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PATENT SPECIFICATION

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Complete Specification Accepted: Nov. 20, 1930.

COMPLETE SPECIFICATION.

Improvements in or relating to Steam Generators.

We, TRAJAN VUIA, of 7, rue de Toulon, Garches (Seine-et-Oise), France, and EMMANUEL YVONNEAU, of 35, Avenue du Parc Montsouris, Paris, France, both citizens of the French Republic, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to steam generators and has for its object to provide improvements in high pressure superheated steam generators of the type comprising a central ignition chamber around which are arranged concentrically a plurality of annular combustion chambers, these annular combustion chambers alternating with water and steam circulation compartments.

It has previously been proposed to construct a steam generator in which the boiler was to consist of a hollow cylindrical element of elongated **U**-section and divided internally by partitions and the two surfaces of this boiler element were to be heated by contact with combustible gases admitted at the base.

According to the present invention a steam generator of the type specified above comprises a central combustion chamber surrounded by a number of concentric annular chambers alternating with water and steam circulation compartments, wherein the annular chambers or compartments are divided by partitions which cause the circulating fluid or fluids to flow through each divided chamber or compartment twice in the vertical direction (from top to bottom and bottom to top or vice versa).

A further characteristic feature of the invention consists in arranging a sparking plug on the cover of the central combustion chamber opposite to the burner and at the point where the combustion gases leave the ignition chamber to circulate in the concentric combustion chambers. Owing to the speed of the jets of ignited gas in circulation there is in fact produced at this point a partial vacuum zone in which the temperature is lower; the plug arranged adjacent this zone does not therefore run the risk of deterioration.

The improved generator according to the invention also possesses the following characteristic features:—

1. The annular concentric chambers or compartments are formed by chambers of annular cross section hollowed out, preferably by tubular cutters, of a block of steel which forms the body of the generator; these annular chambers may also be formed by welded tubes.

2. The cylindrical body forming the central combustion chamber is made of a metal capable of resisting very high temperatures, preferably chrome-nickel steel; this cylindrical body thus constitutes a heat accumulator.

Owing to the adoption of these two means an apparatus is obtained which is absolutely tight and capable of resisting high pressures and temperatures.

In the accompanying drawing there is shown diagrammatically and by way of example a number of embodiments of the invention.

Fig. 1 is a longitudinal section of an embodiment of the improved generator.

Fig. 2 is an end view partly in cross section.

Figs. 3, 4 and 6 are diagrammatic views of three modifications.

Fig. 5 is a section on the line V—V of Fig. 4.

Figs. 7 and 8 are sections on the lines VII—VII and VIII—VIII of Fig. 6.

As shown in Figs. 1 and 2, the generator consists of three annular water circulation and vaporisation chambers 1, 2 and 3, which are arranged respectively between annular concentric compartments 4—6, 7—9 and 10—12, of four annular combustion chambers 14, 15, 16 and 17, a gas manifold 27 and a central ignition chamber 13.

The annular chambers 1, 2 and 3 on the one hand and 14, 15, 16 and 17 on the other hand, in accordance with the invention are formed by recesses of suitable section hollowed out of a block of steel which forms the body of the generator proper.

This hollowing operation is preferably effected by means of tubular cutters.

In order to reduce the thickness of the stream of water in circulation, the water chambers 1, 2 and 3 are each divided by partitions 5, 8 and 11 respectively, into two compartments which only communicate with each other at one end. In the embodiment shown in the drawing, these partitions 5, 8 and 11 are formed by concentric cylindrical tubes welded to a ring 31 secured by fixing devices to the cover 29 of the apparatus.

The combustion gas circulation chambers 15 and 16 are also divided into two compartments by partitions 6^1 and 9^1 welded to the bottom 28 of the generator.

Owing to this partitioning of the annular combustion chambers, the path traversed by the hot gases through the generator is considerably increased, this resulting in an increase in the transmission co-efficient of the heat to the jet of water in circulation. As moreover, the thickness of this jet of water is reduced by the partitioning of the annular water chambers 1, 2 and 3, there is obtained in the generator in question a practically instantaneous production of steam. Experience has, in fact, proved that in the generator according to the present invention, the rate of vaporisation per square meter of heating surface per hour is five to six times greater than that of ordinary boilers.

The central ignition chamber 13 is formed by a cylindrical tube 18 screwed into the bottom 28 of the generator and made of a metal capable of resisting high temperatures, preferably chrome-nickel steel. The upper end of this tube is located at a certain distance from a sparking plug 21 which ignites the mixture of air and fuel only when starting up.

The body of the apparatus is housed in an outer jacket 19 provided with a ring 30 which is assembled by means of bolts to the cover 29.

The mode of operation of the generator described above is as follows:—

The fuel with which the generator is fed may be a mixture of air and liquid or solid fuel; it may also be possible to consider using a porous fuel emanating from a gas-producer or from the combustion of coal on a forced-draught grate disposed under the central chamber. This mixture of air and fuel is injected at 20 into the central ignition chamber 13 where it is ignited on starting up, either by the sparking plug 21 or by other means.

The combustion takes place in the annular chambers 14, 15, 16 and 17 and the gases leave at 22 after having passed through the manifold 27. The wall 18 of the central chamber which is thus raised to a very high temperature, acts as a heat accumulator and maintains the complete combustion in the centre of the chamber 13. The water to be vaporised is injected at 23 into the outer compartment of the annular chamber 1; it passes through the inner annular compartment of this chamber to penetrate into the outer annular compartment of the water chamber 2, when, after having traversed the inner annular compartment of this chamber it passes into the inner annular chamber of the water chamber 3; it then passes into the inner compartment of this chamber, leaving the generator at 26 in the form of superheated steam.

Owing to the fact that the circulation of the hot gases is identical with but in opposite direction to that of the water to be vaporised, the resultant advantage is that a mean temperature per annular compartment is set up in the generator in question. The water at the lowest temperature thus circulates in the annular chamber 1 which is the nearest to the periphery; in like manner the coolest gases circulate in the annular gas chamber 17 which serves as a jacket for the water chamber referred to above.

In other words, in the generator according to the present invention, the temperature of the water to be vaporised rises progressively as it passes from the periphery towards the centre, whereas the gases emanating from the central chamber gradually cool in the successive chambers 15, 16 and 17 whilst transmitting their heat to the streams of circulating water.

A further characteristic feature of the generator in question consists in mounting the sparking plug 21 in the top of the central part of the generator body, and in the prolongation of the axis of the cylindrical tube 18 which forms the central ignition chamber. This arrangement of the sparking plug is an extremely important factor in its preservation. It is, in fact, necessary to consider that the temperature prevailing in the central ignition chamber is very high (the combustion temperature may for example be brought up to 1700° C.) and that the point of the plug exposed to such a temperature would incur the risk of melting rapidly.

According to the invention, this drawback is avoided by placing the sparking plug at a short distance from the upper end of the tube 18 and in the prolongation of its axis, i.e. at a point where, owing to the rapid circulation of the combustion gases, a partial vacuum zone is formed. In fact during their passage from the central chamber 13 to the combustion chamber 14, the hot gases tend to deviate towards the lower end of the

cylindrical tube 18 creating in the centre of the outlet orifice of this tube a zone in which, owing to the partial vacuum referred to above, the temperature is maintained within the limits compatible with the preservation of the sparking plug.

The embodiment of the generator which has just been described is only given by way of example; it may undergo modifications of detail without thereby exceeding

mounted on the cover of the central combustion chamber, opposite to the burner and at the point at which the ignited gases leave the ignition chamber to circulate in the concentric combustion chambers.

3. A steam generator according to claim 1 wherein the concentric annular chambers or compartments consist of recesses of annular section formed by welded tubes or hollowed out [illegible]

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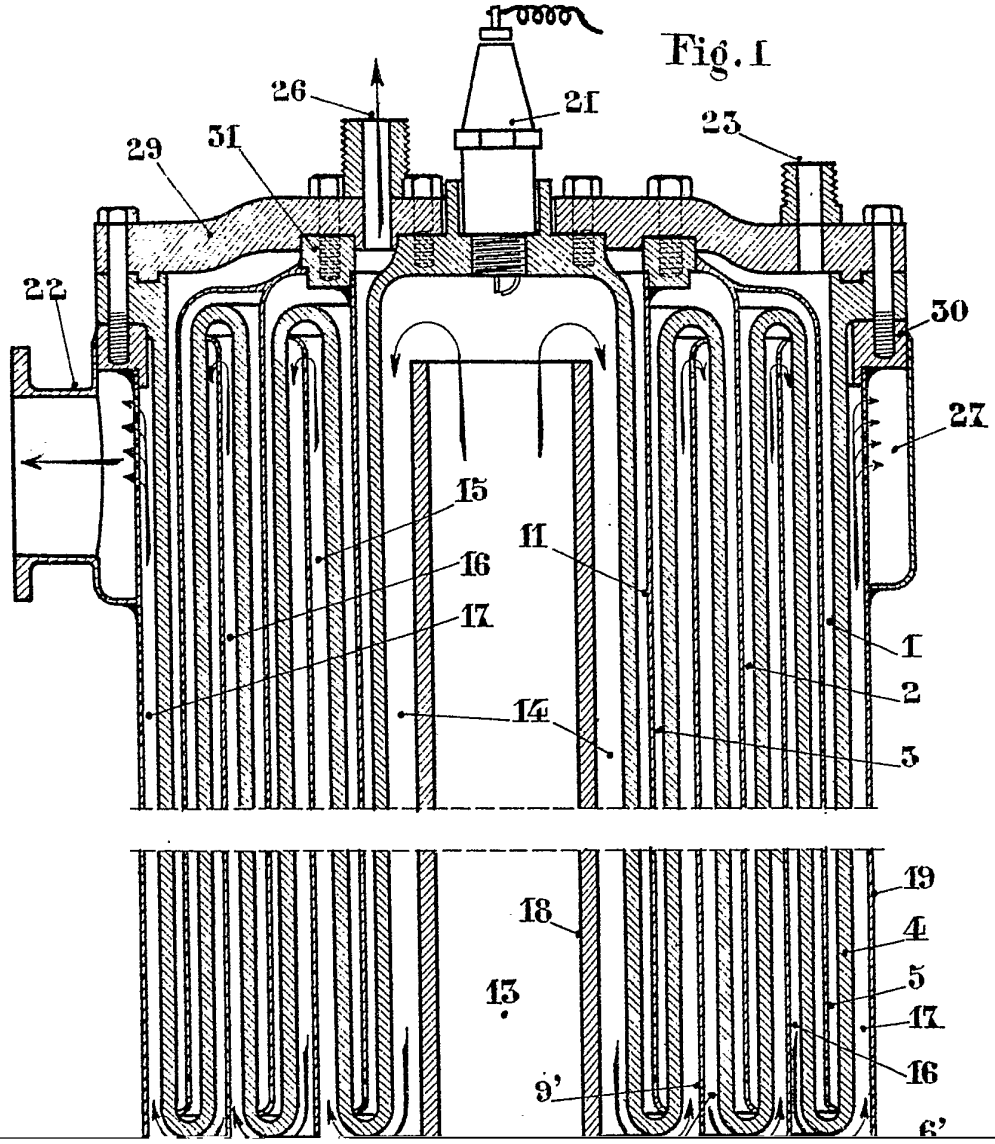
Fig. 1



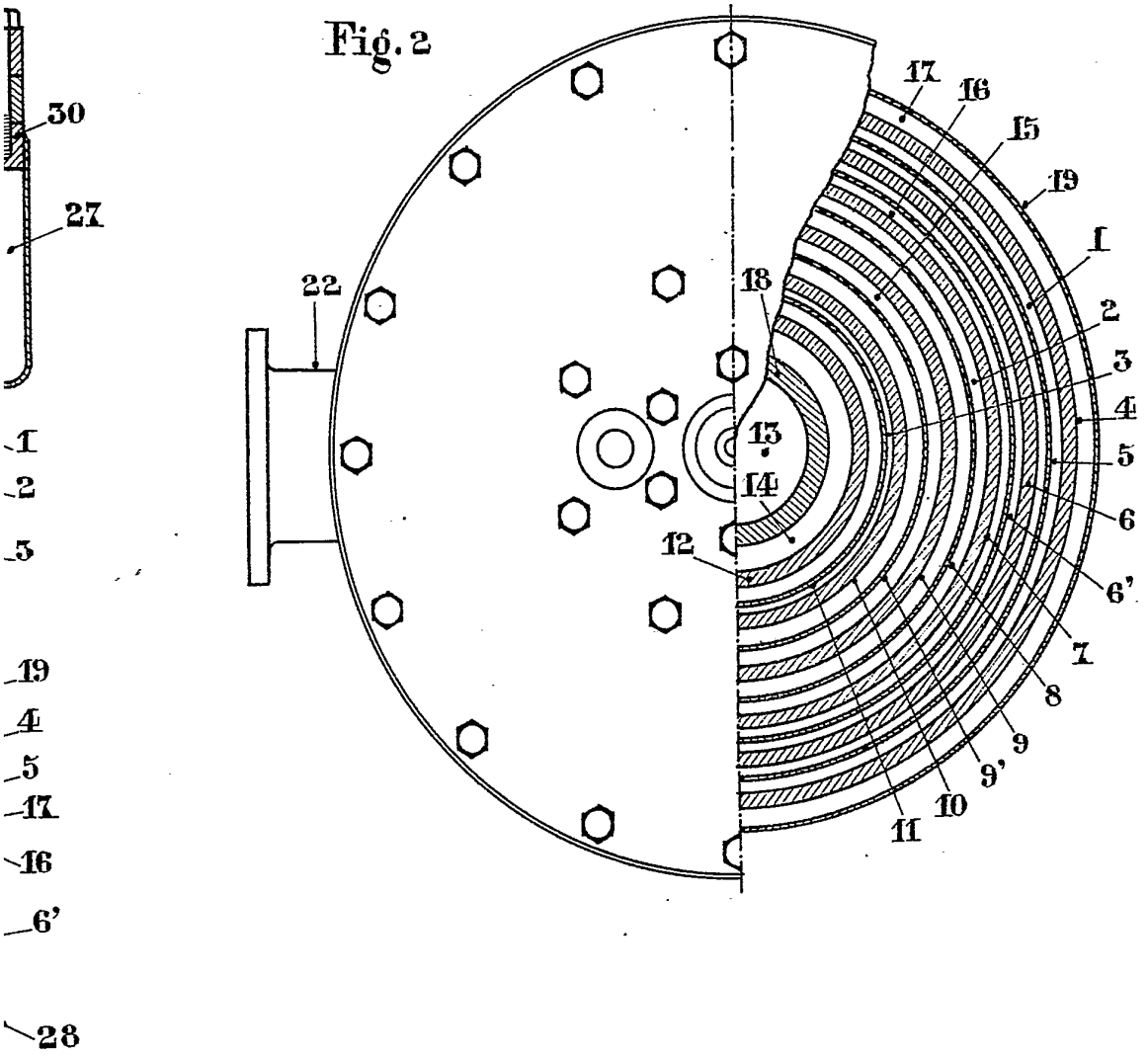


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Fig. 1

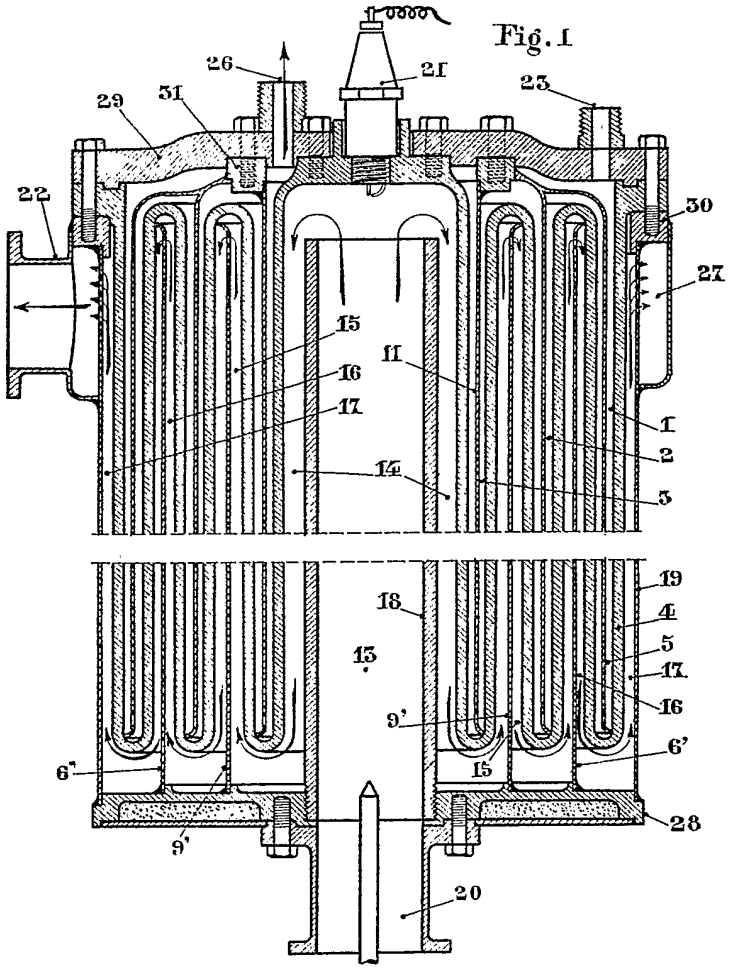

Fig. 2

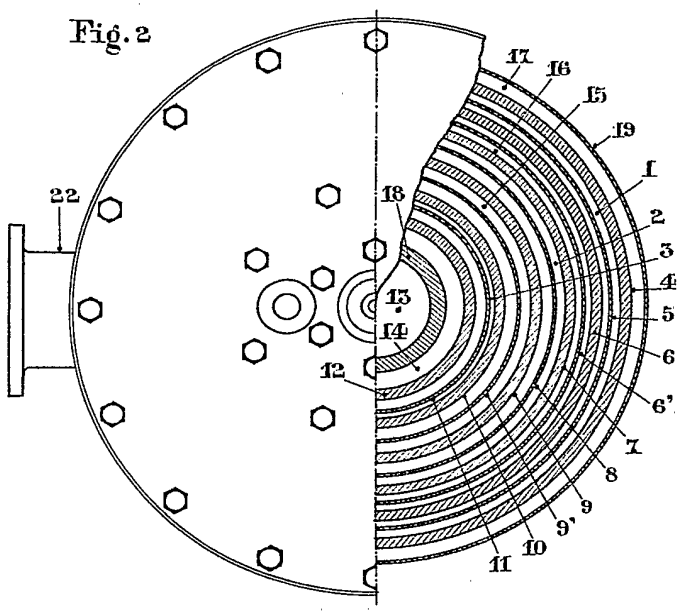

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Fig. 3

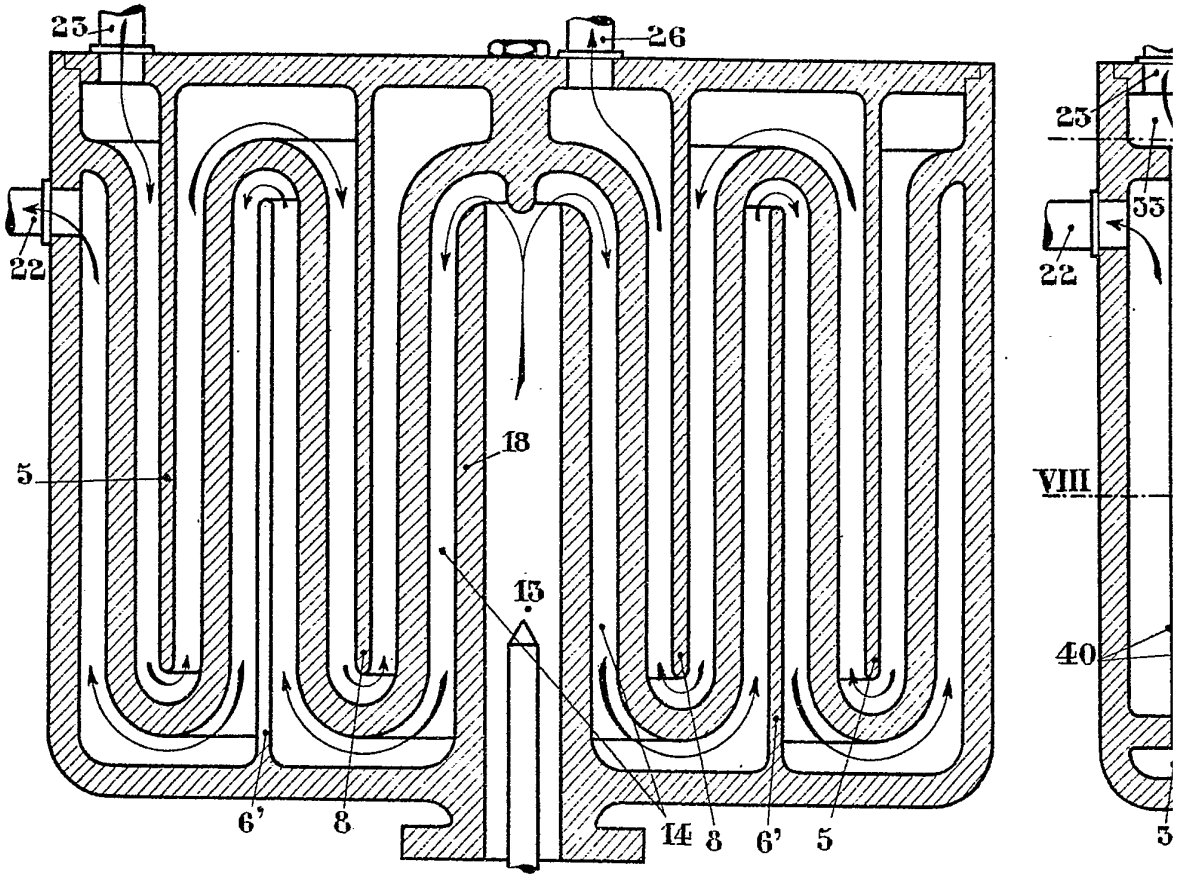

Fig. 6

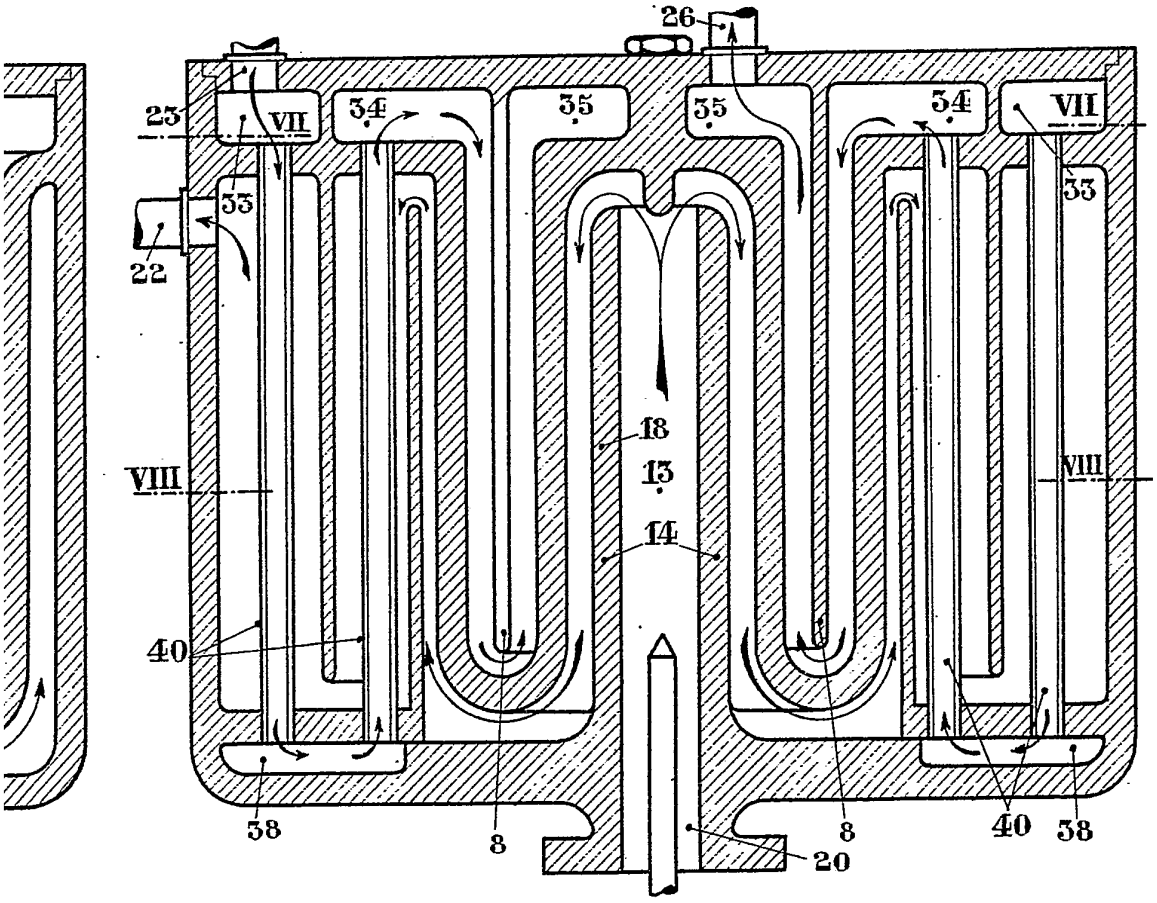

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Fig. 5

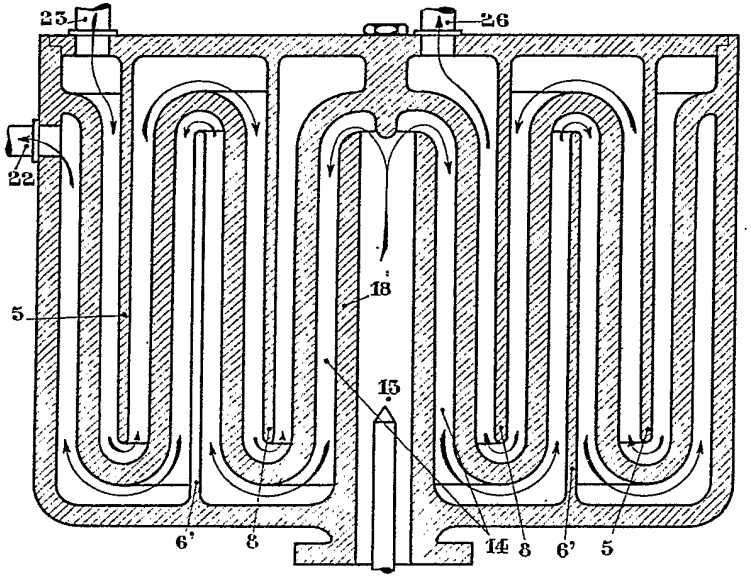

Fig. 6

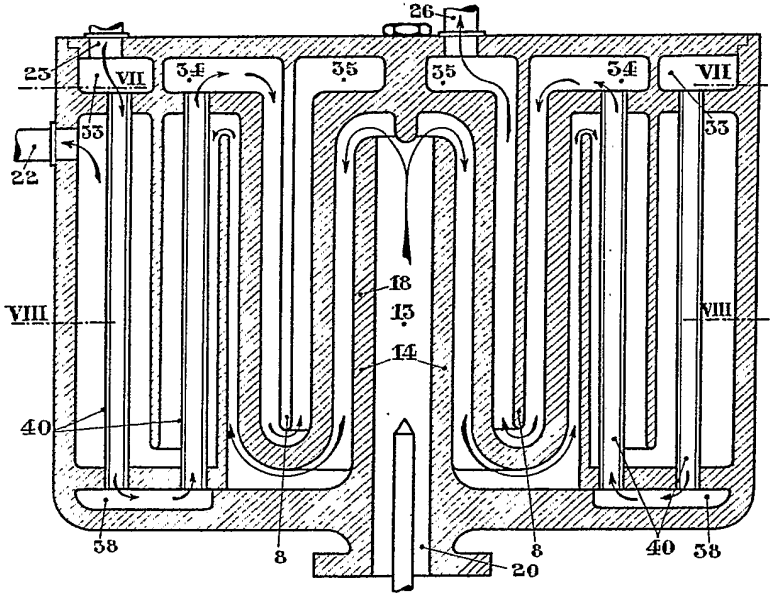

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Fig. 4

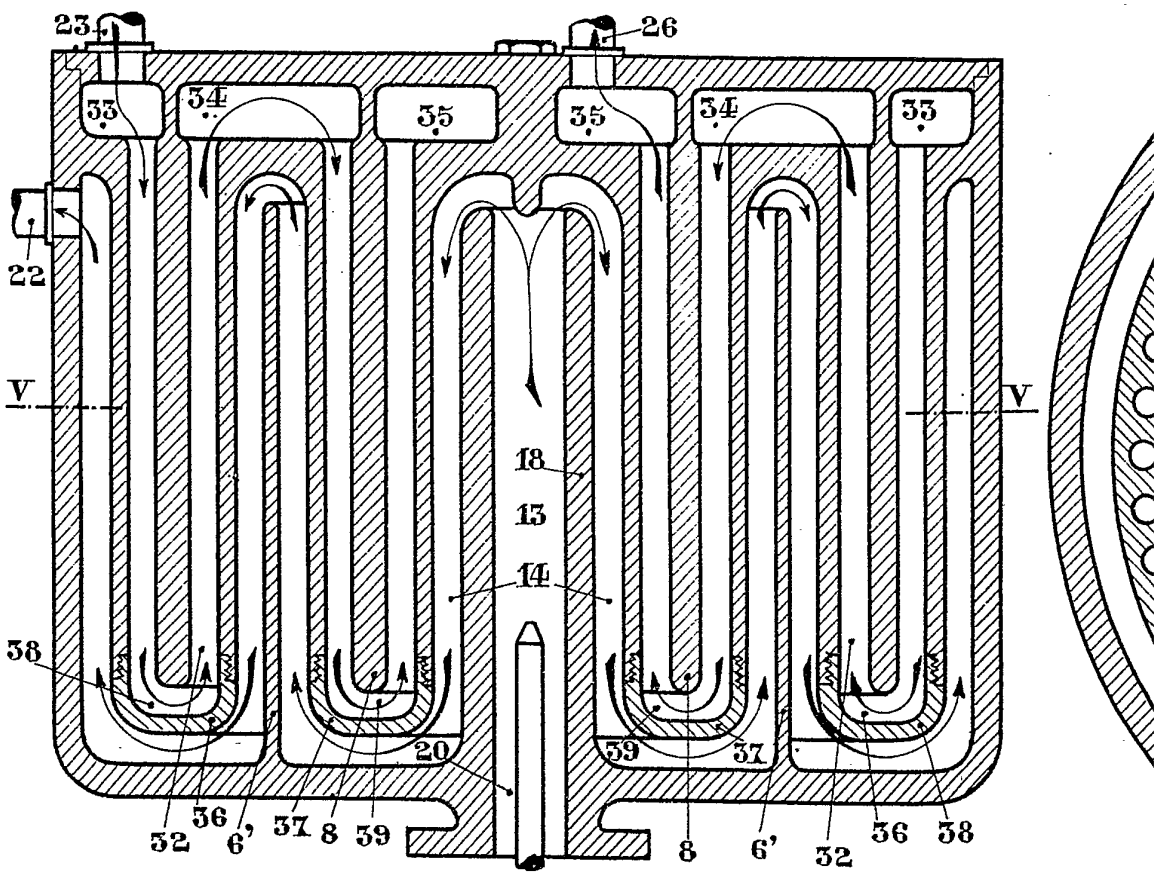

Fig.5

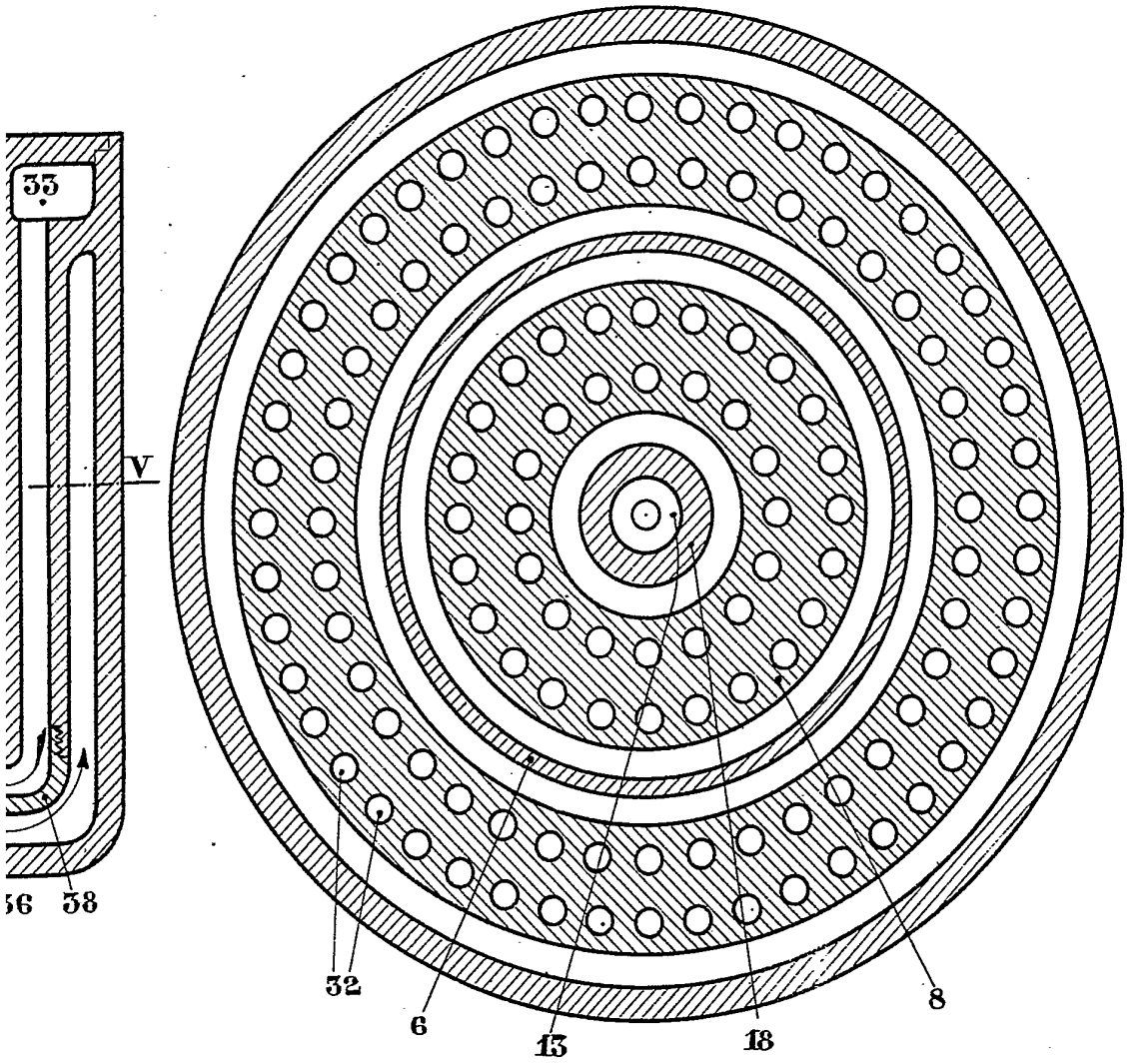

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Fig. 4

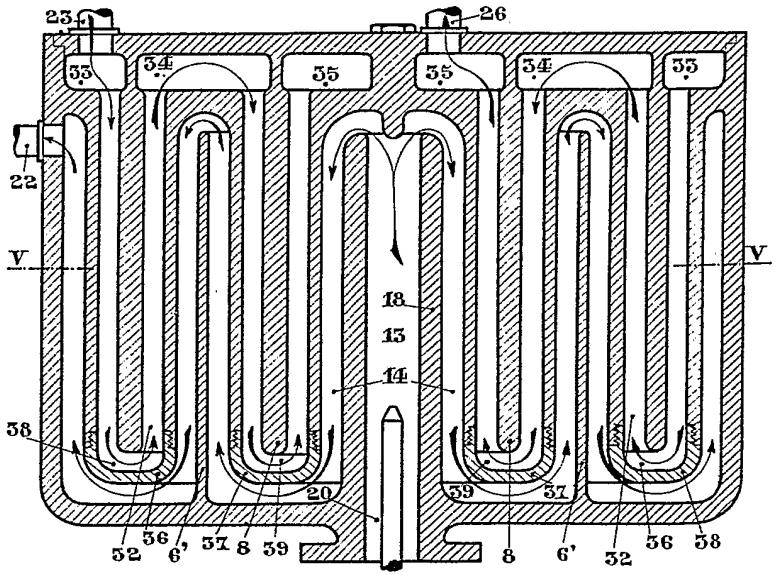

Fig. 5

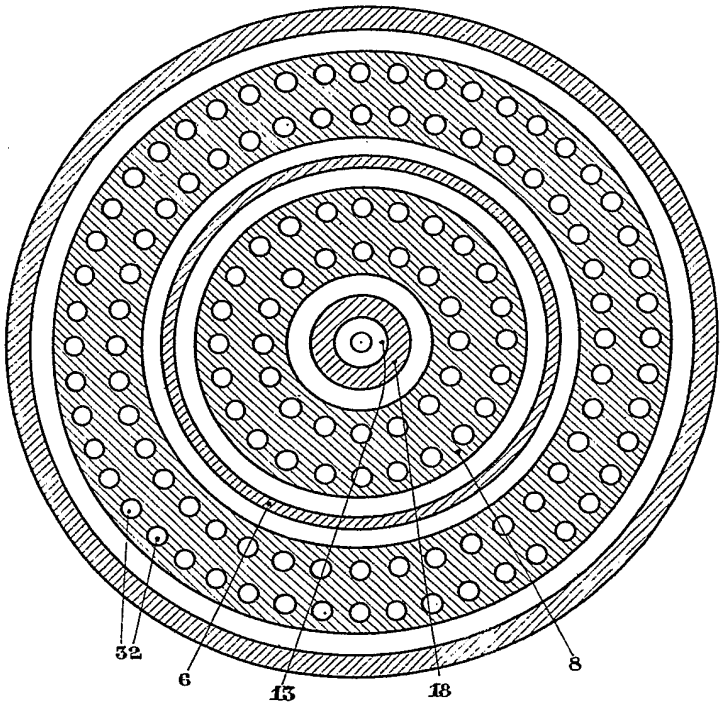

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Fig. 1

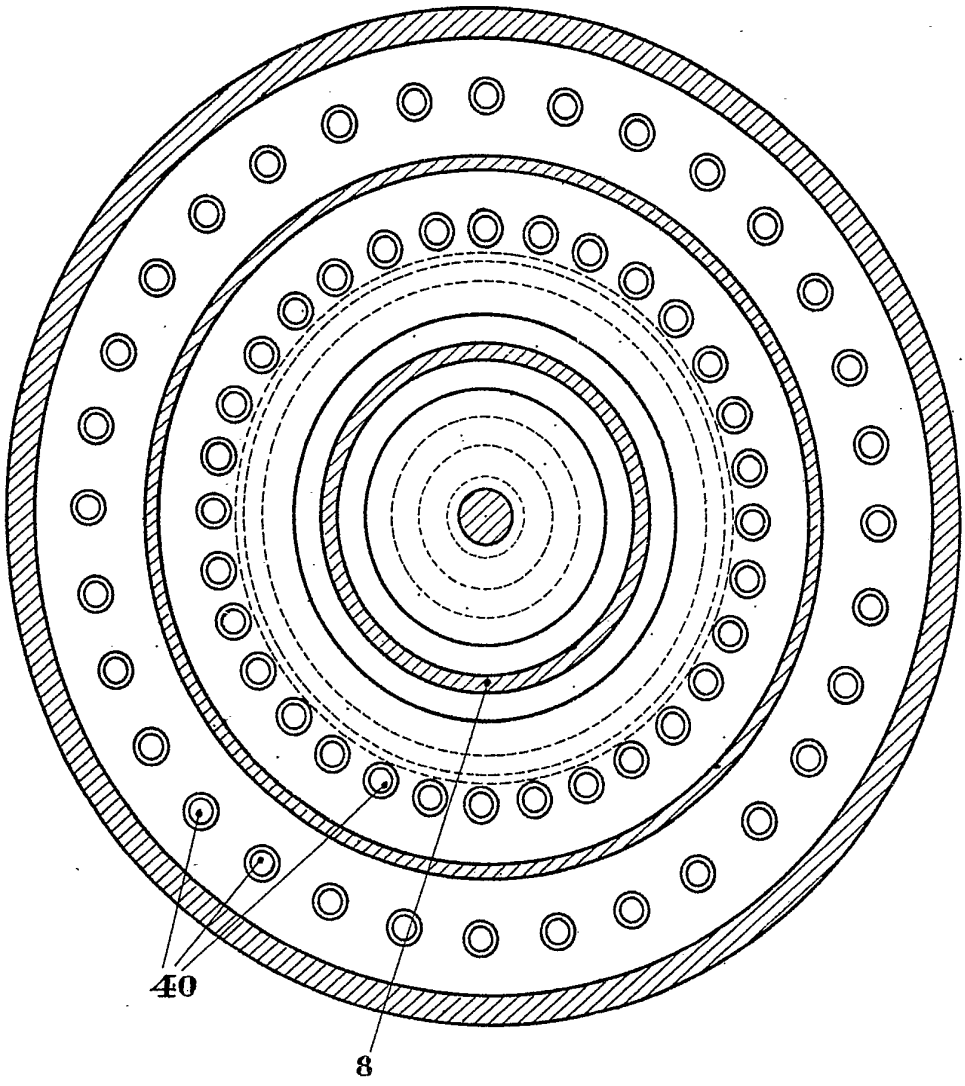

Fig. 8

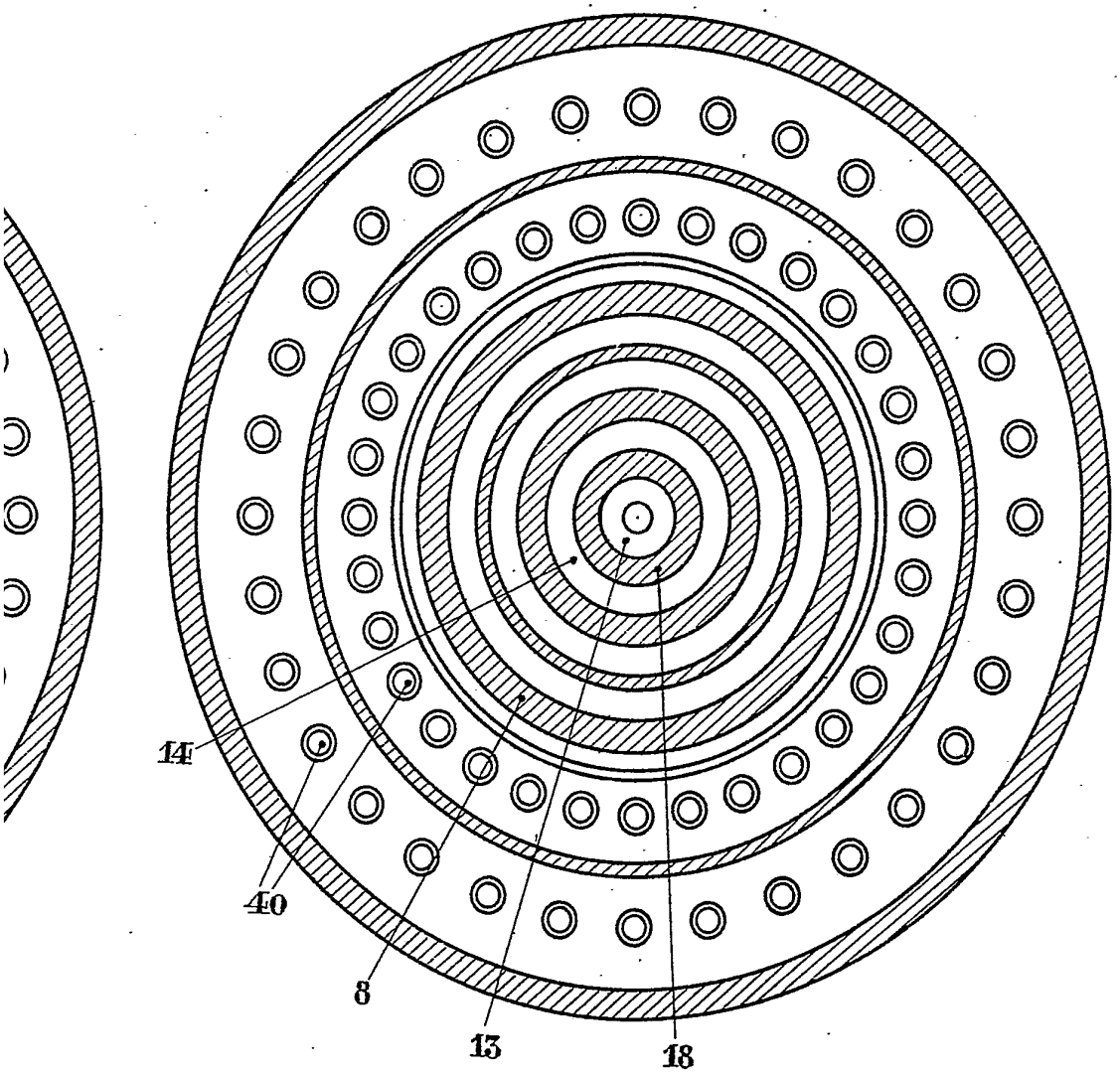

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Fig. 7

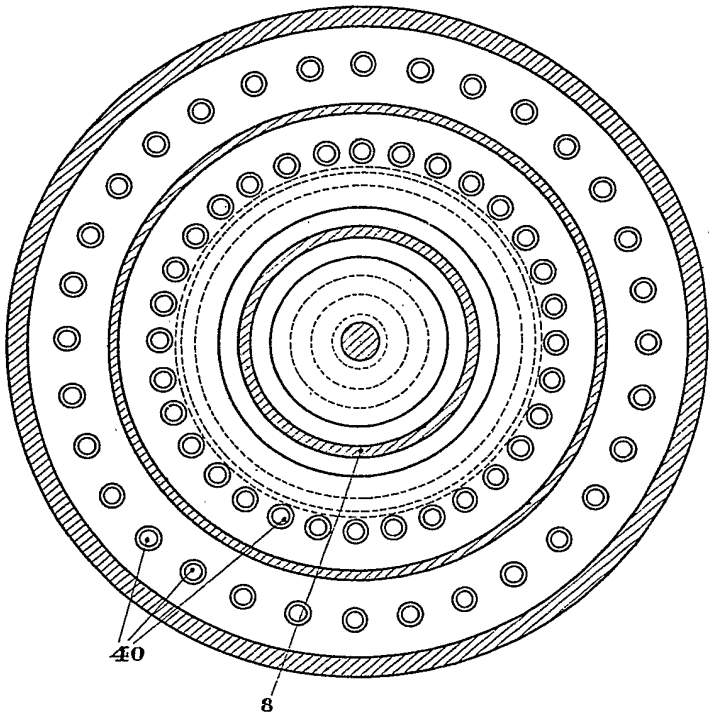
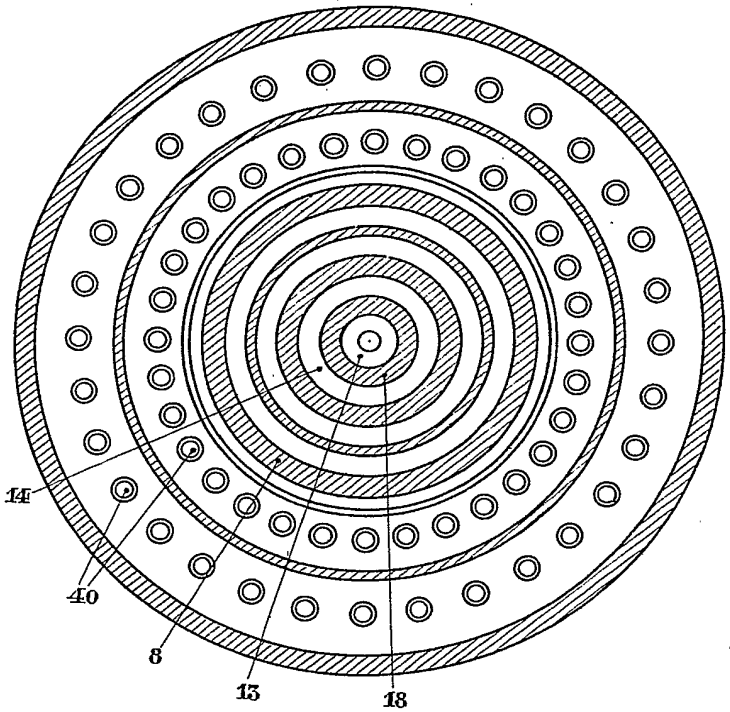


Fig. 8



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