

(No Model.)

J. N. PEW.  
NATURAL GAS FURNACE.

No. 308,518.

Patented Nov. 25, 1884.

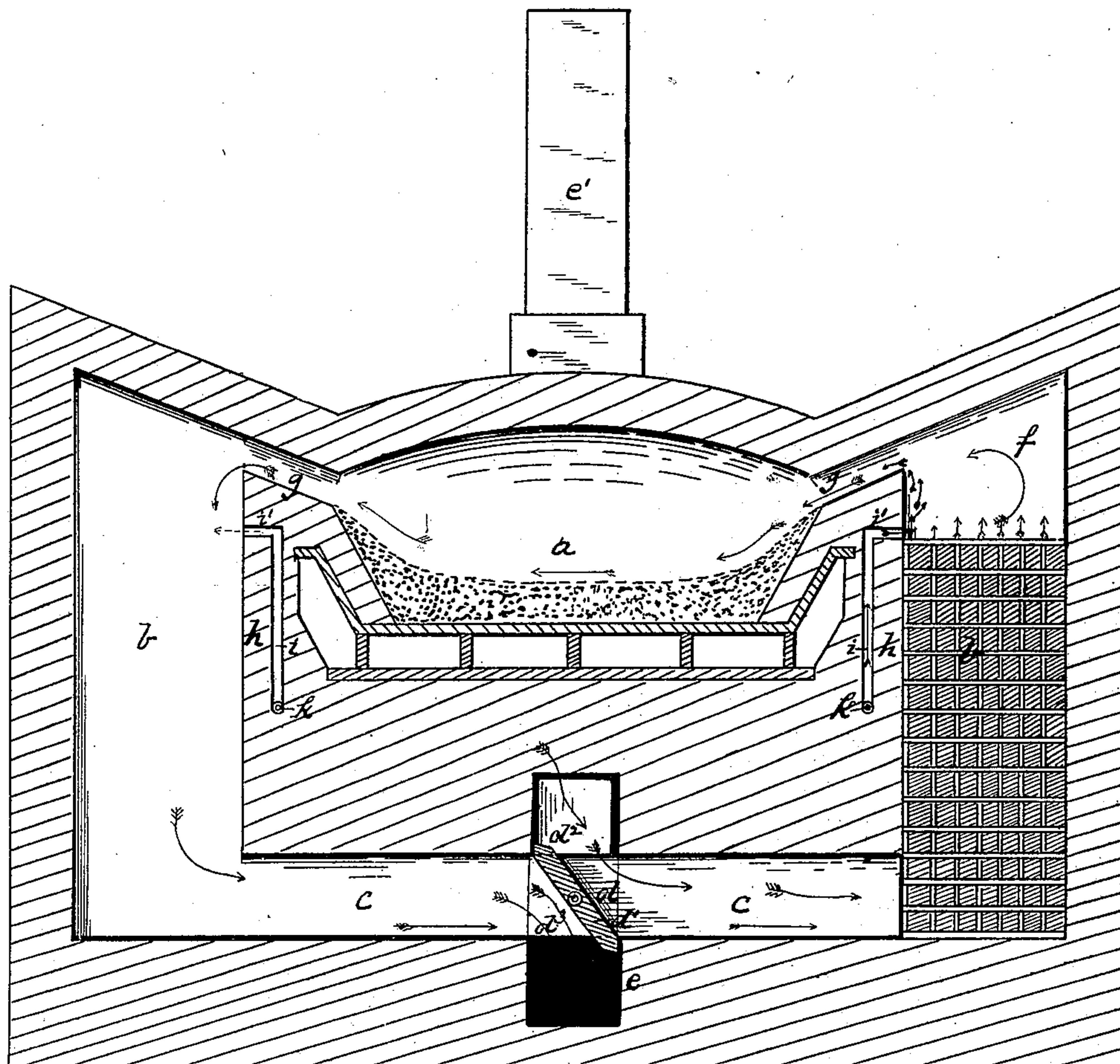


Fig. 1.



Fig. 2.

Witnesses

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## NATURAL-GAS FURNACE.

SPECIFICATION forming part of Letters Patent No. 308,518, dated November 25, 1884.

Application filed January 4, 1884. (No model.)

*To all whom it may concern:*

Be it known that I, JOSEPH N. PEW, of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Natural-Gas Furnaces; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a longitudinal section of a puddling-furnace provided with regenerators for heating the air, and with flues for supplying natural gas to the furnace. Fig. 2 is a view of one of the gas-pipes.

Like letters of reference indicate like parts in each.

The furnace *a* is of the ordinary construction, and is provided at the opposite ends with regenerators *b*, the interiors of which are filled with brick checker-work in the usual way.

Connected with the base of the chambers *b* are the usual flues, *c*, which lead from a central reversing-valve box, *d*, in which is a valve, *d'*, of the usual construction. The upper end, *d''*, of the box *d* is open for the admission of air. The lower end, *d'''*, communicates with the stack-flue *e*, which leads to the stack *e'*. The direction of the waste from the furnace and the air entering into the furnace through the regenerator-flues is indicated by the arrows. The upper ends of the regenerators are preferably vacant, as shown at *f*, for the purpose of affording an expansion and mixing chamber for the air and gas. The flues *g*, which lead from the regenerators into the furnace, stand at an angle of about twenty-two degrees, so as to project the current of inflowing air and gas down upon the top of the metal in the bed *a*. This construction of the flue also causes the outgoing waste products to pass clear of the inner vertical wall of the expansion-chamber *f*, so that no dust or cinders are carried toward or into the mouth of the gas-flue.

In the side walls, *h*, are vertical flues *i*, of any desired depth, and in the bottom of each flue is a perforated gas-pipe, *k*, which delivers the gas into flue *i* in finely-divided streams, so as to permit its expansion and reduce the natural velocity of its flow. The upper end of the flue *i* communicates with the upper ends

of the regenerators by means of lateral flues *i'*, which open into the regenerator-chambers at substantially right angles to the inner walls of said chambers and just below the flues *g* through or below the bridge-wall. This construction and arrangement of the gas-delivery pipe not only protects it from the cinders, &c., carried over the bridge-wall by the waste products, but also serves to protect it from the direct action of the heat, which would burn out the mouth of the flue, with its consequent bad results. The gas-pipes *k* connect with the main pipe in the usual way.

The operation of the furnace, in so far as relates to the regenerators and reversing apparatus, is not different from those heretofore in use. The regenerators are alternately heated by the passage of the waste products of combustion from the furnace through them. The air entering the opening *d* passes into the furnace through the hot regenerator *b*, and becomes highly heated in its passage. It meets the gas in the chamber *f* and becomes partially mixed with it there. The natural course of the gas, however, is up along the face of the wall *h*, as indicated by the small arrows in Fig. 1, and then it enters the flue *g* at the lower side. The current of the air, on the other hand, is outside of and above the gas, as indicated by the large arrows in chamber *f*, but being heavier than the gas the two bodies flow into each other in the flue *g* and become thoroughly intermixed. The chamber *f* is of considerable size as compared with the flues *i* and *g*. This difference in size has the effect of checking the velocity of the current of gas which comes from the flue *i*, as it allows it to expand in the larger space of the chamber *f*. It also has the effect of producing a current through the flue *g* of much greater velocity than that through the chamber *f*.

By the construction and arrangement of the flue *i* with relation to the air-regenerator *b*, chamber *f*, and flue *g*, I am enabled to bring the current of air in outside of and above the current of gas and to obtain in a natural-gas furnace the well-known desirable results due to such manner of supplying the air and gas in an ordinary regenerator-furnace.

Heretofore it has been customary to project the gas in from the top or side of the furnace, and it has been almost impossible to obtain



economical results in metallurgical furnaces in the use of natural gas.

My manner of supplying the gas through the flue on the inner wall of the inlet-chambers below the bridge-wall flue *g* obviates all the defects of the former constructions in this regard and enables me to obtain perfect combustion of the fuel. I bring the flues *i'* in laterally, so as to prevent the cinder and other débris from the furnace and walls from running down into them and stopping them. If preferred, the checker-work may be continued up to the top of the furnace, thus filling the chamber *f*. In this case the gas would be compelled to pass through the interstices of the checker-work on its way from the flue *i'* to the flue *g*, or the checker-work may be omitted near the bridge.

Among the other advantages of my improvement is the fact that I can apply it to any of the ordinary regenerator-furnaces now in use, not only for puddling and heating, but also for steel and glass melting furnaces.

In applying my improvement to puddling-furnaces of the ordinary form I would construct a regenerator at each end for heating the air, which regenerator, as many of the furnaces are built with the stack at the end, could be placed at the side of the stack and the flues *c* and *e* and valve-box *d* placed in any desired position. It is not necessary to have the vertical flues *i*, as the gas-pipes can be placed in the lateral flues *i'*.

An important feature of my invention is the fact that the area of flue *i* or *i'* is relatively much greater than that of the perforations of the gas-pipe *k*, so that the said flue permits the expansion of the gas and reduces its pressure preferably to a minimum. The arrangement of the gas-pipe *k* in the flues *i* protects it from burning out—a point of great difficulty with furnaces having the gas-pipe or its nozzles exposed to the heat. The gas-pipes *k* may come together at the main pipe and be controlled by a three-way cock, so that the course of the gas may be reversed by one valve when the furnace is reversed.

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

1. In a metallurgic furnace, the combination, with a hearth or working-chamber, of reversing-regenerators arranged on opposite sides thereof and connecting therewith by downwardly-inclined flues, and horizontal gas-flues arranged in the bridge-walls of the furnace and opening into the upper ends of the regenerators at substantially right angles to the walls thereof, substantially as and for the purposes specified.

2. In a metallurgic furnace, the combination, with a working-chamber or hearth, of a horizontal gas-flue arranged in the bridge-walls and opening into the air-supply flue at substantially right angles to the line of draft, and a perforated or jet gas-delivery pipe arranged in the gas-flue, substantially as and for the purposes specified.

3. In a metallurgic furnace, the combination, with a hearth or working-chamber, of a regenerator-chamber arranged in juxtaposition to the bridge-wall of the furnace, having an expansion and mixing chamber at its upper end and connected with the working-chamber by a flue, and a horizontal gas-flue arranged in the bridge-wall of the furnace and opening into the expansion-chamber of the regenerator at substantially right angles to the line of draft, substantially as and for the purposes specified.

4. In a metallurgic furnace, the combination, with the working-chamber or hearth *a*, having the vertical and horizontal flues *i* *i'*, and the perforated gas-pipe *k*, arranged in said flue, of the regenerator *b*, having the expansion-chamber *f*, into which the gas-flue *i'* opens, substantially as and for the purposes specified.

In testimony whereof I have hereunto set my hand this 29th day of December, A. D. 1883.

JOSEPH N. PEW.

Witnesses:

W. B. CORWIN,  
THOMAS B. KERR.