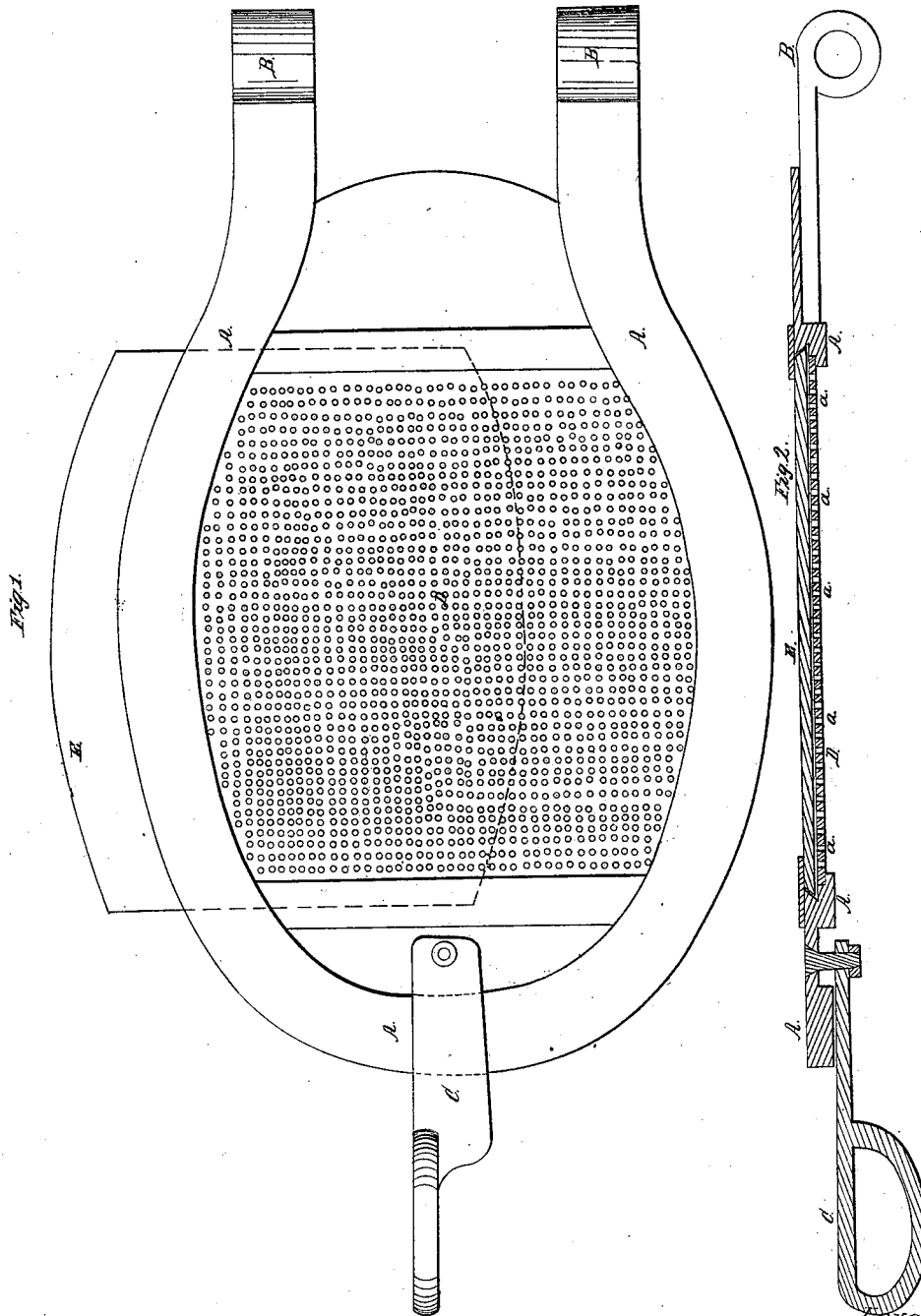


*J. Wickersham,*

*Steam-Boiler Attachment.*

*No 51,638.*

*Patented Dec. 19, 1865.*



*Witnesses:*  
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# UNITED STATES PATENT OFFICE.

JOHN WICKERSHAM, OF BALTIMORE, MARYLAND.

## IMPROVEMENT IN FURNACE-DOORS.

Specification forming part of Letters Patent No. 51,638, dated December 19, 1865.

*To all whom it may concern:*

Be it known that I, JOHN WICKERSHAM, of the city and county of Baltimore, and State of Maryland, have invented a new and Improved Furnace-Door for Steam-Generators and for other purposes; and I do hereby declare that the following is a full and exact description thereof, reference being had to the drawings, and to the letters of reference marked thereon.

The nature of my invention consists in the arrangement and combination of a blank slide with a perforated furnace-door, for the purpose of introducing air through a large number of small orifices or perforations made in said door above the fuel-bed of a furnace or other heater, so that the columns or jets of air entering and passing through said orifices may mix more readily with the gases arising from the fuel, serving better to burn such gases, economize fuel, and aid in producing a better blast.

The universal and rapidly-increasing use of steam as a motive power has led to many experiments whereby to economize fuel in generating the same, and while some success has been obtained, it has been but partial and insufficient, as also attended with more or less complications and expense. Perfect combustion and the economy of fuel has also been desirable in other heaters not generating steam. To accomplish these results or ends my invention has been made.

In the drawings, Figure 1 represents an elevation of the furnace-door of a locomotive or boiler with my invention applied, and Fig. 2 is a central section through the same.

A represents the frame of the door; B B, the hinges; C, the latch; D, a plate perforated with a series of small orifices, *a a*, through which the air enters; E is a slide-door behind this plate, to regulate the quantity of air to pass in. It is self-evident that the air supplied through these orifices *a a* will enter the furnace above the fuel-bed as a series of small columns or jets of air, and will mingle more intimately and readily with the gaseous products, assisting in a more rapid and complete combustion of the said gases, as well as of the fuel itself. This feeding of air, too, acts as a blower, giving a better blast. These results have been fully established by experiment. The action of these jets of air (entering the furnace as a shower, exposing so much more surface than

if supplied in any other way) may be compared to a series of blow-pipe blasts, insuring a higher temperature, a more perfect chemical action, and consequently a more perfect combustion, for these gases, without a properly regulated quantity of air, and that properly supplied or fed, will pass off unconsumed and wasted into the flue or chimney. In entering the furnace these small currents or jets of cold air have a tendency to fall down upon the mass of fuel, (arising from the difference in their specific gravity and that of the heated air within,) and, meeting the ascending currents of heated gases, as they arise from the same fuel, the more speedy and perfect mingling is facilitated. The temperature of these small currents is somewhat modified by friction in passing through the orifices or perforations.

If necessary, the slide-door may be put in front of the perforated plate, and inclined slats may be put on the inside to deflect the currents of air more directly down upon the fuel-bed. If a thick non-combustible substance be used in the door the orifices may be bored with an inclination downward on the inside. These modifications and others may be made without effecting the nature of my invention, and these series of small orifices may be made or placed elsewhere, if desired, than in the furnace-door.

Some of the results obtained by experiment by supplying air in this manner over the fuel-bed of a locomotive-furnace are the following—viz: that bituminous coal reduced to a fine dust yields as good a fire as the lump coal; that it is not drawn through the flues to the same extent, (less by three-fourths;) that the particles lodged in the smoke-box are much smaller in size; that by opening the exhaust, which change is shown to be admissible and advisable always when possible, the smoke-box may be rendered nearly, if not quite, entirely free from coke; that the smoke-stack throws but little smoke or coke, except while the fire-door is open and fresh fuel is being added, and hence there is much less liability of fire therefrom, and that the front of the smoke-box is not liable to be burned out. Again, the coal passes over the period of coking without crusting upon the top, and the use of the poker is but seldom required. A continuous blaze is kept up over the entire

coal-bed, which is not burned in strips or holes, as is otherwise generally the case. That when the proper quantity of air is found it shows that in rising an inclined plane, there being more steam used and exhausted in the smoke-stack, the steam-gage always indicates an increase of steam in the boiler at that time, which usually necessitates the opening of the smoke-box door, so as to counteract the effects of the exhaust.

It has been shown by experiment on a stationary engine that a more regular head of steam, with a saving of nearly twenty-five per cent. of fuel and with a reduction of nearly one-half of the labor of the fireman, is obtained; also, that an inferior quality of coal can be used, which otherwise could not be. Screenings from anthracite or semi-bituminous coal, (usually termed "lime-burners' coal,") being the lowest-priced coal sold in our markets, when mixed with one-half or less Cumberland, yielded the same fire as when Cumberland alone was used.

I have found that orifices about one-sixteenth by one thirty-second are a good size for ordinary purposes; but the diameters may be varied—increased or decreased—if found desirable, under varying circumstances.

The principle of my invention is equally applicable to all kinds of furnaces, stoves, or heaters for burning fuel, and is especially applicable in the burning of anthracite coal, so as to produce an abundant blaze. Any of the usual devices may be employed to regulate the amount of air to be introduced. This method of feeding air is a great protection to the door if perforated, preventing, in a great measure, its burning out. Plate-iron about one-eighth inch thick, for locomotive purposes, will be a sufficient thickness.

I am aware that air has been introduced into the fire-box of locomotives, stationary furnaces, &c., in various ways—from underneath, from the sides and front, through tubes, hollow stay-bolts, or other large-sized holes.

I am aware that double perforated doors have been used; also, in a few instances, single ones, having a few large-sized holes at the bottom and a perforated slide connected therewith; but all these devices have failed to secure anything like, or even approaching, a maximum amount of combustion, and most have been condemned upon trial as inefficient and expensive in mechanical construction, as also wasteful of heat and fuel. They differ

from my invention in the means, and more particularly, in the result to be obtained, which, in my case, is secured by a large gain of "chemical force," brought about by supplying the air in the manner I do—through a door resembling a fine sieve.

In the double doors which have been used (intended to restrain the air and raise its temperature) volume and velocity are both sacrificed, as well as chemical force, blast, &c., this owing to the few large holes in front plate, as, also many large ones comparatively in inside plate.

In the rare instances of single doors with a few large holes—say, one, two, or three—and a perforated slide, chemical force—one of the most important results gained by my invention—is lost. In such doors it will be found the slide so operates as to affect each hole alike, opens or closes, or partially opens or closes, each and every one, so that the greater necessity for air in the furnace the wider they depart from the principle of chemical force or affinity, and by lowering the temperature of the furnace it causes effects diametrically opposite to those intended, and which ought to follow. With my slide I close or obliterate entirely just such a number of holes as I desire, leaving the rest entirely open, in order to secure the necessary quantity or supply of air (at the same time I preserve the blast or velocity) and the chemical force arising from a multiplicity of minute currents of air falling upon the fire-bed and mixing with gaseous products.

My invention is both blast and mixture, and may be used on both sides of fuel-door, so as to cover the whole of the fire-bed, insuring more perfect combustion than has hitherto been attained.

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

The combination and arrangement of the blank-slide A and perforated door B, whereby to regulate the supply of air over a fire-bed without affecting the velocity or blast, at same time preserving the molecular currents, which secure a large gain of chemical force.

JNO. WICKERSHAM.

Witnesses:

S. S. FAHNESTOCK,  
A. EBERT.