(No Model.) 2 Sheets—Sheet 1.

A. B. COSBY.

STEAM BOILER FURNACE.

No. 502,617. Patented Aug. 1, 1893.

Fig. 1.

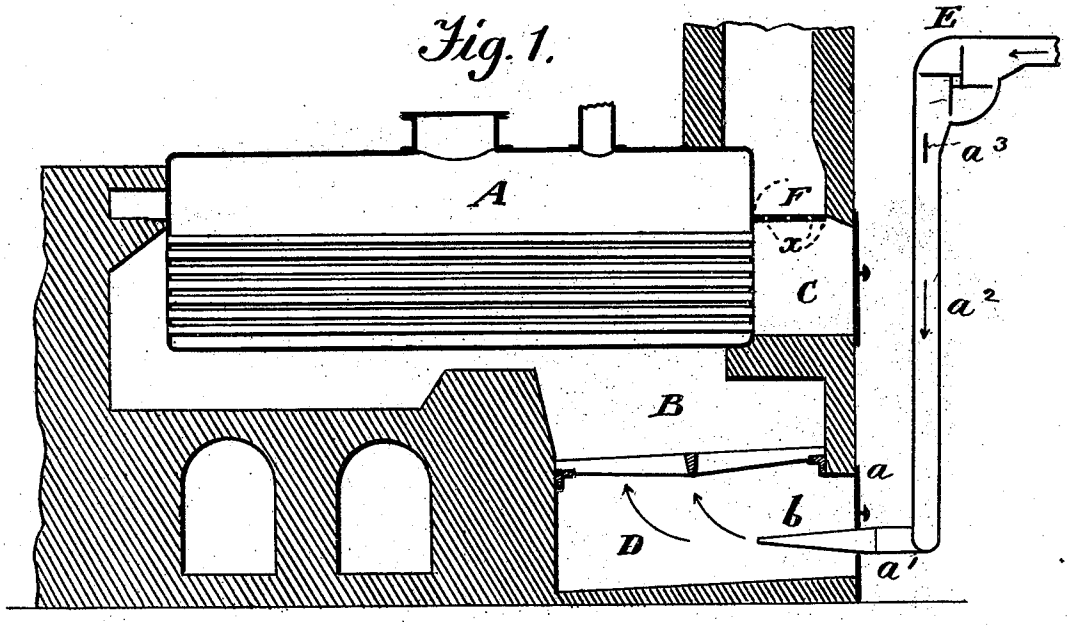


Fig. 2.

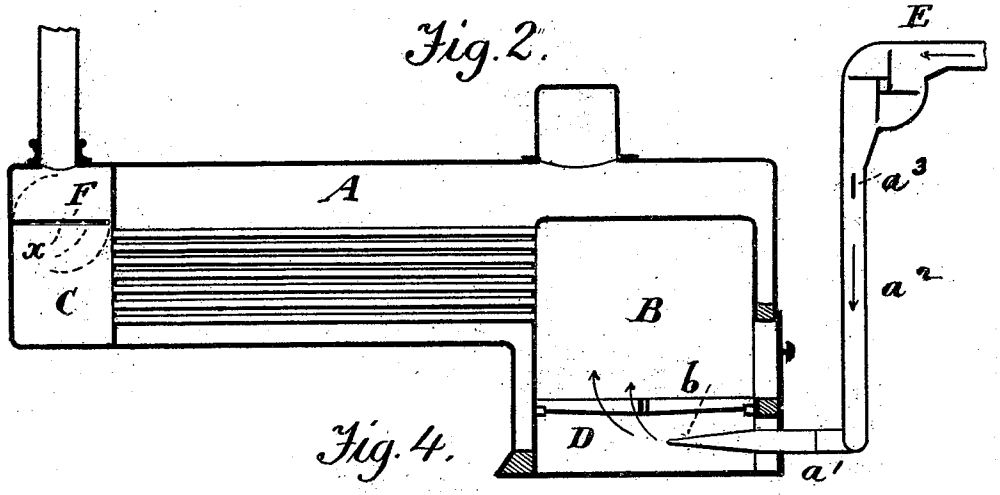
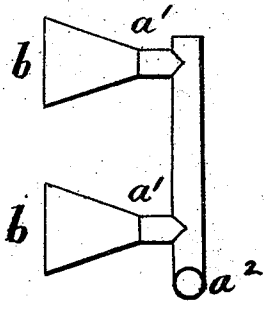


Fig. 4.



Witnesses
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(No Model.) 2 Sheets—Sheet 2.

A. B. COSBY.

STEAM BOILER FURNACE.

No. 502,617. Patented Aug. 1, 1893.

Fig. 3.

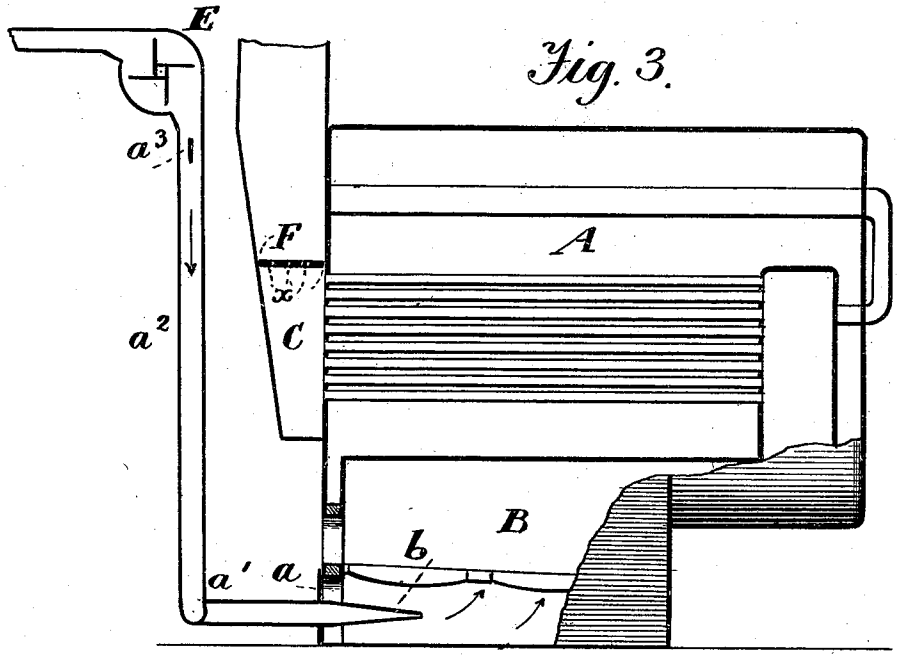


Fig. 5.

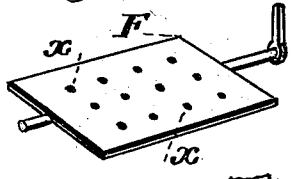
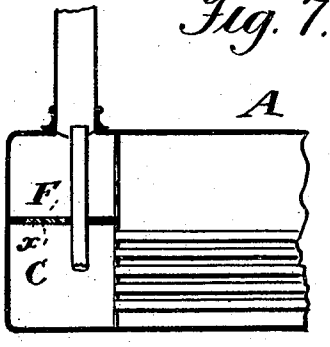


Fig. 6.

Fig. 7.



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UNITED STATES PATENT OFFICE.

ANDERSON B. COSBY, OF RICHMOND, VIRGINIA, ASSIGNOR OF TWO-THIRDS TO MARK M. STRAUSE AND SAMUEL PROSKAUER, OF SAME PLACE.

STEAM-BOILER FURNACE.

SPECIFICATION forming part of Letters Patent No. 502,617, dated August 1, 1893.

Application filed May 2, 1893. Serial No. 472,777. (No model.)

To all whom it may concern:

Be it known that I, ANDERSON B. COSBY, of the city of Richmond, in the county of Henrico and State of Virginia, have invented an Improvement in Steam-Boiler Furnaces, of which the following is a specification, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My invention, considered as a method, relates, more particularly, to promoting and obtaining practically a perfect combustion of fuel in a boiler furnace, and increasing the steaming capacity of the boiler by preventing loss by the too free escape of heated gases, and thus effecting economy in the use of fuel, as hereinafter described.

Heretofore, that is to say before my present invention, efforts have been made to effect, practically, perfect combustion in a boiler furnace by means of a forced draft and to realize the full benefits derived from such substantially perfect combustion, but they have failed for the reasons, first, that either too much or too little air was introduced under pressure to effect the required combustion; and, secondly, that the heated products of combustion, principally carbonic acid gas, and the nitrogen constituting the incombustible element of the air introduced, were allowed to escape too freely and at too high a temperature, thus carrying away heat which should have been communicated to the water in the boiler and thus utilized in the generation of steam.

In my invention, hereinafter fully described, I have obviated the defects above enumerated and produced practically perfect combustion, at the same time preventing the loss of heat resulting, as before stated, from the unnecessary discharge of intensely heated products of combustion from the chimney.

In carrying out my improved method, I provide the boiler with a tight ash-pit and a tight furnace, and introduce to the former a sufficient quantity of air under pressure to properly combine with the fuel, and no more. I also close the smoke box to prevent waste of heat, leaving only for the exit of such products of combustion as are not consumed in the furnace, a minute area of escape, and that only. I thus reduce the whole subject of the combustion of fuel to one of calculation. I force into the furnace, to combine with the fuel therein, the proper quantity of air for the purpose of supporting combustion, taking into consideration, and making proper allowance for, the nitrogen constituting the incombustible element of the air forced in under pressure, and take from the furnace only the results of such combustion, which may be considered to consist of carbonic acid gas and the nitrogen. To properly effect this result with a given quantity or weight of fuel fed to the furnace per hour, I introduce to the tight ash-pit the requisite volume of air to combine with such weight of fuel, and adjust the area of the exit aperture in accordance with the principles above stated. Under this arrangement, excepting when starting the fire, I do not require a chimney, except such as shall serve to carry off the incombustible gases which reach the smoke box.

In the accompanying drawings, Figure 1 is a longitudinal section of a common type of stationary boiler shown adapted to the carrying out of my method and illustrating mechanical attachments adapted for such purpose. Fig. 2 is a similar view of a boiler of the locomotive type. Fig. 3 is a similar view of a boiler of a known marine type. Figs. 4, 5, 6 and 7 are details, as will hereinafter be described.

In the drawings A represents the body of the boiler; B the furnace or fire box, and C the smoke box. The ash-pit D is closed by front doors *a* through which pass branches *a'* having air-delivering nozzles *b* which, by preference, have long and narrow mouths as shown in Fig. 4. The branches *a'* communicate with a leading pipe a^2 which in turn is attached to a blower E or other medium for creating a blast. The pipe a^2 is furnished with a suitable damper a^3, by means of which the air under pressure may be shut off from the pipe a^2, its branches *a'* and the nozzles *b*. I do not restrict myself to any construction of pressure-producing apparatus, to the described devices for furnishing air to the ash-pit, to the shape of the nozzles *b* delivering

the air, or to other details, provided the air shall be injected under the grate to produce the effect described.

In the smoke box, at a point just above the upper row of flues, or about at the water line is placed a diaphragm F which in itself may constitute a damper by being arranged to move pivotally as shown in Fig. 5, or in two perforated parts, one sliding upon the other, as seen in Fig. 6. Normally, or when the boiler is steaming, the diaphragm F, if of the construction of Fig. 5, extends entirely across the space between the flue sheet and the head of the smoke box, so as to tightly close and shut off all escape except that of the small body of incombustible gases.

In operation, the fire having been kindled, air is admitted under pressure under the grate, the oxygen producing rapid combustion. It is to be understood that, until the fire gains some headway, the damper is open and there is a free escape of smoke and products of combustion through the flues to the stack as in ordinary practice. If the damper is of the character shown in Fig. 5, in order to give free escape to the stack, the damper is swung to a vertical position; but if of the sliding grate description shown in Fig. 6, the moving portion of the damper is slid so as to open the apertures to their fullest capacity. Combustion having been fully established in the fire box, the damper must now be closed; that is to say if it is of the character shown in Fig. 5, it must be swung to a horizontal position, thus completely closing the space between the tube sheet and the front door of the smoke box. There is still, however, a minute escape for the incombustible gases through the series of small apertures x with which the damper is provided. If the damper is of the sliding description, it is to be closed except so as to leave the minute area of escape described. Thus the stack E is practically closed and rendered inoperative, there being no need of a stack except as a means of the liberation of the nitrogenous and other incombustible products that pass through the flues. The release of these incombustible bodies is effected by the draft of the stack as in ordinary practice, or by a steam blast as indicated in Fig. 7, the nozzle of which extends above the damper or diaphragm. Such steam blast or jet is found necessary in the locomotive class of boilers, where rapid steaming and the consequent rapid liberation of the said incombustible gases are required.

It is found that the best results are produced by placing the diaphragm or damper in the smoke box almost immediately above the upper row of tubes, so that the heated incombustible gases shall be detained, deflected or temporarily held back in the smoke box and below the water-line of the boiler before they are finally delivered to the stack through the apertures existing in the damper.

All the units of heat temporarily retained below the water line are conducted to the water and help to make steam, whereas those carried above the water line have the effect only of superheating the steam which is of no practical value inasmuch as the tension of the steam is not increased; hence a damper placed in the chimney is not the equivalent of a damper or diaphragm placed in the smoke box substantially at the water line.

I disclaim a construction in which hot air is carried under pressure from above the fire into the combustion chamber and a damper is employed in the chimney; and here make no claim to the details of construction described and claimed in my application, Serial No. 454,356, filed December 7, 1892; but,

Having described my invention, I claim—

1. The herein described method of economizing fuel by producing the proper combustion thereof in a boiler furnace and preventing loss of heat resulting from the too free escape of the heated incombustible elements released in the process of combustion of the fuel, which otherwise should have communicated their heat to the water in the boiler, the same consisting in feeding fuel to the furnace, feeding air, the latter under pressure, below the fire temporarily arresting the incombustible gases in the smoke box, below the water line of the boiler and allowing their escape in a degree proportioned to the combustion produced in the furnace, substantially as set forth.

2. The herein described method of producing the proper combustion of fuel in a boiler furnace and preventing the loss of heat resulting from such combustion and thus economizing fuel, the same consisting in feeding fuel to the furnace, feeding air under pressure, below the fire in such proportions as shall effect a combustion practically without loss, temporarily arresting the incombustible products of combustion in the smoke box, below the water line of the boiler and freeing them from the smoke box by a draft proportioned only to the work of carrying off the said incombustible gases, substantially as set forth.

3. The within described method of economizing fuel by producing the proper combustion thereof in a boiler furnace and preventing loss of heat resulting from the too free escape of the incombustible gases released in the process of combustion of the fuel, the same consisting in feeding fuel to the furnace, maintaining air under pressure below the fire, causing the ascent of the compressed air through the fire into the combustion chamber, heating said air and causing it to mingle with the products of combustion evolved, temporarily arresting the incombustible gases in the lower portion of the smoke box in or near the plane of their entrance thereto from the flues, or at a point practically at the water line of the boiler, and allowing the escape of said incombustible gases in a

degree proportioned to the combustion produced in the furnace, substantially as set forth.

4. The combination herein described in a boiler having a tight ash-pit and a tight furnace, of a fan or similar pressure producer, means for delivering the compressed air under the grate, an adjustable diaphragm or damper which in its normal position shall stand in the smoke box above the top row of flues or practically at the water line of the boiler and close the space between the tube sheet and the head of the smoke box, and shall be entirely closed except as to minute openings for the escape of incombustible gases, and a chimney or stack for conveying off said incombustible gases, substantially as set forth.

In testimony whereof I hereto set my hand and seal.

ANDERSON B. COSBY. [L. S.]

Witnesses:

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LEON L. STRAUSE.