

(No Model.)

3 Sheets—Sheet 1.

A. F. KINGSLEY.
BOILER FURNACE.

No. 568,200.

Patented Sept. 22, 1896.

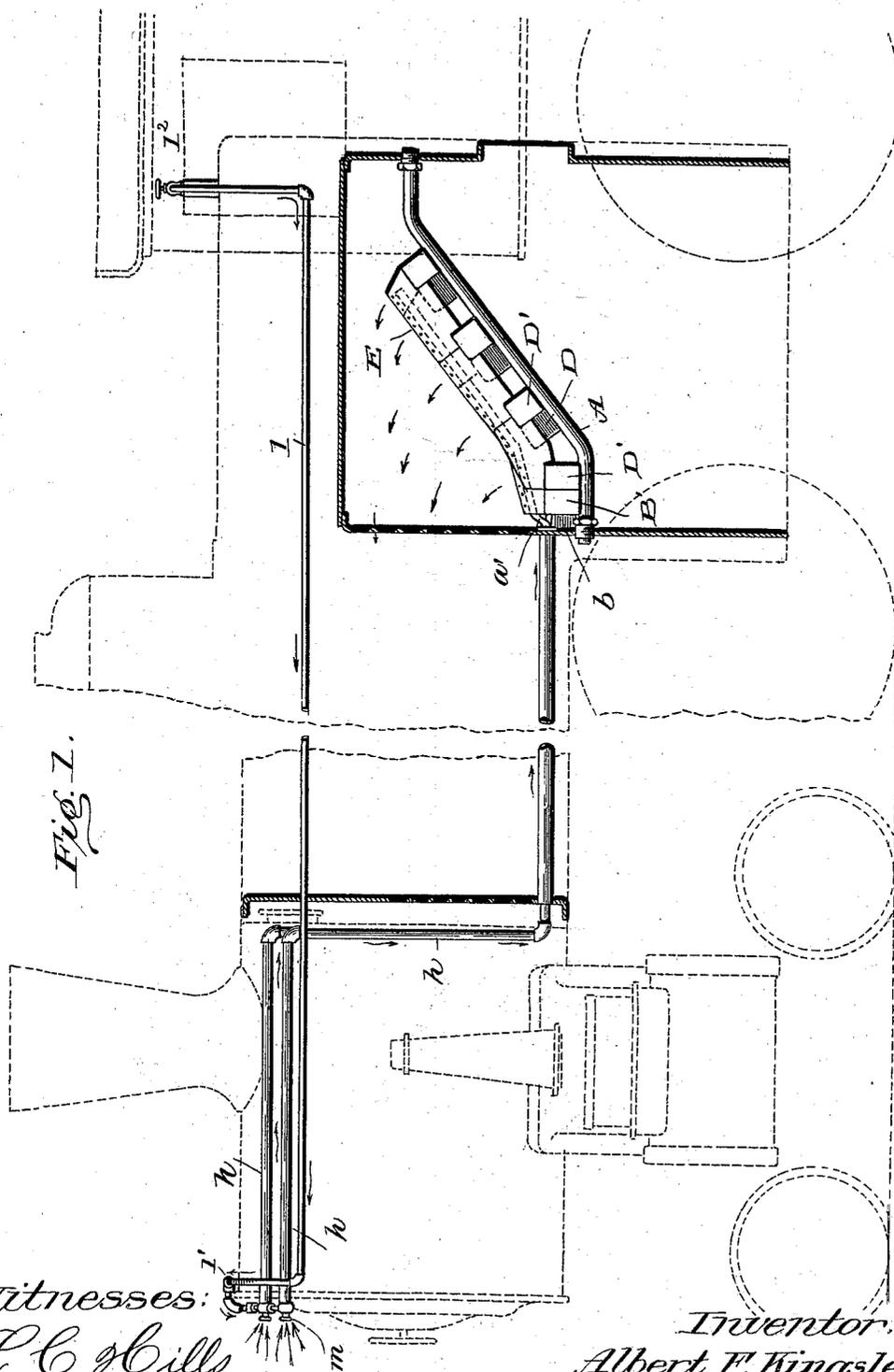


Fig. 1.

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J. B. Keefe

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by *Manuel Pailly*
his Atty.

(No Model.)

3 Sheets—Sheet 2.

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Fig. 5.

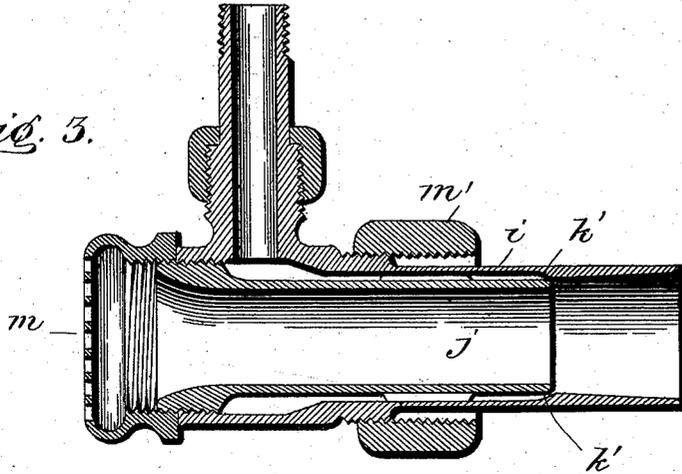


Fig. 2.

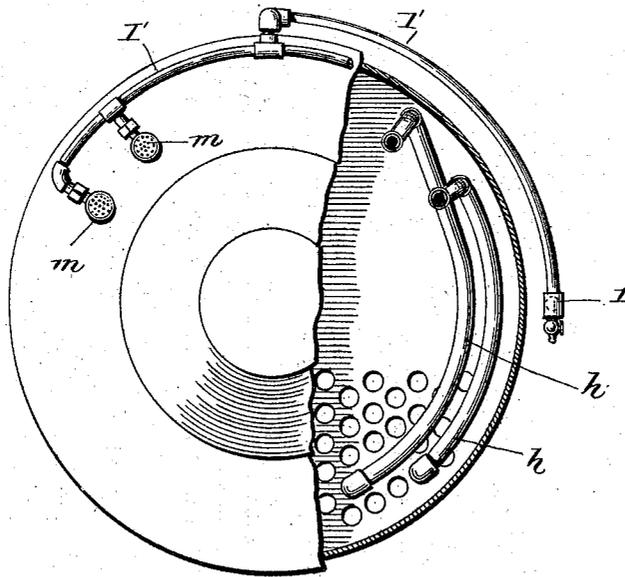
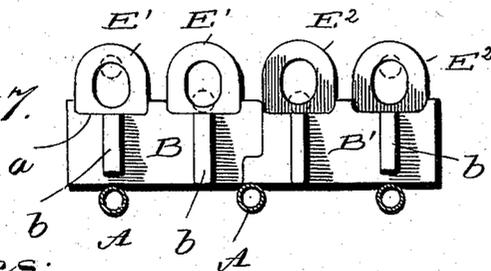


Fig. 7.



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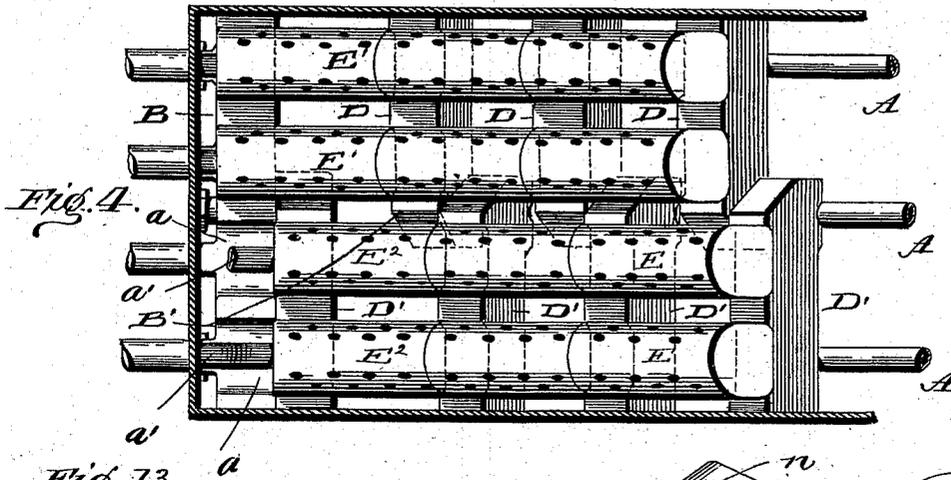


Fig. 4.

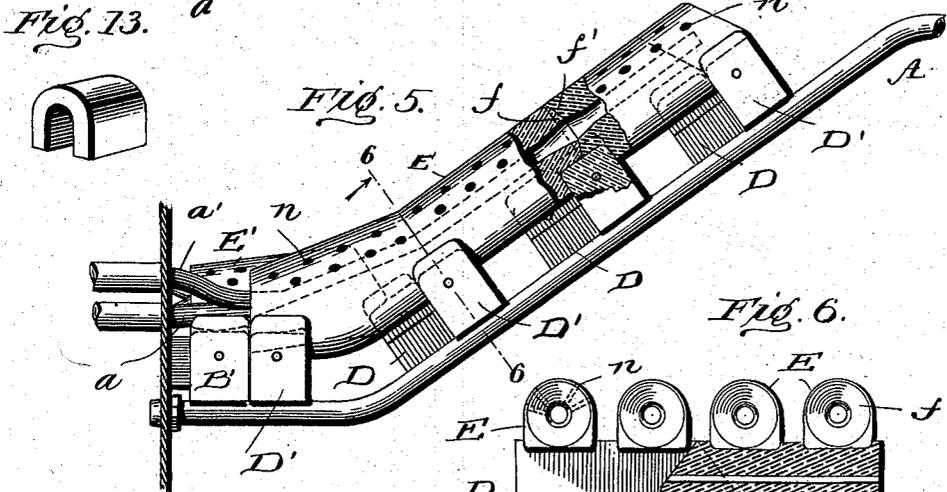
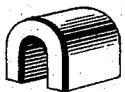


Fig. 5.

Fig. 8.

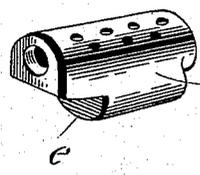


Fig. 9.

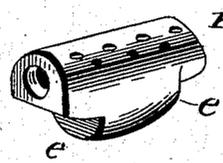


Fig. 6.

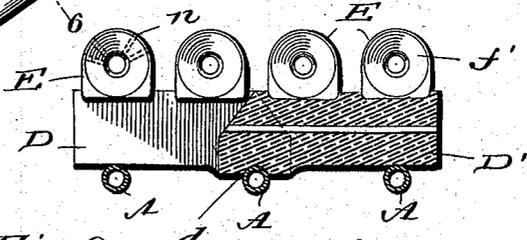


Fig. 10.

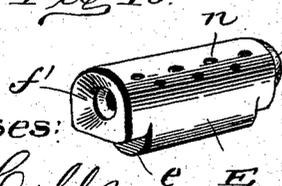


Fig. 11.

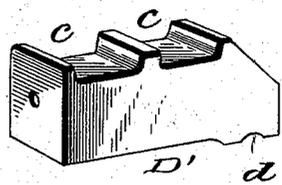
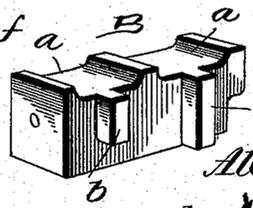


Fig. 12.



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UNITED STATES PATENT OFFICE.

ALBERT F. KINGSLEY, OF WASHINGTON, DISTRICT OF COLUMBIA.

BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 568,200, dated September 22, 1896.

Application filed April 30, 1896. Serial No. 589,736. (No model.)

To all whom it may concern:

Be it known that I, ALBERT F. KINGSLEY, of Washington city, in the District of Columbia, have invented a new and useful Improvement in Boiler-Furnaces, of which the following is a specification.

My invention is directed to appliances for securing perfect combustion in boiler-furnaces, particularly the boiler-furnaces of locomotives, and is an improvement upon the organization which is the subject of my Letters Patent No. 506,595, of October 10, 1893, involving as it does the use in combination of a series of air-conduits formed each of tubular laterally-perforated sections put together end to end and a series of fire-clay supports for said conduits placed below and extending crosswise of the latter, said supports and sections being provided, respectively, with recesses and locking-shoulders, whereby they are interlocked, the one serving to hold the other properly spaced without any rigid connection or joint between the two.

In my patented structure the fire-clay supports, which were placed crosswise of the furnace, were made in one piece or continuous in length from one side of the furnace to the other and were supported upon two water-bars, one along each side of the furnace, upon which bars the ends of the supports rested. In practice it was found that the supports under these conditions were not strong enough to uphold the load, even when reinforced by metallic core-rods, and that they required some intermediate support. To this end three or more water-bars (depending upon the width of the furnace) were provided; but it was then found that, owing to unavoidable inequalities in expansion and contraction of the parts, the solid continuous fire-clay cross-pieces would at times be held so unevenly by their supporting water-bars as to render the cross-pieces very liable to break and to make the structure as a whole quite insecure. A further disadvantage of the structure was that, owing to the use of fire-clay cross-pieces of continuous length, it was necessary, in making repairs at any one point in the structure, to remove the whole structure. To remedy these and other disadvantages, I now employ three or more water-bars, and in connection with them I employ, for

the purpose of supporting the sectional air-conduits, fire-clay cross-pieces, which, instead of being continuous, are made each in sections, and are so combined with the water-bars that each one of the sections of any one cross-piece will be supported by two of the water-bars only. In this way I get an articulated structure made up of parts of short length (in practice none of the sections need exceed eighteen inches in length) jointed together in such manner as to yield and adapt themselves to any irregularities or strains, whether lengthwise, crosswise, or vertical; and to further promote this end and to obtain a structure the parts of which will readily adapt themselves to changes in conditions the meeting ends of the fire-clay air-conduit sections are fashioned on the plan of a ball-and-socket joint, so that one section may readily move in any direction on the other to accommodate itself to changes and inequalities due to expansion or contraction of any of the parts.

I have also improved the mechanism for supplying air to the air-conduit; but this, together with the other portions of my improvements, can best be explained and understood by reference to the accompanying drawings, which I will proceed to describe, after which I will point out in the claims those features which I believe to be new and of my own invention.

In the drawings, Figure 1 is a longitudinal vertical central section, partly in elevation, of so much of a locomotive as needed to illustrate my invention. Fig. 2 is a front elevation, partly in section, of the head of the smoke-box of the locomotive, showing the air-supply inlets and the arrangement of the piping connected therewith. Fig. 3 is a section of one of the air-injectors enlarged. Fig. 4 is a plan of the air-gratings proper on enlarged scale. Fig. 5 is a side elevation of the same, partly in section, to show the form of joint between the members of the air-conduits. Fig. 6 is an end elevation, partly in section, of the same. Fig. 7 is an end elevation of that end of the grating next to the flue-head. Figs. 8 to 13, inclusive, are perspective views of the different parts which make up the fire-clay portions of the device.

The structure shown in the drawings is one

designed for the ordinary locomotive, in which the fire-box extends down below the axles. A fire-box of this kind is usually some thirty-four inches in width. For a fire-box of this width three water-bars A will suffice, one near each side wall and the third midway between the other two. They extend from a point slightly below the flues in front to a point above the fire-door in rear. They are tubular, of course, and they open into the boiler at each end, and for a short portion of their length at the front, where they adjoin the flues, they are horizontal and then are bent so as to extend up diagonally at a point above the door. Next to the boiler-head at front, and upon the horizontal portion of the water-bars, rests a sectional cross-piece composed of two fire-clay sections B B', which are placed end to end. Their abutting ends interlock, as shown in Fig. 7, the inner end of the section B resting on the inner end of section B', and this end of section B' in turn resting upon the middle water-bar A. The sections are of such length that when thus fitted together they will stretch in a continuous length between the sides of the fire-box. They have on top recesses *a*, and are also provided on their vertical faces, next to the flue-head, with vertical ribs *b*, which at the top are opposite to the recesses *a*. The air-supply pipes *a'* from the flues extend across the top of these ribs *b*, which serve to protect the metal pipes from burning, the latter being covered above by a fire-clay hood, such as shown in Fig. 13, or by a coating of fire-clay applied in plastic condition after the pipe is in place. Directly in the rear of section B' and resting upon the horizontal part of a pair of the water-bars A—the middle bar and one side bar—is one section D' of a fire-clay cross-piece.

Besides the parts B, B', and D' on the horizontal portion of the water-bars there are three fire-clay cross-pieces on the inclined portion of the water-bars, each cross-piece consisting of two sections D D' of the form shown in Fig. 11. These two sections are of a length to lap by one another. Each at its outer end rests upon one of the side water-bars and at its inner end rests upon the middle water-bar, which is thus common to the two sections. At the inner end each section is formed on its under side with a seat *d* to engage or saddle on the middle water-bar, so as to avoid any danger of end movement of the section. Each section also has in its top two recesses *c* to interlock with the air-conduit sections. The inner overlapping ends of the cross-piece sections are also beveled at the top, as shown in Figs. 6 and 11, so that they may not interfere with the air-conduit sections.

The air-conduit sections are shown at E E' E² provided with the usual air-perforations *n* for the discharge of air. There are three sections in each conduit, and these sections at the bottom are provided with shoulders *e* to

interlock with the recesses *c*, &c., in the top of the cross-pieces in the manner set forth in my Patent No. 506,595. The rearmost section is closed at its outer end. The abutting ends of the sections are formed the one *f* convex to fit a concave *f'* in the other, after the fashion of a ball-and-socket joint, thus permitting slight changes in direction of individual sections without breaking joint between them. The front section of each conduit is somewhat differently fashioned from the others, and two of them E', Fig. 8, which rest upon the sill or cross-piece B, are somewhat different in shape from the two E², Fig. 9, which rest upon the contiguous sill or cross-piece section D'. This particular sill D' is employed and placed in the position in which it is seen because of the fact that the sections D D' of each of the other cross-pieces are placed, not end to end, but so as to overlap and pass by one another at their inner ends, this being to enable them to take a better bearing individually on the middle water-bar. This necessitates a corresponding change in location of the air-conduit sections, whose ends must rest upon their respective cross-piece sections.

The peculiar shape of the sections E' E² is due to the fact that they rest at one end upon a support or sill which has a horizontal top and at the other end upon a support which has an inclined top. Air is led into these sections by the metal pipes *a'*, one for each, which extend from selected ones of the lower row of boiler-flues to their appropriate sections. The air-grating when thus constructed is articulated or jointed throughout both its length and its breadth, so that it can readily adapt itself to changes or inequalities in practically any direction without detriment or without in any way endangering its permanency.

The overlapping arrangement of the cross-piece sections D D' is due to the fact that there are only three water-bars, so that I must make use of the middle water-bar as a support for the inner ends of both sections of each cross-piece; but where, as in very large or "Mogul" locomotives, the fire-box is considerably wider, and four water-bars are called for, I can support each of the sections upon two water-bars only and yet place them end to end.

Air is supplied to those boiler-flues which are put in communication, by the pipes *a'*, with the air-grating through pipes *h*, which are led from the outside to the flues. These pipes, as shown in Fig. 1, at the front open out through the upper part of the head of the locomotive. They thence pass through the upper part of the smoke-box and down in front of the flue-head until they reach the particular flues at the bottom with which they are to communicate. By locating the air-inlets at or near the top of the head I get them out of the way and in a position where they are not likely to be injured or obstructed by

snow or other objects thrown up by the locomotive, and by carrying the pipes through the course shown in the smoke-box I am enabled to superheat the air and thus to supply it to the air-grating in a condition best calculated to insure complete combustion.

It is very necessary to the practical working of the air-grating that the supply of air should be readily controlled and adjusted and that it should be wholly independent of the movement of the locomotive. To this end I provide each pipe with an injector by which the air supply can be regulated to a nicety. This injector (see Fig. 3) consists of an outer shell *i* and inner air-tube *j*, between which is an annular passage through which steam may pass. The air-supply tube screws back and forth and is adjustable in the shell, so as to regulate the size of the annular nozzle or slit *k'*, through which the steam discharges. The supply of steam is taken from the boiler through a pipe *l*, connected by manifolds *l'* to the various injectors and controlled by the valve *l²* in the locomotive-cab, as shown in Figs. 1 and 2. The outer end of the air-inlet or tube *i* is protected by a screen or perforated head *m*. A coupling *m'* on the air-injector unites it to its air-pipe *h*.

Having described my improvements, what I claim herein as new, and desire to secure by Letters Patent, is as follows:

1. The combination with the flues and fire-box of a boiler-furnace, of three or more water-bars, a series of fire-clay cross-pieces resting upon and supported by said water-bars, each cross-piece being composed of sections each of which is supported by two water-bars only, and a series of air-conduits formed each of tubular laterally-perforated sections put to-

gether end to end, said sectional cross-pieces and air-conduits being provided with recesses and engaging shoulders whereby they are interlocked the one serving to hold the other properly spaced and in place, whereby said parts are caused to form an air-grating, which is articulated or jointed both lengthwise and crosswise, substantially as and for the purposes hereinbefore set forth.

2. The air-conduit composed of sections whose abutting ends meet in a ball-and-socket joint as described in combination with the sectional cross-pieces having locking recesses or shoulders to interlock with corresponding recesses and shoulders on the air-conduit sections and a series of three or more water-bars upon which the sections of the cross-pieces are placed in such manner that each section of each cross-piece shall be supported by two water-bars only substantially as set forth.

3. In combination with the air-grating, and the fire-box, smoke-box and boiler-flues of a locomotive, the air-pipes *h* extending from the front and upper part of the head of the locomotive down through the smoke-box and in front of the flue-head, to those flues through which air is conducted to the air-grating, an air-injector for each pipe, and a steam-supply pipe, connected to said injectors and controlled by a valve or cock in the locomotive-cab or at some other point convenient to the engineer or fireman, substantially as and for the purposes hereinbefore set forth.

In testimony whereof I have hereunto set my hand this 30th day of April, 1896.

ALBERT F. KINGSLEY.

Witnesses:

FREDERIC B. KEEFER,
EWELL A. DICK.