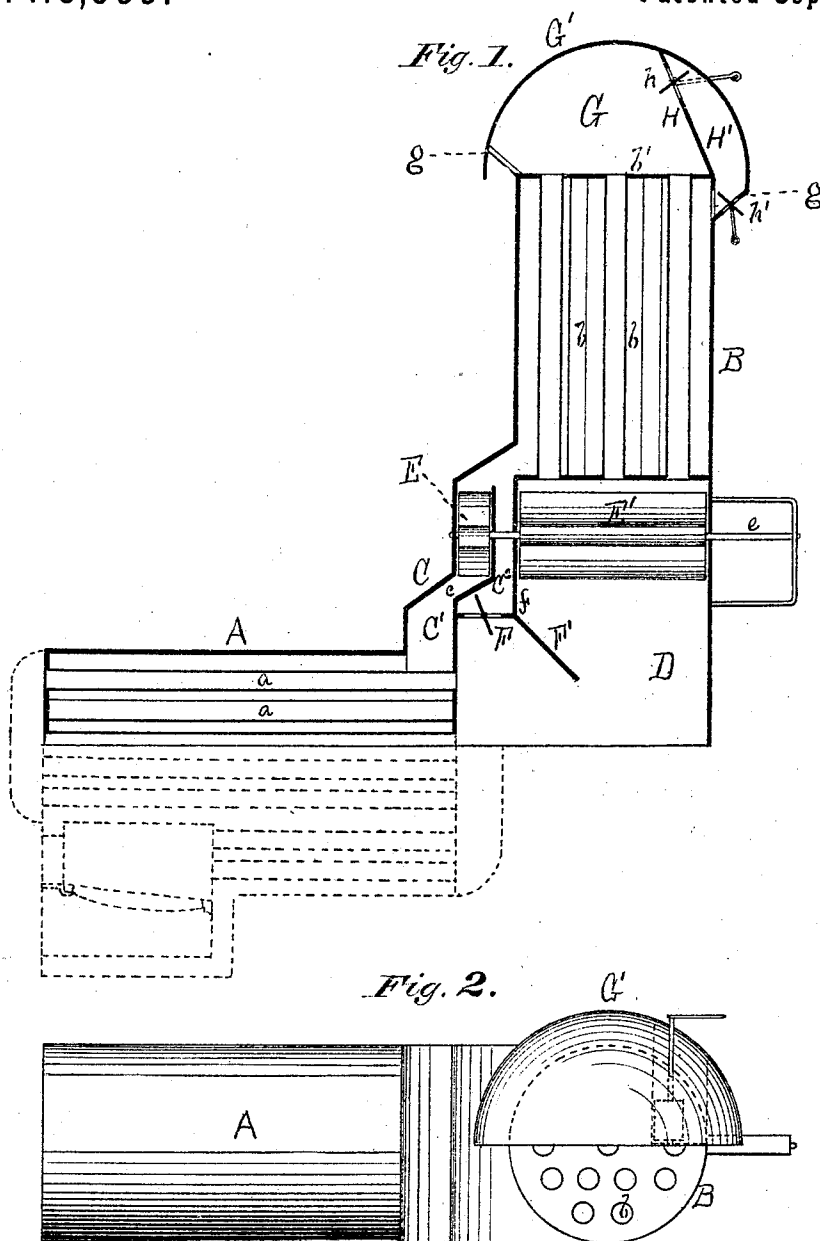


BENJAMIN F. SMITH.
Improvement in Smoke-Stacks for Furnaces.

No. 118,883.

Patented Sep. 12, 1871.



Witnesses:
T. C. Brecht.
Edwin James

Inventor:
Benjamin F. Smith.
per J. E. D. Holmead.
Attorney.

UNITED STATES PATENT OFFICE.

BENJAMIN F. SMITH, OF NEW ORLEANS, LOUISIANA.

IMPROVEMENT IN SMOKE-STACKS FOR FURNACES.

Specification forming part of Letters Patent No. 118,883, dated September 12, 1871.

To all whom it may concern:

Be it known that I, BENJAMIN F. SMITH, of New Orleans, in the parish of Orleans and State of Louisiana, have invented certain new and useful Improvements in Smoke-Stacks for Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawing and the letters of reference marked thereon forming part of this specification, in which—

Figure 1 is a vertical sectional view through the center of the smoke-stack. Fig. 2 is a top view, part of the hood or cap being removed.

The object of my invention is to supply a device that will utilize a large per cent. of what are now the waste products of combustion. This I accomplish by securing within the smoke-stack of a furnace the necessary means or agent to produce a powerful counter or upward-and-downward draught, whereby the products of combustion, such as carbonic-oxide and other gases, and the mechanical products of carbon, and also the unconsumed air, are not allowed to escape, but are returned to the fire-box or furnace. My invention consists, first, in giving to the chimney or smoke-stack a novel form. Instead of erecting a tall and expensive stack to secure the necessary draught-passage, I construct it of three sections, a horizontal, a vertical, and an intermediate. The first two are supplied with flues and the latter with fans. These are so arranged that the horizontal chamber fitting over the boiler secures the radiation of the same, while its tubes or flues receive the gases as they escape from the furnace. These separating in the intermediate chamber are conveyed in different directions, the lighter to the top of the chamber, from which, through a valve-opening, they escape by means of a flue to the blower, and from which, through the action of a fan or equivalent force, they are returned to the furnace. The carbonic-acid gas and the other like heavy partially-consumed products of combustion do not, with the light gases, ascend to the top of this chamber, but, impinging against an inclined partition or diaphragm, are conveyed down under the same and in such position as to be readily acted on by a fan which revolves in a direction directly the reverse of the small fan just alluded to. Through the action of this last-mentioned fan these gases,

and whatever other valuable or unconsumed products of combustion now remaining with them, are driven through the vertical flues or tubes into a supplementary chamber, which is formed by a hood or bonnet so secured at and over the upper section of the smoke-stack or chimney as to leave an open circular or annular discharge-passage between the same. It is here in this supplementary chamber that the final separation takes place. The worthless gases and other exhausted products of combustion, being discharged through the opening between the smoke-stack and the hood, pass off, while the valuable ones, or those which still contain elements or ingredients which may be rendered serviceable, possessing sufficient specific gravity to ascend to the top or dome of the supplementary chamber, and from thence through a graduated valve, are conveyed to a flue formed by an inclined plate and the wall of the hood. On the outer wall of this flue, and at the section thereof which forms the point of union between the hood and smoke-stack, is another graduated valve, so arranged as to be adjustable at any required position between fully closed and wide open. Through this valve is admitted fresh air, which mingles with the gases and other products of combustion passing down between the tubes and in and around the same, thus extracting heat from the same in their passage to the blower, and from which they are conveyed to the furnace through the action of the fan, as hereinbefore stated.

The construction and operation of my invention are as follows: The smoke-stack consists of a horizontal section, A, and a vertical section, B, which are connected by means of a zigzag passage, C. The section A is filled with a series of horizontal tubes, *a a*, and the section B with a series of vertical tubes, *b b*. The general contour or outline of the stack is clearly shown in Fig. 1. The section A is designed to fit over and around the sides of the boiler so as to receive the radiating heat therefrom, its rear face being flush with the boiler-head and in such relative position thereto that, through a hood or any other suitable contrivance, the gases, &c., can be readily introduced into the open-mouthed tubes *a a*. These tubes *a a* communicate with a chamber, D, which extends under the entire surface of section B and partially under the passage C of the

smoke-stack. This passage C, by means of a partition, *c*, is divided into two divisions or compartments, C¹ C², C¹ being also zigzag in form and the other nearly L-shaped. It is the first of these, C¹, that affords the direct connection between the vertical section B and the horizontal section A of the smoke-stack. In this division C¹ is secured on a suitable axle—the fan E. The division or compartment C² acts as a flue for the escape of the light gases that are discharged by the tubes *a a* into the chamber D to the upper section of the passage C¹. At the mouth of this flue C² there is an adjustable valve, F, which works on an axle secured in suitable bearings supported on the walls *c* and *f* of the flue. F' is an inclined deflecting-plate or diaphragm that extends from the wall *f* down into the chamber D. In the upper section of this chamber is secured the fan E'. This fan E', like the fan E, is secured to the axle-shaft *e*, which works in suitable journals in the sides of the smoke-stack. The fans E E' are so connected as to insure their revolving in opposite directions, so as to produce the counter-currents necessary to the effective working of my invention. This fan E' revolves immediately below the open mouths of the tubes *b b*. The other ends of these tubes *b b* communicate with the supplementary chamber G. This chamber G is formed by the perforated plate *b'* and the dome-shaped hood or bonnet G'. This hood G' is supported and held in position by the inclined rods *g g*, and at such relative position thereto as to leave a discharge-passage or opening between the smoke-stack and the hood G'. H is a partition or wall that cuts off a section of the chamber G and forms an independent chamber, H', which communicates directly with the vertical section B of the smoke-stack. *h h'* are two graduated valves, one secured on a suitable revolving shaft working in an opening in the upper section of the partition H, and the other in a like opening cut through the outer wall of the section B of the smoke-stack and directly at the lower section of the chamber H'. The first of the valves serves for the escape of the lighter gases into the chamber H', and the other for the admission of fresh air, which, mingling with the gases, returns with them down through the section B of the smoke-stack and so on to the furnace. These fans E E' I have described as being attached to a single shaft, *e*, but they may be otherwise arranged, and in any desired manner that will accomplish the result aimed to be attained—that is, their working in opposite directions, so that while one produces a downward the other shall produce an upward current.

Instead of fans steam-jets may be used when the same are so arranged and applied as to effect and insure like results. In some instances, owing to the cramped space or condition of the boilers, it may be found necessary to dispense with the horizontal section A, in which case I lengthen the section B, by which I secure the necessary heat-absorbing surface.

The operation is as follows: The smoke-stack

being constructed as distinctly herein described is secured to a boiler in the manner stated—that is, its horizontal section A fitting over and around the sides of the boiler as a cap, so as to receive and retain the radiating heat therefrom. The front end of this is on a line with the head of the boiler. The gases, as well as all of the partially-consumed products of combustion, are, as already stated, by any suitable device, such as a hood or its equivalent, conducted directly to the tubes *a a*. Entering and passing through these channels they are discharged in continuous volumes into the chamber D. From this chamber the lighter gases, and even, perhaps, some of the more volatile particles of the partially-consumed products of combustion, ascend, and, passing through the valve F, are conveyed by the flue C² to the upper section of the chamber C¹, and from which, by the direct action of the fan E, are immediately returned over the heated surfaces of the tubes *a a*. As the lighter gases and particles are being thus reconveyed, the carbonic acid and the other heavier gases, &c., which, striking the angular plate or diaphragm F', are carried under the same into the open or unobstructed section of the chamber D, where they are caught, and, through the strong draught of the large fan E', are driven up through the vertical tubes *b b* to the chamber G, where the worthless gases and the thoroughly exhausted or consumed particles are separated from those which still contain ingredients or elements which may be utilized, and are, consequently, still valuable. The former are discharged through the opening *g'*, and the latter, ascending by their specific gravity to the upper section of the chamber G, are deflected by the dome G', through the valve *h*, into the chamber H', and, where mingling with the pure atmosphere which is continually being admitted through the valve *h'*, are drawn down over the heated surfaces of the tubes *b b* until they reach the upper section of the chamber C¹, when, through the action of the fan E, they are driven down over the highly-heated surfaces of the tubes *a a*, and from thence to the furnace.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. One or more chambers, D, arranged in such relative position to the smoke-stack that it shall receive all the gases, &c., from the furnace, so that they can be separated therein, by their specific gravity, to be conveyed in different directions, substantially as described.
2. The fans E E', arranged in a smoke-stack in such manner that, through their working, an upward-and-downward draught shall be produced for the purpose stated, substantially as described.
3. The section A of a smoke-stack, provided with flues *a a*, chambers D C¹, flue C², and valve F, either with or without the fan E, when the same are so combined as to secure the return to the furnace of the lighter gases, &c., substantially as described.
4. The vertical section B having tubes *b b*, chambers D G H', valves *h h'*, and passage *g'*,

either with or without the fan E', when the same are so combined and arranged as to operate substantially as described.

5. The smoke-stack, consisting of the sections A B having tubes *a a b b*, passage C, and chambers D G H', when the same are provided with valves and fans so as to operate substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

BENJ. F. SMITH.

Witnesses:

JOS. T. K. PLANT,
W. H. BOSS.