M. GROSS.

Apparatus and Process for Making Illuminating Gas.

No. 206,724. Patented Aug. 6, 1878

Fig: 1.

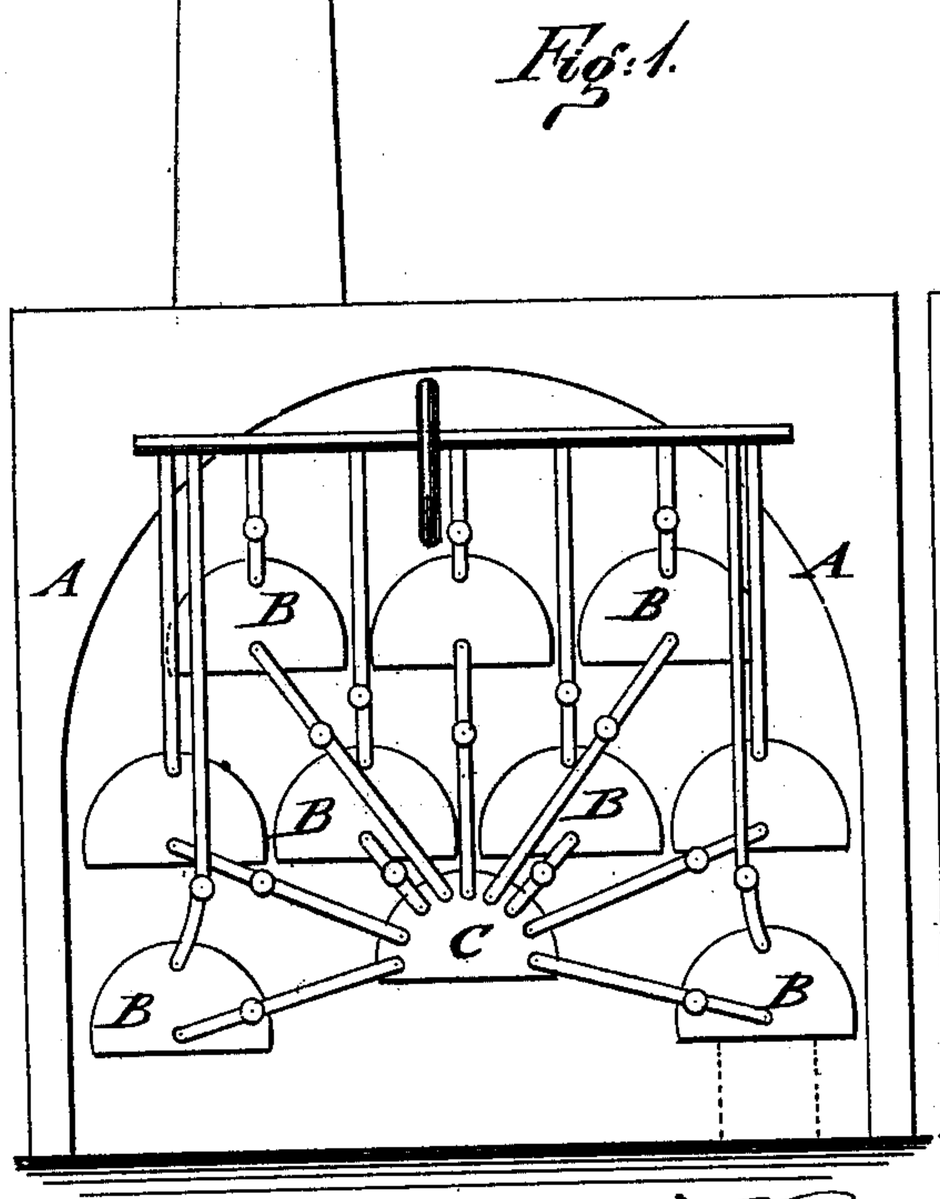


Fig: 2.

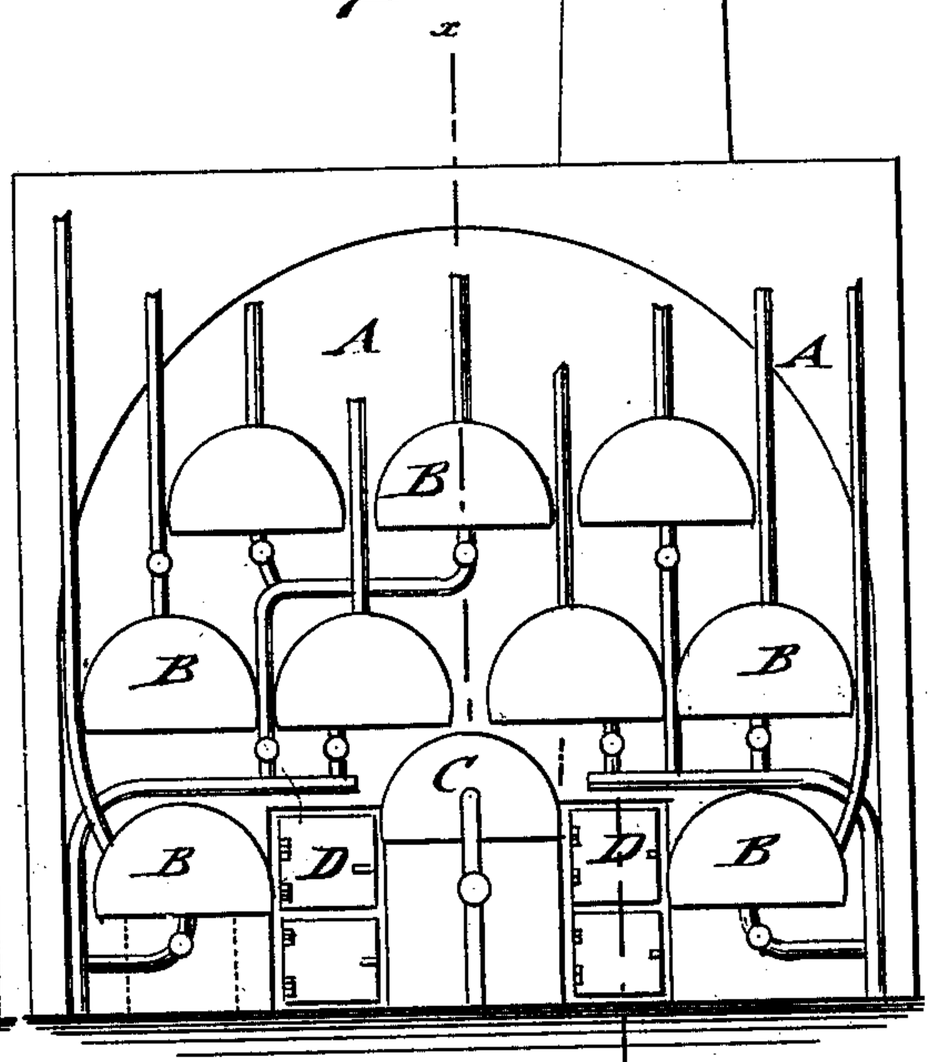
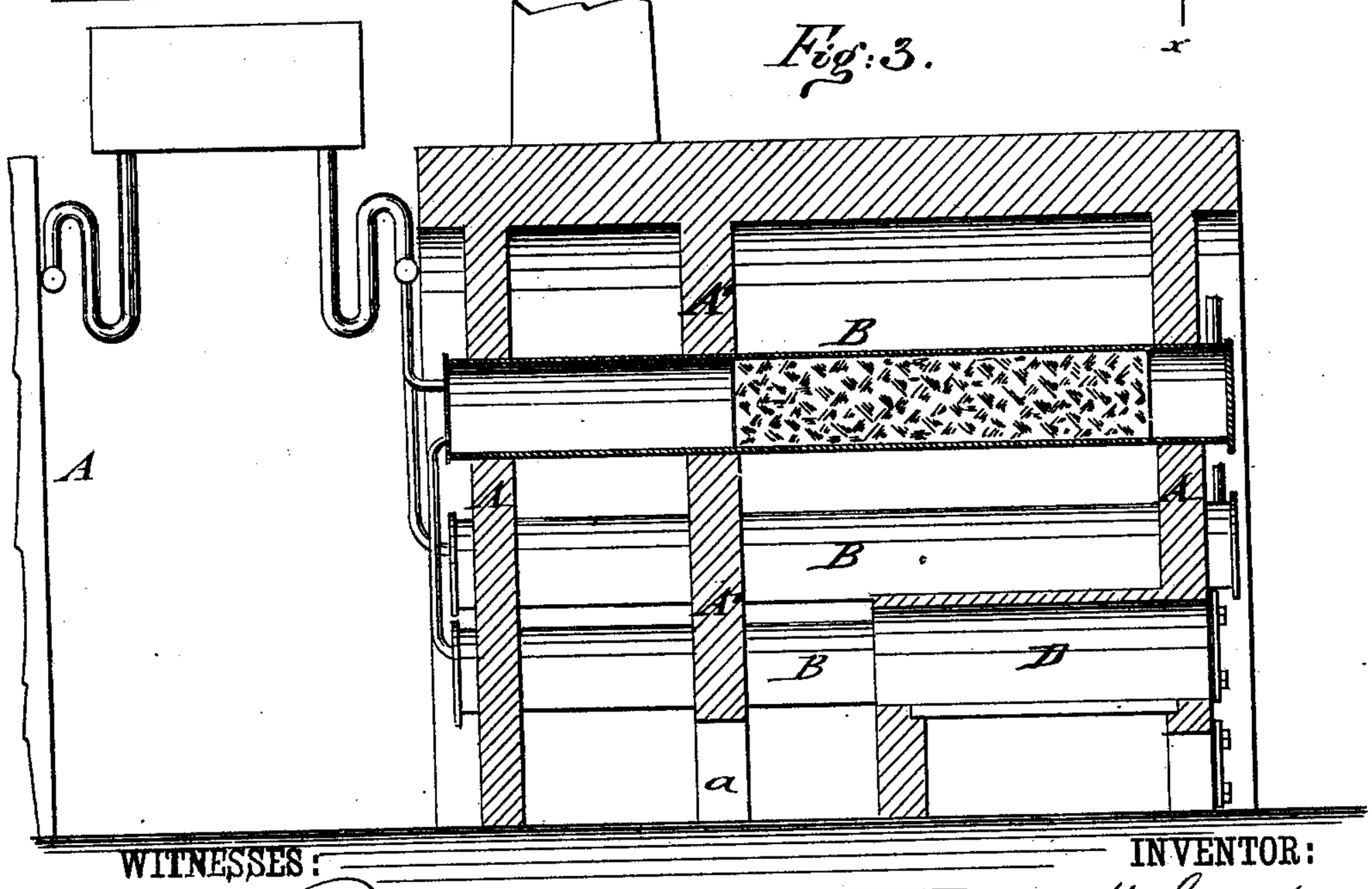


Fig: 3.



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IMPROVEMENT IN APPARATUS AND PROCESSES FOR MAKING ILLUMINATING-GAS.

Specification forming part of Letters Patent No. **206,724**, dated August 6, 1878; application filed April 9, 1878.

To all whom it may concern:

Be it known that I, MAGNUS GROSS, of the city, county, and State of New York, have invented a new and Improved Apparatus and Process for Making Illuminating-Gas from Naphtha or other light liquid hydrocarbons, of which the following is a specification:

The main impediment and objection hitherto to the manufacture of illuminating-gas from commercial naphtha or other light hydrocarbons consisted in the surplus of carbon in the naphtha, which either floated in the gas-mixture and rendered it smoky or had to be turned into carbonic oxide and carbonic acid, of which the carbonic oxide makes the gas dangerously poisonous, while the carbonic acid interferes with its illuminating-power. The introduction of steam for the purpose of obtaining more hydrogen, with a view to forming additional hydrocarbons, also involves the formation of carbonic oxide or carbonic acid by the union of the oxygen of the steam with another portion of the floating carbon. If, therefore, the gas obtained from naphtha and steam shall neither smoke nor have too high a percentage of the poisonous carbonic oxide and of the light-destroying and sluggishly-moving carbonic acid, a certain proportion of the carbon contained in naphtha (and still more so in petroleum or other heavy hydrocarbons) must be removed instead of being allowed to become a component part of the gas-mixture in the shape of floating carbon, carbonic oxide, and carbonic acid, either of which interferes with the quality and usefulness of the illuminating-gas.

My method of avoiding these drawbacks to the manufacture of a fixed non-smoking gas from naphtha and steam essentially consists in passing the commingled steam and vapors of the hydrocarbon through an incandescent mass of porous material, without access of air, for the purpose of fixing the gases and eliminating a proportion of the carbon, and periodically shutting off the hydrocarbon and blowing out the deposited carbon by steam to form carbonic oxide and light carbureted hydrogen, which is directed into the furnace and utilized as fuel.

In the employment of the process due regard is to be had to the following details of manipulation: First, the volume of steam admitted with a given weight of naphtha is regulated with a view to checking the formation of an excess of carbonic oxide. Secondly, the entrance of atmospheric air is made impossible to prevent the oxidizing of carbonic oxide into carbonic acid altogether. Thirdly, a porous substance, serving as the incandescent material in the hottest part of the gas-generator, is made use of, which can absorb a large portion of the floating carbon passing along with the gases, retaining it in its numberless meshes or little cells. Fourthly, the naphtha and steam, on entering the retort, (the gas-generator,) intermingle intimately, and in this condition pass through the red-hot porous body. Fifthly, periodically the influx of naphtha is cut off and the admission of superheated steam increased for the purpose of turning all the carbon deposited in the porous body into carbonic oxide and carbureted hydrogen, (by combining it with the respective elements of the decomposed steam,) which products of a blowing-out operation are, however, sent to the fire-places, to be consumed as fuel instead of being allowed to pass into the hydraulic main to deteriorate the gas. Sixthly, the feeding of the gas-generator with naphtha and steam is made automatic, and so arranged that one retort after another can be freed of its accumulated carbon without interfering with the gas-making in the other retorts. Seventhly, by means of two fire-places, alternately to be fed with fuel, a uniform temperature is maintained within the vault of the bench, and the hottest fire is concentrated around the central portion of the retorts, where the gases pass through the incandescent material. Eighthly, the retorts are only opened when it becomes necessary to replace the porous substance in consequence of its having crumbled to dust.

The invention also consists in a bench with two distinct fire-vaults, produced by a transverse partition-wall dividing off its rear section, and allowing the retorts only to pass through, the said retorts extending through said partition and to the outer walls, and the greatest heat being concentrated within the vault nearer the front of the bench, where the

grate-bars are and the fuel is supplied. The retorts are arranged in the bench in series, with double fire-places, and supplied in a uniform manner with naphtha and superheated steam at the rear parts, and filled at their middle sections with porous calcined bone, specially prepared to that end, the lateral partition-wall and arrangement of the flues allowing the greatest heat to be concentrated around that part of the retorts, while a less degree of heat is exerted on the rear chambers, where the naphtha and steam enter. The front chamber of the retort permits of an expansion of the gases before their exit into the hydraulic main, or through the blowing-out tubes into the fire-places.

By referring to the accompanying drawing, which illustrates my invention, Figure 1 represents a rear elevation of the bench with a number of retorts and a steam-superheating retort as connected by pipes for supplying the naphtha and superheated steam. Fig. 2 is a front elevation of the same, showing the retorts and steam-superheater with exits and blow-out pipes; and Fig. 3 is a vertical longitudinal section of the bench on line *x x*, Fig. 2, showing one of the retorts in section.

Similar letters of reference indicate corresponding parts.

In the drawing, A represents a bench that is constructed of fire-bricks in the usual manner. The retorts B are supported at their front, middle, and rear parts, supporting brick pillars ascending through the vault being discarded. By preference, nine retorts are arranged in symmetrical manner above and sidewise of a central steam-superheater, C, and of two fire-places, D, of which one is placed at each side of the superheater. The fire-places D are fed alternately, so that a uniform and uninterrupted temperature may be kept up within the interior vaults and in the retorts, and thereby a continuous generation of gas for any length of time is obtained, by which the quantity and quality of gas are improved, with a corresponding economy in labor and fuel.

The retorts are divided into three chambers, of which the middle and longer ones are charged with a porous material, for which, in preference to any other, calcined bones, properly selected and prepared, are employed, which porous medium and method of preparing the same I propose to cover in a separate application. The middle portions of the retorts are supported by a partition-wall, A′, that runs parallel to the front and rear walls of the bench, in such a manner that the larger chambers of the retorts are placed between the front and partition walls, while the rear chambers, in which the vapors are formed, are placed between the partition and rear walls. The supply of naphtha is furnished to the retorts from a suitable receptacle by means of an automatically-feeding pipe arrangement with suitable stop-cocks, the steam being also supplied to the rear ends of the retorts by steam-supply pipes radiating from the central superheating-retort, that receives its supply of steam from a suitable steam-pipe entering at the front.

All the cast-iron appliances for supplying steam and naphtha and for blowing out the accumulated carbon in the front and rear of a bench can be detached from the clay retorts proper.

The products of combustion are conducted by interior flues first around the middle sections of the retorts, that are filled with the porous material, and then drawn off through a bottom opening, *a*, at a point farthest from the chimney, thence passed around the rear sections of the retort, and finally out of the chimney. In this manner the middle portions of the retorts are exposed to a higher degree of temperature than the rear portions, while the smaller front portions or chambers, that extend through the front wall of the bench, are exposed only to a very inconsiderable degree of heat. Thus the naphtha applied is vaporized in the rear chamber of the retorts and simultaneously mixed with the superheated steam at a lower temperature, while a higher temperature, of from 1500° to 1800° Fahrenheit at the utmost, is exerted on the middle chamber filled with the porous material. The vapors of naphtha and steam expand in the rear sections of the retort, and pass then through the incandescent material, where, in a carbon atmosphere at red heat, the steam is decomposed, and the various gases are properly combined, while the superabundant floating carbon is retained during the passage of the intermingled and readjusted gaseous elements through the small cells of the porous material, the division of the gaseous molecules and the attendant friction causing the more intimate intermingling of the illuminating-gas product and the depositing of the floating carbon, which latter is prevented from being suspended any longer in the gas.

The gases are drawn off through the hydraulic main by the conducting-pipes at the front part of the retorts, and the carbon deposited in the cells is blown out into the fire-places from time to time. The deposited carbon is thereby changed into carbureted hydrogen and carbonic oxide, which may profitably be consumed as fuel in the fire-places, instead of being passed directly to the chimney.

When the porous material is thus cleaned, the operation of gas-making is resumed and continued until the porous material becomes so brittle as to crumble to dust, when it requires replacing.

In defining my invention more clearly, I would state that I am aware that it is not new to preliminarily heat the steam and hydrocarbon, and subsequently heat them to a higher temperature to fix the gas.

I am aware, also, that a porous material, such as pumice-stone, has been saturated with a hydrocarbon to enrich the gaseous product of steam and incandescent coal.

It is also old to carry steam and a vapor-

ized hydrocarbon through a retort containing an incandescent porous material to fix the gases.

My invention differs from all of these, and proceeds upon the principle of getting rid of the surplus carbon by blowing it out as fast as it deposits in the retort, instead of oxidizing it into carbonic oxide and carbureted hydrogen and leaving it in the gas, which is objectionable, as before stated.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. The process herein described of manufacturing illuminating-gas free from an excess of carbon, carbonic oxide, and light carbureted hydrogen, which consists in passing the commingled steam and hydrocarbon vapors through an incandescent porous material to fix the gases, and periodically turning off the supply of naphtha and blowing out the deposited carbon by means of steam, and conducting the same into the furnace in the form of carbonic oxide and carbureted hydrogen, substantially as described.

2. The combination, with the furnace having a transverse wall, A′, with opening *a*, of the bench of retorts B, extending through the partition-wall A′ and through the end walls of the furnace, to receive suitable steam and hydrocarbon supply pipe, and having also a body of porous material located in the chamber or vault next to the fire, substantially as and for the purpose described.

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Witnesses:
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