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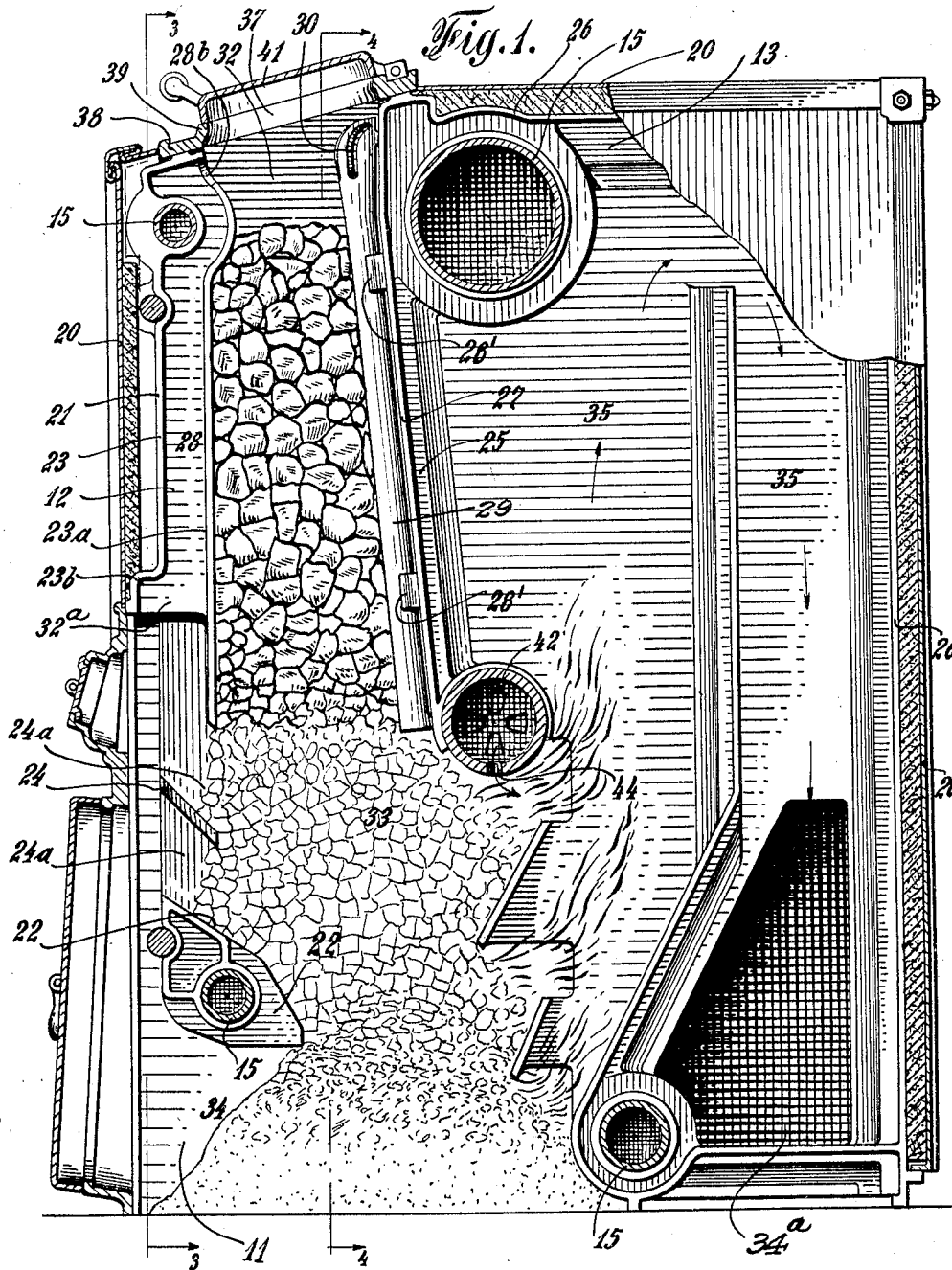
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BOILER

Filed Dec. 31, 1920

5 Sheets-Sheet 1



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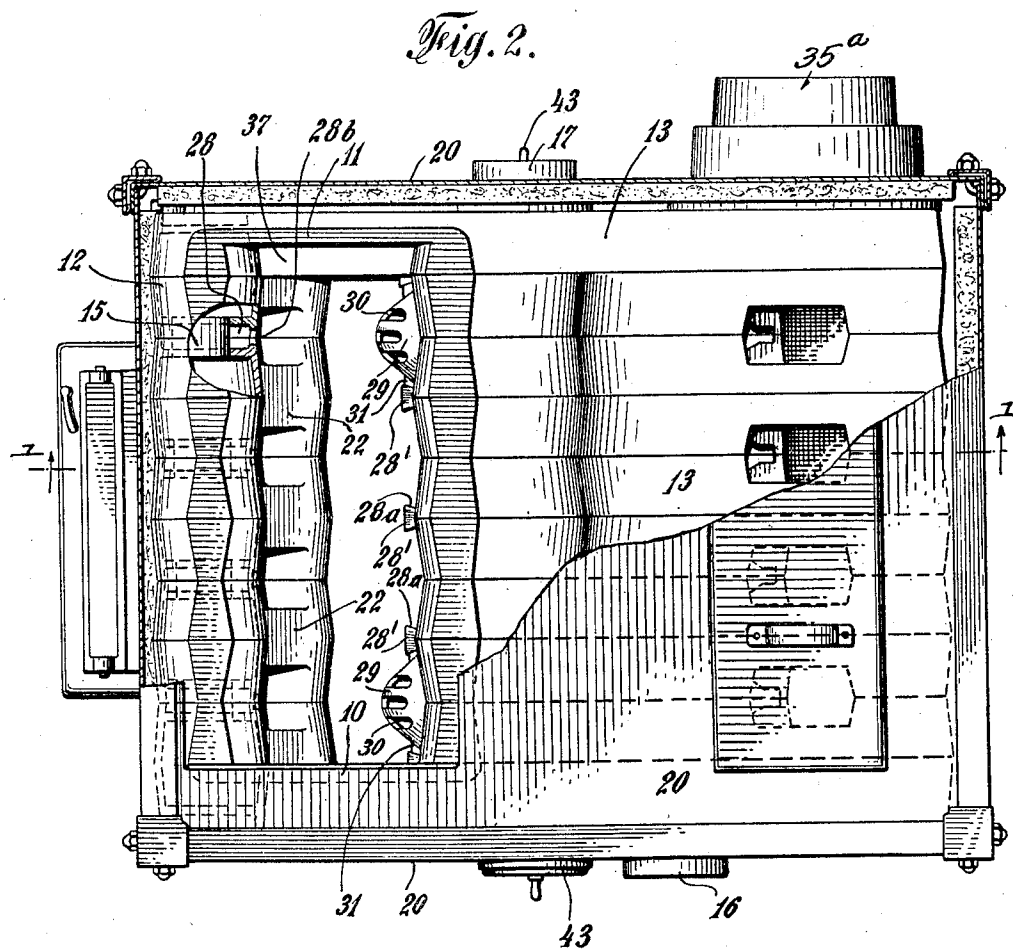
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BOILER

Filed Dec. 31, 1920

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1,501,847

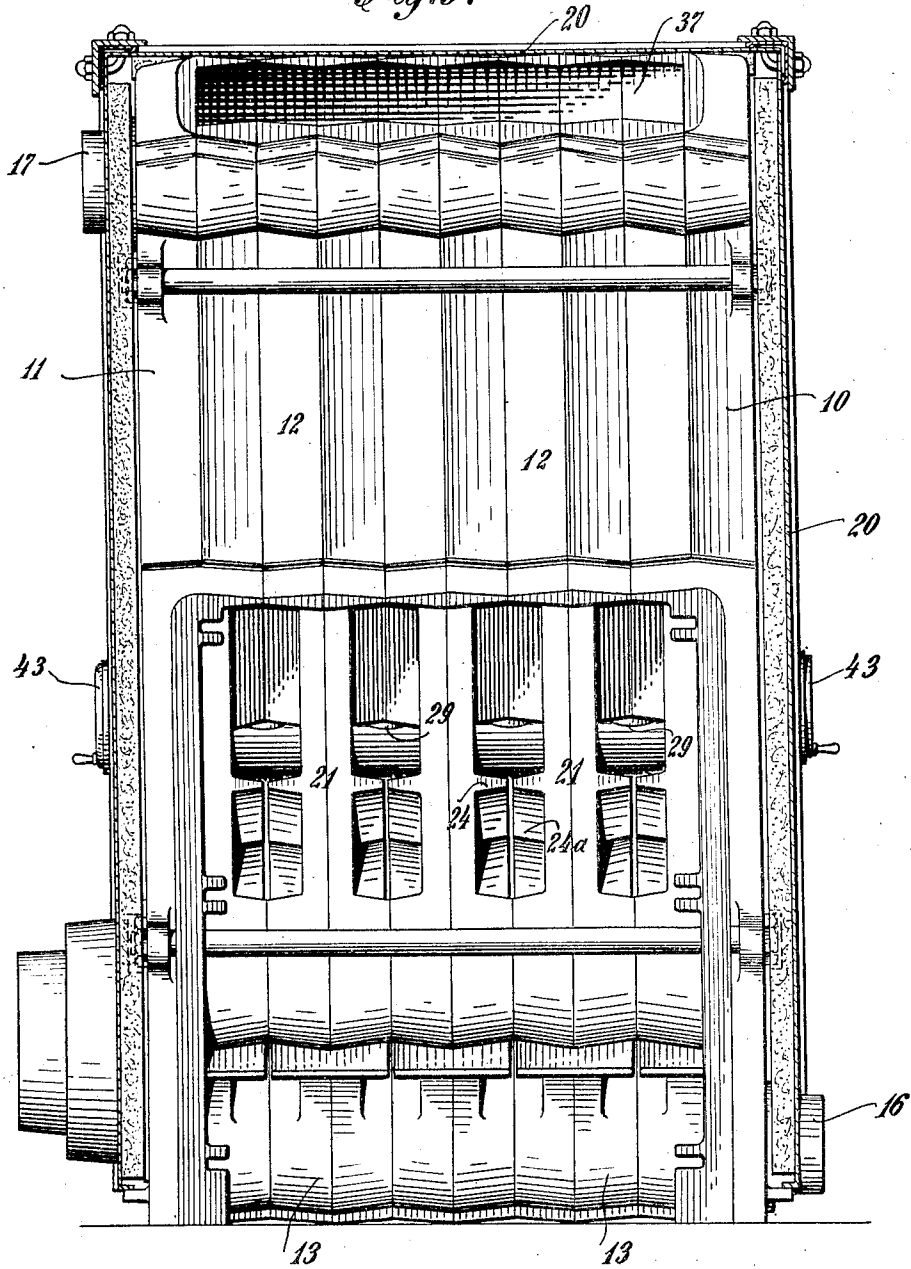
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Filed Dec. 31, 1920

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Fig. 3.



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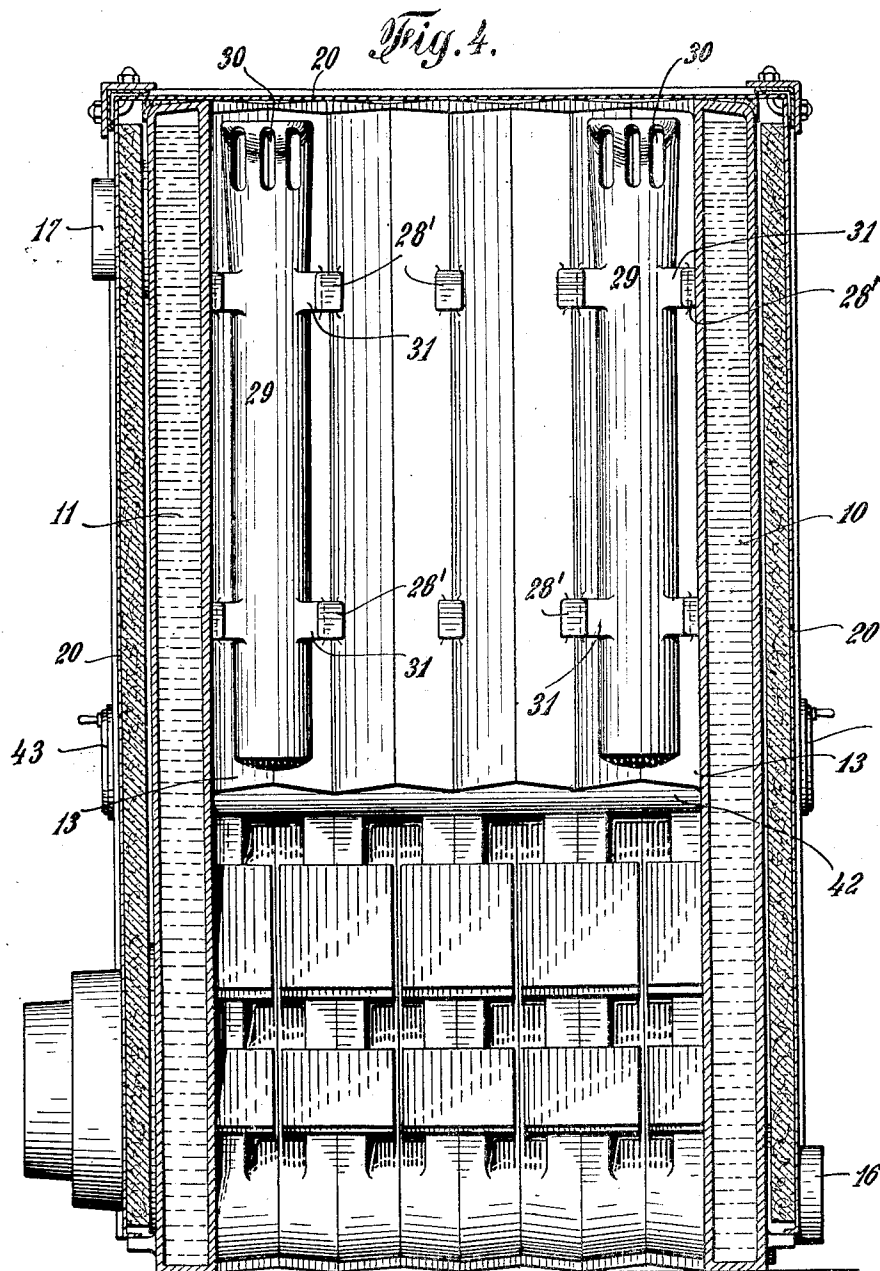
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Filed Dec. 31, 1920

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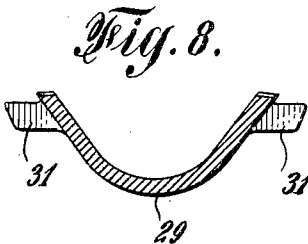
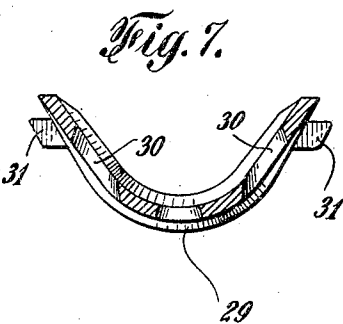
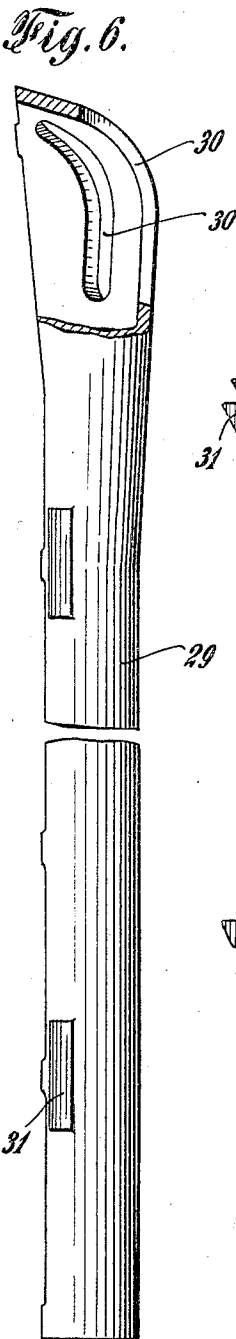
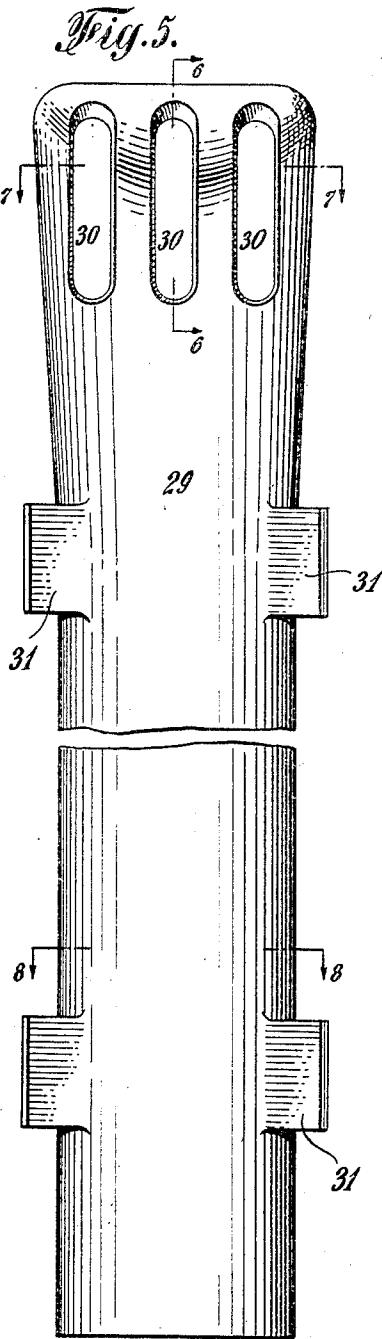
1,501,847

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BOILER

Filed Dec. 31, 1920

5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE.

FRANK B. HOWELL, OF BUFFALO, NEW YORK, ASSIGNOR TO AMERICAN RADIATOR COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF NEW JERSEY.

BOILER.

Application filed December 31, 1920. Serial No. 434,261.

To all whom it may concern:

Be it known that I, FRANK B. HOWELL, a citizen of the United States, residing at Buffalo, Erie County, in the State of New York, have invented certain new and useful Improvements in Boilers, of which the following is a full, clear, and exact specification.

My invention relates to improvements in boilers, more particularly to boilers used in connection with heating systems, and the same has for its object to provide a boiler with means for continuously supplying the proper volume of air to the combustion chamber of the boiler during the operation thereof.

Further, said invention has for its object to provide a boiler having a fuel receptacle in which the undue distillation of the fuel within the receptacle will be prevented.

Further, said invention has for its object to provide a boiler having a fuel receptacle with an auxiliary air supply so arranged as to prevent the heat of the flue gases from being transmitted to the fuel in the receptacle.

Further, said invention has for its object to provide a boiler in which the undue distillates, either separately or mingled with air, caused or produced in the fuel receptacle, will be drawn off from the top of said fuel receptacle and carried down into the combustion chamber and there mixed with the products of combustion and consumed therewith.

Further, said invention has for its object to provide a boiler with means whereby the same may be quickly and effectively converted so as to burn either hard coal or soft coal, as may be desired.

Further, said invention has for its object to provide a boiler having one or more flues or heat-receiving or heat-conducting portions, which are separated from the fuel receptacle by air cells or members extending substantially the entire height of the fuel receptacle, and which serve also to conduct the auxiliary air to the combustion chamber.

Further, said invention has for its object to provide a boiler having a fuel receptacle in which conduits for an auxiliary air supply are positioned between the fuel receptacle and the flue or flues.

Other objects will in part be obvious, and in part be pointed out hereinafter.

To the attainment of the aforesaid objects and ends, my invention consists in the novel details of construction, and in the combination, connection, and arrangement of parts hereinafter more fully described and then pointed out in the claims.

In the accompanying drawings, one illustrative embodiment of the invention is shown, and for purposes of illustration, the invention is herein shown in connection with a boiler of the sectional type.

In said drawings—

Fig. 1 is a sectional view taken on the line 1—1 of Fig. 2, showing one form of boiler constructed according to, and embodying my said invention;

Fig. 2 is a top view, partly broken away, and in section;

Fig. 3 is a front elevation, partly broken away;

Fig. 4 is a detail section taken on the line 4—4 of Fig. 1, looking in the direction of the arrow.

Fig. 5 is an enlarged detail face view showing a removable flue member;

Fig. 6 is a side elevation thereof; and

Figs. 7 and 8 are transverse sectional views taken on the lines 7—7 and 8—8, respectively, of Fig. 5.

Referring to the drawings, the boiler comprises hollow end sections 10 and 11, and a plurality of hollow intermediate sections, each of which is composed of a front member 12 and a co-operating rear member 13. Adjacent their upper and lower portions said sections are provided with registering openings within which are secured nipples 15 in order to permit of the circulation of fluid throughout the boiler, which is provided with a water inlet or return 16, and a fluid outlet 17. The assembled sections of the boiler are preferably enclosed by a casing or jacket 20.

Each of the front members 12 comprises a vertical or upper portion 21 and a downwardly and inwardly inclined lower portion 22 which serves as a partial support for the fuel undergoing combustion. The said vertical or upper portion 21 has laterally extending ribs 23 at its front, the edges of which are ground and engage the edges of the corresponding ribs of adjacent sections

to form tight joints therewith. The lower inclined portion 22 has one or more oppositely-disposed, laterally-extending inclined ribs 24, which register with the corresponding ribs of adjacent sections and form a plurality of tuyeres or air inlets 24^a therebetween for the admission of air to support combustion of the incandescent fuel.

The rear member 13 of each section has its forwardly extending portion 25 inclined, and is further provided at the top, back and bottom edges with transversely-extending peripheral ribs 26, and the front wall of the forwardly-extending inclined portion 25 provided with transversely-extending ribs 27.

The front portions 25 of certain of said rear members 13 are provided with lugs 28' having recesses therein, and within said recesses are fitted removable members 29 forming conduits or flues for conducting air and gases liberated by the fuel and which may collect in the upper part of the fuel receptacle 32 and in the combustion chamber of the boiler. The said members 29 are of curved or trough-like form in cross-section and are open at their lower ends. The upper ends of said members 29 are closed and provided with a plurality of vertical openings 30 which are of sufficient size and number to permit of the passage of the required volume of air therethrough, but prevent the entry of particles of fuel into said members.

The upper, rear edges of said members 29 are arranged at slight angle to the remainder thereof, in order to conform fully to the forwardly-extending rib portion of each pair of the rear members 13 with which the same are associated.

In order to hold the members 29 duly in position, the same are provided along their opposite edges adjacent to their upper and lower ends with projections 31 having inclined edges adapted to engage with the recesses 28^a in the lugs 28'.

Each front member 12 has its upper or vertical portion 21 provided at its inner or rear vertical edge with oppositely-extending ribs 23^a which engage with registering ribs 23^a of the adjoining members to form air passages 28 having inwardly facing outlet openings 28^b adjacent to their upper ends, and intake openings 32^a about midway of the height of said members, and above the openings 24^a which serve to admit the main air supply to support the combustion of the fuel.

In order to insure the due admission of air to the vertical passages 28, the lower ends of the outer ribs 23 are turned slightly forwardly and then downwardly at 23^b to form enlarged entrance portions for said intake openings 32^a.

The inner ribs 23^a of the front members 12 serve as the front wall of the fuel recep-

tacle or magazine 32, and to insure the proper distribution of fuel to the burning zone the lower ends of said ribs 23^a are carried downward below the intake openings 32^a, of the vertical air passages 28, to a point substantially in the same horizontal plane with the lower ends of the forwardly-extending portion 25 of the rear members 13.

When the several boiler sections are assembled, the registering ribs of the adjacent sections engage one another to form the fuel magazine or receptacle 32, a burning zone or incandescent fuel chamber 33, and an ash receiving portion 34. The said ribs also serve to form revertible flues 35 between the water compartments of adjacent sections, which flues communicate with the combustion chamber formed intermediate the portions of the front members 12 and the front of the forwardly-extending portions 25 of the rear members 13.

The fuel is introduced into the fuel receptacle 32 through a charging opening 37 preferably in the top of the casing 20. Positioned over the opening 37 is a frame having a ground surface 39 upon which are fitted pivotally secured covers 41.

42 denotes an auxiliary air supply tube which extends transversely of the boiler, and has its ends which extend through the side members 10 and 11 provided with perforated rotating discs or dampers 43 for controlling the supply of auxiliary air which is permitted to issue through the apertures 44 into the combustion chamber.

In operation, the fuel is supported upon the lower inwardly inclined portion 22 of the front members 12, and by the bed of ashes in the ash pit, the fuel feed being maintained constant by the reserve fuel contained within receptacle 32. The main supply of air necessary to support combustion passes through the spaces or tuyeres 24^a between the ribs 24, and into the column of fuel, and the products of combustion pass through the combustion chambers, the flues 35 and the openings 34^a into the smoke pipe 35^a. As the products of combustion pass from the combustion chamber or chambers into the said flues, the supplemental air and volatile gases collecting in the upper portion of the fuel receptacle will be drawn downwardly through the conduits formed by the members 29. The said supplemental air will be admitted to the upper ends of the conduits through the air passages 28 formed between the ribs 23, 23^a of the front members 12. The supplemental air passes upwardly through said passages, and thence across the upper portion of the fuel receptacle and over the fuel therein and to the upper ends of the members 29, through the opening 30 thereof, and thence downwardly through said members 29, and issue from the lower open ends thereof, and

mingles with the volatile gases liberated by the incandescent fuel. The air will be increasingly heated in passing through said members 29 until it enters into the combustion chamber or chambers, at which time its temperature will be further raised by mingling with the heated air issuing from the auxiliary air tube 42 as to insure proper combustion of said volatile gases liberated from the fuel, and prevent any undue cooling of said combustion gases. As the air conduits are positioned between the rear members 13 of the intermediate sections, the supply of supplemental air which is delivered into the combustion chamber or chambers will thus be heated and be uniformly distributed throughout the width thereof and thereby insure a uniform mixing with, and the combustion of the gases liberated by the fuel.

As the supplemental air upon entering the conduits formed by the passages 28 and openings 28^b and tube 42 is at a low temperature as compared to the temperature of the flue gases, and does not attain its maximum temperature until it reaches the combustion chamber or chambers, it will serve in a measure as a heat insulating medium to prevent heat from being transmitted to the fuel within the fuel receptacle 32, and thereby avoid any undue distillation of the fuel therein.

Having thus described my said invention, what I claim and desire to secure by Letters Patent is:—

1. A boiler comprising a combustion chamber, a fuel receptacle communicating therewith, a flue extending from said combustion chamber, and a member removably disposed between said flue and said fuel receptacle for feeding air into said combustion chamber, substantially as specified.

2. A boiler comprising a combustion chamber, a fuel receptacle communicating therewith, a flue extending from said combustion chamber, and a member removably disposed between said flue and said fuel receptacle for feeding air into said combustion chamber, and means for securing said removably disposed member in position for feeding air into said combustion chamber, substantially as specified.

3. A boiler comprising a combustion chamber, a fuel receptacle communicating therewith, a flue extending from said combustion chamber, and a removably-disposed trough-shaped member arranged upon the inner side of said fuel receptacle adjoining said flue, and means for securing said trough-shaped member in position for feeding air into said combustion chamber, substantially as specified.

4. A boiler comprising a combustion chamber, a fuel receptacle communicating therewith, a flue extending from said com-

bustion chamber, and a removable member of substantially semi-circular form in cross-section disposed upon the inner wall of said fuel receptacle for feeding air into said combustion chamber, substantially as specified.

5. A boiler comprising a combustion chamber, a fuel receptacle communicating therewith, a flue extending from said combustion chamber, and a member of substantially semi-circular form in cross-section disposed upon one of the inner walls of said fuel receptacle, and means for detachably securing said member in position, substantially as specified.

6. A boiler comprising a combustion chamber a fuel receptacle communicating therewith, a flue extending from said combustion chamber, and a plurality of members removably disposed between said flue and said fuel receptacle for feeding air into said combustion chamber, substantially as specified.

7. A boiler comprising a combustion chamber, a fuel receptacle communicating therewith, retaining means provided within said fuel receptacle, a flue extending from said combustion chamber, a member removably supported by said retaining means having its lower end communicating with said combustion chamber, and means for supplying air to the upper end of said removable member, substantially as specified.

8. A boiler comprising a combustion chamber, a fuel receptacle positioned above and communicating therewith, a flue extending from said combustion chamber and leading upwardly therefrom, a series of separate, detachable vertically extending conduits between said flue and said fuel receptacle having their lower ends communicating with the combustion chamber, and their upper ends terminating below and communicating with the upper end of said fuel receptacle, and means for admitting air to said conduits, substantially as specified.

9. A boiler comprising a combustion chamber, a fuel receptacle positioned above and communicating therewith, a flue extending from said combustion chamber, and a member forming a conduit between the said flue and said fuel receptacle, said member having its lower end open and communicating with said combustion chamber, and its upper end closed and provided with openings, and communicating with the upper end of said fuel receptacle, substantially as specified.

10. A boiler comprising a combustion chamber, a fuel receptacle positioned above and communicating therewith, a flue extending from said combustion chamber, a member forming a conduit between said flue and said fuel receptacle; said member having its lower end open and communicating

with said combustion chamber, and its upper end closed and provided with inlet openings communicating with the upper end of said fuel receptacle, and means provided
5 within the boiler for supplying air to the upper end of said member, substantially as specified.

11. A boiler comprising a combustion chamber, a fuel receptacle communicating
10 therewith, retaining lugs provided upon the inner side of said fuel receptacle, a flue extending from said combustion chamber and leading upwardly therefrom, and a trough-like member detachably secured
15 within said retaining lugs forming a conduit between said fuel receptacle and said flue and having its lower end communicating with said combustion chamber and its upper end communicating with the upper
20 portion of said fuel receptacle, substantially as specified.

12. A boiler comprising a combustion chamber, a fuel receptacle positioned above and communicating therewith, a flue extending from said combustion chamber, a
25 member forming a conduit between said flue and said fuel receptacle; said member having its lower end open and communicating with said combustion chamber, and its upper
30 end closed and provided with inlet openings communicating with the upper end of said fuel receptacle, and a conduit ar-

ranged in said boiler having an air intake opening at its lower end, and an air outlet at its upper end for supplying air to
35 the intake end of the member forming the conduit intermediate the fuel receptacle and flue aforesaid, substantially as specified.

13. A boiler comprising a combustion chamber, a fuel receptacle positioned above
40 and communicating therewith, a flue extending from said combustion chamber, a member forming a conduit between said flue and said fuel receptacle; said member having its lower end open and communicating
45 with said combustion chamber, and its upper end closed and provided with inlet openings communicating with the upper end of said fuel receptacle, and an air conduit arranged adjacent to the front wall of said
50 fuel receptacle having an intake opening at its lower end, and an outlet at its upper end for supplying preheated air to the intake end of the member forming the conduit intermediate the fuel receptacle and flue
55 aforesaid, substantially as specified.

Signed at the city of Buffalo, Erie County, in the State of New York, this 23 day of November, one thousand nine hundred and twenty.

FRANK B. HOWELL.

Witnesses:

CONRAD A. DIETERICH,
W. P. HALEY.