

D. P. BEARD.
STEAM BOILER FURNACE.

No. 179,837.

Patented July 18, 1876.

Fig. 1

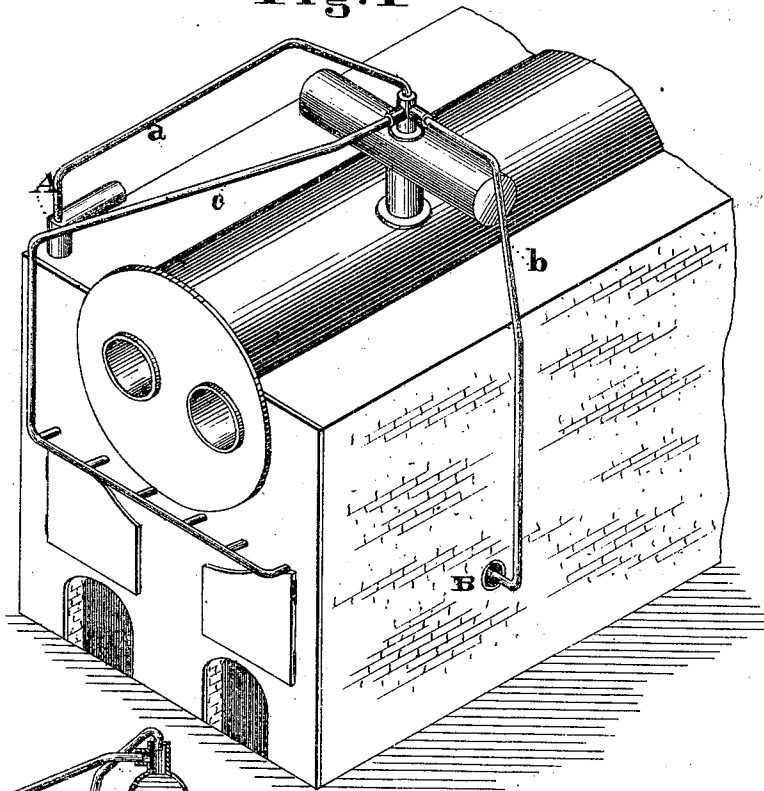


Fig. 2

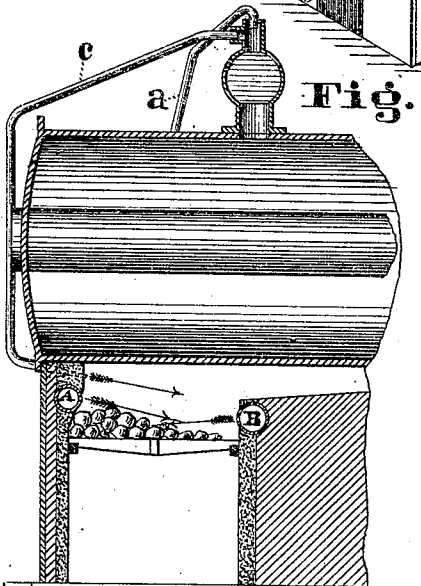
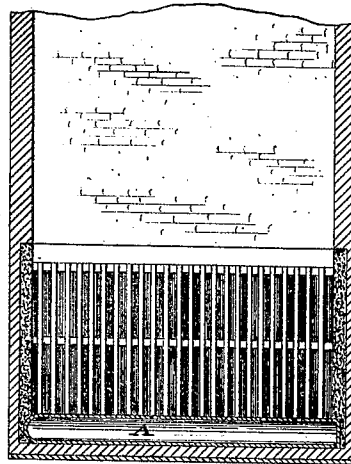


Fig. 3



Attest

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IMPROVEMENT IN STEAM-BOILER FURNACES.

Specification forming part of Letters Patent No. **179,837**, dated July 18, 1876; application filed January 11, 1876.

To all whom it may concern:

Be it known that I, DAVID P. BEARD, of Cincinnati, in the county of Hamilton and State of Ohio, have invented a new and useful Improvement in Steam-Boiler Furnaces, which improvement is fully set forth in the following specification, reference being had to the accompanying drawings.

The object of this invention is to produce a more complete combustion of the fuel in steam-boiler furnaces. This is accomplished by forcing a supply of oxygen from perforated air-chambers in small jets, and in opposite directions into the combustible gases arising from the incandescent fuel by means of steam-siphons, thus producing a violent agitation of the said gases, and causing a thorough mingling and a complete saturation thereof with the oxygen, and also in forcing in the direction of the draft a limited supply of steam through a series of small nipples arranged above a perforated air-chamber, and projecting through the fire-lining over the furnace-doors just below the boiler-plates, for the purpose, not of aiding the combustion, but of distributing the heat generated in the fire-box along the length of the boiler, and thus to prevent the rapid burning out of the boiler-plates directly above the fire-box—a defect that exists in all the so-called smoke-consumers of this character now known.

In the drawings, Figure 1 is a perspective view of the furnace with my improvements attached. Fig. 2 is a central vertical longitudinal section of the same; and Fig. 3 is a horizontal section taken through the front air-chamber, looking down upon the grate-bars.

A is an air-pipe, passing down through the furnace-wall near one of the upper front corners, thence across the front of the furnace above the doors, being embedded in, and protected by, the fire-lining. This pipe is open at its outer end and closed at its opposite extremity. Its side facing the fire-chamber is suitably perforated to allow jets of air to be forced through perforations into the combustible gases arising from the fuel. B is a similar air-pipe entering one of the side walls, and passing across the furnace through the bridge-wall near its top, and being similarly embedded and protected by the fire-lining. Like

pipe A, it is open at its outer end and closed at its inner end, and, like it, has also a series of small perforations on its side facing the fuel. Instead of these pipes A and B, or that portion of them which comes inside the fire-box, corresponding chambers similarly perforated may be constructed in the fire-lining. *a* and *b* are steam-pipes, communicating preferably with the steam-drum on top of the boiler, their opposite ends entering a short distance into the outer ends of the air-pipes A and B. *c* is a steam-pipe, also communicating with the steam-drum. It is carried across the front of the furnace on the outside, and from it branch pipes or nipples extend through the front wall to the inside above the air-chamber A, and just below the boiler, from which nipples small jets of steam are forced between the flame and the boiler. The arrows indicate the directions in which the different jets of air and steam are forced into the fire-box.

When bituminous coal is the fuel, the product of its complete combustion is carbonic acid—the product of its incomplete combustion, carbonic oxide and carbureted hydrogen; and in furnaces in which such fuel is used, the quantity of heat generated is dependent on the relative weight of hydrogen first, and carbon afterward, chemically combined with their equivalent weight of atmospheric oxygen, and it is the failure to supply the carbonaceous gases with their equivalent of oxygen before they are cooled below the temperature of ignition that causes waste and smoke. The gaseous fuels, being lighter than atmospheric air, and expanding by their heat, exert an upward and outward pressure. This pressure must be overcome and the volume of the gases broken before the chemical union between all their parts and the air can be complete. This invention insures their chemical combination by breaking the volume of the gases, and thoroughly mingling with them their equivalent of oxygen while the said gases are at or above the temperature of ignition, which is always the case when the fuel is passing from the solid to the gaseous state, or at the instant the gases are leaving the incandescent coals.

The purpose of the lining of steam forced through the nipples above the air-chamber A

in front of the furnace is to resist the tendency of the gases to rise, and to protect that part of the boiler immediately over the fire-box by distributing the heat generated in the fire-box along the entire length of the boiler, and thus prevent the injurious effects liable to arise from an unequal heating of the boiler-plates.

It is evident that either of the perforated air-pipes A or B, with its steam-pipe *a* or *b*, in combination with the steam-nipples, will produce a good result; but in large furnaces it is better to use the devices as shown in the annexed drawings. The arrangement of the steam-pipes *a* and *b* with their discharge-ori-fices a short distance within the outer ends of pipes A and B makes effective siphons; but should more force in the blast be required any of the well-known steam siphons may be applied to the outer ends of the air-pipes A and B, or either of them.

I claim—

1. The air-pipe A, open at the outer and closed at the inner end, passing across the front of the furnace above the doors, and per-

forated on its side facing the fire, through which perforations air is forced by steam from the boiler passing through pipe *a*, in combination with a series of steam-nipples arranged above perforated part of said pipe A, and just below the boiler-plates, as and for the purpose substantially as set forth.

2. The air-pipe B, located in the upper part of the bridge-wall and steam-pipe *b*, for forcing air through perforations in the fire side of said pipe B, in combination with a series of steam-nipples arranged in the fire-lining across the front of the furnace, and just below the boiler-plates, substantially as described.

3. The combination, substantially as herein described, of air-pipes A and B, steam-pipes *a* and *b*, and steam-pipe *c*, having branch pipes or nipples passing through the front of the furnace just below the boiler-plates, the whole being arranged to operate in the manner described.

D. P. BEARD.

Witnesses:

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