

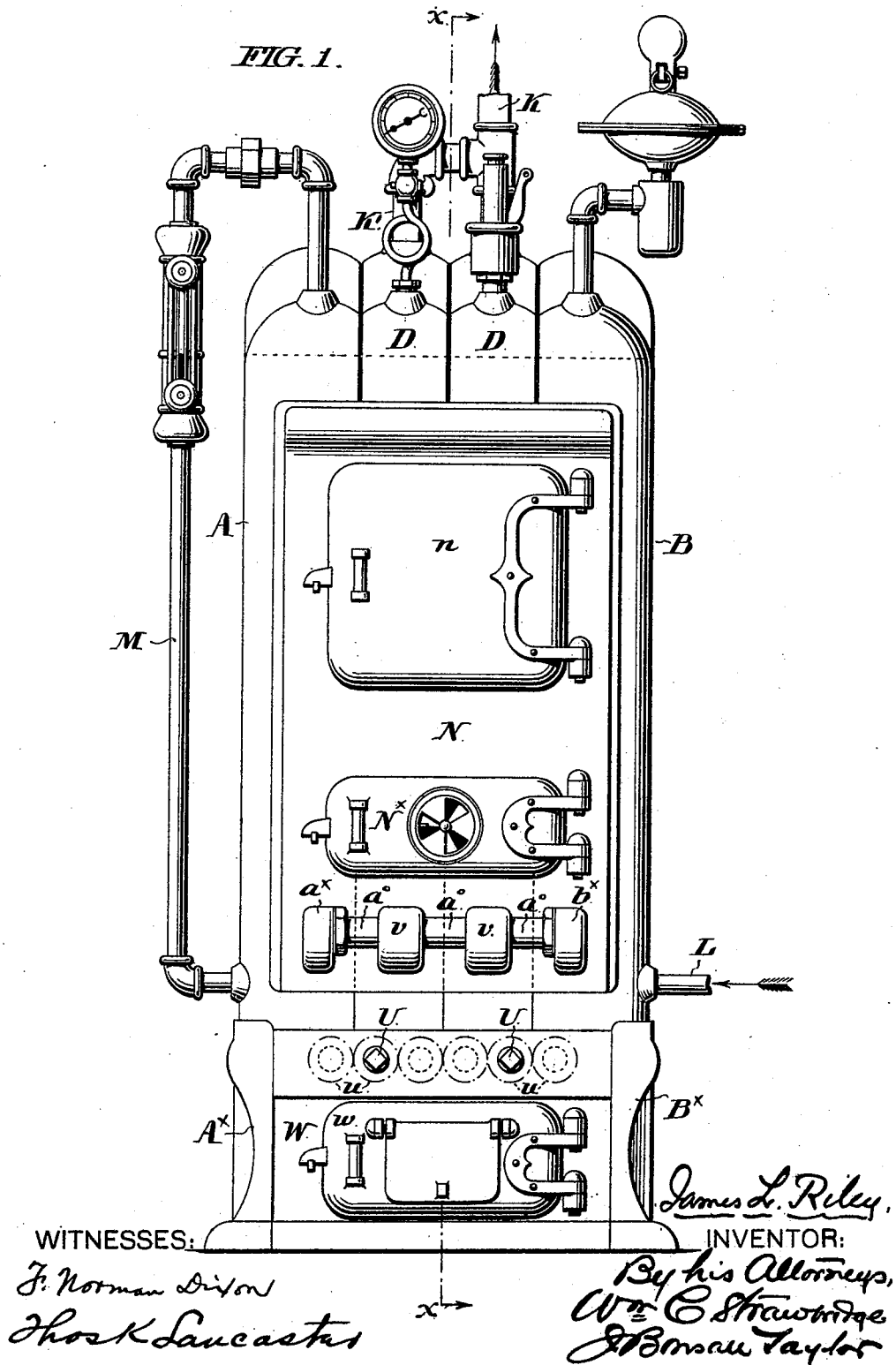
(No Model.)

4 Sheets—Sheet 1.

J. L. RILEY.
LOW PRESSURE STEAM GENERATOR.

No. 581,492.

Patented Apr. 27, 1897.



(No Model.)

4 Sheets—Sheet 2.

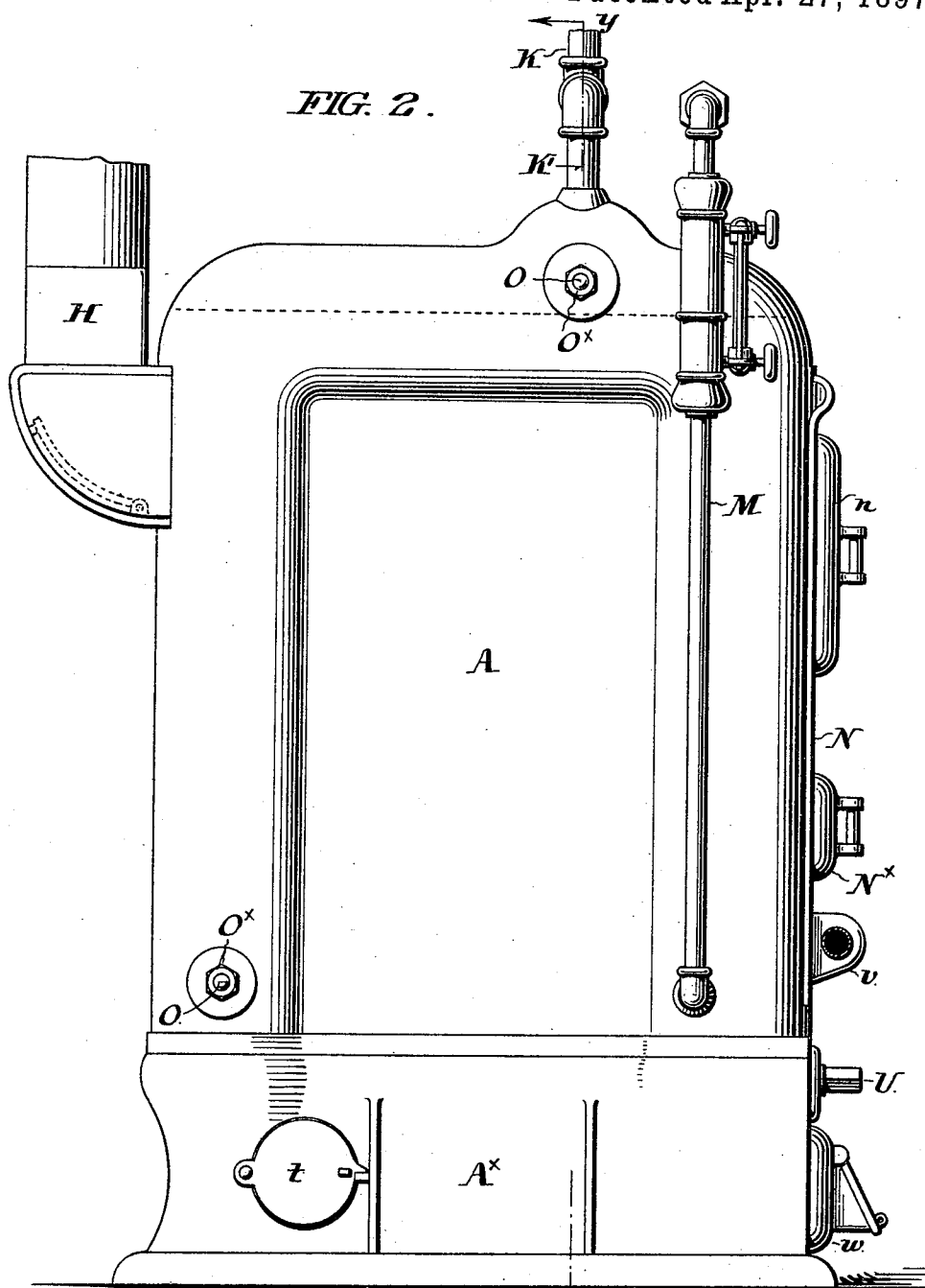
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FIG. 2.



WITNESSES:

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James L. Riley,
INVENTOR:
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Wm. C. Strawbridge
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(No Model.)

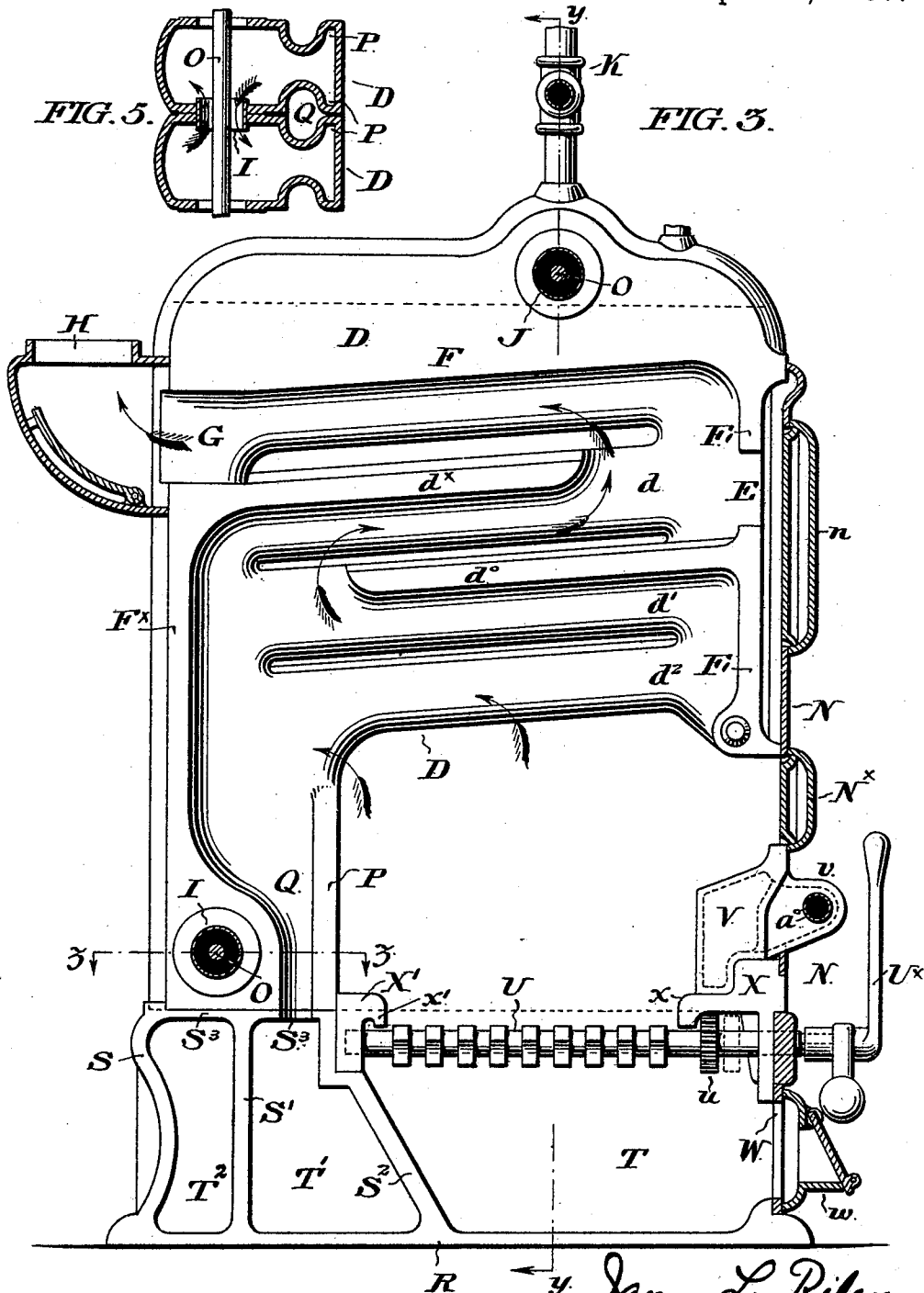
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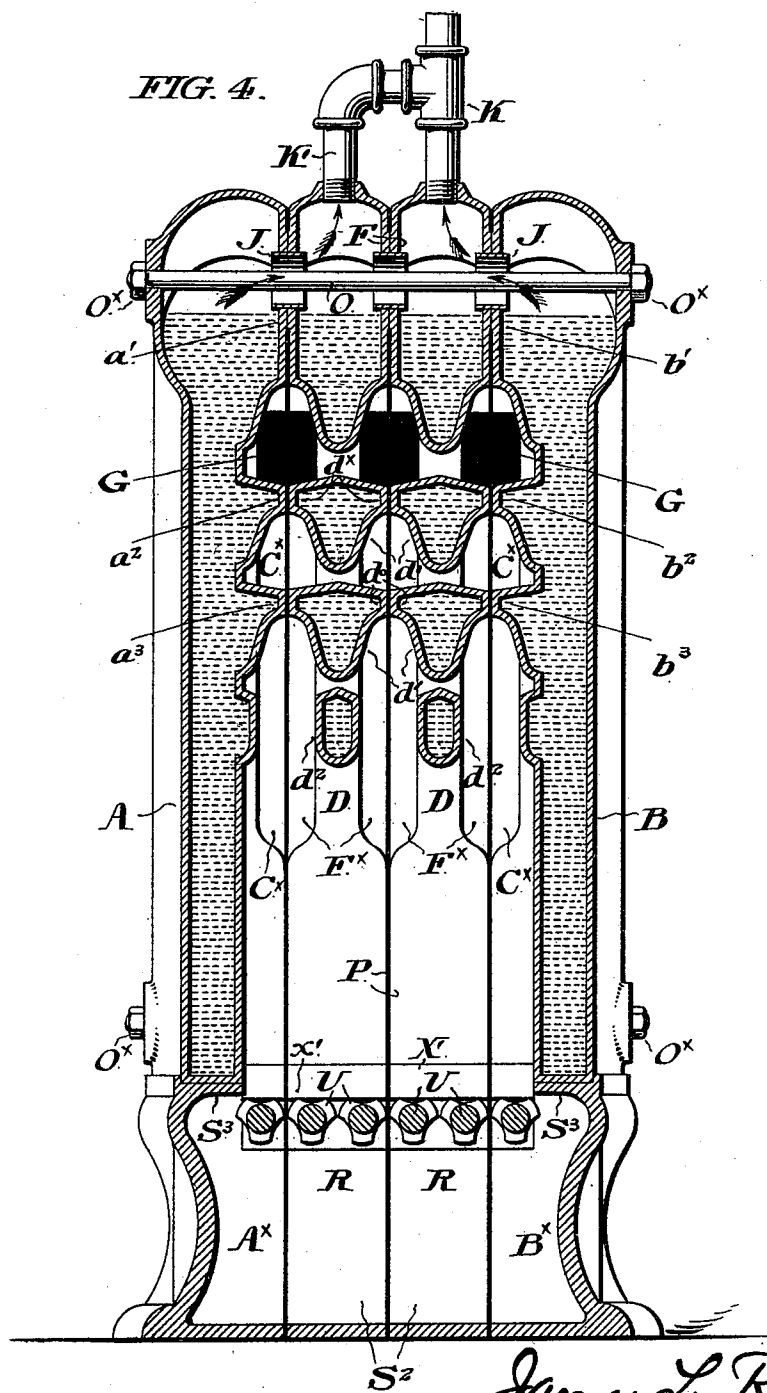
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UNITED STATES PATENT OFFICE.

JAMES L. RILEY, OF PHILADELPHIA, PENNSYLVANIA.

LOW-PRESSURE STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 581,492, dated April 27, 1897.

Application filed November 28, 1896. Serial No. 613,749. (No model.)

To all whom it may concern:

Be it known that I, JAMES L. RILEY, a citizen of the United States, residing in the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Low-Pressure Steam-Generators, of which the following is a specification.

My invention relates to the class of generators employed for the generation of steam under low pressure for circulation through heater pipes, for the heating of buildings, and similar uses.

By reason of the great variations in area of buildings to be heated by apparatus of this character, and the consequent variation in sizes of heaters required, it has been customary, to obviate the necessity for the dealer to keep on hand the patterns and parts of the large number of sizes of heaters required, to so construct generators of this class that they may be built up, so to speak, to any size, from a series of sections, of which a suitable number are to be assembled to constitute a generator capable of furnishing the required amount of steam.

My invention relates to sectional steam generators of the foregoing general character, and its object is to provide a sectional steam generator in which simplicity and inexpensiveness of construction are combined with very great efficiency in operation.

In the accompanying drawings, I show and herein I describe a good form of a convenient embodiment of my invention, the particular subject-matter claimed as novel being hereinafter definitely specified.

In the accompanying drawings,

Figure 1 is a view in front elevation of an apparatus embodying a good form of my invention.

Figure 2 is a view in side elevation of the apparatus shown in Figure 1, sight being supposed taken from the left hand side of said figure.

Figure 3 is a vertical longitudinal sectional elevation, of the apparatus shown in Figures 1 and 2, section being supposed upon the dotted line $x-x$ of Figure 1, and sight being taken in the direction of the arrows applied to said line.

Figure 4 is a transverse vertical sectional elevation of my improved apparatus, section being supposed on the dotted line $y-y$ of Figures 2 and 3, and sight being taken in the direction of the arrows applied to said line.

Figure 5 is a sectional plan of the lower portion of two adjacent generator shells, section being supposed on the dotted line $z-z$ of Figure 3.

Similar letters of reference indicate corresponding parts.

In the construction of sectional generators, as heretofore constructed, the sections have extended transversely of the generator, so that increase in the number of sections increased the distance from front to rear of the generator and also occasioned a corresponding increase in the grate and fire surface area, without, however, increasing the flue area.

In a properly constructed generator, the area of the grate and fire surface should, to insure the best results, bear a given portion to the flue area, and it is obvious that, in generators of the class referred to, the employment of a given fixed flue area, in connection with grate surfaces of varying area, will result in the construction of generators in a large proportion of which the grate area and flue area are disproportioned.

For this reason, the sectional generators constructed in the manner stated, have not been so successful as to lead to their general adoption.

Generally stated, my invention comprehends the provision of a steam generator formed in sections, any desired number of which may be employed in the building up of a generator, which sections extend from front to rear, as opposed to from side to side, of the structure, with the result that increase or diminution of grate and fire surface, is attended by a corresponding increase or diminution of flue area, and accordingly the theoretical proportions existing between these parts is maintained regardless of variation in size of the assembled structures.

In my improved generator, I prefer to make the two end sections, which extend, as do all the sections, from front to rear of the generator, of a construction differing somewhat from that of the intermediate sections, which last

named sections are all counterparts of each other.

In my improved generator, each section is formed of a water shell or section, and a grate section, the aggregate of the water shells forming the generator proper, and the aggregate of the grate sections forming the grate surface, the ash pit, and the support for the water shells, as shown in the drawings.

The outer water shells or sections, designated A and B, are reversely disposed counterparts of each other, being each a hollow shell, imperforate except for the openings hereinafter described, and each formed with its hollow interior continuous from top to bottom, and from end to end, the exterior walls of said sections being flat or of ornamental construction, and the inner faces or walls of said sections being, as to their upper portions, formed into or with lateral transverse abutments a' , a^2 , a^3 , and b' , b^2 , b^3 , and being as to their rear portions formed with lateral vertically extending abutments C^x , and as to their front portions formed with similar vertically extending abutments.

The crests of all abutments are flush with each other.

These sections A and B rest as to their lower ends upon the grate sections $A^x B^x$, as shown, and, extending upward to any desired height, form the side inclosing walls of the combustion chamber.

D D are intermediate sections, of which one or any desired number may of course be employed in a given generator, according to the size of generator desired to be used, all of which intermediate sections are mounted between the end sections, are of general arciform profile when viewed from the side, and are each provided with plane faced lateral abutments, designated $F F'$ and F^x , extending respectively along their upper portions and down their front and rear portions, which abutments when the parts are assembled, make contact with the corresponding abutments of the other intermediate sections, or the faces of the corresponding abutments of the end sections, as the case may be, with the result that when the sections are assembled, a combustion chamber is formed by the water shells or sections, the sides of which are constituted by the end shells or sections A B, and the rear, top, and front walls of which are constituted by the arciform intermediate sections.

Each of the intermediate arciform water shells or sections is preferably provided with a series,—three being shown,—of water tubes d , d' , d^2 , extending from its front leg to its rear leg, said water tubes opening as shown into both said legs, and being disposed in a vertical series.

The tube d^2 is shown as of uniform dimensions from end to end.

The tube d is provided with lateral abutments d^x , one on each side, being branches,

so to speak, of the vertically extending lateral abutments F^x , and extending along said tube to a point in the vicinity of the front leg of the section.

The tube d' is shown as provided with lateral abutments d'^0 , one on each side, being branches, so to speak, of the vertically extending lateral abutment F' , and extending along said tube to a point in the vicinity of the rear leg of the section.

When the parts are assembled the abutments d^x of adjacent intermediate sections or shells are brought into close contact with each other, or, if next to the end sections or shells, with the abutments a^2 ,—while the abutments d'^0 are similarly brought into close contact with each other, or, if next to the end sections or shells, with the abutments b^3 , as shown in Figure 4.

The lateral abutments $d^x d'^0$ of the water tubes $d d'$ serve, as will be obvious, to form a tortuous or sinuous path for the flame and products of combustion of the fire in the combustion chamber, with the result that the water contained in the shells or sections very thoroughly absorbs and utilizes the heat present in the products of combustion before the escape of the latter from the generator,—said products being compelled, as shown by the arrows in Figure 3, to pass rearwardly beyond the ends of the abutments d'^0 , and then forwardly beyond the ends of the abutments d^x , before they are permitted to pass along the under faces of the upper portions of the sections and escape through the smoke holes G.

The rear vertically extending abutments C^x of the end sections or shells,—and the rear vertically extending abutments F^x of the intermediate shells, each embody a transverse channel G, which channels, when the shells or sections are assembled, register with each other, and form a series of openings, or smoke holes, each existing between two shells or sections and formed partly in each.

Each smoke hole may discharge into a separate flue H, or all may discharge into a common flue extending transversely of the structure, as the constructor may desire.

I have shown the water tubes d , d' , d^2 , as slightly inclined upwardly from the rear to the front of the generator, this being to afford the greatest freedom for the ascent of the hotter water in the shells to the upper portion of the latter and to afford free circulation for the water.

By forming the abutments $d^x d'^0$ of the water tubes $d d'$ at the upper portions of the latter, said tubes, in section, as shown in Figure 4, approximate equilateral triangles in outline, or, as it may be more definitely expressed, the lower portions of said tubes, in section, have the outline of a double ogee, with the result that not only is the maximum area of said pipes exposed to the flames beneath them, so that the contained water is very quickly heated, but also the upper portions of said

tubes, which serve to catch and retain a large amount of the soot, being flat, enable the very easy and expeditious removal of said soot.

5 The front vertical abutments of the end sections or shells, and the abutments F' of the intermediate sections or shells, each embody a transversely extending recess or depression, E, which recesses, when the shells or sections are assembled, constitute a series of soot openings, one situated between each pair of sections.

10 The assembled sections are placed in communication with each other, by series of slip nipples I, J,—the nipples I being located in the lower rear portions of the shells or sections, below the water line, whereby the water is maintained at a uniform level in all the sections,—and the nipple J being located in the upper portions of the shells or sections above the water line, whereby the steam circulates from one shell or section to another and exists at a uniform pressure in all.

15 K, Figure 4, is a steam or circulating pipe leading from an intermediate section,—and K' is a branch of said pipe leading from an adjacent intermediate section. One steam pipe is of course all that is necessary so far as the working of the generator is concerned.

20 L, Figure 1, is a pipe leading into the lower end of a shell or section, through which the condensate of the generated steam is returned to the generator. This pipe may of course be placed in communication with a source of water supply.

35 M Figures 1 and 2, is a gage or indicator. The generator is of course to be supplied with any preferred pressure gages, dampers, and like auxiliary devices.

40 The front portion of the generator chamber is covered by a plate, N, Figures 1, 2, and 3, of suitable size to extend over the parts of all the shells or sections employed, and secured thereto in any desired manner.

45 The plate N of course embodies a door *n* through which access may be had to the soot openings E,—and a fire door N^x provided with the usual damper.

50 O are tie bars extending through the series of shells and serving to lock them securely together, said tie bar extending through the bores of the slip nipples and to the exterior of the end sections or shells, and being equipped with the usual heads, nuts, or enlargements O^x.

55 P, Figures 3 and 5, are a series of vertical abutments extending down the front opposing edges of the rear legs of the intermediate shells or sections, and down the inner faces of the end shells or sections, and extending from the level of the grate to a point in the vicinity of the lower water tube.

60 These abutments, when the sections or shells are assembled constitute, in effect a bridge wall over the upper ends of which the smoke and products of combustion must pass, and behind which are formed the chan-

nels Q, through which soot and similar refuse matter may pass down to a soot receptacle or chamber into which said channels discharge. 70

The lower part of the generator is composed of a series of grate sections, the end sections A^x B^x of which (upon which as stated, rest the end water shells or sections A B),—being formed as reverse counterparts 75 of each other and embodying each a side wall extending from the front to the rear of the generator,—and the intermediate sections being counterparts of each other corresponding in number to the number of water sections 80 or shells employed and being mounted or disposed between said end sections.

The end sections A^x B^x and the intermediate sections R are each provided with a rear wall S, an intermediate vertical supporting 85 wall S', and a second intermediate vertical wall S² which rear wall and intermediate walls of the several sections register with each other when the grate sections are assembled in position,—and constitute, first, an ash-pit 90 or receptacle T, between the wall S² and the front of the sections, and, second, a soot chamber T' between the wall S' and the wall S². The space T² is merely an idle space between the rear wall S and the supporting wall S'. 95

t, Figure 2, is a door in the end grate section A^x, opening into the soot chamber, through which the soot may be removed.

A cover plate S³ extends from the top of the wall S to the top of the wall S² of each intermediate section, and upon these cover plates 100 rest the rear legs of the intermediate water shells or sections, said cover plate being, in the end sections A^x B^x, extended to the front end of the generator to afford support for the 105 end water shells or sections A, B, as shown.

The cover plates S³ embody openings in registry with the openings Q to permit the descent of soot to the soot chamber.

Each of the intermediate grate sections is 110 shown as equipped with a plurality of grate bars of any ordinary and convenient type, and the end sections A^x B^x are shown as each provided with one bar, said grate bars, which are designated U, being shown as each 115 equipped in the region of its front end with a gear wheel *u*, and the front end of each grate bar, which ends protrude through the front of the generator, being shown as squared to receive a shaker U^x being a device in the nature of a wrench by which the end of a grate 120 bar may be engaged and manually rotated.

By means of the gear wheels *u* the grate bars are geared together in series of three, so that rotation of any one of said grate bars 125 will occasion the simultaneous rotation of the two other grate bars in the group of grate bars of which it is a member.

The front of the ash-pit is shown as composed of a plate W embodying an opening, 130 covered and inclosed by the usual door or cover *w*.

I prefer to provide my improved generator with an auxiliary water heating device which

may be used to heat water which may be subsequently fed into the water shells or sections, or on the other hand withdrawn for use in domestic or other purposes according to the character and arrangement of the pipe connections with which it may be equipped.

Each of the end sections or shells A B is equipped at its front edge with a forwardly-extending hollow boss or chamber $a^x b^x$ in communication with the hollow interiors of said shells or sections and adapted to extend through openings of suitable shape formed in the lower portion of the front plate N.

V, Figure 3, are a series of auxiliary water chambers, corresponding in number to the number of intermediate sections or shells employed, each consisting conveniently of a hollow body or box adapted to exist within the front portion of the combustion chamber and formed of such shape as may be required by the shape and position of its supporting device, and each provided with a forwardly-extending hollow boss or projection v adapted to extend through an opening of suitable character formed in the lower portion of the front plate N of the generator.

When the parts are assembled, the hollow bosses or projections $a^x b^x$ and v will be in line with each other as shown in Figure 1, and may be placed in communication with each other by a series of nipples or tubes a^0 as shown.

As will be understood, the water in the end sections $A^x B^x$ circulates into the projections or hollow bosses $a^x b^x$ and from them to and through the series of auxiliary water chambers V.

As will be further understood, the water circulating through these auxiliary water heating devices will be subjected to a very high degree of heat because of the immediate contact of the auxiliary heater with the incandescent mass in the grate, and water thus heated, flowing into or circulating through the bodies of the shells or sections, serves to very considerably increase the efficiency of the heater as a whole.

X, Figure 3, is a block or casting extending transversely of the front of the generator, resting as to its under edge upon the upper front edge of the grate sections, and provided with a rearwardly extending plate, x , which serves both as a support for the bodies of the auxiliary water heaters and as a protection for the gear wheels of the grate bars.

X' is a block or casting extending transversely of the generator and mounted in the rear portion of the combustion chamber, being supported in a suitable recess formed for it in the upper portion of the wall S².

This block or casting X' receives the ends of the rotatable grate bars, and is provided with a forwardly-extending plate or lid x' which tends to protect the rear bearings of the grate bars from the heat of the burning mass and from ashes and cinders.

When it is desired to employ the auxiliary

heater as a device for providing hot water to be withdrawn for domestic purposes, a block or cap may be inserted in the tubes which connect the hollow bosses or projections $a^x b^x$ with the boxes or projections v and the hollow bosses or their connections be thereupon connected with any suitable source of water supply and also, of course, provided with an outlet or escape pipe.

Having thus described my invention, I claim and desire to secure by Letters Patent:—

1. A steam generator consisting of a grate and a series of water shells or sections supported over said grate and extending from front to rear thereof, abutments, formed on the inner faces of the end shells or sections, and extending along the top and down the front and rear ends of the same, corresponding abutments formed on both faces of the intermediate shells or sections, means for securing the sections together, and means for placing them all in communication,—substantially as set forth.

2. A steam generator consisting of a grate and a series of water shells or sections supported over said grate, the end shells or sections being formed as hollow walls and the intermediate sections being of arciform outline, abutments formed on the inner faces of the end shells or sections and extending along the top and down the rear ends of the same, corresponding abutments formed on both faces of the intermediate shells or sections, recesses formed in the abutments which extend down the rear portions of the sections, which recesses register with each other when the sections are assembled, and form a smoke hole between each pair of sections, means for securing the sections together, and means for placing them in communication,—substantially as set forth.

3. A steam generator consisting of a grate and a series of water shells or sections supported over said grate and extending from front to rear thereof, the end shells or sections being formed as hollow walls of general rectangular outline, and the intermediate sections being of arciform outline abutments formed on the inner faces of the end shells or sections and extending along the top and down the front and rear ends of the same, corresponding abutments formed on both faces of the intermediate shells or sections, recesses formed in the abutments which extend down the front portions of the sections, which recesses register with each other when the sections are assembled and form a soot opening between each pair of sections, means for securing the sections together, and means for placing them in communication,—substantially as set forth.

4. A steam generator consisting of a grate and a series of water shells or sections supported over said grate, the end shells or sections being formed as hollow walls and the intermediate sections being of arciform out-

line, water tubes extending from one leg to the other of each of the intermediate sections, said tubes being of greatest breadth at their upper portions, their upper walls being approximately flat, and the outline of their lower portions being approximately that of double ogee curves, whereby the maximum amount of tube surface is exposed to the heat of the fire beneath, and means for securing the several shells together and placing them in communication with each other,—substantially as set forth.

5. A steam generator consisting of a grate and a series of water shells or sections supported over said grate, the end shells or sections being formed as hollow walls and the intermediate sections being of arciform outline, inclined water tubes extending from one leg to the other of each of the intermediate sections, said tubes being of greatest breadth at their upper portions, their upper walls being approximately flat, and the outline of their lower portions approximating that of double ogee curves, whereby the maximum amount of tube surface is exposed to the heat of the fire beneath, and means for securing the several shells together and placing them in communication with each other,—substantially as set forth.

6. A steam generator consisting of a grate and a series of water shells or sections supported over said grate, the end shells or sections being formed as hollow walls and the intermediate sections being of arciform outline, water tubes extending from one leg to the other of each of the intermediate sections,

said adjacent tubes being in contact with each other for a portion of their length, means for securing the several shells together, and means for placing them in communication with each other,—substantially as set forth.

7. A steam generator consisting of a series of water shells or sections adapted to be supported over a grate and to extend from front to rear thereof, the end shells or sections being formed as hollow walls of substantially rectangular outline, and the intermediate shells or sections being of general arciform outline in profile, and means for securing the sections together and placing their interiors in communication,—substantially as set forth.

8. A steam generator consisting of a grate, and a series of water shells or sections supported over said grate and extending from front to rear thereof, the end shells or sections being formed as hollow walls, and the intermediate shells or sections being of arciform outline, abutments formed on the inner faces of the end shells or sections and corresponding abutments formed on the intermediate shells or sections, and means for securing the sections together and placing them in communication,—substantially as set forth.

In testimony that I claim the foregoing as my invention I have hereunto signed my name this 20th day of November, A. D. 1896.

JAS. L. RILEY.

In presence of—

J. BONSALE TAYLOR,
F. NORMAN DIXON.