

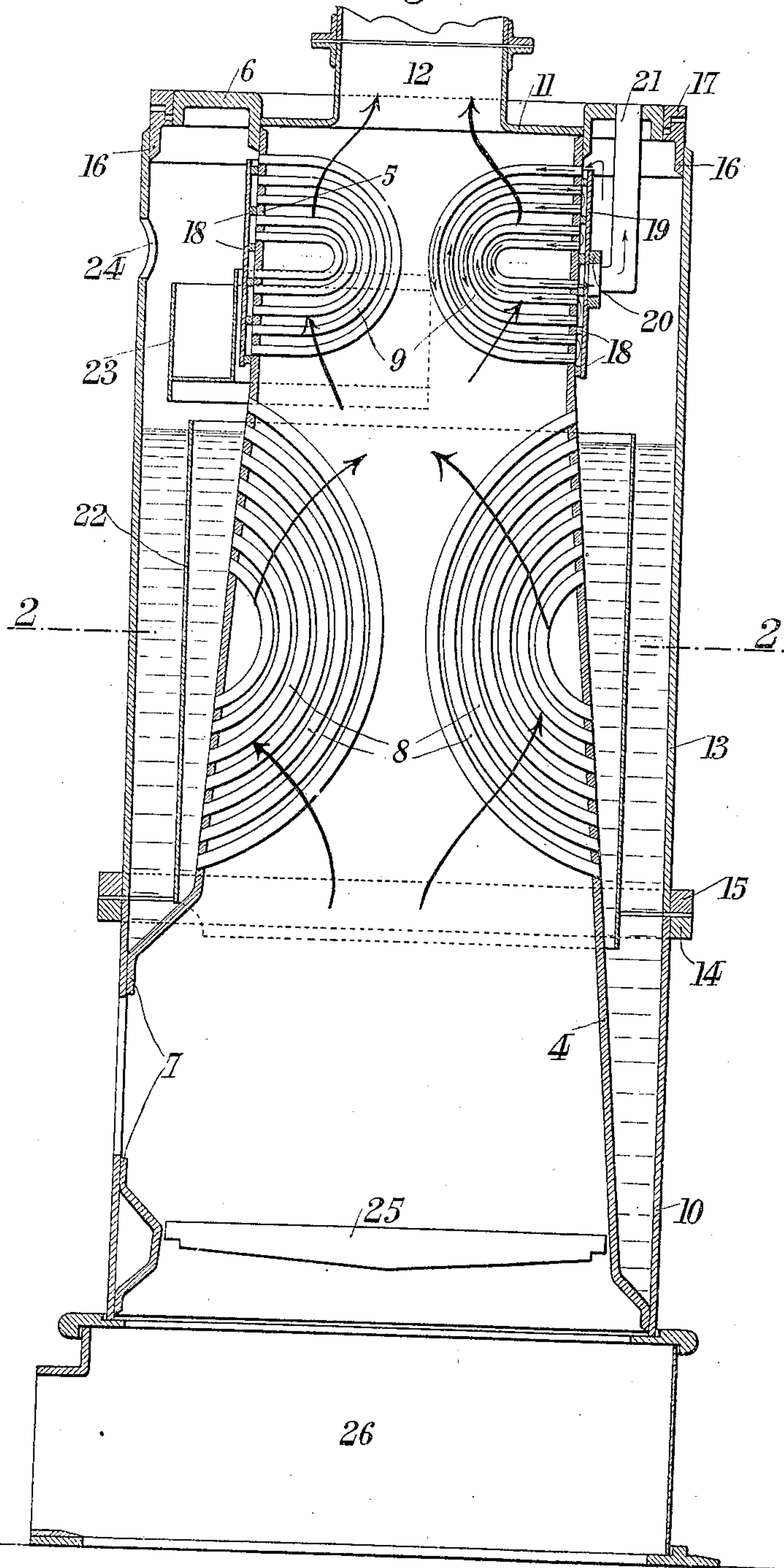
No. 813,133.

PATENTED FEB. 20, 1906.

C. P. ALTMANN.  
STEAM GENERATOR.  
APPLICATION FILED MAY 9, 1905.

2 SHEETS—SHEET 1.

Fig. 1



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Inventor:  
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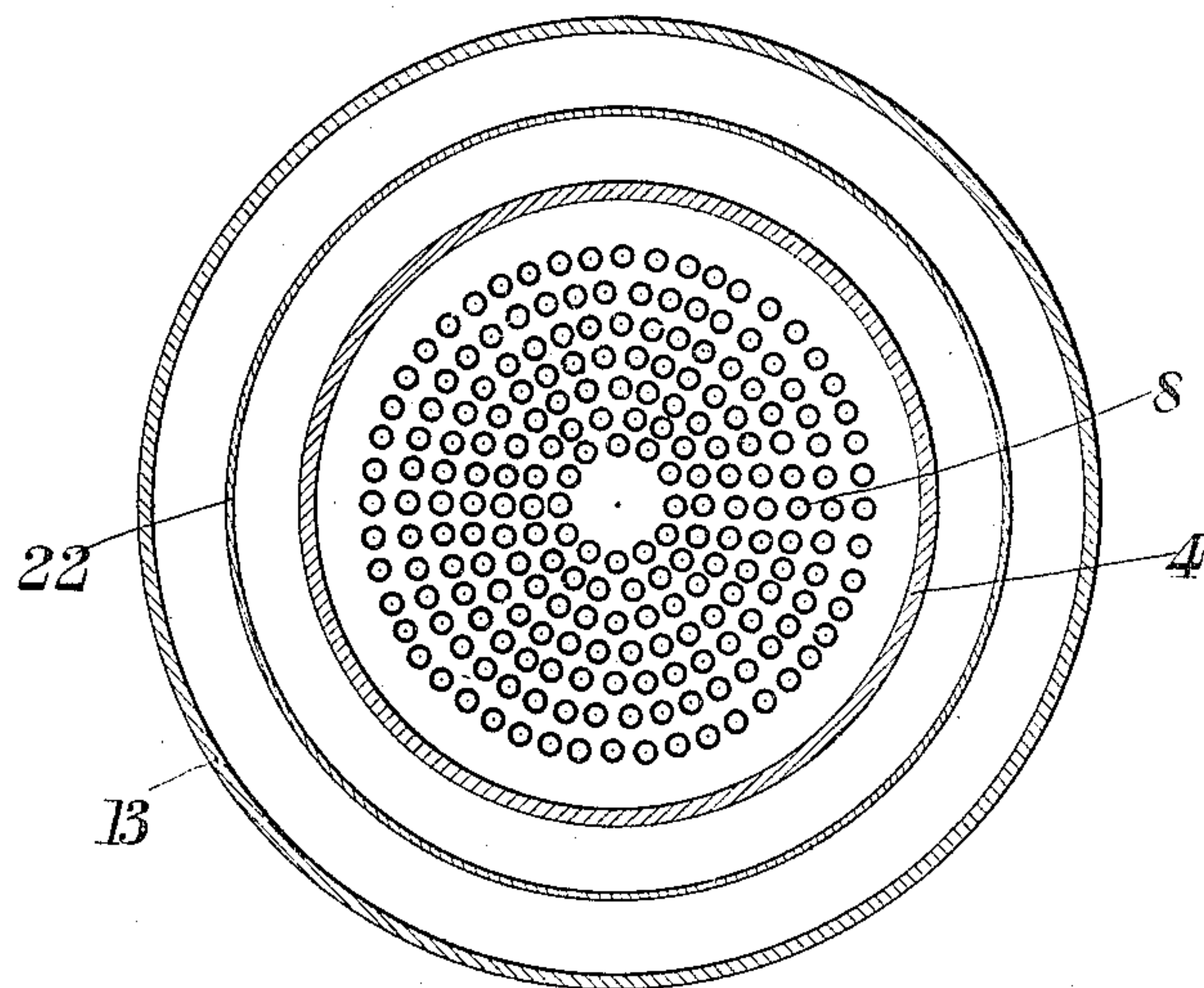
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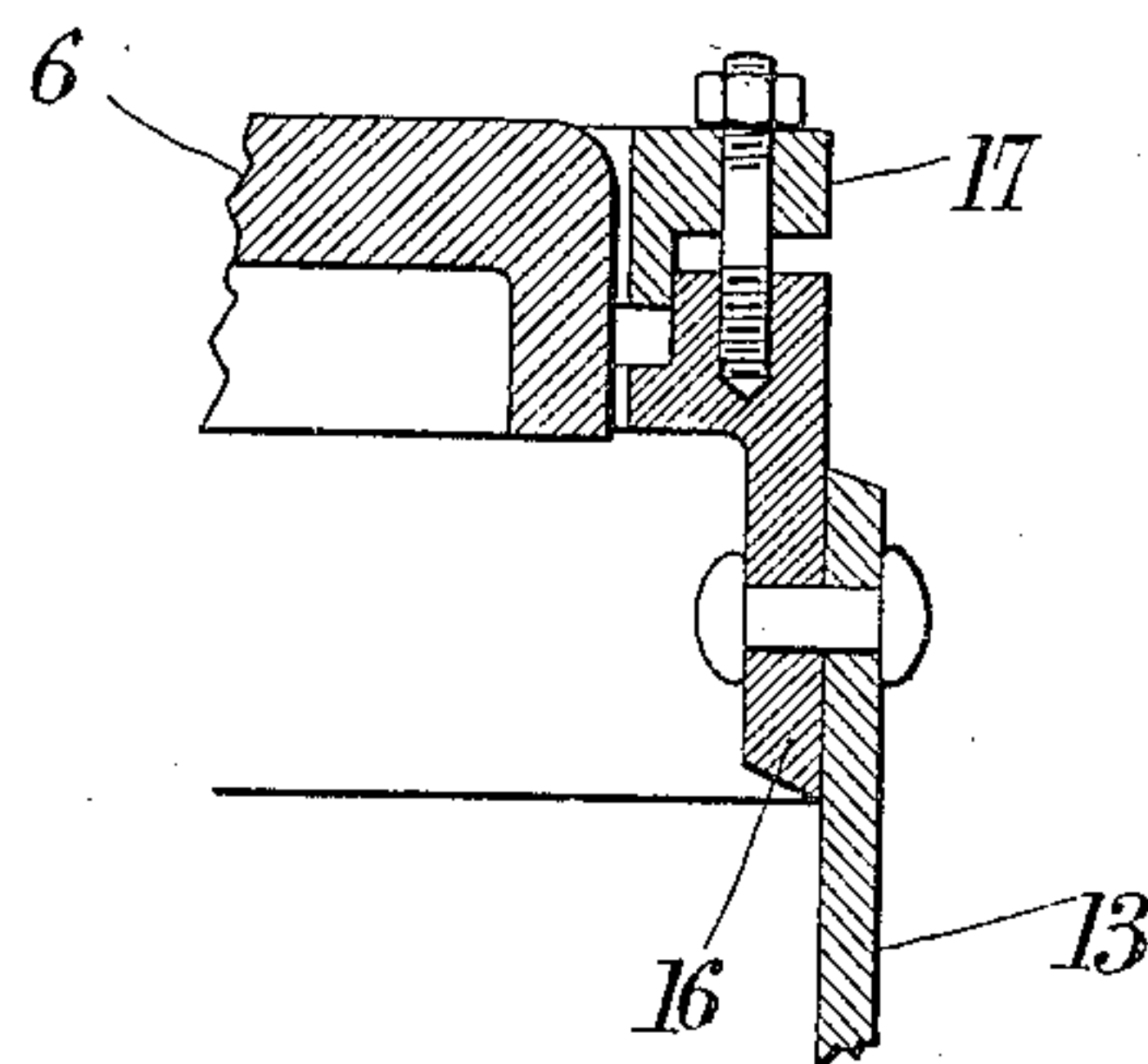
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APPLICATION FILED MAY 9, 1905.

2 SHEETS—SHEET 2.

*Fig. 2*



*Fig. 3*



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# UNITED STATES PATENT OFFICE.

CHARLES PHILIPPE ALTMANN, OF LYON, FRANCE.

## STEAM-GENERATOR.

No. 813,133.

Specification of Letters Patent.

Patented Feb. 20, 1906.

Application filed May 9, 1905. Serial No. 259,589

*To all whom it may concern:*

Be it known that I, CHARLES PHILIPPE ALTMANN, a citizen of the Republic of France, residing at Lyon, France, have invented new and useful Improvements in or Relating to Steam-Generators, of which the following is a specification.

This invention relates to a steam-generator with very quick evaporation and superheating of a very simple construction in which all the parts, which are independent of each other as regards expansion, can be easily examined.

A steam-generator according to this invention is illustrated, by way of example, in the accompanying drawings, in which—

Figure 1 is a vertical section of the steam-generator. Fig. 2 is a horizontal cross-section on the line 2 2 of Fig. 1, and Fig. 3 a detail view.

The furnace 4 is constituted by a truncated cone at the upper narrower portion provided with or terminating in a cylindrical part 5. To the upper end of the furnace is secured a collar or flange-ring 6. The conical portion 4 is laterally bent out at the bottom, so as to close the mouth 7 of the furnace. The upper portion of the cone 4 receives a bundle of curved evaporator-tubes 8, for which purpose it is provided with holes arranged in parallel series or rows, two and two corresponding, so as to receive the ends of the said curved tubes. The upper cylindrical portion 5 receives a bundle of superheater-tubes 9 and is to that end provided with holes arranged in a similar manner to those made in the conical portion. At the bottom the cone 4 is riveted to an outer casing 10 and at the top is closed by a cap 11, in the center of which is arranged a chimney 12. The outer casing is constituted by two superposed parts 10 and 13 of the same diameter. The bottom part 10, riveted to the furnace, is not detachable and is provided at the top with a flange, ring, or angle-iron 14. The upper part 13 is provided at the bottom edge with a similar flange or ring 15, which is secured to the flange 14 by means of bolts or screws. To the top of the casing 13 is riveted a crown 16, constituted by an angle-iron of a special shape in cross-section (see Fig. 3) and turned inside to a diameter slightly larger than that of the ring 6.

This angle-iron is, moreover, provided with an inner circular recess with which engages the depending flange of a ring 17, thus forming a stuffing-box and insuring a tight joint between the ring 6 and the outer casing. This stuffing-box is tightened down onto the angle-iron 16 by means of bolts or screws.

The steam-evaporator tubes 8 are arranged in concentric series and are bent in the shape of arcs of circles. The number of the tubes is not the same in each concentric series, but increases from the series nearest to the axis of the generator to that adjoining the periphery, as will be readily understood on examining Fig. 2. Each series is constituted by a number of tubes generally arranged in the vertical plane, so that their ends are on one and the same generatrix of the cone 4. The various successive series are, moreover, arranged alternately, so as to better break up the gaseous sheet passing through them.

The arrangement of the superheater-tubes 9 presents a great analogy with the preceding one; but the curvature of the tubes is greater and the tubes themselves are preferably thicker and of a smaller diameter. At the place where the superheater-tubes are arranged the cylindrical part of the furnace is provided with a series of rings 18 of square cross-section acting as partitions between the series of holes, with which engage the ends of the tubes. These rings are securely held in place by a thin ring 19, which forms with them a series of circular partitions communicating with each other through the intermediary of the tubes themselves. The arrows show clearly the path which the steam must follow, owing to the arrangement described.

Communicating with the steam-outlet at 20 is a steam-supply pipe 21, which passes through the ring 6, to which its end is secured.

Round the cone 4 is concentrically arranged a cylindrical diaphragm 22 of thin sheet metal, the object of which is to produce circulation of the water contained between the furnace and the outer casing.

A feed-tank 23 is arranged at the top in the steam-space round the furnace, inclosing the whole or part of its circumference. This tank 23 receives direct feed-water sup-



plied by the feed-pump. This water after having filled the reservoir falls in a shower all round and outside the diaphragm 22. Holes 24, suitably arranged so that they can  
5 be closed by means of covers, enable the tank to be examined without the boiler being taken to pieces.

A fire-grate 25 is arranged in the usual manner in the bottom portion of the furnace,  
10 and the whole of the boiler rests on a metal support 26, forming the ash-pit.

Combustion-gases rise in the furnace 4 and pass between the evaporator-tubes 8 and the superheater-tubes 9 before escaping through  
15 the chimney 12. On examining the direction of the arrows in Fig. 1 it will be seen that the gases in order to pass between the evaporator-tubes are obliged to turn twice, once when passing from the furnace to its periph-  
20 ery and again when passing from the periphery to the space between the two sets of tubes 8 and 9. Thence in order to reach the chimney the gases must still pass the superheating set in the same manner as just stated.  
25 In that way the gases reach the chimney only after having given off nearly all the heat they contained.

Water is contained between the furnace 4 and the outer casings 10 and 13. It is kept  
30 practically level with the top of the evaporating set 8 and fills the tubes of that set, and it will be seen that under the influence of the heat from the furnace an active circulation will take place in these tubes. Their great  
35 curvature and the conical shape of the furnace are very favorable to the circulation of the water and to the disengagement of steam-bubbles, which on escaping enter a large receiving-space without the bubbles escaping  
40 from the upper rows or series being liable to form a screen and to interfere with the passage of bubbles from the other rows or series. The diaphragm 22 also plays an important part in the circulation by separating the com-  
45 paratively cold water falling in a shower from the feed-tank 23 from the hot water discharged from the tubes or having undergone the action of the furnace. The more or less moist steam generated on the surface of  
50 the water will rise to the upper portion of the generator and pass in the form of a thin sheet between the upper edge of the wall 19 and the wall of the cylindrical part 5. It is thence obliged to pass, as already stated, through  
55 the different rows of tubes one after another in order to finally enter the steam-pipe 21.

This superheater of extreme simplicity is very efficient, and the position which it occupies above the evaporating set which ab-  
60 sorbs the greatest portion of the heat supplied by the furnace protects it against injurious influence of direct fire. The examination of the sets of tubes and their cleaning

can be effected very easily. The evaporat-  
ing sets, which when water contains large 65 quantities of calcareous salts receive deposits in powdery form, can be very easily cleaned, owing to the curved shape of the tubes. These curves being of the same radius, the tubes can be removed and replaced without 70 it being necessary to remove the adjoining ones. It is sufficient to that end that the holes in which they are fixed should be of a slightly-larger diameter at one end and the tube slightly thickened at one end, so that, 75 as will be understood, it can be thus easily drawn out and replaced. The arrangement of the feed-tank 23 in the steam-space offers the advantage of a partial deposit of sediment in an easily-accessible spot without it 80 being necessary to empty the generator. Moreover, the fall of water in the shape of a shower and around the whole circumference has the advantage of preventing localization of deposits, which thus fall to the bottom and 85 are evenly distributed. The deposit can be easily removed either in the feed-tank or at the bottom of the generator through closable openings and suitably arranged for the purpose. Moreover, in order to examine the 90 generator it is quite easy to release the upper casing 13, secured by bolts to the flange 14. It is sufficient for the purpose to unscrew the bolts connecting the flanges 14 and 15 and also those of the ring 17, whereupon the outer 95 casing 13 can be removed. When fitting up or erecting the generator, the joint 15 14 will be made first without it being necessary to pay any attention to the joint between the rings 6 and 16, which joint is made last and 100 allows the furnace 4 5 to expand freely. It may be finally observed that the various joints are scarcely exposed at all to steam-pressure, which in this kind of generator can be very high without causing any drawbacks. 105

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. A steam generator and superheater 110 comprising a cylindro-conical furnace provided with a set of steam-superheater tubes and a set of water-evaporator tubes, all bent in curves, the steam-superheater tubes being combined with partitions so as to cause the 115 steam to pass successively through all the rows of tubes before escaping, a feed-tank being preferably arranged in the interior of the steam-space and discharging water outside a water-circulator diaphragm arranged 120 between the furnace-wall and the outer casing substantially as described.

2. A steam-generator comprising a vertical outer casing and inner furnace-casing, sets of curved water circulating and evapo- 125 rator tubes arranged within the furnace-cas-

ing and having their ends communicating  
with the space between the said outer and  
inner casings, sets of curved superheater-  
tubes similarly set in the upper part of the  
5 interior of the furnace - casing, partitions  
such as 18, 19 around the tube ends, and a  
feed-water tank adjacent to the superheater  
steam-tubes, substantially as described.

In testimony whereof I have affixed my  
signature in presence of two subscribing wit- 10  
nesses.

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Witnesses:

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