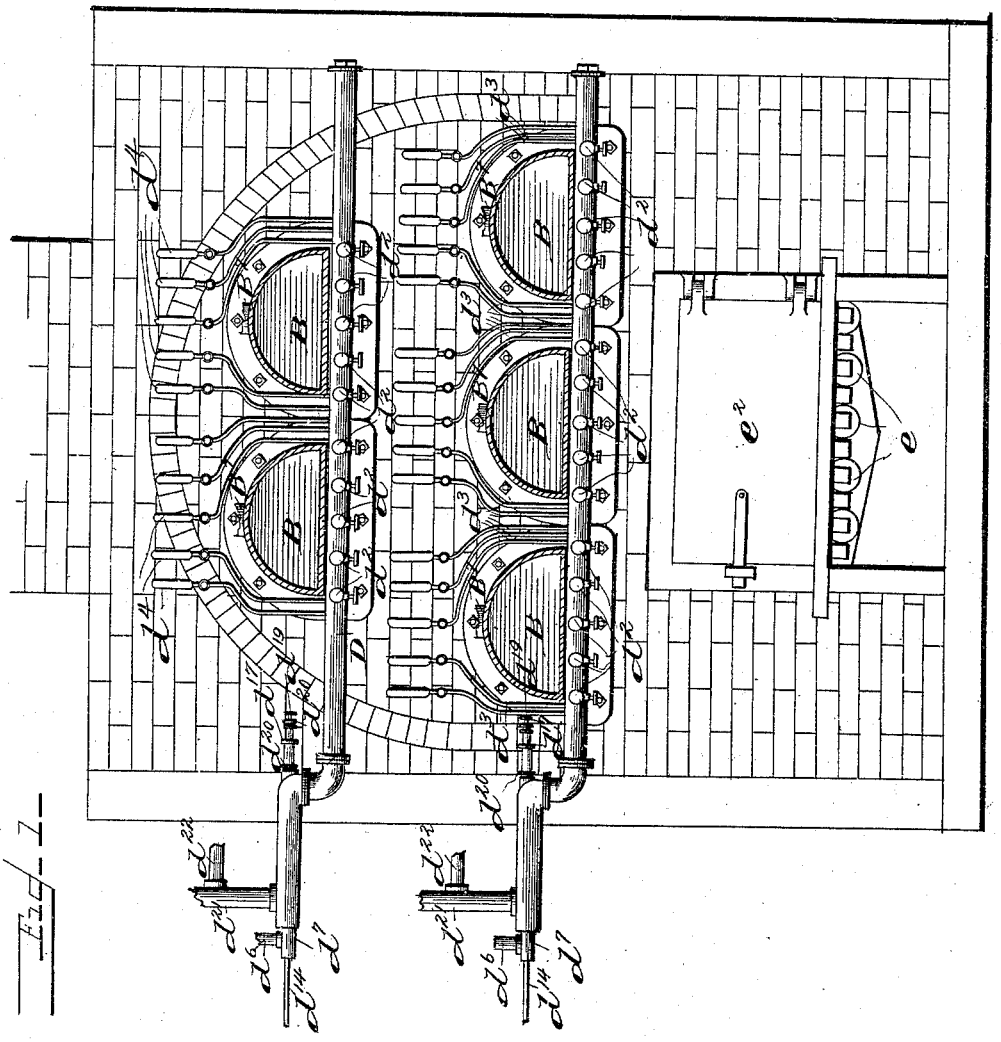
(No Model.) 4 Sheets—Sheet 1.

C. F. CATTELL.

GAS APPARATUS.

No. 493,975. Patented Mar. 21, 1893.



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(No Model.) 4 Sheets—Sheet 2.

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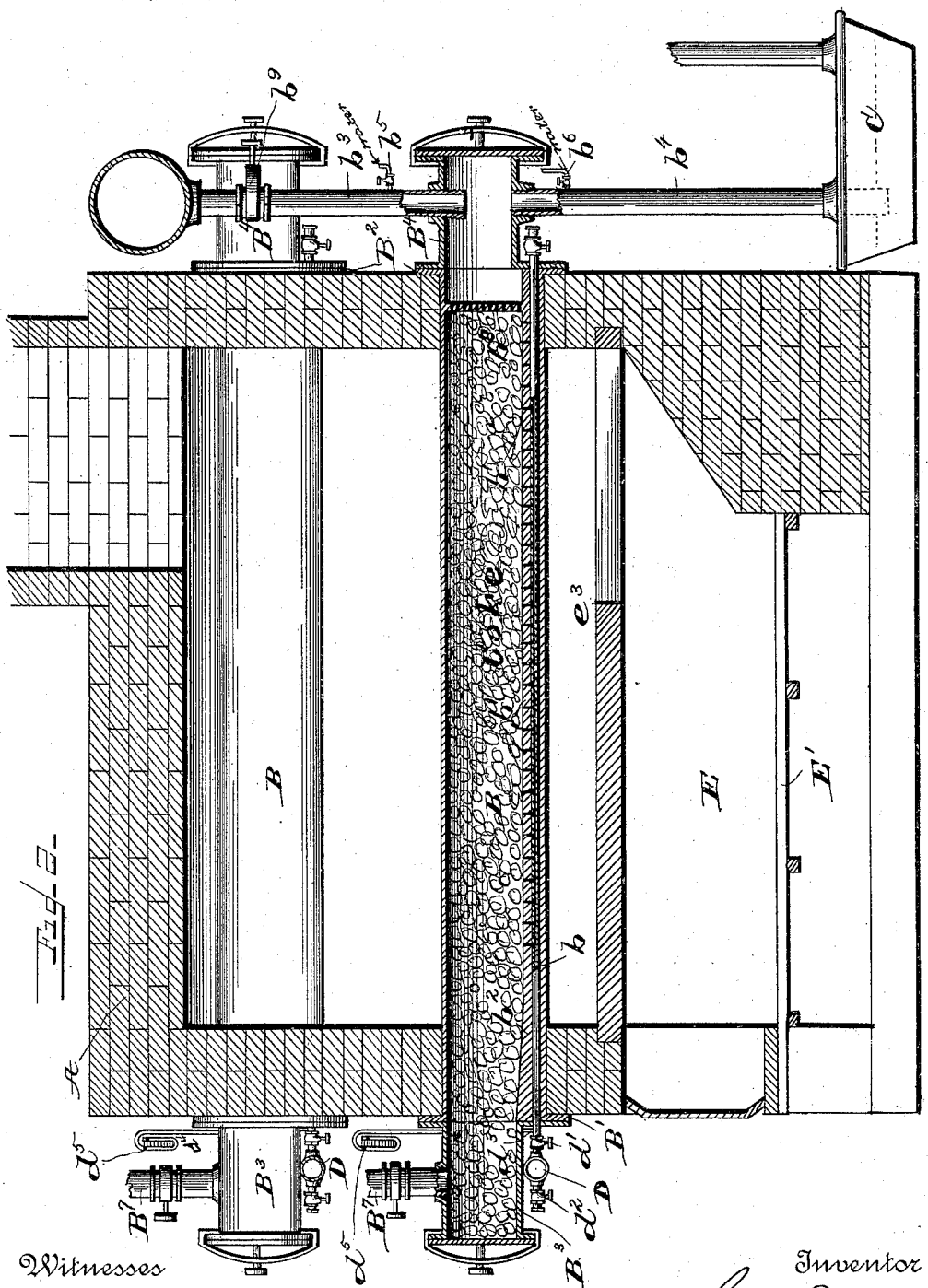

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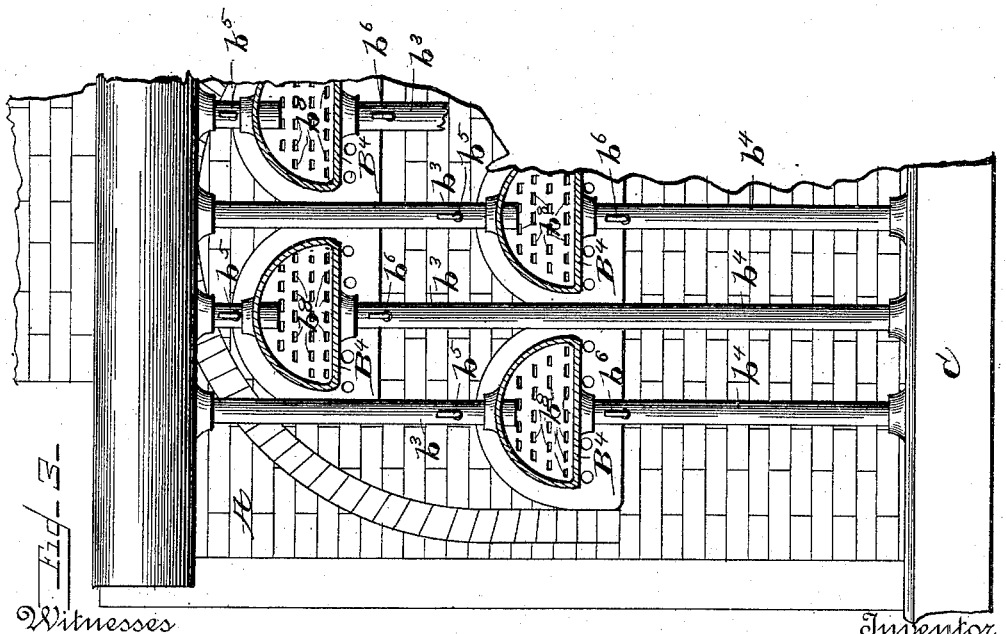

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(No Model.) 4 Sheets—Sheet 4.

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GAS APPARATUS.

No. 493,975. Patented Mar. 21, 1893.

Fig. 4.

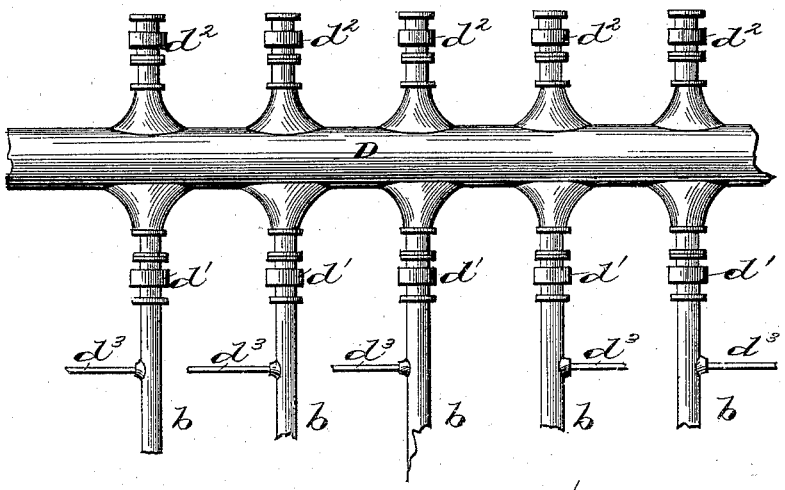


Fig. 5.

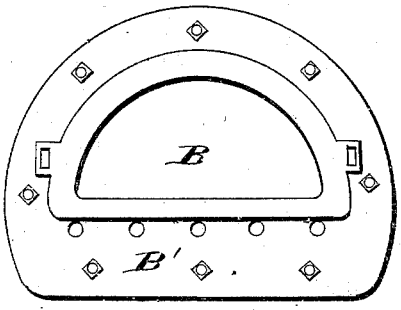


Fig. 6.

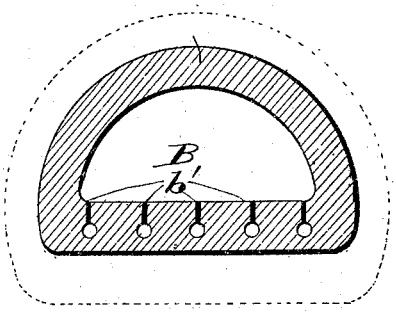
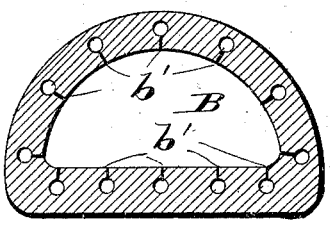


Fig. 7.



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UNITED STATES PATENT OFFICE.

CHARLES FRANKLIN CATTELL, OF DARBY, PENNSYLVANIA.

GAS APPARATUS.

SPECIFICATION forming part of Letters Patent No. 493,975, dated March 21, 1893.

Application filed April 16, 1891. Serial No. 389,154. (No model.)

To all whom it may concern:

Be it known that I, CHARLES FRANKLIN CATTELL, a citizen of the United States, residing at Darby, in the county of Delaware and State of Pennsylvania, have invented certain new and useful Improvements in Gas Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an apparatus for producing either illuminating or fuel gas.

The object of my invention is to produce an apparatus with one or more retorts that will make coal, oil, or water gas separately, therefore it may be used to make all coal gas or oil gas without mixing the gases. The retorts above referred to may be set at any angle, inclined or otherwise and are each provided with an injector suitable to make a vapor of superheated steam and liquid hydrocarbon, or superheated steam liquid hydrocarbon and air, and further a vapor of superheated steam liquid hydrocarbon and hydrogen. The vaporizer is attached to a "head" or "manifold" having one or more tubes (preferably five) extending into, and on, the bottom of the retort or retorts, said tubes being capped on end or they may run the entire length of the retort. These tubes are perforated or they may be provided with suitable slots or other openings, and are cast in the walls or floor of the retort or retorts the entire length of the same. The inner walls or floor of the retort are provided with suitable perforations leading direct into the tubes. Each tube it provided with a gage and a regulating cock, and each retort and vaporizer is also provided with a gage, (not shown.) The tubes are so constructed that the proportion of the pierced holes in the same are "fifty to one" allowing for friction, this causes the vapor to be generated and blended or rather the atoms of the liquid hydro-carbon, dry steam, and air, are welded together forming gas which is forced out of said holes in streams making a "whirlwind" of gases which comes in contact with the fixing surface in the retort. Each retort is provided with two or more pipes in rear of the bench one of which descends direct into a suitable washer box or hydraulic main and is provided with a water pipe (a spray being preferable) to cool the gas and drop the "tar" close to the exit at mouth piece of the retort. The other pipe above referred to is provided with a valve and connects with the flue or stack which valve, when opened, raises the carbon (with natural draft) to incandescence. Flanges are cast on the ends of the retorts by means of which mouth pieces are attached to the same; and with the above in view my invention consists in the parts and combination of parts as hereinafter fully set out.

In the drawings:—Figure 1 is a front elevation of my apparatus with mouth piece in section. Fig. 2 is a central longitudinal section of the same. Fig. 3 is a rear view of the bench showing the rear head in section. Fig. 4 is an enlarged detail top plan of the manifold and tubs. Fig. 5 is an enlarged end view of the retort. Fig. 6 is a cross section of the retort. Fig. 7 is another form of retort.

A represents the casing of the apparatus and B the retorts composed preferably of fire clay. The retorts are provided with flanges B′ and B^2 to which are attached in a suitable manner the front and rear mouth pieces B^3 and B^4 respectively. This manner of attaching the mouth pieces to the retort proper enables the operator to remove deposits should they form in the tubes or generators *b* without disturbing the rest of the retort. The mouth piece B^3 is provided with a draft pipe B^7 having a valve.

b are generators where gas is generated from suitable materials. These tubes are perforated and are preferably cast in the floor of the retort.

b′ are holes or perforations leading from the said tubes into the chamber of the retort.

b^2 is the floor of the retort. The rear mouth pieces B^4 before referred to are provided with an ascension pipe b^3 and a descension pipe b^4. The ascension pipe b^3 is provided with a suitable valve b^9 and is connected with the flue or stack of the furnace.

b^5 is a water spray. The descension pipe b^4 as before stated leads direct to the washer box or hydraulic main C located immediately under the rear mouth piece B^4. The pipe b^4 is provided with a water spray b^6 which is placed as close as possible to the exit at mouth

piece B^4. This spray causes the "tar" to drop, partially cools the gas and prevents any clogging of the pipes thereafter. The retort is provided with a perforated back b^8 which prevents the coal from falling into the back mouth piece and by its use causes the gas to flow through carbon.

D is one end of the manifold pipe provided with a suitable gage (not shown) and d' is a regulating valve on the tubes b and d^2 are valves whereby the said tubes or chambers b may be cleaned by a jet of steam or otherwise. d^3 are small tubes suitably connected to the tubes b and leading to the gages d^4. In this connection attention is called to the fact that I provide each tube or chamber b with a gage d^4 thus enabling me to determine at a glance the condition of the respective tubes b. This is necessary inasmuch as each tube is, in itself, a generator. The gages above referred to are each provided with floats d^5 which serve to prevent the liquid in the gages from being forced out by either pressure or vacuum. The float may be made of rubber, cork, or other suitable material, but preferably a small rubber ball is placed in the glass tube of the gage. If the pressure forces the liquid up to end of gage the float closes the nick which prevents "blowing out" of said liquid.

E is the fire chamber and E' are the grate bars. Secured to the alternate bars are rings e which serve to keep the bars apart and allow them to be moved separately thereby saving fuel.

e^2 is the furnace door and e^3 is an open space above the fire chamber whereby the heat may circulate beneath the floor of the retort. Coal, coke, or carbon of any kind, (gas coal preferably) is charged into said retort, or retorts. After the charge of gas coal (if gas coal be used) is "carbonized" the coke or carbon in the said retort, is in a state of partial incandescence, the front lid of the retort is "lighted off" and removed, then the valve on the pipe b^3 is opened, thus creating a draft of air through said retort to complete incandescence. Or preferably a blast of air is forced into the generating tubes b, which escapes through the perforated holes b' thence up through the coke or carbon, thereby cleaning the generating tubes b and the holes b' of all coal dust and small particles of carbon and at the same time, heating the coke to a perfect incandescence. Then the oil, steam and air from the injector is forced into the tubes b which are bright red hot where it is converted into gas which escapes through the small openings b' into the retort proper, where it comes into contact with the incandescent coke or carbon and is fixed into a permanent gas. From thence it flows through the perforated back b^8 and through the pipe b^4 into the washer box or hydraulic main. The gas while passing through the pipe b^4 is partially cooled, by the spray b^6, close to its exit from the mouth piece. This spray in addition to cooling the gas causes the tar to be "dropped" at this point. The gas is taken from washer box by a suitable exhauster.

The great advantage of employing bright red hot tubes b (about 1,700° to 2,300° Fahrenheit) is for "cracking" or breaking up the liquid oil and blending or welding the atoms together when introduced as a vapor with dry steam and hot air. As the composition of petroleum or liquid hydrocarbon is such that it will not all blend, or weld at the same temperature but must necessarily form a percentage of liquid hydro-carbon vapor varying from twenty to forty per cent. together with the superabundance of steam (not taken up in the welding process) passes through the small perforations in the tubes into and commingling with a bed of white hot fuel (2,800° to 3,200° Fahrenheit) in the retort chamber where it is converted into gases belonging to the marsh gas series ethane, ethylene, &c. This intense heat, which the gas passes through, does not break down or destroy the gaseous hydrocarbon as would be supposed, from the fact that the hydrocarbon vapor is mixed with the proper proportion of diluents and the gas is taken from the retort as fast as generated and welded, (one retort producing as much as two thousand cubic feet per hour) and there still exists a small per centage of hydrocarbon vapor which is carried along with the lighter gases by their carrying power to the burner where it assists the illuminants.

When the valve, on pipe b^3 leading to the stack, is opened to create a natural draft, a blast of air may be forced with proper connections into tubes b, (in conjunction with, and at the same time, the natural draft is working) to free said tubes of any deposit and assist the natural draft in heating the carbon in retort. By the construction of said tubes in the floor of the retort and the attachment of the mouth pieces, as shown, a rod or other suitable cleaner may be pushed through the tubes the entire length for the purpose of cleaning the same without interfering with the retort.

I have herein shown a gas making apparatus, a retort and an injector, but do not claim herein the gas making apparatus or the injector as they will form the subject matter of other applications.

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

1. The combination with the gas retort provided with the tube b opening into the retort by means of small perforations, and the gages connected with each tube of the rear mouth piece provided with the rear ascension pipe the lower end of which extends into the said mouth piece a suitable distance, the damper b^9 and the pipe b^4 provided with a water spray close to the mouth piece, all combined and operating substantially as described.

2. The combination with the gas retort having the perforated back b^8 and the generators

b provided with the valves d', gages connected to each of the generators, of the rear mouth piece provided with the ascension pipe leading to the stack and provided with a damper, the lower end of said pipe extending into the mouth piece a suitable distance and the pipe b^4 leading to a suitable hydraulic main and provided with the water spray b^6 all combined and operating substantially as described.

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

CHARLES FRANKLIN CATTELL.

Witnesses:
JAMES MCGAHEY,
HARRY SIPLER.