W. L. McNAIR.

Heating and Puddling Gas-Furnace.

No. 198,653. Patented Dec. 25, 1877.

Fig. 1

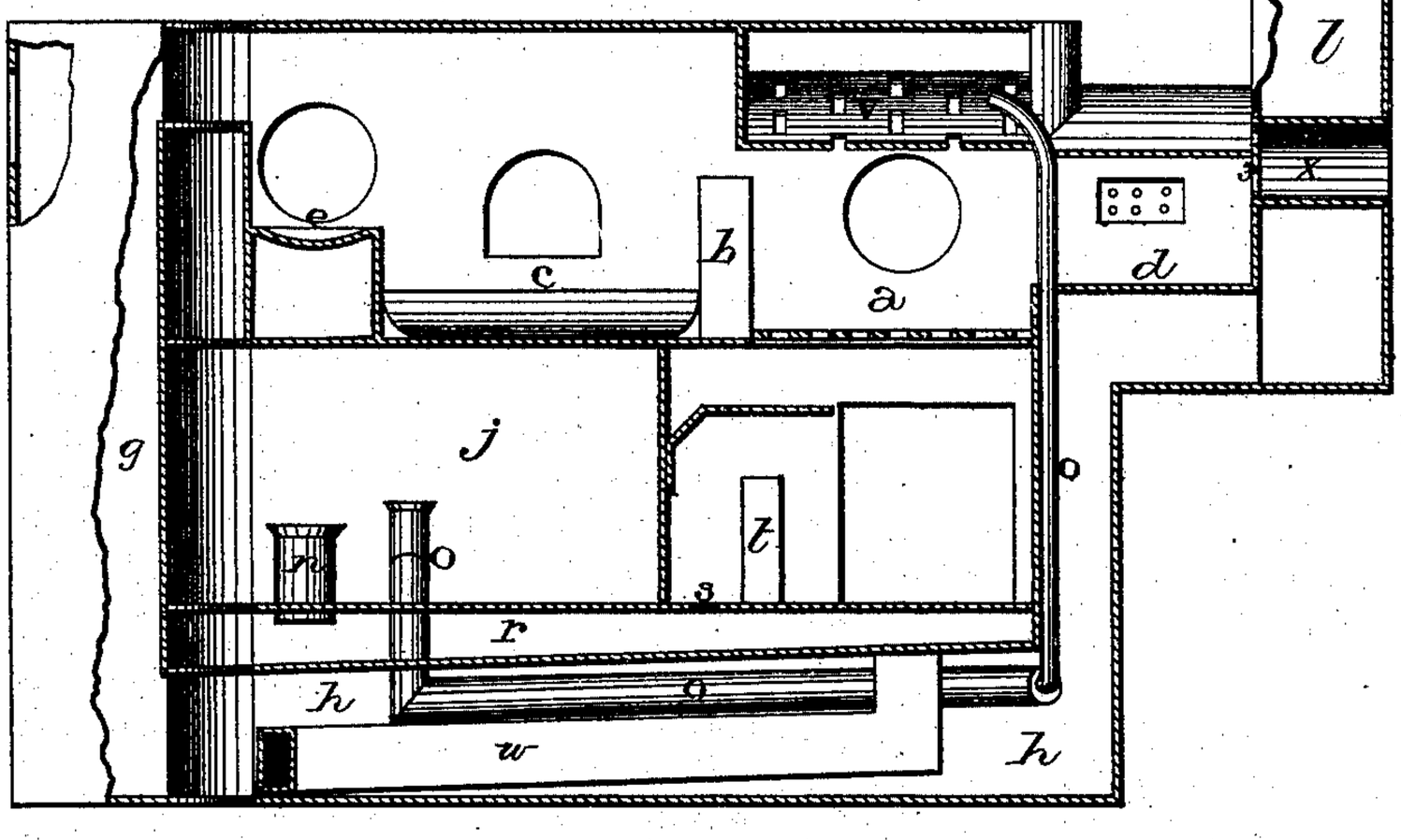


Fig. 2.

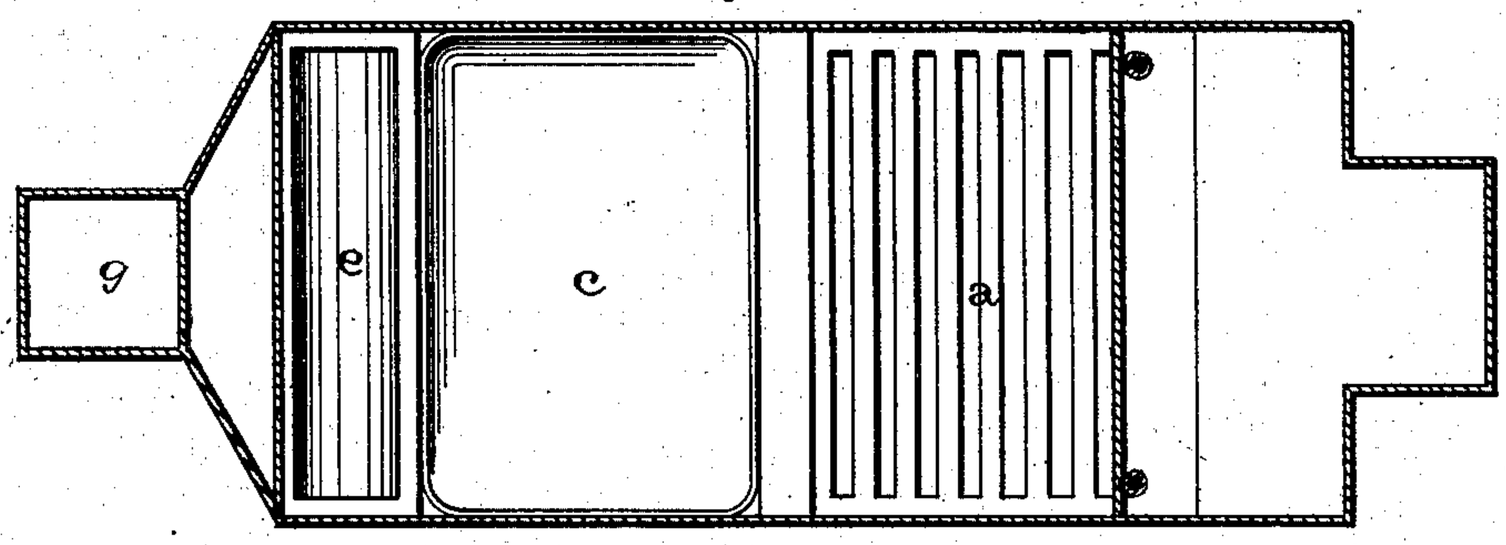
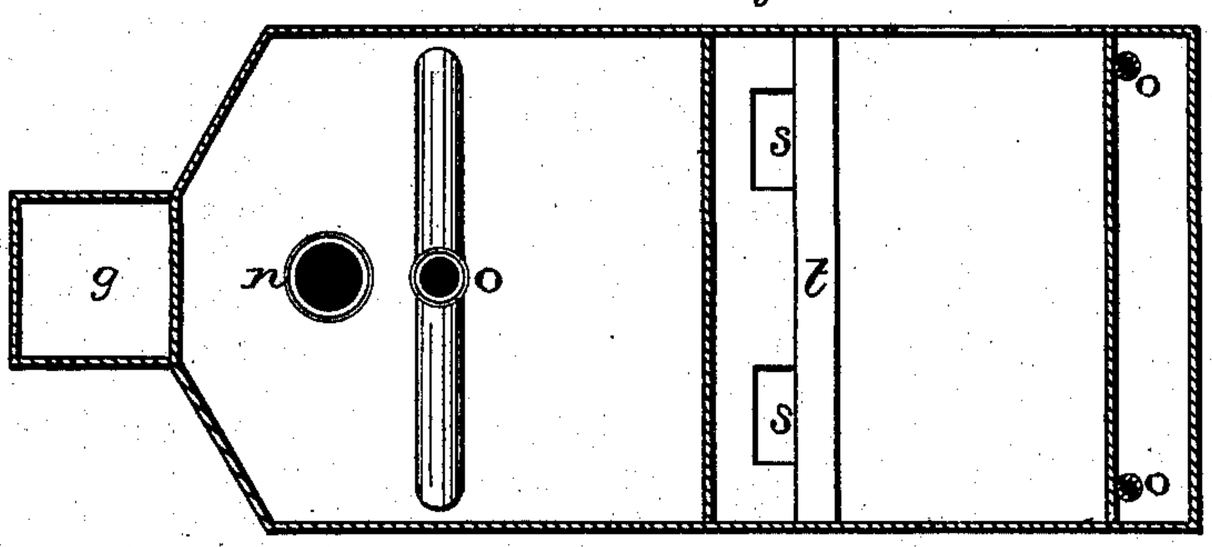


Fig. 3.



WITNESSES.

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UNITED STATES PATENT OFFICE.

WILLIAM L. McNAIR, OF ALLEGHENY, PENNSYLVANIA.

IMPROVEMENT IN HEATING AND PUDDLING GAS-FURNACES.

Specification forming part of Letters Patent No. **198,653,** dated December 25, 1877; application filed November 3, 1877.

To all whom it may concern:

Be it known that I, WM. L. McNAIR, of Allegheny city, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Gas Heating and Puddling Furnaces; 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 pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to an improvement in heating and puddling gas-furnaces; and it consists in placing a shelf or hearth inside of the fire-box for the reception of the fuel when it is first fed into the fire-box, and which hearth is heated from underneath by the waste products of combustion, so as to decompose the coal and generate gas and carbonic oxide, whereby the whole of the coal is used as fuel, and a greater amount of heat obtained from a smaller or the same quantity of fuel, and a great saving effected.

My invention further consists in the arrangement and combination of parts that will be more fully described hereinafter.

The accompanying drawings represent my invention.

a represents the fire-box; *b*, the bridge, and *c* the reducing-chamber, arranged and constructed in the usual manner. In the front end of the fire-box, above and back of the bars, is the hearth *d*, upon which the coal is thrown, so as to be heated and converted into gas or carbonic oxide before it is fed forward upon the grate. Where the coal contains but a small portion of gas, and it is desired to convert a larger portion of it into carbonic oxide, suitable air-holes are made through the front or side of the fire-box above the hearth, so as to admit any quantity of air that may be desired. The hearth being heated from underneath by the waste products of combustion, as shown, the fuel is decomposed, so as to throw off its volatile matter, and then, as the solid carbon that is left behind is fed forward upon the grate, it is converted into carbonic oxid. As the fuel is consumed and the carbonic oxide rises up over the bridge, it receives another equivalent of air, and is then converted into flame in the converting-chamber, where the perfect combustion takes place. One great advantage in thus decomposing the fuel is, that all of the sulphur in the coal is driven off in a gaseous state, and this sulphurous acid, mingling with the air over the bridge, is at once driven off before it can attack the iron in the chamber *c*. By thus protecting the iron from the action of the sulphur, a finer and better grade of iron is produced in every way, both in tensile strength and fiber, and for making steel and fine sheet-iron.

The hearth of the chamber *c* may be made to conform to the use to which the chamber is applied. In the back part of this chamber is a hearth, *e*, upon which a charge of iron may be placed, so as to be heated by the waste heat that is passing off up the stack, and thus prepared to be melted in the chamber as soon as the charge contained therein is drawn off.

The waste products of combustion pass down the flue *g* horizontally forward through the flue *h* on the way to the stack *l*, where they heat the under side of the shelf *d*.

In the stack above the level of the fire-box is formed the horizontal drying-chamber *i*, in which wet or green wood is placed to be dried, and thus prepared for the fire-box. By means of this chamber a constant supply of dry wood is kept on hand, and by thus drying the wood it burns better, gives a fiercer heat, and reduces the iron sooner. Where the finer grades of irons are to be made, wood will be used in the fire-box altogether in preference to coal; but either coal or wood may be used, as preferred.

Under the reducing-chamber *c* is formed the air-chamber *j*, which receives its air from outside. This air keeps the bottom of the fire-box cool, and passes off down through the pipes or flues *n* and *o*. Just beneath this chamber is a much shallower one, *r*, that extends nearly the whole length of the fire-box, and which is heated from below by the products of combustion as they pass through the flue *h*. The air passes from the chamber *j* down through the pipe or flue *n* into the chamber *r*, where it is heated, and then from this chamber it passes through the hole *s* up over the ash-guard *t* to the fire in the fire-box. Beside the flue *n*, the chamber *r* is supplied with

air through the two flues *w*, which pass through the large flue *h*, so as to thoroughly heat the air before it enters the chamber *r*. The air that passes through the flues *o* is also heated in its passage through the flue *h* up in front of the stack *l*, and through the fire-box. These flues *o* reach up over the perforated top of the fire-box, where they discharge all of the heated air that has passed through them. This top V has a large number of holes through it, so that the heated air will be broken up and reduced to particles, instead of descending in volumes upon the products of combustion below. By thus breaking up the air into particles it mingles freely with the products of combustion, and a more perfect and complete combustion is thus caused to take place in the reducing-chamber. Where the air is not broken up it descends in volumes, and the perfect and complete mingling that is necessary with the products of combustion does not take place. All of the flues are provided with dampers at any desired location, so that the flow of air through them can be regulated at will.

In working the fire-box when an oxidizing or reducing flame is needed, the air is allowed to pass through the flues *o* to mingle with the products of combustion, and thereby cause an excess of oxygen in the reducing-chamber. When it is desired to use a deoxidizing-flame, all air is shut off from the flues *o*, and then there will be an excess of carbon in the products of combustion in the reducing-chamber, and the iron will be carbonized thereby. Should there be more heat passing off than is necessary to create an ascending current in the stack, I place another chamber or generator, *x*, in the stack, containing wrought-iron turnings or scrap. After these scraps or turnings have become red hot I turn on a steam-jet, which steam is decomposed. The hydrogen passes off into the combustion-chamber through the small holes 3, and the oxygen, uniting with the iron, forms oxide of iron. This oxide of iron can be used as "fix" for the fire-box, or mixed with the melted iron. The oxygen, being again liberated, combines with the carbon in the iron, and hastens the operation of boiling.

Having thus described my invention, I claim—

1. The combination of the air-chamber *j*, located under the reducing-chamber, with the flue *n* and chamber *r* for supplying heated air to the grate, and the flue *o* for supplying air to the combustion-chamber, substantially as described.

2. The combination of the chamber *j*, located under the reducing-chamber, the chamber *r*, placed between the chamber *j* and flue *h*, the flue *n*, hole *s*, and wall *t*, substantially as specified.

3. In combination with the perforated top V, placed above the fire-box *a*, the hot-air chamber *j*, and flue *o*, substantially as set forth.

4. In combination with a heating or puddling furnace, the hearth *d*, placed on a line with the waste products of combustion, and upon which the fuel is first thrown, so as to be heated from underneath by the said products as they escape up the stack, substantially as shown and described.

In testimony that I claim the foregoing I have hereunto set my hand this 1st day of November, 1877.

WM. L. McNAIR.

Witnesses:
J. J. McCormick,
W. B. Connolly.