J. M. W. KITCHEN.

HEATING APPARATUS.

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993,690. Patented May 30, 1911.

Fig. 1.

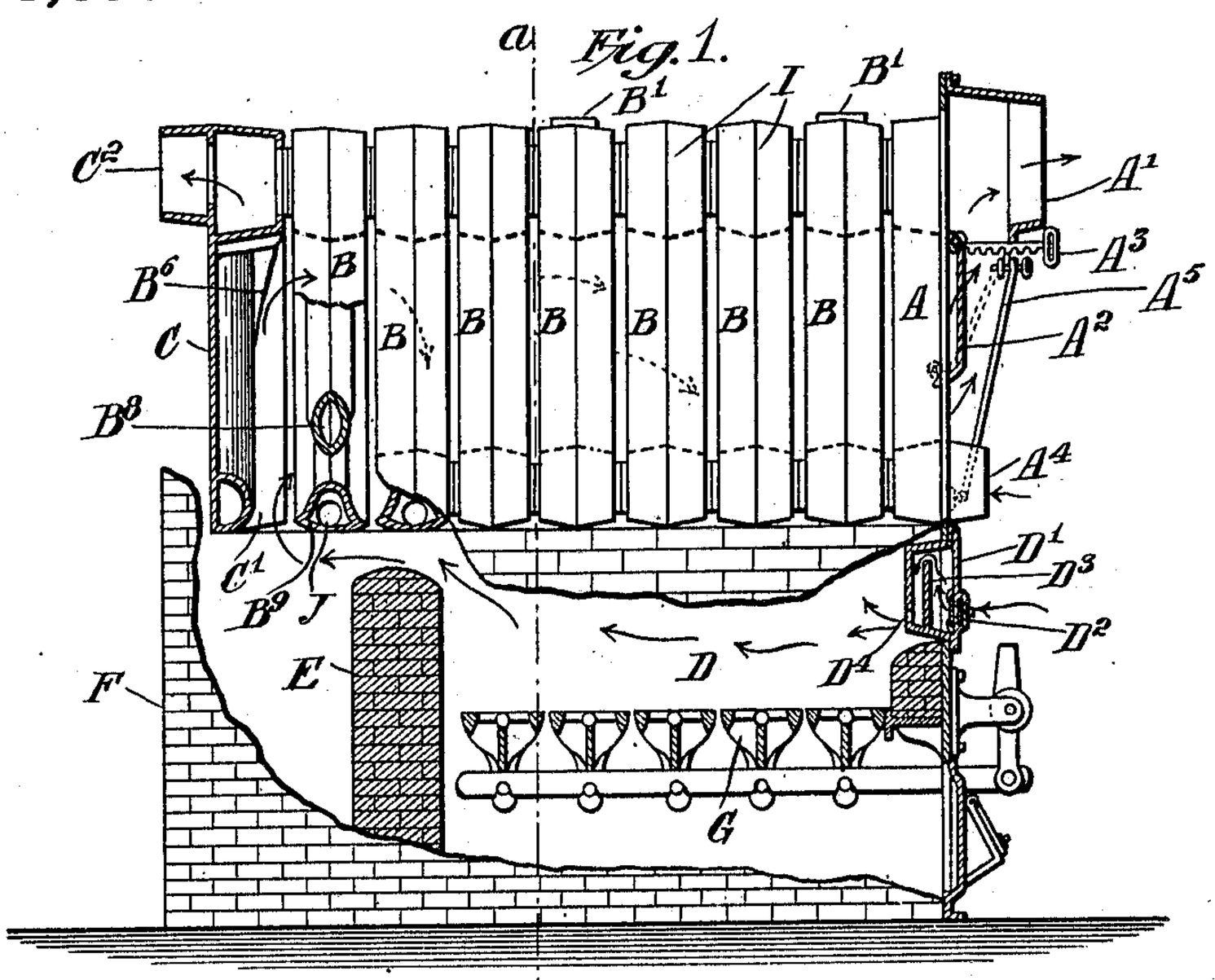

Fig. 3.

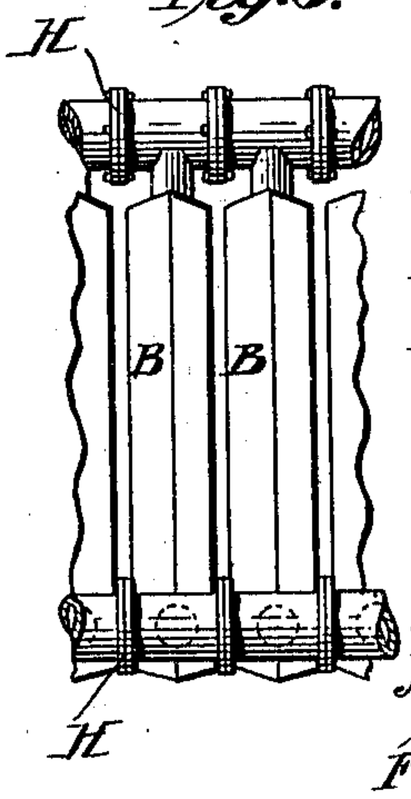

Fig. 2.

Fig. 4.

Attest:

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HEATING APPARATUS.

993,690. Specification of Letters Patent. Patented May 30, 1911.

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To all whom it may concern:

Be it known that I, JOSEPH MOSES WARD KITCHEN, a citizen of the United States, residing in the city of East Orange, county of Essex, State of New Jersey, have made new and useful Improvements in Heating Apparatus, of which the following is a specification.

The invention relates to a special type of boiler which is designed to meet the need of certain installations, as for example where there is little available head room, such as under the side walks, where the smoke outlet must be at the front of the boiler, where soft bituminous coal is used, and where frequent stoking attention can be given to the apparatus.

The following principles are specially applied in this invention. 1. Securing a long horizontal run for the burning gases before much heat is lost from the gases, with provision for securing an adequate mixture of air with the gases volatilized from the fuel. 2. Securing an unusually thorough transmission of the heat to water through a vertical and horizontal counter-current travel of the heating gases and the feed water supplied to the boiler. In several patents granted to me and in co-pending applications I have claimed the application of the counter current principle in heating devices, but in the present invention I claim the application of this principle in connection with peculiar forms of boiler sections.

In the drawings: Figure 1 represents a vertical elevational view of one side of a boiler comprising my invention, parts being in section. Fig. 2 represents a cross horizontal section of the boiler taken on the line *a*—*a*, Fig. 1. Fig. 3 represents a part of a modification of the boiler specially intended for high pressure heating in which flange unions between the sections are substituted for the push nipple unions shown in Fig. 1. Fig. 4 represents a part of one of the sections of the boiler shown in Fig. 3.

The reference characters in part indicate as follows:

A is the front section of the boiler.
B are intermediate sections of the boiler.
C is the back section of the boiler.
D is the furnace of the boiler.
E is a bridge wall.
F is sustaining brick work or base.
G is a grate bar.
H is a flange union.
H^1 is a slit in the fin.
I is a push nipple hub.
J is a contracted water passage.

The boiler here described is particularly intended to burn bituminous coal without smoke, securing a practically perfect combustion. The fuel is fed frequently over the front part of the grate surface, and after being coked is pushed backward and distributed over the grate bars. A sufficient supply of air is introduced from the front of the boiler over the fire through the slide D^2 of the door D^1. The air passes up over the partition D^3, and downward and out through the apertures D^4, which are distributed horizontally in a line across the lower level of the inner face of the door D^1. The gas travel in the combustion chamber D is from the front to the extreme rear of the boiler. No openings are provided in the bottom of the sections B for the gases to rise between the sections except at the extreme rear of the boiler. There is a gas passing opening C^1 provided at the bottom of the rear section C. The inter-spaces between the bottom of the sections are closed with asbestos cement, except at the rear. Hence, the gases partially cooled by the air for combustion supplied through the door D^1, rising up against the bottoms of the front sections B of the boiler do not lose much heat to the water in those sections. This is specially intended so that the water in the front section shall be cooler than the water in the rear sections, and the cooler water is thus able to pick up low degrees of heat that are usually lost, in the forward counter-current travel of the gases and the water. The arrows indicate the travel of the gases. By the time the admixed combustible gases and air have reached the bridge wall they have become heated to a point above the ignition temperature and a substantially perfect combustion is effected. The gases are allowed to rise through the opening C^1 to the crown sheet of the boiler, and travel forward and downward and out through the smoke exit A^1 at the front of the boiler, passing underneath the baffle A^2, which is hinged to open at the top to allow of a more direct updraft if necessary.

A^3 is the baffle operating handle.

In this boiler is applied both the horizontal counter-current and the vertical counter-current travel of gases and water in the sections. Cool feed water enters at the bottom

of the sections from the front A^4, and the heated water emerges at the top level of the boiler at the rear through the exit C^2, the water being progressively heated in the counter-current travel of the water and the gases. In case the boiler is used for steaming, steam outlets B^1 would be provided from the tops of several of the intermediate sections B.

Provision is made for cleaning the sections of the apparatus through the drop door A^5.

The boiler has a brick setting F, and a considerable lateral part of the sections rest on this brick setting, and this prevents much heat from being absorbed into the bottoms of the sections, and does much to maintain a high heat in the gases until combustion has been effected.

In Fig. 2, B^2 represents the water level. B^3 represents strengthening ridges cast inside the section. B^4 represents gas passages between the vertical tubes B^5. B^6 represents triangular vertical ridges or fins cast on the exterior of the vertical water tubes B^5. B^7 represents ridges or fins cast on the inside of the crown plate of the boiler. B^8 represents a horizontal water tube. B^9 represents the bottom transverse water tube of the section B. B^{10} is a tube connecting B^8 and B^9. H^1 represents slits in the transverse fins H^2, which fins are cast integral with the sides of the tubes B^5, the horizontal tubes B^8 and the crown sheet H^3. These fins or ridges contract the size of the gas passages B^4, increase the heat transmission and act to secure a self cleansing of the heating surfaces from soot and ash dust that would otherwise cling to the exterior of the water tubes of the sections.

What I claim as new is:

1. In a heating apparatus, the combination of (1) connected vertical chambered sections, (2) a base for said sections, said base comprising non-conducting side walls preventing lateral transmission of heat from the fire mass in said apparatus, a shaking grate, provision for under grate and over fire mass air introduction, a non-conducting bridge wall and a cavity back of said bridge wall, said cavity containing a gas outlet at a high level, said ash pit and said cavity being divided from each other at a low level, (3) a combustion chamber in said apparatus having means for the elongated horizontal travel of the gases evolved from the fuel in said apparatus, (4) means for a controlled equably diffused introduction of air for combustion above the fire mass of said apparatus, (5) a part of said apparatus separate from and divided from said combustion chamber by chambered strata of water and heat non-conducting means except as for a transversely extended horizontally disposed exit for heating gases at a high level at the rear of said combustion chamber through which exit passes gases from said combustion chamber to said part, said part comprising means for the counter-current travel of the heating gases and the water to be heated passing through said part, said part comprising chambered sections, said water passing through the chambered sections from a low level of said part to a high level and from one end of said part to the other end in counter-current with the travel of said gases with a final exit of the gases from the heating surfaces of said sections at or near a point where cool feed water enters said apparatus, and (6) an outlet for water or steam at a high level of said sections.

2. The combination of a base comprising a fire box and a horizontally elongated combustion chamber, a plurality of connected chambered vertical boiler sections, said sections comprising a front section, said front section having attached thereto a feed water inlet at the bottom of the section, cross horizontal and perpendicular water containing tubes, a controllable baffle for diverting the heating gases downwardly from a high level to a low level of the front section, a hinged door for securing access to and for cleaning said sections and for diverting upwardly by said baffle, and a high level exit for the gases from the front of said front section at a high level thereof, the travel of the gases through said combination being from front to rear through said combustion chamber and from rear to front through said sections and out through said high level exit.

3. In a heating apparatus, the combination with a base containing a furnace, a horizontally elongated combustion chamber, and a plurality of connected chambered vertical boiler sections, of a back section, said back section comprising a plane rear face, an interior corrugated face forming with said plane face vertical water tubes, a horizontal low level water tube connecting said vertical tubes, a water header and steam dome connected with the top of said vertical tubes, an outlet from said header for the exit of steam or water, an inlet for water, said section comprising connections with said connected sections for the inlet for water, a transversely arranged opening at the bottom of said section for the passage of heating gases from said combustion chamber upwardly over said water tubes and to the crown sheet of the assembled sections of said apparatus.

4. In a heating apparatus, the combination with a masonry base containing a grate, fire box and elongated combustion chamber, a front section and a back section, of an intermediate section, said intermediate section being connected with the other sections by a water conveying channel at a high level of and intermediate between the sides of said

sections and by low level water channels on both sides of said section, a water conduit connecting the two low level water channels, said water conduit forming the roof of said combustion chamber, said water conduit when united and assembled with similar sections securing a closure of the space between the sections in the roof of the combustion chamber and preventing the immediate rising of gases from the fire mass of said apparatus up into the heating gas traversing passages of said apparatus, and a gas traversing aperture at the rear of said apparatus for the passing of gases from the combustion chamber into the gas traversing passages of said sections.

5. In a heating apparatus, the combination with a base comprising a combustion chamber and a plurality of connected vertical chambered sections resting transversely on said base, of a section, said section comprising low level push nipple connections and a high level push nipple connection, a horizontal conduit connecting and at the lowest level of the push nipple openings, another horizontal conduit communicating with vertical side and intermediate water tubes comprised in said section, an intermediate vertical water tube connection between the two horizontal conduits, an inclined roofing to the lower horizontal conduit for facilitating the conveyance of steam bubbles from said lower horizontal conduit to and up through the intermediate connecting tube and thence to the top of the section, a water header and steam space for the section, a water or steam outlet from said header, transversely arranged fins projecting from the water tubes, triangular fins projecting from the water tubes, the wider part of the triangular fins being at the crown sheet of the section, and strengthening ridges between the faces of said header for strengthening the header against internal steam pressure.

6. In a heating apparatus, the combination of a plurality of connected vertical chambered water sections comprising a front and a rear section, said sections having water conveying connections at the lower level of the sections on both sides of the sections and water or steam connections at a high level of said sections, and one or more outlets for water or steam at a high level of the sections, a feed water inlet in the front section at a low level of said front section, the parts connecting said sections comprising T flange unions bolted together through the flanges, said sections being constructed and arranged to receive heating gases between the sections at or near the rear section and for the passage of the gases to a high level of the sections and for the exit of the gases at the front of the front section.

7. In a heating apparatus, the combination with a plurality of connected vertical chambered transversely disposed sections assembled and joined and resting upon a base comprising a furnace and a horizontally elongated combustion chamber, of means for introducing air for combustion over the fuel mass of said apparatus, said air being introduced horizontally at a level not much above the upper level of said fuel mass, said air being conveyed upwardly to near the chambered section at the front of said chambered sections, said air being then conducted downwardly and discharged in a horizontally projected series of air currents or films of air at or near the top of the fuel mass, a bridge wall at the rear of the fuel mass, provision in said sections for preventing the gases from said fuel mass rising directly between said sections, means between the last and next to last of the sections at the rear of the apparatus for allowing the gas to rise between said sections, means in said sections for securing a forward and a downward flow of gases over each section and a counter-current upward flow of feed water through each section and for an exit of the gases from the front section of said apparatus at a low level of said front section, and a feed water inlet at a low level of said front section.

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Witnesses:
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GEO. L. WHEELOCK.