

(No Model.)

W. H. WILSON.

MAGAZINE OR BASE BURNING STEAM GENERATOR.

No. 287,603.

Patented Oct. 30, 1883.

Fig. 1.

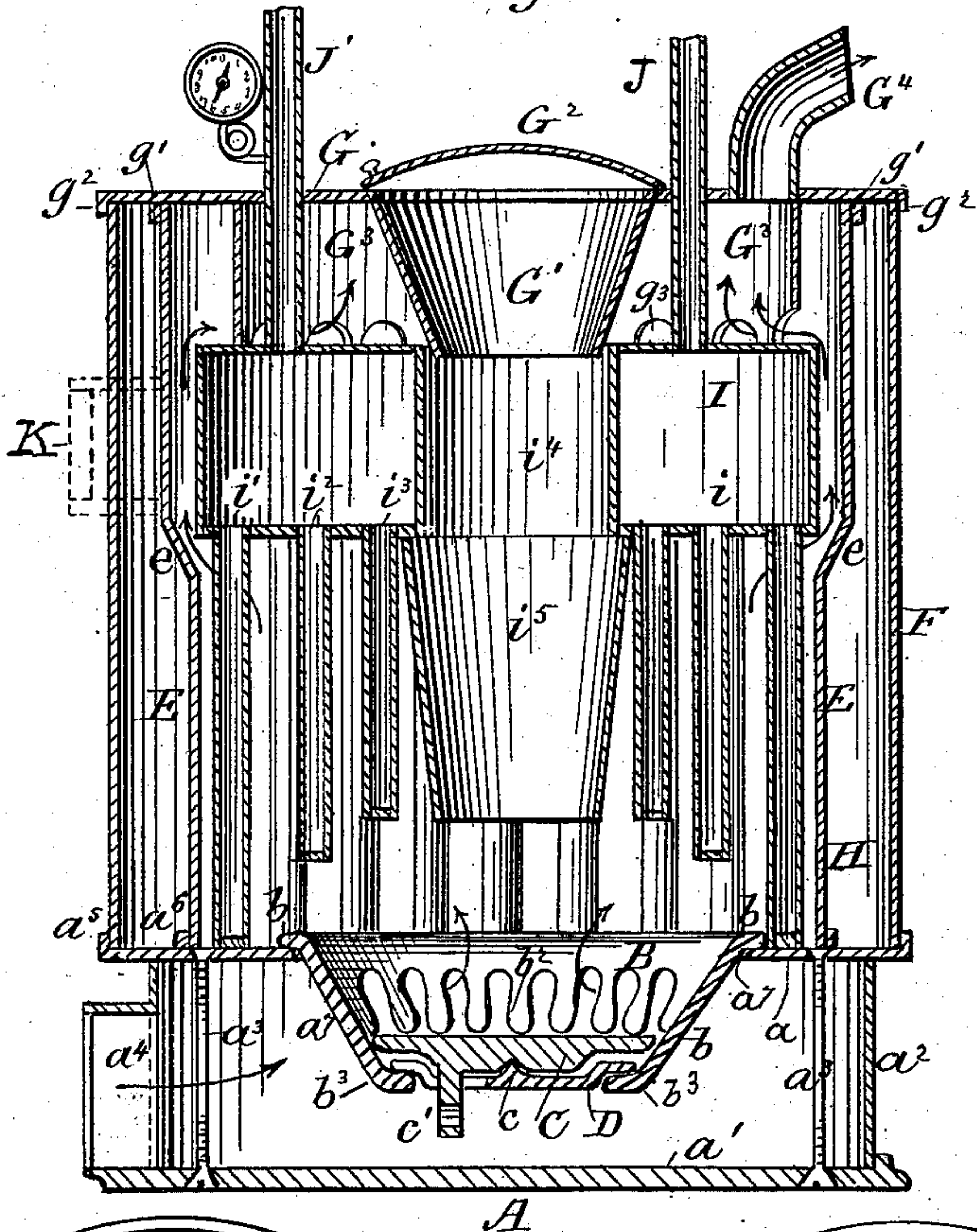


Fig. 2.

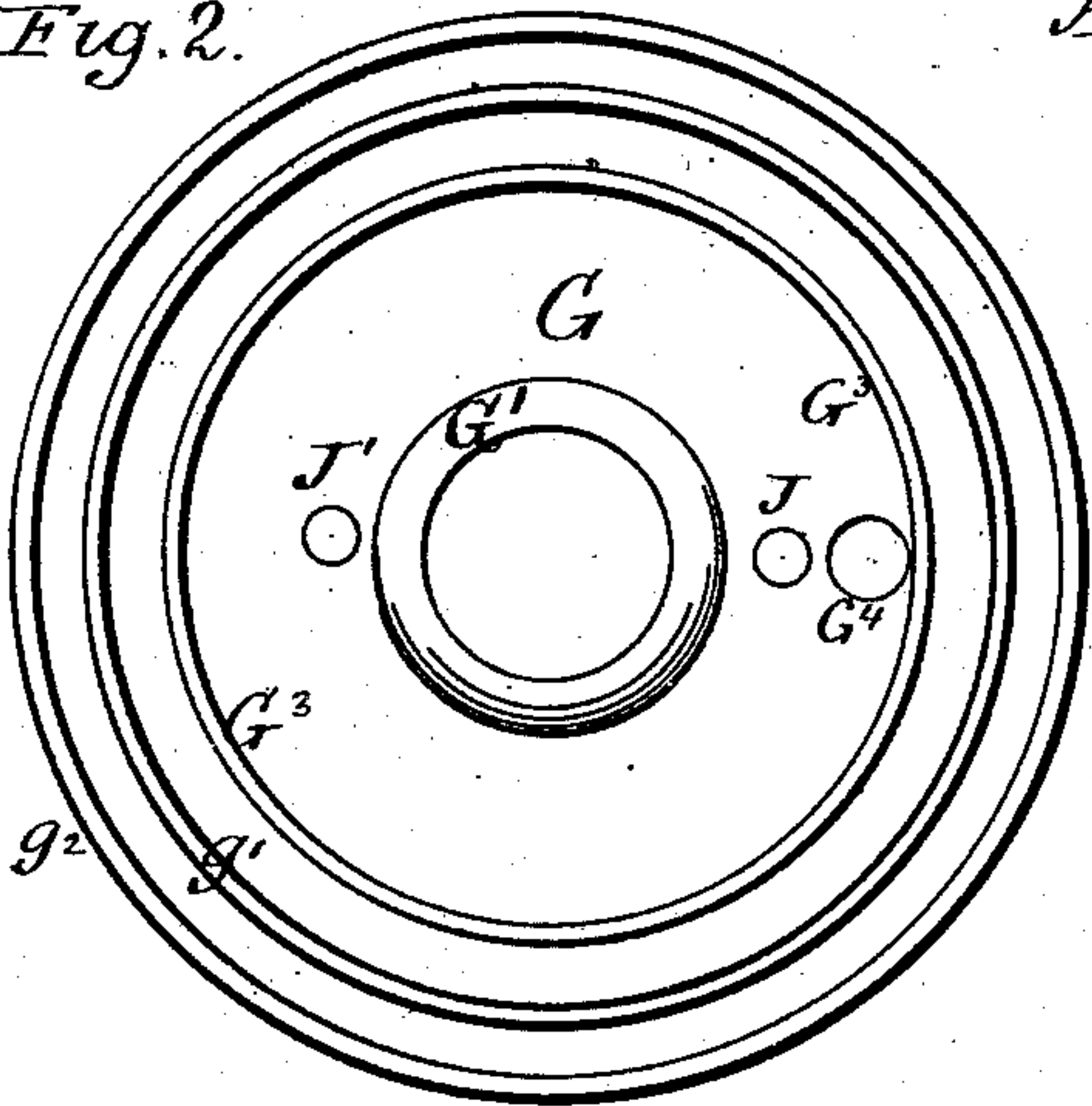
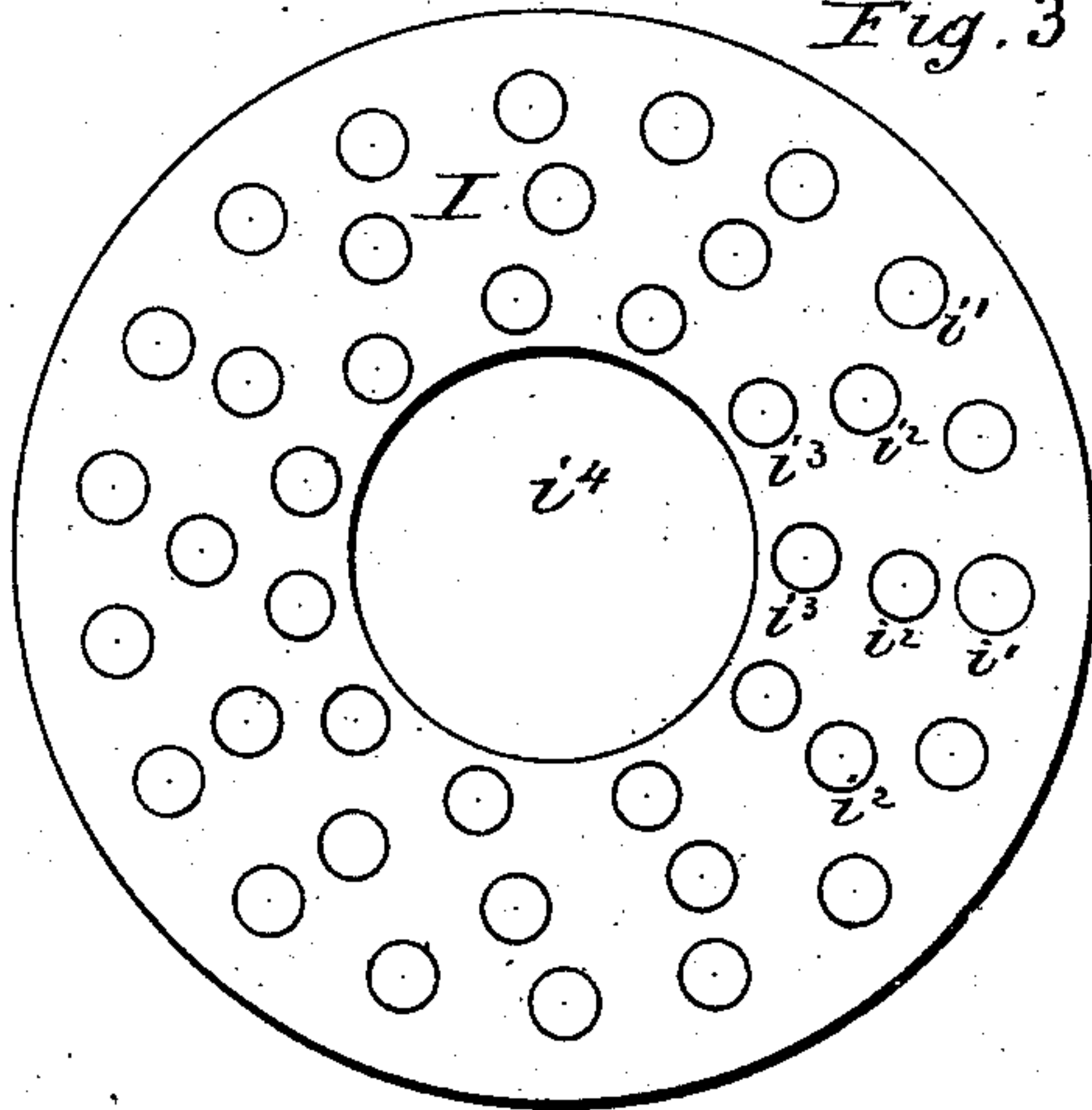


Fig. 3.



Witnesses:

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# UNITED STATES PATENT OFFICE.

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## MAGAZINE OR BASE-BURNING STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 287,602, dated October 20, 1883.

Application filed April 25, 1883. (No model.)

*To all whom it may concern:*

Be it known that I, WILIAM H. WILSON, a citizen of the United States, residing at Westfield, in the county of Chautauqua and State of New York, have invented certain new and useful Improvements in Magazine or Base-Burning Steam-Generators, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention comprises improvements in steam-generators, and in that class of steam-generators which has a boiler provided with a fuel-feed aperture through it, and with water-tubes extending downwardly below its bottom, and which is supported within a shell and over a fire-grate.

The main object of the improvement is to effect in this class of steam-generators a current of the products of combustion along the bottom of the boiler, and thence outward between the downwardly-extending tubes, and thence upward along the periphery of the boiler, and thence along the top of the boiler and over the periphery of the steam portion of it.

The subsidiary objects of the improvements are to simplify the construction of this class of steam-generators in respect to its main elements and the formation of its flues; to provide for the ready assemblage of its parts, and especially for the placing, removal, and replacement of the boiler; to facilitate the separate expansion and contraction of the several elements, especially of the boiler at the points of its greatest heat; to closely apply the heat to and retard it along the boiler; to either dry or superheat the steam; to improve the boiler, and to construct or relatively arrange the parts so that a fuel and fire chamber of effective capacity, shape, or relative position is secured.

A steam-generator of the class described includes a base, which is broadly only a support for the fuel and for the usual mechanical means for effecting its combustion, a shell for surrounding the boiler, and a boiler of the kind above specified. I extend the shell upward and relatively proportion the parts so as to inclose the boiler, and make flues for the products of combustion upward around the boiler practically to its top—that is to say, so that the periphery of the steam-space of the

boiler will always be subjected to their heat—and preferably, also, over the boiler, and thus effect the main purpose of my invention. It is evident that this purpose is effected whether or not the base, shell, and boiler are formed of common parts in a structure which permanently unites them, as by riveting, or whether each (or all, or the boiler only) is a separate or separable structure, or whether the boiler is supported in or on or is suspended over the base, or whether the boiler is attached to the base or shell or unattached to either. In any case the currents of the products of combustion described and the fuel or magazine feed, which are the essentials, are combined. Yet I prefer to effect my main and my subordinate purposes by making the boiler of the class specified to be a structure complete in itself and separate from the other elements of the generator, and to form the fuel or fire chamber, the magazine or fuel feed, and the flues specified by arranging the said boiler over the base and within the shell. I then apply subordinate devices and constructions, to aid in effecting the main and to effect minor objects of my invention. One mode of applying these principles of my invention to effect these objects appears in the drawings, in which—

Figure 1 represents a central vertical section of a steam-generator embodying my invention. Fig. 2 is a bottom view of the cap or top of the shell, and Fig. 3 a similar view of the boiler or water and steam reservoir.

Like letters indicate like parts in all figures.

A represents the base, which is, in this instance, of circular form, and comprises a top casting, *a*, bottom casting, *a'*, and a wall or rim, *a''*, these parts being secured together by the rods *a'''*. In the wall or rim a suitable door or opening, *a''''*, is provided. If desired, the wall or rim may be cast in one piece or in sections, or may be formed of sheet metal. The upper plate, *a*, of the base is provided at its edge with a continuous upwardly-projecting flange, *a<sup>5</sup>*, a similar flange, *a<sup>6</sup>*, located inside of the same, and a central opening, *a<sup>7</sup>*, in this instance circular in contour.

B represents the fire-pot, which is supported within the opening *a<sup>7</sup>* by means of a flange, *b*, formed thereon, which rests upon the upper surface of the top plate, *a*, of the base, the flaring wall *b'* of the pot fitting somewhat loose-



ly within the opening to allow for expansion, and depending below the plate  $a$ , and terminating in points  $b^2$ , ending substantially at or slightly above the grate C.

5 Depending brackets  $b^3$  are formed in the pot B, to support the bridge D, on which the pivot  $c$  of the grate rests. A depending slotted lug,  $c'$ , is provided for shaking and dumping the grate in the usual manner.

10 The depending fire-pot affords, in use with the depending water-tubes, a fuel and fire chamber of greater capacity than would be if the grates were mounted on a level with the top of the base; hence it admits of longer inner tubes and of the use of boilers of less size in their  
15 horizontal direction, since those outer tubes, which are on opposite sides of the boiler, may be much nearer together, and the inner tubes may project much lower, and yet the depending  
20 fire-pot will secure a fuel and fire chamber of sufficient size, which could not be the case in a boiler of such proportions were the grate on a level with the top of the base, though I may use either disposition of grate; yet for  
25 these and other reasons I prefer the dependiary grate.

A shell, E, formed preferably of cast-iron, and a jacket, F, formed preferably of sheet metal, are fitted within the flanges  $a^6$  and  $a^5$ ,  
30 respectively, and extended to and support the cap or top plate, G, which is provided with two depending flanges,  $g'$  and  $g^2$ , corresponding to flanges  $a^6$   $a^5$  on the base. The shell E is formed or provided with an offset or shoulder,  $e$ , extending completely around the same, and with its lower portion of less diameter than its upper portion. An annular air-space, H, which may be filled with non-conducting  
40 material, is thus provided between the shell and jacket, which space is larger at the lower than at its upper portion, since at the lower portion the heat is the greatest, and therefore at that point there is most need of both protecting the shell against heat and of preventing the loss of heat  
45 by radiation from the apparatus.

I represents the steam and water reservoir or boiler of the generator, and it comprises an annular head or chamber,  $i$ , from the bottom of which extend and with which communicate  
50 several series of vertical tubes,  $i'$   $i^2$   $i^3$ . The outer series of tubes,  $i'$ , are arranged near the periphery of the annular head I, and serve as its sole means of support by resting at their lower ends upon the top plate,  $a$ , of the base, as clearly shown in Fig. 1.

A fuel feed or magazine aperture,  $i^4$ , is formed through the head I, and near its wall the inner series of tubes,  $i^3$ , is arranged, while the remaining series,  $i^2$ , and, if desirable, additional series, are located intermediate those  
60 above mentioned. These downwardly-extending water-tubes are separated—that is, made apart—from each other, so that the products of combustion may pass between them and  
65 outwardly between the outer tubes. This boiler so constructed is complete—*i e.*, has an inclosed drum with a fuel feed or magazine

aperture, and has separated water-tubes extending below its bottom, and has in itself all the parts necessary to a boiler, in contradistinction to a boiler to which one or more of their  
70 parts are contributed by the shell or other parts of the generator. Being such a separate and complete structure, this boiler is capable of use by being placed in the shell and over the  
75 base, being attached or unattached to either or both of these parts, and of being removed in its entirety from the generator. So placed for use in the shell over the base, it at once furnishes a fuel or magazine feed to the grate,   
80 completes the feed or fire chamber, furnishes flues in that chamber around the inner tubes, and from that chamber between the outer tubes, and, by reason of its size relatively to the shell, forms, with the shell, a flue along its  
85 own sides. Upon appliance of the top of the shell, the boiler, with the top of the shell, forms a flue over its top to the outlets for the products of combustion. It will be noticed that in the construction shown only the outer series extend to the base, and that the length of  
90 each successive series toward the feed-passage is shorter than the next outer series, and that the space above the top plate and fire-pots unoccupied by the tubes is substantially conical,   
95 to agree with the natural contour assumed by the fuel when fed through the passages.

The water-tubes may be provided with the usual plugs or other means for opening and closing them for the purpose of cleaning them.  
100 The well-known fire-tubes may be applied to the boiler, extending vertically through it and ending between its water-tubes, without impairing its action; but care should be taken that their combined capacity should not be  
105 large enough to divert the draft from the direction outward through the outer tubes and upward around the boiler. There may be more than one series of outer tubes. The inner tubes are made shorter than the outer or  
110 supporting or wall tubes, to provide above the base a fuel and fire chamber.

A supplementary feed-tube,  $i^5$ , may be provided and sustained concentric with the feed-passage  $i^4$  by attachment to the head or to the  
115 inner series of tubes, as desired, and said feed-tube may be flaring, as shown, or straight, as preferred. It is evident that the tubes of the inner series may be placed sufficiently near each other to perform the function of the  
120 tube  $i^5$ .

I now prefer for some generators to support the boiler by resting the ends at its water-tubes on the base without attachment of them to the base. This unattached position on the base  
125 permits the freest expansion and contraction of the parts and renders them less liable to strain, which injures their strength, and may cause leakage. The base is preferably made of cast-iron, and the shell may be, while the  
130 boiler is preferably made of rolled or wrought-iron. The expansion of cast and wrought iron at the same heat is unequal; also, the expansion and contraction of the main parts of



the generator takes place in a different direction in each of them; also, the parts of the boiler severally expand unequally when unequally heated. The boiler suffers by these expansions and contractions when attached to either of the main parts, especially to the base, and suffers mainly at the joints between its drum and water-tubes. Further, an unattached boiler is more readily removed and replaced. The steam-pipe J (or it may be others, as J') is coupled to the boiler, and extends into the flue-space between the boiler and the shell, where it is subjected to the heat of the products of combustion, to dry or superheat the steam as may be desired, and thence passes through the shell with such construction as not to impede the separate expansion and contraction of the boiler and the shell. The top of the shell can be applied before or after the application of the steam pipe or pipes to the boiler, according as the shape of the steam-pipes may require or permit.

The water-supply is preferably introduced through one of the tubes  $i'$ , at or near the lower end, and steam-pipes J' J are provided to conduct the steam to any desired point and for any desired purpose. A hopper, G', is arranged to guide the fuel into the passage  $i^4$ , and a cover, G<sup>2</sup>, is arranged over the hopper to close the same.

The hopper G', passage  $i^4$ , and the supplemented tube  $i^5$ , or the inner tubes,  $i^3$ , (when  $i^5$  is not used,) constitute a magazine, the hopper extending upward and the tube extending downward the magazine-aperture of the border. The same effect may be produced by substituting for a separate hopper and supplemental feed-tube a magazine between the chamber and the shell, formed by extending the hopper G' through and below  $i^4$ , and, if desired, suspending it, as shown, on the top of the shell, or on the boiler, or on both.

A concentric ring or flange, G<sup>3</sup>, is placed between the cap G and head I. The lower edge of said flange is scalloped, or has apertures through it, so as to form passages  $g^3$ . The partition G<sup>3</sup> is located in the exit-flue G<sup>4</sup>, which is intended to communicate with any suitable chimney. The function of the partition G<sup>3</sup> will be effected if it be applied between the side of the shell and the boiler. Any one of the means or devices now known or used for delaying the products of combustion in the flues of steam-generators, which are applicable to this flue, may be used instead of the partition G<sup>3</sup>.

This being the construction, the operation is as follows: Water being supplied as described, and preferably maintained at a line above the middle of the reservoir I, said supply being shown, if desired, by an indicator, as K, (dotted lines, Fig. 1,) and fuel being supplied through the hopper G', feed-passage  $i^4$ , and tube  $i^5$ , or, instead of through  $i^5$ , through the inner water-tubes, or, instead of either or all of these parts, through a magazine consisting of the hopper G', extended as hereinbefore

described, to fill the pot B and rest upon the top plate,  $a$ , as described, air enters the door or opening  $a^4$ , to maintain combustion, and passes through the grate and between the points  $b^2$  of the pot, and the products of combustion circulate, as indicated by arrows, between the depending pipes, being retarded in their passage upward by reason of the contracted lower portion of the shell E, and while thus retarded a greater quantity of the heat thereof is absorbed by the water in the tubes, and by reason of the enlarged lower portion of the air-space H greater protection against the outward diffusion of the heat where it is highest in degree and an economical expenditure of fuel are attained. After passing the shoulder  $e$  of the shell, the products of combustion are again retarded in their passage by the flange or partition G<sup>3</sup>, and held in contact with the outer periphery at the bottom, so that further absorption of the heat thereof may take place before they escape through the partition. The flange G<sup>3</sup> serves the further purpose of preventing the products of combustion being drawn directly to the opening, for their escape to the chimney, and causes them to be uniformly distributed on all sides of the boiler.

It will be noticed that the flange G<sup>3</sup> will in a measure retard the products of combustion, and when they have passed the partition G<sup>3</sup> they are compelled by the hopper G' to take a course which further retards them and confines them to the steam portion of the boiler and around the steam pipe or pipes. From this channel they escape at the small outlet G<sup>4</sup>.

Considering my generator as a whole, and as shown, it will be seen that the boiler, by being placed on the base and within the shell, constitutes a magazine and flues between its water-tubes; completes the flues from the water-tubes to the outlet; effects a fuel and fire chamber of the contour which vertically fallen fuel naturally assumes; that it is readily placed, removed, and replaced; that the whole structure made of these simple elements is easily assembled; that the boiler is free to contract and expand; that the depending fire-pot, lowering the grate, augments the size of the fuel and fire chamber and facilitates the deflection of the draft through the tubes and uptake; and that the products of combustion are closely held against both tubes and boiler, and are delayed until they give up their heat to the boiler; and that loss of heat by radiation is most prevented; and protection to the shell most effected at the points of greatest heat; and that the hopper and lower tube extend the magazine in both directions, and that the steam portion of the boiler and the steam pipe or pipes are subjected to heat to dry or to superheat the steam, as the case may be, according to the development or the disposition of these ports.

Boilers of this class have heretofore been mounted so that the products of combustion



enveloped their water-tubes and a part of their water-space. This arrangement does not effect the direct heating at the steam-space which I effect. Doubtless when the water 5 may be very low in such a boiler and down nearly to the top of the water-tubes, lower than it is contemplated to have it, there may be an accidental and momentary heating of the water-space. Now, my arrangement 10 makes the heating of the steam-space certain at all times, for I provide that the products of combustion shall pass around the steam-space by requiring the uptake-flue to reach practically to the top of the boiler, and by this I 15 mean to such a height along the boiler that when the boiler has its fullest supply of water the uptake-flue will apply the heat directly to the periphery of the steam-space above the water, thus somewhat drying the steam therein, 20 and by still further extending the flue over the steam-space I increase the effect on the steam, and by placing the steam-pipe in the flue I subject the steam again to heat, and withal I fully utilize the heat of the products of combustion. 25

It is evident that the main principle of my invention, which I have stated, will be effected without the use of all the devices which have been shown and described; hence some of them 30 may be omitted in use. For example, as has been stated, the three main elements—the base carrying the usual devices for effecting combustion of the fuel, the shell, and the boiler—will themselves alone effect it without hopper, 35 supplementary feed-tube, or any anti-heat-radiating or heat-delaying devices, and each of these supplementary devices may be used without the others; also, that while my improved boiler which is described and claimed is peculiarly efficacious in carrying out the purposes 40 of my invention, yet any boiler of the class described, in combination with the other elements, will accomplish the main purpose and some of the other useful purposes of and fall 45 within the scope of some part of my invention. For instance, in some of its combinations, all of its tubes may be of equal length, or it may have but one series of water-tubes extending below and around its bottom. Also, for the 50 effectuation of the main principle and purposes of the invention, as hereinbefore specified, it is immaterial in certain combinations whether the boiler of the class specified be or be not attached to the base or to the shell, or to both 55 of these elements of the construction; or whether it be detachably or permanently attached to one or both of these elements; or whether it rest, is supported on, or is supported above, or above and apart from, the base by supports 60 from the base or from the shell; or whether the shell be supported on the base, or the base be supported by the shell, or the shell embrace the base as masonry; or whether the shell have a top; as shown and described, or a top which 65 extends from the wall of the shell to the upper end of the periphery of the steam and water chamber inclosing the entire periphery

of the boiler and covering only the flue-space between the shell and the boiler, the outlet being in the top or in the wall of the shell. 70

I am aware that a steam-boiler having depending water-tubes has heretofore been mounted on a base and inclosed in a shell, so that the products of combustion pass entirely around it and across its top; but this boiler 75 has no center-feed aperture, but had its water-tubes cut away at one side, and its shell also, to permit feed of fuel. This lessens the steam-generating capacity of the boiler and its security of support and prevents its water-tubes 80 from effecting a complete fuel-chamber, and it does not have the advantage of the inner or magazine feed. Neither this boiler or combination is within my invention.

I am also aware that a steam-boiler of the 85 general class to which my invention relates has been provided with water-tubes which a part of the way around were shorter from the outside inward and the rest of way around shorter from the inside outward, just enough 90 shorter to permit a pipe-tongs to grasp one and turn it without hitting the others, which would be a difference of, say, one inch between successive tiers, and would afford a fuel-chamber, and this I do not claim. In this respect 95 I limit myself to such an angle as mechanically occurs with the contour of the falling material, which will usually be about forty degrees.

I am also aware that it is not broadly new to arrange a steam pipe or pipes between a 100 boiler and its shell for the purpose of drying or superheating the steam.

I am aware of United States Patent No. 257,217, granted May 2, 1882, to C. Gorton, and I claim nothing therein. The boiler of 105 this patent has no water-tube depending from the boiler below its bottom, and no flue which takes the products of combustion which have passed from the inside of such tubes to their outside and conveys them from the outside 110 of such tubes, and no flue which extends from the outside of such tubes upward on all sides of his boiler to a top flue over his boiler. In my claims I mean by the "boiler of the general class described" a boiler provided with a 115 fuel feed or magazine aperture through it, and with water-tubes extending downwardly lower than from or from near its bottom; and by "a boiler of the specific class described" I mean such a boiler as the above having inner water-tubes shorter than the outer water-tubes, for the purposes hereinbefore described. 120

What I claim is—

1. A boiler for steam-generators of the general class described—that is to say, one comprising a steam and water chamber provided 125 with a fuel feed or magazine aperture through it, and with separated water-tubes extending below its bottom—such a boiler having its outer water-tubes continuous around it and continuously longer than the inner water-tubes, as 130 and for the purpose set forth.

2. A boiler for steam-generators of the general class described, having its inner tubes de-



creasing gradually in length to the extent described on all sides from the outer tubes inward, as and for the purpose set forth.

3. In a steam-generator, and in combination, a boiler having a fuel feed or magazine aperture through it and separated water-tubes extending below its bottom, and arranged in a shell and over a grate, and an uptake-flue between it and the shell from its water-tubes and along its periphery to its top, as and for the purpose set forth.

4. In a steam-generator, and in combination, a boiler having a fuel feed or magazine aperture through it and separated water-tubes extending below its bottom, and arranged over a grate attached or unattached, as described, and with its water-tubes directly at a base, and an uptake-flue between it and the shell from its water-tubes along its periphery to its top, as and for the purpose set forth.

5. In a steam-generator, and in combination, a boiler of the general class described arranged, attached or unattached, directly at a base and over a grate and a shell on the base, and an uptake-flue between the chamber of the boiler and the shell, extending from the water-tubes along the periphery of the boiler to its top, and either a supplemental feed-tube or a magazine, as and for the purpose set forth.

6. In a steam-generator, and in combination, a boiler of the general class described arranged over a grate and in a shell, an uptake-flue space between its chamber and the shell, and extending from the depending water-tubes along the periphery of the boiler to its top, and means for delaying the products of combustion along the periphery of the boiler, as and for the purpose set forth.

7. In a steam-generator, a boiler of the general class described arranged over a grate and in a shell, an uptake-flue between the chamber and the shell, extending from the depending water-tubes along the periphery of the boiler to its top, and a steam-pipe arranged in the flue-space, as and for the purpose set forth.

8. In a steam-generator, and in combination, a boiler of the specific class described—that is to say, of the general class—and having shorter inner water-tubes, as described, such a boiler arranged in a shell and over a grate, and an uptake-flue between the chamber of the boiler and the shell, extending from the water-tubes along the periphery of the boiler to its top, as and for the purpose set forth.

9. In a steam-generator, and in combination, a boiler of the specific class described arranged, attached or unattached, in a shell and over a grate, and an uptake-flue between the chamber of the boiler and shell, extending from the water-tubes along the periphery of the boiler to its top, as and for the purpose set forth.

10. In a steam-generator, and in combination, a boiler of the general class described—that is to say, one having a fuel feed or magazine aperture through it and separated water-tubes extending below its bottom—such a boiler

arranged in a shell and over a grate, and an uptake-flue space between it and the shell from its water-tubes and along its periphery and over its top, as and for the purpose set forth.

11. In a steam-generator, a boiler of the general class described arranged over a grate, and enveloped on its periphery and its top with an uptake-flue whose peripheral part is arranged outside of the depending water-tubes, and is extended thence upward on all sides of the exterior of the boiler to its top part, as and for the purpose set forth.

12. In a steam-generator, and in combination, a boiler of the general class described arranged, attached or unattached, over a grate, with its water-tubes directly at a base, and surrounded on its periphery and top with an uptake-flue, as and for the purpose set forth.

13. In a steam-generator, and in combination, a boiler of the general class described arranged over a grate, and enveloped on its periphery and its top with an uptake-flue whose peripheral part is arranged outside of the depending water-tubes, and is extended thence upward on all sides of the exterior of the boiler to its top part, and means in the flue for delaying the products of combustion, as and for the purpose set forth.

14. In a steam-generator, and in combination, a boiler of the general class described arranged over a grate and surrounded on its periphery and top with an uptake-flue, and delaying means, substantially as described, having passages near to the boiler, as and for the purpose set forth.

15. In a steam-boiler, and in combination, a boiler of the general class described arranged over a grate, and surrounded on its periphery and top with an uptake-flue whose peripheral part is arranged outside of the depending water-tubes, and is extended thence upward on all sides of the exterior of the boiler to its top part, and a hopper or a magazine in the flue, as and for the purpose set forth.

16. In a steam-generator, and in combination, a boiler of the specific class described—that is to say, of the general class—and having shorter inner tubes, as described, such a boiler arranged over a grate and surrounded on its periphery and top with an uptake-flue, as and for the purpose set forth.

17. In a steam-generator, and in combination, a boiler of the specific class described arranged, attached or unattached, as described, with its water-tubes directly at a base, and an uptake-flue surrounding its periphery and top, as and for the purpose set forth.

18. In a steam-generator, and in combination, a boiler of the specific class described arranged over a grate, an uptake-flue surrounding its periphery and top, and a hopper or magazine arranged in the flue, as and for the purpose set forth.

19. In a steam-generator, and in combination, a boiler of the specific class described arranged, attached or unattached, as described, with its water-tubes directly at a base, an up-



take surrounding its periphery and top, and a depending fire-pot, as and for the purpose set forth.

20. In a steam-generator, and in combination, a fuel feed or magazine boiler with water-tubes extending below its bottom and inset from its periphery, a shell having a contracted or small and a larger and a connecting portion

or shoulder, and an uncontracted inclosing-jacket, as and for the purpose set forth. 10

In testimony whereof I affix my signature in presence of two witnesses.

WILIAM H. WILSON.

Witnesses:

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WILLIAM A. USBORNE.