B. BAYLISS.

FURNACE AND PROCESS FOR MANUFACTURING IRON AND STEEL.

No. 186,975 Patented Feb. 6, 1877.

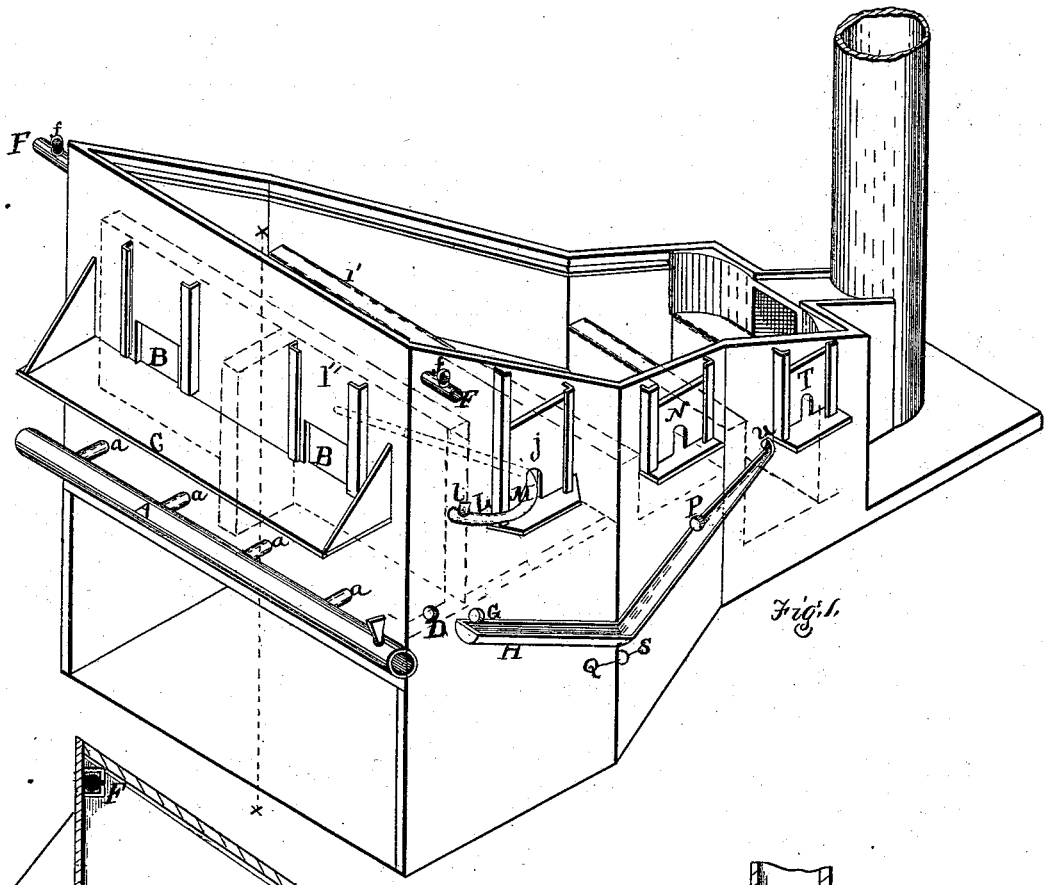

Fig. 1.

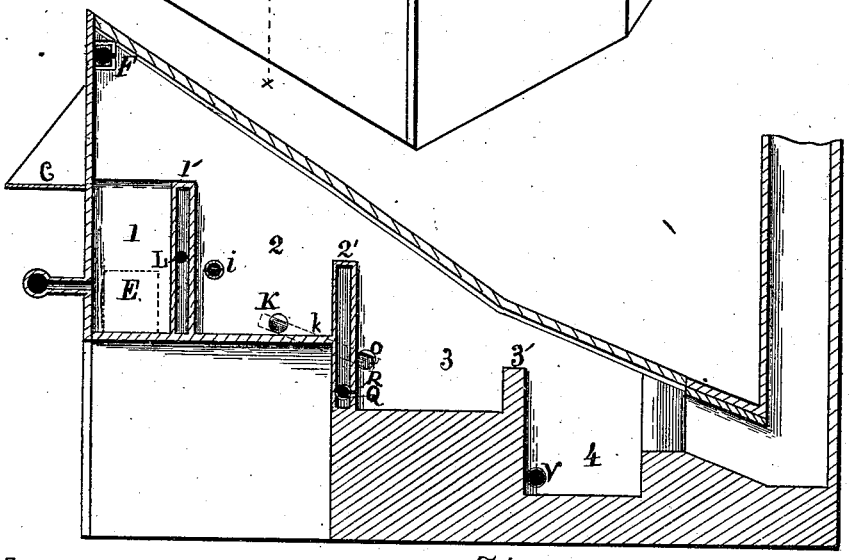

Fig. 2.

Witnesses

J. H. Stevenson

J. B. Hughes.

Inventor

Benjamin Bayliss.

UNITED STATES PATENT OFFICE.

BENJAMIN BAYLISS, OF PITTSBURG, PENNSYLVANIA.

IMPROVEMENT IN FURNACES AND PROCESSES FOR MANUFACTURING IRON AND STEEL.

Specification forming part of Letters Patent No. **186,975**, dated February 6, 1877; application filed February 11, 1876.

To all whom it may concern:

Be it known that I, BENJAMIN BAYLISS, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Metallurgic Furnaces; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawing, and to the letters of reference marked thereon, which form a part of this specification.

My invention consists of a furnace and process by which I purify crude iron, melt or flux steel, iron, and iron-ores, and make the same into cast-steel of such kind and quality as I desire.

In the accompanying drawings, which form part of my specification, Figure 1 is a perspective view, and Fig. 2 is a vertical and longitudinal section, of the same.

The letters and figures in Figs. 1 and 2 represent the same parts of the furnace in different views.

The form of the furnace is designed to carry out my purpose, as herein described, its width being contracted in that chamber (No. 4) in which I complete the process.

It has four chambers, numbered 1, 2, 3, and 4. No. 1 is a chamber for combustion. It has no grate, but has an air-pipe, A, communicating with tuyeres *a a a a*, by which the air is forced into the fuel. It has two fire-holes, B B, through which the coal is charged, and a fore-plate, C, on which coal is thrown. It has also a hole, D, on one side, by which the clinkers are broken up, and on the other side a door, E, by which the clinkers are drawn out. Above the fire-holes is a pipe, F, perforated with small holes; and at each end is attached a pipe with valves *f f*, one for steam and the other for air. I use them alternately or together, as desired. By the use of steam I neutralize any sulphur in the flame, and by the use of air I economize the fuel by consuming the smoke. This chamber (No. 1) is divided into two divisions, the division marked 1″ having a tapping-hole, G, and trough H, communicating with chamber No. 4 at *v*. In the division having the tapping-hole I melt any metallic alloy I may require to use.

No. 2 is the chamber in which pig-iron is melted, or into which molten iron is run from a cupola or smelting furnace through opening *i*. It is provided with a door, J, having an aperture for inserting the rabbling-tool, and has a tapping-hole, K, and trough *k*, by which the iron is run out and conducted into the third chamber at O. Through the bridge 1′, which divides the first and second chambers, a steam-pipe, L, having a valve, *l*, to regulate the flow of steam, is passed, so that on its passage the steam is dried or superheated. To this pipe L another, M, is connected, having a number of fine jets, by which steam is forced into the molten iron to eliminate the sulphur and phosphorus it may contain. The rabbling-pipe M is made detachable from pipe L, for the purpose of removing it from the furnace for repairing and renewing the parts in close contact with the heat of the furnace.

No. 3 is a refining-chamber, in which the iron is refined by the use of air. It is provided with a door, N, through which the bottom is repaired, and an opening, O, by which the iron is run in. It has a tapping-hole, P, by which the iron is run out into the trough H, connecting with chamber 4 at *v*. It is provided with an air-pipe, Q, communicating with tuyeres R, by which air is forced into the iron. This pipe has a valve, S, to admit and shut off the air.

No. 4 is the chamber in which I complete the process. I contract the width of this chamber, so as to intensify and adapt the heat generated by the fuel and combustion of the carbon during the refining of the iron. It is provided with a charging-door, T, a hole, *v*, by which the refined iron is run in, and a tapping-hole, V, and trough, by which the steel is run out. Into this chamber (No. 4) I charge any materials that are suitable, (to produce the quality I desire to make,) such as bar or scrap steel, malleable iron of any description, iron-ores, either raw or calcined.

Having described the different parts and uses of the several chambers of my furnace, I will now describe the mode of operation.

I charge the coal through the holes B B. I

charge or run molten iron into the chamber marked 2″, provided for that purpose, through hole *i;* and at the proper time I charge in the division of chamber No. 1 marked in Fig. 1 as 1″, provided for the purpose, spiegeleisen or any metallic alloy I may require. When the steel is run out of the fourth chamber I turn on the air, to consume the smoke and increase the temperature in the melting or No. 2 chamber. When the iron contained in chamber No. 2 is sufficiently fluid I introduce into it the pipe M, having the fine jets in it, and turn on the steam by means of the valve *l*, and when this operation is complete I run the iron into the third or refining chamber. When ready to tap the iron out of this latter chamber I turn on the air by means of the valve S. The air is then forced through the tuyeres R into the fluid iron. This operation raises an intense heat, which, by the change in form or dimensions of the fourth chamber, I utilize in melting or heating the materials charged into it. Having completed the air-blowing operation, I run the refined iron into the fourth chamber, where the steel, iron, or ores are melted or heated. The refined iron run into these materials at such a high temperature gives rise to ebullition, and reduces them to the fluid state, and in this state I retain the bath till I obtain the desired quality of metal. When boiling ceases and the whole is dead melted, I then run into the bath the metallic alloy, which has been melted in chamber No. 1, division 1″.

The communication between the first and fourth chambers, by means of the trough H, is direct; because, to treat the alloy with steam or air, or subject it to oxidation by running it into the bath before it would be dead melted, would destroy its effects on the steel.

Having thus described the nature, construction, and operation of my invention, what I claim as my improvement is—

1. The combination of the double compound fuel-chamber with the air-blast A and the compound air and steam pipe F, operating substantially as and for the purpose described and shown.

2 The combination, with the steam-pipe L, inclosed within the hollow bridge 1′, of the detachable rabbling-pipe M, provided with perforations, for discharging steam into the molten metal, all substantially as herein set forth.

3. In combination with the hollow bridge-wall 2′, the air-pipe Q, extending laterally therein, and provided with perforations for discharging the contained air, through vents in the bridge, into the molten iron contained within the chamber No. 3, substantially as described and shown, and for the purpose set forth.

4. A furnace having a combustion-chamber, No. 1, fining-chamber No. 2, refining-chamber No. 3, and steel-chamber No. 4, the several chambers communicating with each other by means of troughs, substantially as described, and for the purposes set forth.

5. The herein-described process of fining and refining iron and steel, which consists in subjecting a bath of molten cast-iron in a puddling-hearth to the action of superheated steam, introduced through a rabble-blast, until all contained sulphur and phosphorous impurities are removed, then decarbonizing and refining it in an adjoining hearth by a superheated-air blast, and, finally, recarbonizing to any extent by the introduction of melted spiegeleisen, the successive stages of treatment being all conducted within the same furnace-chamber, for the purpose of concentrating and retaining the heat of the bath, substantially as and for the purpose herein set forth.

In testimony that I claim the foregoing as my own invention I affix my signature in presence of two witnesses.

BENJAMIN BAYLISS.

Witnesses:

J. H. STEVENSON,

T. B. ALCORN.