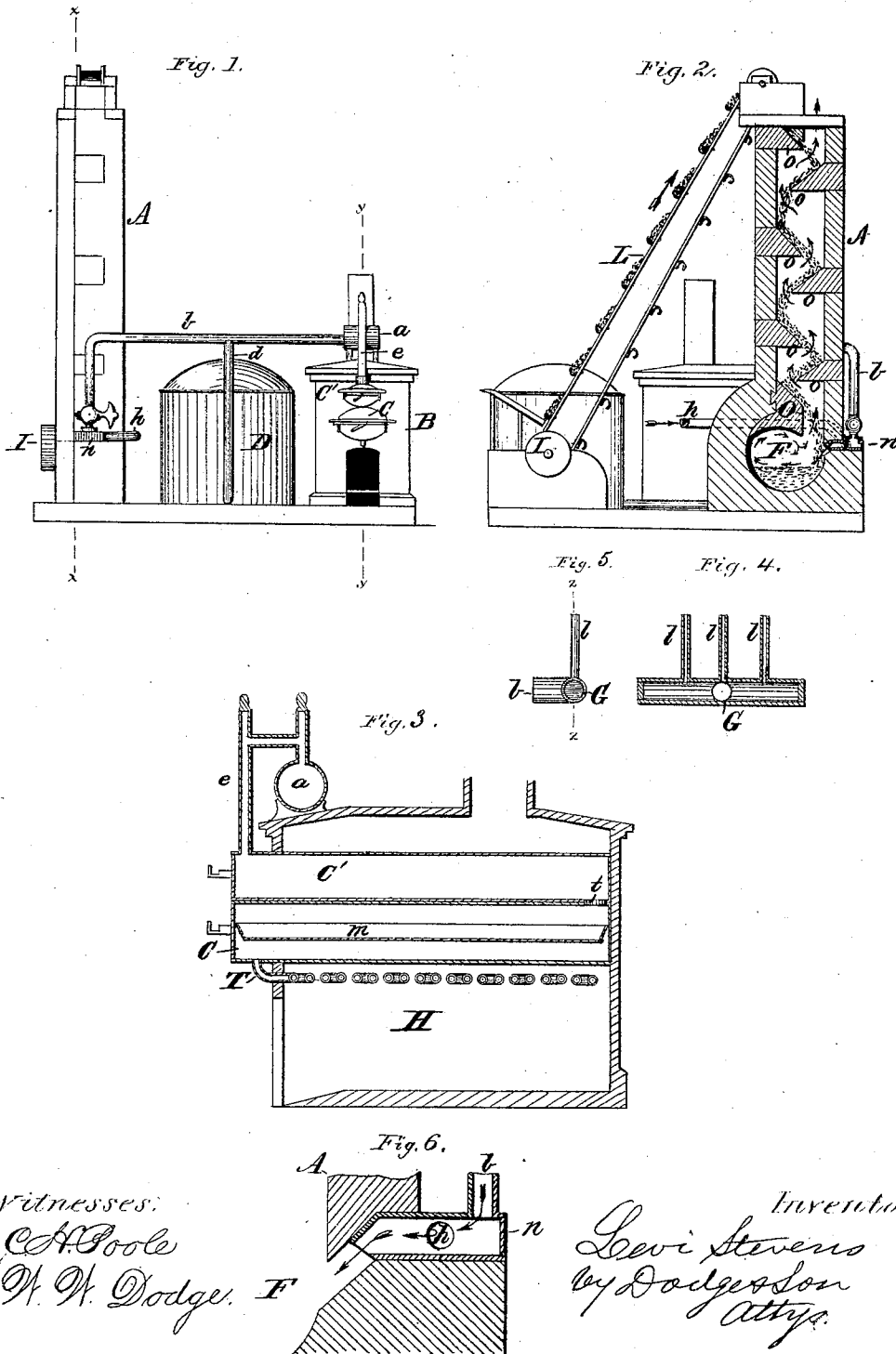


L. STEVENS.

Improvement in Furnace for Treating Ores.

No. 132,331.

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Witnesses:
C. A. Poole
W. H. Dodge.

Inventor:
Levi Stevens
by Dodge & Son
Attys.

UNITED STATES PATENT OFFICE.

LEVI STEVENS, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVEMENT IN FURNACES FOR TREATING ORES.

Specification forming part of Letters Patent No. 132,331, dated October 15, 1872.

To all whom it may concern:

Be it known that I, LEVI STEVENS, of Washington, in the county of Washington and District of Columbia, have invented certain Improvements in Blast-Furnaces, of which the following is a specification:

My invention relates to furnaces for treating ores; and it consists in the peculiar construction of the heating-chamber with its inlet and outlet for the heating-gases in close proximity, whereby they are caused to act upon the ores in a more efficient manner, and in certain other features used in connection therewith, as hereinafter more fully described.

Figure 1 is an elevation of the furnace and gas-generator; Fig. 2 is a side elevation of the same, with the furnace shown in section; Fig. 3 is a longitudinal vertical section of the gas-generator; and Figs. 4, 5, and 6 are views of portions shown more in detail.

In constructing my improved furnace I provide a chamber, F, which is circular in vertical section, with its top slightly flattened, as represented in Fig. 2. This chamber, which is to be heated by gases produced according to the processes heretofore patented to me, has its opening for the inlet of the gas at one end, and its outlet for the same in close proximity thereto, and slightly above the inlet, as represented in Fig. 2, whereby the gas and flame, before escaping from the chamber, is caused to pass entirely around the chamber, as indicated by the arrows, thus creating a reverberatory action of the flame and producing an intense heat in the chamber F, the gas or flame thereafter escaping up through the flue in the shaft A, through which the ore is fed by an elevator, L, as represented in Fig. 2, the shaft with its projections and the elevator being no part of my invention, except as combined with this peculiar form of chamber. In order that the chamber F may be used for smelting ores in the ordinary manner by the addition of coke, charcoal, or other fuel, I make the top part O of the chamber F detachable, as represented in Fig. 2, so that it can be removed when desired, the chamber, of course, being provided with the necessary doors or openings for drawing off the metal and for inspecting its interior, as usual.

To generate the gas to be used for heating the furnace, I provide an ordinary furnace, H,

over which I place a compound retort, consisting of two retorts, C and C', located one above the other and connected at or near their rear end by a passage or opening, t, as shown in Fig. 3. The upper retort is connected by a pipe, e, with a hydraulic main or trap, a, from which a pipe, b, extends to the furnace F and enters it at one side, as hereinafter described. I also provide a gasometer, D, and connect it, by a branch pipe, d, with the main pipe b, as shown in Fig. 1, this being for the purpose of receiving and holding any surplus of gas that may be generated, and insuring a steady supply of gas to the furnace.

As represented in Fig. 3, I arrange a steam-pipe, T, in the furnace H under the retort for purpose of superheating steam, this pipe T terminating in the bottom of the retort C and conveying superheated steam thereto, the steam being taken from a boiler located at any suitable point, but not shown in the drawing. The lower retort is supplied with petroleum or any suitable hydrocarbon, which may be placed in a tray or pan, m, in the retort, and the upper retort is to be supplied with charcoal or coke. I also propose to use lignite or any gas-producing coal where it is more convenient than hydrocarbons in the lower retort, the operation being the same, or differing only in degree. The gas-pipe b does not enter the furnace F direct, but, instead, it enters a rectangular box or mouth-piece, n, which is located in the wall at one side of the furnace, as shown in Figs. 1 and 2. As represented in Fig. 3, where this device is shown enlarged, its inner end terminates in a mouth or opening which is inclined downward; and, as this is located about on a level with the center of the furnace F, it will be seen that the flame of burning gas is deflected or thrown downward at an angle upon the material in the furnace, and from thence passes on around and up the opposite wall and thence back across the circular top to near the point of entrance, from whence it finally passes upward through the flue in the shaft A. By this peculiar method of introducing the gas into the furnace-chamber F it is caused to circulate entirely around it and to keep up a continuous circular motion until it finally escapes therefrom, thus heating all parts of the chamber fully and equally and making a most perfect reverberatory-furnace. To sup-

ply an additional quantity of oxygen to the flame, I arrange an air-tube, *h*, so as to terminate in the mouth-piece *n*, as shown in Figs. 1, 2, and 6, through which air can be supplied from any suitable blower; or, in lieu of this, I substitute the mouth-piece *G* for *n*, the tube or gas-receiver *G* having a series of tubes, *l*, arranged to conduct the gas into the chamber, the tubes *l* being surrounded with larger tubes communicating at their outer ends with the open air and extending inward a short distance beyond the tubes *l*, so that the passage of the gas inward through the latter will draw in a quantity of air through the larger tubes; or the larger tubes may be dispensed with by simply making openings in the wall around the tubes *l*, which will produce the same results. When a coal is used in the gas-generating furnace that contains sulphur, the gas should be passed through a washer and purifier before it enters the reducing-furnace, and when a coal is used that will produce coke it will be found desirable and economical to mix the coke with the ore and feed them together into the reducing flue and chamber, the blast of air being increased in that case, in order to supply more oxygen, as otherwise the coke will remain unconsumed. In the conversion of steam or the oxygen of steam into a protoxide of carbon, as is done by this process, it is necessary that the steam shall be heated to a temperature equal to that required to convert the hydrocarbon or carbonaceous matter used into a vapor or gaseous form; and as this varies with the different kinds of material used, the degree of heat applied to the steam must be likewise varied. When it is desired to use the furnace *F* for smelting iron or other ores with coke the top part *O* of the chamber *F* is removed, it being made detachable, as shown in Fig. 2, for that purpose.

A furnace constructed on this plan is adapted to the chloridizing, desulphurizing, reducing and smelting ores of nearly all kinds, and especially those containing silver and gold.

Its operation is as follows: The gas being turned on and ignited, the pulverized ore is fed in at the top of the flue in the shaft *A*,

and, as it falls, strikes first on the upper projection *O*, from whence it is deflected and thrown across the flue to the opposite side, when it strikes upon the projection on that side, which throws it back again to the other side, and so on continuously back and forth across the flue until it finally reaches the chamber *F*, where it is subjected to the action of the flame, which plays directly upon it. The passage of the ore down the flue is thus greatly retarded, and, instead of falling in an unbroken stream, is being constantly separated, so that every particle is subjected to the action of the uprising current of flame and heat, in the most thorough and effectual manner, and for a much longer time.

The heat generated by the gas produced by the union of the superheated steam with vapors or gas produced by the distillation of hydrocarbons or carbonaceous matter is of the most intense character, and is therefore admirably adapted to this purpose; and by my improved mode of applying it, together with my method of feeding the ores to the furnace and of subjecting them to the heat, I am enabled to produce unusually good results.

Having thus described my invention, what I claim is—

1. The chamber *F*, constructed as described, with its inlet and outlet openings for the gas arranged in close proximity, in combination with the shaft *A*, arranged to operate substantially as described.

2. The chamber *F*, provided with the mouth-piece *n*, or its equivalent, arranged to deliver the flame or blast at a downward angle, substantially as described.

3. The detachable or removable top *O* of the chamber *F*, arranged to operate substantially as set forth.

4. The combination of the gas-generator and the hydraulic main with a furnace for reducing ores, the combination and arrangement being substantially such as described.

LEVI STEVENS.

Witnesses:

EDM. F. BROWN,
W. C. DODGE.