

No. 799,277.

PATENTED SEPT. 12, 1905.

W. H. SUTLIFF & G. S. WATT.

STEAM GENERATOR.

APPLICATION FILED OCT. 17, 1904.

3 SHEETS—SHEET 1.

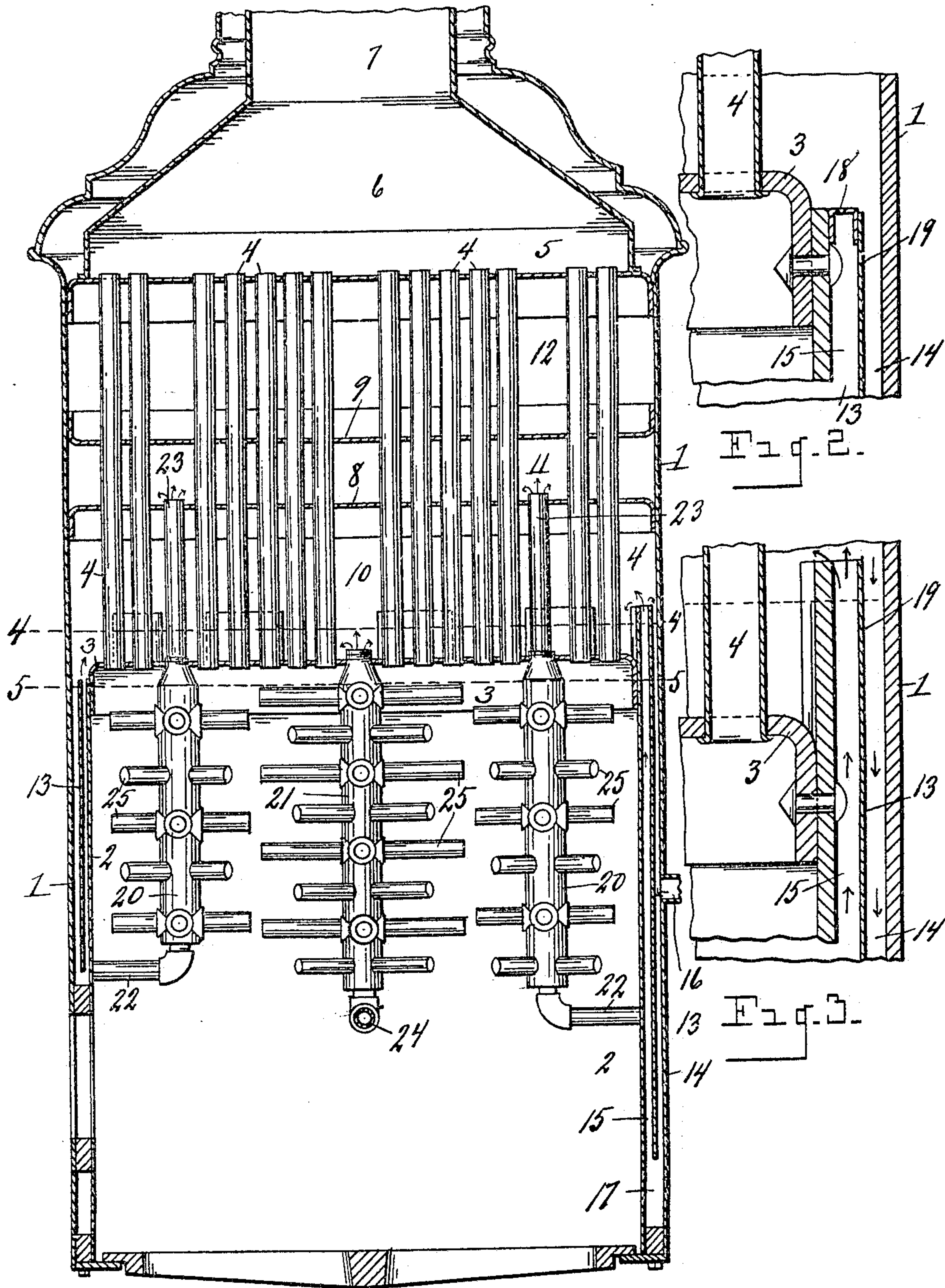


Fig. 1.

Witnesses:

O. B. Baeriger.
J. G. Howlett.

By Their Attorneys

Wheeler & Co.

Inventors

Walter H. Sutliff.
George S. Watt.

No. 799,277.

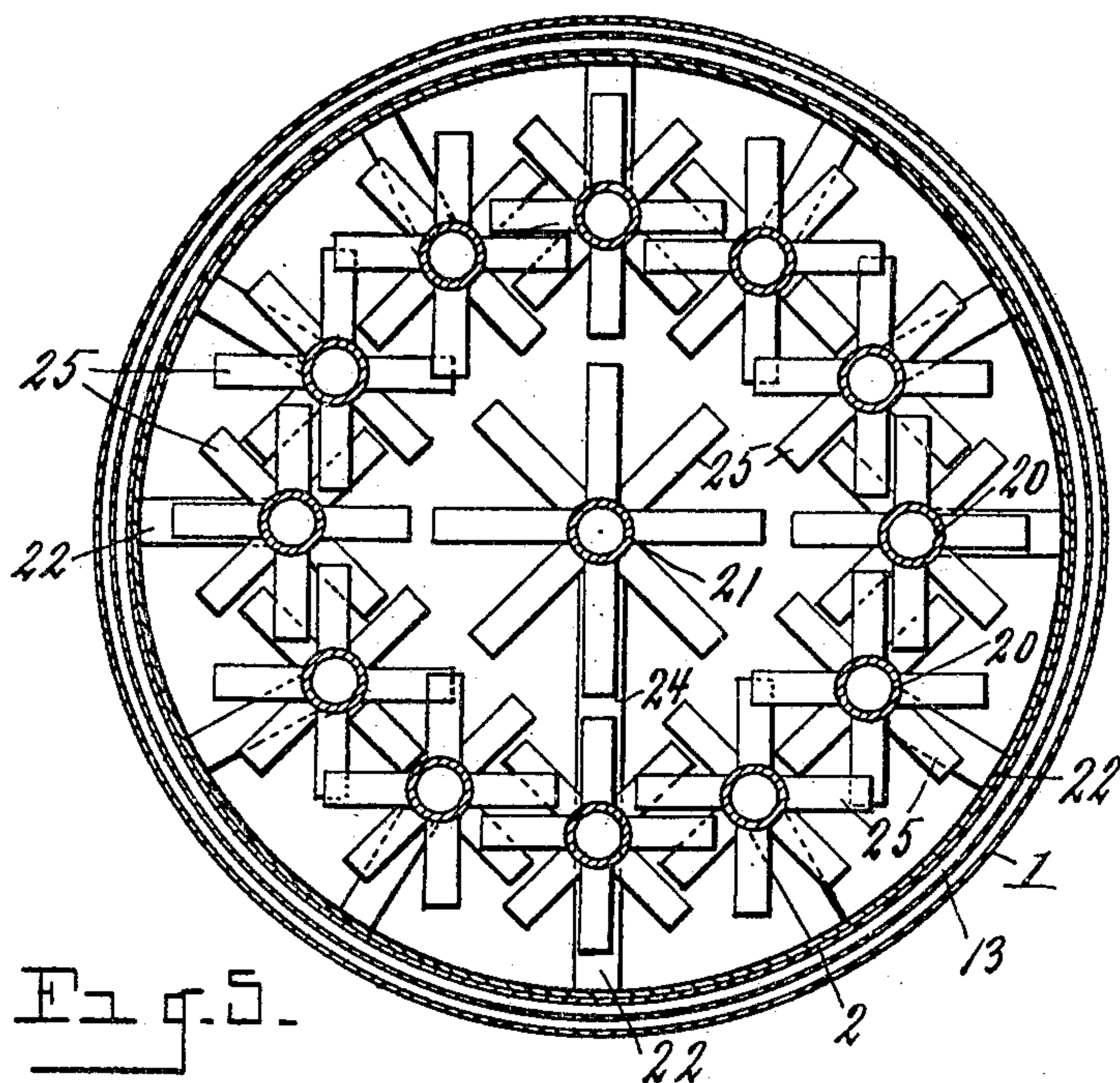
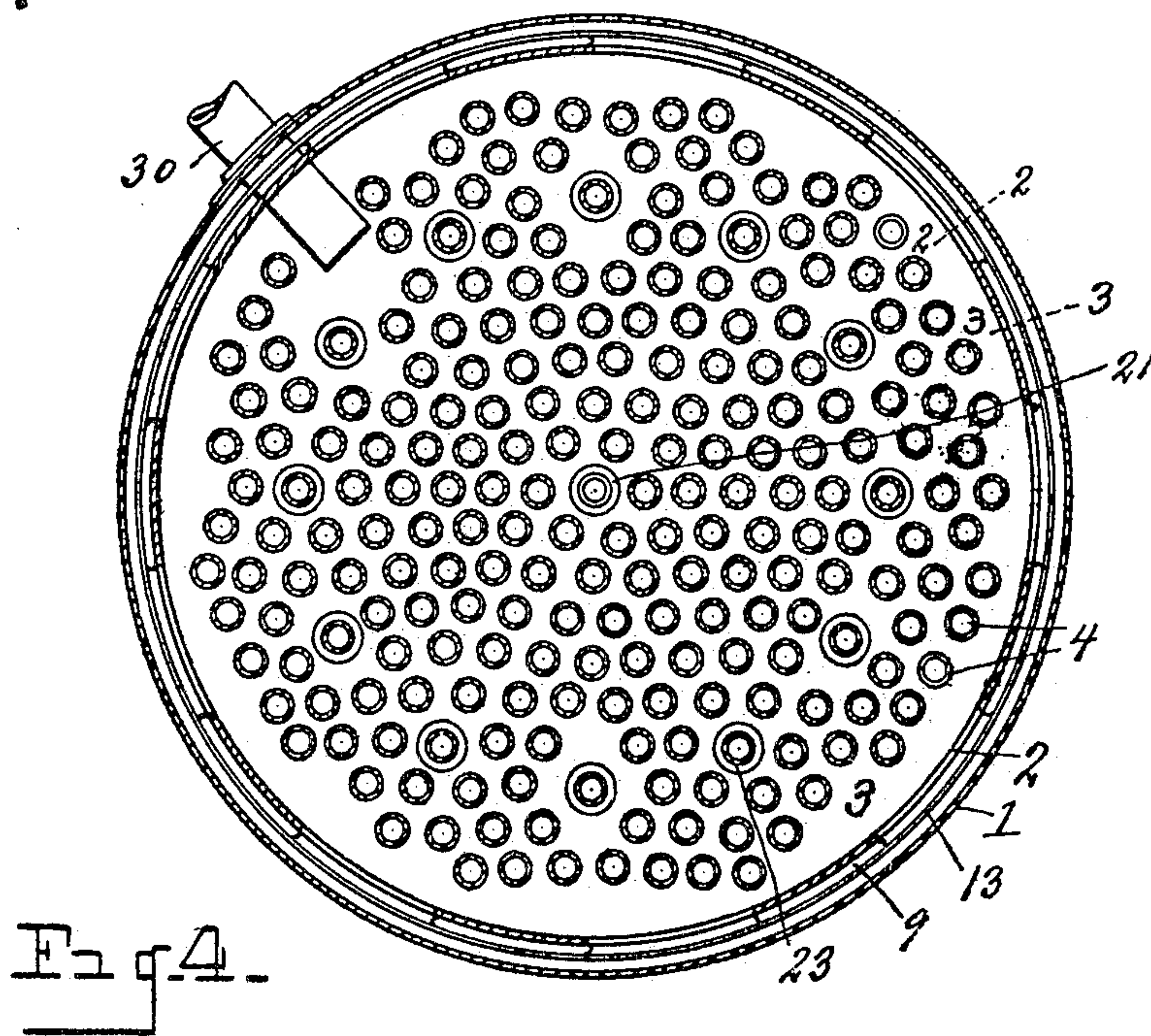
PATENTED SEPT. 12, 1905.

W. H. SUTLIFF & G. S. WATT.

STEAM GENERATOR.

APPLICATION FILED OCT. 17, 1904.

3 SHEETS—SHEET 2.



Witnesses:

O. B. Baenziger.
J. G. Howlett.

By their Attorneys

Inventors

Walter H. Sutliff.
George S. Watt.

No. 799,277.

PATENTED SEPT. 12, 1905.

W. H. SUTLIFF & G. S. WATT.

STEAM GENERATOR.

APPLICATION FILED OCT. 17, 1904.

3 SHEETS—SHEET 3.

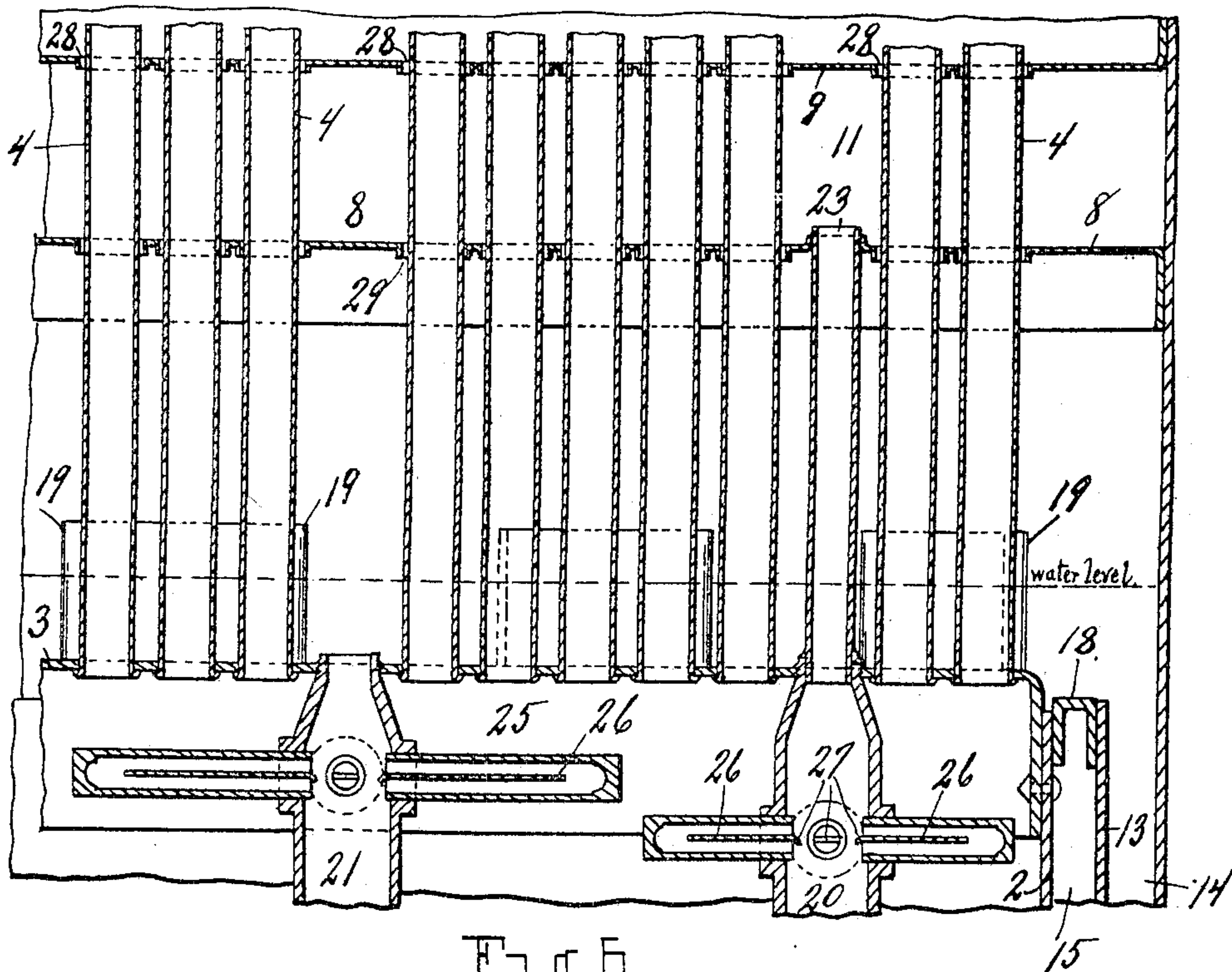


Fig. 6.

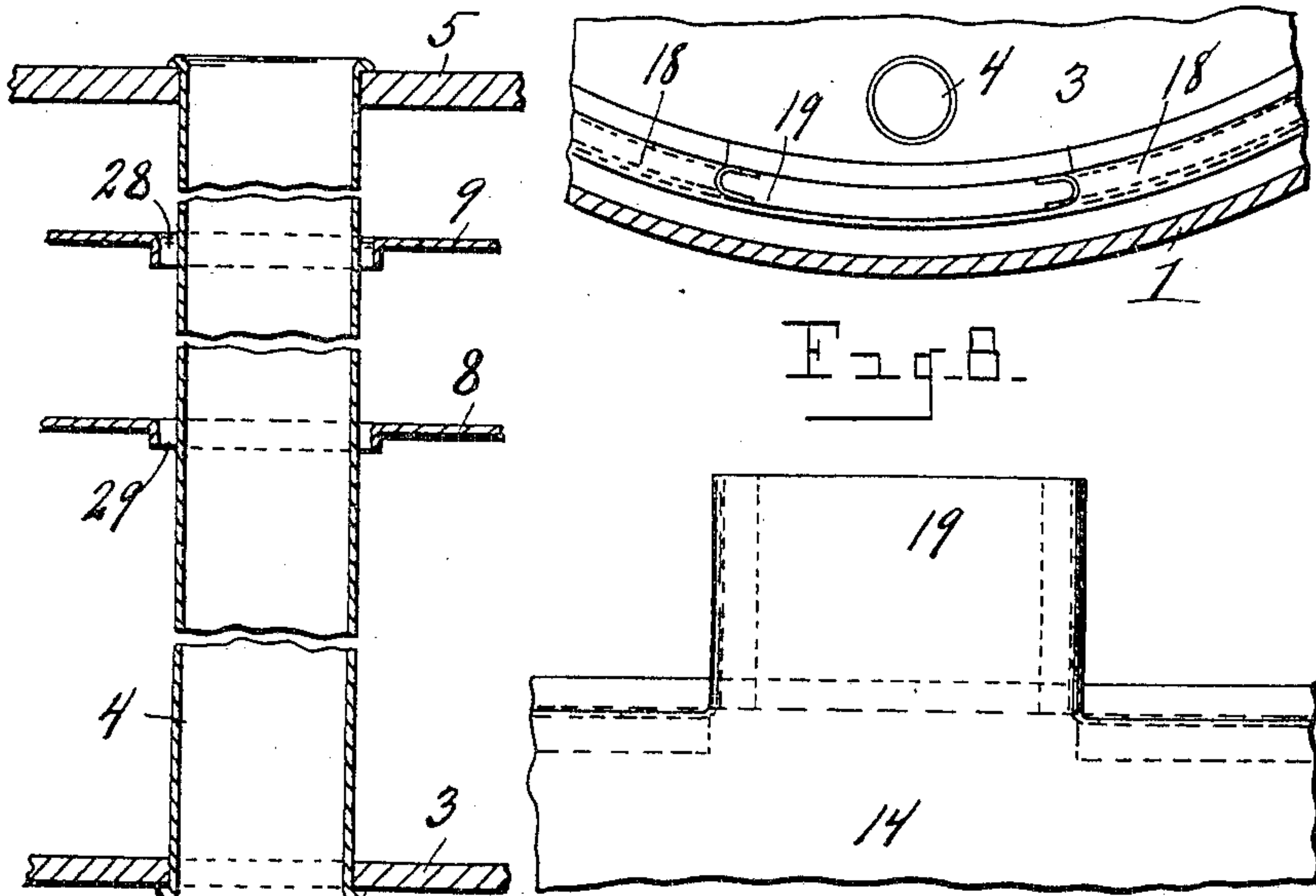
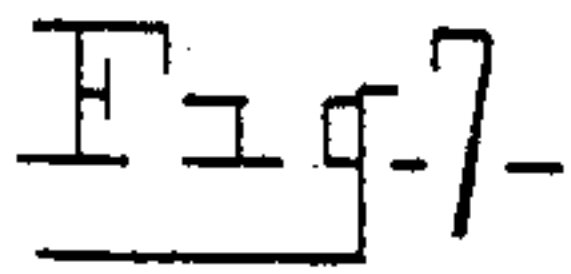



Fig. 7.

Witnesses: 
O. B. Baenziger.
J. E. Howlett.

By their Attorneys 
Inventors
Walter H. Sutliff.
George S. Watt.

UNITED STATES PATENT OFFICE.

WALTER H. SUTLIFF AND GEORGE S. WATT, OF JACKSON, MICHIGAN.

STEAM-GENERATOR.

No. 799,277.

Specification of Letters Patent.

Patented Sept. 12, 1905.

Application filed October 17, 1904. Serial No. 228,666.

To all whom it may concern:

Be it known that we, WALTER H. SUTLIFF, a citizen of the United States, and GEORGE S. WATT, a citizen of the Dominion of Canada, residing at Jackson, in the county of Jackson, State of Michigan, have invented certain new and useful Improvements in Steam-Generators; and we 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 figures of reference marked thereon, which form a part of this specification.

This invention relates to steam-generators, and more expressly to that class used in steam fire-engines; and it consists in the construction and arrangement of parts hereinafter fully set forth, and pointed out particularly in the claims.

The objects of the invention are to produce a steam-boiler or steam-generator of the character described of improved general efficiency wherein provision is made for maintaining a circulation through the water-leg of the boiler and preventing confusion of the circulating currents.

A further object is to provide for an active circulation of water through manifolds immediately over the fire-space and for connecting said manifolds with the water-leg and with the steam-space of the boiler.

A further object is to provide for separating the steam which passes from the manifolds into the steam-space of the boiler from the water which is carried upwardly therewith, superheating said steam and directing the separated water against the fire-flues of the boiler as it returns to the water-level, increasing the steaming efficiency and adding materially to the supply of dry steam.

A further object is to provide for discharging the water which circulates through the central manifold onto the crown-sheet, thereby preventing the overheating of said sheet through a possible lowering of the water-level of the boiler.

The above objects are attained by the construction illustrated in the accompanying drawings, in which—

Figure 1 is a central vertical section through a boiler involving our invention. Fig 2 is a fragmentary view in section, showing the vertical partition dividing the water-leg and the plate which closes a portion of the upper end

of the inner compartment. Fig. 3 is a similar view showing one of the projecting tubes or spouts through which the return-water is discharged into the boiler from the inner compartment of the water-leg above the water-level. Fig. 4 is a horizontal section through the boiler as on line 4 4 of Fig. 1. Fig. 5 is a similar section as on line 5 5 of Fig. 1. Fig. 6 is a detail in vertical section through a portion of the boiler, the steam-separating chambers, the flues, and the upper ends of two of the manifolds. Fig. 7 is an enlarged vertical section through one of the flues, the lower and upper crown-sheets, and the horizontal partitions dividing the steam-space of the boiler. Fig. 8 is a fragmentary view, in horizontal section, through a portion of the boiler-shell above the lower crown-sheet. Fig. 9 is a fragmentary view in elevation of one of the horizontal tubes or spouts through which the return-water from the inner space of the water-leg passes into the steam-space of the boiler.

Referring to the characters of reference, 1 designates the boiler-shell, which is preferably cylindrical in form. Within the shell and spaced therefrom is the wall 2 of the fire-box, forming within the upper portion thereof the combustion-chamber, which is capped or closed by the lower crown-sheet 3. The lower ends of the fire-flues 4 pass through the lower crown-sheet and communicate with the combustion-chamber, while the upper ends of said flues pass through the upper crown-sheet 5 and communicate with the hood 6, leading to the stack 7.

The space between the lower and upper crown-sheets constitutes the steam and water space of the boiler, wherein the normal water-level is indicated by dotted lines in Fig. 6. The boiler-space between the crown-sheets is divided into three compartments by means of the horizontal sheets 8 and 9, which serve as partitions to divide said space into a steam-chamber 10, a separating-chamber 11, and a superheating-chamber 12. The fire-flues pass loosely through apertures in the sheets or partitions 8 and 9, whereby the several compartments formed by said partitions are rendered intercommunicable.

To provide for a circulation through the water-leg of the boiler, there is interposed between the shell 1 and the wall 2 of the fire-box a central sheet 13, which separates the space forming the water-leg into an outer compartment 14 and an inner compartment 15.

The feed-water pipe 16 (see Fig. 1) is connected with the outer compartment through the boiler-shell. The two compartments of the water-leg are made to communicate through the open space 17 at the bottom. The outer compartment of the water-leg being next to the outer shell of the boiler, the water therein will be at a somewhat lower temperature than the water in the inner compartment, which is next to the wall of the fire-box, causing a rising of the water in the inner compartment and a precipitation of the water in the outer compartment, whereby a circulation of water is maintained through the water-leg, and by introducing the feed-water through the pipe 16 it is caused to flow downwardly to a point below the dividing-partition 13; thence upwardly through the compartment 15 to the boiler, thereby obviating the admission of cold water directly into the boiler and raising the feed-water to a comparatively high temperature before it is discharged into the steam-space.

To separate the currents caused by the downward flow of water through the outer compartment and the upward flow of water through the inner compartment of the water-leg, said inner compartment is capped over at intervals by the interposed plates 18, and to afford a proper discharge for the upwardly-flowing water the wall of the fire-box and the dividing-sheet 13 are carried upwardly at the points between the end of said capping-plate to form the discharge tubes or spouts 19, the upper ends of which project into the boiler above the normal water-level, whereby the upwardly-flowing currents of water are discharged into the boiler above the point of the inception of the downwardly-flowing current, thereby preventing the cold water being carried upwardly into the boiler by the current passing through the compartment 15 of the water-leg. Within the combustion-chamber of the boiler above the fire-space are located the manifolds 20 and 21. The manifolds 20 are placed in a circle around the inner wall of the fire-box and are connected at their lower ends by means of the short horizontal pipes 22 with the inner compartment 15 of the water-leg, the upper ends of said manifolds passing through the crown-sheet 3 and having the extension-tubes 23 attached thereto, which pass through the dividing-sheet 8 into the chamber 11. The manifold 21 is located in the center of the manifolds 20 and is connected at its lower end with the water-leg by means of the pipe 24, while the upper end of said central manifold passes through the crown-sheet 3 and discharges into the steam-chamber 10. Each of the manifolds 20 and 21 is provided with the radial tubes 25, plugged at their outer ends and communicating at their inner ends with the interior of the manifolds. Dividing each of said tubes horizontally is a thin metallic partition 26,

whereby a circulation of water is induced through said tubes which is sufficiently strong to prevent the lodgment of sediment therein. The inner ends of the partitions 26, dividing the tubes 25, project slightly into the manifolds and turn downwardly, as shown at 27, thereby more perfectly directing the water into said tubes as it passes upwardly through the manifolds.

By reason of the tubes 23, which connect the manifolds 20 with the separating-chamber 11, the steam and water which pass upwardly through said tubes are discharged into the separating-chamber 11, from which chamber the steam passes through the openings 28 in sheet 9 around the flues 4, while the water falls upon the sheet 8 and flows downwardly therefrom through the openings 29, which direct the water onto the fire-flues which pass through said openings, whereby the water is directed onto and caused to run down the fire-flues on leaving the separating-chamber, and the steam which passes upwardly from said chamber is caused to encircle said flues in passing through the openings 28, thereby superheating it and causing it to pass into the chamber 12 in a high state of expansion, from which it may be withdrawn through the steam-pipe 30. This arrangement whereby the steam and water in leaving the separating-chamber are caused to encircle the fire-flues very materially adds to the efficiency of the heating-surface of the fire-flues and also tends to prevent an undue expansion of said flues, as is common in boilers of this type.

The upper end of the central manifold 21, terminating, as it does, immediately above the crown-sheet 3, causes the water which is forced upwardly therethrough to discharge onto said sheet, whereby its surface is kept covered with water even though the water-level of the boiler should fall below the level of said sheet.

By means of the arrangement herein shown every part of the boiler is rendered accessible and each of the manifolds is rendered independently removable. It will also be noted that by reason of the openings in the sheets 8 and 9, which encircle the flues, every part of the boiler may be thoroughly drained to the lowest point of the water-leg.

Having thus fully set forth our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a steam-boiler, the combination of the boiler-shell and fire-box forming a water-leg, of a central sheet confined within and dividing said leg only into two compartments which communicate at the bottom the inner compartment being closed above except for a series of passages leading therefrom to a point above the water-level of the boiler, a water-induct pipe communicating with the outer compartment, a vertical heating-pipe, in the combustion-chamber communicating at its

lower end with the inner compartment of the water-leg and at its upper end with the steam-space of the boiler.

2. In a steam-boiler, the combination with the shell and the wall of the fire-box spaced to form a water-leg between them, of a central partition limited to and confined within said water-leg dividing it into an outer and an inner compartment which communicate at the bottom of said leg the inner compartment being closed above except for a series of passages leading therefrom to a point above the water-level of the boiler, a water-induct pipe communicating with the outer compartment, a plurality of manifolds within the combustion-chamber connected at their lower ends with the inner compartment of the water-leg and communicating with the steam-space of the boiler.

3. A steam-boiler comprising a steam-space, a water-leg, a combustion-chamber, a plurality of relatively large vertical pipes within the combustion-chamber communicating at their lower ends with the water-leg and at their upper ends with the steam-space of the boiler, each of said vertical pipes having short relatively small radial tubes projecting therefrom, and each of said tubes being divided by a horizontal partition, the inner end of which projects into the vertical tube.

4. A steam-generator comprising a steam-space, a fire-box, fire-flues communicating with the fire-box and passing through the steam-space, a horizontal partition dividing the steam-space of the boiler having openings through which the fire-flues loosely pass, and vertical steam-generating pipes within the fire-space communicating at their lower ends with the water-leg and at their upper ends with the steam-space of the boiler, above said partition.

5. The combination in a steam-generator having a steam-space and a water-space, of a horizontal partition dividing the steam-space, said partition having openings therethrough, circulatory pipes passing upwardly through the fire-space, communicating at their lower ends with the water-space of the boiler and at their upper ends with the steam-space above said partition, fire-flues passing through the steam-space and through said openings in said partition which are of greater diameter than the diameter of the fire-flues, whereby the water which is carried into the space above the partition through said circulatory pipes, may

flow downwardly therefrom through said openings around the fire-flues.

6. A steam-generator comprising a water-space and a steam-space, horizontal partitions dividing the steam-space into a separating-chamber and a superheating-chamber, fire-flues passing through the steam-space and freely through openings in said partitions, and steam-generating pipes connected at their lower ends with the water-space, passing through the fire-space and communicating with the separating-chamber.

7. A steam-generator comprising a steam-space and a water-space, horizontal partitions dividing said steam-space into a steam-chamber, a separating-chamber and a superheating-chamber, said partitions having apertures therethrough which place all of said chambers in communication, fire-flues passing loosely through the openings in said partitions, water and steam circulatory pipes connected at their lower ends with the water-space and communicating at their upper ends with the separating-chamber.

8. In a steam-generator, the combination of the shell and fire-box spaced to form a water-leg, fire-flues passing through the crown-sheet and the steam-space of the boiler, a horizontal partition dividing the steam-space into separate chambers, a plurality of manifolds arranged in a circle within the fire-box, connected at their lower ends with the water-leg, their upper ends communicating with the boiler above said partition, and a central manifold also communicating at its lower end with the water-leg, its upper end passing through and terminating above the crown-sheet.

9. In a steam-generator, the combination with the boiler-shell, of the wall of the fire-box spaced therefrom to form a water-leg, a central sheet dividing said leg into an outer compartment and an inner compartment, said compartments communicating at the bottom of said leg, the outer compartment being open at its upper end and the inner compartment being closed above, except for a series of water-passages leading therefrom to a point above the water-level of the boiler.

In testimony whereof we sign this specification in the presence of two witnesses.

WALTER H. SUTLIFF.
GEORGE S. WATT.

Witnesses:

BENJAMIN WILLIAMS,
I. A. CLUSE.