UNITED STATES PATENT OFFICE.

JAMES HENDERSON, OF BELLEFONTE, PENNSYLVANIA.

BASIC PROCESS OF MANUFACTURING IRON AND STEEL.

SPECIFICATION forming part of Letters Patent No. 284,554, dated September 4, 1883.

Application filed August 10, 1883. (No specimens.)

To all whom it may concern:

Be it known that I, JAMES HENDERSON, of Bellefonte, in the county of Centre and State of Pennsylvania, (formerly of New York city,) have invented a certain new and useful Improvement in Basic Processes of Manufacturing Iron and Steel; and I hereby declare that the following is a full, clear, and exact description of the same.

The invention has for its object the removal of phosphorus from liquid cast-iron; and it consists in subjecting the metal in a basic-lined converter to the action of lime and of air and hydrogen, and under some circumstances to the action of a hydrocarbon, as more fully hereinafter set forth.

In carrying out this invention I make use of a Bessemer converter or similar vessel, lining the same with some basic or non-silicious material, which may be lime, magnesia, or magnesian lime, applied preferably in the form of burned brick; but other modes of applying these substances for which Letters Patent have been granted to me may be used.

The iron to be treated may be cast-iron rich in carbon and silicon, such as is generally used in the "acid process"—say containing two to three per cent. of silicon, three and a half to four per cent. of carbon, and too much phosphorus to make steel by that process; but I do not purpose to limit myself to the use of this iron. It is preferred, also, that the metal contain enough manganese—say from three to five per cent.—to effect the production of steel without the use of spiegeleisen at the end of the blowing. The iron may be taken direct from the blast-furnace to the converter, or melted in a cupola and poured into the converter, and blown in the usual way with air during the "first period," or that portion of the operation which is known as the "desiliconization period," or until the silicon is reduced to about or below five-tenths per cent. At the end of this period the converter preferably may be turned down and the slags poured from it, after which the lime is charged upon or into the metal in any convenient way, as by blowing it in with the air, the converter being raised to its usual position when at work. The blowing is then continued, steam being admitted into the blast-pipe with the air, and thus forced into the metal. The steam is decomposed by the heat into its constituents, the hydrogen becoming an efficient agent, in connection with the lime, in the removal of the phosphorus. After the metal has been blown until the carbon is reduced to approximately one per cent., petroleum or some equivalent hydrocarbon may be introduced with advantage for a period of two or three minutes, (its introduction into the blast-pipe being conveniently effected by means of an Archimedean screw.) The hydrogen of the petroleum contributes toward the removal of the phosphorus, while the carbon serves to increase the temperature of the metal, thus making it easier to pour from the converter. From two to three gallons of petroleum to each ton of metal may be used with advantage.

While it is preferred to use petroleum, as above described, this step in the process may be omitted, and yet good results be obtained. If, again, a sufficient quantity of petroleum be used, the use of steam may be dispensed with, as the petroleum will supply the requisite amount of hydrogen.

As above set forth, the silicious slags are to be poured from the converter after the first period. This, however, is not essential to the process, as the metal can be purified by the use of lime and hydrogen in connection with air, even if the slags are allowed to remain during the steps of the process that follow desiliconization. If the slags are not poured off, the lime may be introduced in the beginning of the process; but, as above set forth, if the slags are to be removed after the first period, it is better not to introduce the lime until afterward. If introduced before, a much larger quantity will be required, as a considerable amount will go into the slags. If the lime be introduced before desiliconization, the proportions should be approximately ten pounds of lime to each pound of silicon in the metal. If introduced after the slags have been removed, from fifty to one hundred pounds of lime will suffice.

For the purpose of removing redshortness and giving steely properties to the metal, it may, after the desiliconization or the decarbonization, be treated with ferro-manganese or with spiegeleisen, in the usual manner as practiced in the Bessemer process.

By the foregoing process the purification of

the metal from phosphorus is effected during the decarbonization period. This renders it unnecessary to use the "after-blow" with basic reagents to remove the phosphorus.

I do not herein broadly claim the use of steam and air in a basic-lined Bessemer converter after desiliconization of the iron, as this is described in Patent No. 283,783, dated August 28, 1883, my present application being an improvement on that in the respect that enough lime is supplied to neutralize the silicon without taking it from the lining for this purpose.

I do not claim, broadly, the use of hydrocarbon in the Bessemer process for keeping up the heat.

What I desire to claim and secure by Letters Patent is—

1. The improvement in the art of manufacturing iron and steel, which consists in charging the molten metal into a converter or other furnace lined with a basic or non-silicious material and dephosphorizing it therein with lime, and with air and hydrogen after desiliconization, substantially as and for the purpose described.

2. The improvement on the manufacture of iron and steel, which consists in charging the molten metal into a converter or other furnace lined with a basic or non-silicious material and dephosphorizing the metal therein with lime and with air and the vapor of water, and with hydrocarbon after desiliconization, substantially as and for the purpose described.

JAMES HENDERSON.

Witnesses:

SAML. A. DUNCAN,

R. F. GAYLORD.