F. L. BENEDICT.

STEAM GENERATOR.

APPLICATION FILED APR. 6, 1912.

1,047,152.

Patented Dec. 17, 1912.

3 SHEETS—SHEET 1.

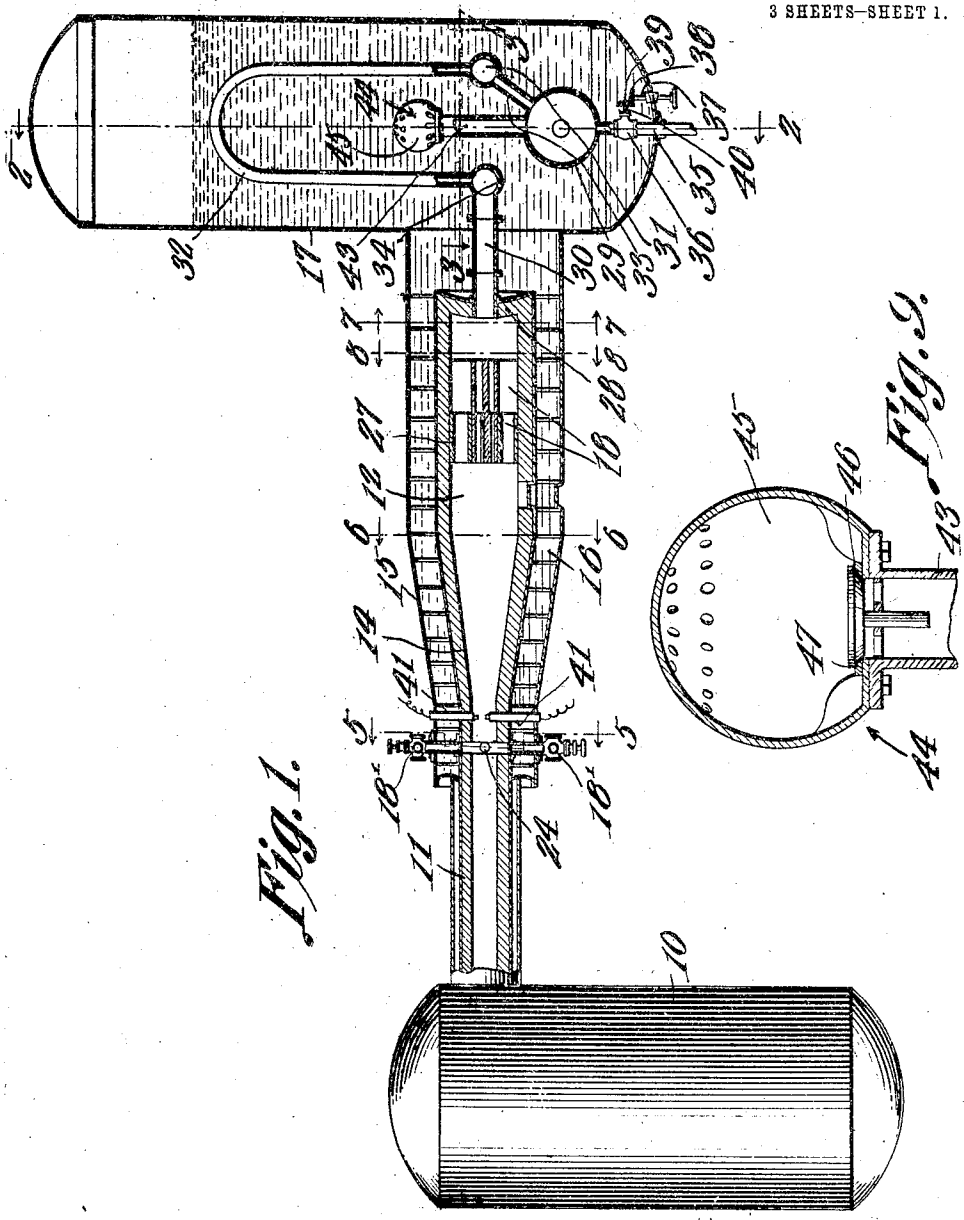

Fig. 1.

Fig. 2.

Witnesses

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3 SHEETS—SHEET 2.

Fig. 2.

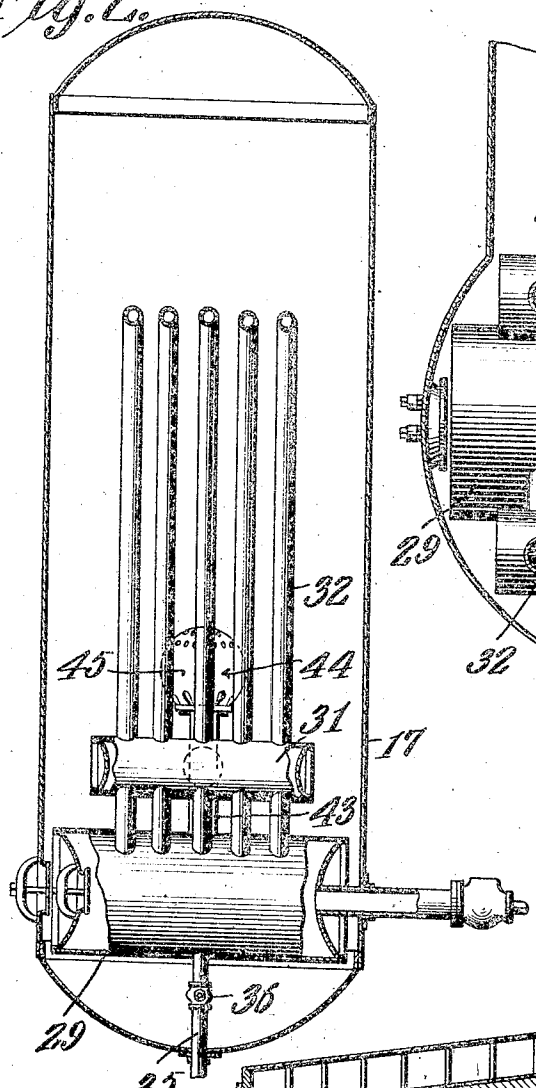


Fig. 3.

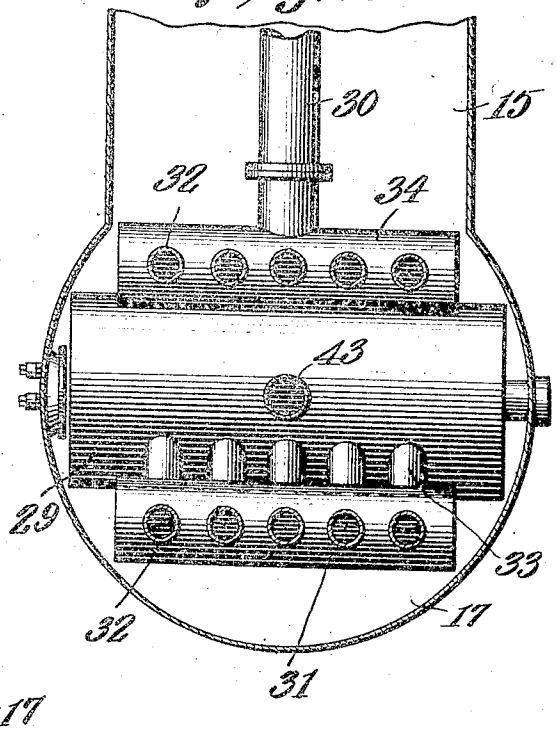
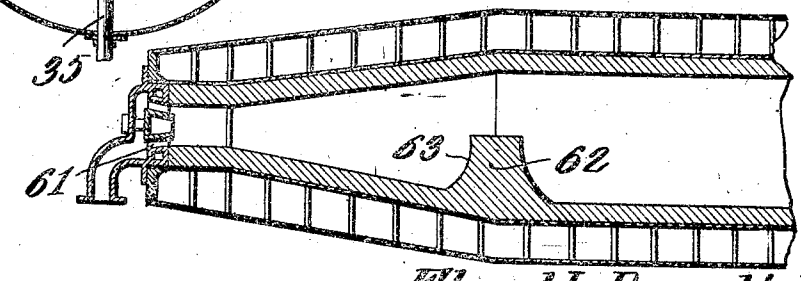


Fig. 4.



Witnesses

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3 SHEETS—SHEET 3.

Fig. 5

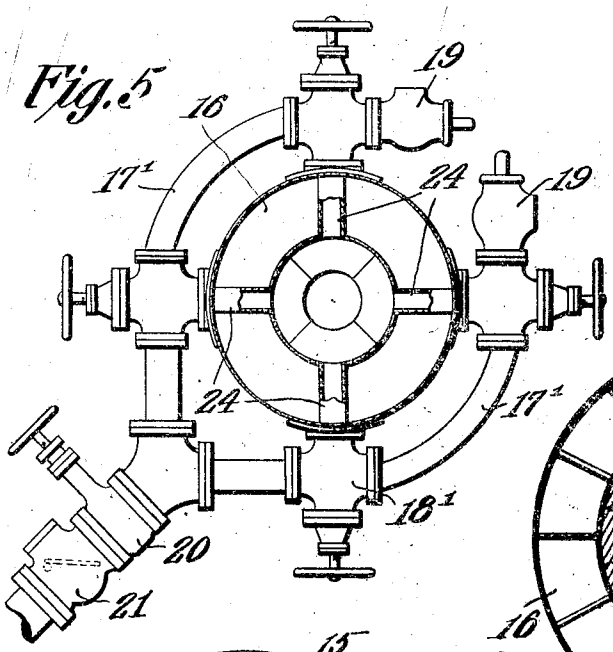


Fig. 6.

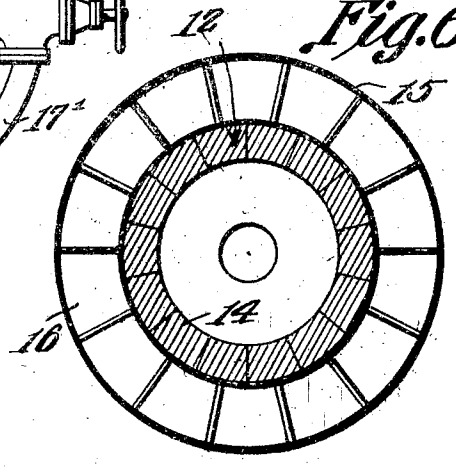


Fig. 8.

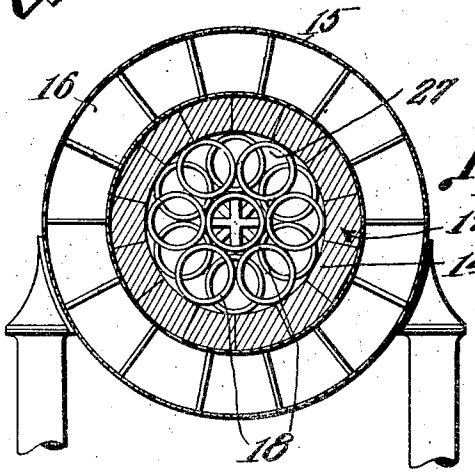
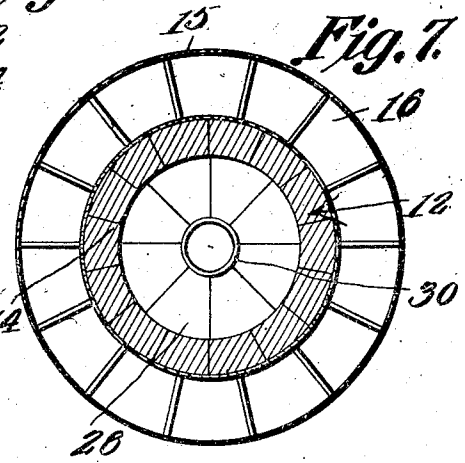


Fig. 7.



Witnesses

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UNITED STATES PATENT OFFICE.

FLOYD L. BENEDICT, OF SOUTH KNOXVILLE, TENNESSEE.

STEAM-GENERATOR.

1,047,152. Specification of Letters Patent. Patented Dec. 17, 1912.

Application filed April 6, 1912. Serial No. 688,902.

To all whom it may concern:

Be it known that I, FLOYD L. BENEDICT, a citizen of the United States, residing at South Knoxville, in the county of Knox and State of Tennessee, have invented a new and useful Steam-Generator, of which the following is a specification.

This invention relates to steam generators.

The primary object of the invention is to provide a generating apparatus in which the water from which the steam is generated is heated by ignited gases, the products of combustion passing through the water and commingling with the steam producing a dry permanent gas saturated with vapor of high specific and latent heat.

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of invention herein disclosed can be made within the scope of what is claimed without departing from the spirit of the invention.

In the drawings—Figure 1 is a longitudinal section of the preferred embodiment of the invention. Fig. 2 is a section on the line 2—2 of Fig. 1. Fig. 3 is a section on the line 3—3 of Fig. 1. Fig. 4 is a view showing a slightly modified form of furnace. Fig. 5 is a detail view of the steam or air injector. Fig. 6 is a section on the line 6—6 of Fig. 1. Fig. 7 is a section on the line 7—7 of Fig. 1. Fig. 8 is a section on the line 8—8 of Fig. 1, and Fig. 9 is a detail view of the valve which controls the passage of the products of combustion to the boiler.

In the drawings, 10 designates a gas generator which may be of any appropriate construction and which is connected by the jacketed pipe 11 to the furnace 12. The furnace 12 is lined with refractory non-combustible material 14. The gases which pass from the generator retain their heat as they pass through the pipe 11 into the furnace 12. The furnace is provided with the conical portion 15, said conical portion and the entire furnace being surrounded with a water jacket 16 which communicates with a boiler 17 in which the steam is generated, the furnace 12 being provided with a commingling grille 18.

The steam or air injector shown in detail in Fig. 5 is arranged at the entrance to the furnace, the said injector consisting of the feed pipe 17′ which surrounds the furnace and communicates with the same by means of valves 18′, spring pressed relief valves 19 being arranged at the ends of each of said pipes 17′, the steam or air admitted to said pipes being controlled by the valve 20 in the main supply pipe 21, a check valve being arranged in said pipe. The injector pipes 24 pass through the water jacket 16 and enter the furnace, the air or steam thus being introduced at the mouth of the same. The grille 18 which is disposed near the end wall of the furnace consists of tile pipes 27 which are disposed end to end as shown in Fig. 8, the pipes being so disposed that the opening in the first set of pipes do not exactly aline with the opening in the second set of pipes. It will be noted that this construction provides an efficient grille for breaking up the gases of combustion.

The end wall of the furnace is connected to the drum 34 by a pipe 30, said drum 34 being connected to a drum 31 by the curved pipes 32 which extend vertically within the boiler. The drum 31 is connected by a series of pipes 33 with the cylinder or drum 29 which is supported at either end by the boiler casing, a drain pipe 35 extending from the drum 29. This drain pipe is provided with a valve 36 which is controlled by the stem 37, the gear 38 on said stem meshing with a gear 39 arranged on the valve stem 40.

The gas is admitted through the pipe 11 retaining its heat of generation as it passes into the furnace, being supplied as it enters the furnace with the necessary amount of air or steam to complete combustion. As before stated, the furnace is lined with refractory non-combustible material which becomes heated to the high state of incandescence after the furnace is in operation. As the gases and air properly mixed, pass into the furnace the mass is ignited by the electric sparkers 41. It will be noted that this sparking of the gases will be unnecessary after the lining of the furnace has been sufficiently heated, the sparking being discontinued and the gases being ignited by the refractory material which is in a state of incandescence, the spark being merely utilized until the furnace is well heated. The ignited gases pass through the tile grille dis-

posed adjacent the end of the furnace and through the pipe 32 to the drum 34 disposed within the boiler 17. This passing of the gases through the grille and through the pipe 32 which constitutes the cooling coils and which connects the retort 34 with the retort 31 assuring a thorough mixture of the gases and oxygen under the most favorable conditions conducive to complete combustion, the combustion being practically completed before the gases leave the furnace. Thus it will be noted that complete combustion is possible without the slightest particle of residue, in the form of tars or solids, carbon or other combustible matter, the structure thus preventing smoke. The water contained within the jacket which surrounds the furnace and the water in the boiler 17 is heated by this passage of the gases and by the heating of the furnace through the explosion of the gases, steam rising in the boiler 16.

The products of combustion which pass through the cooling coils and descend to the drum 29 pass upward through the pipe 43. The coal tar and other residue passing out through the drain 35, the gas forcing the tar through the drain as the valve 30 is opened. The gas rises in the pipe 43 which is provided with a valve 44. This valve 44 consists of the spherical nozzle 45, the top of which is perforated. A valve 46 is arranged within said nozzle, said valve seating itself upon said valve seat 47 which surrounds the opening in the nozzle which communicates with the pipe 43, thus closing the pipe 43. When the pressure of the gas in the cylinder or retort 34 exceeds the pressure of the water within the boiler 17, the valve 46 will open and the gases will pass into the water, passing through the same and commingling with the steam, the resultant mixture being that of a dry permanent gas, saturated with vapor of high specific and latent heat, this mixture being more valuable in the conversion of heat energy to mechanical, than if the gases were expanded independently.

Attention is called to the peculiar arrangement of the air or steam injector, the relief valve 19 accurately regulating the pressure admitted to the furnace. While the structure shown in Fig. 1 has been found efficient, attention is called to the fact that various changes may be resorted to and the same result secured.

In the modified form shown in Fig. 4 the furnace is designed to receive oil, convert the same into gas, and ignite the gas thus formed to heat the water in the surrounding jackets. In this form the furnace is provided with a suitable oil spray 61, air being admitted in any convenient manner. Arranged within the furnace adjacent the oil inlet is a baffle wall 62, the oil being projected against the curved face 63 of said wall, this contact with the wall, breaking up the oil and commingled steam or air to form a perfect mixture. As before stated this form of the device differs from the preferred form only in the fact that the gas is produced in a different way.

What is claimed is:—

1. In a steam generator, a horizontally disposed combustion chamber having a tapered inlet end and a concentrically disposed outlet conduit, a water jacket surrounding the combustion chamber and its outlet conduit, a vertically disposed boiler in communication with the water jacket, the outer end of the outlet conduit being projected into the boiler, a heated gas admitting nozzle disposed concentrically of and within the lower end of the boiler, a valve in said nozzle for closure against exterior pressure, and a gas separating and sediment precipitating means mounted in the boiler and forming an intermediate communicating medium between the outlet conduit and the nozzle.

2. In a steam generator, a horizontally disposed combustion chamber having a tapered inlet end and a concentrically disposed outlet conduit, a water jacket surrounding the combustion chamber and the outlet conduit, a vertically disposed boiler in communication with the water jacket, the outer end of the outlet conduit being projected into the boiler, a heated-gas admitting nozzle disposed concentrically of and within the lower end of the boiler, a valve in said nozzle for closure against exterior pressure, a plurality of curved pipes in communication with the outlet conduit and having their curved portions extending above and down upon the opposite side of the nozzle, and a sediment precipitating and gas separating drum disposed in the lower end of the boiler and forming a communicating medium between the plurality of pipes and the nozzle.

3. In a steam generator, a horizontally disposed combustion chamber having a tapered inlet end and a concentrically disposed outlet conduit, a water jacket surrounding the combustion chamber and its outlet conduit, a vertically disposed boiler in communication with the water jacket, the outer end of the outlet conduit being projected into the boiler, a heated gas admitting nozzle disposed concentrically of and within the lower end of the boiler, a valve in said nozzle for closure against exterior pressure, a drum connected to the outer end of the outlet conduit and within the boiler, a plurality of curved pipes each in communication at one end to the drum with their other ends terminating on approximately the same horizontal line, the intermediate portion of the pipes being above the nozzle, and a sediment precipitating drum disposed

in the lower end of the boiler and forming a communicating medium between the plurality of pipes and the nozzle.

4. In a steam generator, a horizontally disposed combustion chamber having a tapered inlet and a concentrically disposed outlet conduit, a water jacket surrounding the combustion chamber and its outlet conduit, a vertically disposed boiler in communication with the water jacket, the outer end of the outlet conduit being projected into the boiler, a heated gas admitting nozzle disposed concentrically of and within the lower end of the boiler, a valve in said nozzle for closure against exterior pressure, a drum connected to the outer end of the outlet conduit and within the boiler, a plurality of curved pipes each in communication at one end to the drum with their other ends terminating on approximately the same horizontal line, the intermediate portion of the pipes being above the nozzle, another drum into which the plurality of pipes lead, and a sediment precipitating and gas separating drum interposed between the last drum and the nozzle.

5. The combination with a gas burning and supplying furnace, of a steam boiler including a surrounding casing, two transversely disposed drums mounted in the boiler, one of said drums being in communication with the furnace, a plurality of curved pipes having their respective ends connected to the drums, said pipes being disposed below the water line of the boiler, a plurality of short conduits leading from the last drum, an enlarged sediment precipitating and gas separating drum disposed in the lower portion of the boiler and in communication with the short conduits, a conduit disposed concentrically of the boiler and in communication with the last drum, the upper end of said conduit being straddled by the plurality of pipes, a nozzle mounted upon the upper end of the last conduit, and a valve mounted in the upper end of the last conduit within the nozzle for closure against exterior pressure.

6. The combination with a gas consuming furnace having a concentrically disposed outlet conduit, of a boiler and water jacket attachment therefor, comprising a shell surrounding the furnace and the outlet conduit thereof, and in communication with the main compartment of the boiler, the extreme end of the outlet conduit of the furnace being projected within the boiler, and means disposed within the boiler and in communication with the outlet conduit for introducing the burnt gas under pressure into and through the body of water within the boiler and for precipitating the aqueous portion of the gas.

7. The combination with a gas consuming furnace having a concentrically disposed outlet conduit, of a boiler and water jacket attachment therefor, comprising a shell surrounding the furnace and the outlet conduit thereof, and in communication with the main compartment of the boiler, the extreme end of the outlet conduit of the furnace being projected within the boiler, means disposed within the boiler and in communication with the outlet conduit for introducing the burnt gas under pressure into and through the body of water within the boiler and for precipitating the aqueous portion of the gas, and means for withdrawing such precipitated aqueous portion of the gas from the precipitating means.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

FLOYD L. BENEDICT.

Witnesses:
M. P. HENDERLIGHT,
P. M. ARTHUR.