

C. CARPENTER, Jr.

Manufacture of Iron and Steel.

No. 145,843.

Patented Dec. 23, 1873.

Fig. 1.

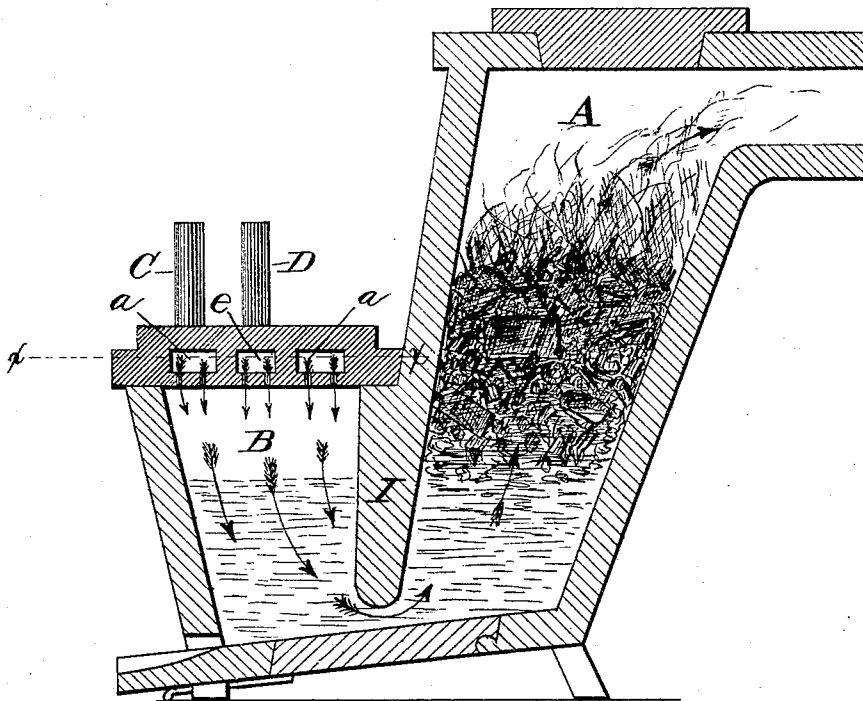
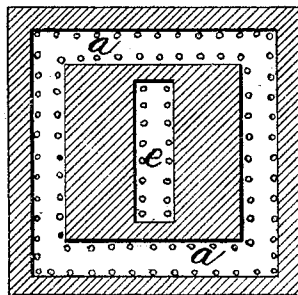


Fig. 2.



Witnesses:

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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN THE MANUFACTURE OF IRON AND STEEL.

Specification forming part of Letters Patent No. **145,843**, dated December 23, 1873; application filed July 2, 1873.

To all whom it may concern:

Be it known that I, CALVIN CARPENTER, Jr., of Seekonk, in the county of Bristol and State of Massachusetts, have invented certain Improvements in the Manufacture of Iron and Steel, of which the following is a specification:

My invention relates to the manufacture of iron and steel; and it consists in a novel construction of the furnace, the application of a chemical-fuel blast, a new compound or flux, and a cold blast of reduced temperature, the whole constituting a new process of treating metals, as hereinafter more fully explained.

Figure 1 is a longitudinal vertical section of my improved furnace. Fig. 2 is a horizontal section on the line *xx* of Fig. 1.

The object of my invention is to treat ores, scrap iron or steel, old castings, refuse malleable castings, iron-slag, and similar material, in such a manner as to produce therefrom malleable cast iron or steel for castings, and by which wrought-iron and steel may be made tough and malleable without the ordinary process of puddling or cementation.

To accomplish these objects, I construct a furnace of the general style and form represented in the drawings, in which—

A represents a chamber, into which I put the ore or metal to be melted, and B represents a chamber or converter, in which the molten metal is treated. As shown in the drawing, these chambers are connected at the bottom by an open passage, whereby the metal as fast as it is melted in chamber A is permitted to flow under the partition-wall I into the chamber B. The chamber B is closed air-tight, and is provided at its top with a series of small openings connecting with two separate passages, *a* and *e*, made in the top portion, as shown in Figs. 1 and 2, a tube, C, entering the passage *a*, and a similar tube, D, entering the passage *e*, as represented in Fig. 1. The passage *e* occupies the center, while the passage *a* occupies the space surrounding it, but separate and distinct from it, as shown in Fig. 2. The furnace may be of any desired size, and will, of course, be provided with a suitable opening with cover for charging it, and also with a similar arrangement at the bottom for removing the residue after completing the operation.

Having thus constructed my furnace, I proceed to prepare my chemical compound, or, as I term it, compound chemical hot-blast, as follows: Into hydrocarbon oil, preferably crude petroleum, I put potash, then vaporize the compound, and hold the vapor under a pressure equal to that required for the blast—say, from twenty-five to thirty pounds per square inch, and then combine with this vapor steam in the proportions of from one-fourth to one-eighth part steam to one-part of hydrocarbon vapor. These vapors thus united, I pass through tube C into the passage *a*, and from thence in small jets into the chamber B, this constituting what I term the fuel portion of my compound blast. Through the other tube D and its passage *e*, I force air, heated to about 600°, as a supporter of combustion, the two blasts uniting in the chamber B, and creating an intense heat in the furnace.

It will be seen that as soon as the metal in chamber A begins to melt, the molten portion will flow under the partition I into the chamber B, and that as soon as the molten metal rises so as to close the passage under the partition I, the compound blast will have to pass down through the molten metal in chamber B, and from thence up through the metal in chamber A, as indicated by the arrows in Fig. 1. By this means the melting and the refining or converting processes are both carried on at the same time and by the same blast.

In order to carry out my process in producing the best quality of iron and steel, I use a flux, which I prepare as follows: I make a powder of about equal portions of lime, clay, and quartz or silica, ground and mixed into a paste by the addition of a strong solution of potash and water. The water is then dried out or evaporated, and the mass again ground or pulverized, so as to be intimately and evenly mixed with the charge in the furnace. This flux imparts to the metal superior weldable properties.

In charging the furnace with ore of about seventy-five per cent. iron, I use from one to two hundred pounds of this flux to a ton of ore; and, when using cast scrap metal, I use about fifty pounds of the flux to the ton of metal, and about two hundred pounds of the flux to the ton of wrought scrap metal. By

altering these proportions, the nature or quality of the resulting product will be altered or varied accordingly, the operator of course varying the proportions according to the result which he desires to produce.

The furnace being charged with the ore or scrap and the flux, as above described, the blast is applied, and continued for a greater or less length of time, according as it is desired to produce malleable or wrought iron, or steel. The longer it is continued the more will the metal be refined, and the more nearly will it be converted into steel, it requiring less time to produce malleable iron, still more for wrought-iron, and more yet for steel.

To impart to iron poured from the furnace into ingots the fibrous texture of wrought-iron, it is only necessary to be rolled or hammered before cooling; and to produce iron or steel of great tenacity and strength the rolled or hammered bars are made into fagots, reheated with the compound blast, and then rolled in the ordinary manner, avoiding the use of mineral coals in heating or welding.

While for the ordinary purpose of producing iron or steel by my process the hot-blast should be used at about 600° of Fahrenheit, still, for certain purposes, I use a cold-air blast. For instance, if it be desired to produce steel specially adapted for magnets, I use the air-blast as cold as possible. The nearer it approaches the freezing-point the better. By using the cold-air blast the atomic structure of the metal is rendered more homogeneous, the atoms assuming more nearly the spherical form, the atoms of steel in that case becoming better recipients and retainers of the magnetic influence or property, and thereby forming magnets of greater retaining power. The heated air has its magnetism more diffused, and it opens to a greater degree of expansion the molten metal, which admits the nitrogen of the air into more perfect union with the hydrogen of the fuel-blast, and excludes a larger portion of the oxygen of the air from entering into combination with the carbon of the fuel-blast, which renders the product more malleable and soft. The cold air, being more positively electric, possesses the property of converting the iron into steel more quickly and with greater uniformity.

The compound chemical blast, as a whole, operates in the furnace to impart to the metal the following properties: The hydrocarbon vapor, saturated with potash, and the air with the steam, gives a chemical union of hydrogen

with the iron to form its malleable qualities—carbon, its hardening property; nitrogen, the fine-grained quality and density of atomic structure; potash imparting strength of texture, while oxygen acts as a purifying and reducing agent—thereby producing a superior quality of steel, adapted for cutlery and similar purposes. It will thus be seen that these chemical constituents are united with the metal in the process of smelting, and that, by regulating the proportions, the product may be rendered malleable or converted into steel at will; the compound chemical blast, thus constituted and applied, being a means of making iron and steel, and iron products generally, of a superior quality, without further treatment by puddling, cementation, or annealing.

I am aware that it has been proposed to construct a furnace with a chamber, in which the metal was to be melted, and from whence it flowed into a separate chamber or reservoir, to be treated; also, that air has been forced through molten metal from above, and also from below; also, that hydrocarbon vapors and steam have been used in blast-furnaces; and therefore I do not claim either of these as my invention; but

What I do claim is—

1. A furnace having the chamber A for melting the metal, and the chamber B, connected thereto, as shown, with the blast-inlets arranged at the top of the latter, the whole being constructed substantially as described, whereby the metal can be both melted and treated in the molten condition by the compound blast, in the manner set forth.
2. The chemical hot-blast, consisting of the vapor of hydrocarbon oil, in which potash has been dissolved, combined with steam, and then superheated, for the purpose of acting as a fuel, and also acting chemically on the metal, as herein set forth.
3. The compound blast, consisting of the combined vapors of steam and hydrocarbon oil, and of a blast of air reduced below the ordinary temperature, applied to molten metal, as described, for the purpose of rendering the product more magnetic, as set forth.
4. The flux consisting of lime, silica, clay, and potash, when prepared for use in a furnace, substantially as herein described.

CALVIN CARPENTER, JR.

Witnesses:

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