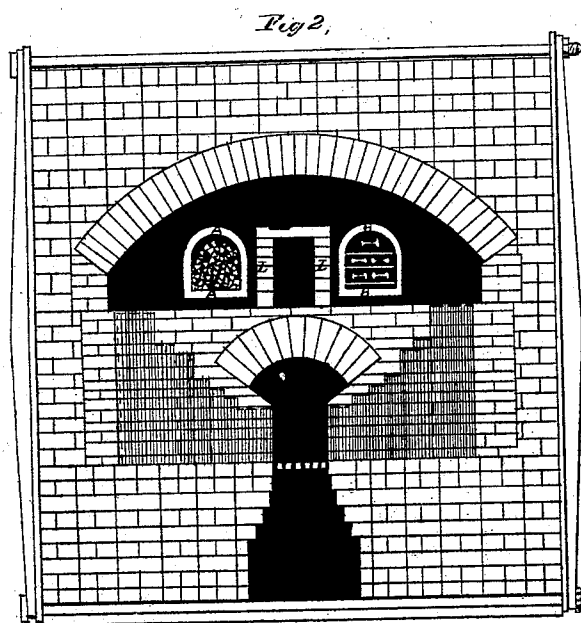
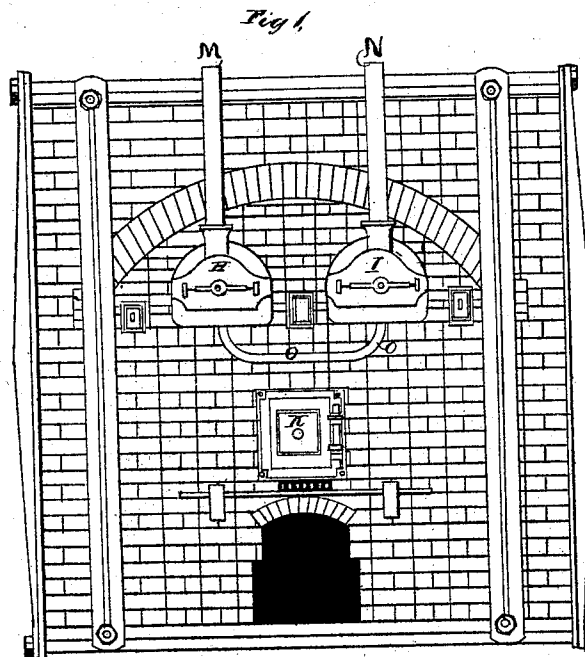


J. WEBSTER.

Apparatus for Converting Iron into Steel.

No. 137,742.

Patented April 8, 1873.



Witnesses:
James B. Clark

H. E. Matthews,

Inventor.

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by Dyer, Beadell & Co.
Attys.

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Fig 3.

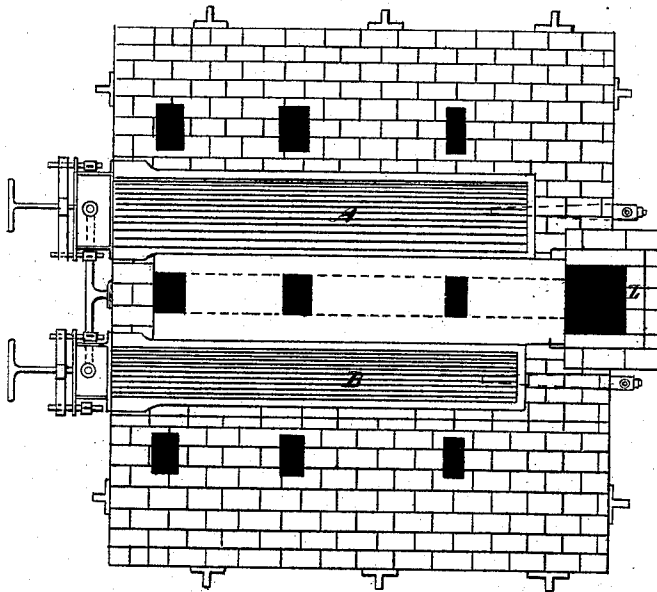
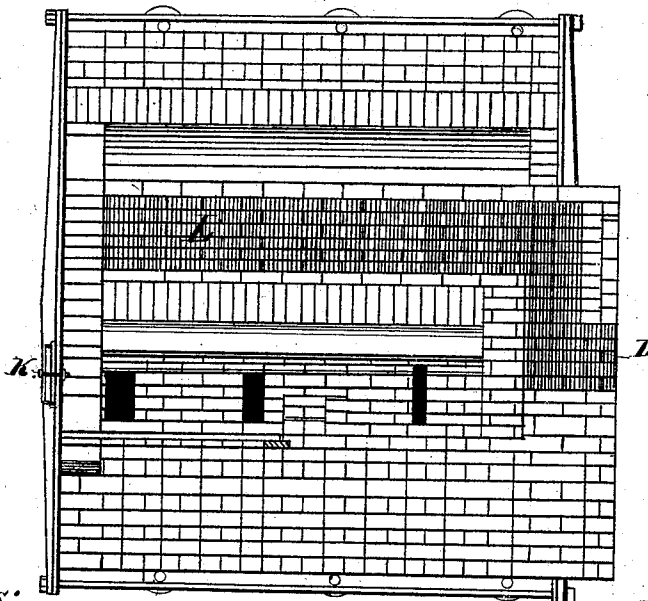


Fig 4.



Witnesses;

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Fig 5.

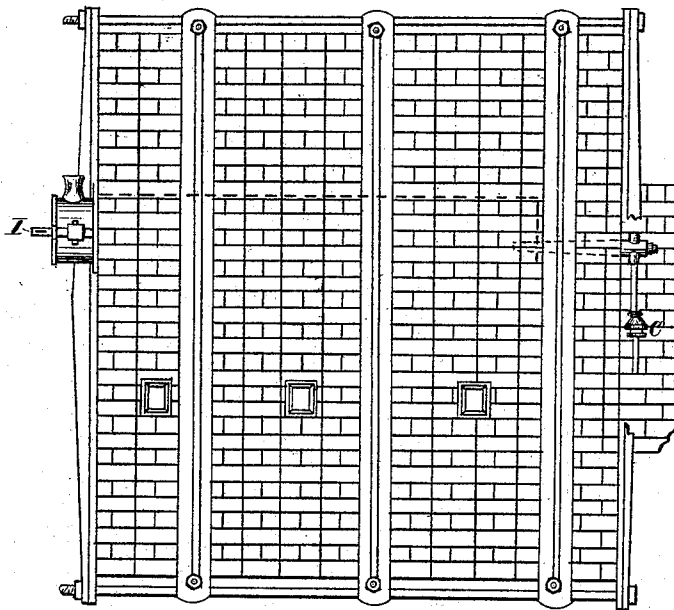
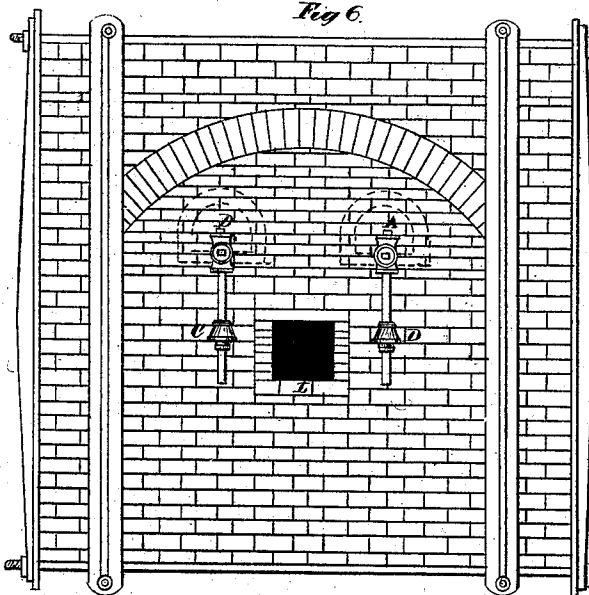
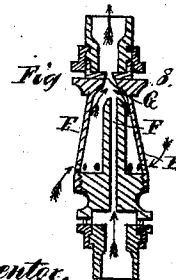
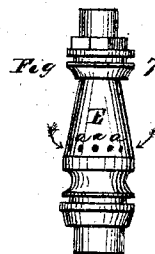


Fig 6.



Witnesses,
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UNITED STATES PATENT OFFICE.

JAMES WEBSTER, OF BIRMINGHAM, ENGLAND.

IMPROVEMENT IN APPARATUS FOR CONVERTING IRON INTO STEEL.

Specification forming part of Letters Patent No. **137,742**, dated April 8, 1873; application filed October 24, 1872.

To all whom it may concern:

Be it known that I, JAMES WEBSTER, of Birmingham, in the county of Warwick and Kingdom of England, engineer, a subject under the Crown of Great Britain, have invented Improvements in the Manufacture of Iron and Steel, and in the recovery of certain gases resulting from such operation; and I do hereby declare that the following is a full and exact description of my said invention—that is to say:

This invention consists in certain apparatus for carbonizing or steeling wrought-iron by passing through it, while in a heated state, carbureted hydrogen or common coal-gas, in combination with nitrogen or atmospheric air; or a combination of carbonic oxide or carbonic-acid gases mixed with nitrogen or vapor of carbon may be used so long as the following four gases, namely, carbon, hydrogen, oxygen, and nitrogen, in suitable proportions and combined or not combined, come into contact with the iron while in a heated or molten state.

The mode in which I prefer to carry out my invention is as follows: The wrought-iron, in any suitable form, is heated in a retort within a furnace closed from the atmosphere to a bright-red heat; while in this state coal-gas mixed with about its own bulk of common atmospheric air or nitrogen from any source is forced or drawn through and among the heated metal, thus carbonizing or steeling the metal to any required degree or depth, and producing carbonate of iron, or spiegeleisen, or blister steel, according to the extent of the operation. The gas in its passage through the retort is deprived of the bulk of its carbon, and the remaining gas, consisting of hydrogen, nitrogen, and carbonic oxide, is then drawn off into a suitable receiver; and the said gas may be employed for the purpose of refining cast-iron or other like metals by being forced into them when in a molten state, recovering such metals from their oxides; or the superfluous gas may be drawn into the furnace to assist in heating the retorts.

The precise nature of my invention will be more readily understood by a description of the accompanying drawing, reference being had to the letters and figures marked thereupon.

Figure 1, Sheet 1, is a front elevation, and Fig. 2 a transverse section, of a furnace suitably constructed for containing two retorts, A and B. Fig. 3, Sheet 2, is a sectional plan of the apparatus; and Fig. 4, a longitudinal section. Fig. 5, Sheet 3, is a side elevation, and Fig. 6 an end elevation, of the furnace.

A and B are the retorts for containing the metal to be operated upon. These retorts are placed in the furnace and are closed from the atmosphere. At the back of the retorts A and B, and communicating therewith by suitable inlet-pipes or tuyeres, are two of my improved nozzles, C and D, Figs. 5 and 6, Sheet 3, for conducting the gases into the retorts. These nozzles can be so adjusted that any required mixture of gases or atmospheric air or nitrogen or carbon may be obtained.

My improved nozzle is shown detached from the furnace and to an enlarged scale in section and elevation, Figs. 7 and 8, Sheet 3, and it consists briefly of two cones, E and F, the gas passing through the inner cone F, and the atmospheric air being drawn through perforations *a* in the outer cone E, and combining or mixing with the gas at or immediately above the point of discharge from the two cones, as at G, and thus passing in a combined form into the retorts.

Other means may, however, be employed for mixing and supplying the gases into the retorts A and B, such as the Bunsen burner for admitting gas, or taps to admit air and gas, or pumps, or other suitable mechanical means.

H and I are the doors of the retorts A and B, suitably fitted to exclude the atmosphere. K is the furnace fire-door, L being the ordinary flue. M and N are funnels or pipes with taps for discharging the gases recovered from the retorts, such gases passing into a suitable receiver or holder for subsequent use, as herein-after described; or the said gases, if not required for use, may be drawn from the retorts into a junction-pipe, O, and from thence into the fire of the furnace.

The remaining parts of the drawing merely illustrate ordinary details, such as are employed in furnaces similar to that shown, and require no further description.

I will now describe the mode of operation, and for the sake of illustration the retort A is

represented as having been filled with scrap-iron, the retort B containing railway rails; but any other form of wrought-iron may be similarly operated upon, such as bars, shafts, wheels, plates, blooms, piles, chains, or other articles requiring to be case-hardened or steeled to a certain depth, or throughout their entire substance. The retorts with the articles contained therein having been heated to a bright-red heat, the gas is turned on below the nozzles C D by suitable taps, at the same time causing a certain amount of atmospheric air to be drawn through the holes or perforations *a*, Figs. 7 and 8, of the nozzles; and such air passing up joins and mixes with the gas at the point G, Fig. 8; and the combined gas then enters the retorts and passes among the wrought-iron scrap and railway rails, when, the articles having been in the retorts for a suitable time, according to the depth of carbonizing or steeling required, may be withdrawn while in a heated state; the railway rails may then be rolled or finished as steel rails, and the scrap-iron being removed may be melted and cast into ingots of cast-steel.

If very hard steel is required to be produced, the process of carbonizing in the retorts is carried on for a longer period than in the case of producing soft steel. If spiegeleisen is required for the manufacture of cast-steel, a high temperature will be necessary, so that the wrought-iron may melted and run from the retort, which is placed in an inclined position for such purpose, a tap being provided at the lower end of the same. Blister or shear steel may also be produced, as described, from wrought-iron bars carbonized in the retorts, for subsequent tilting or welding for cutlery or other like uses. Small articles may be sim-

ilarly carbonized or steeled, such as wood-screws, wire, and chains, and without injury to their form.

The carbonizing gas in its passage through or among the wrought-iron will necessarily be deprived of a great portion of its carbon by its action thereupon, and the remaining gas will consist of hydrogen, nitrogen, and carbonic oxide. This gas I draw off from the retorts through the pipes M and N, Fig. 1, into a suitable receiver, and such gas may be used to purify cast-iron or other metals while in a molten state, and to recover them from their oxides; or the superfluous gas from the retorts may be drawn through the junction-pipe O, Fig. 1, into the fire of the furnace for assisting in heating the furnace.

I am aware of the patent of J. F. Boynton, July 9, 1867, No. 66,452, and July 16, 1867, No. 66,785; and of T. J. Banon, January 1, 1867, No. 60,823; and do not claim the process described therein.

Having thus described the nature and object of my said invention and the manner in which the same may be carried out, I claim—

1. The described furnace, having the retorts A B, pipes M N O, and nozzles C D, arranged as described, for the purpose set forth.

2. The improved nozzle shown in Figs. 7 and 8, Sheet 3, for admitting, regulating, and mixing the gases into the retorts, as herein described.

The above specification of my invention signed by me this 9th day of September, 1872.

JAMES WEBSTER.

Witnesses:

HENRY F. TALBOT,
WM. T. FOULKES.