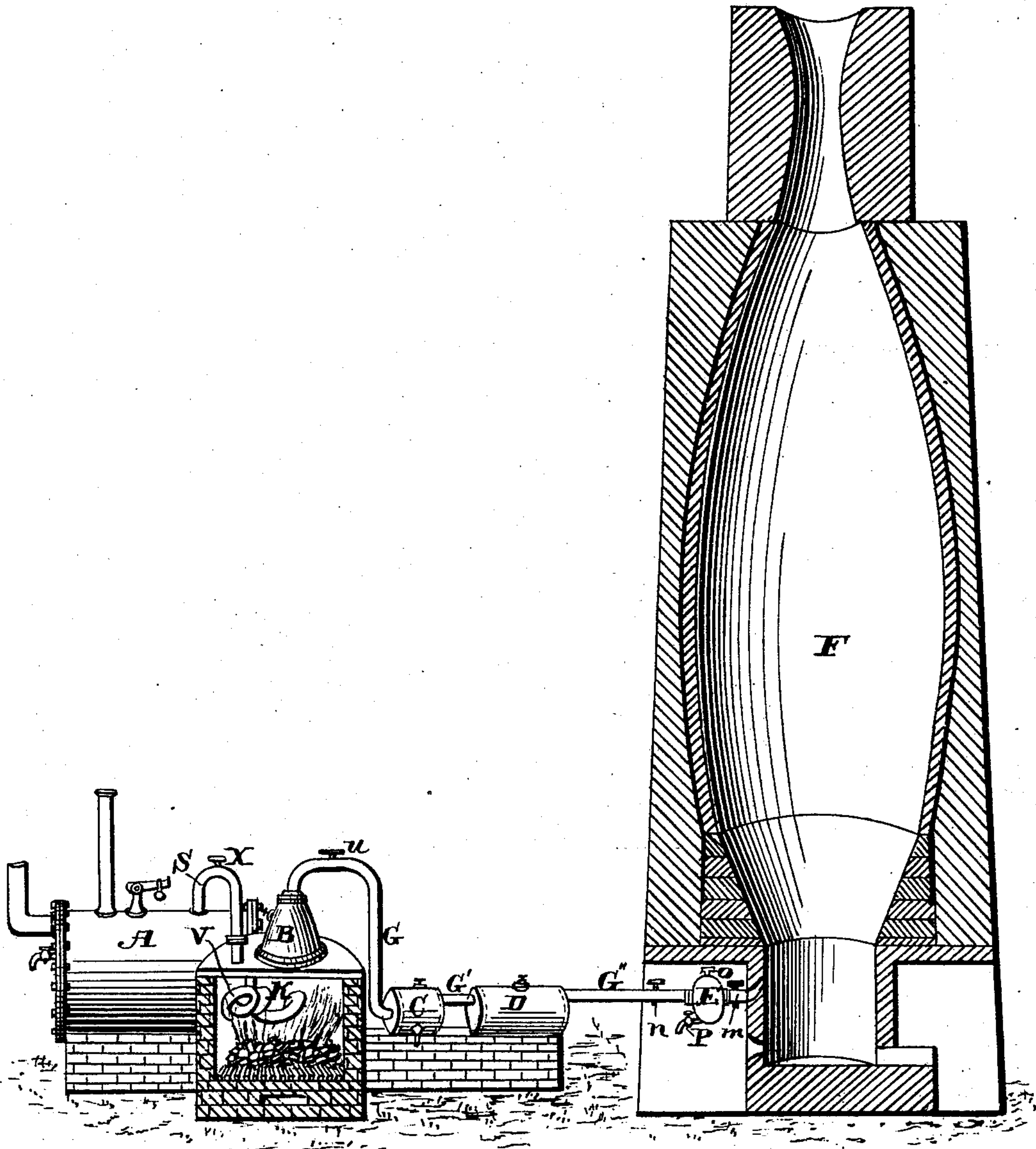


J. P. McLEAN.

Gas Furnace.

No 79,848.

Patented July 14, 1868.



Witnesses:

*John D. Billingsh  
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Inventor:

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# United States Patent Office.

JAMES P. McLEAN, OF NEW YORK, N. Y.

Letters Patent No. 79,848, dated July 14, 1868; antedated July 3, 1868.

## IMPROVEMENT IN REFINING AND SMELTING ORES.

The Schedule referred to in these Letters Patent and making part of the same.

### TO ALL WHOM IT MAY CONCERN:

Be it known that I, JAMES P. McLEAN, of the city and county of New York, in the State of New York, have invented certain novel and useful Improvements in Refining and Smelting Ores, by introducing dry hydrogen gas in a free or pure state, or in combination with other gases in a dry state, into the ore-chamber of a puddling, blast, cupola, or refining-furnace; and I hereby declare the following to be a full, clear, and exact description of the mode of producing and applying the gas, under pressure or otherwise, as shown in the accompanying drawings, which are lettered to correspond with and form a part of the specification.

Letter A is a steam-boiler; B is a retort or gas-generator; C is a cleanser, lined with porcelain, and is provided with a hand-hole at the top, and stop-cock at the bottom thereof; D is a drying-chamber, which is also lined with porcelain, and is provided with a hand-hole at its upper side; E is a dry gas-chamber, which may be lined with a mineral coating if thought best.

The top of the chamber E is provided with a blow-off cock, *o*, and a waste-cock, P, at the bottom thereof. *m* is the cock that admits the gas to pass into the ore-chamber of the furnace F. *n* is the cock which regulates and allows the gas to flow through the pipe G'', from the drier to the gas-chamber E, under a pressure of steam in the boiler A, or without pressure, by simply cutting off the steam in pipe S, after the chambers C and D and dry gas-chamber E are charged. S is a steam-pipe, connecting the steam-chamber of the boiler with the neck V of the retort. X is a stop-cock, which regulates the flow of steam from the boiler to the retort.

The neck V of the retort may be coiled, as shown in the drawings, or otherwise arranged, so that a greater amount of fire-surface is obtained for the steam to pass through prior to entering the retort B. G is a gas-pipe, that connects the retort with the cleanser, and is provided with a cock, *u*, to regulate the flow of gas into the chambers C and D. G is a pipe to admit the flow of gas or gases from the cleanser C to the drier D. K is a charcoal or other suitable furnace, to receive and heat the retort B, which may also be heated by the same fire that creates the steam in the boiler A, if thought best.

The form of the retort may be modified to suit the different furnaces, and the time and place, and it may also be coated on the inside with a suitable non-combustible enamel, similar to chambers C and D, or may be used without coating, particularly if made of a composition of iron, copper, tin, and zinc.

I will next explain the *modus operandi* of my apparatus. First, half fill the retort B, through the top or hand-hole, with iron filings or chips, mixed with zinc filings, or granulated zinc, or they may be used separately, then light the fire in the furnace K, under the retort and neck V, and when the retort and coiled neck V become quite hot, gradually let on the steam from the boiler, through the pipe S, by means of the cock X; open the gas-cocks *u* and *n*, in the pipes G and G''; then open the blow-off cock *o* for a few minutes, to allow any impure gas to escape that may have remained in the chamber E; close the cock *o*, and gradually open the cock *m*, leading into the furnace F. The steam becomes superheated in the neck V prior to entering the gas-generator or retort B, hence is nearly in a dry state.

The oxygen unites with the iron and zinc, while the hydrogen is set free with a small proportion of carbon and sulphur; therefore the hydrogen is not pure until it passes into the cleanser C, which contains potash in solution. That, having the strongest affinity for the carbon and sulphur, allows the pure hydrogen to flow into the drying-chamber D; which contains a quantity of dry chloride of lime. That salt having a stronger affinity for water than for the pure hydrogen gas, consequently the latter is allowed to pass in a perfectly dry state to the dry gas-chamber E, ready to be admitted into the decomposing-ore chamber F, where the metallic oxides part with their oxygen to the pure dry hydrogen, thus producing water, and the decomposition of the ore by the loss of its oxygen, also an increase of combustion caused by the sudden conjunction of the two gases, oxygen and hydrogen.

In case it becomes necessary to use impure dry gas or gases, draw off the liquor in the cleanser C, and allow the gases to flow into the chamber E.

The volume of carbon may be increased by throwing a small quantity of plumbago or fine charcoal into the retort, mixed with the metallic filings or granulated metal. This, however, must be done with great care to prevent the atmosphere from getting into the dry gas-chamber E and pipes G G' G'', by closing off all the cocks while putting the carbon in the retort B, as an explosion might be the result if the cocks were left open.

I would line the pipes G G' G'' with lead or tin, to protect them from the action of any acid that might be formed therein.

I do not confine myself to the above-described apparatus for generating pure, dry hydrogen gas, for smelting or refining ores, in combination with Franklinite or other fluxes, as detached reservoirs or cylinders may be filled or charged with pure dry hydrogen gas, under a pressure, and conveyed from any locality to the different furnaces, and attached in lieu of chamber E to supply the furnace puddling-bed or crucible F with pure dry gas or gases.

I am aware that steam has been extensively employed for the purpose of producing steam-hydrogen, (as it is commonly called,) to desulphurize iron ores. In that case but a small quantity of the hydrogen is disseminated amongst the ores, and that in a crude state, being combined with water or steam, carbon, sulphur, &c.; hence its effect upon the ores is in a measure lost.

But by my process, pure dry hydrogen is introduced in the ore-chamber F in a free state, until it comes in contact with the decomposing ores, where it instantly unites with the oxygen, and more effectually accomplishes its work of desulphurizing or precipitating the metal and assisting combustion. Therefore,

What I claim as novel and useful, and what I wish to secure by Letters Patent of the United States of America, is—

1. The dry gas or gases, prepared and applied to smelting or refining ores, substantially as above set forth, or otherwise prepared, to suit the exigencies of the time and place.

2. I claim the retort B, cleanser C, drier D, gas-chamber E, neck V, with pipes G G' G'', and cocks m, n, o, P, u, and X, prepared and arranged in the manner and for the purpose set forth and shown in the drawings, or otherwise arranged, substantially as described.

In testimony whereof, I hereunto subscribe my name in the presence of two witnesses.

JAMES P. McLEAN.

Witnesses:

JOHN D. BILLINGS,  
G. W. WRIGHT.