T. G. ALDRICH.

STEAM GENERATOR.

APPLICATION FILED NOV. 26, 1907.

913,249.

Patented Feb. 23, 1909.

2 SHEETS—SHEET 1.

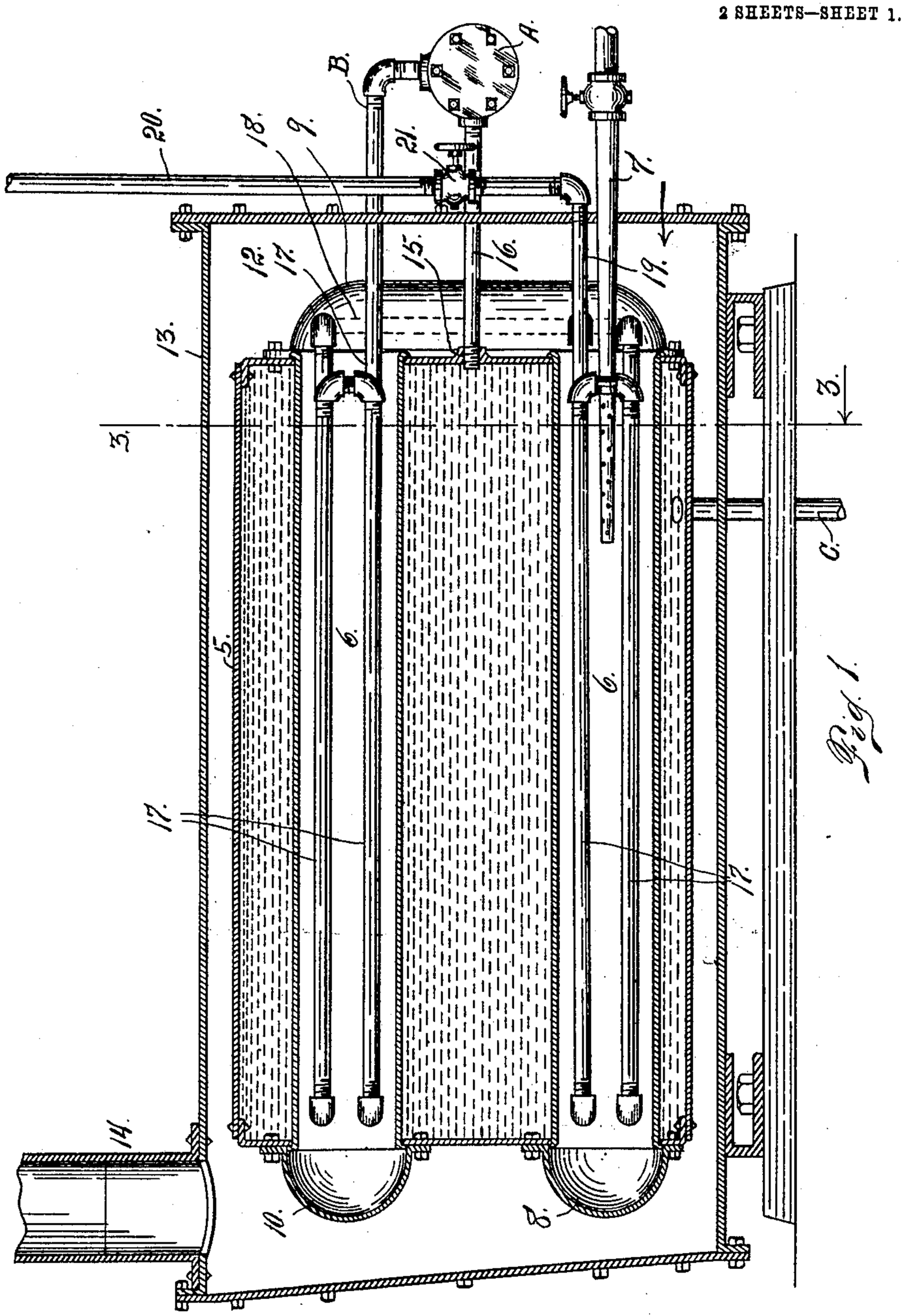

Fig. 1.

Witnesses

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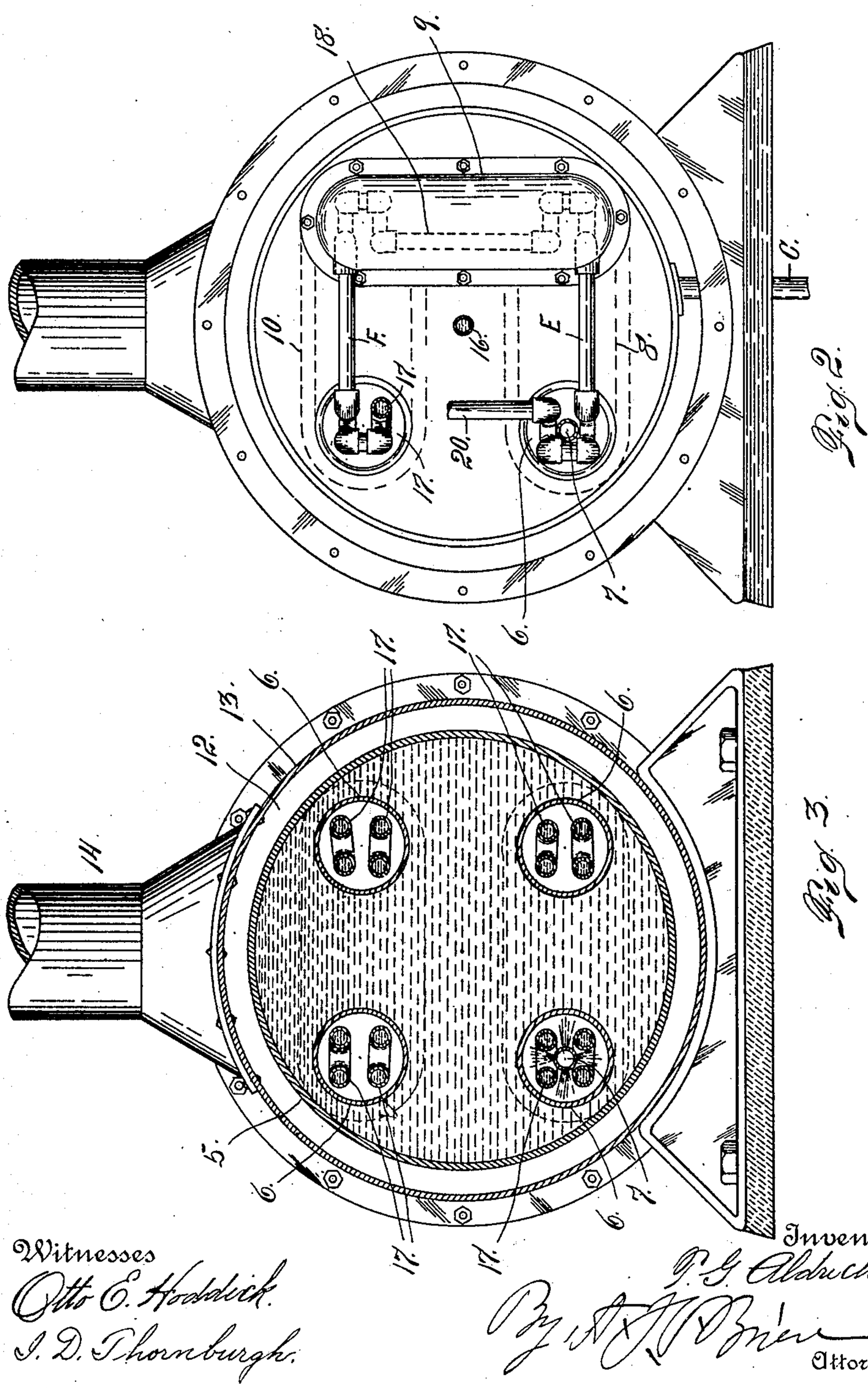

Fig. 2.

Fig. 3.

Witnesses

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STEAM-GENERATOR.

No. 913,249. Specification of Letters Patent. Patented Feb. 23, 1909.

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To all whom it may concern:

Be it known that I, TIMOTHY G. ALDRICH, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Steam-Generators; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in steam generators.

In my improved construction I employ a boiler provided with fire tubes and in these fire tubes are placed water pipes which may extend back and forth within the fire tubes, whereby a number of lengths of pipe are located in each tube, the latter being preferably formed relatively large. This water pipe is continuous through all the fire tubes of the boiler. One extremity is connected with the boiler which serves as a water tank or supply source for the water tube. The other extremity of the tube delivers the steam to the place where it is to be used. The water while following the course of the pipe through the fire tubes of the boiler, is vaporized or formed into steam before reaching the outlet extremity of the pipe. The fire tubes are connected at the opposite ends of the boiler to form a continuous conduit, whereby the heat or products of combustion are caused to travel the entire length of all the fire tubes, before escaping. The boiler or supply tank is incased and the discharge extremity of the fire tube or conduit, delivers the products of combustion into the boiler casing, at the extremity remote from the stack, whereby these products are compelled to travel forwardly around the boiler on their way to the stack, thus utilizing whatever is left of their heating capacity, in heating the water in the boiler.

By virtue of my improved construction the heat is brought into more direct contact with the water while passing through the relatively small pipes located in the fire tubes, than is possible in the ordinary fire tube boiler where the products of combustion simply pass through a relatively large number of small fire tubes, entering at one extremity of said tubes and escaping to the stack at the opposite extremity. In the latter form of construction much of the heat is lost by passing up the stack. In my improved construction the heat or products of combustion may be caused to follow the continuous fire tube (which may be of any desired length), until their heating energy is practically exhausted.

Having briefly outlined my improved construction, I will proceed to describe the same in detail reference being made to the accompanying drawing in which is illustrated an embodiment thereof.

In this drawing, Figure 1 is a vertical longitudinal section taken through my improved steam generator. Fig. 2 is an end view with the casing removed. This is a view looking in the direction of the arrow in Fig. 1. Fig. 3 is a cross section taken on the line 3—3 Fig. 1.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate a boiler which as shown in the drawing is provided with four relatively large fire tubes 6. As shown in the drawing, an oil burner 7 is used to supply the generator with fuel. The perforated extremity of this burner is introduced to the open inlet extremity of the fire tube conduit. The heat or products of combustion travel first through one of the lowermost lengths of the fire tube, thence through a horizontally disposed channel 8 which communicates at its opposite extremity with another fire tube length 6 and travels thence forwardly to the opposite extremity of the last named length, thence through a vertically disposed channel 9 leading to one of the upper fire tube lengths 6, and thence forwardly through the last named length of fire tube, and thence through a horizontally disposed channel 10 which carries the products of combustion to another upper length of fire tube 6 in which the products of combustion pass forwardly and are discharged at the forward extremity of the boiler into a chamber 12 formed by surrounding the boiler with a casing 13. This casing is sufficiently large to leave room for the products of combustion to pass from the forward extremity of the casing to the rear end thereof, the latter being in communication with the stack 14.

It will thus be seen that the various fire tube lengths of the boiler, by virtue of their connecting channels located at the extremi-

ties of the boiler, form a continuous fire tube conduit, into one extremity of which the heat or products of combustion are introduced, while these products of combustion are discharged at the opposite extremity into the casing. The length of this conduit or the number of fire tube lengths may be regulated as desired or as may be found necessary in order to utilize to the maximum degree the heat energy of the fuel.

The water to be generated into steam, is taken from the boiler at one extremity preferably at a central point, the boiler being provided with an opening 15 at its forward extremity to which a pipe section 16 is attached. This pipe section leads to a pump A from which a discharge pipe B leads to a pipe length 17 which passes through one of the upper fire tube lengths 6 a number of times. As shown in the drawing there are four lengths of the pipe 17 in each fire tube. After this pipe has been passed through one of the upper fire tubes 6 four times, it is connected by another pipe section F with a corresponding number of lengths of pipe 17 located in the other upper fire tube, after which it passes downwardly through a pipe section 18 (see dotted lines in Fig. 1), to the pipe lengths of one of the lower fire tube lengths and after passing through the latter the desired number of times, passes through a pipe section E to the pipe lengths of the other lower fire tube and finally escapes by a pipe extension 19 into a vertical pipe section 20 which delivers it to the location where it is to be utilized for power or heating purposes. It is evident that the water taken from the boiler through the action of the pump A is caused to circulate through the various pipe lengths 17 in all of the fire tubes 6, in which it is subjected to the action of the heat and products of combustion in a most advantageous manner, since the pipe through which it is passing is relatively small. This water finally escapes as steam into a pipe forming a continuation of the pipe lengths located in the fire tubes, the steam pipe being provided with a valve 21 whereby its escape is regulated.

As shown in the drawing it will be observed that the water following the pipe through the various fire tubes, travels in a direction opposite the travel of the products of combustion, that is to say the water following the pipe travels first through the upper fire tube lengths and then downwardly through the other fire tube lengths, escaping into the steam pipe at the rear extremity of the lower fire tube length where the oil burner is located. In other words the water following the pipe in which it is confined enters the fire tube conduit at the extremity where the products of combustion escape therefrom, the water in turn escaping from the fire tube conduit where the liquid fuel is introduced or where the products of combustion would enter assuming that an ordinary fire box were utilized for the purpose.

From the foregoing description the use and operation of my improved steam generator will be readily understood. The heat or products of combustion as shown in the drawing, enter one of the lower lengths of the fire tube and pass thence through all the fire tube lengths, traversing the end connecting channels as heretofore explained, and finally escape at the forward extremity of the chamber inclosed by the casing surrounding the boiler and pass thence to the rear extremity of the said chamber and thence out at the stack. The water passing from the boiler, is driven by the pump A through the pipe in which it is confined, first traversing the upper fire tubes and then the lower fire tubes, forwardly passing out as steam at the forward extremity of the fire tube length where the products of combustion enter.

It will be observed that during the vaporization of the water as heretofore explained, the water in the boiler is also heated to a certain extent so that when it enters the pipe in which the steam is generated, its temperature is still considerably above what may be termed normal.

The pump A is an important element in the mechanism since through its agency the water is taken from the boiler and forced through the various pipe lengths until it escapes from the pipe in the form of steam. By virtue of this pump any desired or necessary degree of pressure within the pipe section 17 may be obtained. The pipe lengths 17 virtually constitute the steam generator in my improved apparatus and by the use of the pump A my improved construction becomes a high pressure steam generator.

The tank or boiler 5 is provided with a pipe C for supplying water thereto (see Fig. 1).

Having thus described my invention, what I claim is:

1. In a steam generator, the combination of a boiler provided with relatively large fire tubes, channels connecting the fire tube lengths at the extremities of the boiler, thus forming the said lengths into a continuous conduit, means for introducing heat or products of combustion at one extremity of the conduit, while the opposite extremity of the latter is open for their escape, and a water pipe connected to be fed by the boiler and having a plurality of lengths in each fire tube, the said pipe being continuous whereby the water which enters at one extremity of the pipe, is vaporized while following the pipe through the fire tubes, and discharged as steam at its opposite extremity.

2. A steam generator, comprising a water-containing tank or boiler, relatively large fire tube lengths formed therein, the said

lengths being connected at their extremities to form a continuous conduit, means for introducing fuel or products of combustion under pressure at one extremity of the conduit and causing it to escape at the opposite extremity, a pipe communicating with the boiler or water tank at one extremity, and passing through the entire fire tube conduit, a number of lengths of the pipe being located in each conduit, the pipe length being such that the water is converted into steam by following the pipe through the various conduits of the water tank or boiler, substantially as described.

3. The combination of a water tank or boiler, a casing surrounding the same, the boiler having a number of relatively large fire tubes connected at their extremities to form a continuous conduit, means for introducing heat or products of combustion under pressure at the forward extremity of the said conduit and finally discharging it into the chamber surrounding the boiler at the same extremity thereof whereby it is caused to travel rearwardly around the boiler to the stack and a water pipe passing through said conduit whereby the water is heated and delivered as steam, the travel of the water being in the direction opposite the travel of the products of combustion, substantially as described.

4. A steam generator comprising a water tank or boiler having relatively large fire tubes connected at their extremities to form a continuous conduit, means for introducing heat or products of combustion at one extremity of the conduit and causing it to escape at the opposite extremity thereof, and a water pipe connected at one extremity with the boiler and passing through the various fire tubes whereby the water is heated and delivered as steam at the extremity of the conduit opposite that where it enters, the travel of the water being in the direction opposite the travel of the products of combustion, substantially as described.

5. A steam generator comprising a boiler having relatively large fire tubes, a pipe having a plurality of lengths located in each fire tube, the pipe lengths forming a continuous pipe through all of the fire tubes, and a force pump connected to take water from the boiler or tank and forcing it through the entire length of pipe, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

TIMOTHY G. ALDRICH.

Witnesses:
DENA NELSON,
JESSIE HOBART.