

P. DVORKOVITZ.
APPARATUS FOR THE MANUFACTURE OF GAS.

No. 512,950.

Patented Jan. 16, 1894.

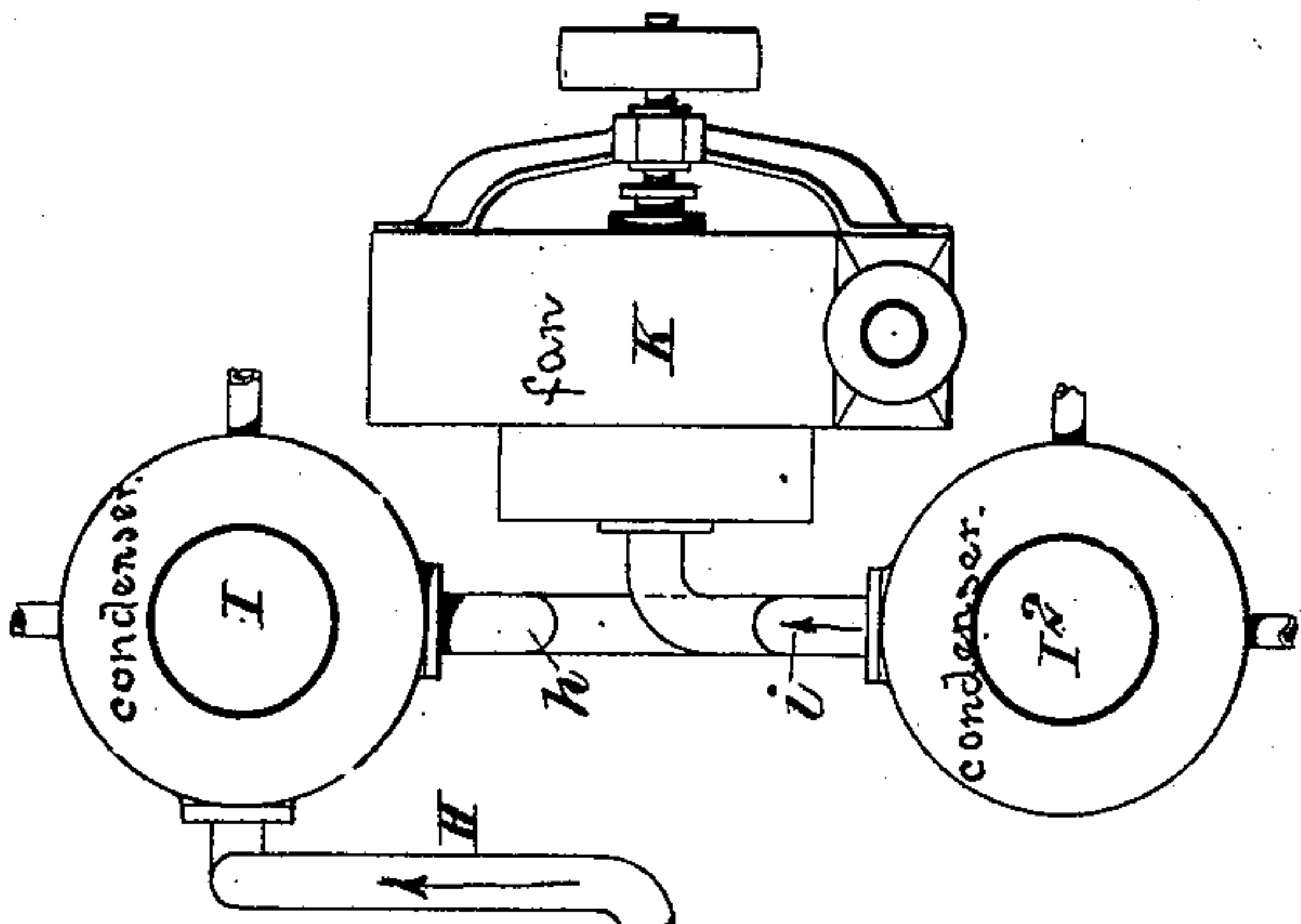
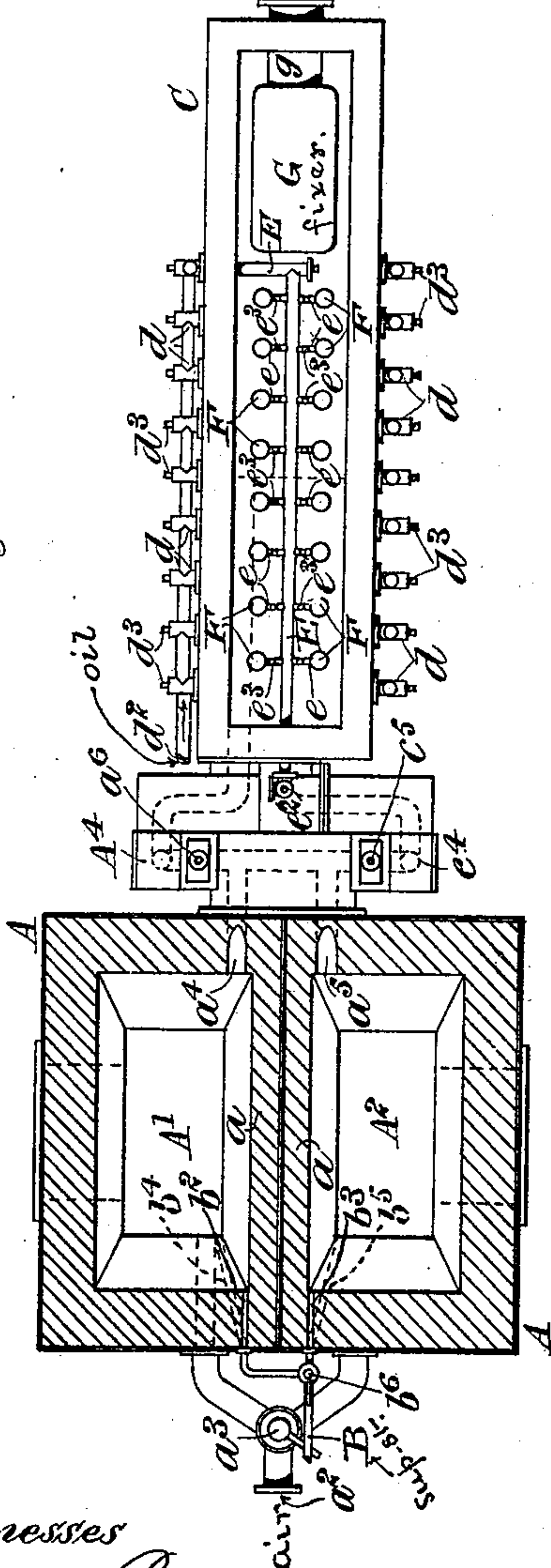


Fig. 1.



Witnesses
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James Gracie

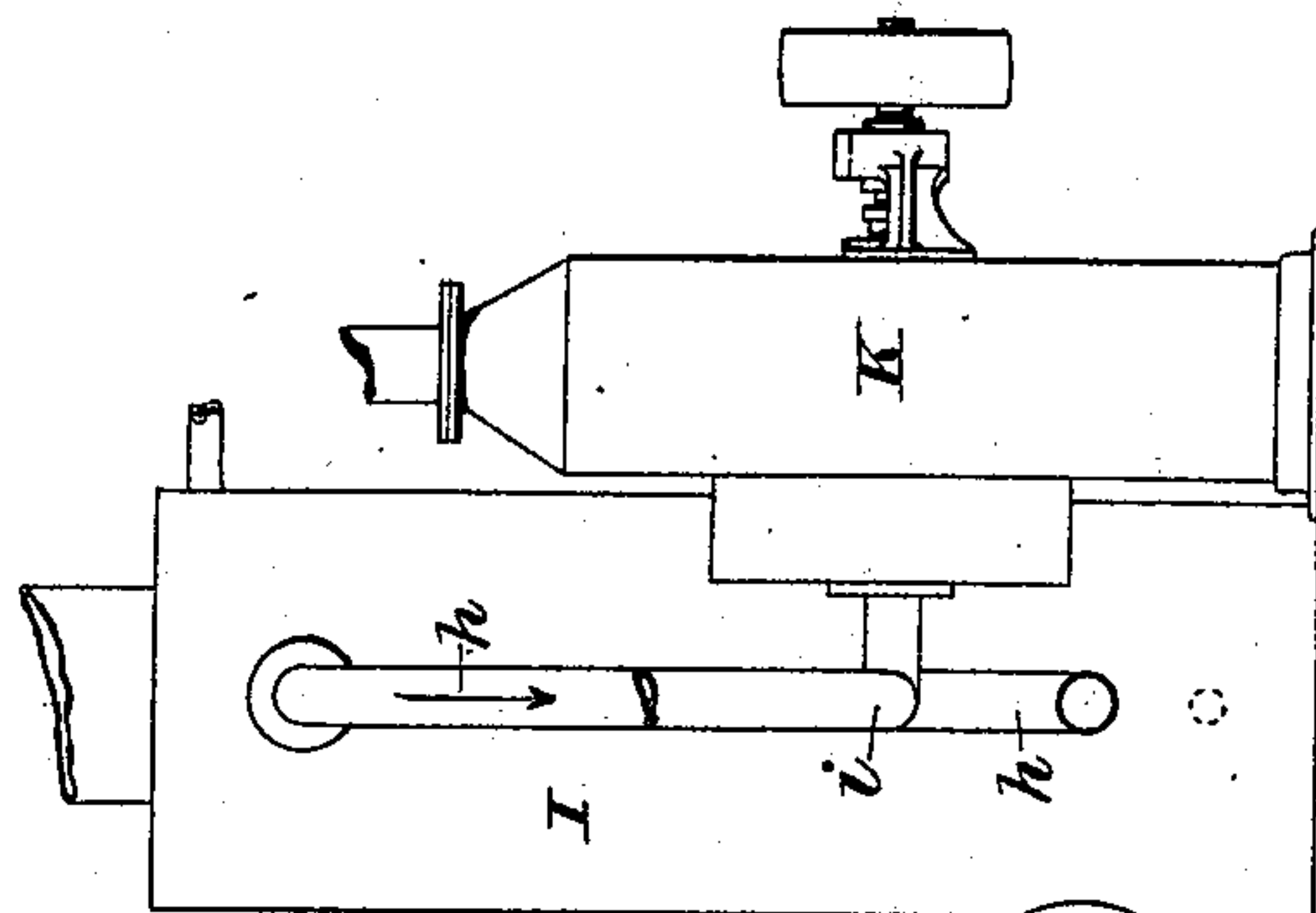
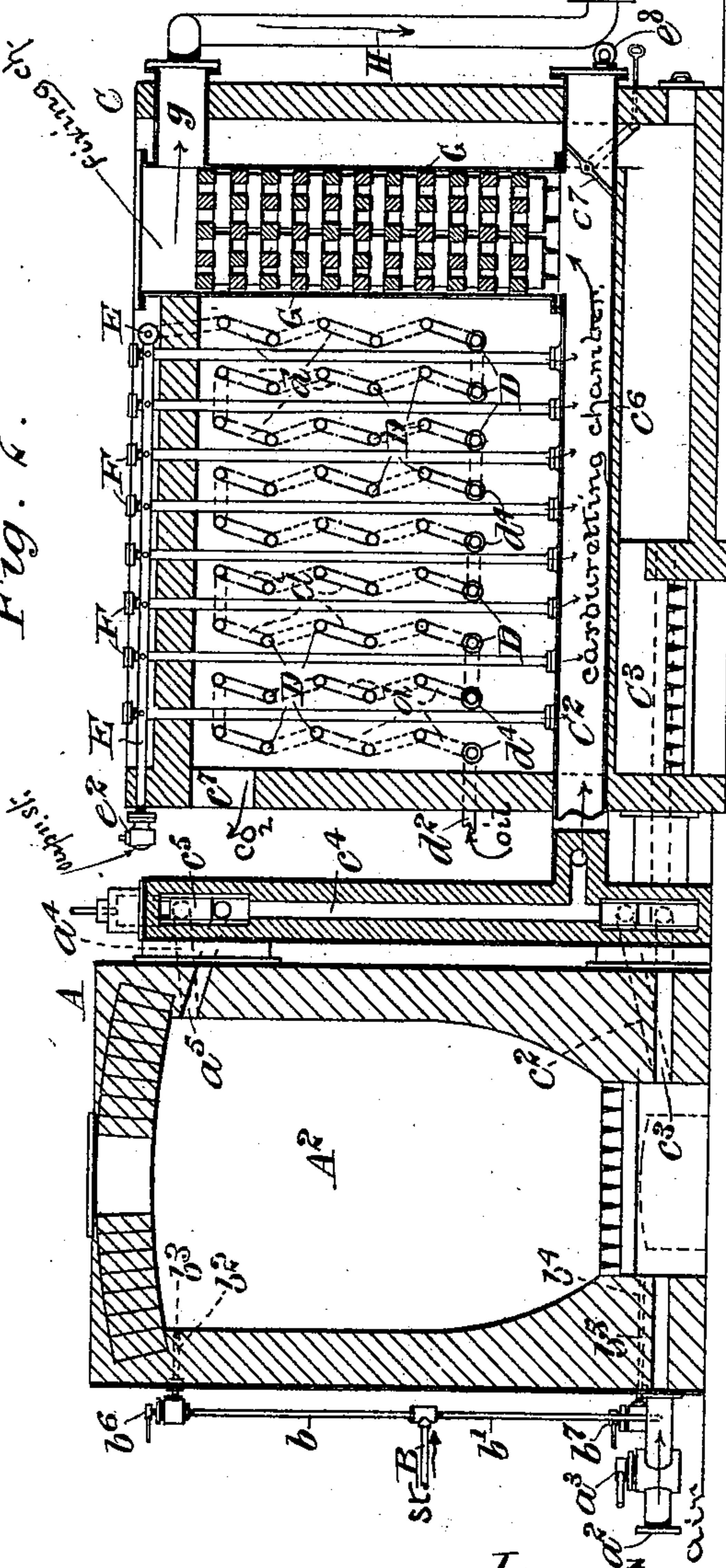


Fig. 2.



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(No Model.)

3 Sheets—Sheet 2.

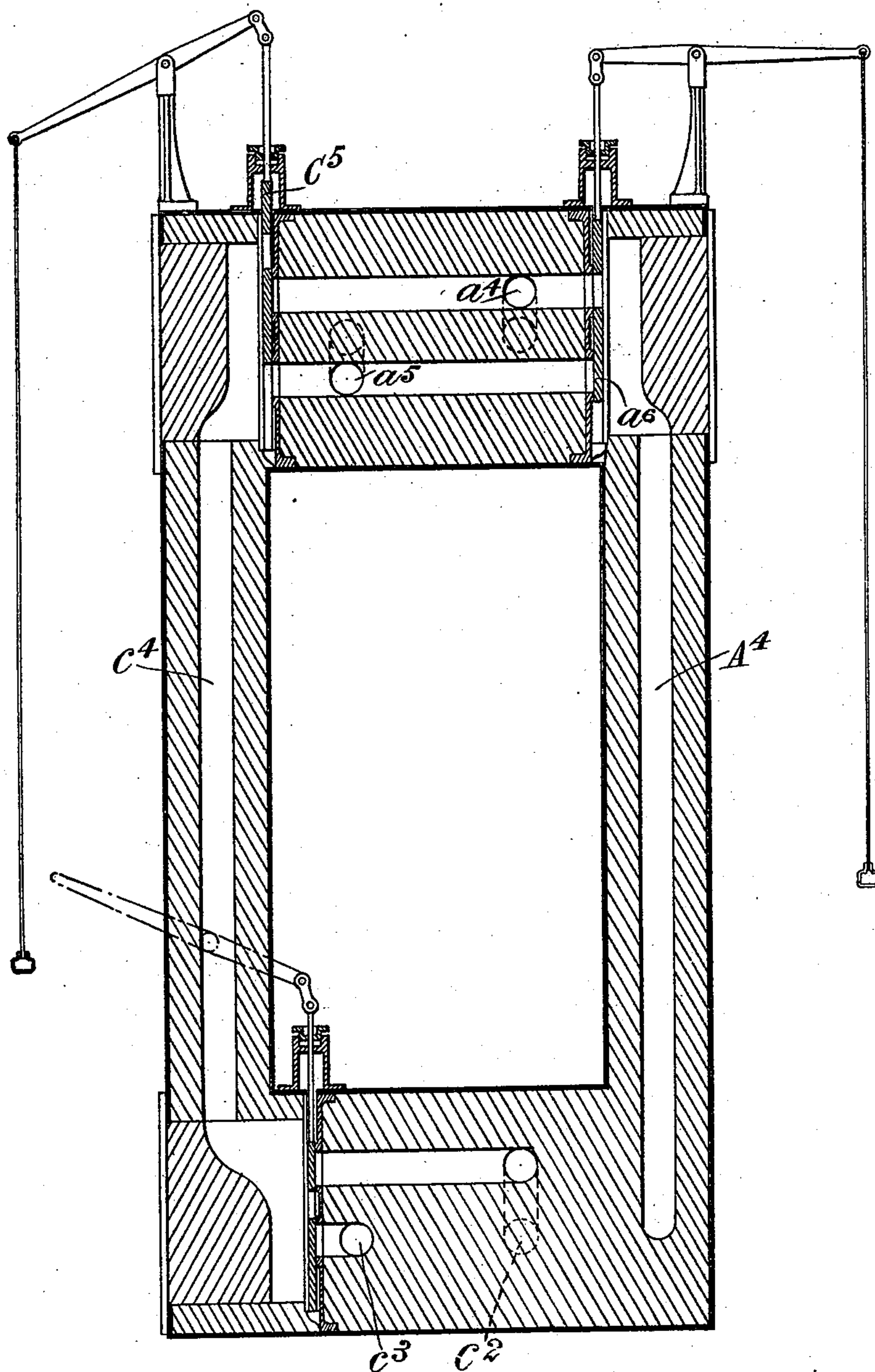
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Fig. 3.



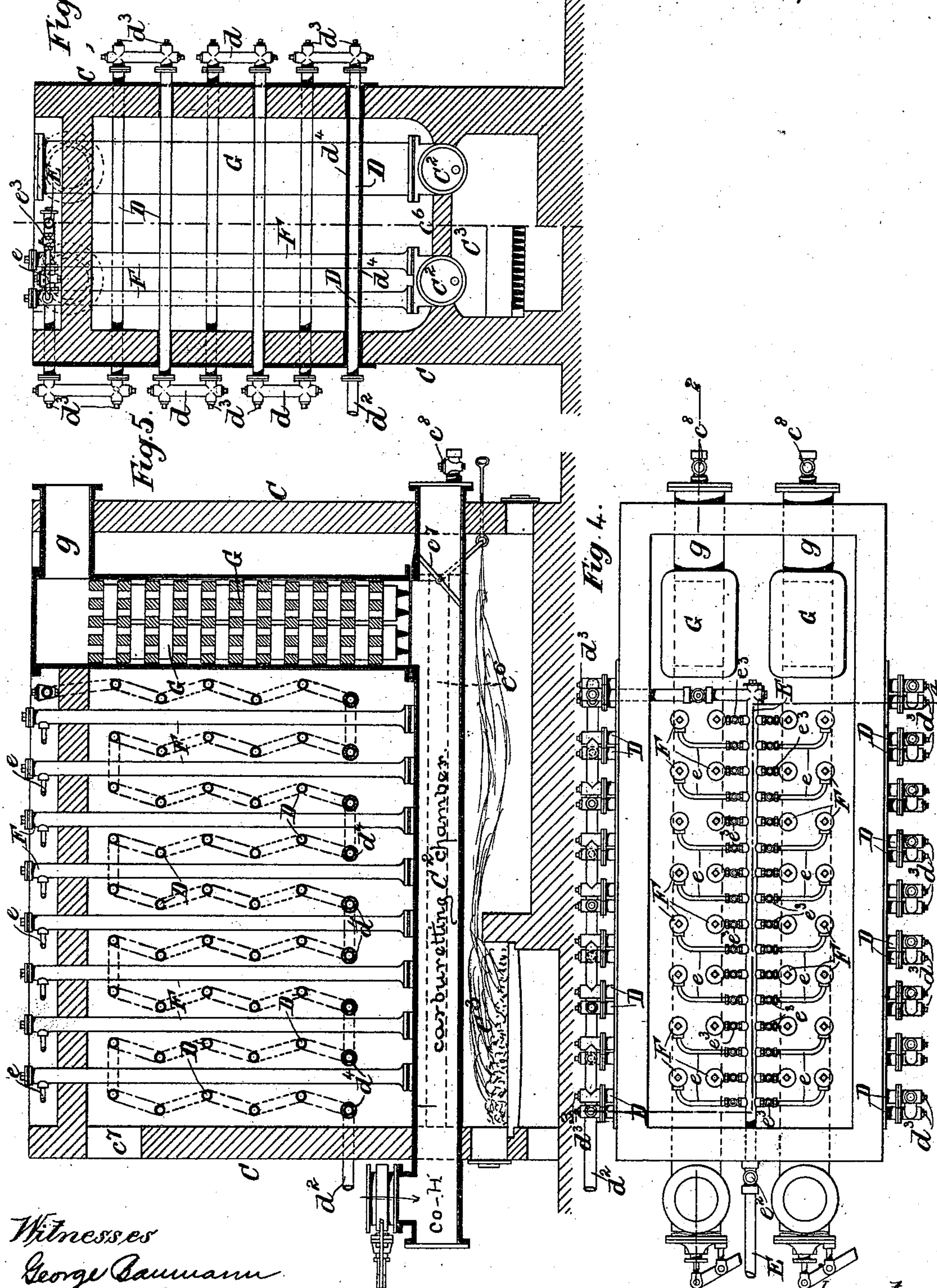
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UNITED STATES PATENT OFFICE.

PAUL DVORKOVITZ, OF LONDON, ENGLAND.

APPARATUS FOR THE MANUFACTURE OF GAS.

SPECIFICATION forming part of Letters Patent No. 512,950, dated January 16, 1894.

Application filed March 31, 1893. Serial No. 468,498. (No model.) Patented in England March 18, 1893, No. 7,893.

To all whom it may concern:

Be it known that I, PAUL DVORKOVITZ, chemist, a subject of the Emperor of Russia, residing at Fernwood, North Hill, Highgate,
5 London, England, have invented certain improvements in and apparatus for the manufacture of gas for illuminating or heating purposes and the obtainment of valuable by-products therefrom, also for the distillation of
10 liquid hydrocarbons and other matters, (for which I have obtained Letters Patent in Great Britain, No. 7,893, dated March 18, 1893,) of which the following is a specification.

My invention relates to the manufacture of
15 illuminating gas from water gas and liquid or liquefiable hydrocarbons (which I will hereinafter refer to as "oil") to the carbureting of coal gas and to the distillation of liquid hydrocarbons and to apparatus whereby the manufacture of gas or the distilling process can be
20 conducted in a continuous manner and without loss of valuable by-products (aromatic hydrocarbons) by gasification or burning, the arrangement being such that the tar and other
25 by-products can be readily removed from the apparatus and the parts wherein the tar deposits can be readily cleaned.

According to my invention I provide a generator or generators for the production of
30 water gas which generator may be of rectangular or other suitable form divided by a partition into two chambers each charged with coke and alternately heated to incandescence by means of superheated air. When the coke
35 in one chamber is raised to the required heat the admission of air is discontinued and superheated steam is admitted thereinto, which steam, in passing through the incandescent coke becomes converted into water gas and
40 passes from the said chamber into a chamber into which oil is admitted to combine with the water gas. The said oil having been previously heated in tubes in what I will call the vaporizing chamber, as hereinafter described,
45 so as to obtain in it the form of a mixture of permanent gas and of condensable vapor of the aromatic hydrocarbons of the oil, I draw the oil gases and vapors from the vaporizing chamber by means of an exhaustor or an ejector through which the water-gas may pass
50 to draw the oil and gas vapors into it or pass

them toward a carbureting chamber where the said water and oil gas combine the exhaustor or ejector preventing the oil gases and vapors from being forced back into the
55 vaporizer whereby soluble by-products (aromatic hydrocarbons) are saved which would be otherwise destroyed, the heavy tar depositing in a carbureting chamber from which it may be readily removed when required,
60 the gases and vapors passing to a condenser or condensers in which the aromatic hydrocarbons deposit, the parts where the tar deposits can be efficiently cleansed by passing steam through the said parts. While the water gas is being made in one chamber of the
65 generator superheated air may be introduced into the other chamber thereof so that by the time the coke in the chamber in which the gas is being made becomes cooled down, the
70 coke in the other chamber will be rendered incandescent ready for the superheated steam to be introduced so that the production of water gas may be carried on continuously. The combined water gas and oil gases and vapors may be forced or drawn by the exhaustor
75 or ejector into a separator or fixing chamber which serves to effect the production of permanent illuminating gas from the water gas and hydrocarbon, but without the destruction
80 of the aromatic hydrocarbons which are obtained in the condenser or condensers the deposit of the heavy tars also is further insured. The said separator or fixing chamber contains an extended surface over or in contact with
85 which the combined water gas and oil gas and vapor pass, the said chamber being heated from the exterior by a furnace assisted by the generator gas obtained in heating the coke in the generator, which generator gas may
90 also be used for heating the tubes in which the gasifying and vaporization of the oil is effected. The gases and vapors are then conducted from the separator or fixing chamber into and through a condenser or condensers
95 in which valuable by-products in the form of aromatic hydrocarbons will deposit and from which the permanent gases will pass into any suitable receiver. The exhausting device may be so situated as to draw the gases and
100 vapors through the carbureting chamber the fixing chamber and the condenser or con-

densers and to force the permanent illuminating gas to the storage tanks or place where it is to be used, or it may be otherwise arranged so as to draw the oil gases and vapors from the gasifier and vaporizer and force them forward through the other parts of the apparatus.

The apparatus can be used for making illuminating gas from oil, alone by omitting the introduction of water gas; or it may be used for enriching coal gas or other gas by admitting such gas in place of water gas, or it may be used for distilling oil by using a temperature sufficiently lower than that used for making gas so as not to convert oil vapors into fixed gas, superheated steam where necessary being introduced into the apparatus to assist in the distillation of the oil.

In order that my invention may be well understood I will further describe with reference to the accompanying drawings what I consider the best means for carrying it into effect in practice.

Figure 1 is a plan and Fig. 2 a longitudinal vertical section of an apparatus constructed according to my invention, and Fig. 3 shows an arrangement of valve for connecting as required one or the other of the chambers of the generator with the carbureting chamber. Fig. 4 shows in plan two carbureting and fixing chambers arranged side by side so as to be used alternately to carry on a continuous process. Fig. 5 is a longitudinal vertical section taken along the line 1—2, Fig. 4, and Fig. 6 is a transverse vertical section taken along the line 3—4, Fig. 4.

Referring to Figs. 1 and 2, A is a generator or retort in which water gas is produced. This generator is divided by a partition a into two chambers A' A^2 , each chamber being charged with coke. These charges of coke are heated alternately to a condition of incandescence by means of superheated air admitted to the lower part of the generator by a supply pipe a^2 leading from the source of supply of such superheated air.

The air supply pipe or passage a^2 is provided with a valve a^3 so arranged that the superheated air can be directed into either the chamber A' or the chamber A^2 as desired. When the coke in one of these chambers has attained the required heat the valve at a^3 is operated so as to shut off the supply of air to this chamber and open the communication between the supply pipe a^2 and the other chamber of the generator.

The generator gases pass from the chamber A' A^2 by pipes or passages a^4 a^5 to a pipe A^4 leading to a chamber C hereinafter described in which the oil is gasified and vaporized, the pipe A^4 being provided with a three-way cock or valve a^6 by which the pipe A^4 may be made to communicate with either chamber A' or A^2 as required.

B is a pipe for conducting superheated steam to the generator A, this pipe having branches b b' fitted with nozzles b^2 b^3 and b^4

b^5 communicating respectively with the upper and lower parts of the interior of the chambers A' A^2 . The branches b b' are each provided at their junctions with the nozzles b^2 b^3 and b^4 b^5 respectively with a three way cock b^6 and b^7 by means of which the superheated steam may be directed into the upper or lower ends of either of the chambers A' or A^2 or be cut off from both chambers as required. The upper and lower parts of the interior of each of the chambers A' and A^2 are in communication by pipes or passages a^4 a^5 and c^2 c^3 respectively with a pipe or passage c^4 leading to a carbureting chamber C^2 arranged in the lower part of the heating chamber C in which the oil is gasified and vaporized, the pipe or passage c^4 being provided with a valve c^5 by means of which the chamber A' or A^2 as required may be made to communicate with the said carbureting chamber C^2 .

The heating chamber C may be provided with a furnace C^3 having a roof c^6 extending from the front but leaving an opening at the end farthest from the furnace by which opening the hot gases pass into the chamber C on their way to the chimney which is in communication with the opening c^7 .

The carbureting chamber C^2 consists of a tube set in the roof c^6 of the furnace and extending through and projecting from each end of the chamber C.

At intervals throughout the chamber C are arranged tubes D which extend to outside the chamber and are connected by tubular connections d so as to form a continuous passage for the oil which enters by the pipe d^2 . These tubes and tubular connections may have removable plugs at their ends as shown at d^3 for cleansing purposes and the lower series of the said tubes are preferably surrounded by tubes d^4 of larger diameter built in the brickwork so as to protect them from burning. The end tube of the series is in communication with a pipe E from which branch pipes e open into tubes F which descend through the chamber C and open into the carbureting chamber C^2 . I have shown two series of tubes F in connection with the carbureting chamber but I may use only one series or more than two series.

The end of the chamber C^2 farthest from the furnace communicates with a fixing chamber G filled with fire brick or other material presenting an extended surface for the contact of the gases.

q is the outlet for the gases from the fixing chamber to which outlet is connected a pipe or passage H leading to a condenser I through which the gases and vapors pass, they afterward passing by the pipe h into another condenser I^2 . The outlet from this second condenser is connected by a pipe i to a fan or exhaustor K by which the gases are drawn through the apparatus and forced to the place of utilization or storage. The valve c^5 in the pipe or passage c^4 through which the water

gas enters the chamber C^2 can be closed when water gas is not to be supplied.

Instead of water gas heated coal gas may be passed through the valve c^5 into the chamber C^2 to be enriched by the hydrocarbon vapor.

e^7 is a valve to prevent the gases or vapors from passing too near to the rearward end of the chamber C^2 and e^8 is a cock or valve by which the tar which deposits in the chamber C^2 can be removed.

The pipe E is provided with a stop cock e^2 by which superheated steam can be admitted when desired to cleanse the tubes E and F.

The branch pipes e are provided with cocks e^3 by which they can be closed when desired.

When the apparatus is in use for making illuminating gas from water gas and hydrocarbon oil, and obtaining as aforesaid the valuable by-products (aromatic hydrocarbon), the chambers A' A^2 of the generator A are charged with coke as hereinbefore described and fired at the bottom. The valve a^3 is then opened so as to admit superheated air into one of the chambers. Presuming that the chamber A' is to be heated the valve a^3 is moved so as to admit the superheated air into this chamber until the coke therein becomes incandescent, the obtained generator gas passing from this chamber by the pipe or passage a^4 and valve a^6 into the furnace of heating chamber C. When the coke in chamber A' has been raised to the required temperature the valve a^3 is moved so as to cut off the admission of air thereto and direct it into the chamber A^2 . Superheated steam is then admitted to the lower end of the chamber A' through the pipe B, branch b' and nozzle b^4 by opening the three-way cock b^7 to so admit the said steam. The steam in its passage upward through the incandescent coke in the chamber A' produces water gas which passes out through the passage a^4 and pipe or passage c^4 into the carbureting chamber C^2 , the pressure of the said gas passing through this chamber acting as an ejector draws the oil gases and vapors through the pipes F in the heating chamber into the chamber C^2 wherein they become intimately mixed with the water-gas and pass therewith into the fixer G the exhaustor K also serving to draw the mixed gases and vapors from the chamber C^2 and preventing the hydrocarbon gases and vapors from being drawn back by the pressure of the water gas into the heating chamber. The separator or fixer G insures that the constituents of the hydrocarbon vapor and gas which it is desired shall be converted into illuminating gas are rendered permanent. The separator or fixer G is heated externally by the heat from the furnace and the generator gas admitted to the chamber C from the generator A while heavy tar deposits in the chamber C^2 can be removed therefrom as required through the valve e^8 . The permanent gas and uncondensed aromatic hydrocarbons pass from the fixer G into the condensers I and I^2 and therein the aromatic hydrocarbons

are deposited and obtained, the permanent gas being forced therefrom by the exhaustor K to the place of utilization or storage. When the coke in the chamber A' of the generator has cooled down and the coke in the chamber A^2 has been raised to the required temperature the steam is shut off from the chamber A' by the three-way valve b^7 and conducted into the chamber A^2 , the water gas made thereby in this chamber passing therefrom by the passage a^5 into the pipe or passage c^4 leading to the carbureting chamber C^2 where it mixes with the oil gases and vapors and passes through the fixer and condensers to the place of utilization or storage of the permanent gases as hereinbefore described. When clinkers are formed in the lower parts of the chambers A' A^2 the valve b^7 is closed and the valve b^6 opened so as to cause the steam to enter the chambers through the upper nozzles b^2 and b^3 and pass downward through the coke and thereby effect the destruction of the said clinkers; the water gas passing from the chamber in the manner hereinbefore described. By working the chambers A' A^2 alternately as hereinbefore described the manufacture of the gas may be continuous.

In Figs. 4, 5 and 6 I have shown two carbureting chambers C^2 and fixers G such as hereinbefore described arranged side by side in one heating chamber C so that when one of the said chambers or fixers requires repairing or cleaning this may be done without discontinuing the manufacture of the gas. If the water gas be omitted the apparatus will make fixed gas and aromatic hydrocarbons as by products from oil alone. If the apparatus is to be used simply for distilling oil the valve c^5 for admitting water gas is closed and oil is admitted at d^2 as before; superheated steam being admitted by opening the cock e^2 to meet the vaporized oil in the pipe E to assist the distillation. The tar deposits in the chamber C^2 as hereinbefore described and the vaporized oil and steam pass out at the opening g and the oil distilled can be condensed and separated in any ordinary or convenient apparatus suitable for the purpose. The temperature will of course be lower when distillation only is to be effected than when a fixed gas is to be obtained from the oil. The fixing chamber G when distilling oil acts only as a separator to separate the distillate from the tar. By closing the cocks e^3 on the branch pipes e which communicate with the pipes F the said pipes F may be cleaned by removing the stoppers at their upper ends.

I have shown the carbureting chamber C^2 and the tubes D as being horizontal but they may be otherwise arranged and the tubes F need not be vertical provided they be so disposed as to allow the deposited tar to pass into the chamber C^2 .

I claim as my invention—

1. In an apparatus for distilling or gasifying hydrocarbons, a heating chamber having a

fire place, tubing over the latter for the circulating and heating of oil under confinement, a tar-receiving chamber over the furnace, and provided with an outlet through which the tar can be removed, in combination with discharge tubes leading from said circulating tubing and opening into the tar-receiving chamber, and heated passages in communication with the tar-receiving chamber to carry off the gas and vapors from the latter, and a condenser with which said heated passages communicate, all substantially as described.

2. In an apparatus for distilling or gasifying hydrocarbons, the combination in a furnace of a chamber C communicating with the fireplace, a chamber C² in the lower part of the said chamber C, with a series of pipes F passing through chamber C and opening at their lower ends into chamber C², and a series of communicating pipes D passing through the chamber C, one end of the series communicating with an oil supply and the other end with the pipes F, substantially as and for the purposes set forth.

3. In an apparatus for distilling or gasifying hydrocarbons, the combination in a furnace of a chamber C² above the fire place, pipes F opening into the said chamber, pipes D connected with the oil supply and communicating with the pipes F, with a chamber G communicating with the outlet of the chamber C, substantially as and for the purposes set forth.

4. In an apparatus for distilling or gasifying hydrocarbons, the combination of a furnace having therein a chamber C², pipes D connected to the oil supply, pipes F communicating with the pipes D and opening into the chamber C², and heating chamber G leading from the chamber C², with a condenser in com-

munication with the chamber G substantially as and for the purposes set forth.

5. The combination of a water gas generator with a furnace provided with a chamber C² having an inlet for the water-gas, a heating chamber C above the chamber C² and provided with pipes F, the lower ends of which open into the chamber C² and with pipes D connected to the oil supply and to the pipes F all substantially as and for the purposes set forth.

6. In an apparatus for manufacturing gas the combination of a heating chamber C provided with a chamber C² in the lower part, series of pipes D and F connected with the oil supply and opening into the chamber C², the chamber C² being provided with an inlet for water gas or other gas and chamber G leading from the chamber C², with an exhaustor as and for the purposes set forth.

7. In an apparatus for manufacturing gas, the combination in a heating chamber of a carbureting chamber C² in the lower part, the chamber C² being provided with a gas inlet with a series of communicating horizontal pipes D, the lower end communicating with the oil supply, a distribution pipe E connected to the upper end of the pipes D, and vertical pipes F connecting the distribution pipe E and the chamber C², substantially as and for the purposes set forth.

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

P. DVORKOVITZ.

Witnesses:

RUDOLPH CHAS. NICKOL,

W. I. WEEKS,

Both of 31 Lombard Street, London.