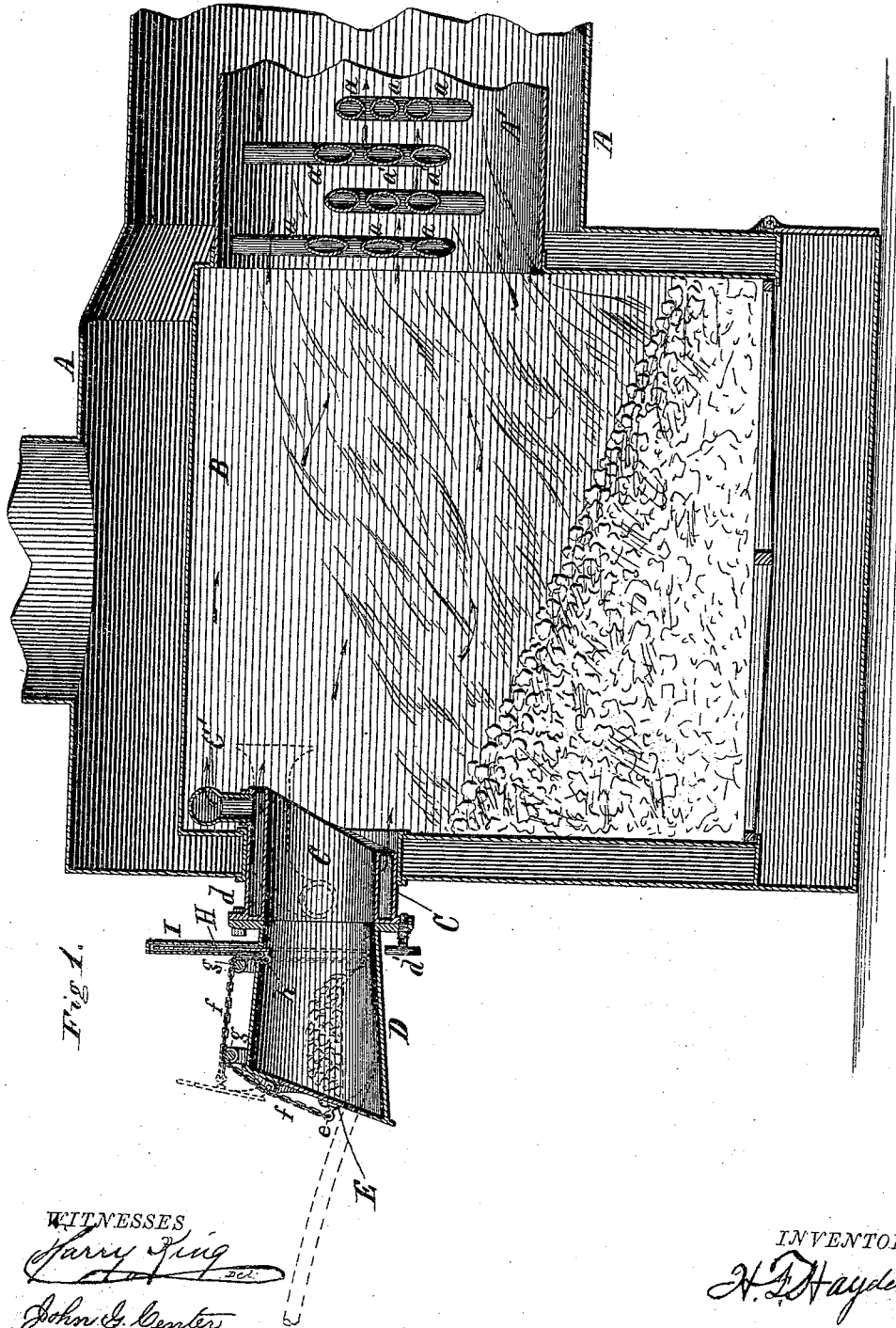


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FURNACE DOORS FOR STEAM-BOILERS.

No. 184,865.

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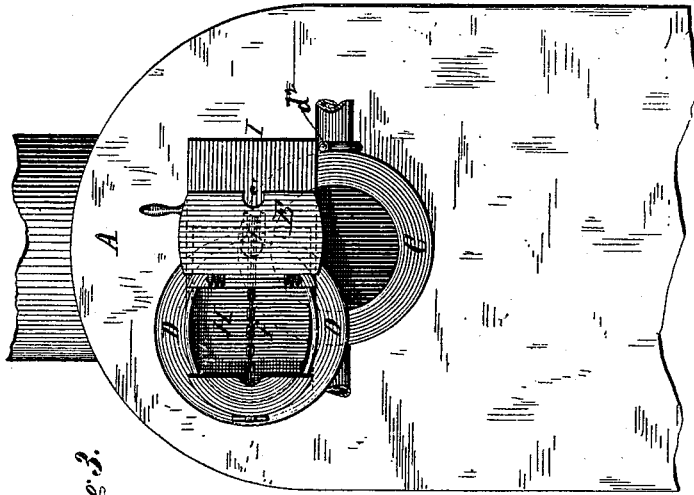


Fig. 3.

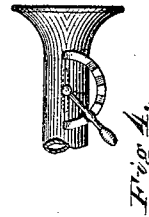


Fig. 4.

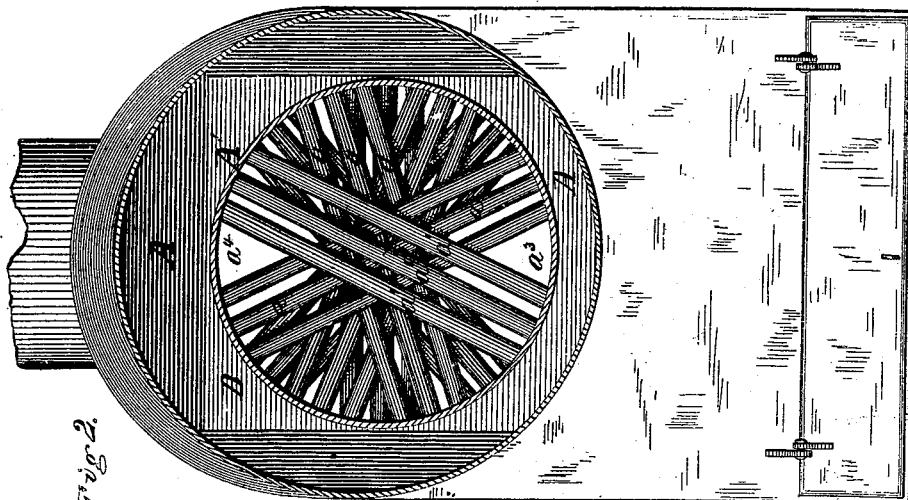


Fig. 2.

WITNESSES

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IMPROVEMENT IN FURNACE-DOORS FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. 184,865, dated November 28, 1876; application filed September 13, 1876.

To all whom it may concern:

Be it known that I, HENRY F. HAYDEN, of the city and county of Washington, District of Columbia, have invented certain new and useful Improvements in Locomotive Boilers and Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 represents a longitudinal vertical section through a locomotive-boiler and fire-box, showing my improvements. Fig. 2 is a transverse section through the same, taken in rear (relative to the fire-door) of the fire-box. Fig. 3 is a front elevation of the boiler, showing the pivoted double door-frame turned up out of the way for affording access to the fire; and Fig. 4 is a side view of a portion of one of the air-pipe nozzles detached, showing an arrangement of valve for controlling the admission of air.

Similar letters of reference denote corresponding parts wherever used.

My invention relates, first, to a novel construction of the furnace-door for preventing the too free admission of external air during the process of replenishing the furnace.

In the ordinary manner of supplying fuel to the fire-boxes of steam-boilers through a single open door, it has been found that the free admission of external air through such door, especially in locomotive-boilers, where an intense artificial draft is usually created, not only caused a rapid and material reduction in the generation of steam by the cooling action of the air upon the boiler-surfaces, but that the air thus admitted, being cold and in large volume, was unprepared to mingle with and ignite the gases and other rising products of combustion, and the latter were consequently carried through to and out of the smoke-stack, in an unconsumed condition, in the form of dense volumes of black smoke and cinder, constituting not only a large waste of fuel, but one of the most serious annoyances attendant upon railroad travel.

The object of my improvement is to overcome the difficulties recited, by preventing, as far as practicable, the admission of air with the fuel in the process of replenishing the fire, except as the same was supplied through

the usual sources of draft; and to this end my invention consists in providing the fire-pot with two doors, so constructed and combined that when one is open the other shall be closed alternately; or, in other words, in such manner that when the outer door is opened to admit the fuel the inner one will be closed to prevent the admission of air, and when the outer door is closed to prevent the admission of air the inner one will be opened to admit the fuel to the fire-pot, thus preventing the admission of any extra quantity of external air with the fuel, except such as may be contained within the small compartment between the two doors, as hereinafter explained.

In the accompanying drawings, A represents the boiler, and B the fire pot jacketed therein, said parts, in themselves, except in particulars hereinafter specified, being of any usual or preferred construction and arrangement. The door-frame C, by preference, is made in the double form, having the annular air-duct described in Letters Patent granted to me October 19, 1875, for the admission of air to perforated pipes or ducts C', conducting it to and discharging it in minute jets at any desired part of the fire-pot, as therein explained; but any usual form of door-frame may be employed, adapting my improvements to be applied to boilers now in use. To the outer wall or flange of this door-frame C is attached an extension door-frame, D, conforming in transverse section to the shape of the door-frame C, and of the same, or nearly the same, internal diameter at the end adjacent thereto. This frame D may be rigidly connected with the frame C, forming an extension thereof; but, for facilitating direct access to the fire, for slicing, &c., I prefer to hinge or pivot it, as at *d*, either directly through the adjacent flanges, as shown, or through lugs or ears formed thereon, for giving greater throw to the frame D when turned on its hinge or pivot. A thumb-screw or other suitable fastening at *d'* serves to secure the frame D when in position shown in Fig. 1.

The frame D may, as above stated, be either cylindrical or polygonal in form, and by preference, for the free admission of the fuel, is

made larger at its outer end, tapering inward, as shown in Fig. 1, and has its outer inclined face or end covered by a door, E, hinged at its upper edge to the frame D, or to a flange formed thereon. The door E, near its lower edge, is provided with a lug or ear, *e*, to which one end of a chain, *f*, is attached, said chain passing thence up over pulleys *g g*, mounted in suitable lugs or standards in the door extension-frame D, and has its other end attached to a vertically-sliding door, H, located at or near the inner end of the door-extension D, and adapted to move up and down in suitable ways therein. The door H slides up and down through an opening in the upper wall of frame D, and for preventing the admission of air or clogging matter, said opening is covered by a closed hood, I, within which the door H rises and falls, being shielded from injury, and its accidental displacement being prevented thereby. The chain *f* is attached to a lug or ear, *h*, near the lower end of the door H, passing up thence through a perforation in the frame D in front of the hood I and over the guiding-pulleys *g* to the door E, as explained.

By this arrangement it will be seen that as the door E is raised by the attendant, the door H, by its own gravity, will descend from the hood I, and close the inner end of the frame D, adjacent to the fire-pot. In this position of the doors, the attendant can insert the shovelfull of coal within the extension-frame D in front of the door H, as shown by dotted lines, Fig. 1, when, by closing the door E, the door H will be raised into the hood I out of the way of the shovel, which can be then thrust forward and its contents discharged upon the fire at any desired point.

The door E, at its open swinging end, is slotted to adapt it to close over the handle of the shovel, as shown at *e'*, Fig. 3; or this opening may be made in the form of a perforation, partly in the edge of the door, and partly in a flange formed at the lower side of the frame D, as shown.

By this arrangement of the two doors, as described, it will be seen that when one is opened the other will be closed, and that when the fuel is deposited upon the fire, one of said doors will be closed for preventing the admission of external air with the fuel, thereby overcoming, in great part, the difficulties referred to, and maintaining, aside from the application of such fresh fuel, the required uniform condition of combustion, pre-arranged and provided for in the construction of the furnace.

The hood I, by its arrangement upon the opposite side of the hinge or pivot *d* to the tubular frame D, is adapted to serve as a counterpoise to the weight of the latter when turned upon its hinge or pivot for giving direct access to the fire for "slicing," &c., as shown in Fig. 3, and may be weighted for that purpose, so as to hold the frame at any desired point of adjustment, and a stop may

be employed, as at *d'*, which, by contact with the hood I, will prevent the frame D from being turned beyond the desired point.

In the ordinary construction of locomotive-boilers the fire-box terminates, at its rear end, in a tube-sheet, from which point the products of combustion are compelled to pass, through a number of small tubes running thence longitudinally of the boiler, to the smoke-stack, and which, from their usually small diameter, generally effectually suppress combustion almost at the instant the products thereof pass the tube-sheet.

This difficulty I obviate by using a large inner cylinder, *A'*, forming a combustion-chamber and fire-box extension, reaching from the fire-box B proper to the exhaust-steam chest or smoke-stack, dispensing with the tube-sheets and longitudinal tubes ordinarily employed; and in lieu of said tubes I employ a series of circulating-tubes, *a a'*, crossing the cylinder in diametrical lines and lines parallel thereto, as shown in Fig. 2, one series, *a*, placed in rear of, and on a different radial line to, another series, *a'*, &c., the several series assuming to each other the relation of the spokes of a wheel, except that they are not in the same vertical plane.

By this arrangement the tubes are made to stiffen and support the inner cylinder *A*, while, at the same time, the different series are sufficiently removed from each other to permit the ready passage around and between them of the smoke, gases, &c., without interfering with the continuance of the process of combustion thereof, even up to their point of exit from the smoke-stack itself, if necessary. By this arrangement, with the aid of the supplies of air thrown in, in minute jets, at the required points, as described in my former patents, and of the double door herein described for preventing admission of air in bulk, smoke will be, to a very great extent, prevented, and the gases and cinders will be almost, if not entirely, consumed.

By preference, the transverse tubes *a a'*, &c., will be so arranged that no series will be exactly vertical, thereby leaving a small through-path, *a''*, at the extreme lower part of the cylinder *A*, through which, by a jet of steam or other suitable means, any deposit of cinders may be readily blown out or removed, when necessary.

If found desirable, water-jacketed air-pipes (described in another application) may be extended through the spaces *a'' a''*, for supplying air at any desired point, or throughout the entire length of the cylinder *A'*, for promoting the combustion of smoke, gases, and cinders in their passage through said cylinder; or this water-jacketed air-supply pipe may be placed centrally of the cylinder *A*, with the circulating-pipes *a a'* radiating from the jacket to and through the cylinder *A'*, and with the air jets or nozzles intermediate between the pipes *a a'*.

In Fig. 4 I have represented a convenient

arrangement of valve and controlling-lever, in connection with the air pipes or nozzles, by means of which the full capacity of the air-supply pipes may be made available, or they may be entirely closed, or set at any intermediate point, as desired. Any suitable arrangement of valves may, however, be employed, placing the supply of air under the control of the engineer.

The ordinary coal-shovel may be used in connection with the double door; but, by preference, a short shovel in scoop form, provided with a straight, or nearly straight, handle, somewhat longer than the ordinary shovel, will be employed; and, with the opening or perforation at *e'* adapted to the handle, the walls of said perforation become a fulcrum, upon which the handle of the shovel, acting as a lever, may rest and move for facilitating the operation of feeding the fire. The extension-door frame may be set slightly inclined for the same purpose.

If preferred, a separate opening or door may be made below the door-frame C, for giving direct access to the fire for slicing, &c., obviating the necessity of hinging or pivoting the door-frame extension for that purpose.

I have described my improvements as es-

pecially applicable to locomotive-boilers; and, while the greatest benefits will be derived from them under such application, it will be apparent that they may be used to advantage in connection with other boilers and furnaces.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with the fire-box, of a door-frame extension provided with two doors, connected, one with the other, in such manner that when one of said doors is opened the other will be closed, adapting the fire to be replenished without admitting external air, substantially as described.

2. The combination, with the fire-pot, of the door-frame extension D, having two doors, and the double frame C, having the annular duct for admitting air, as described.

3. The door-frame extension, provided with two doors for excluding air, as described, and hinged or pivoted, whereby it can be swung up out of the way, substantially as and for the purpose set forth.

H. F. HAYDEN.

Witnesses:

CHAS. P. WEBSTER,
JOHN G. CENTER.