, taken out, and hammered, so as to form a bloom, which may be reheated and drawn either by hammering or rolling.

The steel or steely iron thus produced is a good article for many purposes; but in order to make it into good cast-steel, the hammer-bloom should be drawn into bars about two inches wide and half-inch thick, and then cut into mold pieces or chips, as ordinarily practiced in making crucible-steel. The pieces are then melted in a crucible with the addition of

half pound of black oxide of manganese and a fourth pound of pulverized charcoal to each charge of seventy-five pounds of the pieces of steel.

I have described the operation as it is conducted with the ordinary puddling-furnace, and the ordinary mode of heating such furnace; but other forms of furnaces and other modes of heating may be substituted without departing from the nature of the invention, as hereinabove stated.

I have given the proportions of chemicals to be used when treating an iron of the character of the Mayville pig-metal. Other irons have some more and some less of phosphorus, for which the proportions should be varied accordingly.

I have described the use of soda-salts, which I prefer, but potash-salts may be substituted.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

The process herein described for producing wrought-iron and steel from cold-short pig-iron, consisting in treating such iron with a definite dose, corresponding to the quantity of phosphorus in the iron, of manganese and alkali on the hearth of a puddling or equivalent furnace, with a regulated heat, as described, and the manner of manipulation set forth, all substantially as specified.

In testimony that I claim the foregoing I have hereunto set my hand in the presence of the subscribing witnesses.

C. C. McCARTEY.

Witnesses:

E. C. WEAVER,

GEO. T. GIBBONS.