2 Sheets—Sheet 1

S. BROADMEADOW.

Making Iron Direct from Ore.

No. 3,409. Patented Jan. 20, 1844.

Fig. 1.

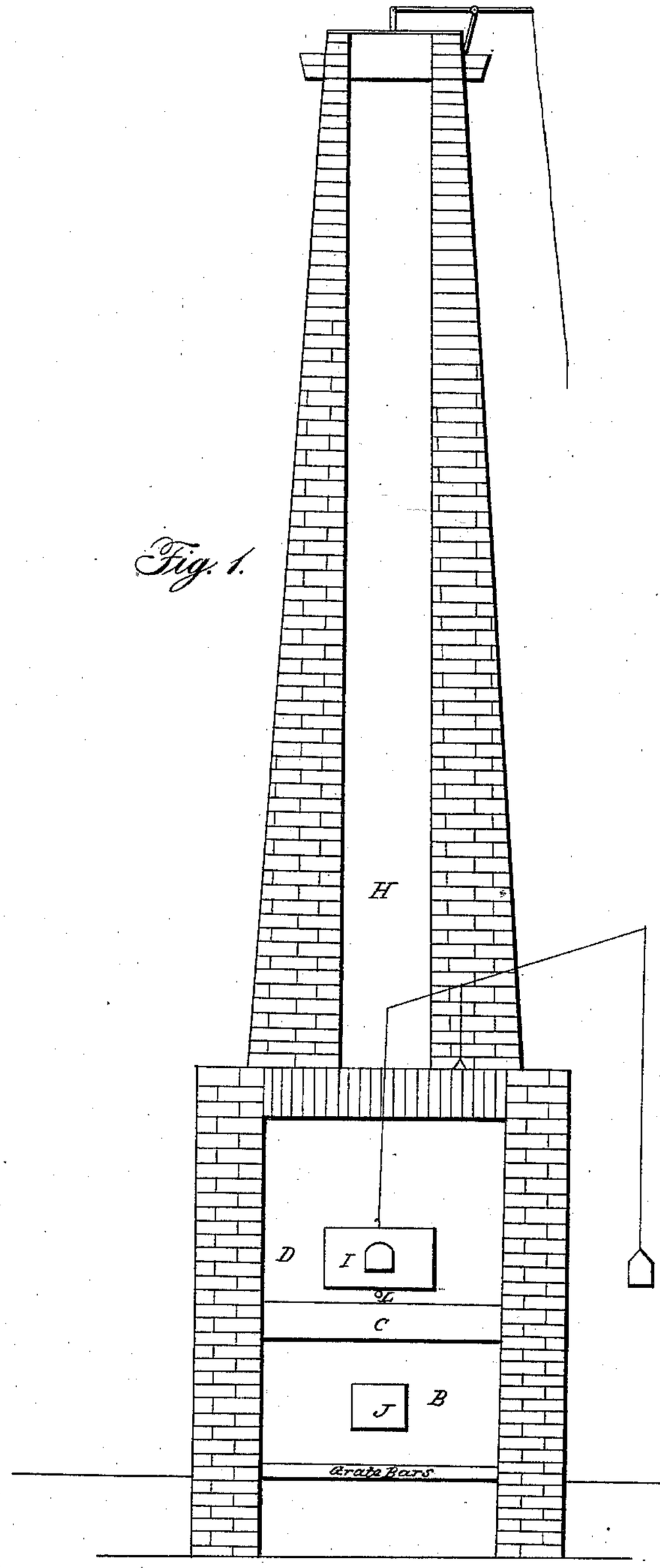

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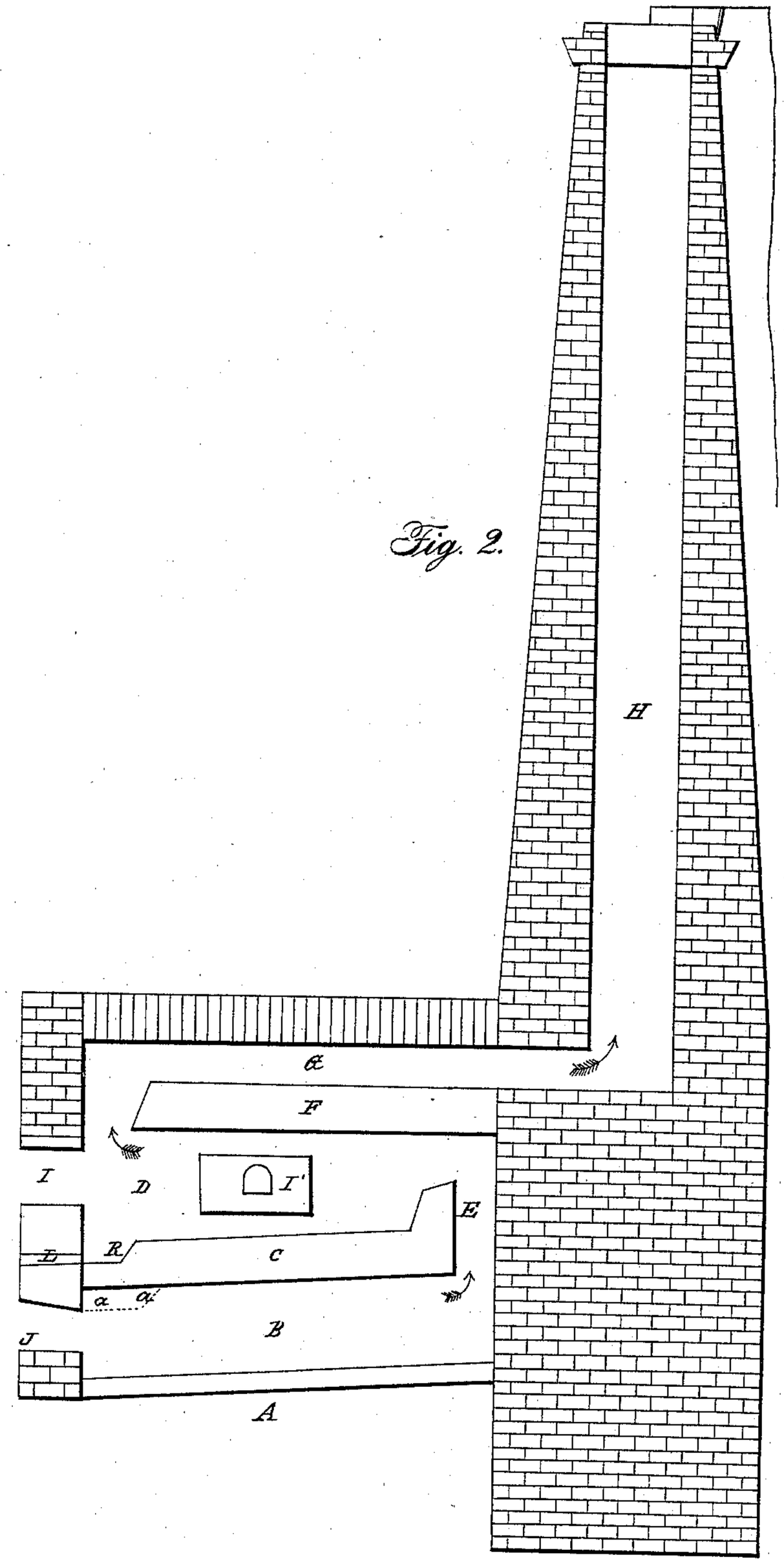
Fig. 2.



UNITED STATES PATENT OFFICE.

S. BROADMEADOW, OF MANAYUNK, PA., ASSIGNOR TO WM. GREEN, JR.

IMPROVEMENT IN REVERBERATORY FURNACES FOR SMELTING OR PUDDLING IRON.

Specification forming part of Letters Patent No. **3,409.** dated January 20, 1844.

To all whom it may concern:

Be it known that I, SIMEON BROADMEADOW, of Manayunk, in the county of Philadelphia and State of Pennsylvania, have invented a new and improved reverberatory furnace for the purpose of directly converting mineral or ores of iron into wrought-iron at the first operation by the process of puddling, using either anthracite, bituminous coal, or other fuel for that purpose, which furnace I also use for the puddling of pig-iron, or of iron in other states, which is to be submitted to that process, and likewise for the melting or heating of metals for various purposes; and I do hereby declare that the following is a full and exact description thereof.

My improvement in the reverberatory or puddling furnace consists in the so constructing it as that the hearth of the furnace shall be heated both on its under and upper sides. For this purpose I construct a fire-chamber in which the fuel rests upon grate-bars directly under the hearth of the puddling-furnace, there being an ash-pit under said grate-bars, such fire-chamber and ash-pit being in the ordinary form. The direct heat of the burning fuel, which is contained in the fire-chamber is consequently made to operate on the under side of the hearth, and the heated air and flame ascend through a flue-space at the rear end of the fire-chamber, then along the puddling-compartment to the front of the furnace, and thence back along a flue over the roof thereof leading to the chimney, which is to be elevated in the ordinary manner to create a sufficient draft.

In the accompanying drawings, Figure 1 is a front elevation of the furnace, the masonry which incloses it and the chimney being omitted for the purpose of showing the outline of the interior. Fig. 2 is a vertical section through the middle of the furnace from front to back.

A is the ash-pit; B, the fire-chamber; C, the hearth of the puddling-furnace D, into which the heated air and flame pass through the flue-space E and operate upon the material within the furnace in the usual manner. F is the roof of said furnace. The hearth and roof should be formed of suitable fire-stone. G is a flue above the roof-stone leading to the chimney H. I represents a front door to the puddling-furnace; but the main working-door is to be made at the side, as seen at I′, this being its usual place. J is the door of the fire-chamber for supplying fuel. K is a basin at the front of the hearth, and L a tap-hole for the removal of slag, &c. As it is desirable to keep the hearth at this part well heated, I sometimes so construct the fire-chamber as to allow it to project a foot (more or less) in front of the furnace, by which means this end is effectually accomplished. The lower part of the basin may be strengthened by giving the hearth-stone the form shown by the dotted lines at *a a*.

When this furnace is used for the purpose of converting mineral into wrought-iron directly from the ore, said ore is to be finely pulverized and thrown upon the hearth, which must be heated to whiteness. In about half an hour the mineral will be fused, and it is then to be treated in the same manner as when puddling pig-iron. By this means the sulphur and other volatile matter contained in the ore will be driven off and the ore will be subjected to the full action of the heated air. Most kinds of ore may be treated in this way without the addition of any flux or of carbonaceous matter; but where the ore is refractory and does not fuse readily, from containing an excess of oxygen, a small portion of charcoal may be added thereto. When the ore is too fusible, owing to its containing an excess of carbon, I add the scales of iron or some analogous substance—such as the highly-oxidized ores—as is sometimes done in the puddling of pig-iron. No rule can be given for this; but the judgment of every competent iron-master will supply all the information that is necessary. Most commonly, as before remarked, the metal will be brought into nature without any such addition to the iron. When the mineral or pig metal has been thus heated until it approaches the melting-point, the fire is to be slackened until it is reduced nearly to a red heat. In this state the ore or the metal is to be worked with a scraper and paddle until the mineral or metal shall have become, as the technical phrase is, "sufficiently dry." At this period the heat is to be raised, and when the welding of the mineral or metal commences it is to be balled into suitable sizes, either for the hammer or for the rollers.

Having thus fully described the manner in which I construct my puddling-furnace, to be used either for the purpose of converting min-

eral or ore directly into the state of malleable or wrought iron, as above set forth, or for the puddling of pig metal or other iron with a like view, and also for the purpose of melting of iron or other metals, what I claim as new, and desire to secure by Letters Patent, is—

The constructing and using of a reverberatory furnace that is heated by means of a fire-chamber situated below its hearth or floor, and from which the flame and heated air are conducted over its top, so as to heat it as well below as above, the respective parts of said furnace being combined, arranged, and operating as represented and described.

Philadelphia, December 21, 1843.

SIMEON BROADMEADOW.

Witnesses:

JOHN STANTON,

JUL. COOK.