Oct. 31, 1933. G. A. STACEY 1,933,229

BOILER

Filed July 7, 1931 4 Sheets-Sheet 1

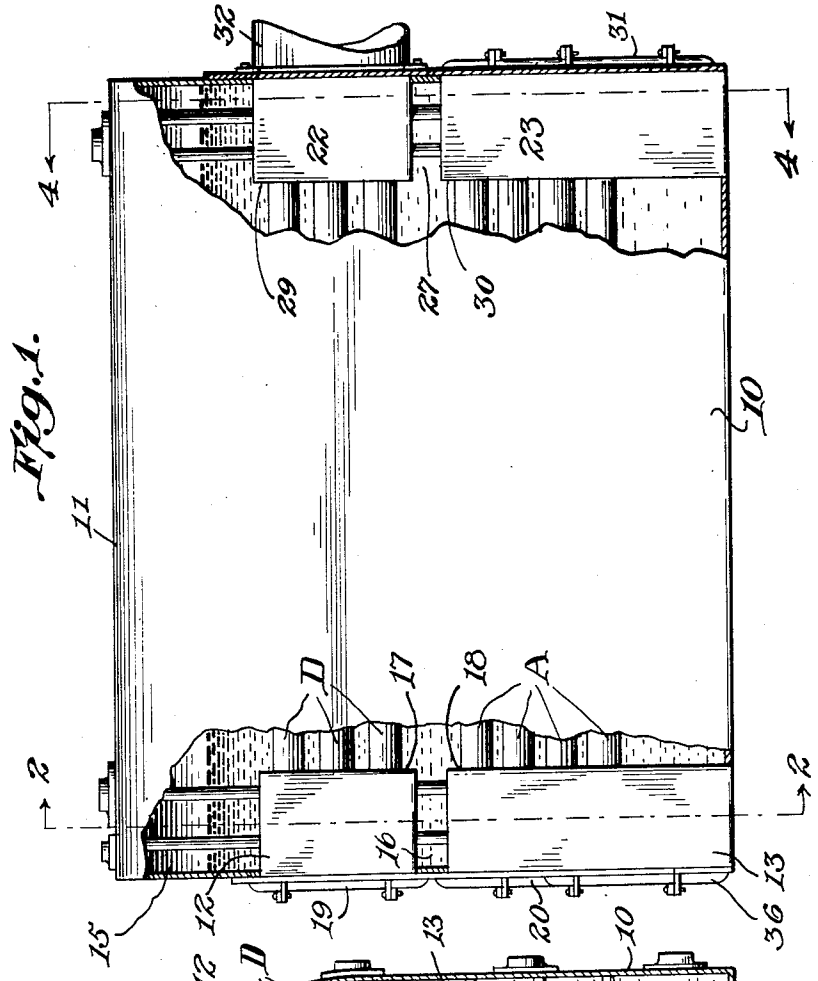


Fig. 1.

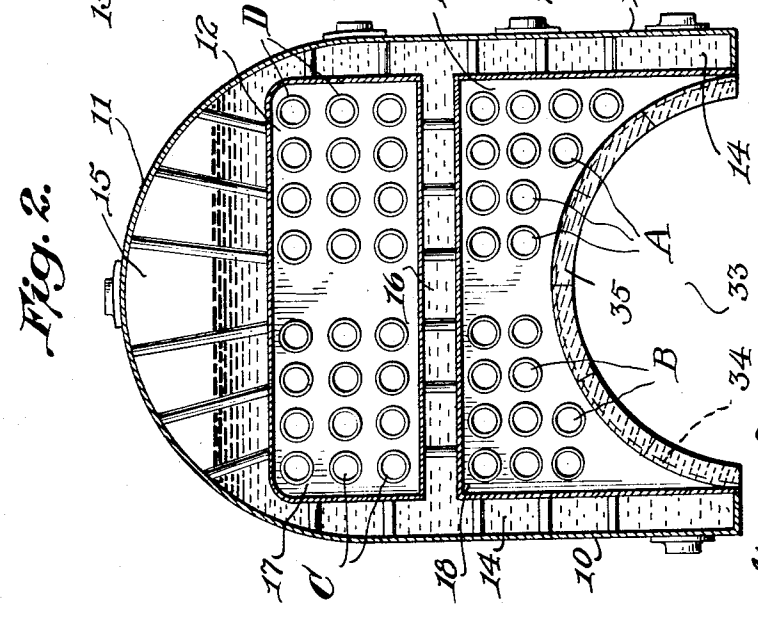


Fig. 2.

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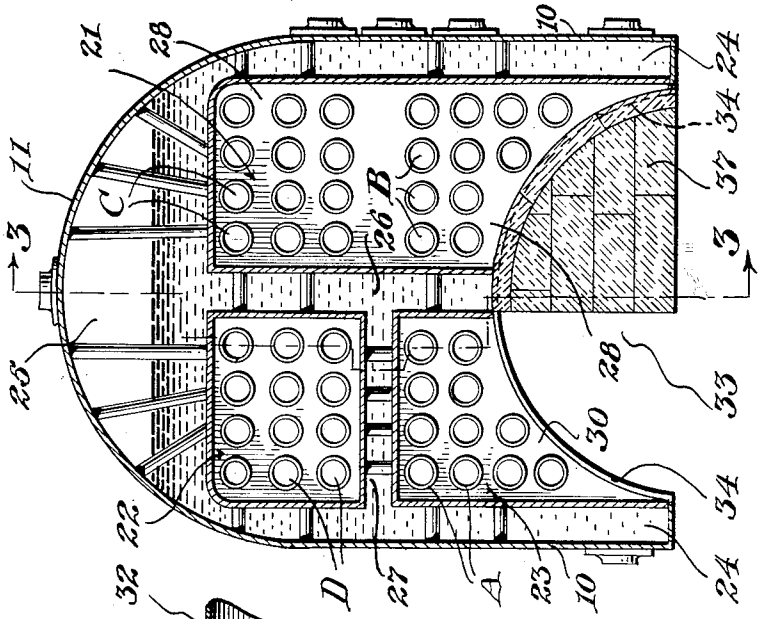


Fig. 4.

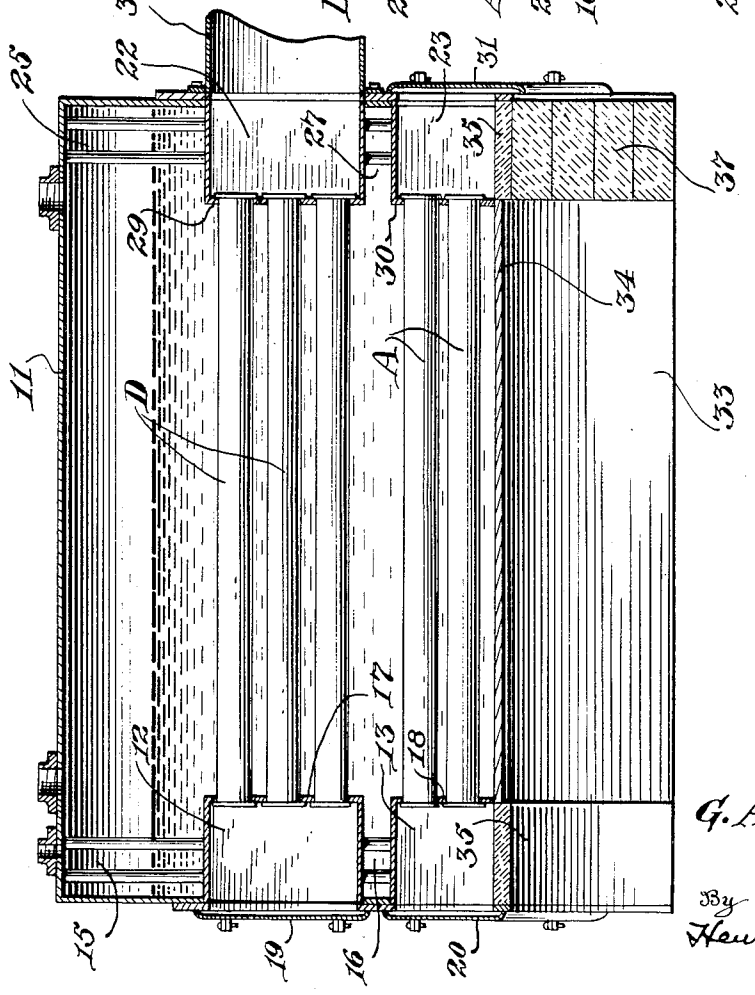


Fig. 3.

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Fig. 5.

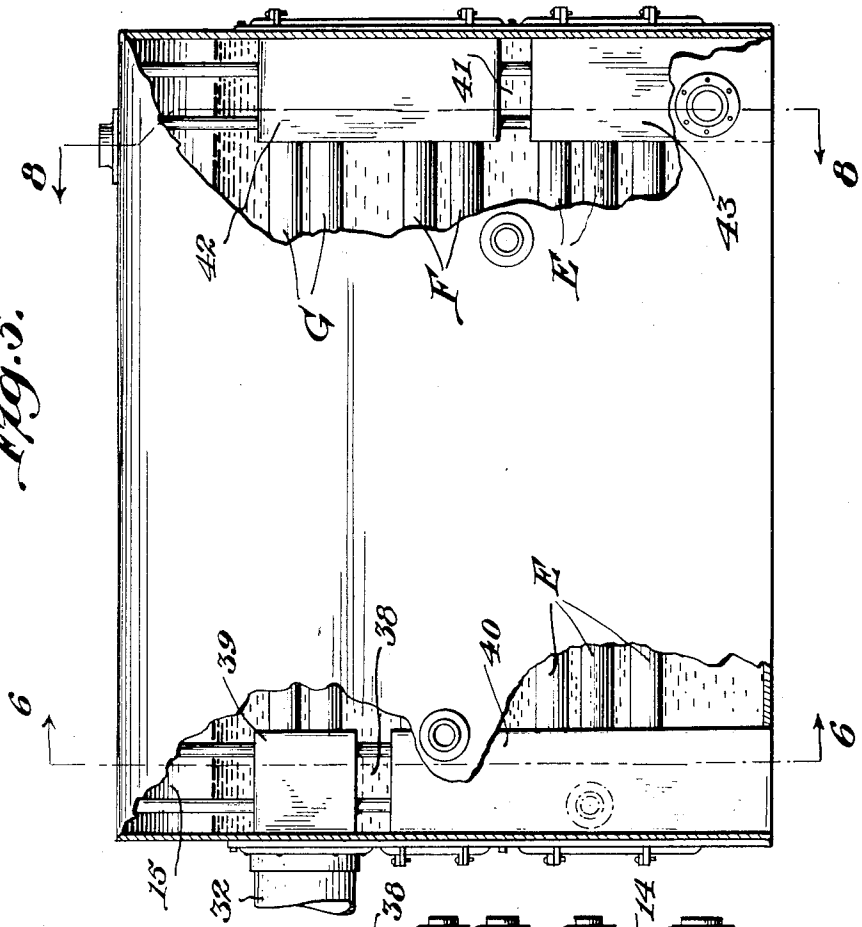
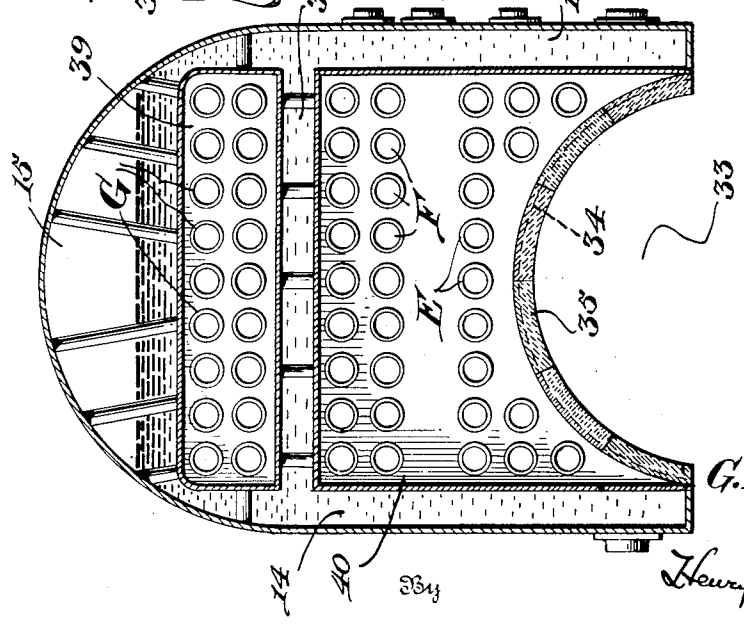


Fig. 6.



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Fig. 8.

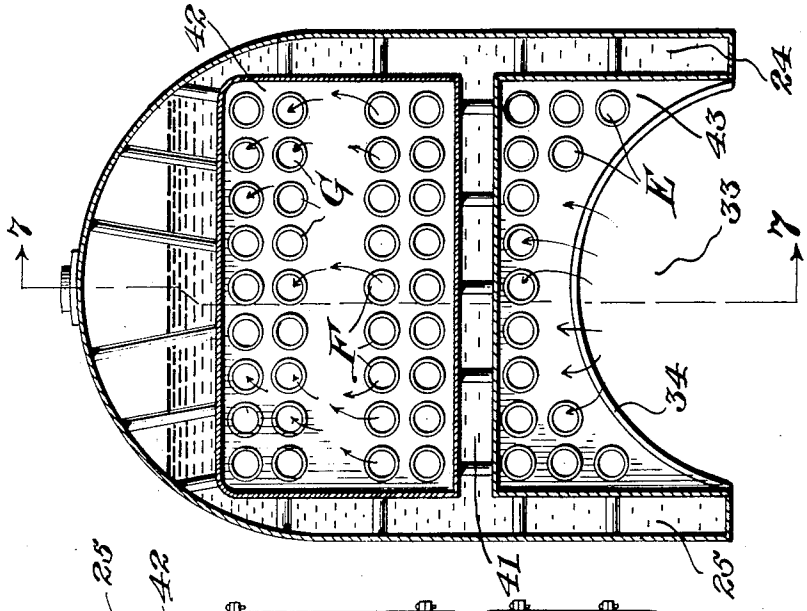
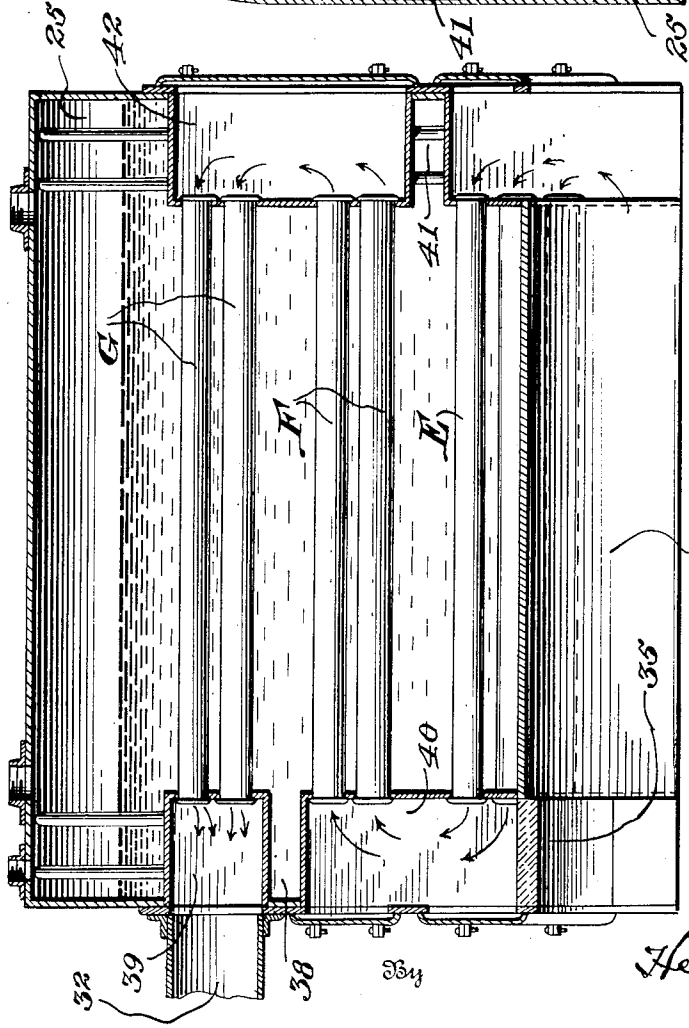


Fig. 7.



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Patented Oct. 31, 1933 1,933,229

UNITED STATES PATENT OFFICE

1,933,229

BOILER

George A. Stacey, Phoebus, Va., assignor of one-half to Charles C. Curtis, Hampton, Va.

Application July 7, 1931. Serial No. 549,260

6 Claims. (Cl. 122—74)

My invention relates to boilers of a type particularly adapted for use as the heating medium in the air conditioning apparatus shown and described in my copending application 549,259. However, it will be understood that my improved boiler is in no way restricted to the use specified as its inherent advantages render it a highly desirable heating source in any hot water or steam heating system.

It is the purpose of my present invention to provide a boiler that will maintain an exceptionally low water line without sacrifice of grate area, combustion chamber space or heat exchange surface, and which will be exceedingly simple in construction with resulting low cost of manufacture.

My improved boiler is particularly adapted for the use of oil and gas as fuel and embodies a construction wherein the combustion gases from the combustion chamber are caused to flow successively through more than two groups of flue tubes, such travel of the combustion gases being controlled mainly by water legs forming an integral part of the boiler. My improved construction provides a self-contained portable boiler having a very long flue travel of the gases of combustion which in turn effects a very high percentage of heat exchange from the gases to the liquid in the boiler, there being a great difference in temperature between the gases when entering the first group of flue tubes and when leaving the last group. Furthermore, by causing the gases to partake of abnormally long flue travel before escaping to the usual stack the evaporation power of my boiler is increased. It is a recognized and desirable advantage of a boiler to have a low water line and the construction of a boiler so characterized, without sacrifice of the necessary grate area, combustion volume, or heat exchange surface constitutes an important element of my invention. The capacity of my improved boiler can be increased by increasing its width and length proportionally without materially increasing its height or the height of its water line and without any diminution of its efficiency.

In the drawings chosen to illustrate my invention the scope whereof is set forth in the appended claims;

Figure 1 is a side elevation, partly in section of a boiler constructed in accordance with my invention;

Figure 2, a section on the line 2—2 of Figure 1;

Figure 3, a section on the line 3—3 of Figure 4;

Figure 4, a section on the line 4—4 of Figure 1;

Figure 5, a view similar to Figure 1 showing a modified form of my invention;

Figure 6, a section on the line 6—6 of Figure 5;

Figure 7, a section on the line 7—7 of Figure 8; and

Figure 8, a section on the line 8—8 of Figure 5.

Referring to Figures 1 to 4 my improved boiler is shown as comprising vertical side outer walls 10 which are mutually connected by an arched top wall 11. The front wall of the boiler is shaped to provide vertically spaced horizontally extending upper and lower pockets 12 and 13 respectively forming vertical water legs 14, a crown water leg 15 connecting the vertical water legs 14, and a horizontal water leg 16 constituting the dividing wall of the pockets 12 and 13 and also connecting the vertical water legs 14. The bottom of the pocket 12 is constituted by a flue tube head 17, while the bottom of the pocket 13 is constituted by a flue tube head 18. Doors 19 and 20 control the open and closed status of the pockets 12 and 13 respectively. The rear wall of the boiler is shaped to provide a vertically extending pocket 21 on one side and vertically spaced upper and lower pockets 22 and 23 respectively on the other side. These pockets are shaped to provide vertical side water legs 24, a central vertical water leg 26 communicating with the crown water leg 25, and separating the pockets 22 and 23 from the pocket 21, and a horizontal water leg 27 separating the pockets 22 and 23 and connecting the central vertical water leg 26 and one of the vertical side water legs 24. The bottoms of the pockets 21, 22 and 23 are formed respectively of flue tube heads 28, 29 and 30. The open and closed status of the pockets 21 and 23 is controlled by suitable doors or other removable closures, such a door 31 being shown in closing relation to the pocket 23. The pocket 22 is in communication with a stack fixture 32. Four distinct groups of flue tubes indicated at A, B, C and D respectively are embodied in my improved boiler, said groups being arranged in lateral and vertical spacement as clearly shown in Figures 2 and 4. The tubes of group A are supported by the heads 18 and 30; those of group B by the heads 18 and 28; those of group C by the heads 17 and 28; and those of group D by heads 17 and 29. The combustion chamber of my boiler is indicated at 33 and has its roof formed of an arched metal sheet 34 of a length equal to the distance between the tube heads of the various groups, which heads and tubes associated therewith said arched sheet supports. Forward of the metal arch 34 I provide a fire brick arch 35 which latter occupies the space between the

forward end of the boiler and the adjacent end of the metal arch.

Entrance to the combustion chamber 33 is controlled by a door or doors 36. Slightly over one-half of the combustion chamber at the rear of the latter is blocked by a fire brick wall 37 so as to exclude direct communication between said chamber and pocket 21 leaving only pocket 23 to directly receive the gases of combustion from chamber 33.

From the foregoing it will be apparent that the gases of combustion in their travel from the combustion chamber 33 will first enter the pocket 23 from whence they will be directed by the water legs 24, 26 and 27 through the group of flue tubes A into the pocket 13 at the front of the boiler. The gases will then be directed from pocket 13 by the water legs 14 and 16 through the group of flue tubes B into the pocket 21 from which latter they will be directed by the water legs 25, 26 and 24 through the group of tubes C into the pocket 12. From this last pocket the gases are directed by water legs 15, 16 and 14 through the group of tubes D into the pocket 22 from whence they pass into the stack fixture 32.

In the modified form of my invention illustrated in Figures 5 to 8 three groups of flue tubes E, F and G are utilized instead of four groups and at one end of the boiler a horizontal water leg 38 connects the water legs 14 and separates the tube group G from the groups E and F and forms in conjunction with the water legs 14 and 15 a gas pocket 39 which communicates with the stack fixture 32 and also forms in conjunction with the water legs 14 and fire brick arch 35 a gas pocket 40 mutually connecting the bores of the tubes of groups E and F. At the other end of the boiler a horizontal water leg 41 connects the water legs 24 and separates the tube group E from the tube groups F and G. In addition this water leg 41 forms in conjunction with the water legs 25 and 24 a pocket 42 and in conjunction with the water legs 24 a pocket 43 which communicates with the rear end of the combustion chamber 33, it being noted that the fire brick wall 37 of the form shown in Figures 1 to 4 is dispensed with and that the gases of combustion are free to enter the pocket 43 throughout the width of the combustion chamber.

In the operation of the modified form the gases of combustion enter the pocket 43 and then travel successively through tube group E, pocket 40, tube group F, pocket 42, tube group G, pocket 39 and thence into the stack 32.

It will be apparent from the foregoing taken in connection with the accompanying drawings that I have produced a boiler of exceedingly low water line without sacrificing grate area, combustion chamber space or heat exchange surface, in fact, in the light of the length and height of the boiler I have provided an exceedingly large area of heat exchange surface with resulting enhancement in the efficiency of the boiler.

I claim:

1. A boiler construction comprising a combustion chamber, two upper and two lower groups of flue tubes, forwardly extending side and crown water legs, rearwardly extending side and crown water legs, a horizontal water leg connecting the two forwardly extending side water legs and disposed between the upper and lower groups of flue tubes, a vertical medial water leg depending from and communicating with the rearwardly extending crown water leg and disposed between both the upper tube groups and the lower tube groups a horizontal water leg connecting one of the rearwardly extending side water legs and the medial water leg and disposed between one of the upper tube groups and one of the lower tube groups, and means closing communication between the combustion chamber and one of the lower tube groups.

2. In a boiler construction including a combustion chamber, more than two groups of flue tubes, and means to cause the gases of combustion to flow successively through the groups of tubes, said means including boiler water legs forming at least two gas pockets at each end of the boiler, with at least one of the pockets at each end of the boiler having four defining side walls formed by the water legs and the remainder of said pockets at each end of the boiler having three defining side walls formed by said water legs.

3. In a boiler construction including a combustion chamber, more than two groups of flue tubes with at least two groups positioned laterally with respect to each other and the remaining groups above said two groups, and means to cause the gases of combustion to flow successively through said groups of tubes, said means including front and rear water legs of the boiler.

4. In a boiler construction including a combustion chamber, more than two groups of flue tubes, and means to cause gases of combustion to flow successively through said groups of tubes, said means including at least one horizontal water leg at each end of the boiler disposed between adjacent groups of tubes.

5. In a boiler construction including a combustion chamber, more than two groups of flue tubes, and means to cause gases of combustion to flow successively through said groups of flue tubes, said means including a horizontal water leg connecting vertical water legs at each end of the boiler, said horizontal water legs being disposed at different levels with respect to each other.

6. In a boiler construction including a combustion chamber, more than two groups of flue tubes, each of said groups having their terminals disposed inwardly of water carrying portions of the boiler to produce a plurality of transverse and a plurality of vertical water legs at each end of the boiler, said legs forming gas pockets for directing gases of combustion from said chamber to a first group of tubes and then successively through the remaining groups.

GEORGE A. STACEY.