United States Patent Office.

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IMPROVEMENT IN THE MANUFACTURE OF IRON AND STEEL.

The Schedule referred to in these Letters Patent and making part of the same.

We, HOWARD SPENCER and LAFFAYETTE K. SAYLOR, of Philadelphia, county of Philadelphia, State of Pennsylvania, have invented certain Improvements in the Manufacture of Iron and Steel, of which the following is a specification:

Nature and Object of the Invention.

Our invention consists in converting iron ore directly into steel, or refined cast-iron at one operation, and in one chamber of a furnace, substantially in the manner described hereafter.

General Description.

In carrying out our invention, we use a blast-furnace or cupola, but any style of furnace will serve the purpose, providing it contains a single chamber of proper capacity, and providing there be a blast of sufficient strength.

The crushed or stamped ore and fuel may be fed to the furnace somewhat after the manner adopted in making blooms direct from the ore, the latter being fed slowly in the first instance, and faster after the heat of the furnace has become more intense.

The rapidity with which the furnace is fed will depend upon the fluidity of the metal, which may be tested from time to time by an attendant. Should the metal become too thick, more charcoal or other fuel should be added, and a less proportion of ore fed to the furnace, and the fluidity of the metal may be increased by adding a little silica, or other equivalent flux, or by increasing the force of the blast.

It is most important in carrying out our invention that the metal should be maintained in a very fluid condition.

After the ore has been reduced, the blast is strengthened, and is allowed to act on the molten metal, which, owing to its fluid condition, is maintained in a state of ebullition, and thereby purified and partly decarbonized, after which it may be drawn off and cast into suitable ingots.

In order to enable others skilled in the manufacture of iron and steel to practise our invention, we will now proceed to describe more minutely the plan we have adopted in carrying it into effect.

In the first place, we used the magnetic ore or black oxide of iron, found in Harford county, Maryland. We have also used the red oxide of iron, found in the same locality, both qualities of ore having been employed both separately and together, with the same result as regards the product.

The fuel employed was charcoal, and the furnace consisted of a structure containing a single chamber, two feet square, and about six feet high.

A hot blast was used, and four tuyeres were employed, two on each side, the orifice of each tuyere having an area of about two inches, and the tuyeres were situated about ten inches above the hearth, and were inclined downward toward the latter.

In feeding the furnace, we proceeded as follows:

The ore was first stamped or crushed, the pieces being of the size of a pin's head, or thereabouts.

The fire having been properly kindled, the surface of the ignited fuel was sprinkled with the stamped ore, three or four shovelfuls being used; then about a bushel of charcoal was added; then more ore and more charcoal, the intervals of feeding with ore and fuel being determined by the condition of the fire and metal.

When the metal appeared to the attendant to be too thick, powdered quartz in small quantities was occasionally added as a flux.

Toward the close of the operation, when the mass of molten metal extended nearly to the tuyeres, we discontinued the feeding with charcoal (but not with ore) for a short time, and increased the force of the blast for from five to ten minutes, so as to maintain the metal in a state of ebullition before tapping.

After tapping the operation was promptly resumed, the only interruption in the continuity of the process being the few minutes consumed in tapping, and in causing the blast to play with increased force on the molten metal for a short time previous to tapping.

We occasionally added to the ore small quantities of manganese or chromate of iron, with the view of producing steel of different qualities.

In the furnace, and by the process described above, we have succeeded in converting the ore directly into steel, at the rate of about five hundred pounds in three hours.

It should be understood that the slag was removed from time to time from the furnace.

It may be remarked here that if the metal, in reducing the ore, be very highly carbonized, less fuel should be used, and the ore should be fed more rapidly to the furnace.

Wrought-iron in small quantities may be added to the molten metal, so as to aid in decarbonizing the same, and for other purposes; and, if desired, manganese or chromate of iron may be added for producing steel of different qualities.

In making refined cast-iron, the ore should be fed to the furnace more slowly, and the quantity of fuel should be increased.

When the blast is acting on the mass of molten metal, toward the close of the operation, it may be increased in force, and this increased blast may be continued for five or ten minutes, or for such a length of time as may be necessary to partly decarbonize and purify the metal sufficiently to make either a high or low grade of steel.

In making refined cast-iron, the force of the blast may be decreased.

In addition to the economical manufacture of cast-steel and refined cast-iron, by the above-described process, we have found that the latter may, with a slight modification in the treatment of the ore, be applied to the conversion of the ore directly into a refined wrought-iron.

Claim.

The process, substantially as described, of converting iron ore directly into steel, or into refined cast-iron, at one operation, and in one chamber of a blast-furnace.

In testimony whereof, we have signed our names to this specification, in the presence of two subscribing witnesses.

HOWARD SPENCER.
LAFFAYETTE K. SAYLOR.

Witnesses:
H. HOWSON,
LOUIS BOSWELL.