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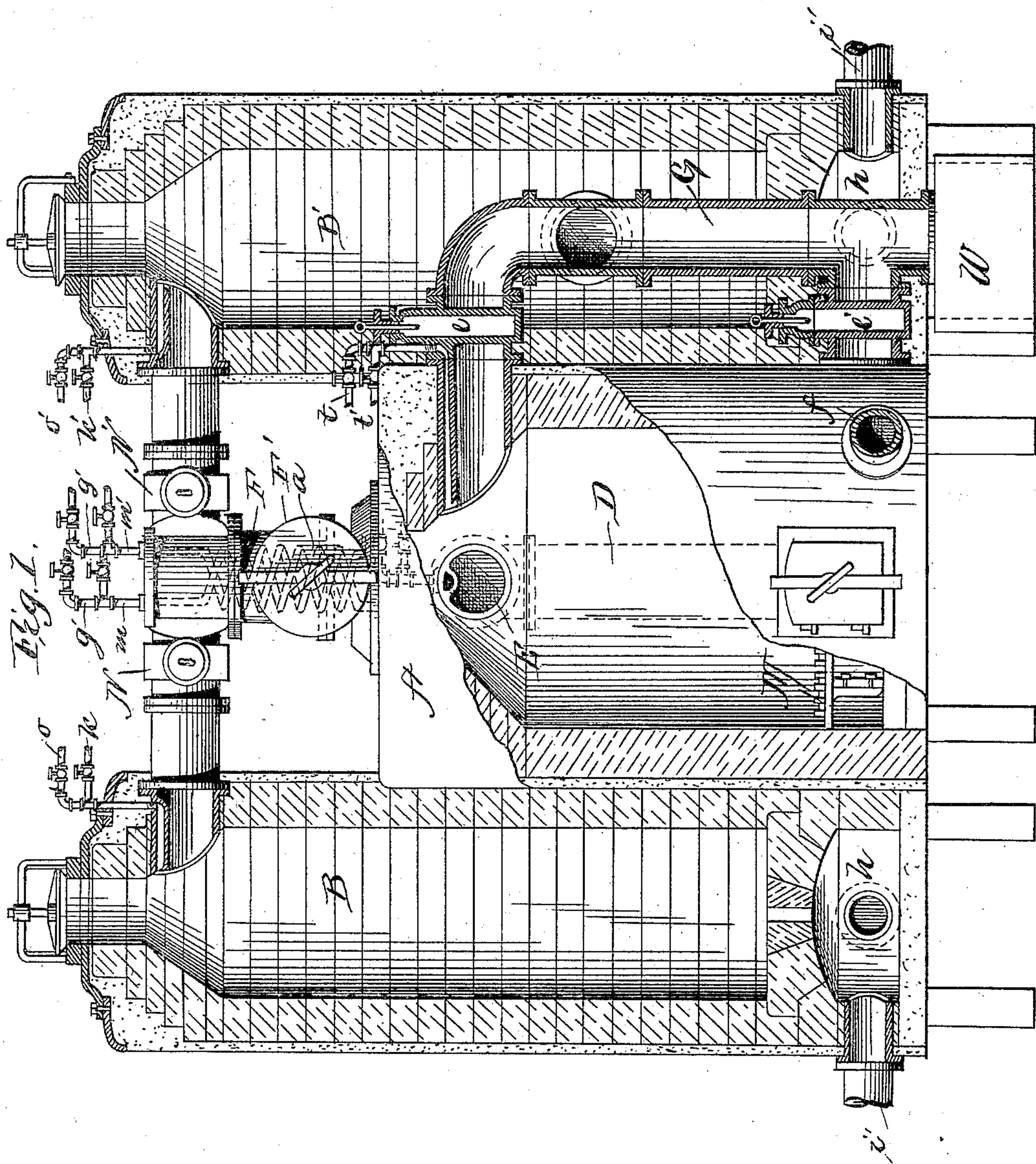
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W. M. COSH.

APPARATUS FOR THE MANUFACTURE OF GAS.

No. 427,747.

Patented May 13, 1890.



Witnesses  
Walter P. Keene.  
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Inventor  
W<sup>m</sup> M. Cosh  
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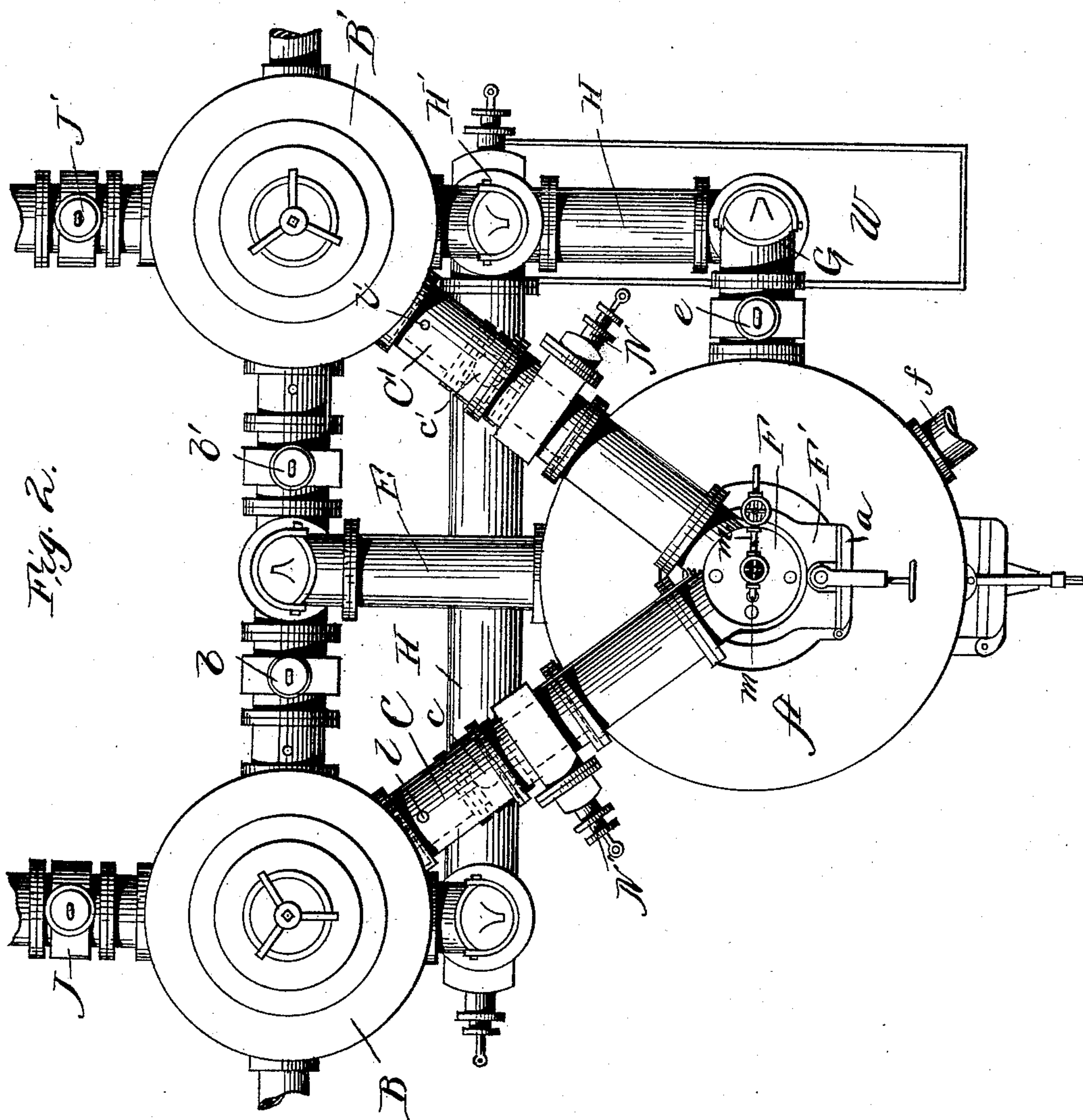
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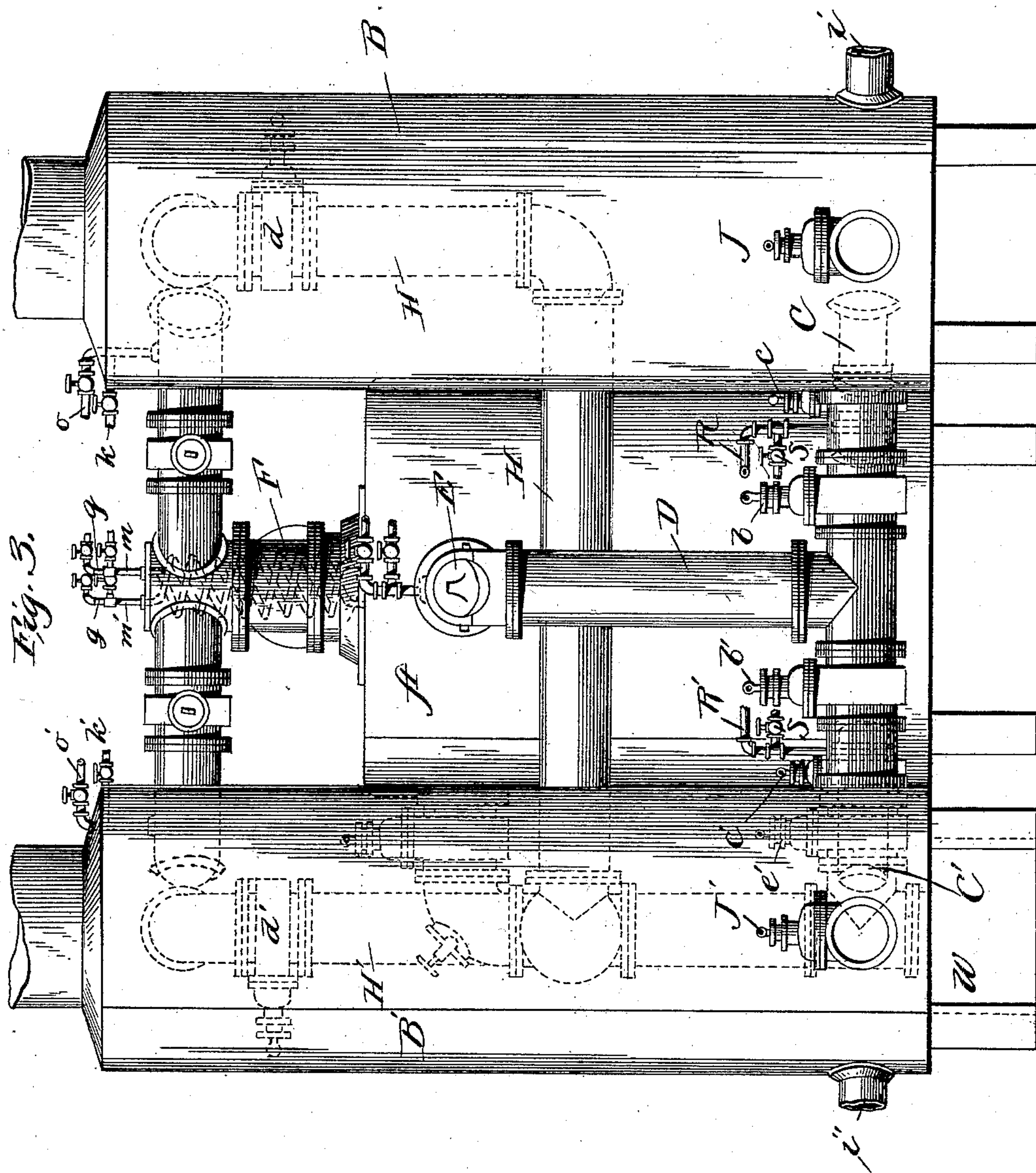
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Patented May 13, 1890.



*Attest*

W. P. Keene.

F. L. Middleton

*Inventor*

W<sup>m</sup>. M. Coste.  
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# UNITED STATES PATENT OFFICE.

WILLIAM M. COSH, OF BALTIMORE, MARYLAND.

## APPARATUS FOR THE MANUFACTURE OF GAS.

SPECIFICATION forming part of Letters Patent No. 427,747, dated May 13, 1890.

Application filed July 15, 1889. Serial No. 317,641. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM M. COSH, of Baltimore, State of Maryland, have invented a new and useful Improvement in Apparatus for the Manufacture of Gas; and I do hereby declare that the following is a full, clear, and exact description of the same.

My invention is an improved apparatus for the manufacture of illuminating or heating gases. It is of that class in which hydrogen gas is produced by the decomposition of steam in the presence of incandescent coal or some equivalent thereof, and is an improvement upon the apparatus shown in Letters Patent of the United States granted me on the 26th of March, 1889, No. 400,060.

The invention which is the subject of this specification consists of a special construction and arrangement of a generator and superheater or superheaters with their connecting pipes and valves, and also in the arrangement of steam, air, and hydrocarbon supply pipes.

It consists, further, of special combination of the duplicate superheaters with the generator and with the connecting-pipes and the hydrocarbon and steam supply pipes, whereby different processes can be carried on in the same apparatus, all as hereinafter explained.

In the accompanying drawings, which illustrate my invention, Figure 1 represents my improved apparatus, partly in side elevation and partly in section, the view being from the front. Fig. 2 is a plan view of the same. Fig. 3 shows a rear elevation of the apparatus. Fig. 4 represents a side elevation of the apparatus.

The generator is represented at A, and its construction is substantially the same as in my aforesaid patent. It is provided with a grate M, adapted to sustain the fuel, and underneath this grate is a space sufficient for the pipes hereinafter described. The generator is adapted to be used with coal, this being the preferred form of fuel and gas-generating material; but the apparatus may be adapted to use any other equivalent material, as a matter of course. The upper part of the generator is provided with a casting F', which extends obliquely upward toward

the front, and is provided with a cap *a*, with means for holding it in place. The opening in this oblique extension is designed for the admission of the fuel. The casting has also another extension F, projecting directly upward for connection with the top of the superheaters. This extension is closed at the top, excepting where it admits the lateral pipe of the heater, and it has two pipes *m m'*, extending down through the top, with coils in the lower part. The lower ends of these pipes terminate a suitable distance above the fire-surface. The pipes are provided with cocks outside of the casting, and each pipe has also a steam-pipe connection, marked, respectively, *g g'*, these also being provided with suitable cocks. Through these pipes steam and hydrocarbon liquid or vapor are admitted and introduced into the top of the generator at a sufficient distance above the surface of the coal for a result hereinafter explained. Below the grate M is a pipe *f*, leading to a suitable source of air-supply for the purpose of supplying blasts of air to the generator underneath the grate.

In rear of the generator and a little to each side are located chambers B B', adapted to act either as fixing-chambers or as superheaters. These are to be filled before using with fragments of brick or of any other suitable refractory material having interstices through which steam will freely pass or through which the products of combustion may be drawn, as the occasion in the use of the apparatus may require, as hereinafter explained. Underneath the chamber in which the fire-brick fragments of refractory material are to be placed is a combustion-chamber *h*. The top of this chamber has an opening upward and downward, with suitable covers, all as shown clearly in Fig. 1. There are passages from the combustion-chamber in the base up to the superheating and fixing chamber above the base, and there is also an air-supply *i*, which may be provided with a suitable valve (not shown) for supplying air regularly to the mouth in the combustion-chamber. The combustion-chambers are connected by pipes C C', respectively, with the space in the generator beneath the grate M, and these pipes are provided with valves *c c'*



for regulating the passage of the gases or cutting them off altogether. A horizontal pipe E from the upper part of the generator is connected with the vertical pipe D. The lower end of this pipe has horizontal branches (shown in Fig. 3) leading into the combustion-chambers *h h*, and through these pipes E D and the branches communication is afforded from the top of the generator into the combustion-chambers underneath the superheating and fixing chambers. The branches are provided with valves *b b'*, by means of which communication can be cut off between the upper part of the generator and either of the combustion-chambers, while the valves *c c'* in the pipes C C' serve to cut off communication between the lower part of the generator and either of the combustion-chambers. Another set of pipes connects the other superheaters and the generator with the wash-box W. Of these pipes H extends across from the top of one superheater to the top of the other, and at the latter point it connects with the pipe H', which is turned to meet the pipe G. (Shown in Fig. 4.) The pipes H H' are shown in Fig. 2. The pipe G is on one side of the generator, and has connection with the top and bottom of the generator, and extends down into the bottom of the wash-box W. The pipes H H' have valves *d d'*, respectively, by means of which communication may be shut off between the upper parts of the superheaters, or either of them, or the upper part of the generator and the wash-boxes. There are also valves *ee'* in the upper and lower extension of the pipe G above and below its junction with its pipe H', which closes these passages and may be used to shut off communication from either the upper or lower part of the generator. There are also valves J J' on outlet-pipes in the bottom of the superheaters, which should be closed when the valves *d d'* are opened. These are the main elements of the apparatus by means of which the various circulations are kept up; but in addition to these there are also oil-supply pipes and steam-supply pipes, besides those which have been heretofore described in connection with the casing F. There are also two steam-supply pipes, marked *k k'*, respectively, with their valves, provided also with oil-supply pipes *o o'*, also having valves and leading into the top of the superheaters B B'. I have provided also two steam-supply pipes *s s'*, provided with valves and connected with oil-supply pipes R R', leading into the chamber of the superheaters B B'; also, steam-supply pipes *l l'*, provided with valves leading into the top of the pipes C C', respectively.

The apparatus heretofore described is adapted to be used in accordance with several methods, slight and easy manipulations of these methods being productive of valuable results. The first of these methods is as follows: The generator is first charged with coal or its equivalent, this being the material ordinarily used. The cover of the generator is secured in place, and during the first part

of the operation the covers of the superheaters are removed. In this method of use of the apparatus the blast is passed up through the mass of coal, thence to the bottom of the superheaters, and up through the superheaters. For this purpose the valves *b b'* are opened. The valves *c c'* in the other lower pipes, the valves *d d'* in the pipes leading from the upper part of the superheaters, the valves *ee'*, and the valves J J' are closed. The valve of the blast-pipe *f* is open, and the air is admitted at the bottom of the generator and to the combustion-chambers *h h'*. The blast under the coal in the generator brings it to the incandescent condition. The products of combustion arising from the upper surface of the coal pass down through the pipe D and through its lateral branches through the combustion-chambers *h h'*. Carbonic oxide and the unconsumed carbon in these products meet in the chambers *h h'* an additional supply of air and undergo complete combustion, the products of which rise up through the refractory material and bring this material to a high heat, while the coal within the generator is coming to a condition of thorough incandescence. When the coal has reached this condition, the covers of the superheaters (if both are used) are secured in place, and the air-supply is cut off from the bottom of the superheaters and the bottom of the generator. Then the valves *d d'* in the upper outlet-pipes of the superheaters are opened and steam is admitted at the bottom of the generator. This steam passes up through the body of incandescent coal, and by its decomposition hydrogen is set free, while the oxygen unites with the carbon monoxide and a small percentage of carbon dioxide.

If it be desired to manufacture illuminating-gas, naphtha or other hydrocarbon liquid is admitted to the top of the generator through pipes heretofore described, and is vaporized by heat. This vapor is taken up by hydrogen arising from the surface of the coal, and the whole mixture passes through the pipes E D and their connections into the bottom of the superheaters. The superheaters act upon this mixture as fixing-chambers, and the gas passes over them to the wash-box of the purifying-chamber.

The construction of the apparatus is adapted to give still better results by another method of operation by which the quality of the gas is improved and a larger quantity obtained from the supply of coal. As in the method last referred to, the coal in the generator is brought to a proper incandescence, as heretofore explained. The blast from the pipe *f* is then shut off and the tops of the superheaters secured in place. The valves *b b'*, *d d'*, N N', and J J' are closed. The valve *e* in the outlet-pipe from the top of the generator and the valves *cc'* in the connecting-pipes between the bottom of the generator and the bottom of the superheaters are opened. The steam is wholly shut off elsewhere, but is admitted



to the top of the superheaters B B' through the pipes *k k'* and passes through the highly-heated refractory material contained in the superheaters, where it is brought to a highly superheated and attenuated condition. It is then admitted through the pipes C C' into the bottom of the generator, and in this dry and heated state steam is brought more readily into contact with the heated coal, and is more thoroughly decomposed. Hydrogen gas thus generated passes from the top of the generator through the opening at the valve *e*, thence down into the pipe G, and thence directly down into the wash-box. If it be desired to have it take up hydrocarbon vapor in its passage, this vapor may be supplied by hydrocarbon-pipes *t*, which, with the steam-pipe *t'*, is located in the passage above the pipe G. After this process has been continued for a time, the length of which may be easily determined by an operator skilled in the art to which my invention appertains, the point where the steam is admitted is changed. The valves *d d'*, *b b'*, *c c'*, and *e* are closed and the valves N N' are opened, as is also *e'*. Steam is then admitted to the bottom of superheaters through the pipes S S', and the steam is thus brought in its passage in contact with the first heated refractory material, which is in the bottom of the superheater, and is brought to a highly superheated and attenuated condition. In this condition it passes through the openings at the valves N N', and thence through the connection in the casting F into the upper part of the generator, where it comes in contact with a fresh surface of coal and passes downward through the mass, where it is decomposed as it expands. The resultant hydrocarbon gas passes through the valve *e'* at the bottom of the generator into the pipe G, and thence directly to the wash-box.

If desirable, when the current is in one direction naphtha may be introduced at R R' and in the other at *m m'*. In the manner above described the apparatus may be worked at a single heat repeatedly in opposite directions, the change in directions of the current being made as many times as desired, and if the supply of coal is exhausted it may be renewed and brought to a proper condition, as before explained. The apparatus is capable also of use in accordance with another method, which is specially adapted to the manufacture of illuminating-gases. By this method after the requisite heat has been obtained, as heretofore described, the valves J J' *b d e e' c'* are closed and the valves *c d' b'* are opened. Steam is admitted at the top of the superheaters B, and, passing down through the heated material therein to the bottom of the generator, enters through the pipe C in a superheated state. It then passes up through the incandescent coal and is converted into hydrogen gas. Rising from the coal in the top of the generator, it meets a hydrocarbon vapor from the coils (heretofore explained) in the casting F. This vapor is taken up by the

hydrogen, and the whole then passes to the bottom of the superheater B', and as it ascends through the highly-heated material therein it becomes thoroughly mixed and fixed, and then passes to the wash-box. After the operation is continued in the manner above described for a sufficient length of time, which may be determined by an operator skilled in the art, the valves *n J'* are opened and the valves *d' b'* are closed. Steam and oil are admitted as before; but the gas resulting from the operation in other respects, as before described, passes through the valve N' into the top of the superheater B', whereby the gas is brought into a fresh heating-surface of the refractory material, passing down through the same and out at the valve J', and through pipe (not shown) to wash-box. It will also be apparent that the direction of the steam may be reversed in the above operation by closing the valves J, J', *d', b', e, e'*, and *c* and leaving *c', d*, and *b* opened. Steam is then admitted at the top of the superheater B', and passing downward, as before described, is superheated, and may be thence taken to the generator, where it is converted into hydrogen gas. The course of the steam may again be reversed by opening the valves *n' J* and closing *d* and *b*. The steam may also be made to pass downward through the coal and from *d'* to *b'* to the connecting-pipes C C', and steam-pipes *l l'* on top of connecting-pipes C C' are for the purpose of letting in a supply of steam to the hydrogen gas in case it should be hot enough to take up more steam and convert it into hydrogen.

It will thus be seen that the apparatus is capable of a variety of methods of operation, due to the arrangement of pipes and to the addition of the hydrocarbon and steam supply introduced into the pipes and other parts. The generator has connections from its upper part, both with the bottom and the top of the superheaters, by suitable valves for opening and closing these pipes.

I claim as my invention—

1. In combination, a generator, a pair of superheaters, said superheaters having combustion-chambers in the bottom thereof and covers in the tops, pipe-connections having valves between the top of the generator and the top and bottom of both superheaters through branches, and pipe-connections from the bottom of the generator with a suitable valve, said pipe-connections last specified leading both to the bottom and top of the superheaters, with suitable outlets and with hydrocarbon and steam supply pipes, as described.

2. In combination, a generator and superheaters having combustion-chambers in the bottom, valved pipes connecting the top of the generator both with the bottom and with the top of the superheaters, both having oil-supply pipes, air and steam supply pipes in the bottom of the generator, air-supply in the bottom of the superheaters, and removable covers



in the top of the superheaters, and outlet-pipes from both the bottom and top of the superheaters, all substantially as described.

3. In combination, a generator and super-  
5 heaters having combustion-chambers in the bottom, valved pipes connecting the top of the generator both with the bottom and with  
the top of the superheaters, having oil-supply  
pipes, air and steam supply pipes in the bot-  
10 tom of the generator, air-supply in the bot-  
tom of the superheaters, and removable covers  
in the top of the superheaters, and outlet-  
pipes from both the bottom and top of the  
superheaters, and pipes H H', leading to the  
15 wash-box, having valves *d d'*, substantially  
as described.

4. In combination, a generator and super-  
heaters having combustion-chambers in the  
bottom, valved pipes connecting the top of the  
20 generator both with the top and bottom of  
the superheaters, having oil-supply pipes, air  
and steam supply pipes in the bottom of the  
generator, air-supply in the bottom of the  
superheaters, and removable covers in the top  
25 of the superheaters, and outlet-pipes from  
both the bottom and top of the superheaters,  
pipes H H', having valves *d d'* and connect-  
ing the tops of the superheater with the pipe  
G, which has valved passages both to the top  
30 and bottom of the generator, and wash-box  
connections, substantially as described.

5. In combination, a generator and super-

heaters having combustion-chambers in the  
bottom, valved pipes connecting the top of the  
generator both with the top and bottom of the 35  
superheaters, both having oil-supply pipes, air  
and steam supply pipes in the bottom of the  
generator, air-supply in the bottom of the  
superheaters, and removable covers in the top  
of the superheaters, and outlet-pipes from both 40  
the bottom and top of the superheaters, out-  
let-pipes J J' in the bottom, and outlet-pipes  
H H' in the top, all leading to wash-box con-  
nections, substantially as described.

6. In combination with a generator and a 45  
superheating and fixing chamber having  
combustion-chambers in the lower part, valved  
pipes extending from said combustion-cham-  
bers into the generator beneath the grate  
thereof, a casting on the top of the generator, 50  
said casting having an oblique extension for  
the admission of fuel, and an extension F,  
closed at the top, and pipes leading from said  
extension F into the top of the superheater,  
and connections with the wash-box, all sub- 55  
stantially as described.

In testimony whereof I have signed my  
name to this specification in the presence of  
two subscribing witnesses.

WM. M. COSH.

Witnesses:

JOHN G. SCOTT,

THOS. KELL BRADFORD.