

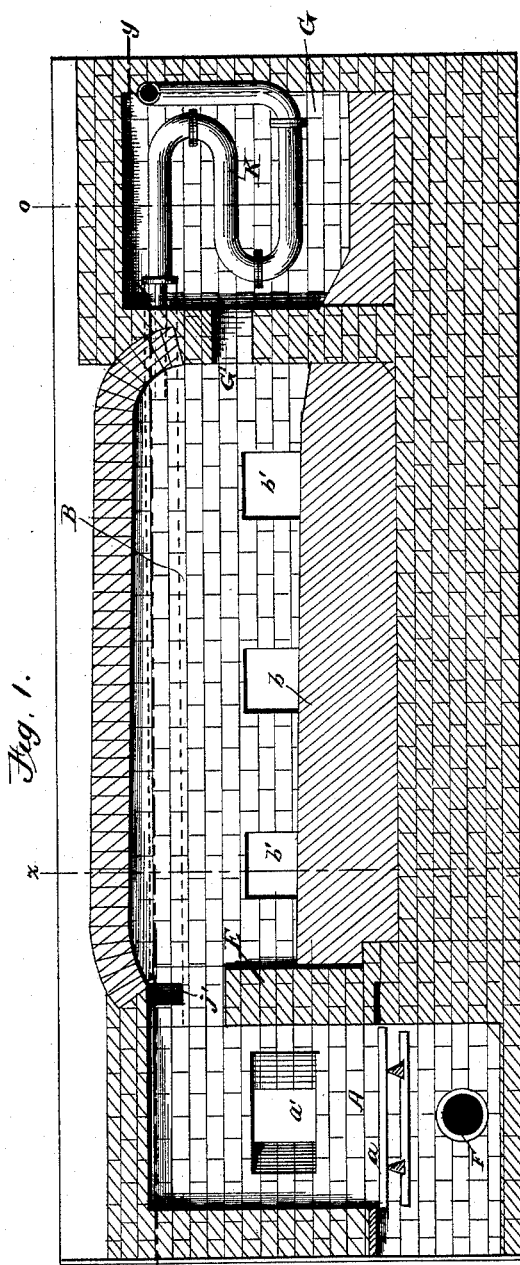
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3 Sheets—Sheet 1.

W. STUBBLEBINE.  
REVERBERATORY FURNACE.

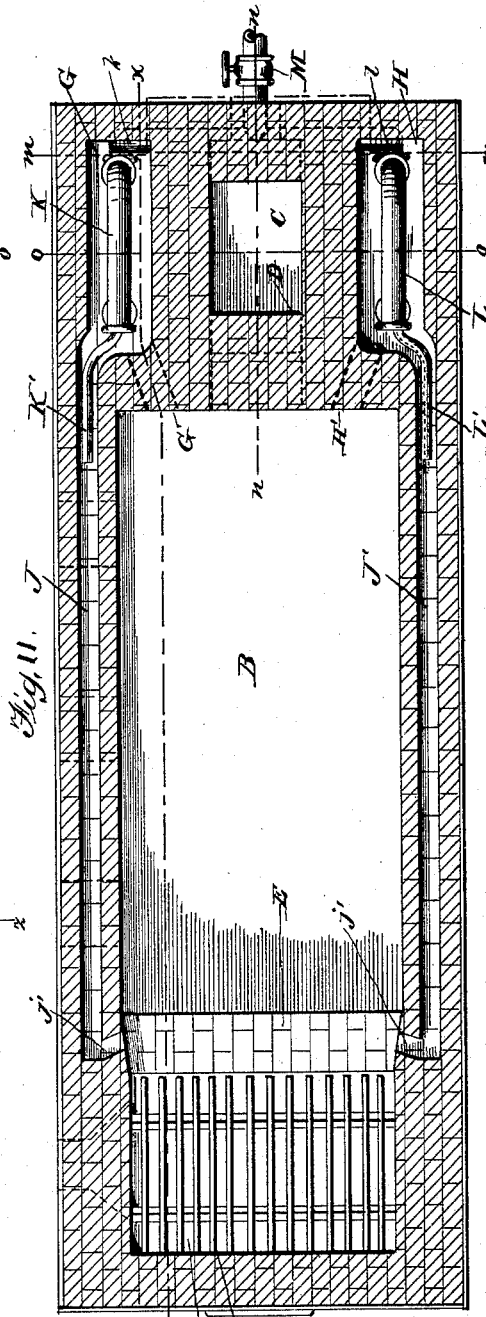
No. 456,663.

Patented July 28, 1891.



Witnesses

Wm. A. H. Knight  
W. D. Bernhard



Inventor

William Stubblebine

By

His Attorneys,

Edson Bros.

(No Model.)

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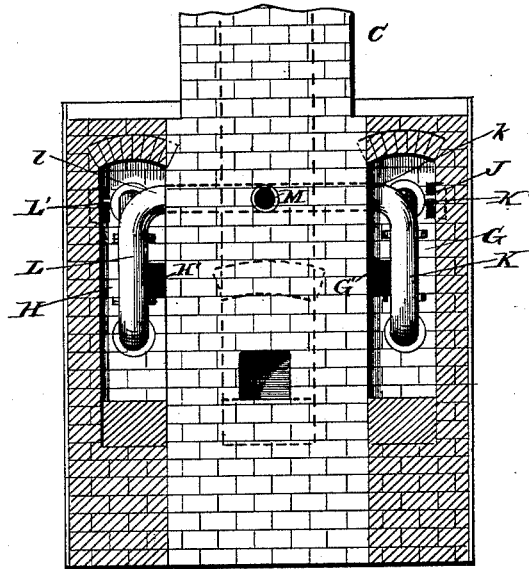


Fig. III

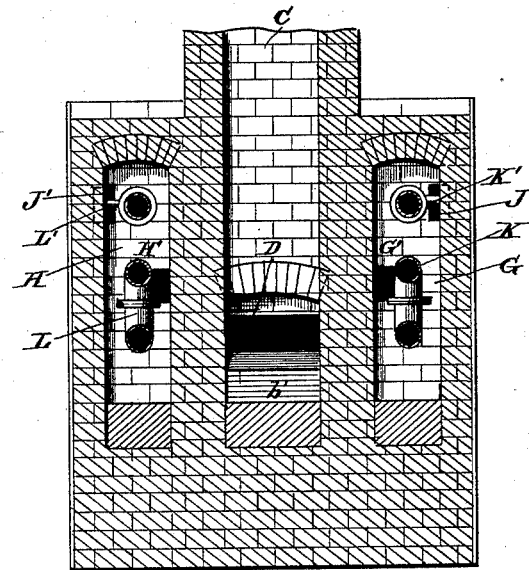


Fig. IV.

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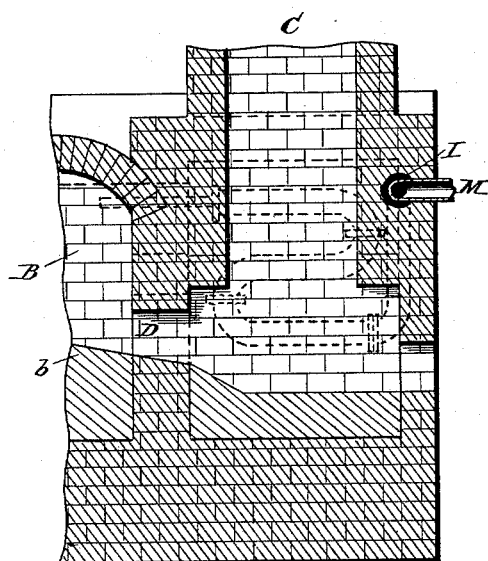


Fig. V

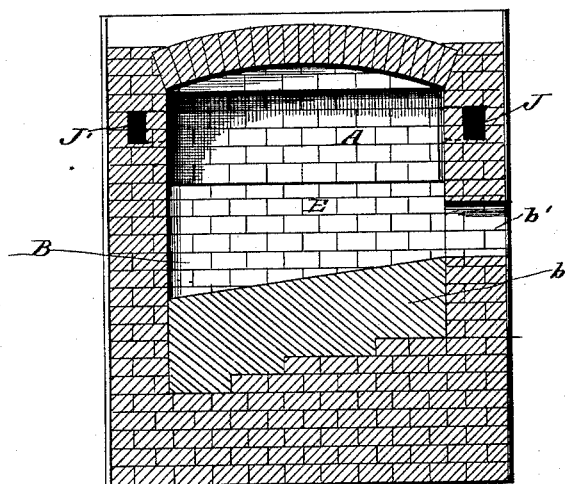


Fig. VI.

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# UNITED STATES PATENT OFFICE.

WILLIAM STUBBLEBINE, OF BETHLEHEM, PENNSYLVANIA.

## REVERBERATORY FURNACE.

SPECIFICATION forming part of Letters Patent No. 456,663, dated July 28, 1891.

Application filed February 14, 1891. Serial No. 381,493. (No model.) Patented in Canada February 25, 1891, No. 56,115.

*To all whom it may concern:*

Be it known that I, WILLIAM STUBBLEBINE, a citizen of the United States, and a resident of Bethlehem, in the county of Northampton and State of Pennsylvania, have invented certain new and useful Improvements in Reverberatory Furnaces, (for which I have filed an application, No. 56,115, for a Canadian patent;) and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to heating, puddling, or other reverberatory furnaces; and the object of the invention is to insure thorough combustion of the gases evolved from the burning of coal or natural gas or oil used as fuel in the fire-chamber of the furnace and the maintenance of a high degree of heat in the furnace.

In my improved furnace I employ two air-heating chambers, located at the rear of the puddling-chamber, preferably on opposite sides of the neck and uptake of the furnace, which chambers communicate with the rear end of the puddling-chambers by passages or conduits provided in the masonry on the sides of the furnace-neck to convey a portion of the unconsumed gases from the puddling-chamber into the air-heating chambers, which gases are utilized to heat the air or steam contained in the coils of pipe or a drum located in said air-heating chambers. In conjunction with the air-heating chambers and the air-heating blast-pipes or a drum I employ mixing flues, arranged longitudinally of the furnace on opposite sides of the puddling-chamber and extended from the air-heating chambers to the fire-chamber, and into these mixing-flues, which communicate directly with the air-heating chambers, extend the jet pipes or nozzles of the air-blast pipes or the steam-pipes, whereby heated air or steam is injected into the mixing-flues, and the gases from the air-heating chambers are drawn into said mixing-flues. The air or steam and gases are intimately mixed in said mixing-flues, which convey the mixed air and gases to the fire-chamber and discharge them at points over or in juxtaposition to the bridge-

wall of the fire-chamber, where they meet the flame and gases from the fire-chamber, thereby insuring perfect combustion and creating intense heat with a less quantity of fuel than is possible with furnaces of ordinary construction.

My invention further consists in the novel construction and arrangement of parts, as will be hereinafter more fully described and claimed.

I have illustrated my improved furnace in the accompanying drawings, in which—

Figure I is a vertical longitudinal sectional view through a furnace constructed in accordance with my invention, the plane of the section being taken on the irregular line *x x* of Fig. II and cutting through the puddling and fire chambers on one side of the central line thereof and through one of the air-heating chambers and the port-connection of said chamber with the puddling-chamber. Fig. II is a horizontal sectional view through the furnace on the plane indicated by the dotted line *y y* of Fig. I, the section cutting through the longitudinal mixing-flues, the air-heating chambers, the uptake, and the puddling-chamber, the neck of the furnace being indicated by dotted lines, and also the transverse pipe which connects with the blast-pipe and the two coils of pipes K L. Fig. III is a vertical transverse sectional view, partly in elevation, on the plane indicated by irregular line *m m* of Fig. II, the section cutting through the rear of the air-heating chambers and the exterior walls of the furnace, the rear of the chimney or uptake being shown in elevation. Fig. IV is a vertical transverse section taken centrally through the uptake and chimney and the two air-heating chambers, the section being taken on the plane indicated by the dotted line *o o* of Figs. I and II. Fig. V is a vertical longitudinal sectional view on the plane indicated by the dotted line *n n* of Fig. II, the section cutting centrally through the uptake or chimney and the neck of the furnace, one of the coils of heating-pipes being indicated by dotted lines. Fig. VI is a vertical transverse section through the puddling-chamber on the plane indicated by the dotted line *z z* of Fig. I.

Like letters of reference denote correspond-

ing parts in the several figures of the drawings.

The furnace proper is similar in construction to any of the ordinary puddling-furnaces, and it has the fire-chamber A, containing the grate *a*, the puddling-chamber B, the uptake C, situated at the rear of the puddling-chamber, and the neck or flue D, leading from the puddling-chamber to the uptake. As is usual a bridge-wall E is provided between the fire-chamber and the puddling-chamber, a blast-pipe F discharges below the grate in the fire-chamber, and the puddling-chamber has a working-bed *b*. A fuel-charging door *a'* is provided in the side of the fire-chamber, and working-doors *b'* are likewise provided in the sides of the puddling-chamber. All of the parts are constructed as in the common puddling-furnaces familiar to those skilled in the art to which my invention relates.

The uptake C is arranged in the longitudinal center of the furnace and partially surrounded by the air-heating chambers G H, which lie on opposite sides of the uptake, said chambers being connected by a transverse flue or chamber I, located in the rear of the uptake. (See Fig. III.) The air-heating chambers are connected directly with the puddling-chamber B by passages or flues G' H', formed in the masonry on opposite sides of the neck or flue D, leading from the puddling-chamber to the uptake, whereby a portion of the unconsumed gases and heat are caused to pass from the puddling-chamber through the passages to the air-heating chambers.

J J' are the mixing-flues provided in the masonry of the furnace and arranged on opposite sides of the puddling-chamber and above the horizontal plane of the working-bed therein, these mixing-flues extending longitudinally of the furnace from the air-heating chambers G H to the fire-chamber or bridge-wall at the front of the furnace. The rear ends of the mixing-flues open into or communicate directly with the air-heating chambers, while the front ends of the flues terminate in ports *j' j'* immediately over the bridge-wall, whereby the commingling air and gas contained in the flues are discharged directly into the flame and gases from the fire-chamber.

Coils of pipe K L are arranged in the air-heating chambers, and these pipes are connected by branch pipes *k l* to a valved blast-pipe M, which is common to both coils of pipe and supplies the air-blast to both mixing-flues. The coils of pipe are provided with the jet nozzles or pipes K' L', which are of less diameter than the coils, and said reducing jet-nozzles are extended into the rear ends of the mixing-flues, discharging the air into said flues. The gas passages or flues G' H' open into the air-heating chambers at points in rear of the jet-nozzles, and said nozzles are arranged to leave spaces between themselves

and the flue-walls, through which the gases and heat in the producing-chambers are free to pass when drawn by the suction created by the air-blast into the mixing-flues to be commingled therein with the air and discharged by the flues into the flame passing over the bridge-wall. An equivalent of the coils of pipes consists of a drum located in each producing or heating chamber, which drums are connected to the blast-pipe, and each drum is provided with a jet pipe or nozzle extending into the mixing-flues.

In the air-blast coils of pipe I may arrange concentric coils of steam-pipe, as indicated by dotted lines in Fig. I, said coils of steam-pipes having their discharge ends terminating within or beyond the jet-pipes, so as to inject the steam therein into the mixing-flues.

The furnace is charged and worked in the usual manner; but instead of all the heat and gases from the puddling-chamber escaping into the uptake a portion of such gases and heat passes through the gas flues or passages G' H' into the chambers G H. The air and steam (either or both) contained in the coil of pipe (or the drums) are heated by passing through said pipes by the gases and heat from the puddling-chamber, and the suction created in the mixing-flues by discharging the air-blast or steam into said flues is sufficient to draw the gases from the heating-chambers into the mixing-flues. The air, steam, and gases are intimately commingled and mixed in the flues, and they are highly heated while passing through the flues by reason of the flues being in close proximity to the puddling-chamber. The commingling air and gases in their heated condition are discharged from the flues immediately over the bridge-wall and they meet the flame and heat passing from the fire-chamber into the puddling-chamber, thereby insuring increased combustion and the maintenance of a high degree of heat in the furnace. The blast in the pipes K L can be adjusted by regulating the valve *m* in the blast-pipe M. I am thus enabled to utilize a portion of the gases and heat taken from the rear end of the puddling-chamber to heat an air-blast or steam-blast and to commingle said blast and gases, highly heat the same, and utilize them as fuel in maintaining the heat of the furnace.

It has been found by experience with a furnace embodying my present invention that in addition to promoting combustion and maintaining a high degree of heat, a superior quality of iron is produced from the pig-iron, and that economy is effected in the brick and wear of the furnace.

I am aware that changes in the form and proportion of parts and details of construction can be made without departing from the spirit or sacrificing the advantages of my invention, and I therefore reserve the right to make such modifications as fairly fall within the scope of my invention.

Having thus described my invention, what

I claim as new, and desire to secure by Letters Patent, is—

1. In a furnace, the combination, with a puddling-chamber, a fire-chamber communicating therewith, and a bridge-wall, of the air-heating chambers communicating directly with the rear of said puddling-chamber, the uptake situated between the air-heating chambers and communicating with the rear end of said puddling-chamber, the mixing-flues in communication with said air-heating chambers and having ports which discharge on opposite sides of the bridge-wall and above the same, and the blast-pipes discharging into said mixing-flues, substantially as and for the purpose described.

2. In a furnace, the combination, with a puddling-chamber, an uptake at one end of said puddling-chamber, and a fire-chamber at the opposite end of said puddling-chamber, of the air-heating chambers located on the opposite side of the uptake and communicating directly with the rear end of the puddling-chamber, the mixing-flues communicating with the said air-heating chambers and discharging through ports *j'* into the fire-chamber, and the blast-pipes having their discharge ends terminating in the mixing-flues, substantially as described.

3. In a furnace, the combination, with a puddling-chamber, a fire-chamber at one end of said puddling-chamber, and an uptake receiving from the opposite end of the puddling-chamber, of the longitudinal mixing-

flues arranged on opposite sides of the puddling-chamber and having discharge-ports *j'* into the fire-chamber, the air-heating chambers situated on opposite sides of the uptake and communicating with the mixing-flues, the gas flues or passages intermediate of the puddling-chamber and the air-heating chambers, and the blast-pipes having their discharge ends terminating in the mixing-flues in advance of the gas flues or passages, substantially as described.

4. In a furnace, the combination, with a puddling-chamber and a fire-chamber and an uptake connected to the rear end of said puddling-chamber and communicating with the forward end of the puddling-chamber, of the air-heating chambers connected directly with the rear end of the puddling-chamber by gas-passages, the longitudinal mixing-flues arranged on opposite sides of the puddling-chamber and connected at their rear ends to the air-heating chambers, the front ends of said mixing-flues provided with discharge-ports above the bridge-wall, and the coils or pipes located in the air-heating chambers and having discharge-jets terminating in the mixing-flues in advance of the gas-passages, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM STUBBLEBINE.

Witnesses:

JACOB DAUTRIET,

ELIZABETH A. KRAUSE.