Jan. 12, 1932. T. VUIA ET AL 1,841,230

STEAM GENERATOR

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Fig. 1

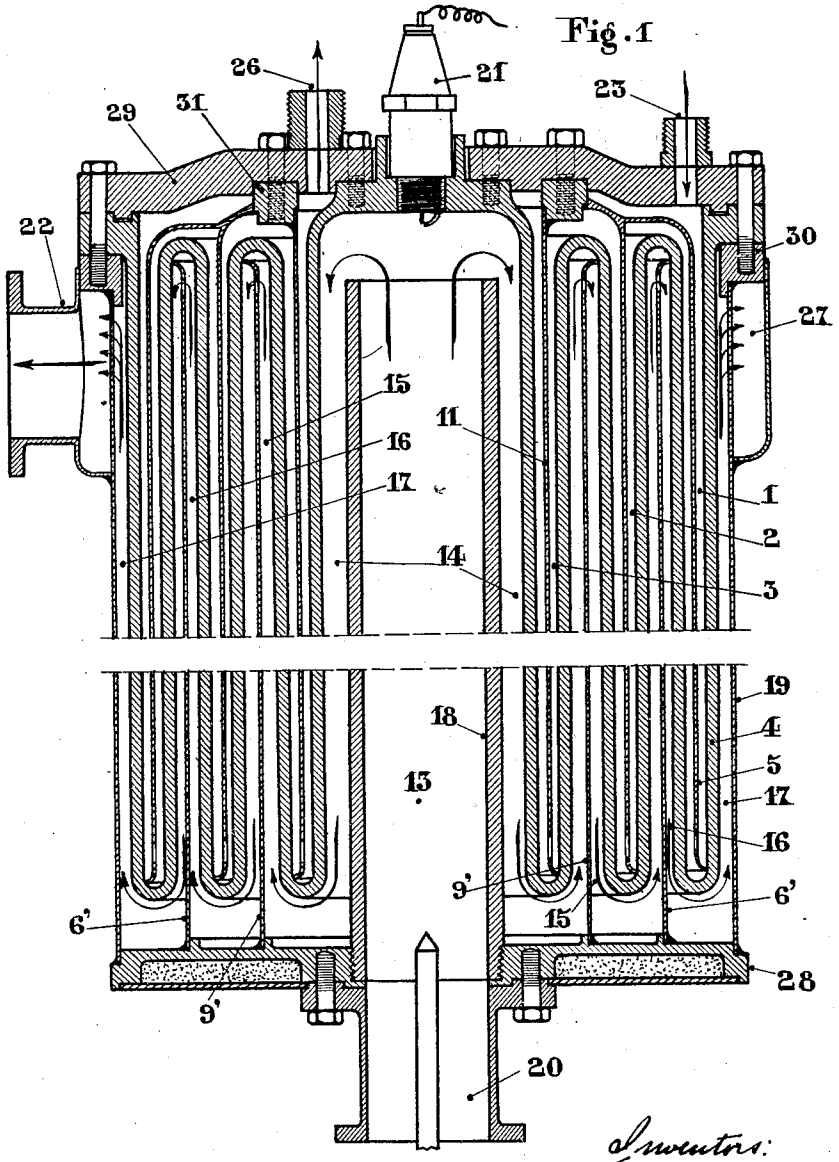

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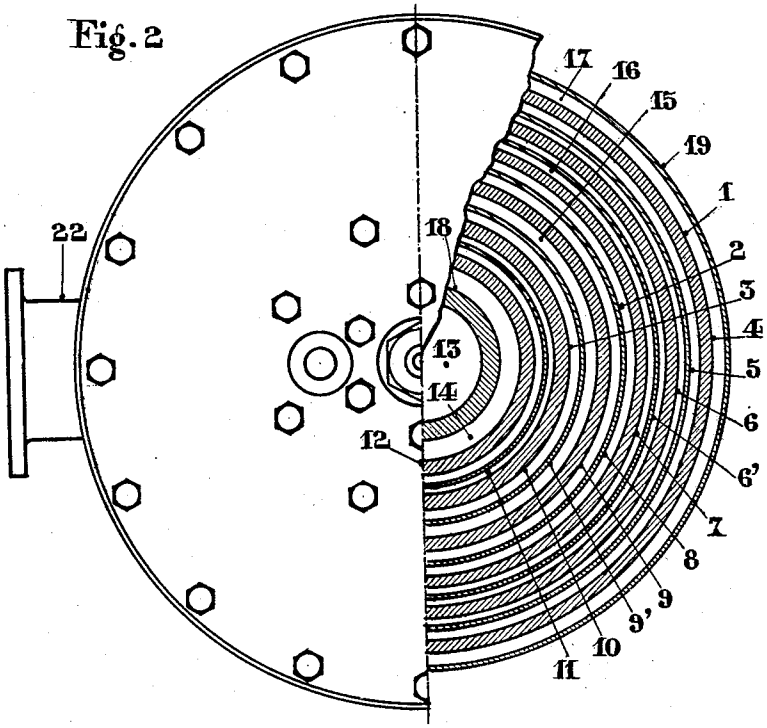
Fig. 2



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Jan. 12, 1932. T. VUIA ET AL 1,841,230

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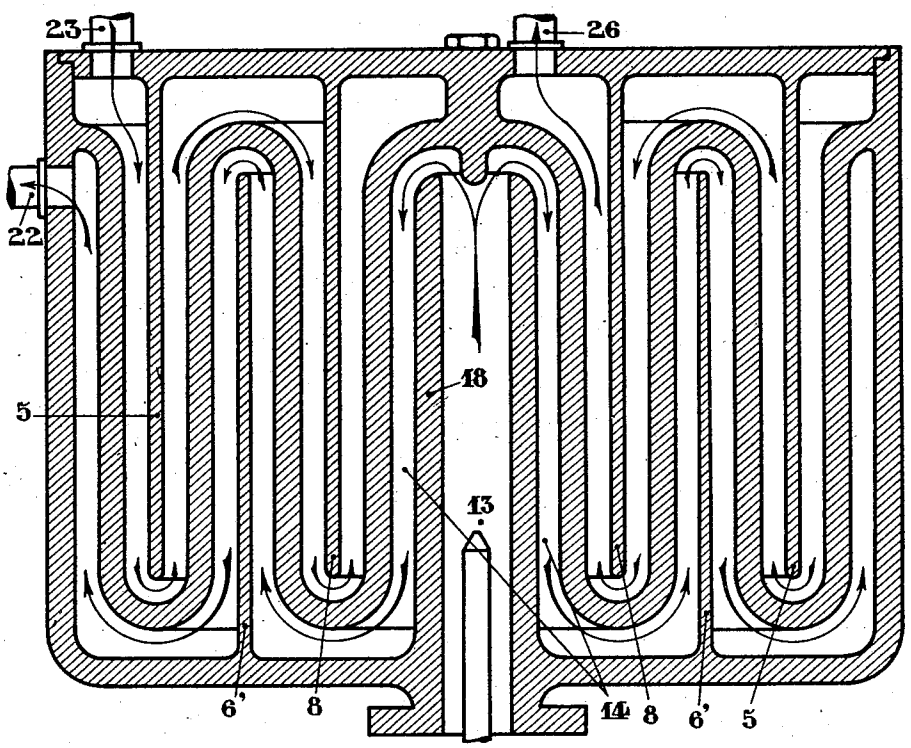
Fig. 3



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Jan. 12, 1932. T. VUIA ET AL 1,841,230

STEAM GENERATOR

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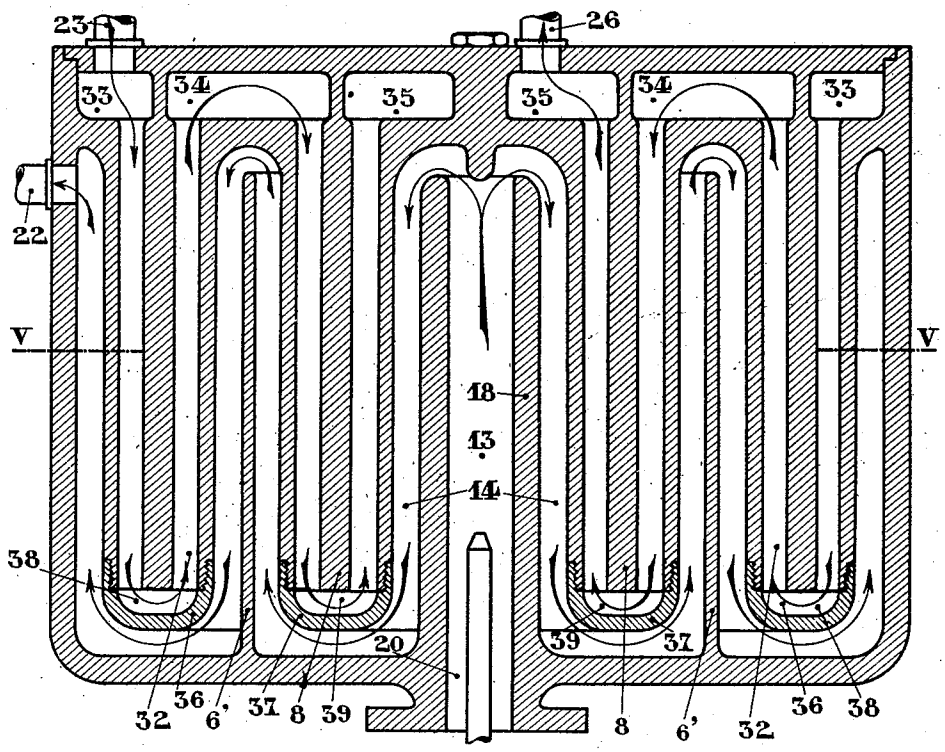
Fig. 4



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Jan. 12, 1932. T. VUIA ET AL 1,841,230

STEAM GENERATOR

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Fig. 5

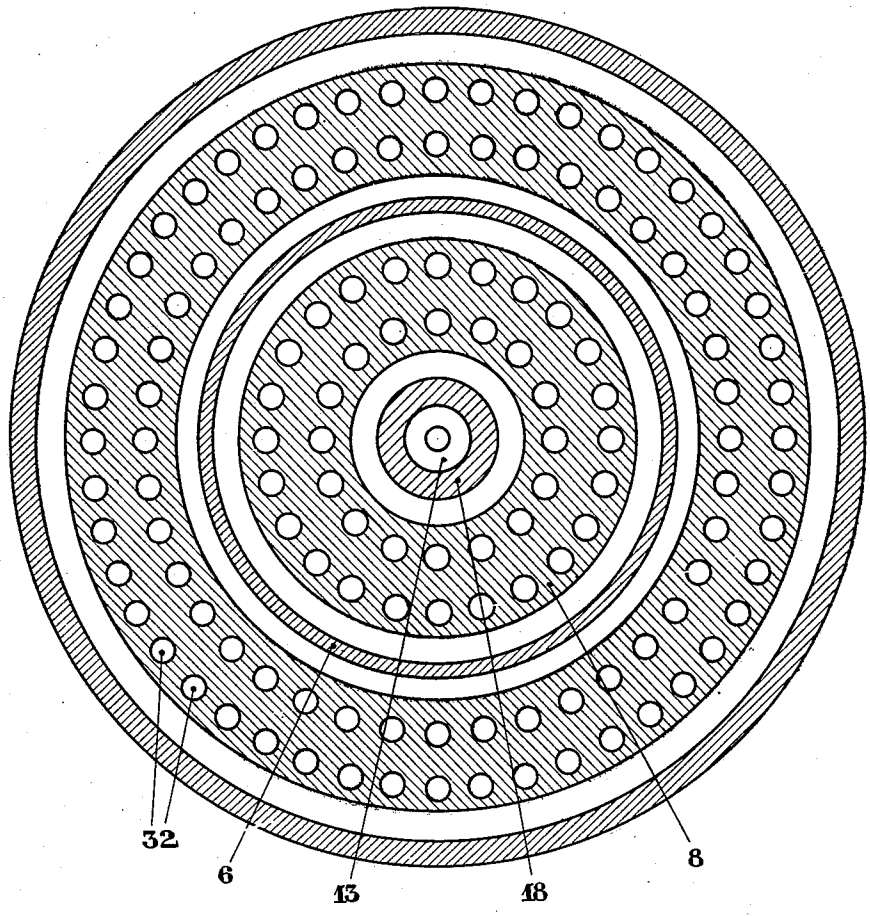

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Fig. 6

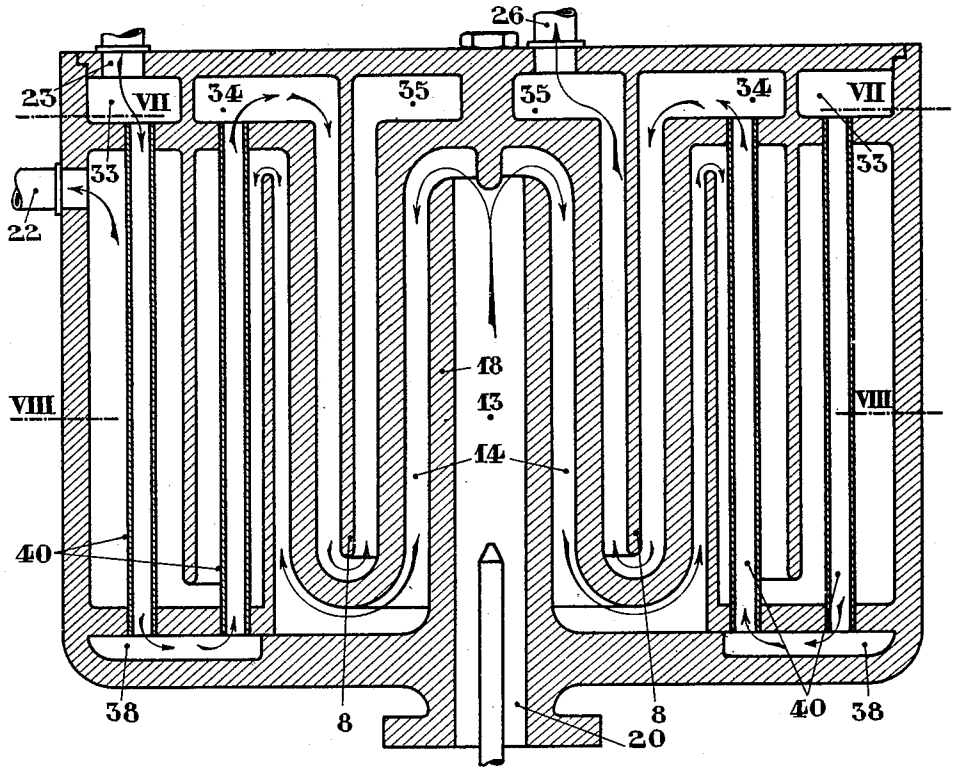

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Fig. 7

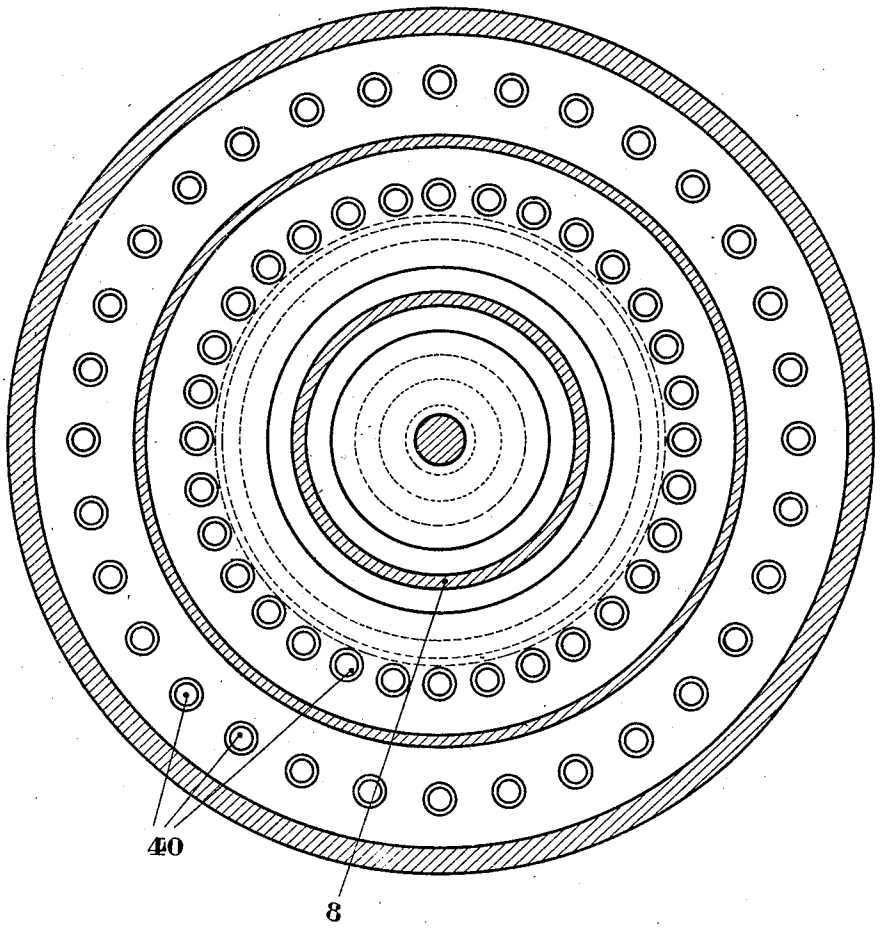

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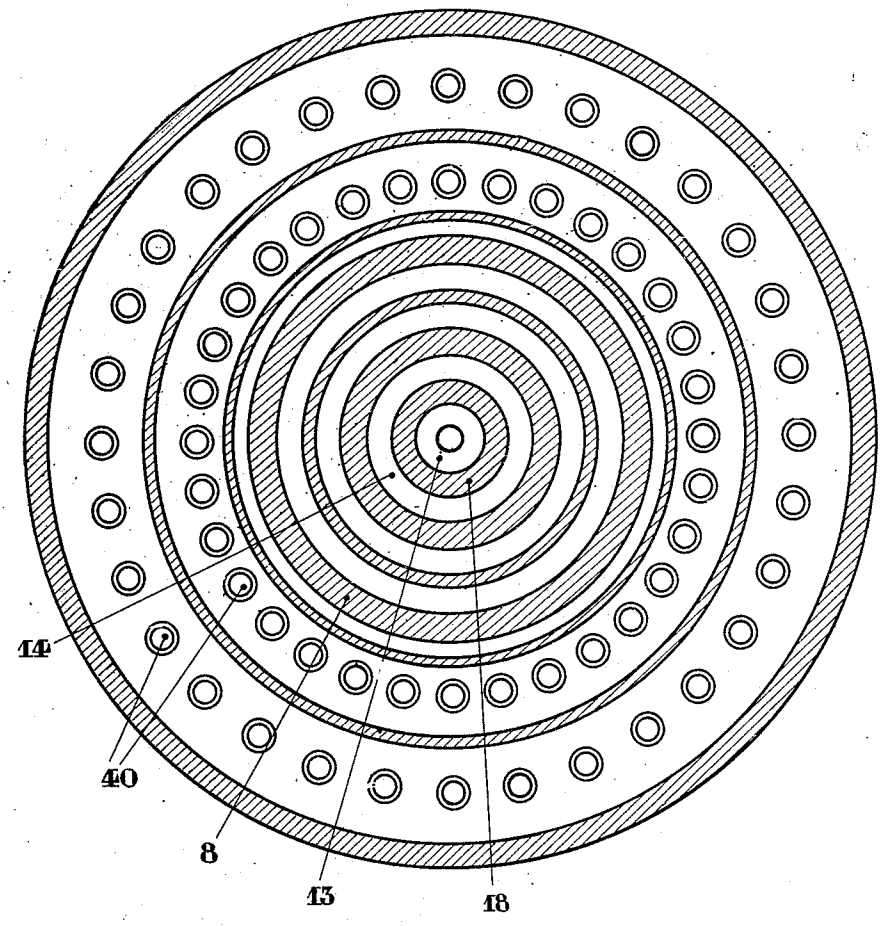
Fig. 8



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Patented Jan. 12, 1932 1,841,230

UNITED STATES PATENT OFFICE

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STEAM GENERATOR

Application filed January 18, 1929, Serial No. 333,273, and in France January 21, 1928.

This invention relates to improvements to very high-pressure superheated steam generators of the type comprising a central ignition chamber around which are arranged concentrically a plurality of annular combustion chambers, said chambers alternating with rooms in which water and steam circulate.

The improvements consist in the main in multiplying the heat exchanging surfaces by partitioning the rooms for circulation of the fluids this increase being obtained within the smaller space and with the smallest weight.

According to this invention, partitions are inserted in the middle of each of said rooms of whatever kind, said partitions forcing the circulating fluid to pass twice in the vertical direction (downwards and upwards or vice-versa).

Another feature of the invention consists in providing the cover of the central combustion chamber with a sparking plug, opposite to the burner and at the point where the burning gases issue from the ignition chamber to circulate in the concentric combustion chambers. On account of the speed of streams of the circulating burning gases, a zone of depression arises in which the temperature is the lowest. The sparking plug placed near this zone is therefore not exposed to deterioration.

This improved generator presents furthermore following features:

1. The annular concentric rooms consist of annular cavities hollowed by any suitable means, but preferably by means of tubular cutters of suitable diameters, in a piece of steel which forms the body of the generator. These annular rooms may however be made also of welded tubes.

2. The cylindrical body forming the central combustion chamber is made of a metal resisting perfectly to high temperatures preferably of nickel-chrome steel, this cylindrical body acts as an heat regulator.

By the combination of these two means, an apparatus is obtained absolutely tight and resisting perfectly to high pressures and high temperatures.

In the accompanying drawings several embodiments of this invention have been shown diagrammatically by way of examples.

Figure 1 is a longitudinal section through an embodiment of the improved steam generator;

Figure 2 is an end view of the same with partial cross section;

Figures 3, 4 and 6 are diagrammatic views of three different embodiments;

Figure 5 is a section taken along line V—V of Figure 4;

Figures 7 and 8 are sections taken along lines VII—VII and VIII—VIII of Figure 6.

As shown on Figures 1 and 2, this steam generator consists of a plurality (three in this example) of annular rooms 1, 2 and 3 in which circulate water and steam (said rooms being limited by the circular walls 4—6, 7—9 and 10—12) of a suitable number of annular combustion chambers (four in the example illustrated) 14, 15, 16 and 17, of a gas collector 27 and of a central ignition chamber 13.

The annular rooms 1, 2 and 3 on one hand and the chambers 14, 15, 16 and 17 in the other hand consist, according to this invention, of cavities with suitable cross-section cut in a steel block forming the body of the generator proper.

This cutting is carried out preferably by means of tubular cutters of suitable diameter.

In order to reduce the thickness of the circulating water sheet, the water rooms 1, 2 and 3 are divided respectively by partitions 5, 8 and 11 in two compartments communicating with one another only by one of their ends. In the embodiment shown in the drawings, these partitions 5, 8 and 11, are formed by concentrical, cylindrical tubes welded to a ring 31 attached by any suitable means to the cover 29 of the apparatus.

The combustion and gas circulation chambers are also divided in two compartments by suitable partitions 6′ and 9′ which are welded to the bottom 28 of the generator.

On account of these compartments in the annular combustion chambers, the path of the hot gases through the generator is considerably increased which results in an in-

crease of the heat transmission coefficient to the circulating water sheet. As, on the other hand, the thickness of this sheet is reduced by a similar division in compartments of the annular water rooms 1, 2 and 3, the production of steam is practically instantaneous in this steam generator. Experience has shown that the ratio of evaporation per square meter of heating surface and per hour is five to ten times greater with this steam generator than with the ordinary boilers.

The central ignition chamber 13 consists of a cylindrical tube 18 screwed in the bottom 28 and made of a heat resisting metal, preferably of nickel-chrome steel. The other end of this tube is at some distance of the sparking plug which ignites the mixture of air and fuel only when starting.

The body of the apparatus is clad with an exterior housing 19 provided with a ring 30 attached by means of bolts to the cover 29.

The above described generator operates as follows:

The fuel fed into the generator may be a mixture of air and liquid or solid fuel. Gaseous fuel from a gas producer, or from the combustion of coal on a grate with air blast, located under the central chamber may also be used. This mixture of air and fuel is blown at 20 into the central ignition chamber 13 where it is ignited when starting either by means of the sprak plug 21 or by any other suitable means.

The combustion takes place in the annular chambers 14, 15, 16 and 17 and the gases escape at 22 after having passed through the collector 27. The wall 18 of the central chamber raised thus at a very high temperature acts as a heat accumulator and insures complete combustion at the center of chamber 13. The water to be evaporated is fed under pressure at 23 into the outer compartment of the annular room 1. It passes through the inner annular compartment of said room to enter the annular outer compartment of the water room 2. After having passed through the inner annular compartment of said room, the water enters the inner annular compartment of the water room 3. It then enters the inner compartment of this room and leaves the steam generator at 26 as superheated steam.

The circulation of the hot gases is identical with that of the water, but in the reverse direction of the water to be evaporated, and it has the advantage that a mean temperature is established in each of the annular compartments of the steam generator considered. The coldest water circulates thus in the annular room 1 next to the periphery; the coldest gases circulate likewise in the annular gas chamber 17 which acts as a casing for said water room.

In other words in this steam generator the temeprature of the water to be evaporated rises gradually as it passes from the periphery to the center while the gases coming from the central chamber cool down successively in the chambers 15, 16 and 17 transmitting thereby their heat to the circulating water sheets.

Another special feature of the steam generator considered is the arrangement of the spark plug 21 on the top of the central portion of the generator body and in registry with the center line of the cylindrical tube 18 which acts as central igniting chamber. This arrangement of the sparking plug is capital for its preservation as the temperature in the central ignition room is very high (up to 1700° C.) and the end of the plug exposed to such temperature might melt quickly.

According to this invention this is avoided by locating the end of the spark plug at a small distance of the upper end of the tube 18 and in registry with its axis i. e. in a spot where, on account of the rapid circulation of the heating gases a depression arises. The hot gases when passing from the central chamber 13 to the combustion chamber 14 have a tendency to deflect towards the lower end of the cylindrical tube 18 creating thereby in the center of the outlet of said tube a zone in which on account of above mentioned depression the temperature remains within limits which permit the preservation of the sparking plug.

The embodiment of the steam generator just described is disclosed only by way of example; it is subject to alterations in its details without departing from the scope of this invention.

The steam and water circulating rooms may consist of a series of annular rooms the walls of which have a diametral section in form of a coil (Fig. 3) or by a series of cylindrical perforations 32 (Figs. 4 and 5) connected at their upper ends by means of annular rooms 33, 34 and 35 and at the bottom by the annular rooms 38 and 39 (closed by means of annular caps which may be screwed or welded thereto); the latter rooms may be substituted by elbows connecting two by two the perforations belonging respectively to two circular concentric series. These perforations may as a whole affect in diametrical section the form of a coil (Fig. 4).

The water and steam circulating rooms may also be formed by a combination of annular chambers (shown on Fig. 3) with the vertical conduits system (shown on Fig. 4). This combination is shown on Figures 6, 7 and 8. In the latter embodiment, the conduits for the circulation of water and steam are formed by tubes 40 connected at the top with the same annular rooms 33—34 as in the embodiment shown on Figs. 4 and 5 and connected at their lower end by the annular room 38.

What we claim is:

A steam generator of the type referred to comprising in combination a central ignition chamber, heating means placed in said chamber, a plurality of annular combustion chambers arranged concentrically around said ignition chamber, a plurality of circulation rooms for water and steam alternating with the combustion chambers, partitions positioned in each of said annular chambers and circulation rooms so as to force the combustion gases, water and steam to pass twice through each of the annular chambers and circulation rooms respectively, said annular chambers and circulation rooms having their inlets and outlets positioned so that the direction of circulation of the combustion gases is the reverse of that of water and steam.

In testimony whereof we have signed our names to this specification.

TRAJAN VUIA.
EMMANUEL YVONNEAU.