Feb. 12, 1929. 1,701,836

H. B. CANNON ET AL

FURNACE

Filed Feb. 28, 1921

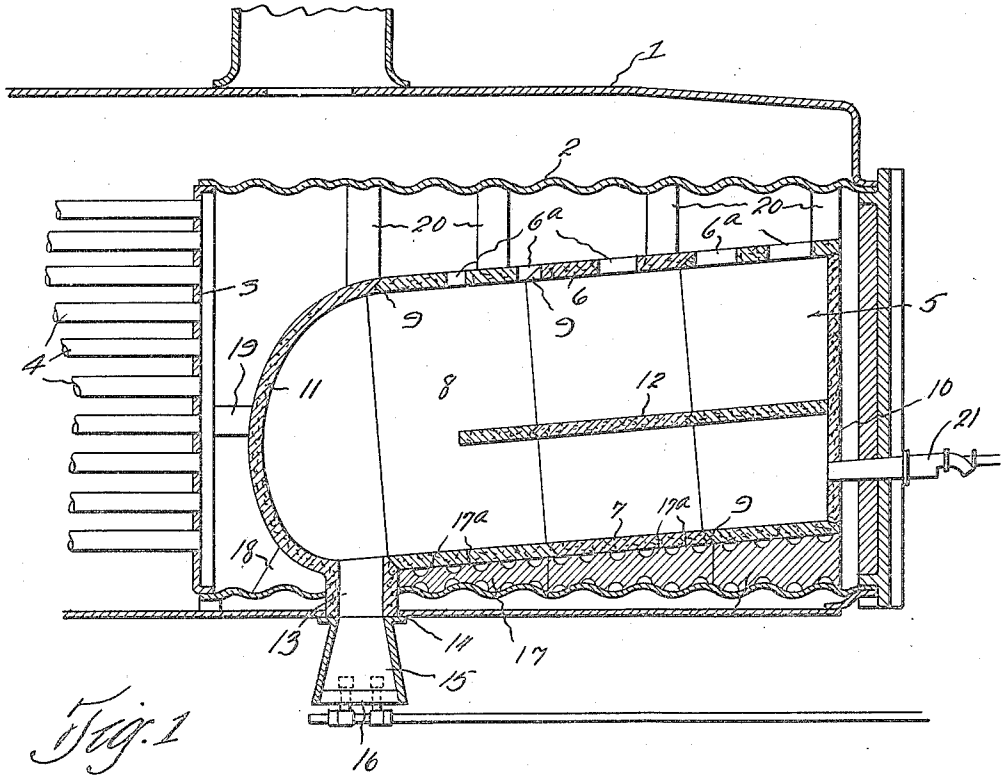

Fig. 1

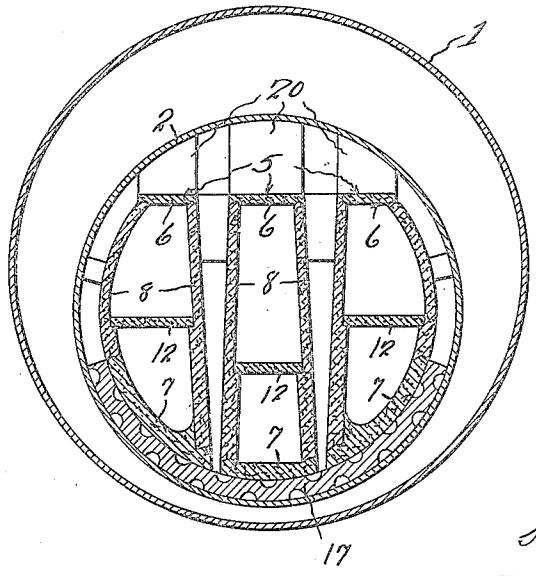

Fig. 2

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Patented Feb. 12, 1929. 1,701,836

UNITED STATES PATENT OFFICE.

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FURNACE.

Application filed February 28, 1921. Serial No. 448,339.

This invention relates to steam-boiler furnaces, and more particularly to furnaces of the locomotive type, and has for its general object to effect the efficient and economical heating of the boilers for such furnaces; also to enable such heating to be accomplished in and through the use of pulverized fuel.

In the drawings forming a part hereof Fig. 1 represents the central longitudinal sectional elevation of the rear end of a locomotive boiler, showing our invention applied thereto; Fig. 2 a sectional elevation of the rear of such boiler, the said section being taken between the slabs 10 and the front ends of the partitions 12.

Describing the parts by reference characters, 1 denotes the outer shell and 2 the cylindric inner or fire box shell of a locomotive, the fire box shell projecting into the main body of the boiler from the rear or firing end thereof, as is customary with locomotive boiler construction. At the front of the fire box is a tube sheet 3 from which the fire tubes 4 extend forwardly, as is the usual practice.

Mounted in the fire box and extending forward from the rear thereof are a plurality of combustion chambers, each indicated generally at 5. Three such combustion chambers are shown, although the number may be varied as desired. Each chamber is composed of a plurality of sections each made up of a top slab 6, a bottom slab 7 and side slabs 8, the sections being united by joints 9, to which, if desired, a refractory cement is applied, preferably of the same material as that employed for the slabs,—carborundum. The rear section of each chamber is provided with a closure slab 10 and the front section is formed from a curved slab 11 having concave face presented inwardly.

Between the top and the bottom of each combustion chamber there is a partition 12 which projects forward from the slab 10 toward the front wall 11 of said chamber, being spaced at its front end from such wall. The front section of each chamber is provided with an outlet pipe 13, preferably of the same material as the said section, which outlet pipe projects through an aperture 14 in the bottom of the boiler and is adapted to discharge into an ash pit 15 having doors 16 by which it and the combustion chamber are sealed against the admission of air.

Each combustion chamber is so mounted as to slope downwardly from the rear to the front thereof, whereby the bottom wall will have an inclination of about 15° to the horizontal. The slabs and the partition of which each cumbustion chamber are composed consist of carborundum, preferably mixed with a small portion of binding or bonding material (such as fire clay) and molded to shape. A combustion chamber made of this material is practically indestructible by high temperatures, has a low coefficient of expansion, whereby it will not crack on rapidly heating and cooling, is extremely permeable to heat, and possesses great heat radiating capacity.

Each of the combustion chambers is supported on the inner bottom sheet of the fire box, preferably by means of a slab of carborundum indicated at 17 and generally made up of a number of sections, the said slab having projections 17ª at its upper surface adapted to engage the bottom walls of the combustion chambers and providing, between such projections, spaces for the circulation of air. The front end of each combustion chamber is supported against the action of gravity by means of suitably shaped blocks 18 and 19, preferably of carborundum, interposed between such end and the bottom sheet of the fire box and between such end and the tube sheet 3. Between the top of each combustion chamber and the top of the fire box are blocks 20. Extending through the plate or slab 10 and below the partition 12 is a burner 21 through which a mixture of pulverized fuel (such as coal) and air is injected. This mixture, being ignited, traverses the combustion spaces formed beneath and above the partition, the products escaping through the slots 6ª provided between the slabs 6. These slots are arranged so as to provide outlet ports which progressively increase in area from the front toward the rear of the combustion chamber for the purpose of equalizing the delivery of the products of combustion through the said openings or slots.

As is well known, in the combustion of finely divided fuel, such as coal, a certain proportion of slag or clinker is produced. This material tends to accumulate upon the relatively cold surfaces of boilers, constituting a serious detriment to the efficient heating of the latter and making it necessary to shut down such boilers repeatedly for the purpose of removing this material. Because

of the temperature to which the combustion chambers are heated by the fuel, the clinker or slag is maintained in a molten condition, and the inclination of the partition and the bottom of each chamber causes the slag or clinker to be discharged by gravity thru the outlet 13. Furthermore, the shape of the front wall of each combustion chamber, in cooperation with the adjacent end of the partition, tends to throw outwardly and against such wall any ash that may be in the burning mixture, which ash will also be d... from the outlet 13.

By locating the openings or slots 6ª as shown, the products of combustion are directed against the upper or crown sheet of the fire box and thence pass forwardly through the fire tubes 4.

In operation, each of the combustion chambers shortly becomes heated to a temperature at which its exterior assumes a yellowish white color, resulting, not only in the most efficient combustion of the fuel, but in the very effective heating by radiation and convection of the surrounding wall of the fire box. By the time the products shall have reached the openings 6ª, all of the solid carbon will have been consumed, with the result that there will be no deposition of carbon upon the wall of the fire box or within the tubes.

The two side combustion chambers of the combustion-chamber assembly are provided with curved lateral walls which are substantially concentric with the wall 2 of the fire box and are in close proximity to such wall. This arrangement, together with the arrangement of the tops 5 and the openings therein, results in an extremely efficient heating by radiation and convection of the fire box wall as well as providing for additional heating through the products of combustion which escape through the openings in the tops or covers 5.

By the use of our combustion chambers, it is possible to bring the furnace up to its maximum capacity in a comparatively short time and without danger to the boiler.

Having thus described our invention, what we claim is:

1. A locomotive boiler having a fire box, a combustion chamber mounted in said fire box and having a bottom wall sloping downwardly toward the front of said fire box, such bottom wall, having near the front end of the chamber a delivery connection, means for sealing said connection against the admission of air, the said chamber having a partition between the top and the bottom thereof and extending forwardly from the rear toward and spaced from the front wall, and being provided with a plurality of outlet openings in the top thereof, the cross sectional area of such openings varying progressively from the front toward the rear of such top, and means for supplying a mixture of air and fuel to the rear of such chamber and beneath the said partition.

2. The combination, with a locomotive boiler and a substantially cylindric fire box, of a central combustion chamber and lateral combustion chambers spaced from the central combustion chamber, each of the lateral combustion chambers having a curved lateral wall spaced a short distance from the adjacent curved wall of the fire box and each combustion chamber having an upper wall adjacent to the wall of the fire box thereabove and each chamber being closed at the front thereof, each combustion chamber having an outlet near the rear thereof, and means for supplying a mixture of air and fuel to the rear of each combustion chamber, each combustion chamber being composed of refractory material of high heat permeability.

3. The combination, with a locomotive boiler and a substantially cylindric fire box, of a central combustion chamber and lateral combustion chambers spaced from the central combustion chamber, each of the lateral combustion chambers having a curved lateral wall spaced a short distance from the curved wall of the fire box and each combustion chamber being closed at its front end and having an upper wall adjacent to the wall of the fire box thereabove, each combustion chamber being provided with a partition intermediate the top and bottom thereof and extending from the rear toward and spaced from the front thereof, each combustion chamber having an outlet near the rear thereof, and means for supplying a mixture of air and fuel to the rear of each combustion chamber below the partition therein, each combustion chamber being composed of refractory material of high heat permeability.

4. The combination, with a locomotive boiler and fire box, of one or more combustion chambers mounted in said fire box and extending forward from the rear thereof, each such combustion chamber being closed at its front end and having a partition intermediate the top and bottom thereof and projecting forwardly from the rear toward and spaced from the front of such chamber, the upper wall of each combustion chamber being contiguous to but spaced from the fire-box wall thereabove and provided with a plurality of outlet openings varying progressively in cross sectional area from the front toward the rear of such top, and means for supplying a mixture of air and fuel to the rear of such chamber beneath the said partition, the said chamber being composed of refractory material of high heat permeability.

5. The combination, with a locomotive boiler having a fire box, of a plurality of combustion chambers mounted in said fire box and extending forwardly from the rear

end thereof, each such combustion chamber having its top contiguous to but spaced from the wall of the fire box thereabove and provided with an outlet near the rear thereof, and braces interposed between the top and the front of each combustion chamber and the corresponding parts of the fire box, the said combustion chambers and braces being composed of refractory material of high heat permeability.

6. The combination, with a locomotive boiler having a fire box, of a plurality of spaced combustion chambers mounted in said fire box, the said combustion chambers having walls in proximity and conforming in contour to the corresponding portions of the fire box, each combustion chamber having an outlet near the rear thereof, means for supplying a mixture of air and fuel to each of said combustion chambers, the products of combustion being delivered through the outlets thereof in operative relation to the wall of the fire box thereabove, and braces interposed between the said combustion chambers and the fire box, said combustion chambers and braces being composed of refractory material of high heat permeability.

7. The combination, with a locomotive boiler having a fire box, of a combustion chamber mounted in said fire box and extending forward from the rear thereof, said combustion chamber being inclined downwardly from the rear toward the front thereof, said chamber being closed at its front end and having a partition extending from the rear toward but spaced from such front end, the said partition being arranged intermediate the top and bottom of said chamber, the said chamber having an outlet opening near the rear thereof, means for supplying a combustible mixture to the said chamber on the opposite side of the said partition from the said opening, a support for the bottom of said combustion chamber extending forwardly from the rear of said fire box, the chamber-engaging surface of said support being inclined downwardly from rear to front thereof, and means interposed between the combustion chamber and the fire box for bracing the said chamber, the said combustion chamber, partition, support and bracing means being composed principally of carborundum.

8. The combination, with a locomotive boiler having a fire box, of a plurality of laterally spaced combustion chambers mounted in said fire box and extending forwardly from the rear end thereof, each combustion chamber having a top, bottom and front wall of refractory material of high heat permeability, the said top, bottom and front walls being arranged adjacent to the top, bottom and front of the fire box, respectively, whereby each combustion chamber is adapted to heat such top, bottom and front of said fire box by radiation, and means for circulating and burning a combustible mixture within each such combustion chamber.

9. The combination, with a locomotive boiler having a fire box, of a plurality of laterally spaced combustion chambers mounted in said fire box and extending forwardly from the rear end thereof, each combustion chamber having a top, bottom and front wall in proximity to the top, bottom and front of the fire box, respectively, and the combustion chambers at each end of such lateral series of chambers having each a side wall in proximity to the corresponding side portion of the said fire box, one wall of each of the combustion chambers being provided with one or more outlets for products of combustion, and means for supplying a combustible mixture to each of said combustion chambers.

10. The combination, with a locomotive boiler having a fire box, of a combustion chamber mounted in said fire box and extending forwardly from the rear end thereof, the said combustion chamber having a top, bottom and front wall of refractory material having high heat permeability, the said top, bottom and front walls being in proximity to the top, bottom and front of the fire box, respectively, whereby the said combustion chamber is adapted to heat the top, bottom and front of the fire box by radiation, one of the walls of the combustion chamber being provided with one or more openings for the discharge of products of combustion, and means for supplying combustible mixture to the said combustion chamber.

In testimony whereof, we hereunto affix our signatures.

JOHN W. CANNON.
HIRAM B. CANNON.