

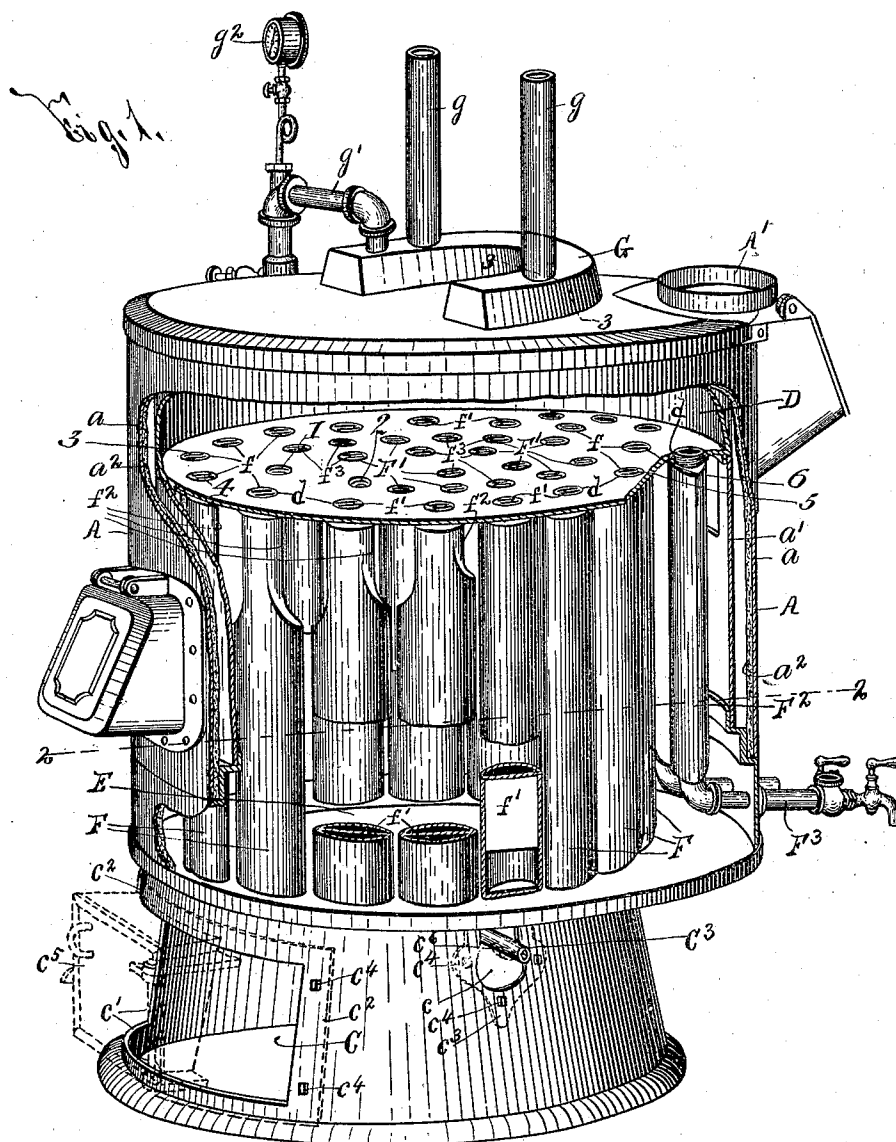
(No Model.)

2 Sheets—Sheet 1.

F. J. FURMAN.
GENERATOR.

No. 545,885.

Patented Sept. 10, 1895.



WITNESSES:

H. C. Chase,
H. H. Thobald.

INVENTOR

Frederick J. Furman

BY

Hay & Parsons

ATTORNEYS,

(No Model.)

2 Sheets—Sheet 2.

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Fig. 2.

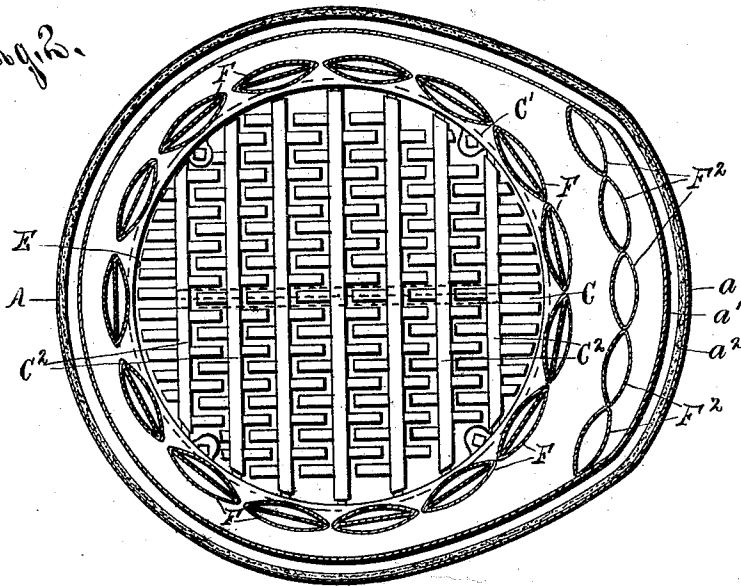


Fig. 3.

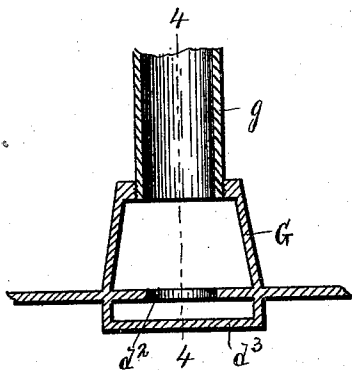
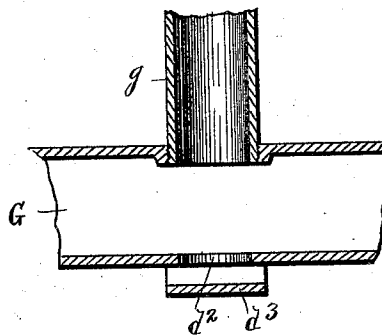


Fig. 4.



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UNITED STATES PATENT OFFICE.

FREDERICK J. FURMAN, OF GENEVA, NEW YORK.

GENERATOR.

SPECIFICATION forming part of Letters Patent No. 545,885, dated September 10, 1895.

Application filed January 17, 1895. Serial No. 535,203. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK J. FURMAN, of Geneva, in the county of Ontario, in the State of New York, have invented new and useful Improvements in Generators, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

My invention relates to improvements in generators of the type set forth in my prior patents, Nos. 421,261 and 452,637, dated, respectively, February 11, 1890, and March 19, 1891, and has for its object the production of a simple and practical construction for facilitating the combustion of fuel to a maximum degree and thoroughly utilizing the heat of the products of combustion; and to this end it consists, essentially, in a dome and a series of upright water-tubes connected to the dome and arranged outside of the combustion-chamber in such a manner that spaces or interstices of unequal width are interposed between their adjacent side edges.

The invention furthermore consists in a supplemental dome above the main dome and in the detail construction and arrangement of the component parts, all as hereinafter more particularly described, and pointed out in the claims.

In describing this invention, reference is had to the accompanying drawings, forming a part of this specification, in which like letters indicate corresponding parts in all the views.

Figure 1 is a perspective view of a generator embodying my invention, portions of its outer shell, the dome, and the water-tubes being broken away for the purpose of more clearly illustrating its construction. Fig 2 is a horizontal sectional view taken on line 2 2, Fig. 1. Fig. 3 is a detail vertical sectional view taken on line 3 3, Fig. 1; and Fig. 4 is a vertical sectional view taken on line 4 4, Fig. 3.

A is the outer shell or jacket of my generator, which is of any desirable form, size, and construction, and preferably consists of separated walls $a a'$, one of which may be provided with a suitable lining a^2 . The shell or jacket A is provided with a smoke-outlet A' and is supported above an ash-chamber C,

having its upright wall provided with openings $c c'$, closed by plates $c^2 c^3$, secured in position by suitable fastening means c^4 . The plate c^2 is provided with an ash-door c^5 of any desired construction, and the plate c^3 is formed with a bearing c^6 for the shaking-spindle of the grate immediately to be described. The opening c in the upright wall of the chamber C is of greater width than the diameter of the grate-frame C', (shown by dotted lines at Fig. 2,) for permitting insertion and withdrawal of said frame, and the opening c' is of greater width than the shaking-spindle of said grate.

The grate-frame C' is of any desired construction, and is suitably mounted and supports grate-bars C², having their corresponding ends connected together in the usual manner by suitable connecting devices (indicated by dotted lines at Fig. 2) and supported by the frame C' for simultaneously rocking said bars. As these connecting devices form no part of my present invention, and as their construction and operation will be readily understood by one skilled in the art, I have deemed it unnecessary to further illustrate and describe the same. A rocking spindle C³ projects from one of the grate-bars C², through the opening c' , and its outer end is supported by the bearing c^6 and is readily engaged by an actuating-crank. (Not illustrated.) When the plates $c^2 c^3$ are removed the grate-frame may be readily moved laterally a sufficient distance to permit the passage of the spindle C³ through the opening c' into the ash-chamber, and then said frame may be withdrawn through the opening c . An ash-chamber and a bearing of this construction for the rocking spindle of a grate are particularly applicable for use with my generator, but form no part of my present invention.

Supported at the upper part of the outer shell or jacket A is a dome D of any desirable form, size, and construction, the top face of which may form the top wall of the generator. I have here illustrated but a single dome, although a series of domes arranged alongside of each other may be used, if desired. The combustion-chamber E is arranged beneath the dome D, and is preferably en-

closed by a series of water-tubes F, which are arranged outside of said chamber in a substantially circular plane, although they may obviously be otherwise arranged. The tubes F are preferably formed substantially elliptical, with the exception of their upper extremities f , which are cylindrical, and are connected to the dome D, being preferably threaded openings d in the lower wall of said dome. Partitions f' extend lengthwise within the tubes F from their upper ends to a point in close proximity to their lower ends and effect a positive up-and-down circulation in each tube.

The adjacent side edges of the tubes F are preferably separated for permitting outward passage of the products of combustion from the chamber E, and thereby effecting a better combustion of the fuel and a more perfect utilization of the heat evolved than would otherwise be possible. As clearly seen at Fig. 2, the side edges of the water-tubes F at the rear of the generator, in proximity to the smoke-outlet A', are in close contact, and the side edges of the tubes directly opposite are considerably separated. A number of the water-tubes F adjacent to those considerably separated are so arranged that the spaces between their side edges decrease gradually from the front to the rear of the generator. Consequently the major part of the products of combustion passes from the chamber E between the separated tubes F to the front of the generator, and thence backwardly at the outside of said tubes to the rear of the generator.

In order to facilitate the effective escape of the products of combustion from the chamber E, the upper extremities of a number of the tubes F are formed with cut-outs f^2 in their side edges of unequal size, being uniform in depth and length, and these cut-outs are so arranged that the one of greatest depth and length is substantially opposite to the smoke-outlet A', and the others decrease gradually in depth and length toward said outlet. These cut-outs f^2 cause the greater portion of the products of combustion passing to the front of the generator to rise to the top thereof. In the preferable construction of my invention this desirable result is effected by cut-outs of unequal length or width; but it is obvious that the cut-outs may be formed of uniform length and varying width, or vice versa. The dome D is also provided with a series of shorter water-tubes F', arranged above the combustion-chamber E, and also preferably formed with diaphragms f^3 for insuring a positive circulation in each tube, but the arrangement of these tubes forms no part of my present invention. At the outside of the rear water-tubes F are an additional series of water-tubes F², having their upper ends connected to the drum D and their side edges in close proximity. As

clearly seen at Figs. 1 and 2, the rear tubes F² are considerably shorter than the tubes F, and the side edges of the outer tubes F² are arranged in close contact with the inner wall of the outer shell or jacket A. The tubes F² thus form a wall at the rear of the tubes F for partially shutting off or deflecting the passage of the products of combustion discharged into the shell or jacket A between the pipes F from the combustion-chamber. Consequently the products of combustion are compelled to pass downwardly beneath the lower ends of the tubes F² at the rear of the generator and thence upwardly to the outlet A'. This arrangement of the tubes F F² is very effective in thoroughly utilizing the heat of the products of combustion. To facilitate the accomplishment of this desirable result the return-pipes F³ discharge into the lower ends of the tubes F², and as any mud in the generator accumulates in the tubes F² the pipes F³ are provided with outlet-valves, through which the mud may be discharged.

Directly above the dome D is a supplemental dome G, preferably formed integral therewith, and, as clearly seen at Figs. 3 and 4, the top wall of the dome D is provided with openings d^2 , which connect the domes D G. The dome G is preferably formed U-shaped, although it may be otherwise constructed, and opening therefrom are the outgoing steam-pipes g g . If desired, a pipe g' , connected to a steam-gage g^2 , unnecessary to herein illustrate or describe, may open from the dome G. In order to prevent upward passage of the water into the supplemental dome G, I arrange beneath the openings d^2 cross-bars d^3 of greater width than the diameter of the openings d^2 . The supplemental dome G insures the discharge of dry steam when my invention is used as a generator, and adds greatly to its efficiency. It is obvious, however, that my invention may be used as a hot-water generator, and in that event the supplemental dome may be dispensed with, if desired, and the pipes g g may open from the dome D.

The operation of my invention will be readily perceived upon reference to the foregoing description and the accompanying drawings, and it is apparent that the same is simple in construction and practical and effective in operation.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a generator, the combination of a dome, and a series of upright water tubes connected to the dome and arranged outside of the combustion chamber, a number of said tubes having cut-outs in their side edges of unequal size for permitting passage of the products of combustion, substantially as and for the purpose set forth.

2. In a generator, the combination of a shell for receiving the products of combustion provided with an outlet, a dome, and a series of

depending water tubes within the shell opening from the dome and arranged outside of the combustion chamber, the tubes substantially opposite the outlet being formed with cut-outs in their side edges for permitting passage of the products of combustion, and the next adjacent tubes being formed with cut-outs of less size than the former cut-outs for permitting the passage of a less amount of the products of combustion, substantially as and for the purpose described.

3. In a generator, the combination of a dome, and a series of upright water tubes connected to the dome and arranged outside of the combustion chamber, said tubes having their side edges unequally separated for permitting passage of the products of combustion between said edges, substantially as and for the purpose specified.

4. In a generator, the combination of a shell for receiving the products of combustion provided with an outlet, a dome, and a series of depending water tubes within the shell opening from the dome and arranged outside of the combustion chamber, the water tubes substantially opposite to the outlet being separated a greater distance than the tubes nearest to the outlet for permitting passage of the products of combustion, and the tubes adjacent to said opposite tubes being separated a less distance than the same for permitting the passage of a less amount of the products of combustion, substantially as and for the purpose set forth.

5. In a generator, the combination of a shell for receiving the products of combustion provided with an outlet, a dome, and a series of depending water tubes within the shell opening from the dome and arranged outside of the combustion chamber, the water tubes substantially opposite to the outlet being separated a greater distance than the tubes nearest to the outlet and formed with cut-outs in their adjacent side edges for permitting passage of the products of combustion, and the tubes adjacent to said opposite tubes being separated a less distance than the same, and formed with cut-outs in their side edges of less size than the former cut-outs for permitting the passage of a less amount of the products of combustion, substantially as and for the purpose described.

6. In a generator, the combination of a dome, a series of upright water tubes connected to the dome and arranged outside of the combustion chamber, a number of said tubes having cut-outs in their side edges of unequal size for permitting passage of the products of combustion, and an additional series of tubes at the outside of the tubes substantially opposite to the former tubes for deflecting the products of combustion, substantially as and for the purpose specified.

7. In a generator, the combination of a dome, a series of water tubes connected to the dome and arranged outside of the combustion cham-

ber, a number of said tubes having cut-outs in their side edges of unequal size for regulating the passage of the products of combustion, an additional series of tubes for deflecting the products of combustion arranged at the outside of the former tubes and substantially opposite to the tubes, provided with said cut-outs, and a shell inclosing the water tubes and the additional series of tubes, and arranged with its inner face substantially in contact with the outermost tubes of said additional series for preventing the passage of the products of combustion between the shell and said outermost tubes, substantially as and for the purpose set forth.

8. In a generator, the combination of a dome, a series of upright water tubes connected to the dome and arranged outside of the combustion chamber, and a supplemental dome connected to the former dome, substantially as and for the purpose specified.

9. In a generator, the combination of a dome, a series of upright water tubes connected to the dome and arranged outside of the combustion chamber, and a supplemental dome arranged above the former dome and formed integral therewith, substantially as and for the purpose set forth.

10. In a generator, the combination of a dome provided with an opening in its top wall and a bar extending crosswise of said opening, a series of upright water tubes connected to the dome and arranged outside of the combustion chamber, and a supplemental dome arranged above the former dome and communicating with said opening, substantially as and for the purpose described.

11. In a generator, the combination of a dome provided with an opening in its top wall, a series of upright water tubes connected to the dome and arranged outside of the combustion chamber, and a supplemental dome arranged above the former dome and formed integral therewith and communicating with said opening, and a cross bar arranged in one of said domes beneath the uptake pipe and formed of greater diameter than the uptake pipe, substantially as and for the purpose specified.

12. In a generator, the combination of a dome, a series of upright water tubes connected to the dome and arranged outside of the combustion chamber, a number of said tubes having cut-outs in their side edges of unequal size for permitting passage of the products of combustion, and a supplemental dome arranged above the former dome and formed integral therewith, substantially as and for the purpose set forth.

13. In a generator, the combination of a dome provided with an opening in its top wall, a series of unequally separated water tubes connected to the dome and arranged outside of the combustion chamber, and a supplemental dome arranged above the former dome and formed integral therewith, and a cross

bar arranged in one of said domes beneath the uptake pipe and formed of greater diameter than the uptake pipe, substantially as and for the purpose described.

5 In testimony whereof I have hereunto signed my name, in the presence of two attesting witnesses, at Geneva, in the county of

Ontario, in the State of New York, this 4th day of January, 1895.

FREDERICK J. FURMAN.

Witnesses:

FRANCIS A. HERENDEN,
E. R. BURROUGHS.