W. A. STEPHENS.

Furnace for the Manufacture of Iron and Steel Direct from Ore.

No. 167,800. Patented Sept. 14, 1875.

Fig. 3.

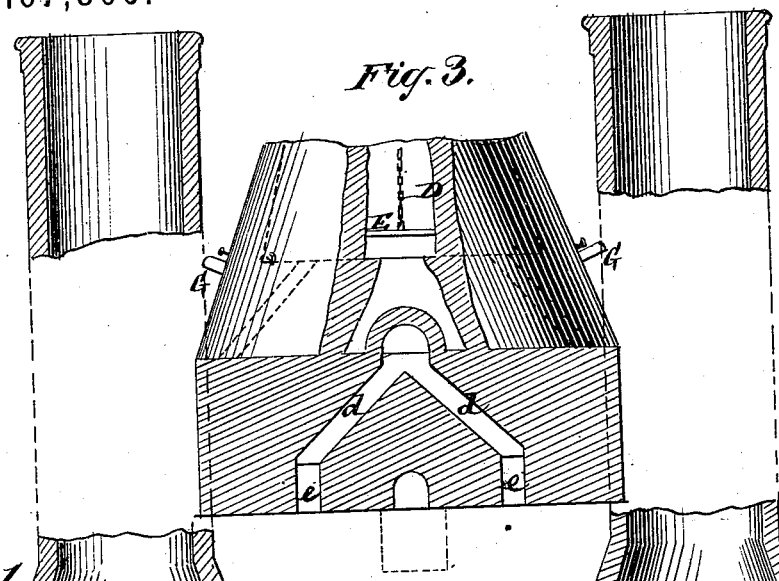


Fig. 1.

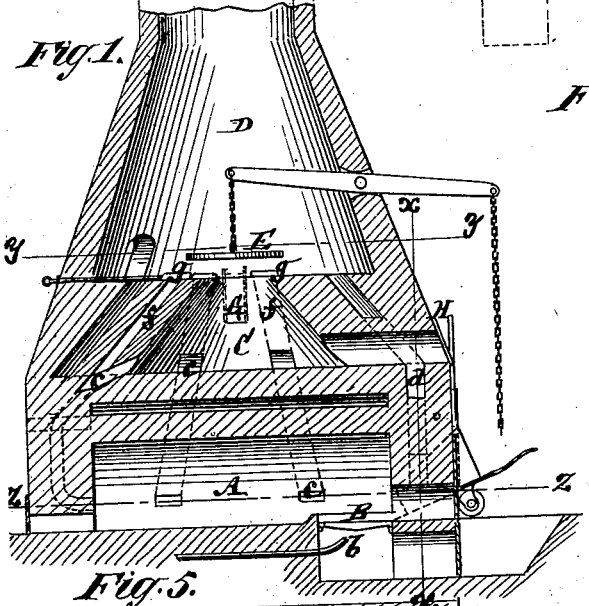


Fig. 2.

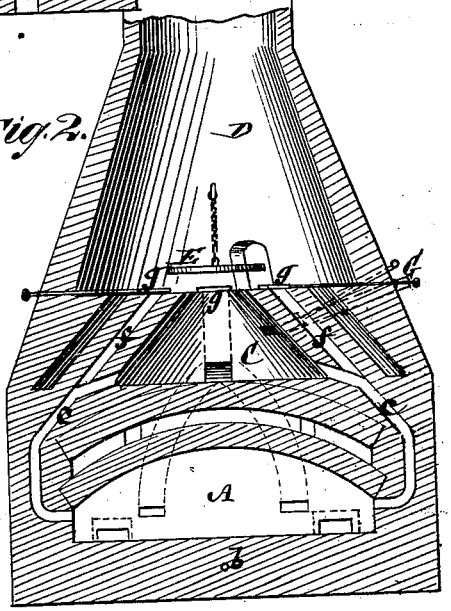


Fig. 5.

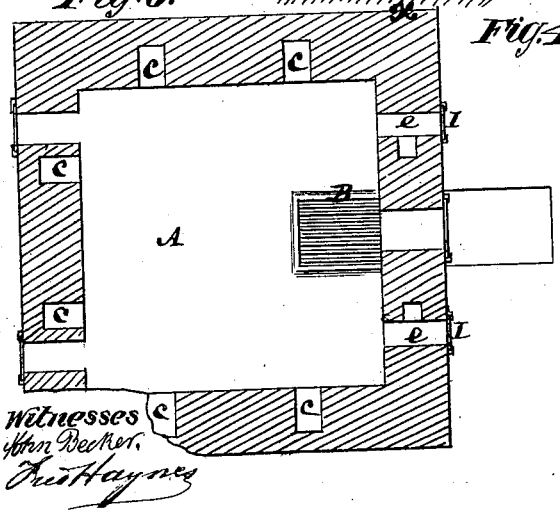
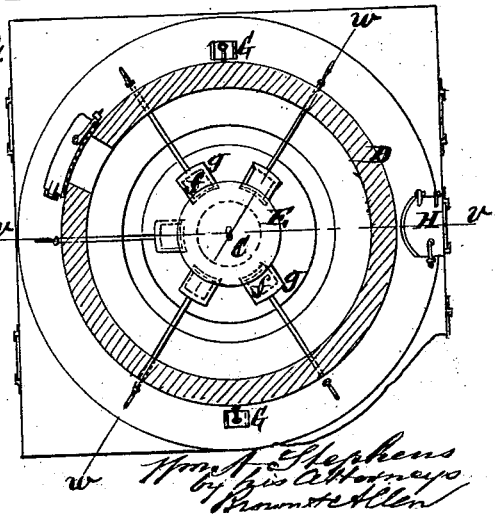


Fig. 4.



Witnesses
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UNITED STATES PATENT OFFICE

WILLIAM A. STEPHENS, OF SUCCASUNNA PLAINS, NEW JERSEY.

IMPROVEMENT IN FURNACES FOR THE MANUFACTURE OF IRON AND STEEL DIRECT FROM ORE.

Specification forming part of Letters Patent No. **167,800**, dated September 14, 1875; application filed March 4, 1875.

To all whom it may concern:

Be it known that I, WILLIAM ALEXANDER STEPHENS, of Succasunna Plains, in the county of Morris and State of New Jersey, have invented certain Improvements in Furnaces for the Manufacture of Wrought-Iron Direct from the Ore; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing forming part of this specification, and in which—

Figure 1 is a sectional elevation, on the line *v v*, of my improved furnace; Fig. 2, a further sectional elevation on the line *w w;* Fig. 3, a vertical section on the line *x x;* Fig. 4, a horizontal section on the line *y y;* and Fig. 5, a further horizontal section on the line *z z.*

The invention consists in a furnace for the manufacture of wrought-iron direct from the ore, in which a lower arched chamber, provided with a fire-place, has combined with it a superposed conical chamber, in communication with the lower chamber by flues, which pass the gaseous products of combustion from the lower to the upper chamber.

The invention also consists in certain combinations, with said upper and lower chambers and furnace-stack, of flues, dampers, and passages, for passing the gaseous products of combustion either from the lower to the upper chamber, or from the lower chamber to the stack direct, and for otherwise controlling the action of the gaseous products; likewise for transferring the ore, after it has been roasted and deprived of sulphur and other impurities in the upper chamber, to the lower chamber of the furnace, to be puddled or worked.

Referring to the accompanying drawing, A is the lower arched chamber of the furnace, and B the fire-place thereof, having a blower connected with it, and of which *b* is the blast-pipe. C is the superposed chamber, of conical construction, and in communication with the lower chamber by flues *c c*, through which the gaseous products of combustion pass from said lower to said superposed chamber, and whereby, and by the disposition of the two chambers relatively with each other, and by the conical and reverberatory construction of the upper chamber, the heat of the lower chamber and of the gaseous products therefrom is most thoroughly utilized to effect the treatment of the ore in the upper chamber. D is the stack of the furnace, and E a damper, adjustable over the upper open end of the conical upper chamber, to regulate or shut off communication between the latter and the stack.

The ore is supplied to the upper chamber by a side opening down an inclined plane or chute, G; and after the ore in said chamber has been deprived of its sulphur and other objectionable impurities by the heat of the lower chamber and action of the gaseous products of combustion passing up therefrom, and acting on the ore in a reverberatory manner within the conical upper chamber, it is drawn off from the latter down passages *d d*, communicating between the doors H I of the upper and lower chambers, and with the stack, into barrows or their equivalents, by which it is transferred through openings *e* into the lower chamber A.

Connected with the flues *c c* are other flues or branches *f f*, provided with dampers *g g*, which, on being opened, establish a direct communication between the lower chamber A and the stack D; also, communication between the upper chamber C and the stack D, in addition to the communication established through the top opening in the upper chamber, controlled by the damper E. In this way or by these means the heat in or draft from both chambers may be tempered or regulated as required with the greatest nicety.

In the general operation the ore is first broken into egg-size, or smaller, and two distinct charges of the same put, one in rear of the other, within the upper chamber C; and after the front charge has been sufficiently treated in said chamber it is drawn off into the lower chamber, and the remaining charge drawn forward in the upper chamber, also a fresh charge introduced in rear of the one brought to the front in the upper chamber. This operation is repeated continuously, the front charges being transferred successively, one at a time, to the lower chamber C, and by the time each charge so transferred has been treated or operated on in the lower chamber the next front charge in the upper chamber is ready to be transferred. Thus the operation is continuous as regards both chambers.

The metal, after being puddled or balled in the lower chamber, may be taken to the squeezers or hammer, or be otherwise treated as in the ordinary manufacture of wrought-iron.

By a furnace constructed as herein described, ore containing as much as twenty per cent. of sulphur may be made into good wrought-iron without stopping the operation of the furnace, and with the greatest economy as regards fuel.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, in a furnace for making iron and steel, of the lower arched chamber A, the fire-place B, stack D, and the conical ore-chamber C, superposed between the stack and the arched chamber, and communicating with the latter by passages *c c*, substantially as described, for the object specified.

2. The combination, with the arched chamber A, fire-chamber B, stack D, and conical chamber C, superposed between the stack and arched chamber, and its upper end opening into the stack, of the passages *c c*, communicating with the arched and superposed chambers, the flues *f* forming a continuation of the passages *c* and communicating with the stack, and the dampers E, *g*, and *g*, for closing and opening the flues *f* and the open end of the chamber C, as set forth.

3. The combination, with the upper and lower chambers A B and stack D, of the passages *d d*, communicating between the doors H I of the upper and lower chambers and with the stack, substantially as and for the purpose herein specified.

W. A. STEPHENS.

Witnesses:

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VERNON H. HARRIS.