United States Patent [19]

O'Connor

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[54] **ROTARY BOILER**

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[52] **U.S. Cl.** **122/11,** 60/49

[51] **Int. Cl.** **F22b 31/00**

[58] **Field of Search** 122/11; 60/49, 108

[56] **References Cited**

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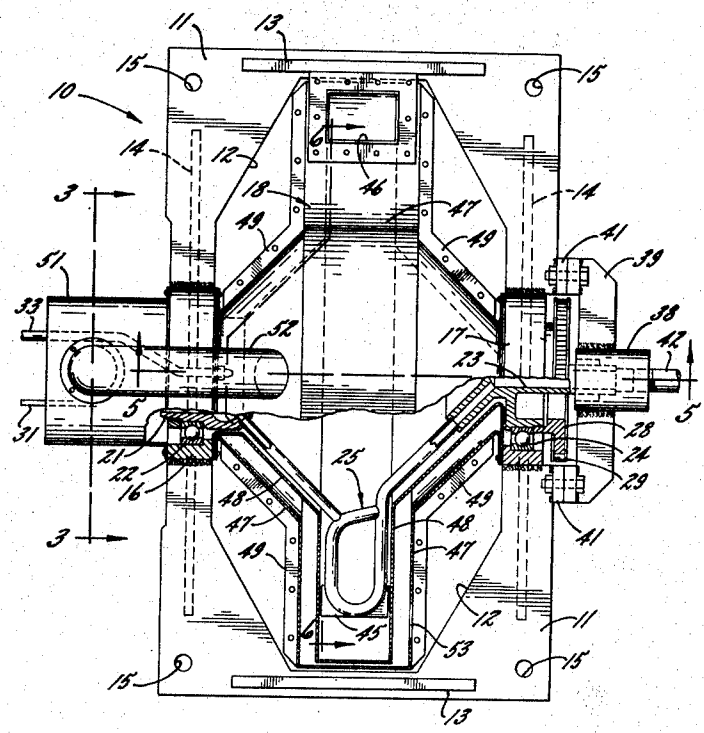
Primary Examiner—Kenneth W. Sprague

Attorney, Agent, or Firm—Wolfe, Hubbard, Leydig, Voit & Osann, Ltd.

[57] **ABSTRACT**

A boiler in which a plurality of generally A-shaped tubes connect to, and are rotatably driven with, an annular hub and a steam discharge pipe in a generally circular chamber. Water and fuel for combustion are introduced through the hub. The tubes act like an impeller fan drawing air for combustion through the hub. The chamber is double-walled to define an air cooling jacket and air is drawn through the double wall before being directed to the hub.

5 Claims, 6 Drawing Figures



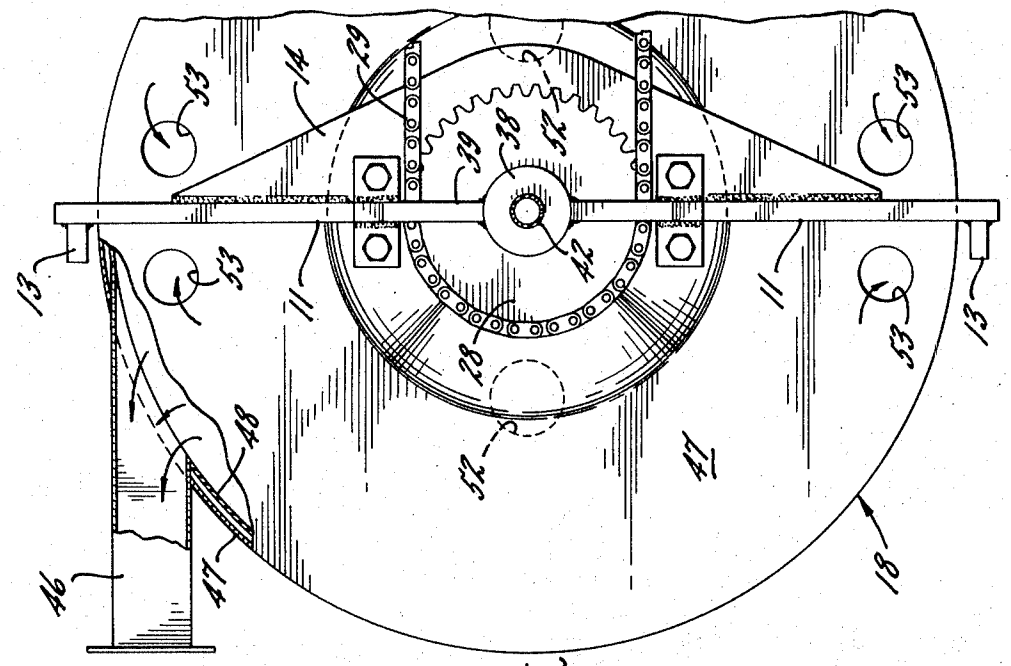


FIG. 2.

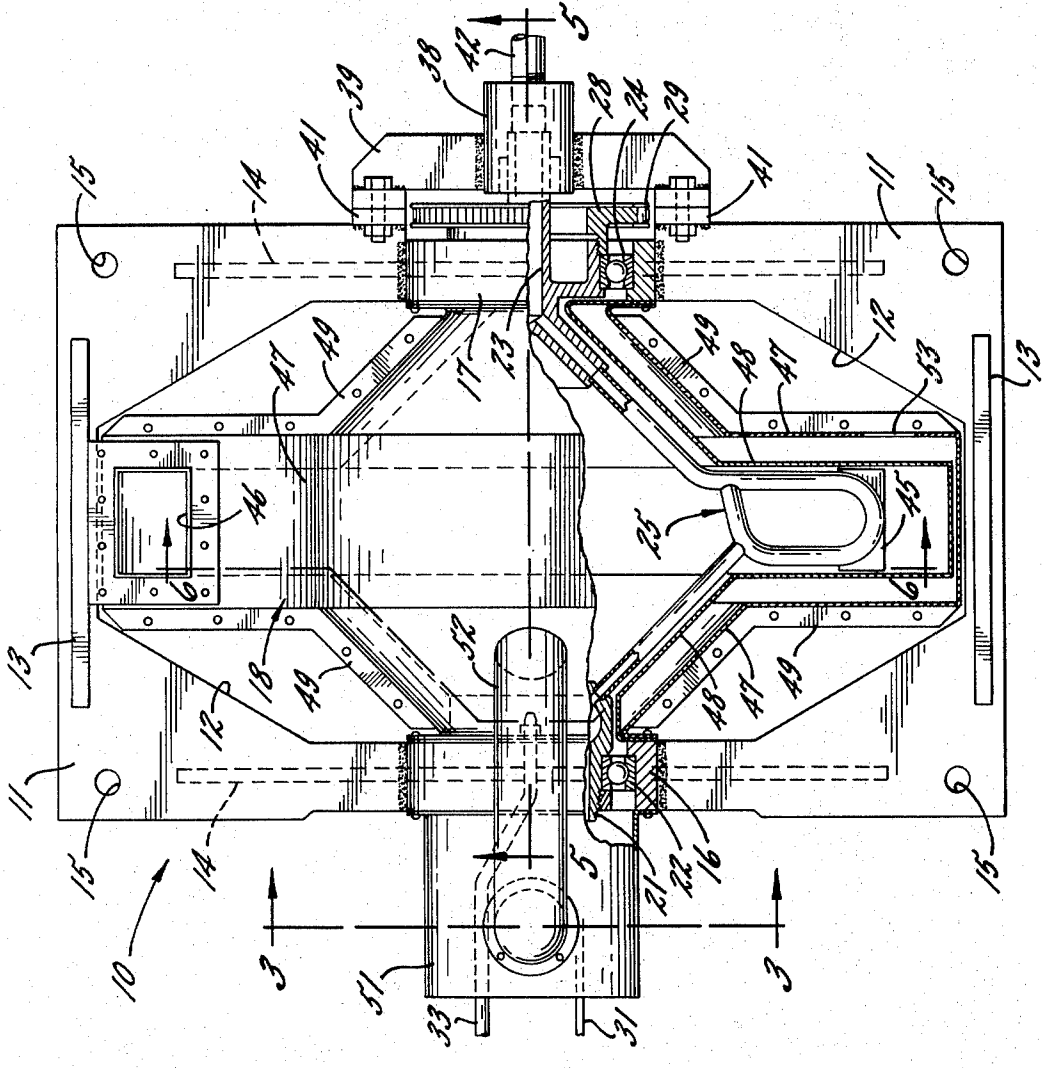


FIG. 1.

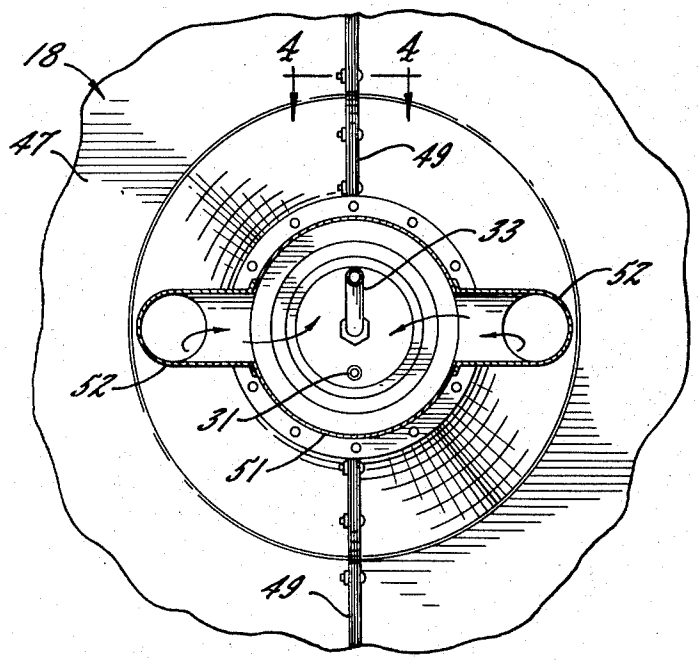


Fig. 3.

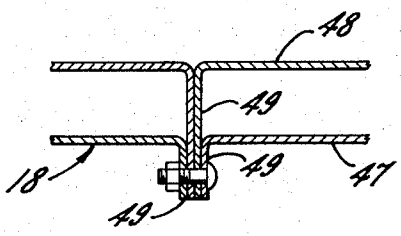


Fig. 4.

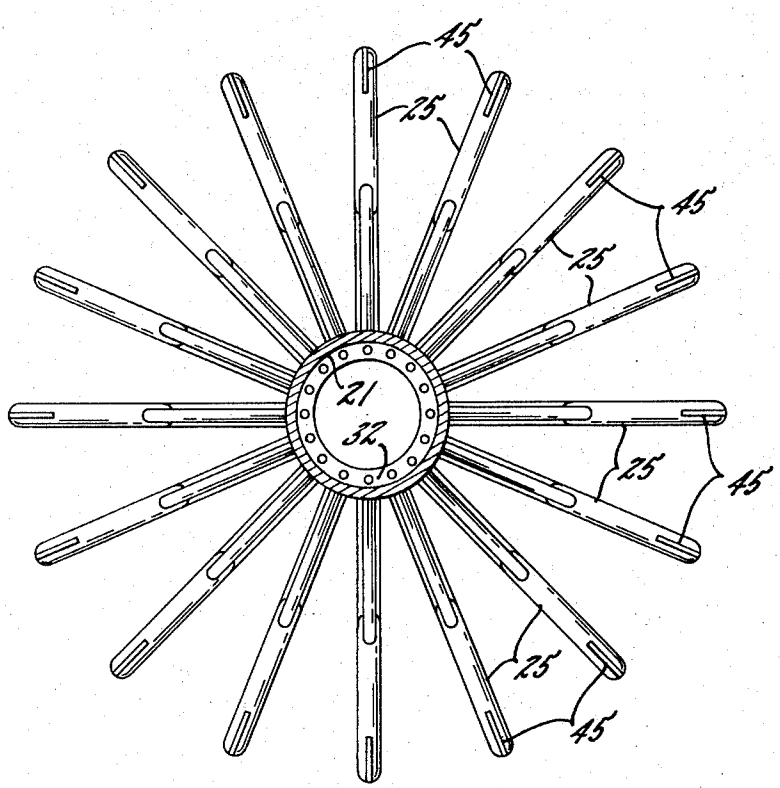


Fig. 6.

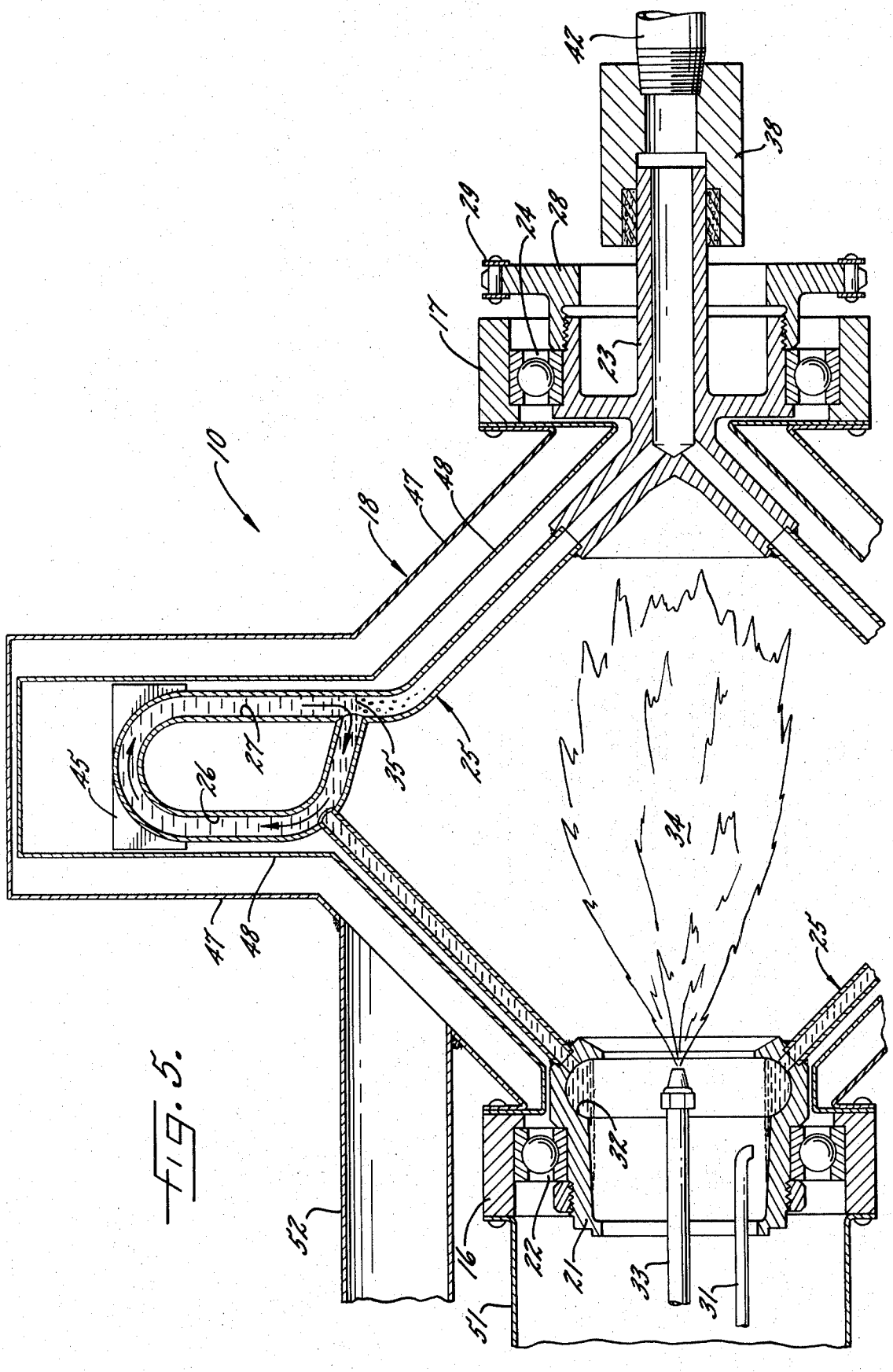

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FIG. 5.

ROTARY BOILER

This invention relates to a steam generating boiler and more particularly concerns a compact rotary boiler.

For various reasons, renewed interest has developed in relatively small steam engines having power ranges suitable for vehicle propulsion. In such applications, the steam engine must be considered as part of a larger package since the steam generator or boiler supplying the engine is quite important to the performance of the total system and, indeed, the boiler may well be the limiting factor in judging cost, efficiency, compactness, etc.

Accordingly, it is the primary aim of the invention to provide a novel steam generating boiler which is lightweight, compact and efficient, and hence well suited for smaller portable power plant applications.

In more detail, it is an object of the invention to provide a rotary boiler having the above characteristics which operates with circulating, pressurized water in the heating zone although feed water is simply poured in at atmospheric pressure. Another object is to provide a boiler of this type which develops an air flow that air cools the unit and then provides a preheated, forced air supply for insuring complete combustion of the heating fuel at a rate giving high steam production.

It is also an object to provide a boiler as described above which is economical to manufacture.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

FIG. 1 is an elevation, partially sectioned, of a rotary boiler embodying the invention;

FIG. 2 is a fragmentary elevation of the boiler shown in FIG. 1;

FIG. 3 is a partial section taken approximately along the line 3—3 in FIG. 1;

FIG. 4 is an enlarged fragmentary section taken along the line 4—4 in FIG. 3;

FIG. 5 is an enlarged fragmentary section taken approximately along the line 5—5 in FIG. 1; and

FIG. 6 is a section taken along the line 6—6 in FIG. 1.

While the invention will be described in connection with a preferred embodiment, it will be understood that I do not intent to limit the invention to that embodiment. On the contrary, I intend to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Turning first to FIG. 1, there is shown a rotary boiler 10 constructed in accordance with the invention and assembled on frame plates 11 having central cutouts 12, stiffening ribs 13 and 14, and mounting holes 15. A pair of collars 16 and 17 are fixed in the plates 11 and the ribs 14, and a generally circular (see FIG. 2) combustion chamber 18 is mounted on the collars 16, 17 within the cutouts 12.

In carrying out the invention, an annular hub 21 is mounted in a bearing 22 in the collar 16 for rotation in the chamber 18, a steam discharge pipe 23 is mounted in a second bearing 24 in the collar 17 for rotation in the chamber, and a plurality of tubes 25 in an annular array (see FIG. 6) are mounted with the opposite ends of each tube opening into the hub 21 and into the pipe 23. Preferably, the tubes are generally A-shaped (see FIG. 5) with the opposite legs connecting respectively with the hub 21 and the pipe 23, and the apex defining a generally circular water circulation path 26 and 27.

The hub 21, pipe 23 and tubes 25 are rotated through a sprocket 28 and chain 29 connected to the pipe 23 which is powered by any convenient source, normally the engine with which the boiler 10 is associated. Water is introduced through a line 31 in the hub 21 so that centrifugal force holds the water in an annular groove 32 within the hub 21 and carries water out into the tubes 25. A fuel line 33 is also positioned in the hub 21 for creating and maintaining combustion in the chamber 18 so as to generate steam in the tubes 25 which flows to the pipe 23.

As so far described, fuel from the line 33 is burned within the chamber 18 creating a flame envelope 34 surrounded by intensely heated gas through which the tubes 25 and in particular the circulation paths 26, 27 are driven, thus putting those portions of the tubes in good heat exchange relationship with the intensely heated gas. Centrifugal force will tend to pressurize the water in the paths 26, 27 so as to produce a pressurized boiler although water is introduced at atmospheric pressure to keep the water level at about a line 35. Steam generated in the paths 26, 27, being lighter than water, flows toward the axis of rotation of the tubes 25 to the pipe 23. Water continually circulates as indicated by the arrows in the paths 26, 27 because the colder feedwater at the outgoing portion 26 of the path is heavier than the heated steam carrying water at the ingoing portion 27 of the circulating path, and hence centrifugal force produces the circular flow. As the water flows, steam is taken off at the approximate line 35.

In the illustrated construction, the outer end of the pipe 23 is fitted and sealed in a collar 38 supported by a bracket 39 bolted to lugs 41 on the frames plates 11, and a line 42 is fitted into the collar 38 to carry away the generated steam.

As another aspect of the invention, the tubes 25 are formed with air moving blades 45 at their apexes and the chamber 18 is formed with a tangential exhaust passage 46 so that rotation of the tubes 25 create an impeller fan effect drawing air for combustion through the hub 21 and exhausting the gases of combustion through the passage 46. This tends to insure complete combustion of fuel at a rate giving high steam production.

As a feature of the invention, the chamber 18 is formed of outer and inner sheet metal walls 47 and 48, respectively, spaced to define an intermediate air cooling jacket. Preferably, the chamber 18 is made up of two half sections of both inner and outer walls 47, 48 formed with outturned flanges 49 which abut and are bolted together in the plane of the frame plates 11 (see FIG. 4). The flanges 49 of the inner walls 48 thus divide the air cooling jacket into two sections.

Preferably, air is force-circulated through the air cooling jacket between the walls 47, 48 by enclosing the outer end of the hub 21 with a cylindrical cover 51 secured and sealed to the collar 16, providing air conducting tubes 52 from each half of the air cooling jacket to the cover 51, and forming air inlet holes 53 in the opposite sides of the outer wall 47 of the chamber 18. The impeller fan effect of the rotating tubes 25 thus pulls air through the inlet holes 53, around within

the air cooling jacket defined between the chamber walls **47, 48,** through the air conducting tubes **52** to the cover **51,** through the hub **21** into the combustion region, and finally out of the exhaust passage **46.**

Those familiar with this art will appreciate that the rotary boiler **10** is particularly compact and can be economically made to be relatively lightweight. The design facilitates the very efficient generation of steam, particularly attributable to the pressurized water effect and the good heat exchange relationship obtained between the driven tubes **25** and the gases of combustion. The air cooling arrangement of the combustion chamber contributes to the lightweight, economical construction of the boiler.

I claim as my invention:

1. A steam generating boiler comprising, in combination, a generally circular chamber, an annular hub mounted for rotation in said chamber, a steam discharge pipe mounted for rotation in said chamber in alinement with said hub, a plurality of tubes in an annular array with each tube opening into said hub and into said pipe, means for rotating said hub, pipe and tubes, means for introducing water into said hub so that centrifugal force carries water into said tubes, means including a fuel line in said hub for creating and maintaining combustion in said chamber so as to generate steam in said tubes which flows to said pipe, said tubes being generally A-shaped with the legs connecting respectively to said hub and said pipe and the apex defining a generally circular water circulation path whch rotates in the heat of said combustion.

2. The combination of claim **1** in which each of said tubes is formed with an air moving blade near its apex and said chamber is formed with a tangential exhaust passage so that rotation of the tubes creates an impeller fan effect drawing air for combustion through said hub.

3. The combination of claim **2** in which said chamber is formed of double walls defining an air cooling jacket with air inlet openings and air outlet conduits leading to said hub so that said impeller fan effect draws air between said double walls to the hub.

4. A steam generating boiler comprising, in combination, a generally circular chamber, an annular hub mounted for rotation in said chamber, a steam discharge pipe mounted for rotation in said chamber in alinement with said hub, a plurality of tubes in an annular array with each tube opening into said hub and into said pipe, means for rotating said hub, pipe and tubes, means for introducing water into said hub so that centrifugal force carries water into said tubes, means including a fuel line in said hub for creating and maintaining combustion in said chamber so as to generate steam in said tubes which flows to said pipe, said chamber being formed of double walls defining an air cooling jacket.

5. A steam generating boiler comprising, in combination, a generally circular chamber, an annular hub mounted for rotation in said chamber, a steam discharge pipe mounted for rotation in said chamber in alinement with said hub, a plurality of tubes in an annular array with each tube opening into said hub and into said pipe, means for rotating said hub, pipe and tubes, means for introducing water into said hub so that centrifugal force carries water into said tubes, means including a fuel line in said hub for creating and maintaining combustion in said chamber so as to generate steam in said tubes which flows to said pipe, said means for introducing water including a water line, and said hub having an open inner diameter sufficient to receive said fuel line and said water line while still permitting the free passage of air for combustion through the hub.

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