No. 736,187. PATENTED AUG. 11, 1903.

L. E. WRIGHT.

STEAM GENERATOR.

APPLICATION FILED DEC. 6, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

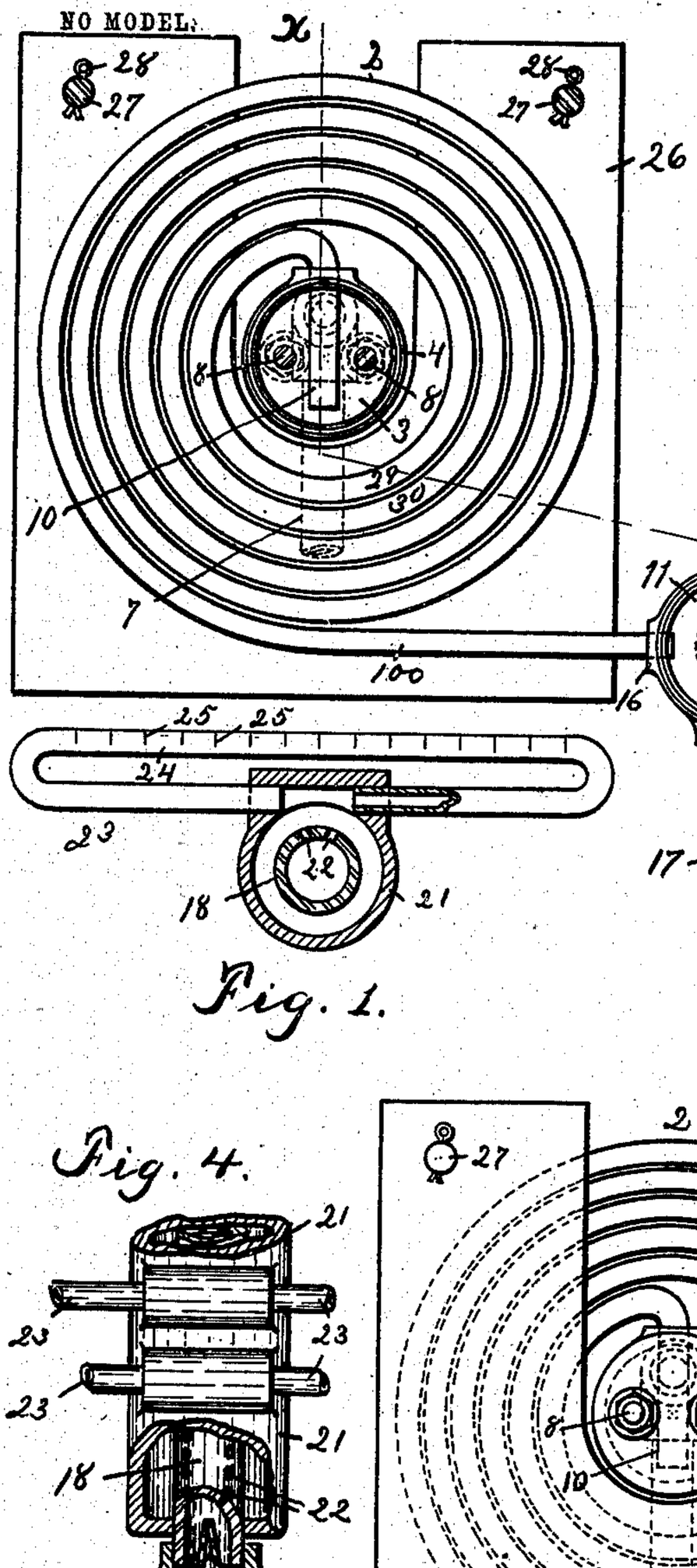


Fig. 1.

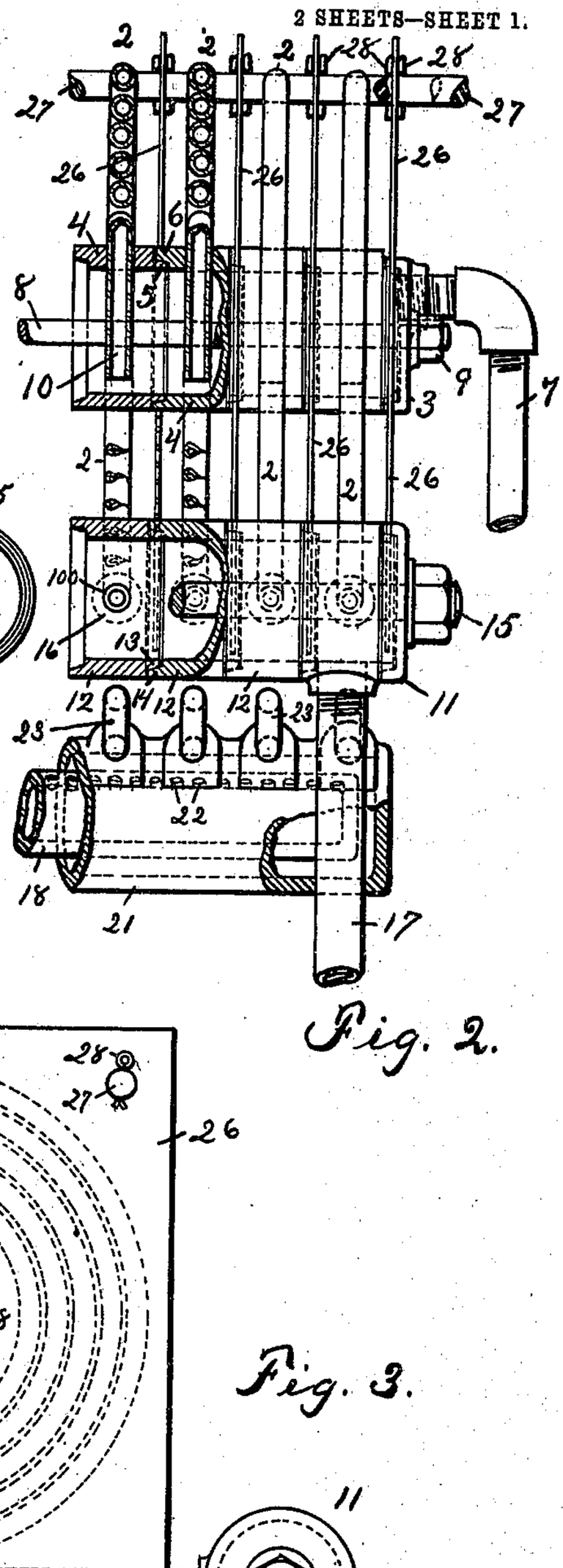


Fig. 2.

Fig. 4.

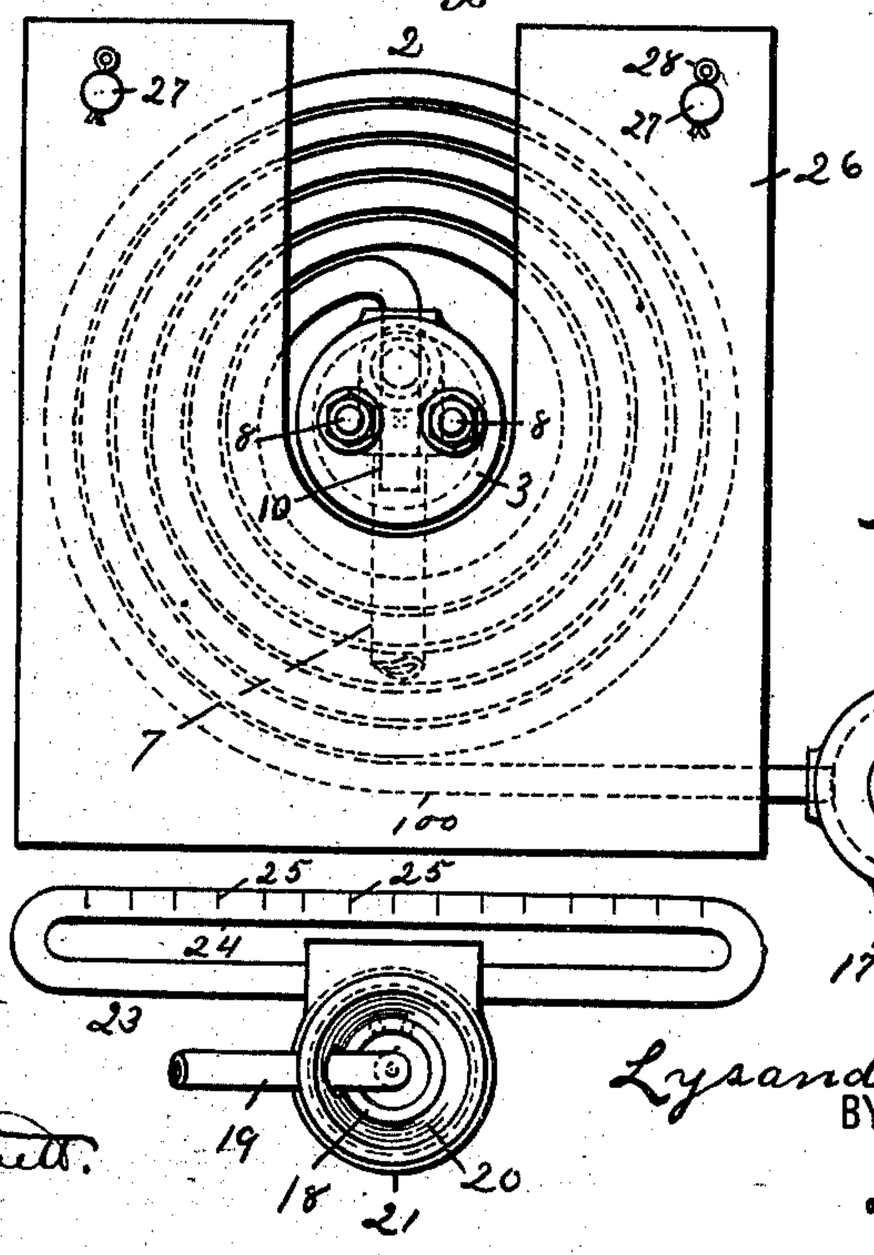
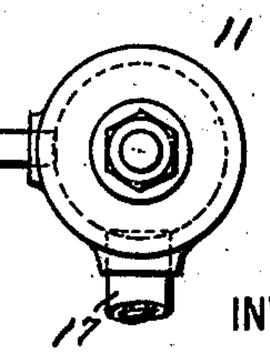


Fig. 3.



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NO MODEL. 2 SHEETS—SHEET 2.

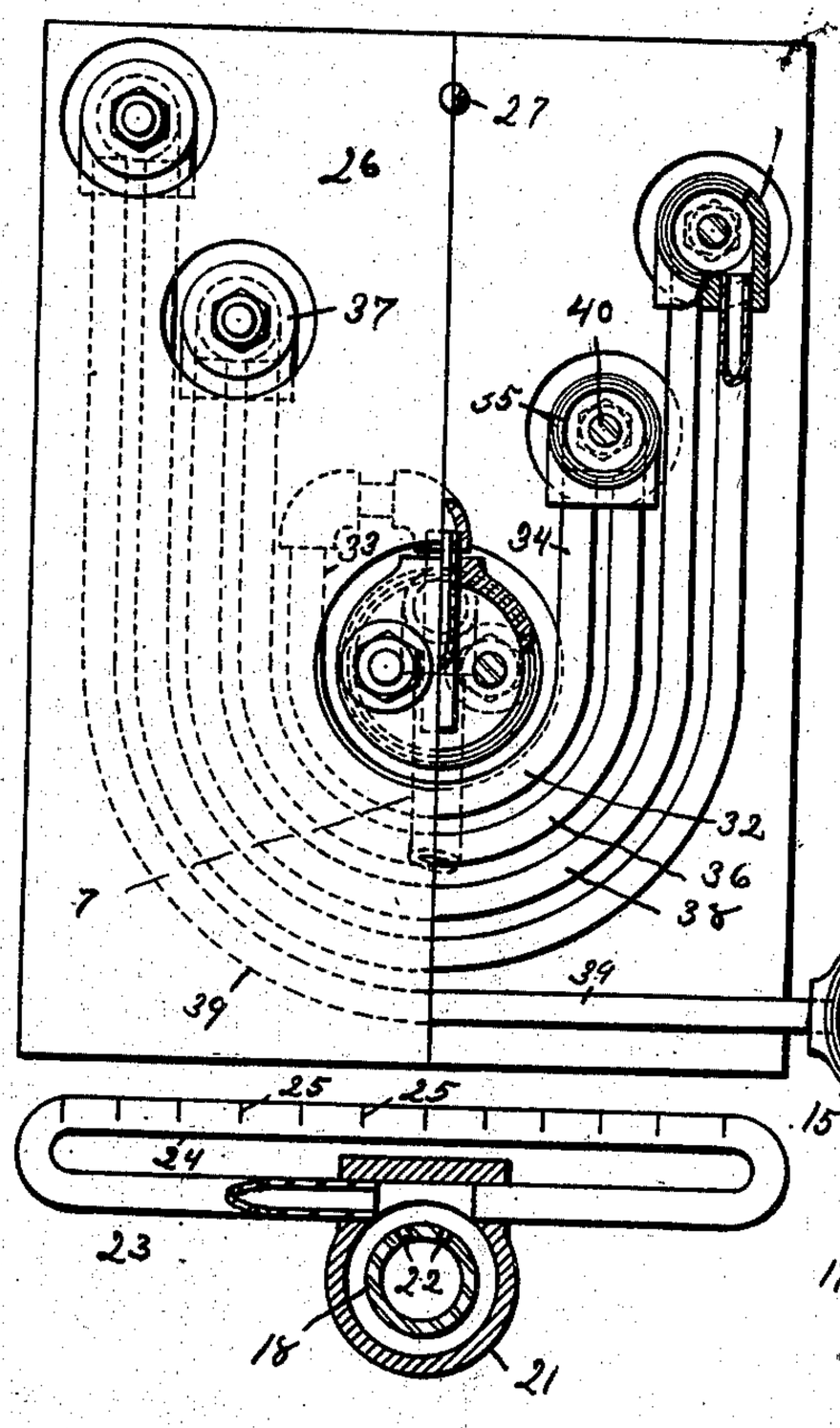

Fig. 5.

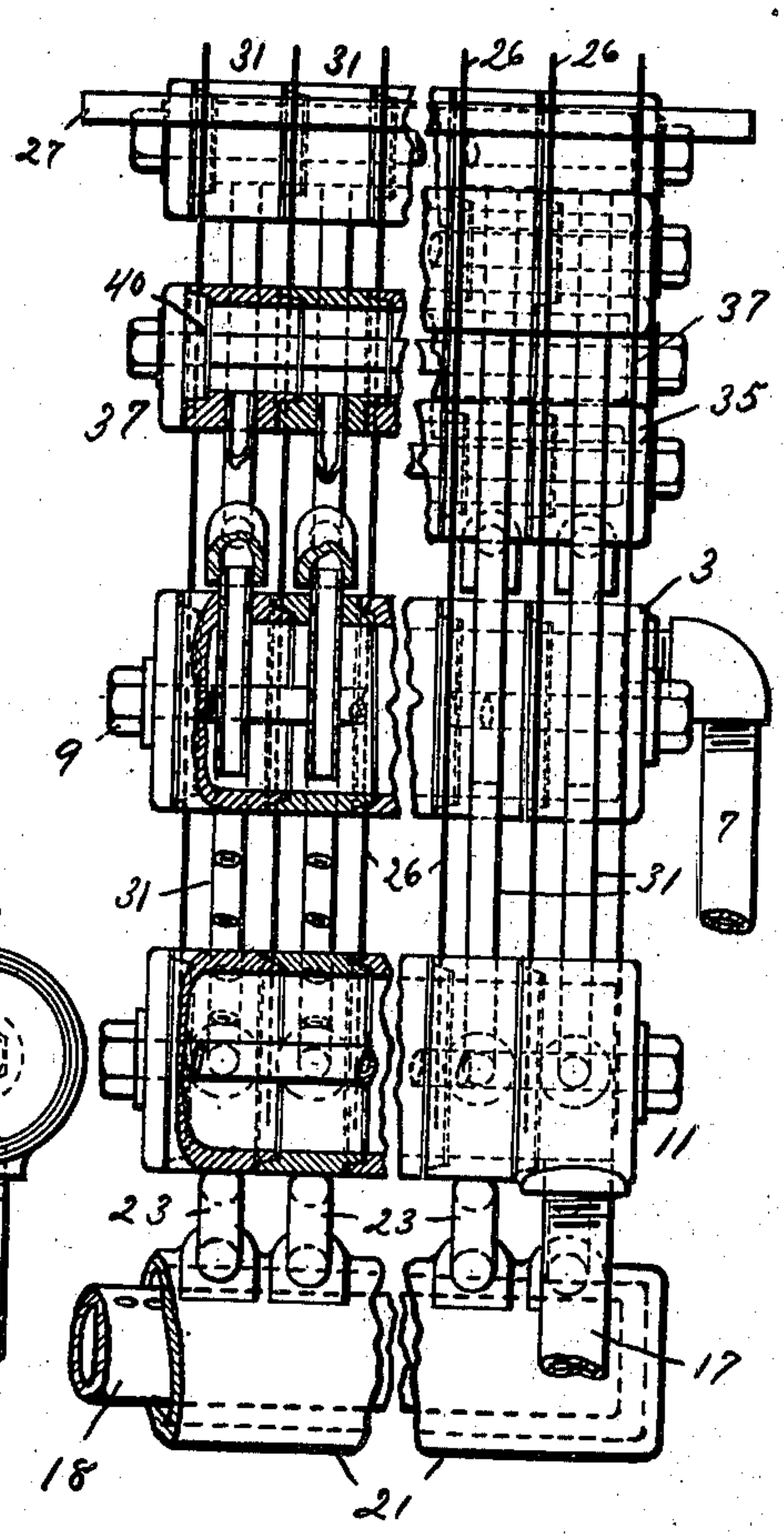

Fig. 6.

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No. 736,187. Patented August 11, 1903.

UNITED STATES PATENT OFFICE.

LYSANDER EDWIN WRIGHT, OF NEWARK, NEW JERSEY.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 736,187, dated August 11, 1903.

Application filed December 6, 1902. Serial No. 134,080. (No model.)

To all whom it may concern:

Be it known that I, LYSANDER EDWIN WRIGHT, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented and produced a new and original Improvement in Steam-Generators; and I do hereby 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 figures of reference marked thereon, which form a part of this specification.

This invention relates to that class of steam-generators known as "flash-boilers;" and the objects of the invention are to obtain a large heating-surface, to secure an equal distribution of heat, to provide a sectional construction permitting any desired number of sections to be employed and facilitating the making of repairs, to secure in each section a series of chambers or chamber portions which successively approach nearer and nearer the source of heat, to thus receive water at a low temperature and convey the same to boiler portions of gradually-increasing temperature until it reaches a point of explosion or total evaporation and then continues to boiler portions of further increasing temperature for superheating, and to obtain other advantages and results, some of which will be hereinafter referred to in connection with the description of the working parts.

The invention consists in the steam-generator herein described and in the arrangements and combinations of parts of the same, all substantially as will be hereinafter set forth and finally embraced in the clauses of the claim.

Referring to the accompanying drawings, in which like figures of reference indicate corresponding parts in each of the several figures, Figure 1 is a cross-sectional view of my improved steam-generator and burner therefor. Fig. 2 is a side elevation of the same, partly in section, as upon line *x*, Fig. 1. Fig. 3 is an end view of the generator and burner. Fig. 4 is a detail plan view, partly in section, of a portion of a burner. Fig. 5 is an end view, partly in section, illustrating a modified construction of a boiler; and Fig. 6 is a side elevation of the same, partly in section.

In said drawings, 2 2 indicate the separable sections of my improved steam-generator, each comprising in the preferred construction a tube coiled spirally to lie in a single plane. Any desired number of such coils may be set up together to form a steam-generator of a desired capacity, each coil occupying a vertical position and being held rigidly in place parallel to one another by means hereinafter described. Through the centers of said coils extends a cylindrical water-chamber 3 at right angles to the planes of the coils, said water-chamber being formed of annular sections 4, one for each coil, and which are adapted to join at their meeting ends by means of male and female flanges 5 6. The said sections are open at their opposite ends with the exception of the two endmost ones, which are closed outwardly and one provided with a water-supply pipe 7, leading thereinto. Longitudinally through said water-chamber 3, preferably on opposite sides of a vertical plane, extend clamping-bolts 8 8, provided at their ends outside the water-chamber with tightening-nuts 9. By screwing up said nuts, therefore, the sections 4 of the water-chamber are pressed firmly together, the joint made by one section with the next being adapted to secure an impervious connection.

Each water-chamber section 4 is apertured at its top to receive the end 10 of the pipe which is coiled to form that particular boiler-section 2, and said pipe end extends diametrically of the interior of the water-chamber section nearly to its lower side, as shown, for the purpose of securing circulation.

The opposite end of the coiled pipe or boiler-section 2 extends horizontally and laterally, as at 100, from the lowest point of the coil and enters a steam-chamber 11, extending parallel to the series of boiler-sections near their bottoms. Said steam-chamber 11 is composed of a series of sections 12 after the manner of the water-chamber 3, said sections correspondingly engaging each other by male and female flanges 13 14 and being held together by a single central longitudinal clamping-bolt 15. Each section receives the end 100 of its coil 2 at the side, as at 16, and from

the bottom of one section, preferably an end section, a steam-pipe 17 leads away.

Beneath my improved boiler thus described I place for heating purposes a specially-constructed hydrocarbon-burner comprising a tubular mixing-chamber 18, into one end of which opens a gas-nozzle 19, air being admitted around said nozzle, as at 20. Said tubular mixing-chamber 18 is inclosed in a larger distributing-chamber 21, into which the mixed gases escape through perforations 22 in the top of the mixing-chamber, the combined area of said perforations being less than that of the inlet of the mixing-chamber in order to secure a uniform pressure from end to end of said mixing-chamber. Upon the upper part of the distributing-chamber 21 are arranged transverse elliptical coils or loops 23 of pipe, each disposed in the same vertical plane with a coil 2 of the boiler and having its ends approaching at the middle of its under side and entering opposite points of the distributing-chamber to communicate with the interior thereof. The upper side or portion 24 of each loop 23 has transverse saw-slits 25, from which the gaseous fluid may issue and be ignited, the flame from each individual burner thus reaching upward to envelop an individual coil 2 above. To further secure an equal distribution of heat to each water-section, I place between the successive boiler-sections or coils 2 battering plates or partitions 26, vertically disposed and being perforated at suitable points to receive stay-rods 27 27, upon which the said plates are held in position by means of cotter-pins 28 on either side thereof. The battering plates or partitions are preferably recessed or slotted from the top to receive the water-chamber 3 or may be apertured for this purpose, as shown in Figs. 5 and 6.

In operation it will be understood that water enters the said water-chamber 3 until the same is filled, when it overflows into the innermost whirl 29 of each coil. When this whirl is filled, the water overflows into the next whirl 30, and so on successively until a point is reached at which the water is converted into steam. Said steam then passes on to farther coils, in which it is superheated, and finally issues into the steam-drum 11. It will be noted that the water-chamber is exposed to a medium degree of heat and that as the water or steam passes from one successive whirl to another it approaches at the lower portion of said whirl nearer and nearer to the source of heat. This prevents any possible decrease of temperature from what has been previously attained and insures the delivery of steam to the steam-chamber in a condition of maximum usefulness.

In Figs. 5 and 6 I have shown a construction which may under some conditions be substituted for that shown in Figs. 1 to 3, inclusive. Here the boiler-sections 31 instead of being composed of successive whirls of a single spirally-coiled pipe are made up of successive U-shaped tubes nested, as shown, in a vertical plane. The first of said U-shaped tubes or one nearest the center, as 32, communicates at one vertical arm 33 with the water-chamber 3 and at its opposite vertical arm 34 extends to a height above said point of communication with the water-chamber and communicates by a union or return-bend 35 with the adjacent upper end of the next outer U-shaped tube 36. This tube 36 at its opposite end extends to a higher point than the union 35 and is similarly joined by a union or return-bend 37 to the adjacent arm of the next successive U-shaped tube 38. This continues through any number of tubes desired, the last tube, as 39, extending from its lower portion horizontally outward to the steam-chamber 11 in the form of an elbow, as shown. This construction, it will be seen, secures the same results in generating steam as does the preferred construction first described, since each successive U-tube must be filled here before water enters the next succeeding one, as there each successive coil must be filled before water enters the next. It, however, involves the use of many joints, while the other construction has no joints exposed to the action of the heat.

In the said modified construction shown in Figs. 5 and 6 and last described the unions or return-bends, as 35 37, which connect the two adjacent ends of corresponding pairs of U-tubes in the successive sections of the series forming the boiler, are joined end to end throughout the length of the boiler by means of clamping-rods 40, extending centrally therethrough, the interiors of said unions communicating and the general construction being similar to that of the water-chamber and steam-drum.

Obviously various modifications and substitutions may be made in the detail construction of my invention without departing from the spirit and scope of the claims, and I therefore do not wish to be limited by the positive descriptive terms employed except as the state of the art may require.

Having thus described the invention, what I claim as new is—

1. In a steam-generator, a horizontally-extending series of sections each comprising a tube tortuously arranged in vertical plane, and vertical partition-plates alternating with said sections and each separated therefrom by a draft-space.

2. A steam-generator comprising successive tubular portions arranged in series in a vertical plane, and vertical battering-plates forming walls at the sides of said series separated therefrom by draft-spaces.

3. The combination with a source of heat and a water-supply, of a flash-boiler comprising successive tubular portions connected in series in a vertical plane, each successive por-

tion rising higher than the preceding one and extending nearer to the source of heat.

4. A flash-boiler consisting of a tube coiled spirally and arranged in a vertical plane, parallel battering-plates adjacent to the opposite sides of the coil, and means for supplying heat between said plates.

5. A flash-boiler consisting of a series of parallel tubes each coiled spirally and disposed in a vertical plane, parallel battering-plates between said coils, and means for connecting said tubes.

6. A steam-generator comprising a series of spirally-coiled tubes arranged in parallel vertical planes, a water-chamber extending longitudinally through the centers of said coils and a steam-chamber outside said coils, each coil connecting at opposite ends with said chambers, partition-plates disposed vertically between said coiled tubes and being apertured to receive said water-chamber.

7. In a steam-generator, the combination of a series of sections each comprising a series of tubular portions arranged in vertical planes, and a series of burners arranged one in the plane of each of said sections, whereby the same are heated equally.

8. In a steam-generator, the combination of a series of sections each comprising a series of tubular portions arranged in vertical planes, vertically-disposed partition-plates alternating with said sections, and means for supplying heat.

9. In a steam-generator, the combination of a series of sections each comprising a series of tubular portions arranged in vertical planes, a series of gas-jets beneath each section in the plane thereof, and partition-plates vertically disposed between said sections and terminating at their lower edges above said gas-jets.

10. In a steam-generator, the combination of a series of sections each comprising a tube tortuously arranged in a vertical plane, means for supplying water to, and receiving steam from, said tubes, partition-plates between said sections, and gas-jets arranged between said plates in the planes of the sections.

11. In a steam-generator, the combination of a series of sections each comprising a tube tortuously arranged in a vertical plane, means for supplying water to, and receiving steam from, said tubes, and a series of gas-jets arranged one in the same plane with each of said sections.

12. A steam-generator comprising tubular portions connected in series in a vertical plane, each successive portion approaching more closely to the source of heat than the preceding one, and means for supplying water to, and receiving steam from, the opposite end portions in said series, respectively.

13. A steam-generator comprising a series of parallel sections each consisting of a series of tubular portions arranged in one vertical plane, each successive portion rising higher than the preceding one and extending lower, and means for supplying heat stationed beneath said series of sections.

14. A steam-generator composed of a series of spirally-coiled tubes arranged in parallel vertical planes, battering-plates between said coiled tubes, a series of gas-jets beneath each coiled tube, and means for supplying water to, and receiving steam from, all said tubes simultaneously.

15. In a steam-generator, a series of spirally-coiled tubes arranged in parallel vertical planes and each providing a central open space and having its inner end bent diametrically thereacross and each having its outer end turned away from the coil, a water-chamber extending through the central openings of the coils and receiving at its upper side the tube ends, a source of heat arranged beneath said series of coils, and a steam-chamber to which all the outer ends of the tubes are connected.

16. A steam-generator comprising a series of sections, each consisting of a series of tubular portions arranged in vertical planes, an annular water-chamber section and an annular steam-chamber section, both arranged in the same plane with the said series of tubular portions and being connected one to each end thereof, and a battering plate or partition at one side of and parallel to, each series of tubular portions and being separated therefrom by a draft-space, said plates being apertured to receive said water and steam chambers.

17. In a steam-generator, the combination of a parallel series of vertical sections and battering plates or partitions separating said sections, said plates alternating with the sections and being separated from the same by draft-spaces.

18. In a steam-generator, the combination of a series of vertical sections, partitions separating said sections one from another, and gas-burners arranged one between each two adjacent partitions in the plane of the section therebetween.

In testimony that I claim the foregoing I have hereunto set my hand this 3d day of December, 1902.

LYSANDER EDWIN WRIGHT.

Witnesses:
C. B. PITNEY,
RUSSELL M. EVERETT.