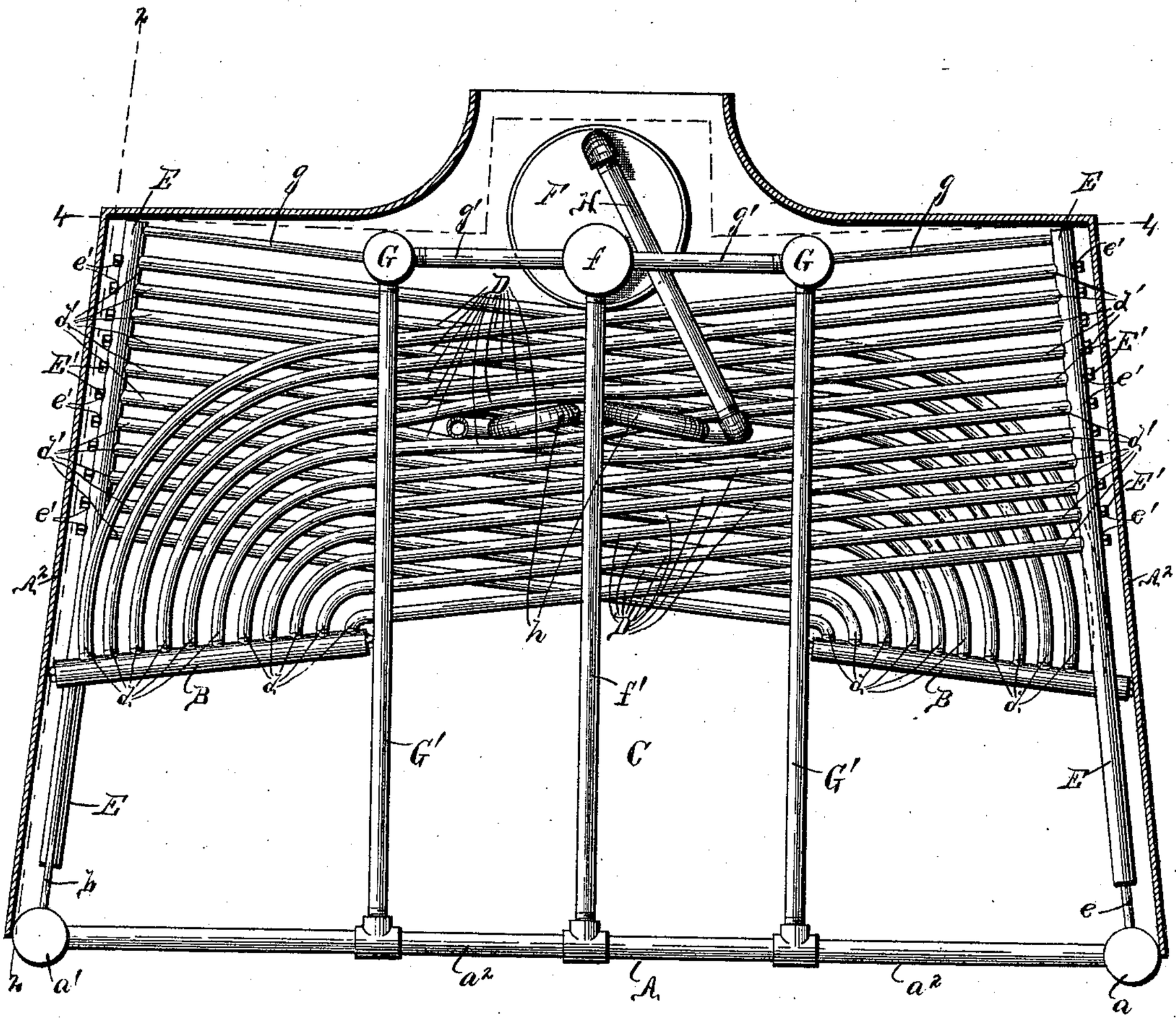
(No Model.) 5 Sheets—Sheet 1.

T. FEARON.

STEAM GENERATOR.

No. 486,098. Patented Nov. 15, 1892.

Fig. 1.



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(No Model.) 5 Sheets—Sheet 2.

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Fig. 2.

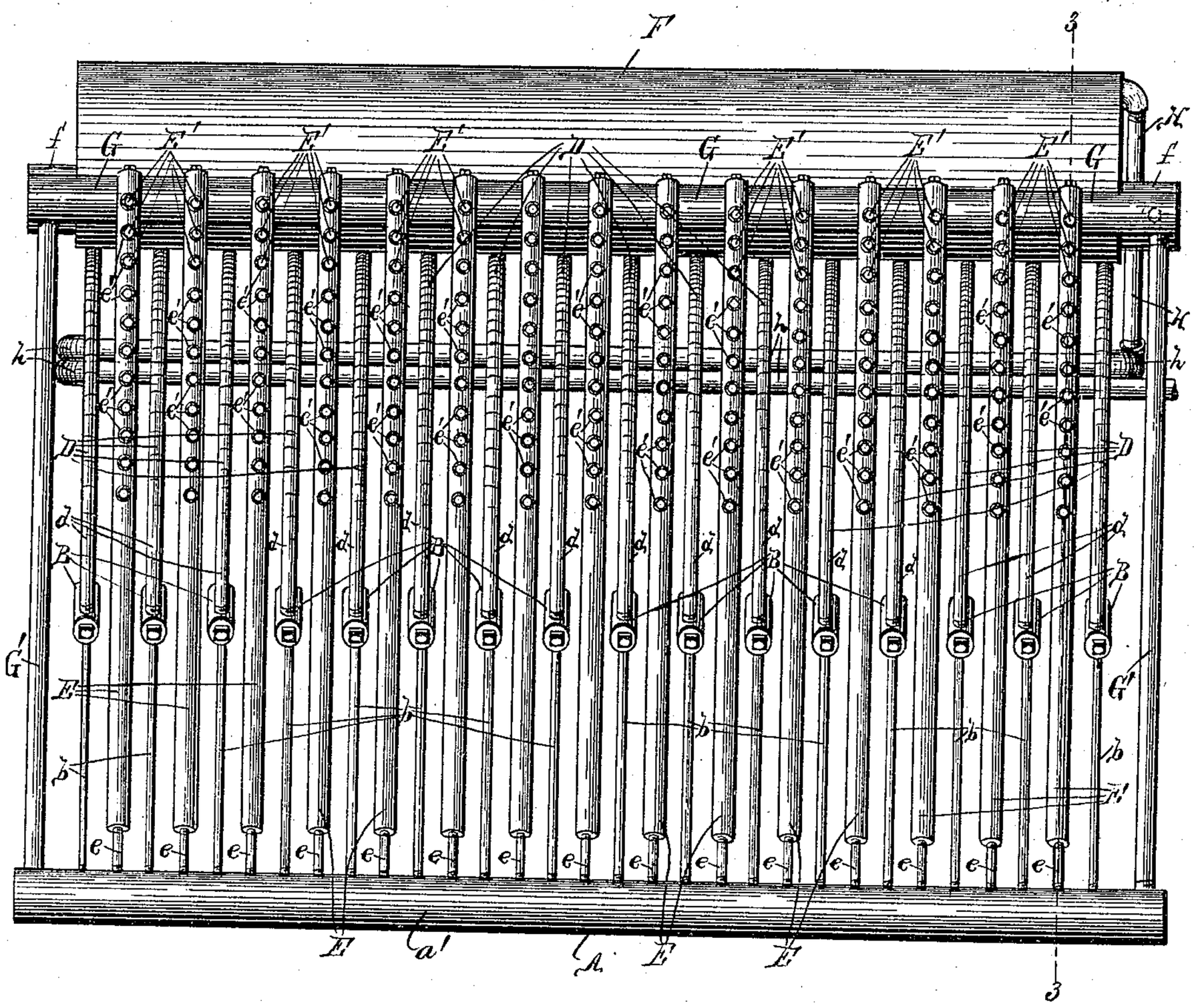

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Fig. 3.

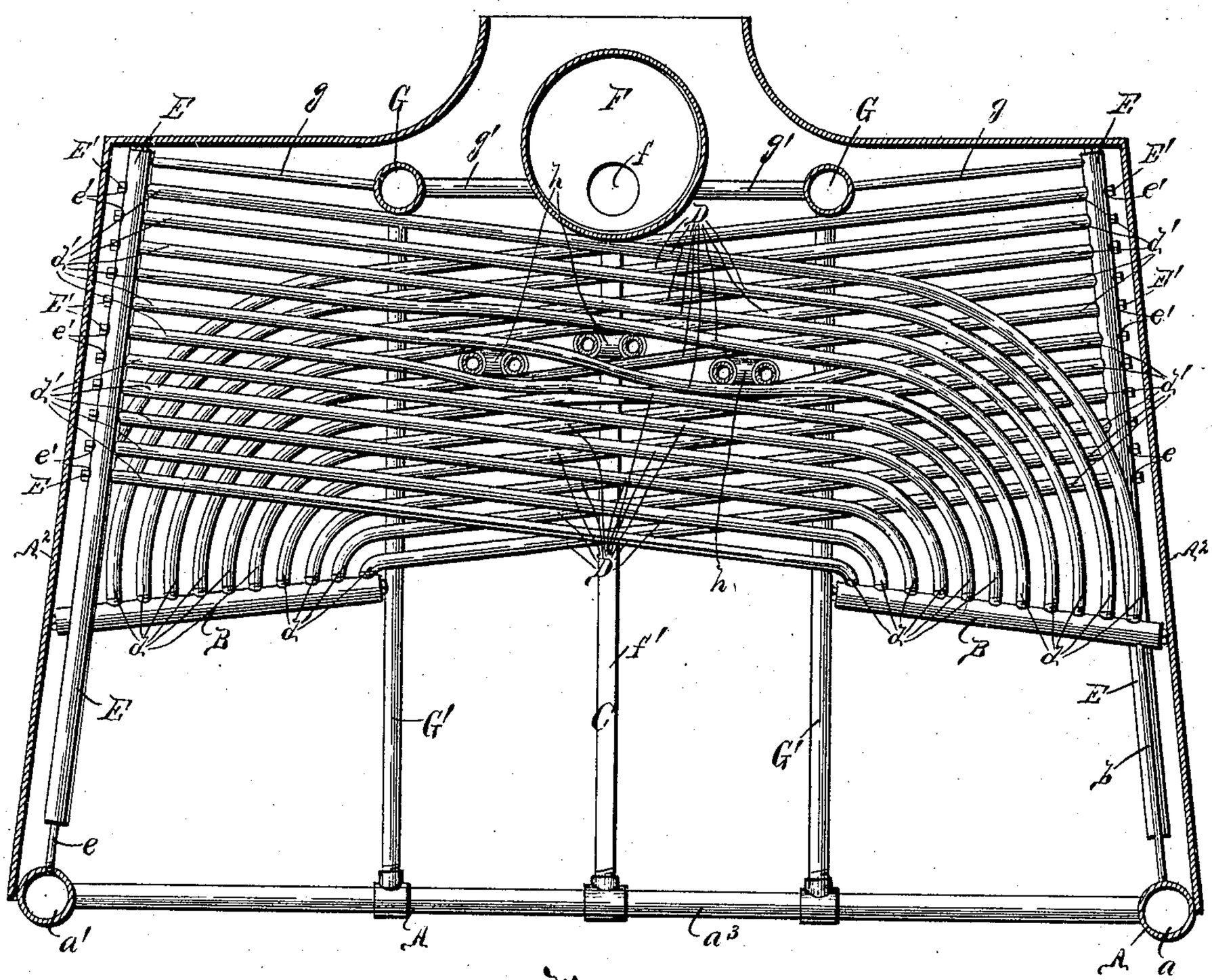
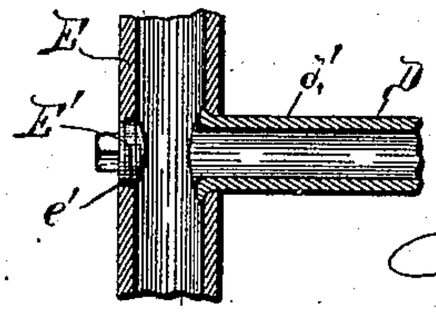


Fig. 5.



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(No Model.) 5 Sheets—Sheet 4.

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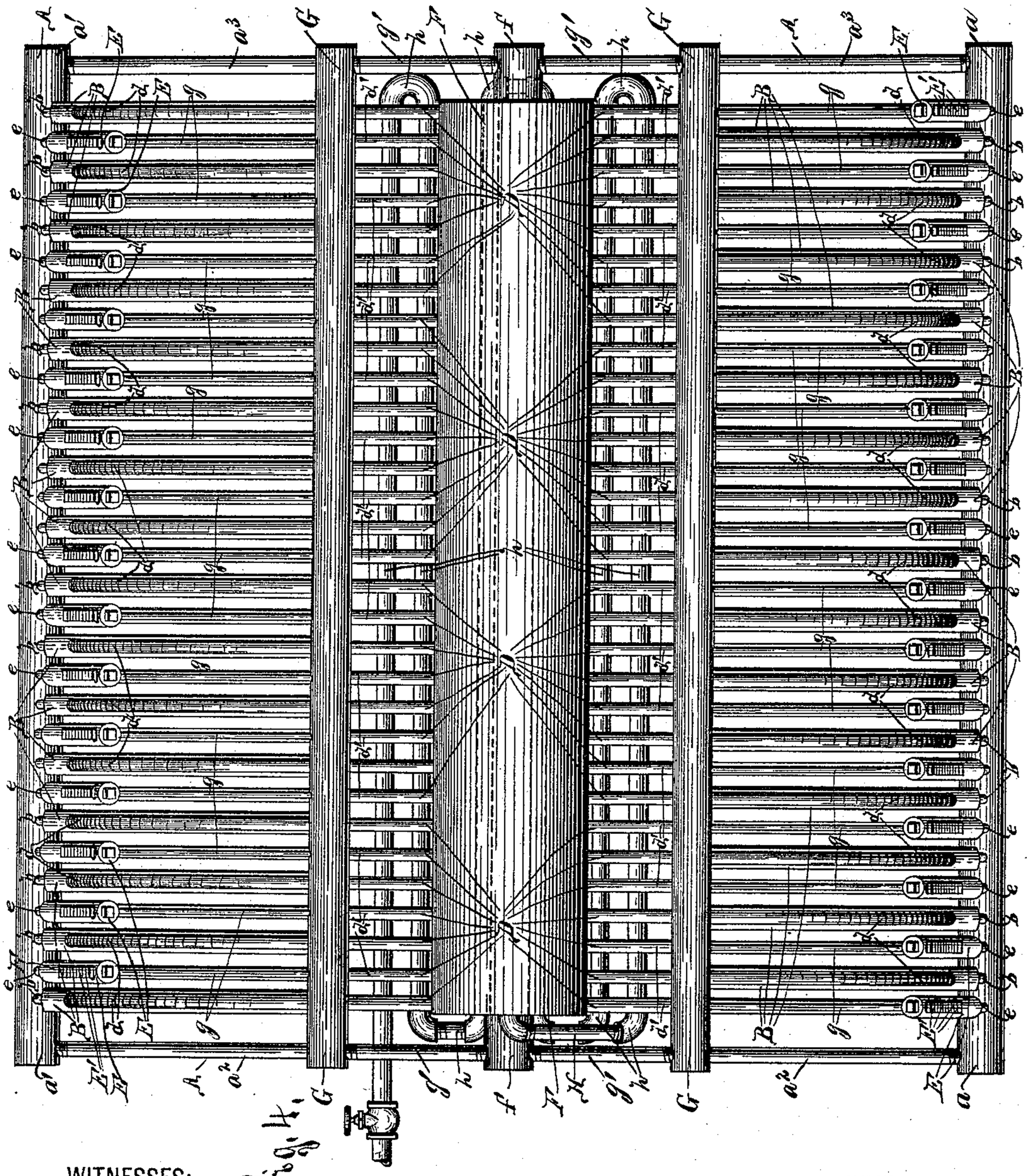

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(No Model.) 5 Sheets—Sheet 5.

T. FEARON.

STEAM GENERATOR.

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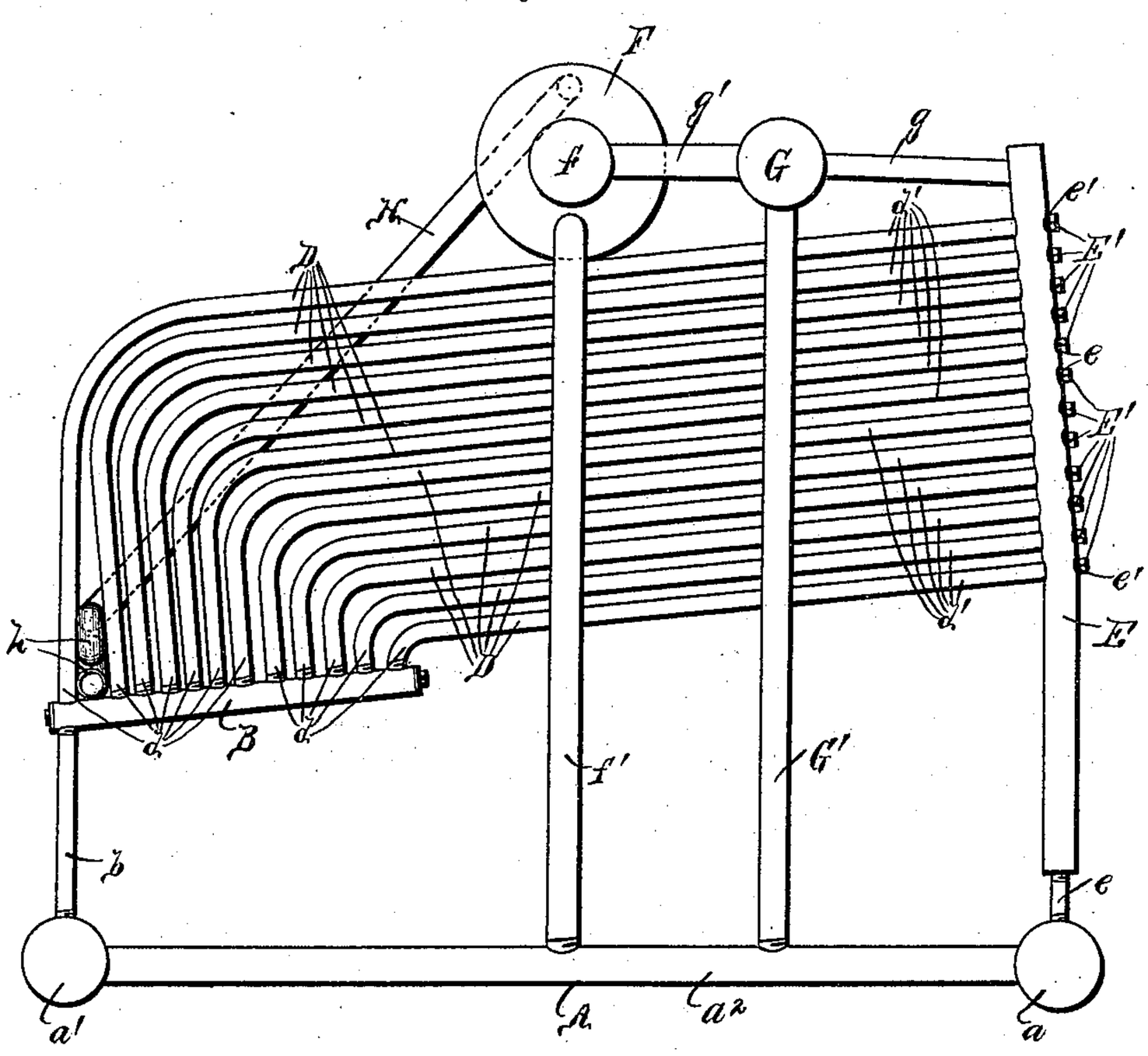
Fig. 6.



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UNITED STATES PATENT OFFICE.

THOMAS FEARON, OF YONKERS, NEW YORK.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 486,098, dated November 15, 1892.

Application filed December 14, 1891. Serial No. 414,943. (No model.)

To all whom it may concern:

Be it known that I, THOMAS FEARON, of Yonkers, in the county of Westchester, in the State of New York, have invented new and useful Improvements in Steam-Generators, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

My invention relates to an improved steam-generator of somewhat similar construction to that shown in my pending application, Serial No. 391,215, filed May 1, 1891, capable of producing a maximum degree of steam with a minimum amount of fuel and requiring for repair the exercise of a minimum degree of skill or ingenuity; and to this end it consists, essentially, in a head extending laterally from one side of the generator, a series of heating-tubes projecting from said head and arranged in planes one within the other, whereby the tubes may be successively screwed or otherwise secured in the desired position, an upright head connected to the opposite extremities of the tubes, and a steam-drum arranged above the tubes and connected to said head.

The invention furthermore consists in a series of these independent heads arranged at opposite sides of the fire, heating-tubes lapping one with the other and inclining upwardly at their free extremities, upwardly-extending heads, separation-drums between the steam-drum and the upwardly-extending heads, and connections between the water-containing base and the separation-drums, and in the detail construction and arrangement of the 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 side elevation of my improved invention, a portion of the outer casing being shown in section. Fig. 2 is a longitudinal sectional view taken on line 2 2, Fig. 1, for further illustrating the construction of the parts of my invention. Fig. 3 is a transverse sectional view taken on line 3 3, Fig. 2. Fig. 4 is a horizontal sectional view taken on line 4 4, Fig. 1. Fig. 5 is a sectional detail view for representing one of the plugs in the upright heads of my generator, and Fig. 6 is an elevation of a modified form of my invention.

The water-containing base A of my generator is preferably rectangular in form and is composed of the side pipes or heads a a' and the front and back pipes a^2 a^3, which may be of smaller diameter than the pipes or heads a a'.

B represents heads extending laterally from the opposite sides of the generator and preferably disposed in a slightly-inclined plane above the combustion-chamber C. These heads B are preferably independent of each other and are connected to the pipes or drums a a' by tubes b of less cross-sectional area than the heads B.

Opening from the laterally-extending drums are the heating-tubes D, which are usually arranged in planes one within the other and with their extremities inclining upwardly to facilitate the circulation and augment the efficiency. It will thus be noted, as best seen at Figs. 1 and 3 of the drawings, that one extremity d of the tubes is turned downwardly and the other d' disposed in an inclined plane. By arranging the heating-tubes as aforesaid their lower downturned extremity may be suitably secured to the laterally-extending head B, as by screwing the same into said head, and then one by one the heating-tubes adapted to be disposed in the next adjacent planes may be likewise successively secured in position, thereby greatly facilitating the construction of the generator. The upper extremity of the heating-tubes D discharge into an upright head E, disposed, preferably, in a plane at right angles to the plane of said upper extremities d' of the tubes D, and, as best seen at Figs. 1, 2, and 3, the head E is connected to the adjacent pipe or drum by a short nipple e of less diameter or cross-sectional area than the head E. The upper ends d' of the tubes D are expanded into the head E, and to facilitate this construction I form said head with a series of apertures e', arranged opposite to the tube extremities for permitting the entrance of an expanding-tool and adapted to receive removable plugs E', Fig. 5.

From the foregoing it is apparent that the head B, its connecting-pipes b, the heating-tubes D, and the head E and its connecting-

nipple *e* form one of the generator-sections A′, and upon reference to the drawings it will be noted that the generator is composed of a number of these sections, alternating with each other and so arranged that the heating-tubes of one section incline in a reverse direction to the corresponding tubes of the other section, thereby producing a series of oppositely-flowing, quick, and positive circulations from side to side of the generator, which, I have observed, is a particularly-effective method of generating steam. Moreover, in the aforesaid construction the water-containing heads B are directly above the combustion-chamber, and it is evident that the water is subjected to a very great degree of heat at the commencement of its circulation, which is augmented as the water reaches the center of the heating-tubes.

F represents a steam-drum mounted above the tubes D and extending from front to back within the generator above its central portion. This drum is connected to the separate heads by pipes *g* and *g′*, between the ends of which is interposed a separation-drum G for permitting the separation from the steam of any water carried by the same into the pipe *g*. The separate heads E are each provided with a separate steam-discharge pipe *g*, although but two pipes *g′* at the opposite extremities of the separation-drums G are discharged into hubs *f*, formed at the ends of the steam-drum; but it is evident that more of these pipes *g′* may be used if desired. The water is conducted from the separation-drums by means of pipes G′ discharging into the water-containing base A, and in order to facilitate the separation of the steam and water these drums G are preferably disposed slightly below the upper extremity of the heads E, and the pipes *g*, discharging thereinto, incline slightly downward.

To further obviate the presence of water within the steam-drum F, I provide a pipe or pipes *f′*, which may extend downwardly from one or both extremities of said drum and discharge into the water-containing base A.

Steam is taken from the upper portion of the drum by means of a pipe H, extending downwardly to about the central portion of the heating-tubes, and is there passed through coils *h* in said pipe, which extend from front to back of the generator between the heating-tubes and serve to superheat the steam for increasing its efficiency, the heating tubes being formed with deflected portions D′ for permitting the easy passage of the coils *h*.

At Fig. 6 I have shown a modified form of my invention, in which the laterally-extending heads B are arranged at one side only of the generator, the upright head E at the other side, a single separation-drum G at one side of the steam-drum F, and the superheating-coils just above the outer end of the laterally-extending head E; but this is evidently no departure from my invention.

The operation of my generator will be readily perceived from the foregoing description and upon reference to the drawings, and it will be particularly noted that the same is provided with a great amount of heating-surface, the tubes being so arranged that the circulation is rapid and effective; that the parts are compactly assembled and all water separated from the steam discharged from the heating-tubes, so that the presence of water within the steam-drum is entirely obviated; that the steam is superheated by means of coils disposed between the heating-tubes, and that any one section of the generator may be quickly and readily removed for any desired purpose and the generator then fired without inconvenience after the openings in the side drums *a a′* and the distributing-drums have been suitably plugged. I have here shown a portion of the outer shell A^2 for indicating the general contour of the same; but this shell forms no part of my present invention, and as my generator is not limited to any construction of grate or supporting-base I have neither shown nor described such parts. It is evident, however, that the construction of my generator may be somewhat varied from that shown and described without departing from the spirit of my invention. Hence I do not limit myself to such precise construction and arrangement.

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

1. In combination, a combustion-chamber, a water-containing base, a head connected to said base and arranged above the base and over the combustion-chamber, a series of upwardly-inclining heating-tubes arranged in planes one within the other, opening from said head, and a steam-drum connected to the heating-tubes, substantially as and for the purpose described.

2. In combination, a combustion-chamber, a water-containing base, a head extending laterally from the side wall of the generator, arranged above the base and over the combustion-chamber, a series of heating-tubes secured to said head and arranged with their free extremities disposed in planes one above the other and their free ends inclining upwardly, and a steam-drum connected to the upwardly-inclining ends of the heating-tubes, substantially as described.

3. In combination, a combustion-chamber, a water-containing base, a laterally-extending head, heating-tubes opening from said head, and an upwardly-extending head connected to the free ends of said heating-tubes and to the water-containing base, substantially as and for the purpose set forth.

4. In combination, a combustion-chamber, a water-containing base, a laterally-extending head arranged above the combustion-chamber and connected to the water-containing base, heating-tubes arranged in planes, one within the other, having one extremity opening from said head and the other inclining

upwardly, an inclining head connected to the upper ends of said tubes, and a connection between the inclining head and the water-containing base of less diameter than the head, substantially as and for the purpose specified.

5. In combination, a combustion-chamber, a water-containing base, a laterally-extending head arranged above the water-containing base and over the combustion-chamber, a depending connection between the laterally-extending head and the water-containing base, formed of less diameter than the head, heating-tubes arranged in planes, one within the other, having one extremity opening from the laterally-extending head and the other inclining upwardly, and an upwardly-extending head connected to the upper ends of said tubes, substantially as and for the purpose set forth.

6. In combination, a water-containing base, a pair of laterally-extending heads at opposite sides of the generator, connected to the water-containing base, heating-tubes opening from said heads and extending from opposite sides of the generator, whereby said heating-tubes lap one with the other, a steam-drum connected to said tubes, and a separation-drum interposed between the steam-drum and the heating-tubes, substantially as and for the purpose specified.

7. In combination, a water-containing base, a pair of laterally-extending heads at opposite sides of the generator, connected to the water-containing base, heating-tubes opening from said heads and extending from opposite sides of the generator, whereby said heating-tubes lap one with the other, and a steam-drum connected to said tubes, substantially as and for the purpose set forth.

8. In combination, a water-containing base, a pair of laterally-extending heads at opposite sides of the generator, connected to the water-containing base, heating-tubes opening from said heads and extending from opposite sides of the generator, whereby said heating-tubes lap one with the other, upwardly-extending heads connected to the extending ends of the heating-tubes, a steam-drum extending from front to rear of the generator between the upwardly-extending heads, and connections between said upright heads and the steam-drum, substantially as and for the purpose set forth.

9. In combination, a water-containing base, a head extending laterally from the side wall of the generator and connected to the water-containing base, a series of heating-tubes secured to said head and arranged with their free extremities disposed in planes one above the other, a steam-drum above the heating-tubes, connected thereto, and superheating-coils connected to said steam-drum and passed between said heating-tubes, substantially as and for the purpose specified.

10. In combination, a pair of laterally-extending heads at opposite sides of the generator, heating-tubes opening from said heads and extending from the opposite side of the generator, whereby said heating-tubes lap one with the other, a steam-drum above the heating-tubes, connected thereto, and a superheater passed between the lapped heating-tubes, substantially as and for the purpose set forth.

11. In combination, a combustion-chamber, a water-containing base, a head extending laterally from the side wall of the generator above the water-containing base and over the combustion-chamber, a series of heating-tubes secured to said head and arranged with their free extremities disposed in planes one above the other, a steam-drum connected to the upper extremities of the heating-tubes, and a separation-drum arranged substantially parallel with the steam-drum and interposed between the steam-drum and the heating-tubes, substantially as and for the purpose specified.

12. In combination, a water-containing base, a head extending laterally from the side wall of the generator and connected to the water-containing base, a series of heating-tubes secured to said head and arranged with their free extremities disposed in planes one above the other, a steam-drum above the heating-tubes, connected thereto, a separation-drum between the steam-drum and said heating-tubes, and a return connection between the water-containing base and the separation-drum, substantially as and for the purpose specified.

13. In combination, a water-containing base, a head extending laterally from the side wall of the generator and connected to the water-containing base, a series of heating-tubes secured to said head and arranged with their free extremities disposed in planes one above the other, a steam-drum above the heating-tubes, connected thereto, a separation-drum between the steam-drum and said heating-tubes, and superheating-coils connected to said steam-drum and passed between said heating-tubes, substantially as and for the purpose set forth.

14. In combination, a water-containing base, upwardly-inclining heating-tubes connected to said base, upright heads connected to the upper extremity of the tubes, separation-drums disposed below the plane of the upper extremity of said heads, and downwardly-inclining connections between the separation-drums and the upper extremity of the heads, substantially as and for the purpose set forth.

15. In combination, a pair of laterally-extending heads at opposite sides of the generator, heating-tubes opening from said heads and extending from the opposite side of the generator, whereby said heating-tubes lap one with the other, and a steam-drum above the heating-tubes, connected thereto, substantially as and for the purpose set forth.

16. The herein-described heater, the same being composed of a combustion-box, a water-containing base, a series of independent heads connected to said base and arranged above the combustion-box, heating-tubes projecting

from the heads, independent uprightly-extending heads connected to the ends of said heating-tubes and to the water-containing base, a steam-drum above the heating-tubes, connected thereto, a separation-drum between the steam-drum and said heating-tubes, and a connection between the separation-drum and the water-containing base, substantially as and for the purpose specified.

17. In combination, a water-containing base, a pair of laterally-extending heads at opposite sides of the generator, connected to said base, heating-tubes opening from said heads and extending from the opposite side of the generator, whereby said heating-tubes lap one with the other, a steam-drum above the heating-tubes, connected thereto, a separation-drum between the steam-drum and said heating-tubes, and a return connection between the water-containing base and the separation-drum, substantially as and for the purpose set forth.

In testimony whereof I have hereunto signed my name, in the presence of two attesting witnesses, at the city of Yonkers, in the county of Westchester, in the State of New York, this 23d day of November, 1891.

THOMAS FEARON.

Witnesses:
JOHN BRIGHT,
OLIVER G. PARSONS.