

1,033,008.

J. H. GROVE.
LOCOMOTIVE BOILER FURNACE.
APPLICATION FILED OCT. 19, 1908.

Patented July 16, 1912.

2 SHEETS—SHEET 1.

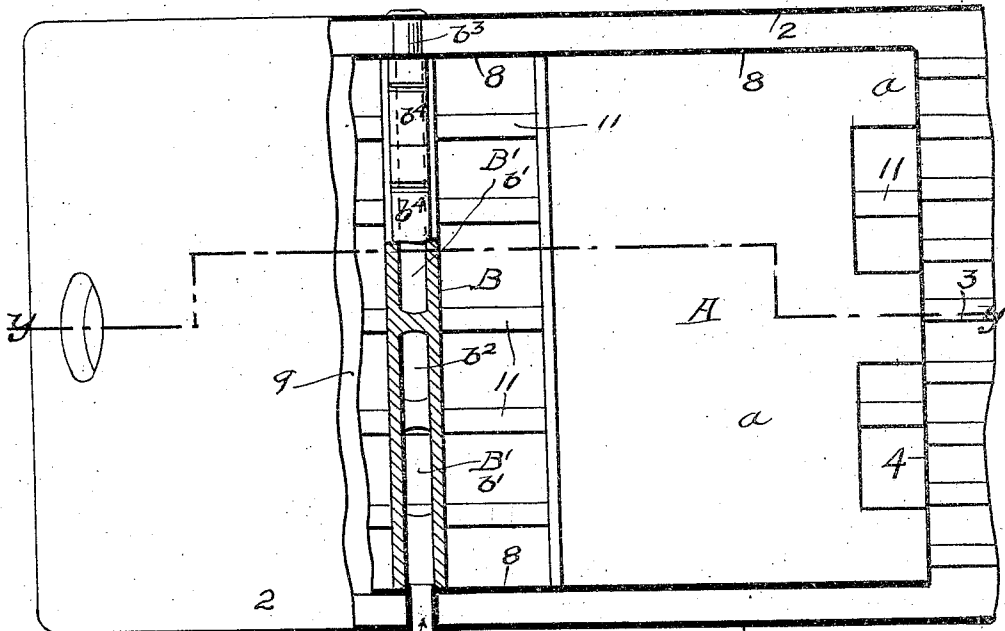


Fig. 2.

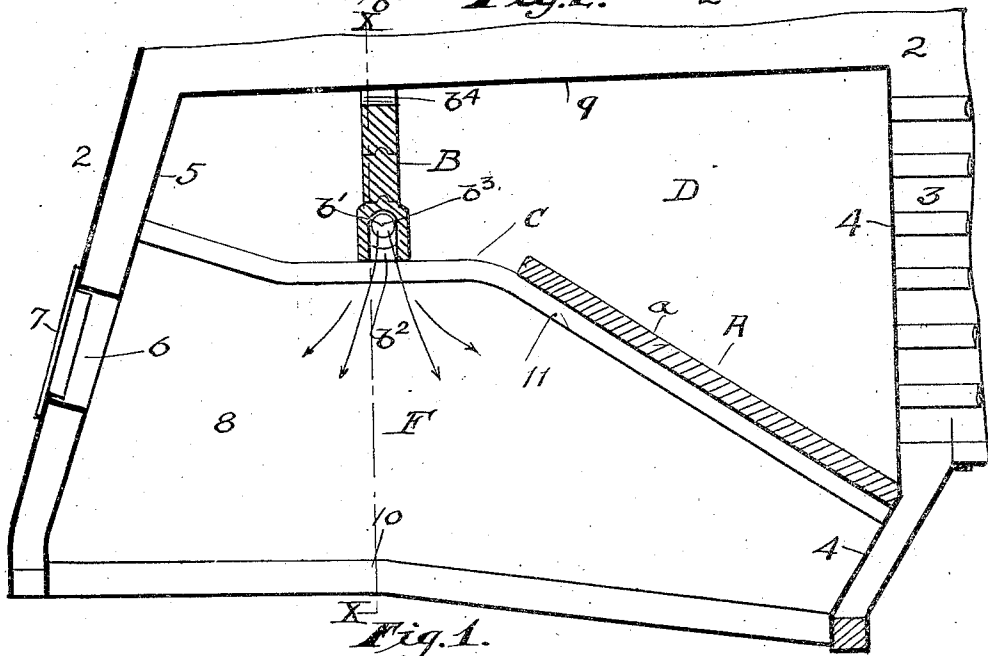


Fig. 1.

Witnesses:
Arthur Nelson
M. Simon

Inventor:
JAMES H. GROVE,
By *James H. Grove* his Attorney

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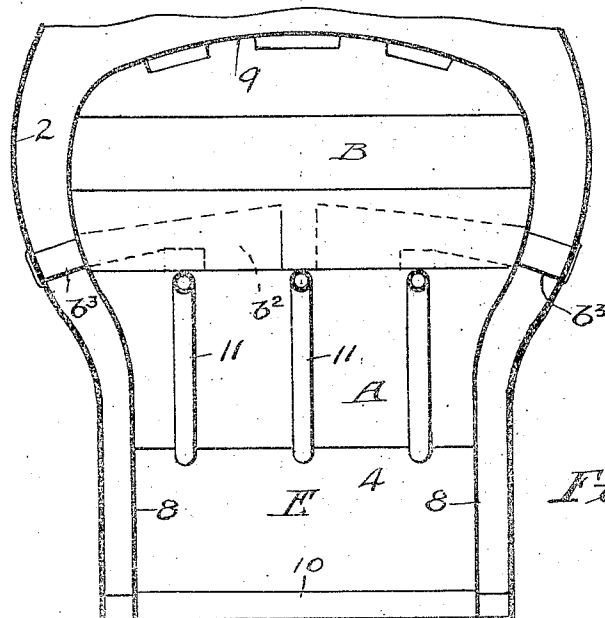


Fig. 4.

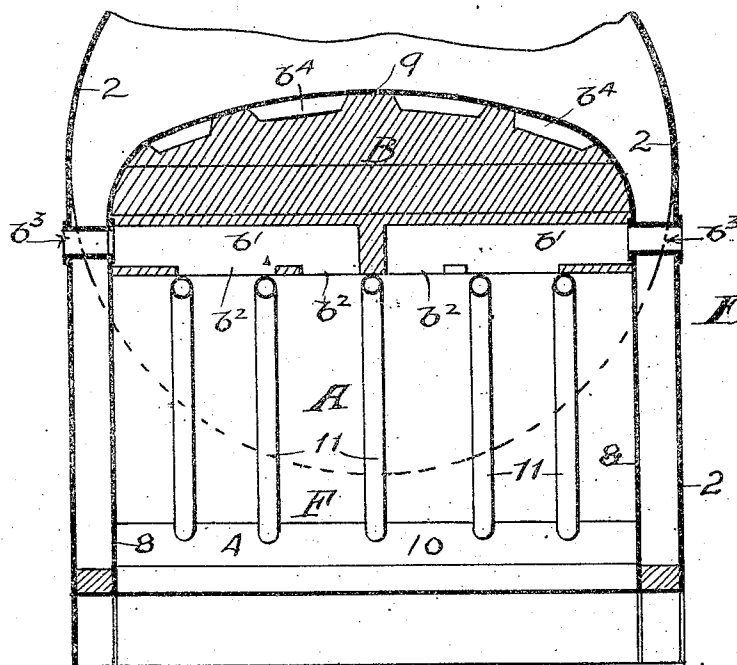


Fig. 5.

Witnesses:
Arthur W. Nelson
M. Simon

Inventor:
JAMES H. GROVE.
By *[Signature]*
HIS ATTORNEY

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.

LOCOMOTIVE-BOILER FURNACE.

1,033,008.

Specification of Letters Patent.

Patented July 16, 1912.

Application filed October 19, 1908. Serial No. 458,526.

To all whom it may concern:

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

My invention relates to locomotive boiler
furnaces and has special reference to im-
provements whereby such furnaces are
adapted to the burning of lignite.

The object of my invention, specifically
considered, is to provide means for baffling
or interrupting the flow of gases from the
grate to the flues and causing the thorough
admixture thereof in the firebox, and fur-
ther, to at the same time, admit hot air and
enforce the admixture thereof with the com-
bustibles in the firebox.

My invention consists generally in a loco-
motive boiler furnace comprising a firebox
having a flue sheet at one end and a fuel
door at the other end, in combination with a
refractory front arch occupying an inclined
position in the front portion of the firebox
between the flue sheet and the grate and a
vertical or crown arch occupying the upper
central portion of the firebox, above and
back of the front arch; said vertical or
crown arch being provided with air pas-
sages and openings for heating, introducing
and projecting air downwardly in the fire-
box adjacent to the rear end of the front
arch.

My invention will be more readily under-
stood by reference to the accompanying
drawings forming a part of this specifica-
tion and in which:

Figure 1 is a vertical section of a locomotive boiler furnace embodying my invention, on the line Y—Y of Fig. 2. Fig. 2 is a plan view thereof, the crown sheet of the firebox being broken away to disclose the arches. Fig. 3 is a vertical section on the line X—X of Fig. 1. Fig. 4 illustrates my invention as applied to fireboxes of the "narrow" type.

As shown in the drawings 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; 10 the grate; and, 11 the arch supporting tubes.

A represents the front arch and B is the vertical or crown arch. Both of these arches are composed of refractory material; in other words, each is made up of a plurality of refractory bricks of suitable form, supported by the arch tubes, 11. The front arch is a so called solid arch, that is, it is made up of imperforate bricks, *a*. It extends from the flue sheet in a rearward and upward direction and terminates substantially at the center of the firebox. The arch, B, may be termed a hollow arch inasmuch as in its lower portion it contains air channels or ducts, *b*¹, and openings, *b*², whereby communication is established between the air passages and the firebox. These openings are arranged on the bottom or lower edge of the arch. The air is supplied to the passages, *b*¹, through tubes or timbles, *b*³, in the sides of the firebox. The upper portion of the crown arch, B, may be formed of solid brick. At the top of the arch I prefer to notch or recess the bricks as shown at *b*⁴ to reduce the area of contact between the arch, B, and the crown sheet of the firebox. The opening, C, between the upper end of the arch, A, and the lower part of the arch, B, is termed the throat of the furnace. The chamber, D, above the arch, A, is called the combustion chamber; the space, F, below the arch, A, and back of the arch, B, is termed the firechamber.

The operation of my invention is as follows: A partial vacuum or draft is produced in the firebox by the action of the blower or exhaust nozzle, not shown, in the "front end" of the boiler. The burning gases therefore tend to flow direct from the bed of fuel on the grate to the flues or smoke outlet, 3. This movement of the gases is, however, interfered with and prevented by the arches A and B. The arch, A, causes the gases from the front end of the firebox to flow rearwardly toward the throat, C, and the arch, B. The arch, B, serves to cut off the direct flow of gases from the rear end of the firebox to the front end thereof and thus the gases from all parts of the fire chamber are caused to come inle beneath the throat, C. The vacuum in the firebox causes air to rush through the passages *b*¹ of the arch, B, and the air being therein heated is

directed downwardly upon the bed of fuel on the grate. The streams of hot air are expanded rapidly and merge with the conflicting streams of gases beneath the throat, C, in effect a substantial barrier of hot air is established beneath the throat between the front arch and the crown arch, and all of the combustibles are forced to pass through this barrier or strata of heated air before entering the throat, C. As a direct consequence of the employment of the arches A and B, together with the admission of hot air at the latter, the firebox gases are not only thoroughly admixed while still within the fire chamber, but are also forcibly admixed and enriched with the heated air therein; as a result substantially perfect combination of combustibles is produced in the fire chamber and substantially perfect combustion is secured in the chamber, B. A further and important effect of the descending streams of hot air at the throat of the furnace is the suppression of burning fuel solids and ashes, caused by the force of the descending air and the sudden lessening of the vacuum in the region of the throat of the furnace, both of which forces tend to deprive the fuel particles of velocity and cause their return to the grate. The very satisfactory performance of the furnace with lignite is gained in this manner.

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

1. 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 a refractory front arch occupying an inclined position back of the flue sheet, and a hollow refractory vertical or crown arch depending from the top of the firebox back of said front arch and adapted to direct streams of hot air downwardly beneath said arches and toward the fire, substantially as described.

2. A locomotive boiler furnace comprising a firebox having a grate and provided with a flue sheet at one end and a fuel door at the other end, in combination with a refractory crown arch depending from the top of the firebox, said crown arch being provided with air passages and having air discharge open-

ings in its lower edge, air passages in the sides of the furnace communicating with the air passages in said arch, thereby forming means whereby air can be discharged into the fire box, and an inclined front arch interposed between said crown arch and the flue sheet, as and for the purpose specified.

3. A locomotive boiler furnace comprising a fire box having a grate and provided with a flue sheet at one end and a fuel door at the other end, in combination with a crown arch depending from the crown sheet of the furnace a little back of the middle part of the fire box, said crown arch having air passages in its lower part, air flues in the sides of the furnace communicating with and adapted to deliver air to the air passages in said arch, said air passages having outlets in the bottom of the arch serving to emit air downward toward the bed of fuel, inclined arch tubes serving to support said crown arch, a solid front arch supported by said arch tubes in an inclined position, the rear end of which is distant from the crown arch forming a throat or passage therebetween, substantially as described.

4. A locomotive boiler fire-box having a grate and provided with a flue sheet at one end and a fuel door at the other end, in combination with an arch composed of refractory brick extending upwardly and rearwardly from the lower part of said flue sheet, a crown arch extending between the sides of the fire-box and downwardly from the top of the firebox, said crown arch being composed of refractory bricks and being positioned back of the upper rear end of the first mentioned arch, air admission tubes in the sides of the fire box adjacent to respective ends of said crown arch, and said crown arch being provided with air passages in its lower portion opening through its lower edge and at opposite ends communicating with said air tubes, as and for the purpose specified.

In testimony whereof, I have hereunto set my hand, this 10th day of October, 1908, in the presence of two subscribing witnesses.

JAMES H. GROVE.

Witnesses:

P. B. MYERS,
S. J. BURGSTROM.