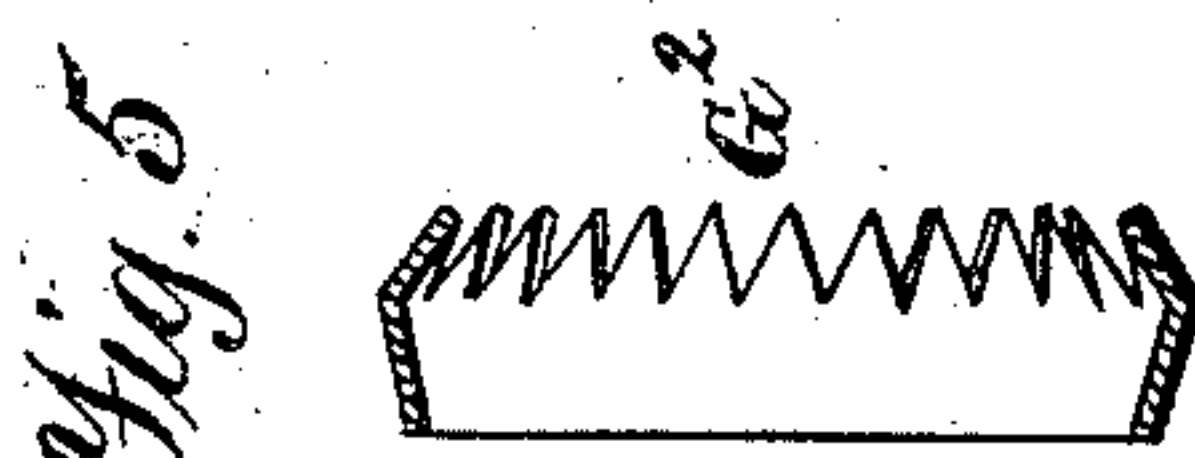
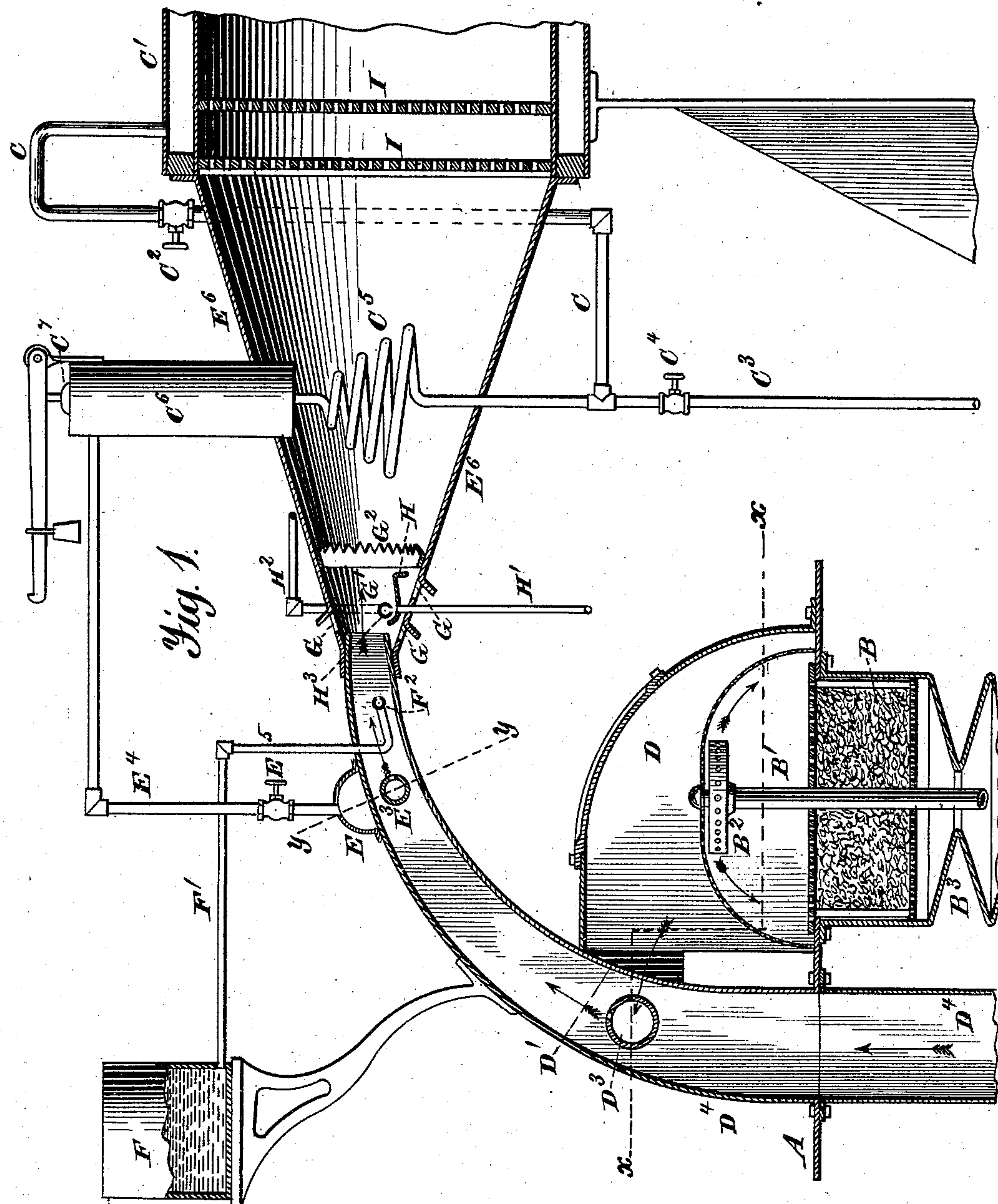


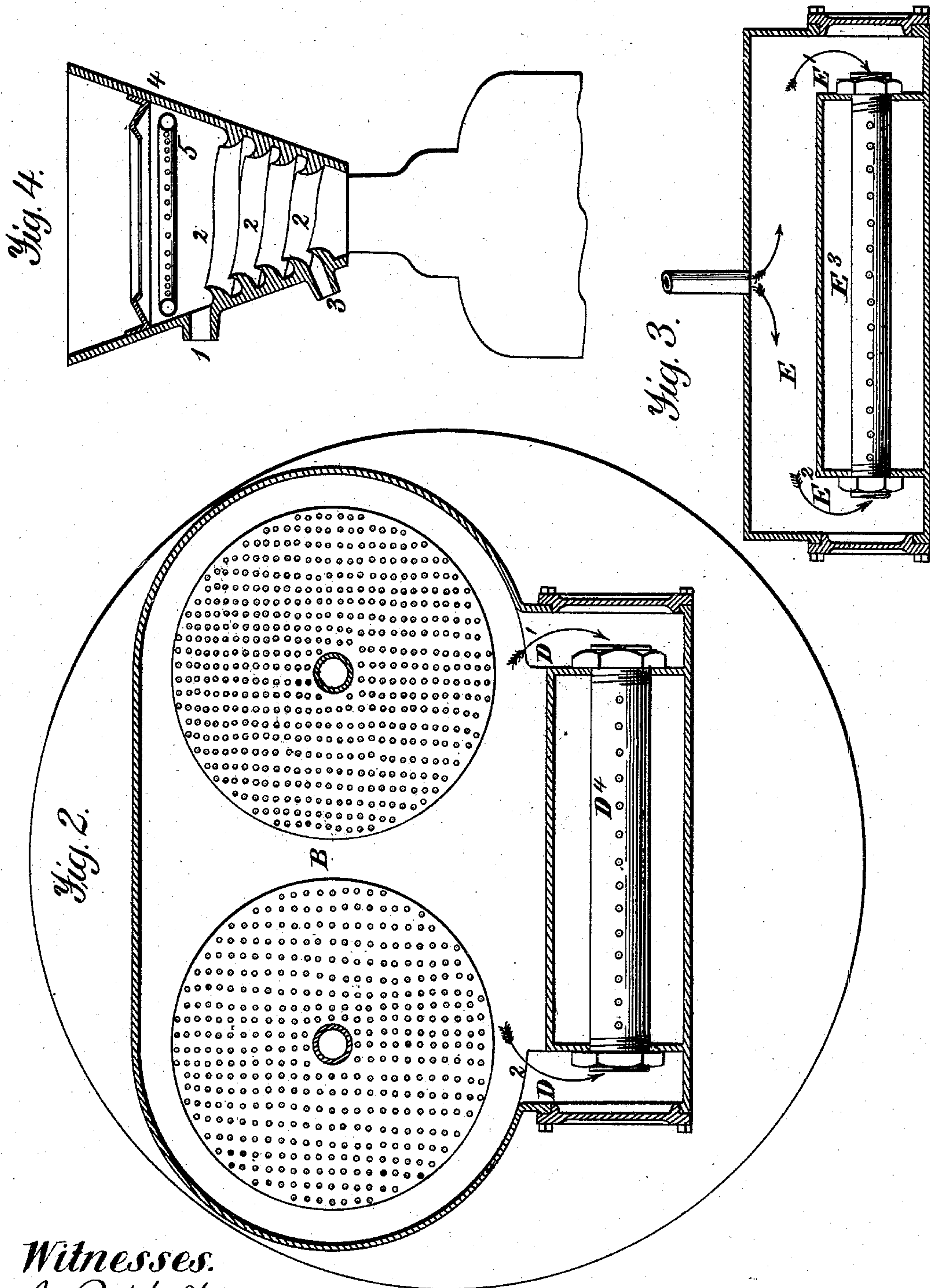
A. E. WATKINS.
Gas-Generator for Hydrocarbon Furnaces.
No. 229,344. Patented June 29, 1880.



Witnesses.
A. Rupert,
C. M. Connell

Inventor,
Alfred E. Watkins
Per. Jas M. Blanchard
Attorney.

A. E. WATKINS.
Gas Generator for Hydrocarbon Furnaces.
No. 229,344. Patented June 29, 1880.



Witnesses.
A. Ruppert,
G. M. Connell

Inventor.
Alfred E. Watkins
By Jas M Blanchard
Attorney.

UNITED STATES PATENT OFFICE.

ALFRED E. WATKINS, OF BALTIMORE, MARYLAND, ASSIGNOR OF A PART OF HIS RIGHT TO SAMUEL H. ADAMS, JOHN F. ADAMS, AND JOHN SAVAGE WILLIAMS, OF SAME PLACE.

GAS-GENERATOR FOR HYDROCARBON-FURNACES.

SPECIFICATION forming part of Letters Patent No. 229,344, dated June 29, 1880.

Application filed July 29, 1879.

To all whom it may concern:

Be it known that I, ALFRED E. WATKINS, of Baltimore, in the county of Baltimore and State of Maryland, have invented certain new and useful Improvements in Gas-Generators for Hydrocarbon-Furnaces; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it ap-
10 pertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

Figure 1 is an elevation, partly in section, showing my improvements in connection with a horizontal steam-generator; Fig. 2, a transverse section on line *xx* of Fig. 1; Fig. 3, a section on line *yy* of same figure; and Fig. 4 is a sectional elevation, showing a modification of the gas-generating chamber designed for application to vertical boilers or other furnaces. Fig. 5 is an enlarged sectional view of the serrated ring for mixing the gases.
15 20

Corresponding letters denote like parts in all of the figures.
25

This invention relates to that class of devices which are designed to generate gas from petroleum and other hydrocarbon substances, and for burning the same, it being an improvement upon an apparatus for a similar purpose for which an application for Letters Patent of the United States was filed by me on the 3d day of February, 1879, and which was passed for issue on the 24th day of May following, to which reference is made for a description of parts not here shown or claimed.
30 35

Devices designed for the generation of gas from hydrocarbons, and for the burning of the same for the purpose of generating steam and for the treatment of metals, have been constructed heretofore; but such devices have been different in their methods of generating the gas and in preparing it for being burned, as well as in burning the same. The object of my present invention is to provide such a combination of parts as will cause the device to convert into gas a larger proportion of the material used, and to more thoroughly commingle there-
40 45 with the requisite amount of air, or air and

steam, for the promotion of combustion, and also to provide the means of adding to the out-
50 flowing current of gases a jet or jets of chemically-treated liquid for use in the treatment of metals; and, further, to provide for adding to the flame, after it leaves the burner a volume
55 of gas generated from oil of less specific gravity than that used in the generation of the main body of the gas.

My present invention also has for its object certain combinations of parts for causing the admixture of the gases after they have passed out of the burner, should any pass out unignited, and also a combination of parts for facilitating the use of steam in generating gas in the commencement of the operation; and
60 65 to these ends my invention consists in the combination of certain parts for producing the above-recited results, which will be more fully described hereinafter, and definitely pointed out in the claims.
70

In constructing my improved gas generator and consumer I provide a plate, A, with which to attach it to a chamber for containing oil to be burned in generating the gas necessary for commencing the operation, as shown and described in the case above referred to. To the under surface of this plate one or more receptacles, B, are attached, consisting of wire, perforated metal, or other suitable substance, which are to be supplied with steel or iron shavings, small bits of metal, or some porous incombustible material, which shall serve to retard the downward passage of the oil, which is delivered thereupon through a pipe, B', and sprinkler B², which are connected with a pump
75 80 85 or other oil-forcing device, and it is thus kept for a greater period of time in contact with highly-heated or gas-generating surfaces.

Immediately under the receptacles B B the corrugated or otherwise formed gas-generating chambers B³ B³ are placed, upon the interior surfaces of which any oil not converted into gas in the receptacles B falls, where it receives additional heat from the steam which surrounds them and is converted into gas. Should any of the oil thus treated fail to be gasified in its passage through the apparatus, it is returned to the pipe B' and sprinkler
90 95

B² by means of a pump provided for that purpose, and is again passed over the heating-surfaces, and so on until it has all been converted into gas except such parts as assume a
 5 semi-solid form, which may be drawn off from the reservoir into which they fall by means of a cock provided for that purpose.

For the purpose of converting the oil or other form of hydrocarbon into gas in the generating-chambers above alluded to a pipe, C, is connected with the steam-generator C' when the apparatus is used for generating steam, or with a separate generator when used for heating iron or other furnaces. The passage of the
 10 steam through this pipe is controlled by a valve, C², the pipe extending down by the side of the apparatus and joining a pipe, C³, which leads the steam into the chamber surrounding the gas-generating chambers, as shown in my
 15 previous application, above referred to, it being supplied with a valve, C⁴, by which the steam or a portion of it can be shut off from contact with said chambers and directed into a coil of pipe, C⁵, which is located within a
 20 passage leading from the gas-burner to the generator or other furnace, and directly in the path of the flame, which is thus made to act upon all parts of said coil, and thus superheat the steam which passes through it.

To the upper end of the coil C⁵ there is attached a steam-drum, C⁶, which communicates therewith, the drum being supplied with a safety-valve, C⁷, for the purpose of regulating the pressure therein. This drum serves as a
 30 reservoir for steam which may be generated in the coil when the apparatus is being put in operation and before steam of the required pressure is formed in the generator, the water therefor being supplied to the coil through the
 35 pipe C³ and a branch leading therefrom to a pump or other forcing device.

When a fire has been lighted in the pan placed below the generating-chambers, as shown and described in my application of February 3, 1879, above referred to, gas is gener-
 45 ated and passes up through said chambers, and through and around the receptacles B, into a receiving-chamber, D, a diaphragm of wire-gauze being placed above the sprinkler B² to prevent any oil being carried upward by the
 50 escaping gas. From the chamber D the gas passes through ducts D' and D² into perforated or slotted pipe D³, which is placed in the air-duct D⁴. This perforated or slotted pipe has
 55 screw-threads formed upon its ends and nuts are placed thereon, as shown in Fig. 2 of the drawings, so that it may be firmly secured in its position and so that the jets or current of gas may be directed as desired. This
 60 pipe being, as above stated, placed in the air-duct D⁴, which conducts air to the burner, soon to be described, it follows that a commingling of the air and gas takes place at that point, from which they pass on toward
 65 the outlet until they arrive at the point where the steam-chamber E is attached to the air-

duct. This chamber is similar in construction to the gas-chamber D', it having end passages, E' E², for conducting the steam to a per-
 70 forated or slotted pipe, E³, running across the air-duct, as shown in Fig. 3. From this pipe the steam passes through its perforations into the air-duct D⁴, and is there mingled with the air and gas previously admitted, in doing
 75 which it carries the whole body forward with great velocity, thus inducing a current of air through the duct D⁴, steam for this purpose being taken in its superheated condition from the drum C⁶ through a pipe, E⁴, its passage
 80 being regulated by a valve, E⁵. From the last-named point the commingled gas, air, and steam passes on to the outlet-orifice of the air-duct D⁴, which is made to enter or is otherwise connected with a hood or passage which
 85 conducts the flame and other heated products to a steam-generator, or to any other form of device in which it is desirable to produce a high temperature.

The igniting-point of the gas is at the outlet-orifice, or where the air-duct enters the
 90 hood E⁶; but as the gas is mingled with sufficient air to furnish the requisite amount of oxygen for the support of combustion before it reaches that point, it is believed that a considerable portion of the duct D⁴, between the
 95 point where the jets enter it and its outlet, will be filled with flame, and as it may be desirable at times to change the character of the flame chemically, in order to produce certain
 100 results upon the substance to be operated upon, and especially when treating iron and steel, there is placed in any convenient position a reservoir, F, into which any desired chemical
 105 solution is placed, a pipe, F', being connected therewith, and supplied with a valve for regulating the amount of solution which shall be used at any time, said pipe extending into
 110 and across the air-duct at a point near its outlet end and within the flame, its surface within the duct being perforated, so as to deliver the solution in small jets directly into such
 115 flame, and thus convert it into steam, which operation it is believed will beneficially affect iron when being converted into steel or when being heated for the purpose of being welded,
 120 and when ingots of steel or iron are being heated for the purpose of being rolled into bars. In this way iron may be carbonized or decarbonized, and thus improved, according to circumstances.

When this appendage is used for facilitating the welding of iron the tank should be supplied with a strong solution of borax, and when used for further carbonizing iron it may be filled with petroleum or any other of the hydrocarbon liquids.

For the purpose of admitting a fresh supply of oxygen to the flames at or near the point where they enter the hood or passage E⁶, apertures G are formed either in said hood or in
 130 the conduit. These passages may be in the form of perforations or of slots. In either

case they will admit a fresh supply of oxygen to contact with the flame within the mixing-chamber G', and by providing them with doors or valves the amount thus admitted can be regulated as desired.

The mixing-chamber just alluded to is located in front of and around the delivery-orifice of the air-duct D⁴, and is provided with a band or strip of metal or other substance, G², having upon it inwardly-projecting serrations or projections for the purpose of dividing the flame and gases that pass it into jets or strata, and thus thoroughly mixing the air and gas, should any of the latter pass that point unconsumed, in order that it may be ignited in the hood or passage E⁶.

As a means of supplying carbon to the gas in the mixing-chamber, and thus controlling the quality of the same when admitted to the hood, there is formed in the chamber G', and extending across the same, a trough or pan, H, which is of such form as to enable it to hold a considerable quantity of oil the specific gravity of which is less than that used in the generating-chambers B and B³. Leading to this trough or pan is a pipe, H', which may be connected with an oil-reservoir or with a pump for supplying it with oil, said pipe being supplied with a valve or cock for regulating the flow to the pan. As the point where the pan is located is in the path of the flame, it follows that it will become highly heated; and as it is intended generally to use refined, or partially refined, oil at this point, it becomes necessary to provide some means by which the solid carbon, which is likely to collect upon its surface, can be removed; and for this purpose a pipe, H², is provided, which is connected with the steam-generator, and is furnished with a cock or valve, in order that upon stopping the working of the apparatus, or at any other desired time, steam may be passed through said pipe and into a cross perforated pipe, H³, located in the mixing-chamber, and thus brought into direct contact with the pan, which will have the effect to remove any substance deposited thereon, as it will not have become hardened at such time.

The hood or passage in which the mixing-chamber is located, and which conducts the flame to the generator or furnace, may be of the form shown, or of any other that circumstances may require, and it may be made of iron, bricks, or any other suitable material, and the coil of pipe may be located in any part thereof, as it is not my intention to limit my improvements to the particular form or location of the parts, but to reserve the right to change them according to the requirement of particular cases so long as the combinations claimed are not affected thereby.

In that portion of the steam generator or furnace to which the outer end of the hood or passage for the flame and gases from the burner to the place where they are to be utilized is located there is placed two or more perforated

disks of cast-iron, soap-stone, such material as fire-bricks are made of, or any other material that will resist the action of the flames and yet be a good absorbent of heat.

The function of these disks, which are lettered I I, is to comminute the current of gases and to distribute them evenly over the surface of the end of the generator, or to deliver them upon a large surface of an iron-smelting or other furnace, as well as to serve as a means of igniting any gas that may arrive at that point in an unignited condition. They also form the ends of an additional mixing-chamber, into which, if desired, a fresh supply of air may be admitted by a pipe leading therefrom to the atmosphere outside, so that, should there be a lack of the requisite supply of oxygen for the support of combustion while the gases are passing through the flues, it can be supplied at this point.

It will be observed that the air-duct D⁴ is supplied with caps at the points where the perforated gas and steam pipes are located, the object being to provide a ready means for the removal of such pipes, and especially the one through which the gas enters, in order that any carbon or other solid substance that may collect therein may be removed, and that they may be removed for repairs or renewal.

I have shown in Fig. 4 of the drawings a modified form of the gas-generating chambers, in which 1 represents an induction-aperture for the oil; 2 2 2, a spiral passage for it to the point 3, where it is taken out. In this case it is proposed to place about the spiral passage 2 and within the casing 4 a perforated annular or otherwise suitably-formed pipe, 5, to be connected with the superheating-coil or with the steam-drum in such a manner that steam thus heated may be admitted thereto and passed out through the perforations, so as to travel at a right angle, or nearly so, toward the center of the ascending column of gas, for the purpose of supplying oxygen for the support of the combustion of the gas, and thus prevent loss, and also prevent the escape of what is usually termed "smoke."

This modified form of generator is designed principally for application to vertical boilers or furnaces, to which it is particularly adapted.

I am aware that it is not new to generate gas from petroleum and other hydrocarbons and utilize it in the generation of steam, and for heating iron and other furnaces, devices capable of producing such results being shown in the patents of David Dick, of October 28, 1862, No. 36,769, and of June 2, 1863, No. 38,732, and in others; and I am also aware that it is not new to combine such gas-generating apparatus with air-ducts and steam-passages for the purpose of mingling such gases with gas generated from the hydrocarbons. I do not therefore claim, broadly, the generation of gas from such materials, or the use of it for any particular purposes, or, broadly, the combination of devices for the utilization of

such gas; neither do I claim, broadly or separately, any of the devices herein named; but,

Having described my invention as consisting of certain combinations, what I do claim, and desire to secure by Letters Patent, is—

1. In combination with the air-duct D^4 of a gas generating and burning apparatus, the removable perforated pipe D^3 , for the introduction of gas from the generator to said duct, the gas-conducting passages D' and D^2 , and the chamber D , which receives the gas from the generator, all substantially as set forth.

2. In combination with the air duct or passage D^4 of a gas generating or burning apparatus, a steam-chamber, E , extending down upon each side of the air-duct and forming steam-passages E' and E^2 , for conducting steam thereto, and a removable perforated pipe, E^3 , all substantially as and for the purpose set forth.

3. The combination of the air-duct D^4 , hood E^6 , serrated bands or rings C^2 , having upon their forward edges inwardly-projecting extensions, whereby they are made to aid in commingling the air and gas which pass that point, substantially as described.

4. The combination, in a gas generating and burning apparatus, of the hood E^6 , having in it passages G G , for the introduction of air, and conduit D^4 , for conducting to said hood the flame caused by the ignition of the commingled gases escaping from said conduit, substantially as set forth.

5. The combination of the air-duct D^4 , hood E^6 , and perforated disks I , substantially as and for the purpose set forth.

6. In combination with the air and gas induction duct or passage D^4 of a gas generating and burning apparatus, a fluid-reservoir, F , containing a chemical solution, a discharge-pipe, F' , and the distributing-pipe F^2 , arranged within the gas-passage, whereby a chemically-charged fluid may be mingled with the flame at or near the point where the gas is ignited, and whereby the character of iron may be to some extent controlled when the apparatus is used in connection with an iron-furnace.

7. In combination with the air and gas duct D^4 and the hood E^6 , the trough or pan H , located in front of the orifice of said duct and in the path of the burning gas, for containing oils of less specific gravity than that of those used in the generating-pans, whereby the flame at that point is supplied with an additional amount of carbon.

8. In an apparatus for generating and burning-gas, the combination of a steam-generator, C' , a discharge-pipe, C , controlled by a regulating cock or valve, C^2 , a steam-generating coil, C^5 , located in the path of the escaping flame, a steam reservoir or drum connected to said coil, and a pipe, C^3 , by which water may be supplied to the coil and steam conducted to the generating-chambers, all substantially as and for the purposes set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

ALFRED E. WATKINS.

Witnesses:

J. W. PILLING,

C. M. CONNELL.