(No Model.) 2 Sheets—Sheet 1.

J. MILTON.

STEAM BOILER FURNACE.

No. 590,846. Patented Sept. 28, 1897.

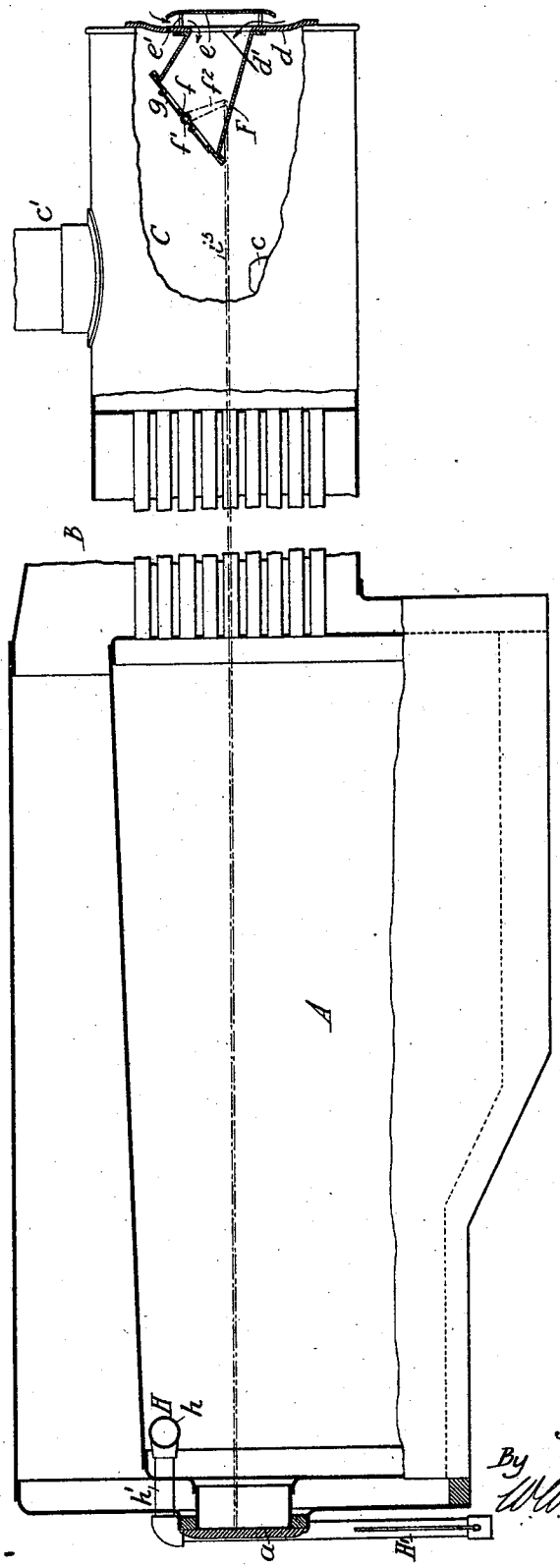


Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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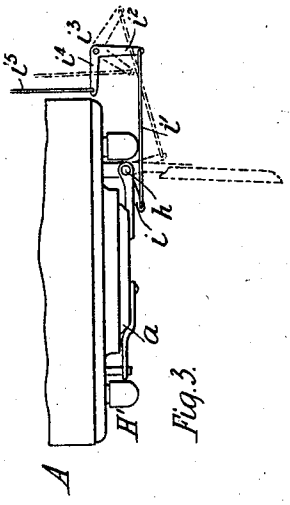


Fig. 3.

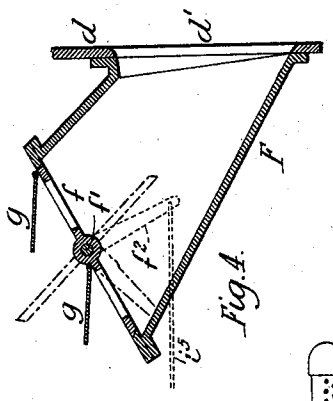


Fig. 4.

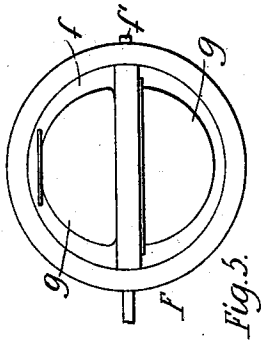


Fig. 5.

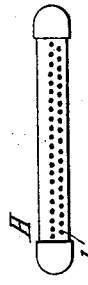


Fig. 6.

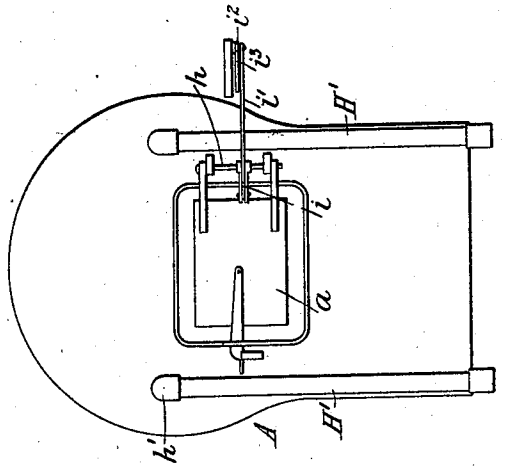


Fig. 2.

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UNITED STATES PATENT OFFICE.

JOHN MILTON, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR OF ONE-FOURTH TO LUTHER H. POTTERFIELD AND GEORGE F. EAMICH, OF LOVETTSVILLE, VIRGINIA.

STEAM-BOILER FURNACE.

SPECIFICATION forming part of Letters Patent No. 590,846, dated September 28, 1897.

Application filed April 27, 1897. Serial No. 634,110. (No model.)

To all whom it may concern:

Be it known that I, JOHN MILTON, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Steam-Boiler Furnaces; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention, while susceptible of embodiment in steam-boiler furnaces generally, is more particularly designed for employment in connection with the furnaces of locomotive-engines wherein the exhaust from the engine-valves is utilized to create the draft for promoting combustion of the fuel.

In the particular type of furnace referred to the action of the exhaust is to obtain within the furnace and boiler flues a partial vacuum, and thereby to induce a strong current or draft of air through the grate-spaces and the body of fuel and to convey the heat products from the burning fuel to and through the boiler-passages, and thence by means of the stack to the outer atmosphere. To insure the admission of the air-draft from beneath the grate, the fire and smoke boxes are made to be normally approximately air-tight, and this condition is unaffected until the opening of the furnace-door for the purposes of stoking and manipulating the body of fuel, when a large unimpeded volume of air enters by the door-opening, with the result of instantly lowering the temperature of the fire-box and of diminishing the air-draft through the bed of fuel. In addition to checking the combustion of the fuel and to lowering the temperature of the heat products, the rapid ingress of the air through the door-opening causes the smaller lighter particles of the fuel to be carried through the flues of the boiler and out through the stack at the forward end of the locomotive. These particles of fuel, or "sparks," as they are technically called, are but partially consumed and their loss from the furnace, besides materially adding to the expense of fuel, contributes to the dangers and discomforts of travel and is a menace to combustible structures in the vicinity of the line of road.

It is the object of my invention to overcome these disadvantages, which are present in the operation of locomotive-boiler furnaces, even of the latest and best types, by the provision of means for the counteraction of the effect of the air-blast in the opening of the furnace-door, which means are susceptible of ready application to any locomotive-engine without modification of its construction.

My invention is chiefly directed to the abatement of the spark nuisance, but in addition thereto its employment insures the maintenance of the high temperature of the fire-box regardless of the opening of the stoking-door, and also the retention within the fire-box of the fuel particles which, as before stated, are now carried out of the furnace, but which by my invention are held within and there consumed.

The nature of my invention is fully disclosed in the following description containing reference to the accompanying drawings, in which I have shown the invention as embodied in a locomotive-engine, although, as before stated, I do not confine myself to such application, nor do I confine myself to the particular details of construction and operation therein shown and described, reserving to myself such modifications as come within the spirit of my invention.

In the said drawings, Figure 1 is a side elevation, partly in section, of a locomotive-engine embodying my invention. Fig. 2 is an end elevation of the same. Fig. 3 is a fragmentary top view of the fire-box. Figs. 4 and 5 are detail views of the air-flue, and Fig. 6 is a detail view with the perforated air-distributing pipe.

Referring to the said drawings by letter, A denotes the fire-box of a locomotive-engine, B is the boiler, and C is the smoke-box or extension-front, these parts being of the usual construction and needing no description, except to say that the fire-box has the usual

door *a* and that in the smoke-box or front is the exhaust-pipe *c* and the smoke-stack *c'*, into which said exhaust-pipe discharges.

My invention consists in providing a controllable opening in the smoke-box or extension-front, the closure for which opening is manipulated coincidently with the manipulation of the stoking-door *a* of the furnace.

My preferred construction is as follows: In the usual door *d* of the smoke-box I make a central opening *d'*, and over said opening I secure, by means of bolts *e'* or the like, a plate *e*, which may have thereon the number of the engine, the diameter of the said plate being, as shown, in excess of the diameter of the opening in order to cover the latter horizontally and preclude the direct admission of air therethrough, as will be understood. The plate beyond the confines of the opening is beveled or rounded inwardly to constrict the space between the door *d* and the plate and to deflect the air from rather than to the opening *d'*. This construction is preferable, as the entrance of the air through the opening is effected by the exhaust, the air being drawn in through the space between the door and plate, as indicated by the arrows in Fig. 1. From the opening *d'* extends inwardly an air-flue F, which is preferably inclined upwardly and terminates above the upper end of the exhaust-pipe *c*. In said flue is a valve *f*, preferably of the butterfly type, mounted to turn on a shaft *f'*, suitably journaled in the sides of the flue. In each of the wings of this valve *f* is an opening controlled by a gravity or other suitable automatic valve *g*.

The door *a* of the fire-box is provided with the usual hinge connection, and on the pintle *h* of such connection is fixedly secured a lever *i*, the outer end of which is connected by a rod *i'* with one of the arms i^2 of a bell-crank lever i^3, pivotally secured to a part of the engine, preferably on the under side of the running-board, and the other arm i^4 of said bell-crank lever is connected by means of a rod i^5 with a lever f^2, fixedly secured on the shaft *f'* of the valve *f*. This lever-and-rod connection between the door *a* and the valve *f* is to insure coöperation between these two parts, it being essential to the purposes of my invention that the valve *f* be opened coincidently with the opening of the door and that on closing the latter the valve be returned to its normal closed position. This coöperation may be effected in ways other than that described and shown, and I do not therefore confine myself to the particular means set forth, as any construction which will effect the automatic opening of the valve coincidently with the opening of the door may be employed.

I have previously stated that the strong volume of air through the opening of the door is induced by the action of the exhaust. To counteract such volume, it is necessary that a body of air be admitted at a point near such exhaust in order to fill the partial vacuum and to spend the force of the exhaust before its influence shall have been materially felt in the fire-box. This counteracting body of air is admitted by the opening of the valve *f* through the opening *d'* and flue F and coincidently with the opening of the door *a*. The admission of this air-body is effected by the action of the exhaust, aided somewhat by the air-currents induced by the moving engine, and as the exhaust is spent in the smoke-box its influence is little felt in the fire-box and no rush of air through the opening of the door ensues. The result is that the high temperature of the fire-box is maintained, and that in the absence of the strong current the smaller particles of fuel or sparks are retained in the fire-box and consumed.

Under some conditions the strength of the exhaust is temporarily largely increased over the normal pressure, so much so as to create a draft sufficiently strong to produce sparks. I overcome this tendency of the exhaust by the use of the automatic valves *g*, which are raised to admit air through the opening *d'* and flue F by the high vacuum produced, the air so admitted counteracting the effect of the exhaust on the air-draft.

I have ascertained that the admission of air in a heated condition into the fire-box at a point above the surface of the bed of fuel is efficient both in mitigating the effect of the exhaust on the draft-air and in assisting in combustion by consuming the fine particles of fuel which are in suspension and also in a measure in consuming the smoke. I therefore prefer to employ in connection with my improvements above described an air-delivery pipe, such as H, located within the fire-box, preferably above the door *a*, and horizontally disposed, said pipe having a plurality of perforations *h* for the discharge of the air. The location of the pipe within the fire-box insures the heating of the air as it passes therethrough, and it is discharged through the perforations at a high temperature. Pipes H' H' supply the air to the pipe H, the former being outside of the fire-box and connected with the pipe H by pipe-sections *h'*, passed through the fire-box sheets. The pipes H' are open at their lower ends for the admission of air, and, if desired, steam-jets may be employed to raise the velocity of the air.

I claim as my invention—

1. A steam-boiler furnace provided with a valved air-inlet adjacent to the stack, and means substantially as described for automatically controlling said inlet coincidently with the manipulation of the stoking-door.

2. In a steam-boiler furnace, a chamber interposed between the boiler-flues and the stack and provided with an air-inlet normally closed by a valve, and a connection between said valve and the stoking-door whereby the manipulation of the latter controls the said inlet, substantially as described.

3. In a steam-boiler furnace, a chamber interposed between the boiler-flues and the

stack and provided with an air-inlet, an air-flue leading from said inlet and provided with a valve, the furnace-door, and lever-and-rod connection between said door and valve, substantially as and for the purpose set forth.

4. In a steam-boiler furnace, a chamber interposed between the boiler-flues and the stack and provided with an air-inlet normally closed by a valve operatively connected with the stoking-door, and a valve carried by and normally closing an opening in the aforesaid valve adapted to be actuated by external air-pressure, substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN MILTON.

Witnesses:
W. T. NORTON,
ARTHUR BROWNING.