

A. F. KINGSLEY.
LOCOMOTIVE AND OTHER FURNACE.
APPLICATION FILED AUG. 27, 1908.

943,942.

Patented Dec. 21, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

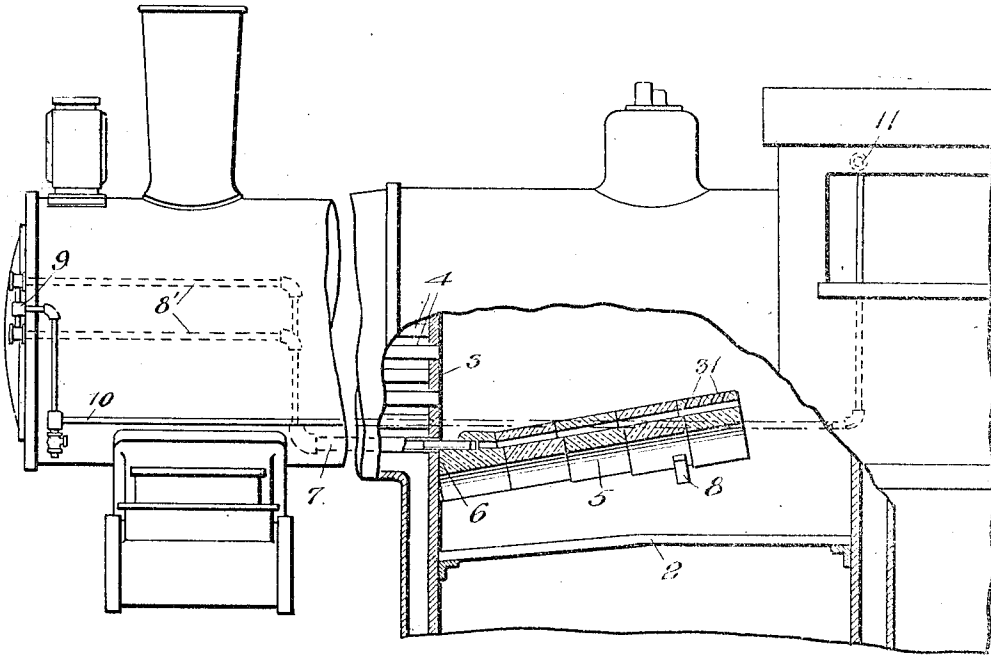
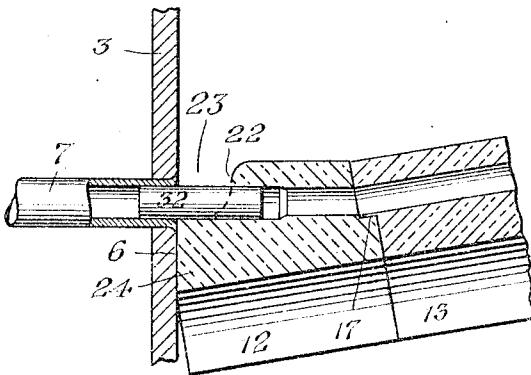
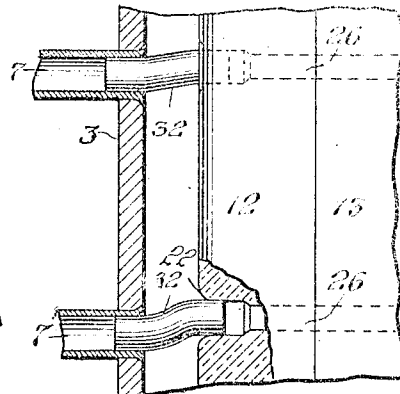


Fig. 4.



WITNESSES:
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E. H. Renne

Fig. 5.



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2 SHEETS—SHEET 2.

Fig. 2.

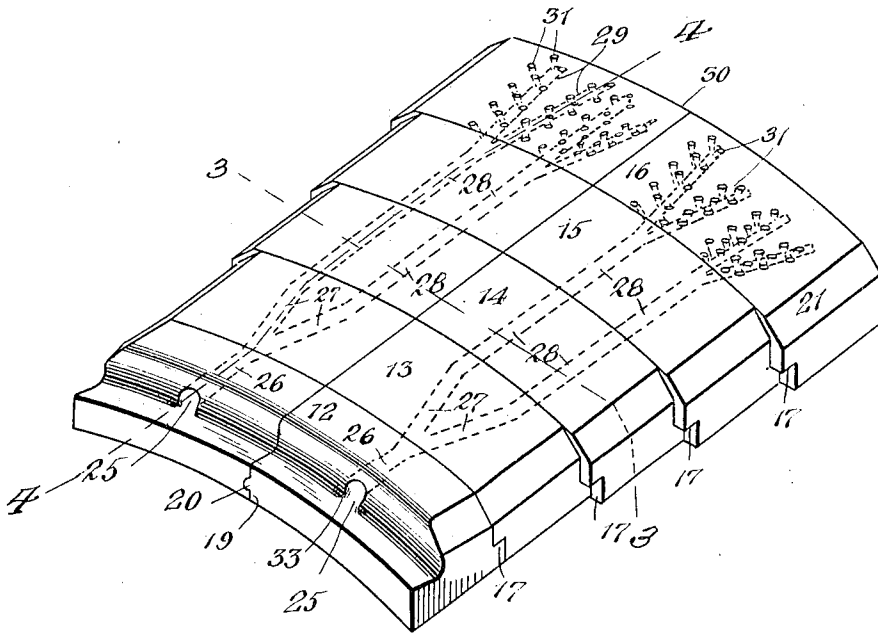
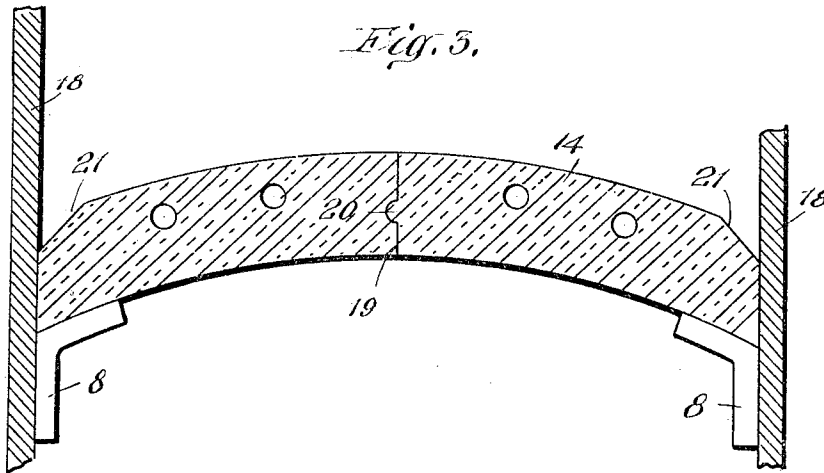


Fig. 3.



WITNESSES:
H. Lockman
E. H. Rennie

Alfred F. Kingsley INVENTOR
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UNITED STATES PATENT OFFICE.

ALBERT F. KINGSLEY, OF NEW YORK, N. Y., ASSIGNOR TO LOCOMOTIVE EQUIPMENT COMPANY, A CORPORATION OF MAINE.

LOCOMOTIVE AND OTHER FURNACE.

943,942.

Specification of Letters Patent. Patented Dec. 21, 1909.

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To all whom it may concern:

Be it known that I, ALBERT F. KINGSLEY, a citizen of the United States of America, residing at New York, N. Y., have invented certain new and useful Improvements in Locomotive and other Furnaces, of which the following is a specification.

My invention relates to an equipment for supplying air to the interior of a furnace fire-box for the purpose of effectively oxidizing and burning the sparks, smoke, and gaseous products of combustion.

My invention has particular reference to locomotives. In locomotives, it is especially desirable that the escape of sparks and smoke be prevented, and that a high steaming efficiency be maintained at small expenditure of fuel.

A practicable and successful smoke and gas consuming device for locomotives must meet several requirements. It must be adaptable to use in connection with the standard locomotive structure with little or no modification of the latter. It must be capable of being readily assembled in the fire-box and removable therefrom, and must not obstruct the flues or other parts, such as may require cleaning and repairing even while a fire is on the grate. It must provide for a thorough preheating of the air to be injected, and for introduction of the same into the fire-box at uniform pressure and at such points of the fire-box as intimately to mix and burn with the gases before the same can reach the flues. In one or more of these respects the smoke consumers heretofore devised have apparently been lacking. The great majority of such devices have been complicated or of such design as to be obviously impracticable in view of the highly developed and well-defined lines of locomotive construction. Other devices have not provided for a proper preheating, or proper pressure of the air to be supplied to the fire-box.

In my invention, I use as an air distributor the deflecting arch commonly found in locomotive fire-boxes, the arch being provided with interior air passages for distributing the air. Such use of the deflector is, of course, broadly old.

My invention resides in the peculiar construction of this arch, and in the manner of supporting the same, and of connecting the air distributing passages therein to certain

of the boiler flues which I use as air feeding and preheating tubes, so that a perfect and endurable connection from such tubes to the deflector is had without obstruction of those flues through which the burning gases pass to the stack; and without interference with the fire on the grate.

The use of the deflecting arch in connection with certain of the flues as an air feeding equipment has heretofore presented difficulties. Such an arch in the first place must be well supported, and, as it is inclined downward to the flue sheet, it is preferable that its forward end rest against the flue sheet, so that the latter may support the arch. The arch, if it rests against the flue sheet at or above the line of the flues, will, however, unless of especial design, obstruct some of the flues, preventing the burning gases from reaching the same, or making access thereto for rolling and cleaning difficult or impossible. If, on the other hand, the arch rest against the flue sheet below the flues and the air connections thereto be made from its upper surface, as had heretofore been attempted, then ordinarily the arch will interfere with the fire on the grate. The distance between the grate and the level of the lower flues in a locomotive of standard construction is not sufficient to permit of an arch being inserted below the flues without protruding below the level of the fuel on the grate.

In my invention the arch rests against and is supported by the flue sheet. It may be at or above the level of the lower line of flues, thereby being removed from the fire on the grate. Preferably, its forward end is at the level of the lower flues. It is so shaped, however, that it does not obstruct any of the flues. The forward edge of the arch is formed or cut to have a step or offset. The outer lip or extension formed by this step rests against the flue sheet immediately below a line of flues, and because of the offset, a space or clearance is provided between the flues and the arch. Across this space there are tubular connections from the air passages in the arch to those flues which are to be used as air supply pipes, and through this space between such connections, the products of combustion may pass to other flues.

The space or clearance between the flues and the offset on the edge of the arch has

another and most important purpose. It permits the tubular air connections crossing it to be bent whenever the mouths or inlets of the air passages in the arch may not register truly with the air feeding flues.

The arch is made in sections of refractory or other suitable material, and the air passages in the different sections thereof are made to register with each other, and should also register with the proper air feeding flues in the flue sheet were the position of the latter invariable in all locomotives. As a matter of fact, however, the position of the flues even in locomotives of the same type varies considerably. The air passages in the arch if extended to the flue sheet would, therefore, in most instances, not properly register with the air feeding flues, and in such instance the delivery of air would be defective or impossible. The offset in the edge of my deflector, whereby the air passages are terminated at a distance from the flues, permits the tubular connections to be bent to be adjusted to any variation of position of flue tubes.

Having set forth the objects and nature of my invention, I will now describe in detail an embodiment of the same, reference being had to the accompanying drawings in which, Figure 1 is a view in longitudinal elevation partly sectional, showing my equipment in place in a locomotive. Fig. 2 is a perspective view of my assembled arch. Fig. 3 is a detail view taken on the line 3—3 of Fig. 2, showing also the side wall of the fire-box and a supporting bracket for the arch. Fig. 4 is an enlarged detail view taken on the line 4—4 of Fig. 2, showing also the flue sheet and flue connection to the arch. Fig. 5 is an enlarged detail plan view showing the connections from the arch to the flues.

In the description to follow that part of the fire-box toward the cab is referred to as the "rear" and that part toward the front of the locomotive as the "front" of the fire-box.

In the fire-box, 1, is a regulation grate 2, supported at its front on the flue sheet 3. Terminating in the flue sheet 3 and opening into the combustion chamber are the usual flues 4. The air distributing and deflecting arch 5 forming the subject of the present invention is mounted in the fire-box above the grate. At its forward end 6, the arch rests against the flue sheet, and at any suitable point the arch may be supported on the side walls of the fire-box as by means of a bracket 8, or by other means.

In my invention as shown in the drawings, two of the lower flues 7 are utilized as air feeding and preheating tubes or pipes. These tubes 7 have pipe connections 8' to the front of the locomotive where they open to the atmosphere. A steam injector 9 of

any suitable type serves to force the air through to the fire-box at any desired or suitable pressure. The steam injector 9 is connected to the boiler by a steam pipe 10 by way of the cab, and by means of a valve 11 in the cab, the steam pressure may be controlled by the engineer.

As shown in Fig. 2, the arch which is of refractory or other suitable fire resisting material, is preferably built in sections. This permits the arch to be readily installed in, or removed from, any locomotive; and, by varying the number or character of the sections, an arch may be constructed to accord to any design or size of locomotive fire-box. The arch is shown as inclined downward and forward, and since the side walls of a locomotive fire-box diverge upwardly, the sections to the rear of the arch must be longer than those to the front, if the arch is to extend completely across the fire-box. I prefer to so construct the arch that its lower and upper surfaces are smooth and continuous, and extend at all points substantially across the fire-box. By so constructing the arch, it serves more perfectly as a deflector, and precludes the escape of unburned products of combustion through the flues. Within the scope of certain features of the present invention, however, it would be possible to modify the structure of the arch considerably, and the arch instead of being continuous entirely across the fire-box might be otherwise formed to suit any particular requirement. The form shown, however, is believed to provide for the most thorough admixture of the air with the products of combustion and for the best possible burning of the same before they reach the flues.

In the drawing, see Fig. 2, the arch is shown as comprising five transverse sections 12, 13, 14, 15 and 16. This number may be varied as desired. The forward of these transverse sections rests at 6 against the flue sheet, and each section to the rear rests upon and forms an air-tight joint with the section immediately in front of it, by means of shoulders 17. In place of the shoulders 17, any other suitable interlocking or air-tight connection may be employed. One or more of the sections, such as the section 15, (see Figs. 1 and 3,) may be supported on the side plate 18 of the fire-box or elsewhere, as by means of the bracket 8. Other suitable means of support may, however, be substituted for the bracket 8.

Each of the transverse sections of the arch is preferably divided longitudinally as at 19 into one or more pieces. In the drawings, each transverse section of the arch is shown as divided at the center of the arch into a right and left hand part, interlocked and supported by means of a joint 20, (see Fig. 3). The particular form of this joint

or locking means is immaterial, and the number of such longitudinal dividing joints is also a matter of convenience and mechanical expediency. To facilitate the shaping of the arch in the fire-box, the outside edges of each of the transverse sections are beveled as at 21.

The front edge of section 12 of the arch is cut away as shown at 22, (see Figs. 4 and 5) to form a step or offset, whereby there is space or clearance 23 between the front edge of the arch section 12 and the flue sheet 3; and a lip or extension 24, the end 6 of which rests against the flue sheet. Opening at one end into the space or clearance 23 as at 25, (see Fig. 2,) and extending rearwardly through the arch, are air feeding and distributing passages. In the arch section 12, there are shown but two of such passages 26. In section 13, there are shown four air passages 27, the two to the left converging to one of the passages 26 in the section 12, and the two to the right to the other passage 26 in the section 12. In the sections 14 and 15 are shown four parallel passages 28, registering each with one of the four passages 27 in the section 13, and terminating each in two smaller divergent passages 29 in the slab 16. The passages 29 do not continue through to the end 30 of the slab or section 16, but are each provided with several vertical air jet openings 31 through the upper surface of the slab 16 into the fire-box. The air passages described provide a continuous path from the inlets 25 in the slab 12 through the various sections or slabs of the arch, over a constantly widening area, to the outlets 31 in the slab 16, thus delivering the air from the upper surface of the rear end of the arch into the fire-box at a point where the air may be most advantageously mixed with the products of combustion for the burning of the latter. The particular form of the air passages of the arch and the point of delivery of air to the combustion chamber may be varied as desired; so also may the number of air passages. In the drawings, I have shown two air inlets to the arch, but those may vary in number from a single inlet to as many as may be desirable.

The arch is so positioned that its forward end rests against the flue sheet at such a level that the air inlets 25 are preferably in line or register with the flues 7 selected to be used as air feeding and preheating tubes. The tubes 7 are connected to the inlets 25 by means of short tubular connections 32 of suitable material, which are fitted at one end into the flue tubes and at the other end into the inlets of the passages 26. It has heretofore been pointed out, however, that the position of the flue tubes in different locomotives is not identical; and one of the functions of the clearance or space 23 is to

permit the use of the connections 32 which (see Fig. 5) may be bent, so that a perfect connection may be made between the flues and the arch inlets, whether the latter register precisely with the flues or not. It is obvious that if this clearance did not exist, but on the contrary the passages 26 were extended to the flue sheet, then in the event the flues did not register with the inlet, the air connection would be defective, or there would be no connection at all. In order that the connections 32 may be readily positioned when bending is necessary, the mouths of the inlets 25 are flared as shown at 33, (see Fig. 2).

I have shown my arch so mounted as to take air from certain of the tubes which commonly constitute the lower line of locomotive flues. The precise number of flues 7 so used as air feeders is a matter of choice, according to the requirements of any particular instance. Two, or more, or less than two, flues 7 may be used. It may happen that in alignment with the flues 7, used as air feeders, there are other flues 4 which are to have their ordinary functions of conveying the burning gases through the boiler to the stack. Where such last mentioned flues are in alignment with air feeding tubes, it is important that the arch does not interfere with the passage of the products of combustion to such flues. Here, therefore, is another important function of the clearance or space 23, as this space permits the passage of the products of combustion past the end of the arch and into any flues which may be in alignment with the air feeding flues. Instead of using one or more of the flues, I may use a specially constructed air feeding equipment to the fire-box. In so doing, however, the advantage of no change in or addition to the locomotive construction, which is one of the advantages of the structure shown in the drawings would be lost.

The structure shown and described in detail answers in an eminently satisfactory manner the requirements of the trade. The air is thoroughly preheated and its pressure is at all times under perfect control. The arch is adaptable to any locomotive. It does not protrude below the line of the flues sufficiently to interfere with the fire and it does not obstruct the flues. It is readily installed and removed, and, although practically indestructible, nevertheless, any section thereof may be readily replaced, if desired.

What I claim and desire to secure by Letters Patent is:

1. In a furnace, a fire-box, a fire arch mounted within the fire-box having an interior air passage terminating at one edge of the arch and openings therefrom through the walls of the arch into the fire-box, the arch having a step edge adjacent the mouth

of said passage to form a lip or extension which rests against one wall of the fire-box to hold the mouth of said passage from said wall of the fire-box, the wall of the fire-box having an air passage therein opposite the edge of the arch, and a tubular connection from the air passage in the wall of the fire-box to the mouth of the passage in the arch.

2. In a furnace, a fire-box, a plurality of tubes extending into the boiler from one wall of the fire-box, some of said tubes being flues and one or more being tubes for delivering air to the fire-box, a fire arch having a continuous stepped edge resting against said fire-box wall in alinement with some of said tubes in the latter, the off-set formed by the step providing a space or clearance between the tubes and the arch, the arch having one or more air passages from said space or clearance discharging into the fire-box, and one or more tubular connections across said space or clearance from the air tube or tubes to the passage or passages in the arch.

3. In a furnace, a fire-box, a fire arch projecting into the fire-box from one wall of the fire-box and having an air passage therethrough from that edge of the arch which rests against the wall to suitable points in the surface of the arch within the fire-box, the wall from which the arch projects having therein opposite the edge of the arch an air inlet, a tubular connection from the air passage in the fire-box wall to the air passage in the arch, and the edge of the arch being cut away at the mouth of the air passage to permit of a bend in said tubular connection when the opening in the fire-box wall does not register with the mouth of the passage in the arch.

4. In a furnace, a fire-box, a grate therein, a flue sheet forming the front wall of the fire-box, flues terminating at the flue sheet, a fire arch for the products of combustion located between the grate and the flues, the forward end of the arch being at the level of certain of the flues at the flue sheet, the lower portion of the front edge of the arch resting against the flue sheet immediately below said certain flues, and the upper portion of the front edge being cut away to provide passage for the products of combustion from the fire-box to those flues at the level of the arch, the arch having one or more air or gas delivering passages therethrough opening to the rear into the fire-box and to the front into the space formed by the cutaway portion of the arch, and tubular connections across said space from one or more of the flues into the passage or passages through the arch.

5. In a furnace, a fire-box, a fire arch in the fire-box in the path of the products of

combustion from the fire, an opening in the wall of the fire-box for delivering air into the latter, the arch being cut or formed to have a step therein at one edge, the outermost portion of said edge of the arch resting against the wall of the fire-box immediately adjacent the air opening therein, the arch having an air passage therethrough opening at one end into the fire-box and at the other end into the space formed by the step in the edge of the arch, and a tubular connection across said space from the opening in the fire-box wall to the air passage in the arch, the step forming said space being elongated to permit the bending of said tubular connections in event the passage in the arch fails to register with the opening in the fire-box wall.

6. In a furnace, a fire-box, a grate therein, a flue sheet forming the front wall of the fire-box, flues terminating at the flue sheet at a point above the level of the fuel on the grate, a fire arch for the products of combustion extending across the fire-box substantially from side to side, the forward end of the arch being substantially on the level of the lower flues of the flue sheet, the lower portion of the front edge of the arch resting against the flue sheet immediately below the flues, and the upper portion of the front edge being cut away to provide passage to the flues for the products of combustion from the fire-box, the arch having one or more passages therethrough opening to the rear into the fire-box, and to the front into the passage formed by the cutaway portion of the arch, and tubular connections across said passage formed by the cutaway portion of the arch from one or more of the flues into the passage or passages through the arch.

7. The combination with the fire-box, the flues, flue sheet and grate bars, of an arch made of suitable material supported above the latter, the said arch having its under and top surfaces smooth throughout its length and provided with a flat front surface, which latter abuts the flue sheet and provided with internal air ducts which at the rear end of the arch and at the top thereof communicate with the interior of the said fire-box, and tubular members extending from the air ducts in the arch to certain of the flues, the arch also being provided with a cutaway portion at its front end for adjusting and inserting the said connection.

Signed by me at New York, New York, this 25th day of August 1908.

ALBERT F. KINGSLEY.

Witnesses:

ROBERT G. PERRY,
F. J. ERWIN.