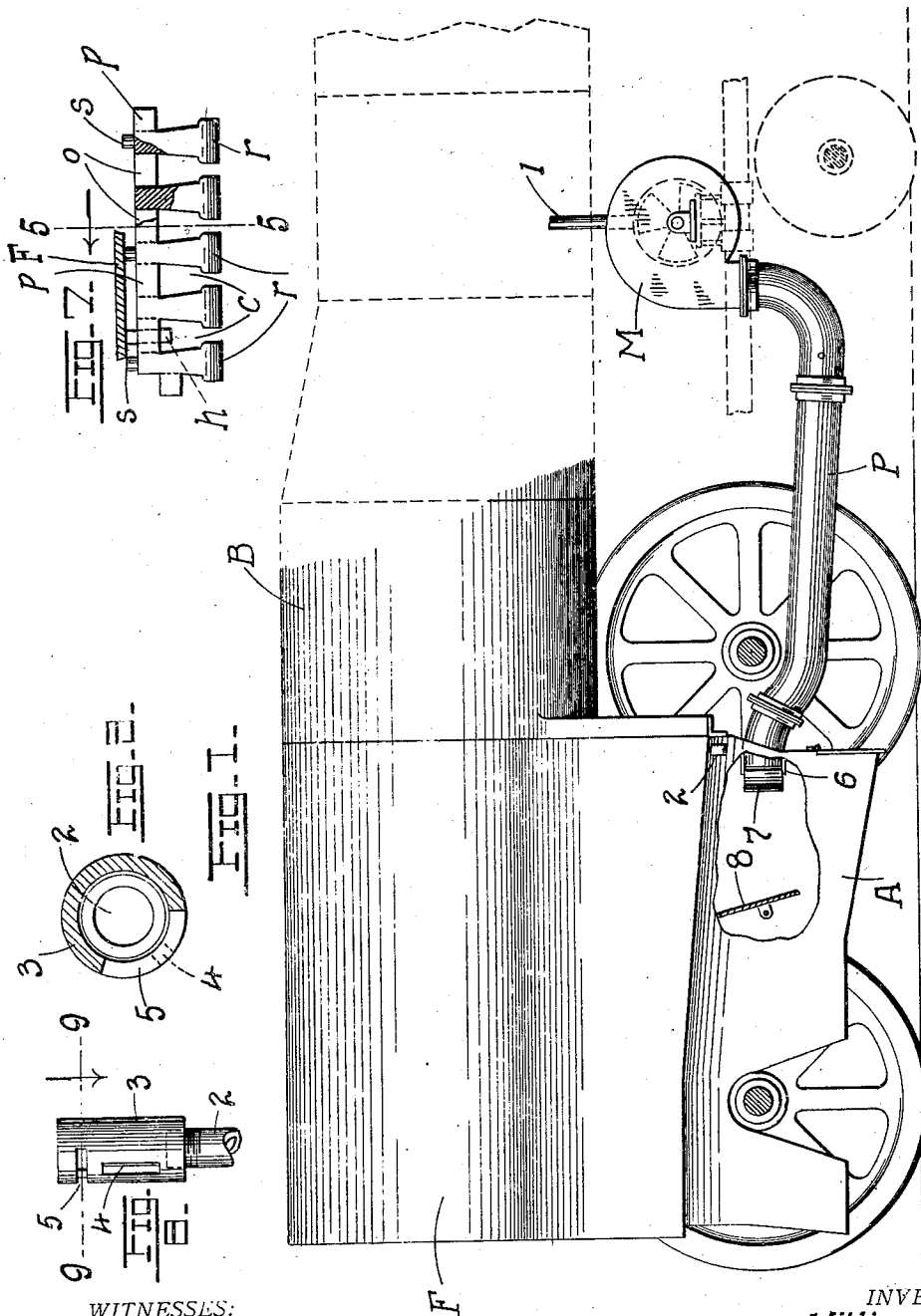


FIRE BOX.

Patented Oct. 26, 1909.

2 SHEETS—SHEET 1.

938,036.



WITNESSES:

Phil J. Noyes
Fannie E. Weber

INVENTOR.

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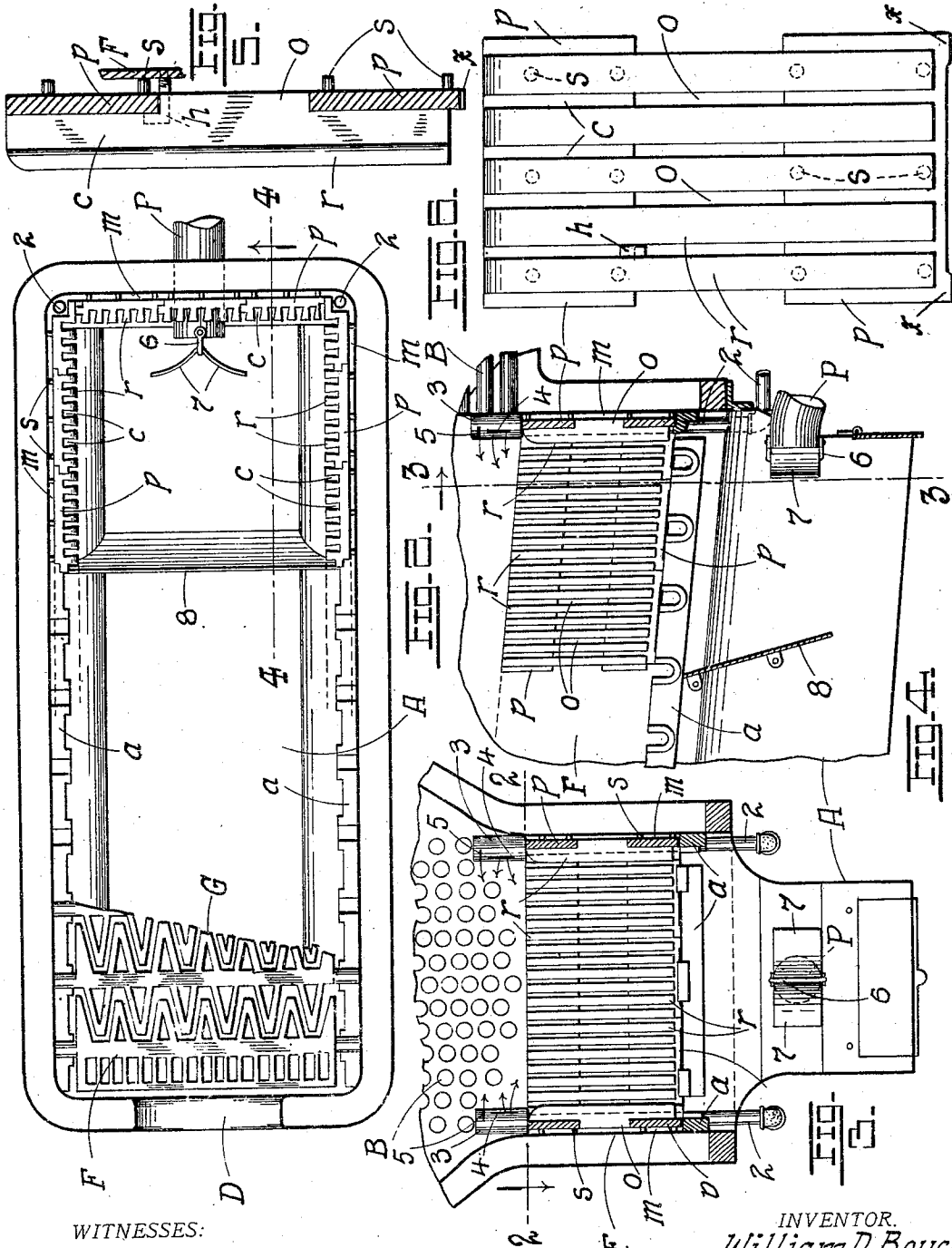
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APPLICATION FILED JULY 13, 1908.

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UNITED STATES PATENT OFFICE.

WILLIAM D. BOYCE, OF ST. LOUIS, MISSOURI.

FIRE-BOX.

938,036.

Specification of Letters Patent.

Patented Oct. 26, 1909.

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To all whom it may concern:

Be it known that I, WILLIAM D. BOYCE, citizen of the United States, residing at St. Louis, State of Missouri, have invented certain new and useful Improvements in Fire-Boxes, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention has relation to improvements in fire-boxes; and it consists in the novel construction and arrangement of parts more fully set forth in the specification and pointed out in the claims.

In the drawings, Figure 1 is a side elevation of a locomotive boiler showing a portion of my invention applied thereto; Fig. 2 is a horizontal section on the line 2—2 of Fig. 3 taken through the fire-box of the boiler; Fig. 3 is a vertical transverse section on the line 3—3 of Fig. 4; Fig. 4 is a longitudinal vertical section on the line 4—4 of Fig. 2; Fig. 5 is a vertical transverse section on the line 5—5 of Fig. 7 taken through one of the sections or plates entering into the construction of the lining of the fire-box; Fig. 6 is an inside face elevation of one of the ribbed plates or sections; Fig. 7 is a top edge view of one of said plates with parts broken away; Fig. 8 is an enlarged elevational view of the discharge head of one of the steam conducting pipes leading into the fire-box; and Fig. 9 is a cross section on line 9—9 of Fig. 8.

The object of my invention is to construct a fire-box into which may be directed currents of mixtures of air and steam, or air or steam alone, at such points where said currents may most effectively commingle with the unconsumed products of combustion rising from the fuel, with a view of rendering the combustion complete. Where air and steam are employed conjointly it is the purpose to have them mingle with the unconsumed products at points within the fire box above the fuel charge, the intermingling being effected by the impact of the steam currents projected against the air currents at the points mentioned. The intersecting of the several currents in the way insures the necessary supply of free oxygen to the unconsumed carbon and to the hydrogen set free in the splitting up of the steam.

The present improvement is herein illustrated in connection with the fire-box of a locomotive boiler, but this constitutes only one

example of the types of boiler to which my invention may be applied, and its advantages may be availed of in almost any boiler-furnace or in fact any furnace where bituminous coal or equivalent fuel is burned. It is well known that commercially it is almost impossible to secure perfect and complete combustion where soft coal is used owing to the lack of oxygen at the critical moment, and it is the object of the present improvement to effect a thorough and complete combustion of the products left unconsumed from the main body of the fuel charge. The advantages of my invention will be best apparent from a detailed description thereof which is as follows:—

Referring to the drawings, B, represents a conventional form of locomotive boiler, F, the fire-box, D, the door, G, the grate, A, the ash-box, and *a* the ledges on which the grate bars are supported. Resting on the ledges *a* and disposed preferably along the front wall of the fire-box, and along portions of the side-walls thereof, and spaced a suitable distance therefrom by means of studs *s* are a series of plates or sections *p* the vertical edges overlapping one another so as to form a continuous wall or lining *p, p*, the studs *s* forming between said lining and the fire-box an air space *m* for a purpose presently to appear. Disposed along the inner faces of the plates *p* are a series of parallel vertical ribs *r* of a cross section tapering toward the plates *p* thereby leaving between them vertical parallel channels *c* of dove-tail cross-section tapering inwardly or toward the fire-box as shown. Formed in the plates *p* between the ribs *r*, are elongated slots or openings *o* which establish communication between the channels *c* and the space *m*.

Mounted at any convenient point in connection with the boiler is an air blower M operated by steam supplied thereto by the pipe 1, leading to the steam space (not shown) of the boiler, the said blower discharging a current of air through an air pipe P into the front of the ash-box below the grate bars. Leading from the steam-space of the boiler are steam-pipes 2, 2, which enter through the bottom of the fire-box at the front opposite corners thereof between the fire-box walls and the meeting edges of the front and side sets of plates *p, p*, said pipes 2, 2, rising above the top edges of the plates *p*, and terminating in

enlarged heads 3, 3. These heads are provided with longitudinal and transverse peripheral slits 4, 5, respectively, through which steam is discharged into the fire-box in sheets, the plane of the sheet issuing from the slit 4 intersecting the plane of the sheet issuing from the upper slit 5.

The discharge end of the air pipe P is provided with a bracket 6 to which is secured, in the path of the air discharged, a pair of diverging wings 7, 7, these serving to distribute the air well along the grate-bars and beneath the lower open ends of the channels *c*, a suitable downwardly and forwardly inclined shield 8 being secured within the ash-box opposite the rear terminal edges of the plates *p*, *p* to further insure the retention of the air discharged by the pipe P within the limits prescribed for it to accomplish the purpose here sought.

In the example here shown, the side plates *p* extend rearwardly (that is, toward the fire-box door D) about one-third the length of the fire-box; but it is to be understood that I do not wish to limit the invention to any fixed point, as the plates may terminate at any point along the sides of the fire-box; and the different sections *p* are constructed with terminal tongues which make a lap joint with one another, so that as a new section is added there will be no break in the wall or lining thus formed. The plates *p* may be considered collectively as a fire-box lining built up of removable sections, said lining being spaced a suitable distance, represented by the width of the space *m*, from the fire-box walls, and provided with open ended channels *c* discharging along their length into the fire-box, and having furthermore communication with the space *m* through the slots or elongated openings *o* formed between the ribs *r* which form the channels. The dove-tail or inwardly tapering character of the channels serves to prevent the clogging up of the channels by lumps of fuel or clinkers, for the moment a piece enters the channel it falls through into the ash-box. That the lumps referred to may be thus better discharged from the bottoms of the channels, and that the air may have ready access into the channels (as presently to be described) not only do the lower ends of the ribs *r* terminate at a point above the lower edge of the plate *p*, but the said edge is somewhat cambered or arched (Fig. 6) so that the plate is virtually supported on the ledge *a* by projections or legs *x*, *x*.

The operation of the invention will be readily understood from the drawings and description as given:—Upon the starting of the blower M, air is forced through the pipe P under the grate as already described, and distributed in the desired manner by the wings 7, 7, and shield 8, and is forced up through the open-ended channels *c*, and

through the openings *o* into the space *m* against the walls of the fire-box, the air being heated in such passage. A considerable portion of this air escapes into the fire-box through the contracted longitudinal lateral openings or slits leading from the channels between the enlarged sides of the ribs facing the fire-box, the air escaping in vertical parallel sheets or planes and mingling thoroughly with the unconsumed products of combustion which are constantly passing from the fuel on the grate toward the flues of the boiler. At the same time the engineer may allow steam to enter the pipes 2, 2, whereupon the steam issues out of the heads 3, 3, through the right-angularly disposed slits 4 and 5 into the fire-box in the form of sheets, one sheet being substantially parallel to the sheets of air entering from the channels *c*, and the other at right angles thereto, so that there results a thorough intermingling of the air and steam with the gases in the fire-box, and the available oxygen is provided for consuming and oxidizing any particles not burned up in the ordinary process of combustion of the fuel charge. Of course it may not be necessary to supply an admixture of steam, as the heated air may be sufficient for the purpose under some circumstances; under others both air and steam may be necessary; under still others, as where anthracite or coke is burned, neither may be necessary. The injection of the oxygen-laden gases (air or steam) in the form of sheets is important for then there is always the assurance that every particle of unconsumed product will be intercepted and having the necessary complement of oxygen added at the proper moment to insure perfect combustion. The channels *c* need not necessarily be vertical, but may be somewhat inclined without departing from the nature of my invention. As the side sections of the lining (*p*) are extended rearwardly, the shield 8 would necessarily be shifted accordingly for reasons already appearing in this description. The slits 4, 5, in the heads 3 are so disposed as to direct the sheets of steam toward the center line of the fire-box, that is to say, at an angle to the planes of the sides of the fire-box. This gives the best results, as the intermingling of the steam and air sheets is then most thorough. The plates *p* are additionally supported by hooks *h* secured to the fire-box wall, the hooks being passed through an opening *o* in the plate as shown (Figs. 5, 6, 7).

Having described my invention, what I claim is:—

1. A fire-box having a side wall provided at the front end with openings discharging currents of air across the path of travel of the combustion products, and means for projecting jets of steam from the front ends of the sides of the fire-box at an oblique angle

to the air currents and in a direction opposed to the general direction of flow of said combustion products.

5 2. A fire-box having a side wall provided at the front end with openings discharging vertical sheets of air across the path of travel of the combustion products, and nozzles at the front corners of the fire-box for projecting horizontal sheets of steam across
10 the air sheets and in a direction opposed to the general direction of flow of the combustion products.

15 3. A fire-box having a side wall provided at the front end with openings discharging vertical air sheets into the fire-box, and nozzles feeding steam in vertical and horizontal sheets above the air sheets, the vertical sheets of steam being directed at an angle to the

direction of flow of the air sheets and impinging against them.

20 4. A fire-box having side walls provided at the front ends with openings discharging vertical sheets of air across the path of travel of the combustion products, and nozzles at the front end of the fire-box adjacent
25 to the sides for projecting jets of steam obliquely across the air sheets and in a direction opposed to the general direction of flow of the combustion products.

In testimony whereof I affix my signature, 30
in presence of two witnesses.

WILLIAM D. BOYCE.

Witnesses:

EMIL STAREK,
FANNIE E. WEBER.