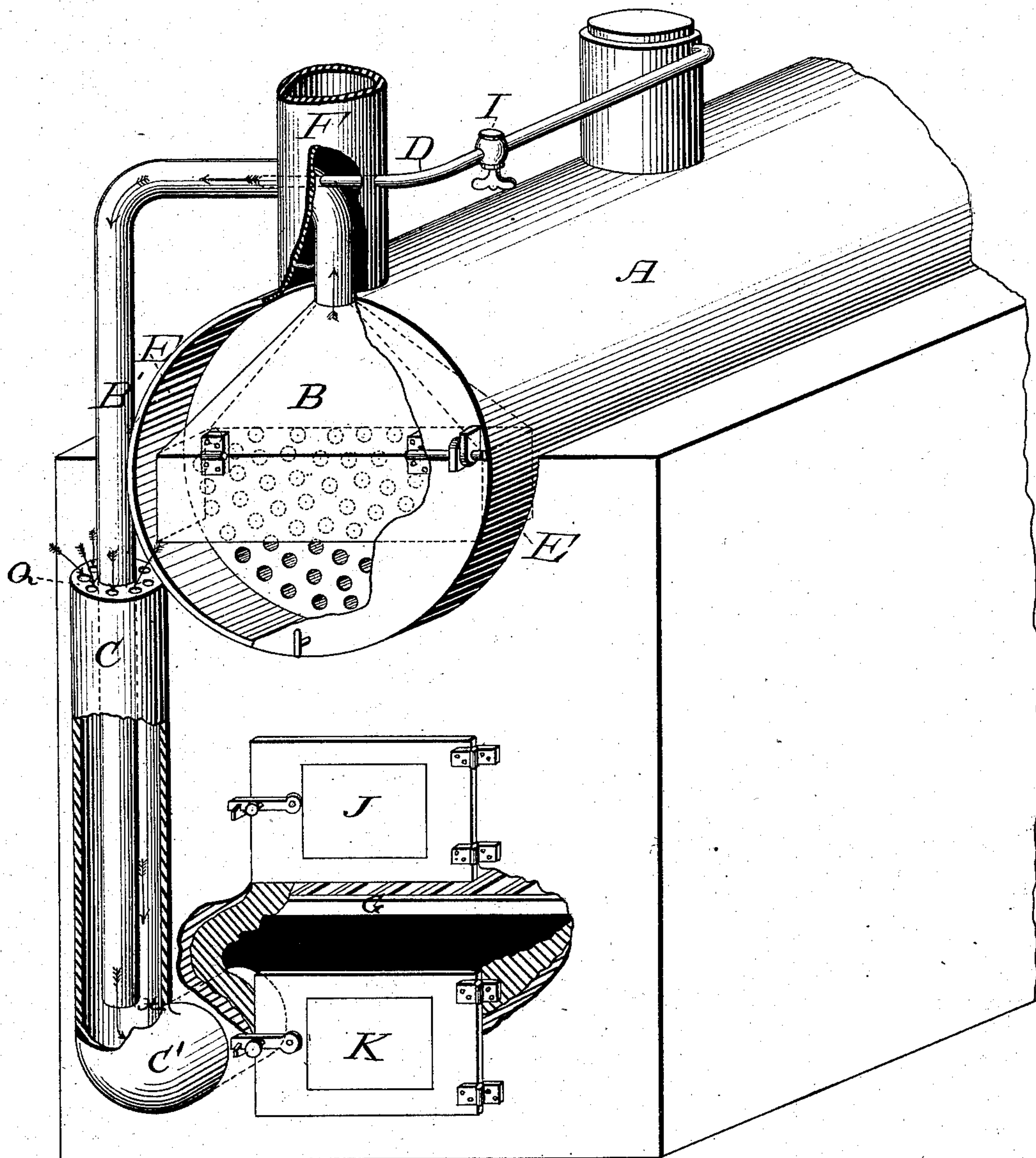


(No Model.)

W. D. SMITH.
Smoke and Gas Consuming Furnace.

No. 238,256.

Patented March 1, 1881.



Witnesses:
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WILLIAM D. SMITH, OF KEITHSBURG, ILLINOIS.

SMOKE AND GAS CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 238,256, dated March 1, 1881.

Application filed September 30, 1880. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM D. SMITH, of Keithsburg, in the county of Mercer and State of Illinois, have invented certain new and useful Improvements in Furnaces for Steam-Boilers and Furnaces generally; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawing, and to letters of reference marked thereon, which forms a part of this specification.

This invention relates to certain devices forming an apparatus to be attached to furnaces to produce a more perfect combustion of fuel and greater economy of the same, and preventing the escape of sparks.

The formation of smoke arises out of the failure of some of the processes preparatory to combustion, or the absence of some one of the conditions which are essential to perfect combustion. The color of the smoke does not determine the combustible gases wasted by being carried off. Carbonic oxide, carbureted hydrogen, and various other hydrocarbons in the form of vapor may escape invisibly from the chimney, and as they are nearly all combustible it is so much fuel wasted.

To remedy this defect in furnaces and to utilize all the waste gases is the object of my invention; and it consists in the construction and arrangement of certain devices by which the smoke and waste gases and sparks escaping from the flues or smoke-box of a boiler or furnace are trapped, then mixed with superheated or dry steam (the steam also forming an injector) and a proper supply of atmospheric air at one or more points, and in such manner that the combined mass is mingled and intimately mixed before its introduction into the furnace.

It also consists in the process of commingling and admixing the gases above referred to, as will hereinafter more fully appear.

The accompanying sheet of drawing illustrates one mode of applying my invention to a furnace of a stationary boiler, and represents, in perspective, the simplest form by which it may be carried out.

Before further describing my invention in

detail, I deem it essential to remark, so that my principle may be better understood, the gas from which smoke proceeds is principally carbureted hydrogen, and, like other inflammable gases, it is combustible only in proportion to the degree of mixture and union which is effected between it and the oxygen of the air. It is well known that the bituminous portion of coal is convertible to heat in the gaseous state, while the carbonaceous portion, on the contrary, is combustible only in the solid state, and what is essential to the perfect combustion of both is to intimately and thoroughly mix and unite them before their admission into the furnace. The carbonaceous part of the gases evolved from the coal remains black at a comparatively low temperature, and utterly inoperative as a heating medium. Now, if this gas escaping with the smoke is not brought into contact with the essential heat and its proper proportion of air it passes off with the invisible gases—such as carbonic oxide—as is usually the case in common chimneys.

I am well aware that there are non-combustible gases, such as carbonic acid, &c., and if such gases were constantly returned to the furnace would eventually destroy the fire; but to prevent such I constantly introduce quantities of air and steam, and they, being mixed with the outgoing gases, form a carbureted gas which is highly inflammable. I thus neutralize the evil effects that the carbonic-acid gas would otherwise have, and which neutralization and constant admixture of the elements of combustion, as before stated, form the gist of my invention.

Referring more particularly to the drawing, A shows the boiler; B, the hood, located within the breeching or smoke-box. This hood B is conical in shape, and has attached to its lower end or base a hinged flap extending down and in front of about two-thirds the area of the tube-sheet, forming a chamber between the tube-sheet and the hood.

B' is a conduit or pipe for conveying the smoke and gases and sparks from the smoke-box. One end of pipe B' fits into or on the apex of the hood B; then passes through the side of the uptake or chimney; thence into and down concentrically through air-pipe C, to

near its base. The air-pipe C is much larger in diameter than the smoke-pipe. Its upper end is perforated with a series of small holes, Q, through which air is admitted in jets.

5 C' is an elbow-pipe connected to the lower end of pipe C opening into ash-pit or furnace, and which forms a mixing-chamber, in which the gases from the smoke-pipe, the steam from pipe D, and the air from perforations Q are all
10 thoroughly mixed before their admission to the furnace.

D shows a steam-pipe leading from the steam-dome to the smoke, spark, and gas conveying flue.

15 E is the smoke-box, and F the uptake, pierced on one side for the gas-flue B', and on the opposite side for steam-pipe D, though the steam-pipe may enter the flue B' from the outside.

20 Pipe D may be coiled within the uptake, by which the steam passing through it may be additionally heated.

I is a stop-cock or valve for regulating the quantity of steam to be used.

25 J is the door for feeding fuel, and K the ash-pit door. It is preferred to have the ash-pit door air-tight. G is the grate.

The operation of my invention is as follows: The fire is started as usual, the smoke passing out of the smoke-stack; but when steam is up
30 the valve I is opened. The steam passing out through pipe D draws the smoke and gases into hood B, thence into flue B', where they become mixed. The velocity of the steam and gases passing down pipe B' forms a vacuum
35 in pipe C, which draws air in jets through the perforations Q in the upper end of said pipe. The air thus drawn in becomes partially heated on its way by its impingement on the outer surface of the smoke and steam pipe B'. The
40 volume of air, being broken by passing through the minute perforations Q, readily mixes with the smoke, gases, and steam in chamber C',

said steam and air supplying the essential constituents to make the otherwise wasted gases a highly inflammable and combustible 45 gas. I thus utilize, as before stated, a fuel that has been heretofore wasted, and I also prevent the great annoyance of smoke and danger from sparks.

It will be observed that pipe B' extends 50 well down into air-cylinder C. This is necessary (as actual tests have proven) to draw the air in with sufficient force to supply the requisite quantity, and give to it the desired heat for ready admixture with the gases. Some air 55 passes up with the smoke from the smoke-box, but not sufficient for perfect combustion.

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

1. The method herein described of consum- 60 ing the waste gases of furnaces, consisting, essentially, of first arresting the smoke, sparks, and gases, then injecting a steam-jet into them, causing a mixture of the same, then drawing in atmospheric air through perforations, thus 65 breaking its volume, then partially heating it before its admixture with the mixture of steam and gases, then mixing the whole in a separate chamber, and forcing the combined mass into the combustion-chamber, in the manner and 70 for the purpose set forth.

2. The combination, in a smoke-burning and spark-arresting furnace, of the smoke-box E, hood B, steam-pipe D, smoke-pipe B', extend- 75 ing into air-cylinder C, as shown, said cylinder being provided with perforations Q, and mixing-chamber C', opening into ash-pit or furnace, all constructed and arranged in the manner shown and described.

WILLIAM D. SMITH.

Witnesses:

GEORGE LUNT,
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