(No Model.) 6 Sheets—Sheet 1.

W. P. ELLIOTT.

APPARATUS FOR MANUFACTURING GAS.

No. 480,919. Patented Aug. 16, 1892.

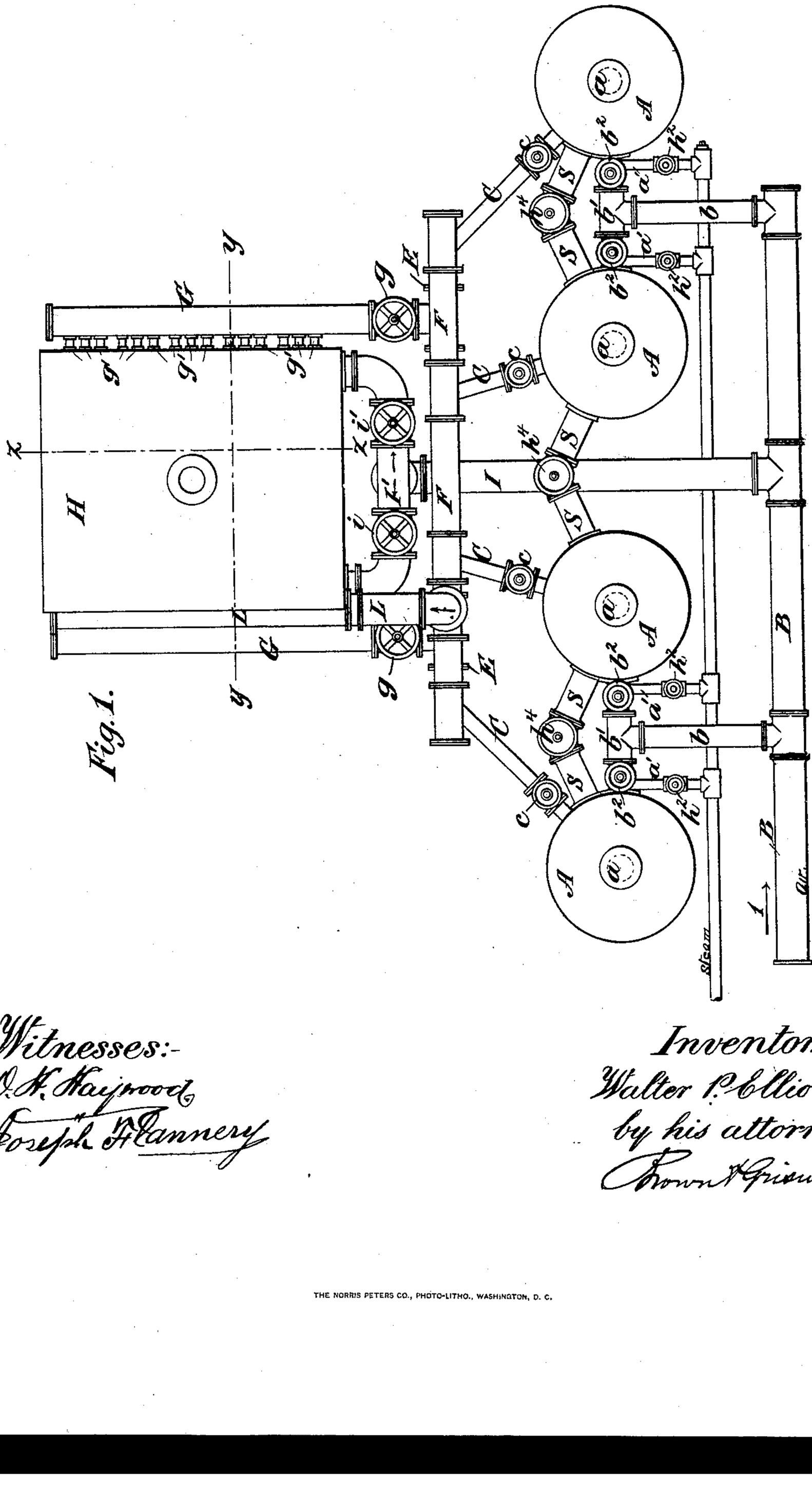

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Fig. 2.

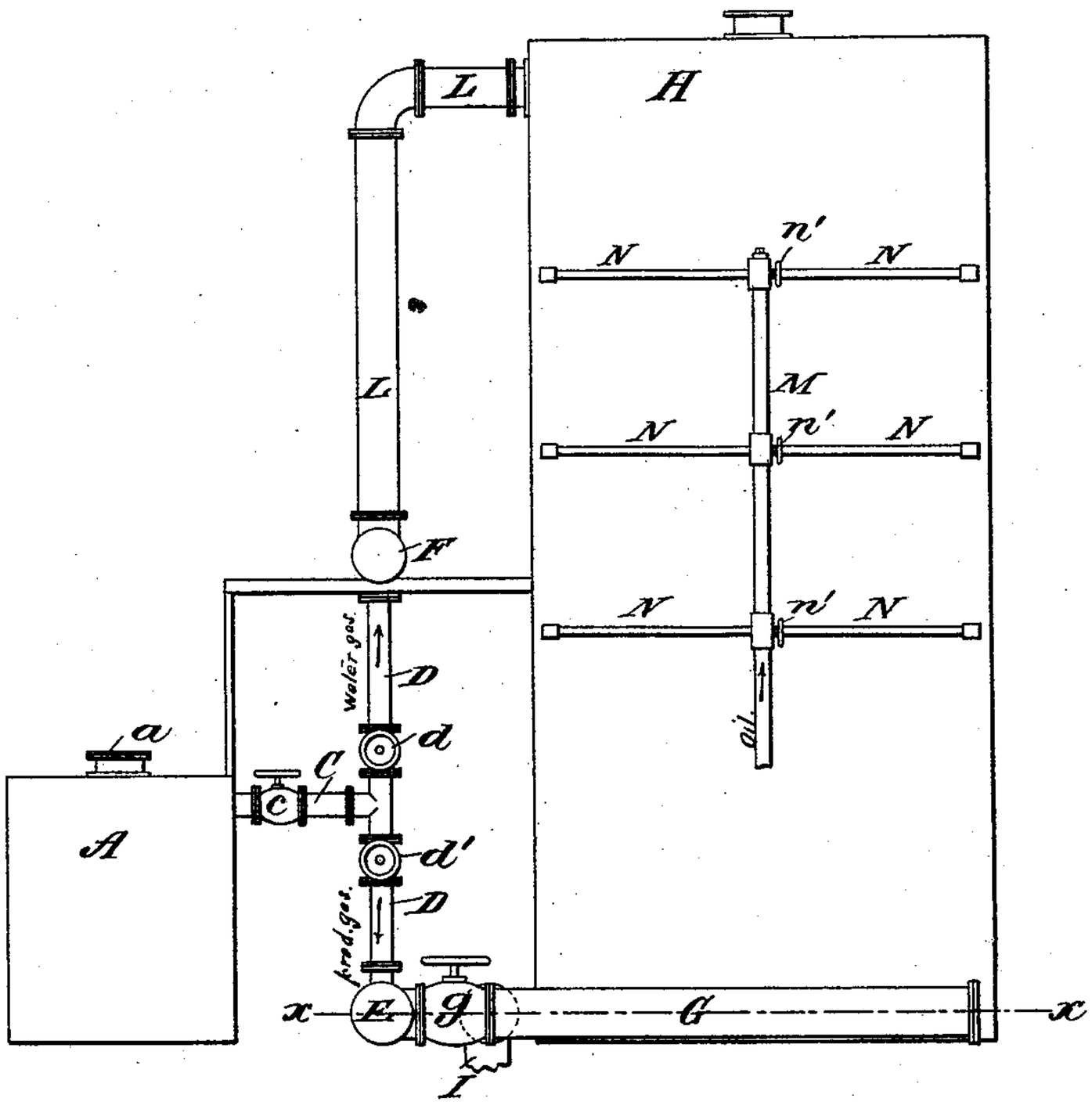

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Fig. 3.

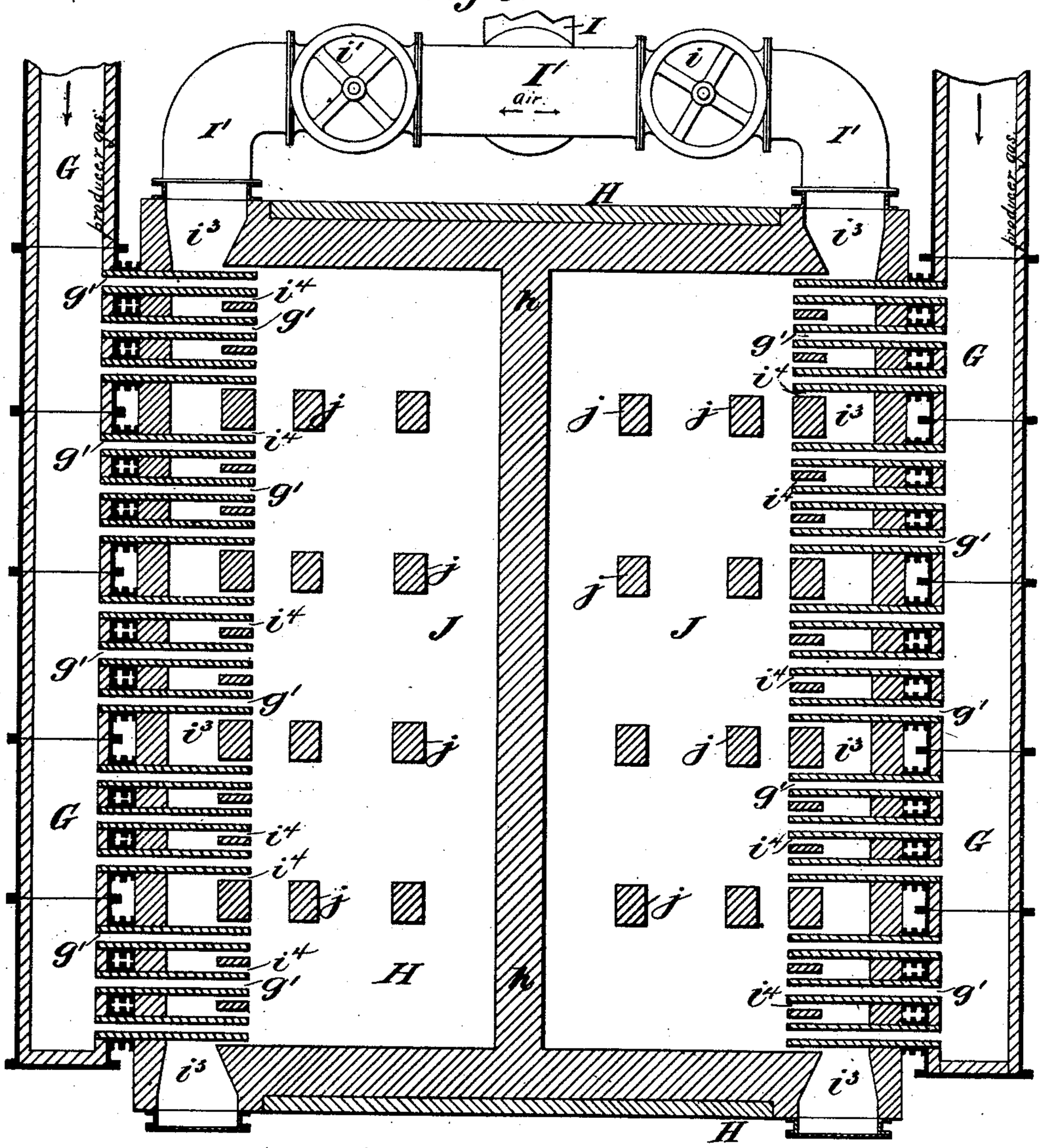

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Fig. 4.

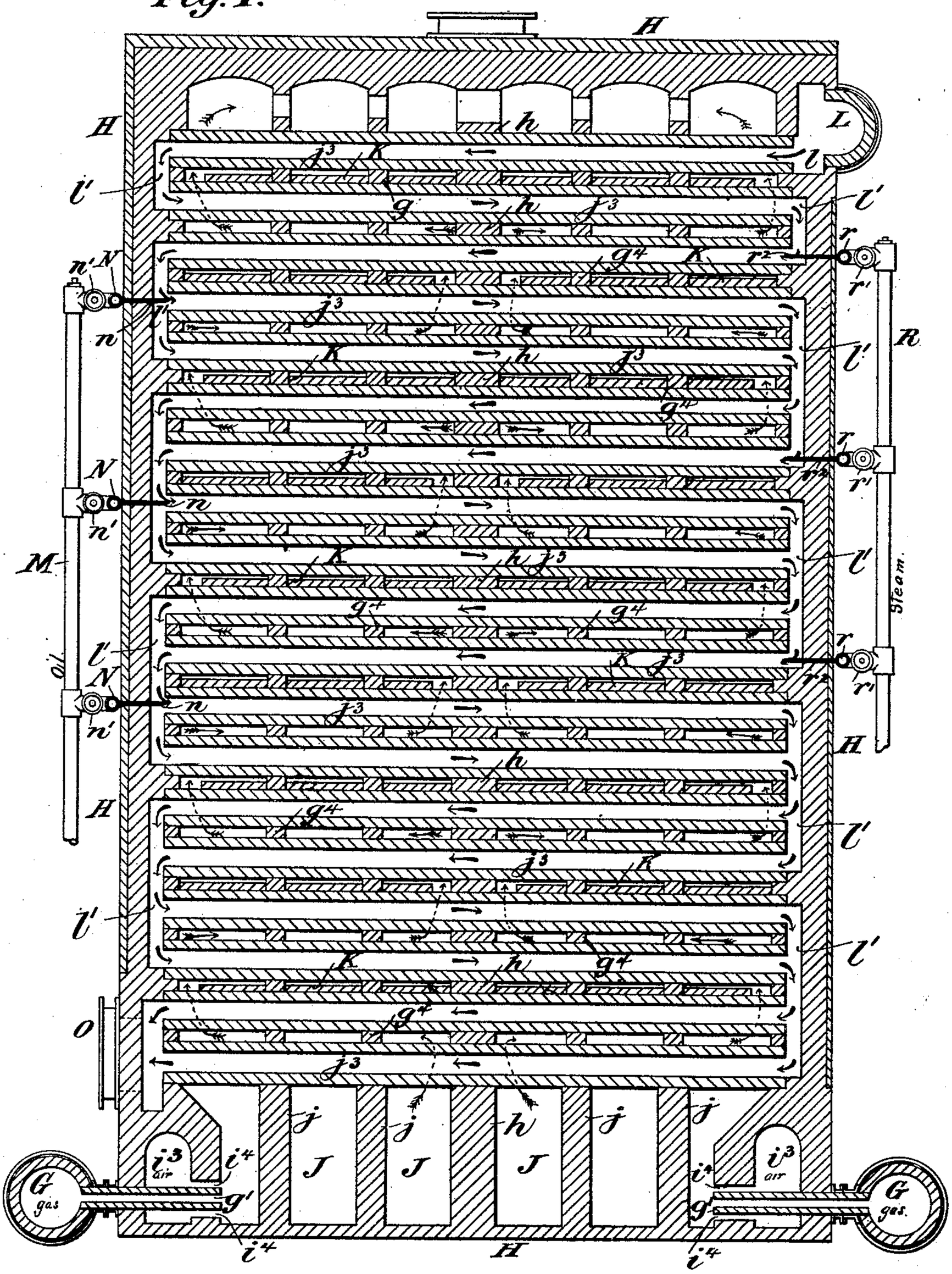

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Fig. 5.

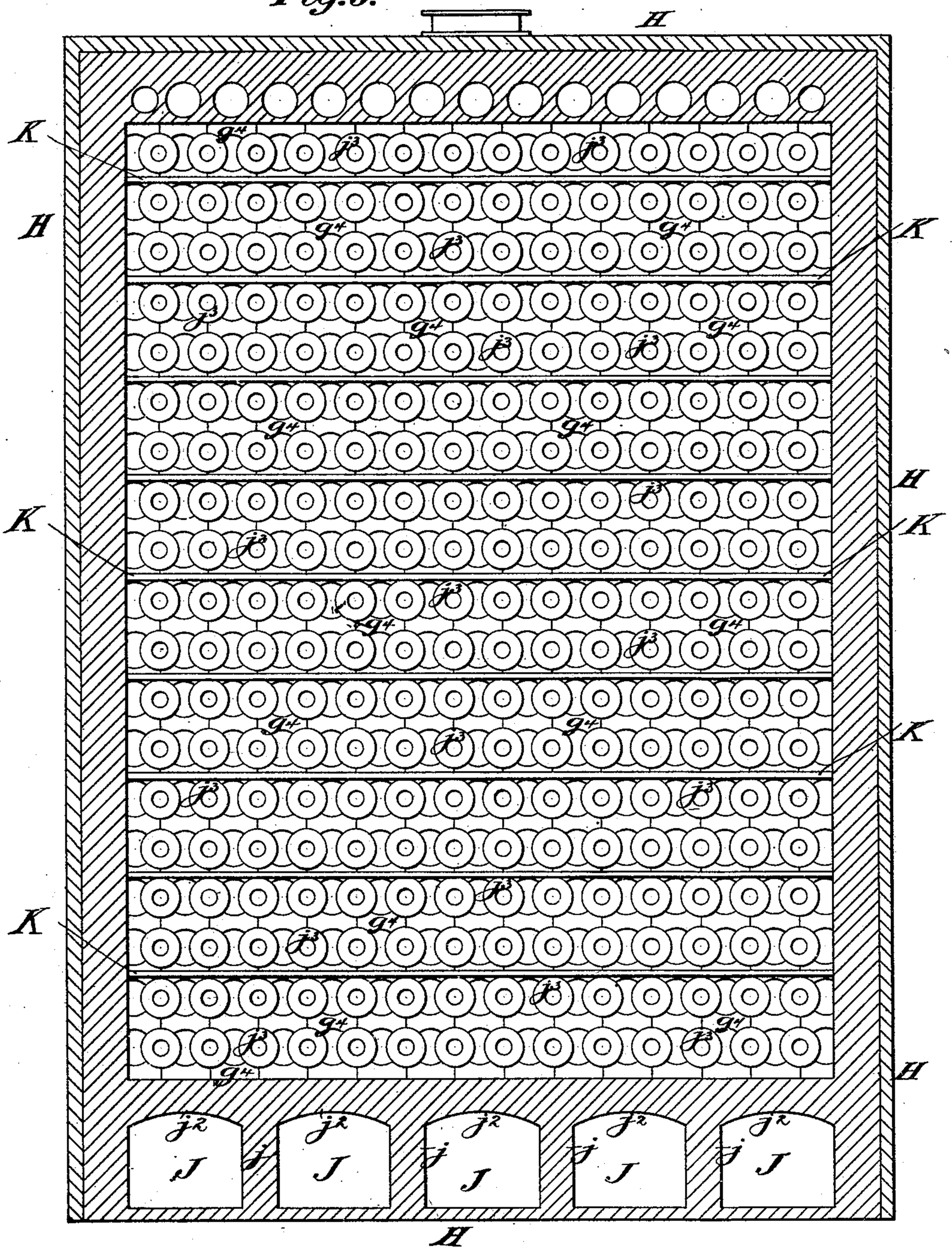

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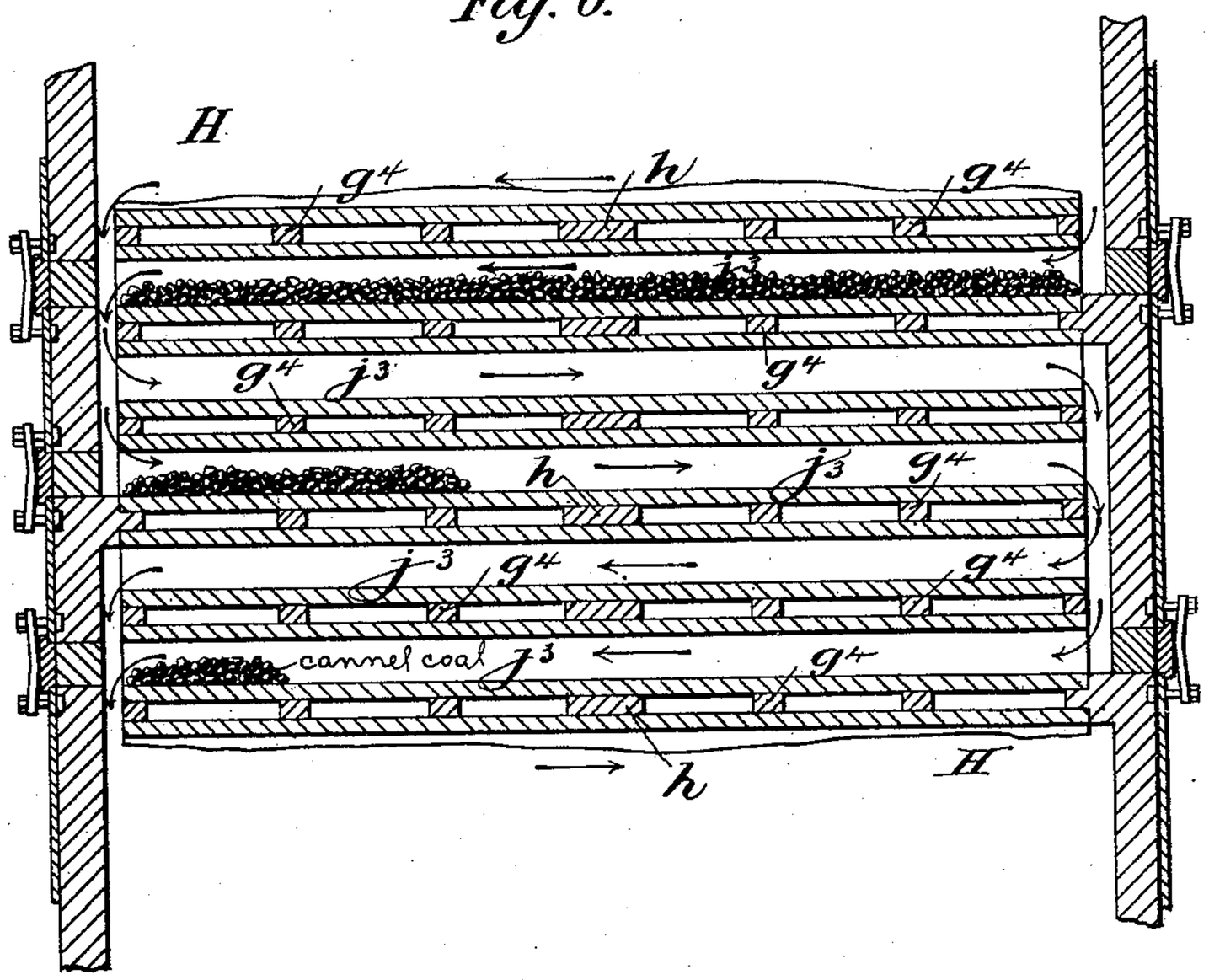
Fig. 6.



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UNITED STATES PATENT OFFICE.

WALTER P. ELLIOTT, OF NEW YORK, N. Y.

APPARATUS FOR MANUFACTURING GAS.

SPECIFICATION forming part of Letters Patent No. 480,919, dated August 16, 1892.

Application filed January 13, 1890. Serial No. 336,733. (No model.)

To all whom it may concern:

Be it known that I, WALTER P. ELLIOTT, of the city and county of New York, in the State of New York, have invented a certain new and useful Improvement in Apparatus for Manufacturing Gas, of which the following is a specification.

I will describe in detail an apparatus embodying my improvement, and then point out the novel features in claims.

In the accompanying drawings, Figure 1 is a plan view of apparatus adapted to carry out my improvement. Fig. 2 is a side elevation of the same. Fig. 3 is a horizontal section of a portion of the apparatus, taken on the line *x x*, Fig. 2. Fig. 4 is a vertical section of a carbureting and fixing chamber employed, taken on the line *y y*, Fig. 1. Fig. 5 is a vertical section of the same, taken on the line *z z*, Fig. 1. Fig. 6 is a vertical section taken on the same line as Fig. 4, but showing a slight modification. Figs. 3, 4, 5, and 6 are drawn to a larger scale than Figs. 1 and 2; and Fig. 6 is somewhat broken away.

Similar letters of reference designate corresponding parts in all the figures.

In carrying out my improvement I first cause a fire of some suitable carbonaceous material to be started in one or more producers, the combustion being accelerated, when desired, by a blast of air or air and steam. The resulting gaseous products are conveyed through a suitable outlet to a superheating and fixing chamber, which may also be a carbureting-chamber, where sufficient air is admitted to produce proper combustion of the gases. The gases are caused while in a state of combustion to pass about the exterior of tubes or retorts arranged in the said chamber, thus heating said tubes or retorts to a high temperature. When the materials in the producer or producers have acquired a sufficient temperature to dissociate and farther on decompose steam, the supply of air or air and steam is cut off, the outlet for the products of combustion is closed, and an outlet for gas is opened. Steam by itself or in combination with the gaseous products from one or more producers, or in combination with the products of distillation of carbonaceous or hydrocarbonaceous material, or steam in combination with the gaseous products from one or more producers and the products of the distillation of carbonaceous or hydrocarbonaceous material, is then admitted to the producer or producers, previously heated, as above referred to. After passing through the above-referred-to heated producer or producers the gaseous product is conveyed away to the aforesaid tubes or retorts arranged in the chamber. The temperature of the said tubes or retorts is sufficiently high to preheat and superheat the base-gas passing through the tubes or retorts, so that when the base-gas comes in contact with carbureting material, should such be used in the tubes or retorts, its temperature will be sufficiently high to materially aid in the destructive distillation of the carbureting material and, should steam be used, to decompose it. The temperature of the tubes or retorts is also sufficiently high to decompose hydrocarbonaceous material.

During the passage of the gas through the tubes or retorts it is carbureted or not, according as it is desired to make illuminating or heating gas. If carbureted, such carbureting is effected by the addition of the products of distillation from liquid hydrocarbon, bituminous or cannel coals, shale, or any suitable carbonaceous material. In the manufacture of heating-gas steam may, if desired, be introduced to the tubes or retorts. The gas in its further passage through the tubes or retorts is converted into a fixed gas and issues from the tubes or retorts into the hydraulic main, and thence passes into and through the scrubbers, condensers, purifiers, &c., in the usual way.

A designates producers, of which I have shown four, but of which I may use one or any desired number. These producers may be of any suitable construction which adapts them for the production of gases. I have shown them as circular and provided upon their tops with manholes *a*. Any suitable carbonaceous material—such, for instance, as coal, either bituminous or anthracite—having been placed in one or more, as desired, of the producers, the same is ignited in any well-known manner. Air or air together with steam is then introduced, preferably in the form of a blast. The air, as shown, is delivered in the direction of the arrow 1, Fig. 1, through the pipe B. From the pipe B extend

branch pipes *b* and from the branch pipes *b* other branch pipes *b'*. The branch pipes *b'* communicate with the interior of the producers. Each of the branch pipes *b'* is provided with a stop-cock b^2, by which the flow of air to the producer may be regulated, or in the case of steam and air being used the flow of steam in like manner can be regulated by a stop-cock h^2, or both steam and air may be wholly discontinued from any of the producers, as desired. The air may issue to the producers beneath the body of coal or directly against the body of coal, or when air and steam are introduced together both may thus be admitted.

Extending from the producers are pipes C, provided with stop-cocks *c*. These pipes communicate with a stand-pipe or stand-pipes D, which stand pipe or pipes are provided with stop-cocks *d d'*, the former above and the latter below the point of connection between the pipe C and the pipe or pipes D. The pipe or pipes D communicate at their lower ends with an accumulator E in the form, as here shown, of a horizontally-extending pipe, and at its or their upper end or ends with an accumulator F, also in the form of a horizontally-extending pipe. The accumulator E communicates with distributers G in the form, as shown, of horizontally-extending pipes, which distributers are provided with stop-cocks *g*. From the distributers G, in this instance, extend a number of pipes *g'*, which pipes extend to the interior of a chamber H near the bottom of the latter. The chamber H is a superheating and fixing chamber; but it may also be a carbureting-chamber. The gaseous products from the producer or producers pass therefrom through the pipes C to the pipe or pipes D and thence to the accumulator E, the stop cock or cocks *d* having previously been closed to prevent the passage of any of said products to the accumulator F. From the accumulator E such products pass through one or both of the distributers G, and thence through the pipes *g'* to the interior of the chamber H. I desire that when the gases thus enter the carbureting or fixing chamber sufficient air should be admitted to produce proper combustion. For this purpose I, as shown, cause a portion of the air entering through the pipe B to pass through a pipe I to a pipe I'. The pipe I' is provided with cocks *i i'*, one upon each side of the point of connection between the pipes I I'. The pipe I' communicates with the chamber H near the bottom and upon both sides of the latter. As shown, said pipe connects with chambers i^3, extending lengthwise of the chamber H. Opening from said chambers i^3 are tuyeres i^4, which tuyeres are adjacent to the inner ends of the pipes I'. The air thus introduced through the tuyeres will commingle with the gaseous products entering through the pipes *g'* and produce a proper combustion of said products.

The chamber H, I have shown as having near its bottom an open portion J, in which are arranged a number of piers *j*. Between the piers *j* extend arches j^2, as shown more clearly in Fig. 5. These piers and arches support a number of tubes j^3, (shown more clearly in Fig. 5,) which tubes constitute retorts.

I have shown the chamber H as divided vertically by a partition-wall *h*, so that there are in effect, in this example of my improvement, two compartments to the chamber, to one or both of which the gaseous products, just described, may be delivered from one or more producers through the distributers G, arranged upon opposite sides of the chamber. This may be accomplished by operating the stop-cocks *g* and *i i'*.

The pipes j^3 are preferably of refractory material—such, for instance, as fire-clay—and are separated from each other in such manner as to afford clear spaces about them for the passage of the gases in a state of combustion. I have shown them as arranged in rows extending widthwise of the carbureting and fixing chamber and as separated from each other and supported by means of blocks g^4, which blocks are made, preferably, of refractory material—such, for instance, as fire-clay. The burning gases in their upward passage through the chamber H are caused in this illustration of my improvement to pursue a circuitous course about the pipes j^3 by means of deflector-plates K, which deflector-plates alternately abut near one of their ends against the wall of the chamber and against the partition-wall, those abutting against the wall of the chamber not extending quite to the dividing partition-wall *h* and those abutting against the partition-wall not extending quite to the opposite wall of the chamber. The course of the gases is shown more clearly in Fig. 4 by the arrows in dotted lines. This upward movement of the gases in a state of combustion heats the pipes or retorts j^3 to a high temperature, the degree of which has been previously described. The pipes or retorts j^3 having been brought to the proper temperature, one or more of the cocks *d'* may be closed and one or more of the cocks *d* opened. At the same time certain of the cocks b^2, by which air is admitted to the previously-heated producers, may be closed. To the producers from which air is cut off steam by itself or in combination with the gaseous products from one or more producers or in combination with the products of distillation of carbonaceous or hydrocarbonaceous material, or steam in combination with the gaseous products from one or more producers and the products of the distillation of carbonaceous or hydrocarbonaceous material, is admitted from branch pipes *a'* or S, cocks h^2 h^4 therein being opened, so that steam or the other products described may flow directly into the producer or producers. The steam or other products passes upwardly through the incandescent mass of coal in the producer or producers and is combined, dissociated, or

decomposed, according to the product thus introduced. The gaseous product thus produced then passes through the pipe or pipes C and the pipe or pipes D to the accumulator F, and from thence through a pipe L to the upper portion of the chamber H.

I have shown the pipe L as extending along one side of the said chamber near the top thereof and in open communication with a chamber *l*, formed in said chamber H. The upper row of the pipes j^3 open at one of their ends into the chamber *l*. The gas passing through the pipe L is therefore delivered into the said upper row of the pipes j^3.

Referring more particularly to Fig. 4 it will be seen that passages *l'* are formed in the side walls of the chamber H, by which communication is afforded from the row or rows of pipes above to those below. These openings are so arranged relatively to each other upon opposite sides of the chamber that the down-flowing gas will be caused to pursue a circuitous course to and fro through the pipes from side to side of the chamber, as indicated more clearly by the arrows in full lines in said figure. The pipes, it will be observed in this instance, extend through the partition-wall *h*, and therefore through both of the chambers or compartments which are formed by said partition-wall.

When the gas has been preheated and superheated to such a temperature in its passage through the pipes that it will decompose a hydrocarbon, I carburet the gas either wholly or in part. I have shown two means for accomplishing this result. By the means shown more particulary in Figs. 2 and 4 I cause a liquid hydrocarbon—such, for instance, as petroleum—to be injected into certain of the pipes j^3. The liquid hydrocarbon flows through a stand-pipe M, from which stand-pipe extend laterally-arranged pipes N. From these laterally-arranged pipes nozzles *n* extend through the wall of the carbureting and fixing chamber and into the ends of the pipes opposite which they are arranged. I prefer that the outlets for these nozzles shall be restricted, so that the hydrocarbon will be delivered into the pipes in the form of a spray. Cocks *n'* upon the nozzles may be operated to regulate the flow of the hydrocarbon. In the other example of my improvement shown the pipes or retorts j^3 are somewhat enlarged. In these pipes or retorts I place a solid carbonaceous substance, such as bituminous or cannel coal or shale rich in hydrocarbon. The down-flowing gas passes over the beds of carbonaceous material, which of course are highly heated, and thus becomes carbureted. In fact I may use both of the means described for carbureting the gas, if I so desire. The gas in its farther passage down through the pipes or retorts becomes fixed and issues in the lower portion of the chamber through a pipe O, from which it passes to the usual purifiers, scrubbers, &c.

I may use but one of the producers or any desired number. By using a number of producers I am enabled to maintain a continuous process—that is to say, gaseous products from one or more of the producers having been passed to one side of the chamber H and the pipes or retorts having been sufficiently heated thereby, the same may be turned off, as described, and the steam or other products introduced and passed through to the tubes or retorts in the chamber H. While this last operation is being carried on other producers may be employed in the production of gas which will be passed to the other part of the chamber H for the purpose of heating the tubes or retorts therein, or in the production of gas which will be passed to the same side of the chamber H for the purpose of maintaining the heat therein, so that by thus alternating the operations of the producers not only can the process be made continuous, but the temperature in the chamber H or any part thereof may be always maintained at a proper degree.

By the use of my process and apparatus the gaseous product during the combustion of the carbonaceous material in the producer or producers is caused to heat the pipes or retorts through which the heating or illuminating gas passes, and there will therefore be no waste of heat, while at the same time the same carbonaceous material from which the first gaseous product is evolved is employed to dissociate and decompose the steam or other aeriform fluid to make the heating or illuminating gas.

I have shown pipes S provided with stop-cocks h^4, by which pipes communication is afforded between the various producers or generators.

It may sometimes be desirable to manufacture fuel-gas only, and in such case carbureting may be deemed unnecessary. I desire, however, in such an event to introduce steam to the tubes or retorts, and I have shown a steam-pipe R, from which extend branch pipes *r*, all provided with suitable cocks *r'*. From the branch pipes *r* nozzles r^2 extend through the wall of the chamber H and into certain of the tubes or retorts. By this means steam may be introduced to the tubes or retorts during the passage of the gaseous products from said tubes or retorts. In fact, steam may be introduced and employed while the gaseous product is also being carbureted, if desired.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In apparatus for manufacturing gas, the combination, with a generator in which carbonaceous material is burned, of a pipe or passage for the introduction of aeriform fluid containing oxygen thereto, a fixing retort-chamber, a pipe or passage from said generator to the said chamber for conveying to the latter the gaseous products resulting from the introduction of said aeriform fluid to the generator, fixing tubes or retorts arranged in said

chamber and externally heated by said gaseous products, a pipe or passage from the generator to and communicating with said tubes or retorts for conveying gaseous products from the generator to said tubes or retorts, and pipes for introducing steam into said tubes or retorts, there to mingle with said gaseous products during their passage through said tubes or retorts, substantially as specified.

2. In apparatus for manufacturing gas, the combination, with a generator in which carbonaceous material is burned, of a pipe or passage for the introduction of aeriform fluid containing oxygen thereto, a fixing retort-chamber, a pipe or passage from said generator to said chamber, having branch pipes for conveying to said chamber gaseous products resulting from the introduction of said aeriform fluid to the generator, fixing tubes or retorts arranged in said chamber and externally heated by said gaseous products, and pipes or passages from the generator to the tubes or retorts for conveying gaseous products from the generator to said tubes or retorts, the said fixing-chamber being divided into separate compartments, through both of which said fixing tubes or retorts extend and into either or both of which compartments the gaseous products first referred to may be introduced for the purpose of heating said tubes or retorts, substantially as specified.

3. In apparatus for manufacturing gas, the combination, with two or more generators in which carbonaceous material is burned, of pipes or passages for the introduction of aeriform fluid containing oxygen thereto, a fixing retort-chamber, pipes or passages from the said generators to the said chamber for conveying to the latter gaseous products resulting from the introduction of said aeriform fluid to the generators, fixing tubes or retorts arranged in said chamber and heated by said gaseous products, pipes or passages from the generators to the said chamber for conveying to the tubes or retorts gaseous products from the generators, and intercommunicating passages between said generators, whereby the gaseous products from one generator may be discharged into another near the lower end thereof, substantially as specified.

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