H. F. HAYDEN.

FIRE BOXES FOR STEAM-BOILERS.

No. 184,866. Patented Nov. 28, 1876.

Fig 1.

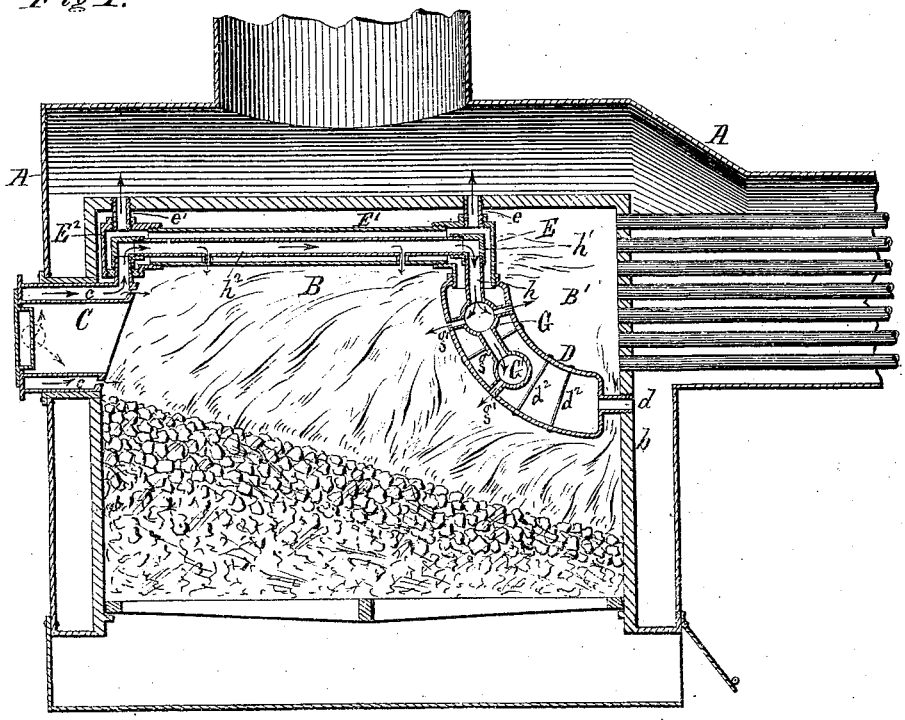
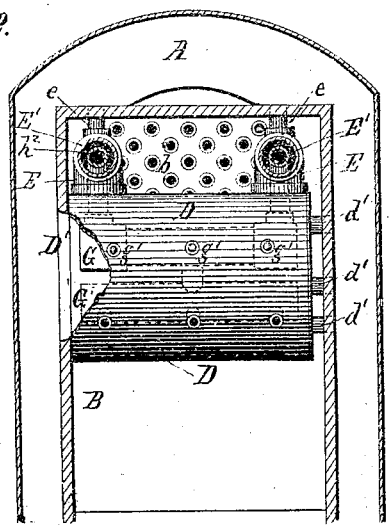


Fig 2.



WITNESSES

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IMPROVEMENT IN FIRE-BOXES FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. **184,866**, dated November 28, 1876; application filed May 11, 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 a certain new and useful Improvement 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 vertical longitudinal section through a portion of a locomotive-boiler, embracing the fire-box and showing my improvements; and Fig. 2 is a vertical transverse section of the same, taken in front of the water-bridge.

Similar letters of reference denote corresponding parts in both figures.

My invention consists in a novel construction and arrangement, in connection with a boiler, of water bridge or deflector and water pipes or jackets, and of air pipes or ducts, inclosed within said bridge and jackets, and surrounded by the water therein and provided with numerous small outlet-pipes, penetrating the walls of said jackets, for supplying air at the sides and rear of the fire-box and in advance of the tube-sheet of the boiler, the object being to promote combustion at said points, while at the same time protecting the air-supply pipes from injury by the fire, as hereinafter explained.

In the accompanying drawings, A represents the boiler, and B the fire-box, jacketed within the boiler, said parts being constructed in any usual or preferred manner. C is the fire-door frame, provided with the double walls, forming an annular air-duct, *c*, around the door for the admission of air, in the manner described in Letters Patent granted to me October 19, 1875, No. 168,899, said door being made in any usual or preferred form. At the rear end of the fire-box B, and attached to the rear wall or tube-sheet *b*, is a bridge, D, in the form of a hollow water chamber or compartment, made by preference in the curved form shown, and extending from a point below the nest of tubes in the tube-sheet *b* forward and upward, as shown, leaving sufficient space above its upper end for the passage of the products of combustion, and forming a combustion-chamber therefor at B′, between the bridge and tube-sheet, as shown. The lower rear end of this hollow bridge is removed slightly from the tube-sheet *b*, and is connected therewith by a short pipe, *d*, communicating with the water-space in the boiler, and supplying water to the bridge D, this construction allowing the cinders to drop out from behind the bridge, and preventing them from banking up against the tube-sheet. The fire pot or box is, ordinarily, only about three feet in width, and the bridge can be made from a single sheet of boiler-metal, having its edges united upon its upper rear face, when the joint or seam will be exposed to less heat than at other points. The sides of the bridge are united to the side walls of the fire-box by short tubes or pipes *d′*, connecting the bridge with the water-space, similar to those described as connecting the lower end with the tube-sheet. The edges of the sheet forming the bridge are by preference upset or turned inward and riveted from the inside to the end or side plates, thereby protecting the flange by contact with the water from injury by the fire.

The bridge thus constructed has its upper and lower walls connected by stay-bolts d^2, suitably arranged for stiffening and mutually supporting said walls against deflection and injury. The upper end of the bridge D has connected with it short sections of pipe E, one near each end, as shown in Fig. 2, of an external diameter nearly equal to the internal diameter of the bridge D, and extending nearly to the crown-sheet, as shown, where they are connected with said crown-sheet and the water-space over the same by smaller short pipes *e*, of sufficient capacity to permit the ready escape into said water-space of the steam generated in the water-bridge and its connecting-pipes. The pipes E, for a purpose which will be explained, are provided each with an elbow or branch facing forward or toward the furnace-door, and have pipes E^1 connected with them, which extend forward in close proximity to the crown-sheet to the forward end of the fire-box, where they are connected with elbows E^2, turning downward and overhanging the inwardly-projecting upper wall of the furnace-door, as shown, or they may, if preferred, be turned inward toward each other and connected by a transverse pipe, extending across

the front of the fire-pot. Ordinarily, however, it will be sufficient to have the pipes E^1 E^1 converge toward their forward ends, so that each will overhang, and can be separately connected with, the fire-door, as hereinafter explained.

Short pipes e', similar to those at e, connect the forward ends of the pipes E′ with the water-space above the top of the fire-box, and other pipes intermediate between e e' may be used, if required, and the pipes E^1 being in close proximity to the side walls of the fire-pot, for the purpose of facilitating the circulation of water in said pipes, they may be connected by short pipes with the water-spaces in the boiler adjacent thereto. Within the water-bridge, and also within the water-pipes E E^1 E^2, thus arranged, is a system of air ducts or pipes, for conveying air to the rear end of the fire-box, and causing it to intermingle with the rising products of combustion, for preventing smoke and causing combustion or ignition of the gases and cinders before they enter the tubes, as follows, viz: G G′ represent pipes connected by short pipes g, or it may be a single pipe, extended in width, of an external diameter less than the internal diameter of the bridge D, and arranged within said bridge, as shown, so as to be entirely surrounded by the water therein. These pipes are perforated, to receive any desired number of tubes, g', which extend outward through the walls of the bridge, and serve as the nozzles through which the air is injected among the products of combustion in front of, below, above, and in rear of said water-bridge, as required.

The pipe G has its ends connected with pipes h, which rise inside the pipes E to the plane of the pipes E^1, where they are coupled, by suitable elbows h^1, with pipes h^2, extending centrally through said pipes to their forward ends, where, conforming to the arrangement of said pipes E^1, above described, they either turn downward and pass through the wall of the pipe or the bushing of the elbow E^2, and are directly connected with the annular air duct or space around the fire-door, as shown, or the connection may be made through a lateral pipe or pipes, and thence with the fire-door and through the annular duct surrounding which air is supplied to the inner pipes.

By the arrangement described, it will be seen that the air-pipes, while carrying the supply of air to the precise points where it is required for use, are fully protected by their water-jackets from injury from the heat of the furnace; and, further, that by the arrangement of said jackets, and of the water-bridge, the boiler-surface exposed to the action of the fire, and the consequent steaming capacity of said boiler, is largely increased, while the free introduction of air, which has been highly heated in its passage, at the rear end of the fire-pot and into the combustion-chamber, serves effectually to prevent the formation of smoke, and to cause the ignition and thorough combustion of the cinders and other rising products of combustion, thereby overcoming or greatly lessening one of the most disagreeable and destructive evils attendant upon the use of locomotive-engines.

The pipes described may be coupled in any usual way, their size being varied, of course, to suit the size and capacity of the boiler, whether locomotive or stationary, to which they may be applied.

The manner of applying bell-nozzles and external pipes to the annular duct around the door-frame, for forcing air through the same, is described in my former patent referred to, and need not be further described here. Any suitable arrangement of valves or dampers may be employed in connection with the external supply-pipes, for placing the supply of air under the control of the engineer.

In some instances it may be desirable to introduce the air to the pipes G from some other point than through the annular door-frame—as, for instance, through pipes running directly through the water-legs of the fire-box—but the changes in this and other features, and in the form of the parts essential to adapt my improvements to the boiler to which it is to be adapted, will readily suggest themselves to the skilled builder or mechanic, the arrangement described being the preferred one for general purposes.

By the arrangement described an abundant supply of air may be injected into the fire-pot just at those points where ordinarily, for the lack of it, combustion is frequently entirely suppressed, and thus by igniting the unconsumed gases and cinders prior to their escape into the tubes, they are not only consumed, but the flames are carried into the tubes themselves, thereby further increasing the steaming-power of the boiler. This action, and the passage of the flames through the tubes, will be greatly facilitated by increasing the diameter of said tubes, such enlargement serving, also, to greatly diminish, if it does not entirely overcome, the injurious effect upon combustion due to the action of the powerful exhaust ordinarily employed.

Only a few of the small air-tubes g are shown in the drawing, but the number may be multiplied, and their arrangement or point of discharge may be varied as circumstances may dictate. Similar pipes or nozzles may extend through the water jackets or pipes E E^1 from the air-pipes inclosed within them, for injecting air into the fire-box, and in some instances it may be found desirable to dispense with the water-bridge D, and to use the water pipes or jackets in lieu thereof, in which case said jackets may be carried to any desired point, and in this way made to carry the supply of air wherever it may be required, conforming to the construction of the furnace or boiler. The number of air supply-pipes and inclosing-jackets may be also increased, if desired, care being observed, however, to leave sufficient space over the water-bridge and between the pipes

to afford ready access to the tube-sheet for repairs and other purposes.

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

1. The tubular water bridge or deflector D, separated or removed at its sides, top, and bottom from the walls of the fire-box, for permitting the products of combustion to impinge on all sides of said deflector and of the fire-box, in combination with pipes jacketed within said bridge and its connecting-pipes, for supplying air to the fire-box, as described.

2. The water pipes or jackets E E^1, in combination with the inclosed air ducts or pipes and their outlet-tubes, arranged and operating substantially as and for the purpose set forth.

HENRY F. HAYDEN.

Witnesses:

ALEXANDER MAHON,

JOHN G. CENTER.