

J. H. GROVE.
LIGNITE BURNING FURNACE.
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1,033,005.

Patented July 16, 1912.

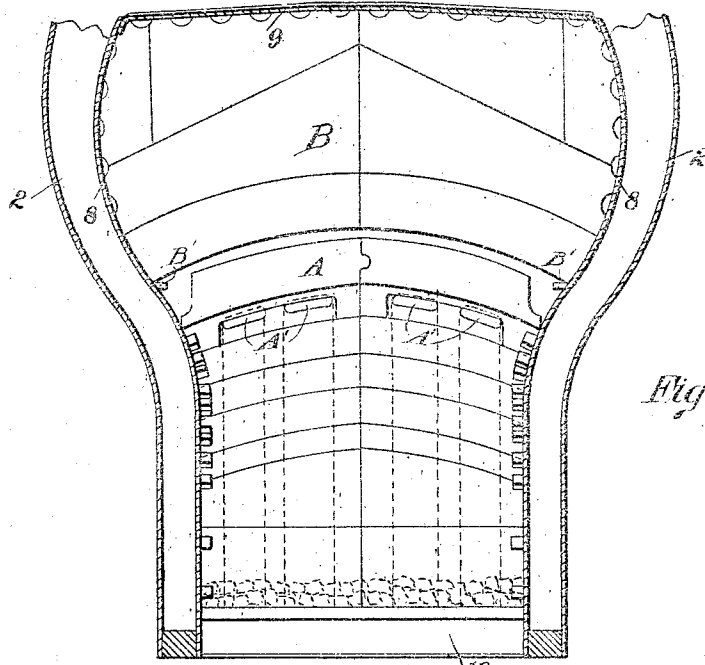


Fig. 1.

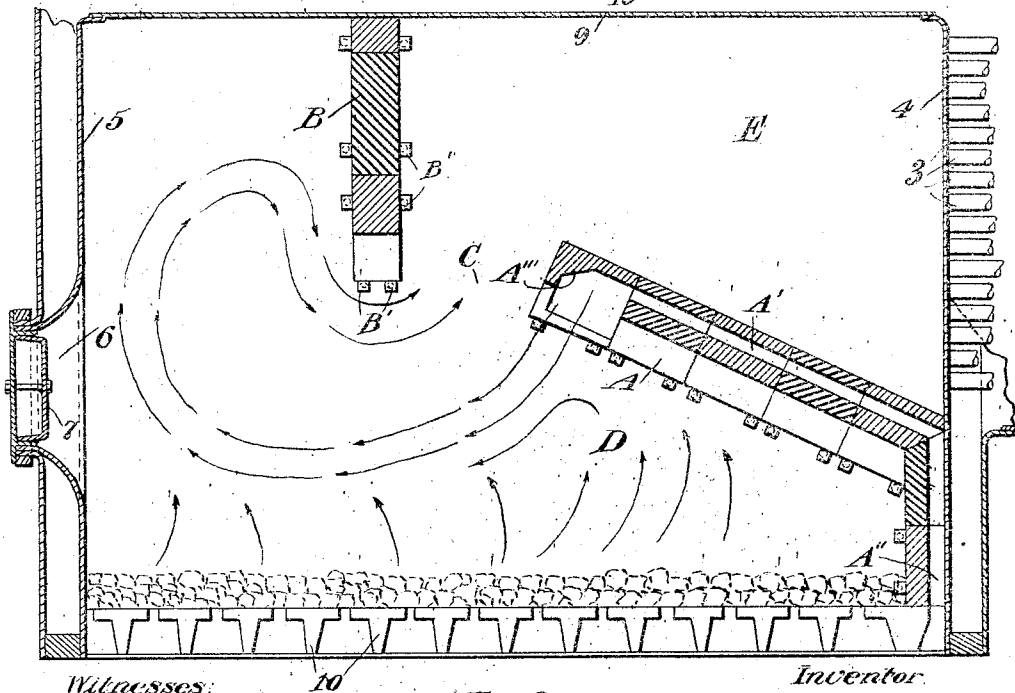


Fig. 2.

Witnesses:
A. W. Nelson
M. Simon

Inventor
James H. Grove.
by *Charles S. H. H. H. H.*
Atty.

UNITED STATES PATENT OFFICE.

JAMES H. GROVE, OF OMAHA, NEBRASKA, ASSIGNOR, BY MESNE ASSIGNMENTS,
TO AMERICAN ARCH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW
YORK.

LIGNITE-BURNING FURNACE.

1,033,005.

Specification of Letters Patent.

Patented July 16, 1912.

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To all whom it may concern:

Be it known that I, JAMES H. GROVE, a citizen of the United States, and a resident of Omaha, Douglas county, Nebraska, have
5 invented certain new and useful Improvements in Lignite-Burning Furnaces, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to
10 make and use the same.

My invention relates to improvements in boiler furnaces and has special reference to improvements in locomotive boiler furnaces.

The draft in a locomotive boiler furnace is induced by a blower or exhaust nozzle in the "front-end" or smokebox of the boiler, and is so forcible that unless special care is used in firing the furnace the burning fuel is lifted off the grate. Hollow arches of the so-called Wade & Nicholson type, by introducing air into the fire box above the burning fuel lessen the velocity of the currents in the firebox, and with ordinary fuels prevent the carrying over of cinders and ashes into the flues. The Wade & Nicholson hollow arches, when used, markedly improve the performance of locomotive boilers, but even these arches do not enable the use of such fuels as lignite, though they go far toward doing so, as the peculiar manner of introducing air into the firebox tends to suppress the rise of the fuel, ashes and cinders from the grate. There are large sections of this country in which lignite is the only fuel that is locally obtainable in sufficient abundance to supply the railroads, and the problem of providing furnaces in which it may be used involves questions and considerations of great importance. Many inventors and engineers have applied themselves to the problem, but up to this time no successful lignite burning furnace has been devised. I have succeeded in solving this problem in a very simple manner, and this
45 present invention has reference to such improvements.

My invention consists generally in a locomotive boiler furnace comprising a firebox having a flue sheet at one end and a fuel door at the opposite end, in combination with an inclined arch of refractory material, arranged in the front part of the fire box, and a second arch, or baffle, also of refractory material, depending from the top
50 of the firebox, back of the front arch. A

furnace of this construction has the effect of so completely suppressing the rise, flotation and escape of combustibles and of ashes and cinders, as to enable the burning of lignite, and in practical use has proven of great
60 value and efficiency.

My invention will be more readily understood by reference to the accompanying drawings forming a part of this specification, and in which,

Figure 1 is a vertical transverse section of a locomotive furnace embodying my invention; and, Fig. 2 is a vertical longitudinal section thereof.

In the drawings I have illustrated a locomotive boiler furnace embodying the invention, the firebox being of a so-called "narrow" type.

2 represents the shell of the boiler; 3 the flues, 4 the flue sheet; 5 the rear sheet of the firebox; 6 the door-opening; 7 the fuel door which closes the opening; 8, 8, the side sheets; 9, the crown sheet; and 10 the grate. In the front part of the firebox, extending rearwardly from the flue sheet, 4, is the inclined Wade & Nicholson hollow arch, A. The air is supplied to the ducts, A', through a vertical duct A'', which opens through the grate. The arch is built up of refractory bricks, and the air passing therethrough is heated to a high temperature. Upon emerging from the ducts, A', the hot air, under high velocity, strikes the refractory deflectors, A''', and is thereby thrown or deflected downward toward the grate and toward the rear end of the firebox. B is a second arch which extends downwardly from the crown sheet, 9, of the fire box. This arch, as well shown in Fig. 2 of the drawings, is arranged back of the arch, A, with its lower edge substantially on a level with the top thereof. The arch, B, is preferably supported on studs, B', which project from the side sheets of the furnace. The arch B may be composed of any suitable number of refractory bricks and I prefer to notch or scallop the edges of the bricks which contact the side and crown sheets to permit flow of furnace gases upon said sheets and equalize the temperature thereof. The depending arch, B, preferably occupies a vertical position and is preferably somewhat more remote from the rear sheet of the firebox than from the rear end of the front arch. The opening, C, be-
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tween the two arches is termed the throat of the furnace. The space D below and behind the arches is called the fire chamber and the space, E, above and in front of the arches, A and B, is called the combustion chamber. All of the hot gases and combustible products from the fire chamber must pass through the throat, C, to enter the combustion chamber, E. In Fig. 2 burning fuel is shown upon the grate. The action of the exhaust nozzle at the front end of the flues creates a partial vacuum in the firebox; hence air rises through the fuel in sufficient quantity to support combustion, and air also enters through the hollow arch, A, by which latter the heated air is thrown downward toward or upon the burning fuel.

It will be noted that the hot air from the arch, A, is projected substantially across and beneath the throat C, and its velocity is such as to turn or deflect the gases rising from the fuel downward and toward the rear end of the firebox, there the currents of gas and air rise behind the depending arch, B, and to escape through the throat C must pass downward beneath said arch, B. The first effect noted is that the light fuel particles and gases from the fuel instead of being permitted to rise directly to the throat of the furnace, are to a greater or less extent precipitated toward the fuel, the force of the streams of air from the arch, A, combining with the reduction of the vacuum above the fuel, due to the admission of air through the arch, and tending to suppress the rise of the gases, fuel particles and cinders. The second effect which is readily observable, is the better combustion of the fuel gases and particles due to the thorough admixture therewith of fresh air from the front arch. The third and important effect of my arch or furnace construction is that the fuel particles and cinders which are carried up by the currents of air and gas are thrown against the rear side of the vertical arch, B, and losing their velocity fall toward or upon the grate. Their escape into the combustion chamber and into the flues of the boiler is thus prevented.

The good effects of the arches are not restricted to the suppression of the carrying over of the cinders and ashes, but include the complete breaking up of the currents or strata of burned and burning gases, giving time for their thorough admixture with air and consequent consumption of the light combustibles and particles of carbon given up by the mass of lignite on the grate. As shown in Fig. 2, I prefer that the vertical or crown sheet arch, B, shall be near the front arch, A, but it should never be moved to a position over the same, for in that case the cinders and ashes impinging on the arch B would be deposited on the top of the arch

A, defeating one of the distinct objects of the invention, by increasing rather than diminishing the clogging of the boiler flues with ashes and cinders.

A further and distinct advantage of my invention follows upon the restriction of the throat, C, of the furnace to a comparatively small size through the employment of the vertical arch without covering up the crown sheet of the boiler. It will be noted that only the upper edge of the crown arch is presented to the crown sheet, and that no other part of the crown sheet is covered or protected from the currents of gas. The heat from the fire rises back of the arch as well as in front of it and consequently I retain the even heating of the crown and side sheets of the furnace, as in other furnaces, and at the same time secure the numerous other advantages before set forth.

Having thus described my invention I claim as new and desire to secure by Letters Patent:

1. A lignite burning locomotive boiler furnace comprising a firebox having a grate and provided with a flue sheet at one end and a fuel door at the opposite end, in combination with an inclined hollow front arch of refractory material through which air is introduced and deflected downwardly, and a second arch or baffle, also of refractory material, depending from the top of the firebox above and back of said front arch, substantially as described.

2. A lignite burning locomotive boiler furnace comprising a firebox having a grate and provided with a flue sheet at its front end and a fuel door at its rear end, said door normally preventing the entrance of air at said rear end, in combination with a hollow front arch arranged to project hot air downwardly and toward the rear end of the firebox, and a second arch or baffle extending downwardly from the crown sheet and from side to side of the firebox, back of said front arch, substantially as described.

3. A lignite burning locomotive boiler comprising a firebox having a grate and provided with flues at its front end and a normally closed fuel door at its rear end, in combination with a front arch of refractory material arranged to project hot air downwardly and toward the rear end of the firebox and a second or top arch also composed of refractory material, depending from the crown sheet of the firebox at a point back of said front arch, there being a throat or opening between said arches, substantially as and for the purpose specified.

4. A locomotive boiler firebox having a grate and provided with a flue sheet at one end and a fuel door at the opposite end, in combination with an arch composed of refractory material and extending rearwardly

and upwardly from said flue sheet, said arch containing air heating passages and having at its upper end a deflector arranged to project the heated air downwardly toward the rear end of the firebox, a crown arch supported between the sides of the firebox and extending from the top of the firebox downwardly to substantially the level of the top of the front arch, said
10 crown arch being arranged between the

rear end of the front arch and the rear end of the firebox, as and for the purpose specified.

In testimony whereof, I have hereunto set my hand, this 25 day of July, 1907, in the presence of two subscribing witnesses. 15

JAMES H. GROVE.

Witnesses:

CHAS. C. LACY,
C. L. HEMPEL.