

UNITED STATES PATENT OFFICE.

CHARLES M. NES, OF YORK, PENNSYLVANIA.

IMPROVEMENT IN THE MANUFACTURE OF SILICON STEEL.

Specification forming part of Letters Patent No. 112,068, dated February 21, 1871.

To all whom it may concern:

Be it known that I, CHARLES M. NES, of York, in the county of York and State of Pennsylvania, have invented certain new and useful Improvements in the Manufacture of Steel, of which the following is a specification:

The nature of my invention consists in the production of a new steel possessing characteristics which do not belong to any steel heretofore known. It is formed by melting ordinary pig-iron with certain ingredients, by which means a steel is produced containing greatly-increased percentage of silicon and a greatly-reduced percentage of carbon, as compared with steel now in use. In order to introduce this silicon into the iron, I prefer to use a silicious magnetic ore, composed in the main of free silica and the magnetic silicide of iron, which may be found in Heidelberg township, York county, Pennsylvania, at a place known as "Nes's Hill." The ore is not, however, limited to this locality, but may be found in many other places; and while I prefer the use of an ore such as described, yet any other substance, whether artificially prepared or not, which will effect substantially the same result, may be used.

As above stated, the peculiar characteristic of the steel herein claimed lies in the greatly-increased quantity of silicon which it contains—an element which seems to take the place of the carbon in great measure.

An analysis of a very high steel made in accordance with my invention is as follows:

| | |
|----------------|---------------|
| Carbon | 0.600 |
| Silicon | 0.552 |
| Iron, &c. | 98.848 |
| | <hr/> 100.000 |

In this very high steel the percentage of silicon is fully double that which is found in ordinary commercial steel, while the percentage of carbon is notably below the average. In lower grades of steel the percentage of carbon continues less than, and the proportion of silicon is still notably in excess of, that heretofore found in ordinary steel of similar grades. Under any circumstances the ratio of silicon to carbon will not be less than one of the

former to two of the latter. This steel, which may be termed "silicon steel," is much better in many respects than the steel now in use. It has increased malleability, tensile strength of material, and greater hardness in tempering. It is capable of sustaining a higher heat, and possesses better welding properties. It may be reheated without injuring its quality, and it is highly magnetic. The silicon takes the place of carbon to a great extent, and the result is the production of a superior steel, whether wrought or cast.

To enable those skilled in the art to understand and use my invention, I will proceed to indicate the manner in which the steel may be produced, using the ore hereinbefore specified as the steel-making agent.

One method I have adopted of making cast-steel is as follows: I employ an ordinary "run-out," such as is used in forges, large enough to contain, say, two tons of metal. On each side of this I have a pot with a hearth at the end, the flue of which communicates with the stack of the run-out. These pots are lower than the chamber or pot of the run-out, and will hold half a ton each, more or less. To the run-out I have water-tuyeres attached, so that I can blow on the fuel and pig-iron. I take six bushels of coke and put one-half of it into the pot or chamber of the run-out. I then take one ton of pig metal—anthracite or charcoal—Nos. 1, 2, and 3, mixed in about equal proportions, and place a layer of it crosswise over the pot in which the coke has been placed, then place a layer of coke upon the layer of metal, and so on alternately until all the metal has been piled on. To the ton of metal I take from one-fifth to one-third of a ton of the ore hereinbefore named, in a washed or unwashed condition, and preferably broken up in pieces about the size of the pieces of coke, which I either mix with the coke or put into the run-out when the metal is nearly melted. I now proceed to blow from the water-tuyeres a blast onto the mass until the metal is perfectly melted and the ore thoroughly mixed with it by boiling. When the metal is nearly ready to come to nature I run it into the side furnace-pots, one-half into each, where I stir it for a short time with a rabble, taking out in a ladle a small quantity of the metal to ascer-

tain whether it will bear the hammer. When I find it will do so I tap it out into molds of any shape desired.

When I desire to make wrought-steel I proceed in the same manner, stirring the metal in the side pots or furnaces until it balls or comes to nature.

I also sometimes produce cast-steel as follows: I take an ordinary cupola, having a capacity of from one to five tons, with a dam-plate and cinder-tap, as in blast-furnaces with water-tuyeres attached. I now put in six hundred pounds of coal, more or less, or an equivalent amount of coke or charcoal, and one ton of pig-iron mixed with from one-fifth to one-half of a ton of ore, depending whether a low or high steel is required. I now blow onto the mass till it is thoroughly melted and the cinder begins to rise. I then tap off the cinder and continue blowing, tapping off through a small orifice for the purpose a small quantity of the metal, to ascertain whether it will bear the hammer. When assured of that fact I tap the metal into molds of any required shape.

If I desire to make wrought-steel from the same, I run the metal from the cupola to a lumping fire or furnace, ordinarily employed for the purpose of balling up metal, and there

stir the metal, ball it up, and then put it under the hammer.

I have thus indicated one or two modes in which my improved steel can be produced; but it is manifest that any apparatus suitable for making steel can be employed for the purpose, such as the converter, Dank's furnace, &c., and while I can use ordinary commercial pig, yet any other suitable cast-iron may be employed.

I do not limit myself to the precise proportion of ore herein specified, as a greater or less percentage may be successfully employed in many instances; nor, as above stated, do I confine myself to the use of the ore found in the particular locality hereinbefore named; but

What I claim as my invention, and desire to secure by Letters Patent, is—

The improved steel or steel-like metal herein described, and denominated "silicon steel," in which the ratio of silicon to carbon is not less than one to two:

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

Witnesses:

CHAS. M. NES.

M. BAILEY,

EDM. F. BROWN.