

# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN THE MANUFACTURE OF STEEL.

Specification forming part of Letters Patent No. **145,005**, dated November 25, 1873; application filed November 21, 1873.

*To all whom it may concern:*

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

This invention relates to the manufacture of steel, either wrought or cast, from ordinary pig or cast iron, by an admixture with the same of pig-iron made from magnetic silicide of iron ore, commonly called Coderus ore, or from said ore mingled with ordinary hematite or other good iron ore, the said admixture of silicon pig-iron and ordinary pig-iron being treated or worked substantially as herein described.

To enable others to understand and use my invention, I shall describe the manner in which I prefer to produce said silicon pig-iron, and state the characteristics of said product, and will then specify some of the ways in which it may be employed, with or without ordinary pig, for the production of steel.

The following is one method of producing the silicon pig to be used in the after manufacture of steel: I charge a blast-furnace, cupola, or any other suitable furnace for the manufacture of pig-iron, with coal and iron ore, in the usual proportions well known to iron-manufacturers; but, in lieu of ordinary iron ore, I use for the ore-charge an admixture of equal, or substantially equal, parts of ordinary hematite, or other good iron ore, and the silicious magnetic or Coderus ore. After charging the furnace, I proceed to blow on the charge with a blast, such as is used in ordinary smelting-furnaces for the production of pig-iron, and, after the charge has been reduced, I run off the metal into pigs in the usual way. The pig thus produced is what I term "silicon pig," and is effectual for the manufacture of steel, either separately or in combination with ordinary pig-iron. The silicon pig can also be made by simply melting ordinary pig-iron in the cupola and stirring in from fifteen to twenty per cent. of the Coderus ore in pulverized form.

Many other ways of making the pig will readily suggest themselves to those practically experienced in iron manufacture. I wish to say that the proportions above given may vary—that more or less than stated of ordi-

nary ore, or pig or cast iron made from such ore, may be mingled with the Coderus ore, and that the pig may, if desired, be made wholly from the Coderus ore, although this would not, in the majority of cases, be necessary.

I here give an analysis of the silicon pig-iron, premising that the same may vary to some extent: Two ingots, fine grain, silicon 1.13 assay; one ingot, coarse grain, silicon 3.47 assay; one ingot, silicon 7. assay, nearly.

This silicon pig-iron can be used to make steel, or to convert ordinary cast-iron into steel, by simply decarbonizing the same in an ordinary puddling-furnace, refinery, blooming-fire, Danks' furnace, Bessemer converter, cupola, or any ordinary mode in use for decarbonizing cast-iron. When this silicon cast-iron is decarbonized, instead of turning to wrought-iron, it is silicon steel.

One of the modes employed is to use a common puddling or reverberatory furnace, fettling the same in the usual manner; charge the furnace with four hundred pounds of common pig-iron and two hundred pounds of the silicon pig-iron, and proceed to treat the same as is ordinarily done in puddling iron. An excellent silicon steel is thus produced.

Another mode, which is intended for making cast-steel, is as follows: I use a cupola in conjunction with a Bessemer converter; I melt in the cupola the silicon pig with ordinary pig, taken in the proportions stated in the preceding example, and then run the molten metal from the cupola into the converter. I then proceed to blow into the converter, as is ordinarily done in making Bessemer steel. There can thus be produced a fine silicon steel, which may be made even from inferior iron, with or without the use of spiegeleisen, and will be capable of hardening and tempering.

The above is sufficient to indicate the manner in which my invention is, or may be, carried into effect. I do not, of course, limit myself to the special method of procedure above described, the main and essential feature of my invention being the production of steel from an admixture of the silicon pig with ordinary pig-iron, or from the silicon pig separately, the special form of apparatus in which these elements are combined and treated being, of course, dependent, in a measure, upon the



quality of the product desired; nor do I limit myself to the special proportions of the mixture specified.

The quantity of silicon pig used with the ordinary pig will vary to some extent, according to the quality of the silicon pig. The proportions I have given relate to a silicon pig made of equal, or substantially equal, parts of good iron ore and Codorus ore. Where the silicon pig is made with less proportion of the Codorus ore, a greater quantity of the pig will be needed to make steel, and, on the other hand, a less quantity of the silicon pig may be used for the purpose when a greater quantity of the Codorus ore is used for making said pig.

The use of the silicon pig for steel-making purposes derives great importance from the fact that none of the crudities and impurities which are so apt to remain in the mass when the Codorus ore itself is mingled with the ordinary pig or cast iron to be converted into steel, find their way into the steel, or mass from which the steel is made, and a better, more homogeneous, and finer product is thus more readily obtained. Another advantage is, that the silicon pig can be made directly at or in the immediate vicinity of the mines, and

then transported to any place or any works where it is to be used for the purpose of making steel. Under the methods now in use for the making of steel by means of silicon ore, the ore itself must be transported to the place where it is to be used for steel-making, however distant that place may be from the mines; but, under my invention, this is remedied. The silicon pig is equally as effective as, and in some respects better than, the Codorus ore, is much less bulky, can be handled with greater ease, and costs very much less to transport than the ore.

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

The manufacture of steel from silicon pig-iron, either separately, or in combination with ordinary pig or cast iron, substantially as described.

In testimony whereof I have hereunto signed my name this 19th day of November, 1873.

CHAS. MOTIER NES.

Witnesses:

JOHN A. WILSON,  
JOHN W. STEWART.