

C. D. WILLIAMS.

Boiler-Furnaces.

No. 135,869.

Patented Feb. 11, 1873.

Fig. 1.

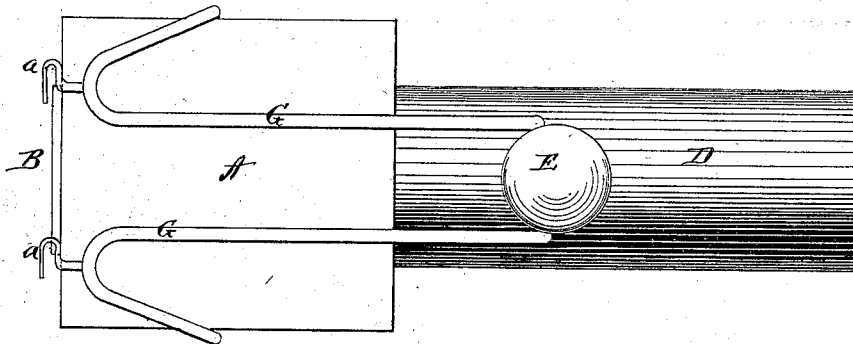


Fig. 2.

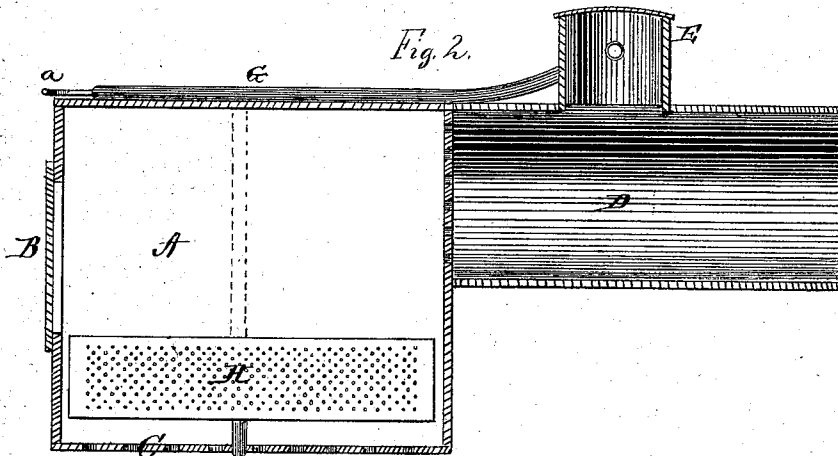


Fig. 3.



Witnesses:

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UNITED STATES PATENT OFFICE.

CHARLES D. WILLIAMS, OF ST. PAUL, MINNESOTA.

IMPROVEMENT IN BOILER-FURNACES.

Specification forming part of Letters Patent No. 135,869, dated February 11, 1873.

To all whom it may concern:

Be it known that I, CHARLES D. WILLIAMS, of St. Paul, in the county of Ramsey and in the State of Minnesota, have invented certain new and useful Improvements in Device and Process for Consuming Smoke; and do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing and to the letters of reference marked thereon making a part of this specification.

The nature of my invention consists in the construction of an apparatus for the decomposition of water or steam for the purpose of generating oxygen and hydrogen gas to be used in burning and consuming smoke or attenuated carbon of artificial fuels, coals, wood, and all other kinds of fuels, when used or found in the fire boxes or places connected with locomotives, stationary engines, steamboats, and steam fire-engines.

In order to enable others skilled in the art to which my invention appertains to make and use the same, I will now proceed to set forth how the device by means of which my invention may be carried out is constructed, referring to the annexed drawing, in which—

Figure 1 is a plan view, and Fig. 2 a longitudinal vertical section of a steam-boiler with fire-box and my device attached. Fig. 3 is an enlarged end view of one of the gas-generators in the fire-box.

A represents the fire box or place. B is the door to the fire box or place. C is the grate or bottom of the fire-box or fire-place. D represents a horizontal boiler, the openings in its inner end representing the ends of the tubes for the passage of the heat, &c. E is the dome of the boiler. G G are pipes for conveying steam from the dome on the boiler or water from the tank to the gas-generators. *a a* are stop-cocks in the pipes G G for regulating the admission of steam or water to the gas-generators in fire-boxes or fire-places. H H are the gas-generators inside of the fire-box or fire-place, the inner plates of said generators being perforated, as shown in Fig. 2.

The water or steam is made to pass from the water-tank, if water is used, or from the boiler or from the top or the sides of the dome of the boiler, if steam is used for this purpose, or from any other convenient place, through the pipes

G G, on each side of the tank, dome, or boiler, or other convenient place, and which enters the fire-box or fire-place A either through the sides of the fire box or place, or through the bottom or top of the same, as may be deemed necessary, there connecting with the gas-generators.

These gas-generators may be made of iron, copper, or any other suitable metal, and may be placed on the insides of the fire-box, so that the generator-plates will become sufficiently heated, by means of which the water or steam is decomposed, and the oxygen and hydrogen of which it is composed are thus generated and set free, and allowed to escape, through the small apertures or perforations in the plates of which the generator is composed, into the fire box or place, uniting with and consuming the smoke or attenuated carbon of which the smoke is composed.

The gas-generators H H may be of any shape, and may consist of one or two plates, which may be concavo-convex, or one plate concavo-convex and the other plane, or double concavo-convex in form, or double plane; and the steam or water pipes may connect with or enter the space between or at the edges of the plates, when two plates are used to form the generator; or may enter the generator at any other convenient point, as the circumstances of using it may require. The result is that the smoke is burned up and the heat thereof directly applied to the generation of steam in the boiler. By this process or method less fuel is required to produce a given result, as none of the fuel is allowed to pass off in attenuated carbon or smoke.

It is found that a supply of hydrogen gas, larger than is usually found in combination with fuels or in the atmosphere from which oxygen is derived to support combustion, is essential to complete combustion. The analysis of water or steam proposed, and claimed to be carried out by this invention, supplies the requisite amount of hydrogen and oxygen, and thus more nearly complies with the laws of combustion, and adding, therefore, very largely to the heat in the fire-box or fire-place by burning all surplus oxygen and hydrogen not required for the consumption of the smoke. The amount or quantity of water or steam necessary to employ or use in generating the oxy-

gen and hydrogen gases desired for use is regulated by the stop-cocks *a a*, which are so arranged as to be readily under the control of the engineer or operator. The best fuels are those which contain the most carbon and hydrogen and requiring the largest amount of oxygen for their consumption. In all fuels thus rich in these two properties, especially in carbon, a sufficient amount of atmosphere cannot usually be obtained, except by artificial means, to make the combustion complete; hence a large percentage is lost in the form of smoke, which is carbon in an attenuated form. This result is more likely to occur in the absence of a due proportion of hydrogen gas to unite with the oxygen, so as to intensify the heat necessary to consume the surplus carbon in smoke form.

Another result arises out of this invention—viz., the amount of cold air usually admitted through the fire-grates of the fire box or place will be very much lessened by supplying oxygen from water or steam instead of producing it from the atmosphere, and can therefore become more nearly regulated and adapted to the wants of combustion, and correspondingly exemption from its cooling action upon the boiler, and parallel reduction of steam. Combustion, being a chemical process, is attended by the disengagement of heat when performed in the presence of oxygen, hydrogen, and the carbons. The operation is valued for the forces which result therefrom.

Oxygen has always been held to be a supporter of combustion, while hydrogen and carbon, burned in it, were called combustibles; yet the fact is equally true, and well authenticated, that if oxygen is burned in the presence of a due proportion of hydrogen, the oxygen will become the combustible and the hydrogen the supporter of combustion. The action, therefore, is mutual. All combustibles require a certain elevation of temperature up to the point of ignition, and must be so maintained to give off by rapid chemical action the heat necessary to consume all the smoke or carbon present, and to be acted upon. Hence the necessity of producing oxygen and hydrogen gases in the fire-

box or fire-places, and that it be applied in the midst of the flame, where the attenuated carbon or smoke is found, simply because atoms separated are more powerfully attracted by supporters of combustion, and the impaction and arrest of motion develop the forces known as heat. The combustible which unites with the most oxygen in the act of burning will eliminate the most heat, hydrogen being pre-eminent, as it is shown in burning that it consumes, weight for weight, three times as much oxygen as carbon does; hence the intensity of heat from burning these two gases and their utility in consuming smoke or partially-oxidized fuel, also in form of smoke, from all kinds of fuel. This fact becomes the more important, in a commercial sense, because all the hydrocarbons used as fuel, whether found in bituminous coal, petroleum oil, shale-oil, and their residuums, require at least one thousand degrees of heat to ignite them. This principle is especially applicable to the burning of anthracite coal, as that fuel contains oxygen with but very little if any hydrogen.

I do not wish to be understood as limiting or confining my invention to the fire-boxes and fire-places of locomotives, stationary engines, steamboats, and steam fire-engines, but desire to use it in cook-stoves, and in heating-stoves and furnaces of all kinds.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

The combination, with the boiler *D*, of the furnace *A* and the perforated chambers *H H*, arranged in the bottom of the furnace above the grate *C*, and communicating with the steam space or dome *E* by means of the pipes *G G*, substantially as and for the purposes herein set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 20th day of November, 1871.

CHARLES D. WILLIAMS.

Witnesses:

EDWIN GRIBBLE,

EDWARD WALTHER.