2 Sheets--Sheet 1.

B. SLOPER & R. M. POTTER.

Improvement in the Manufacture of Illuminating Gas.

No. 123,052. Patented Jan. 23, 1872.

Fig. 1.

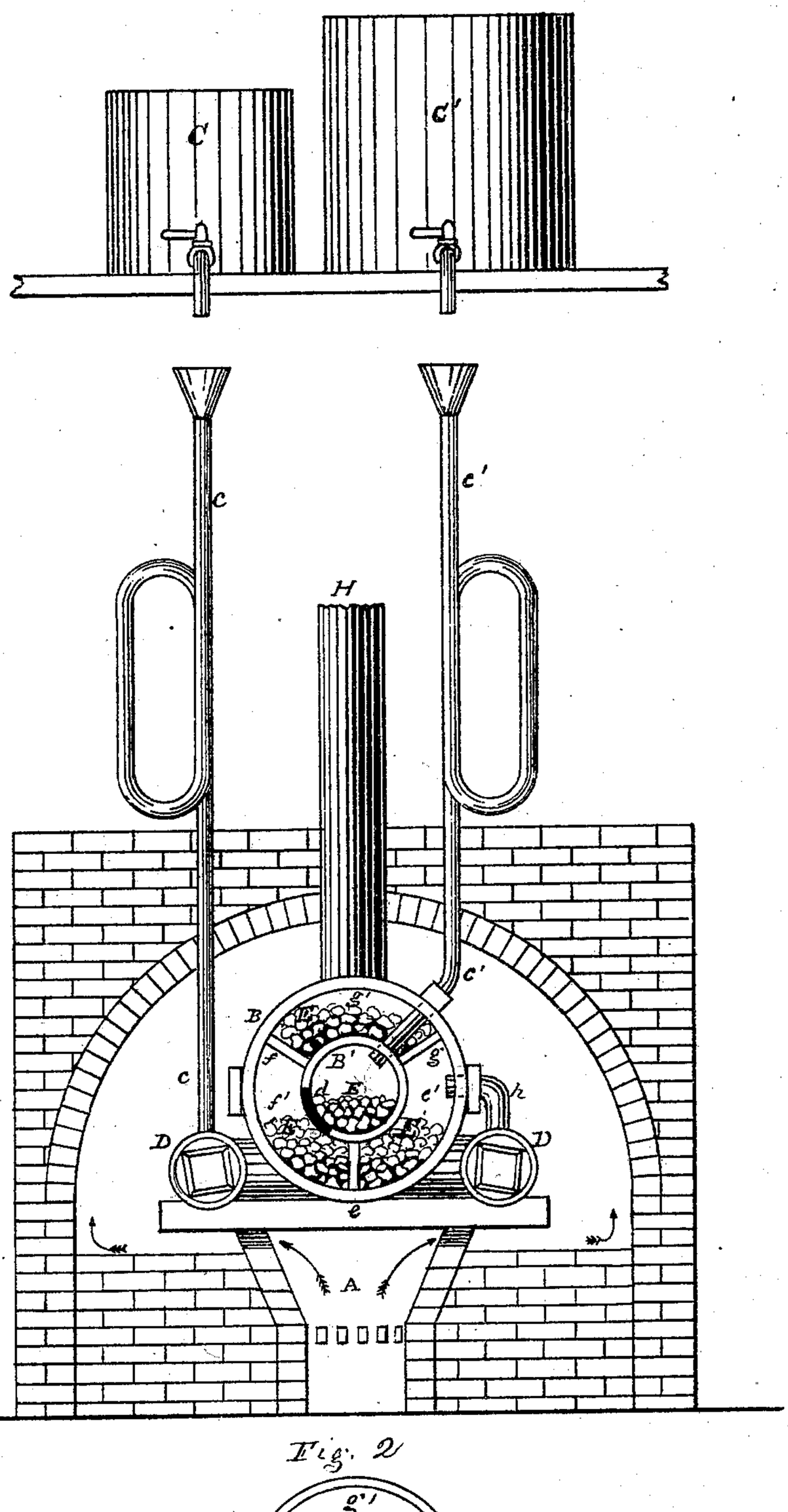
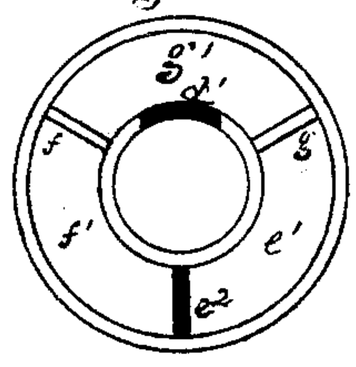


Fig. 2



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2 Sheets--Sheet 2.

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Fig. 3.

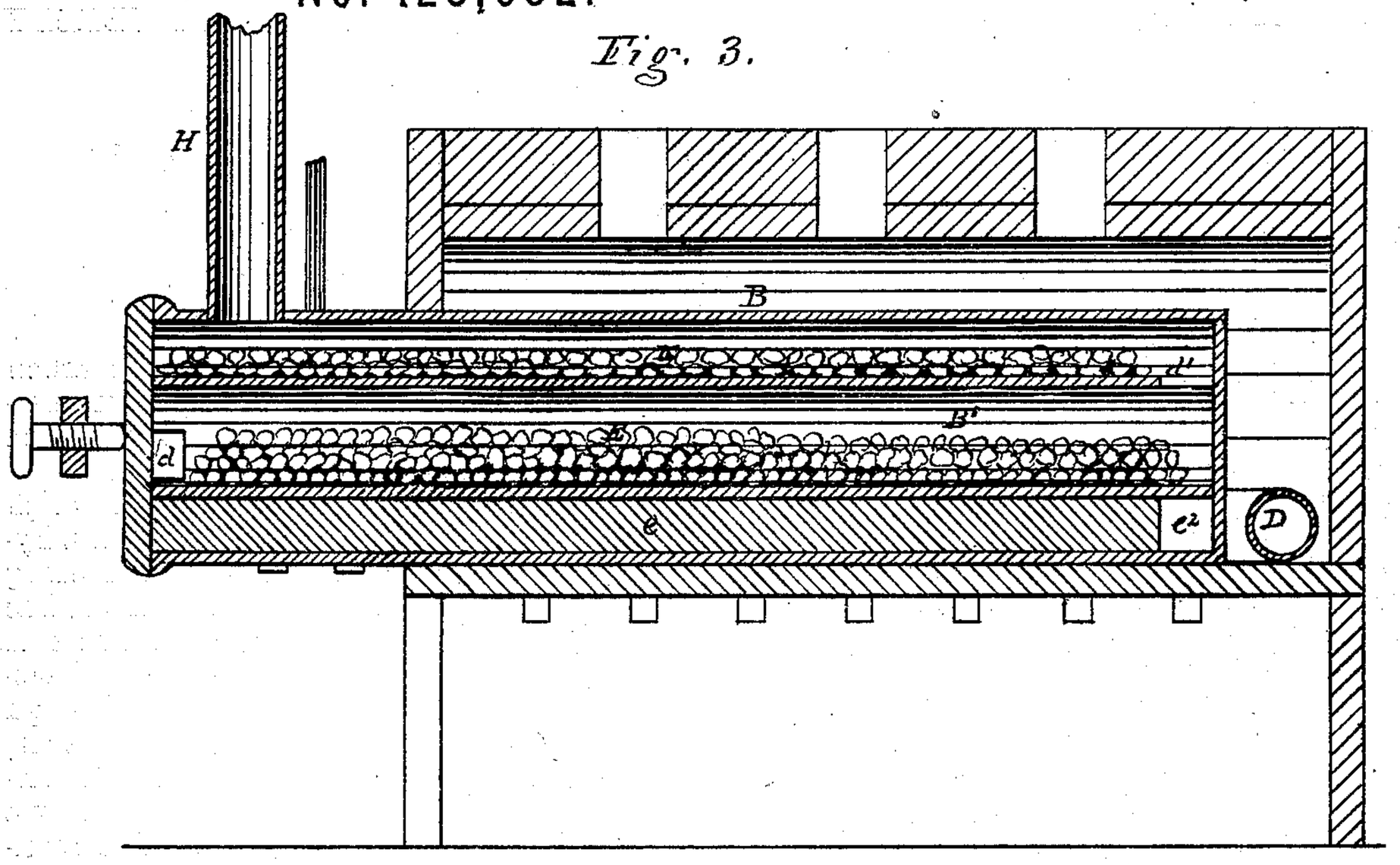
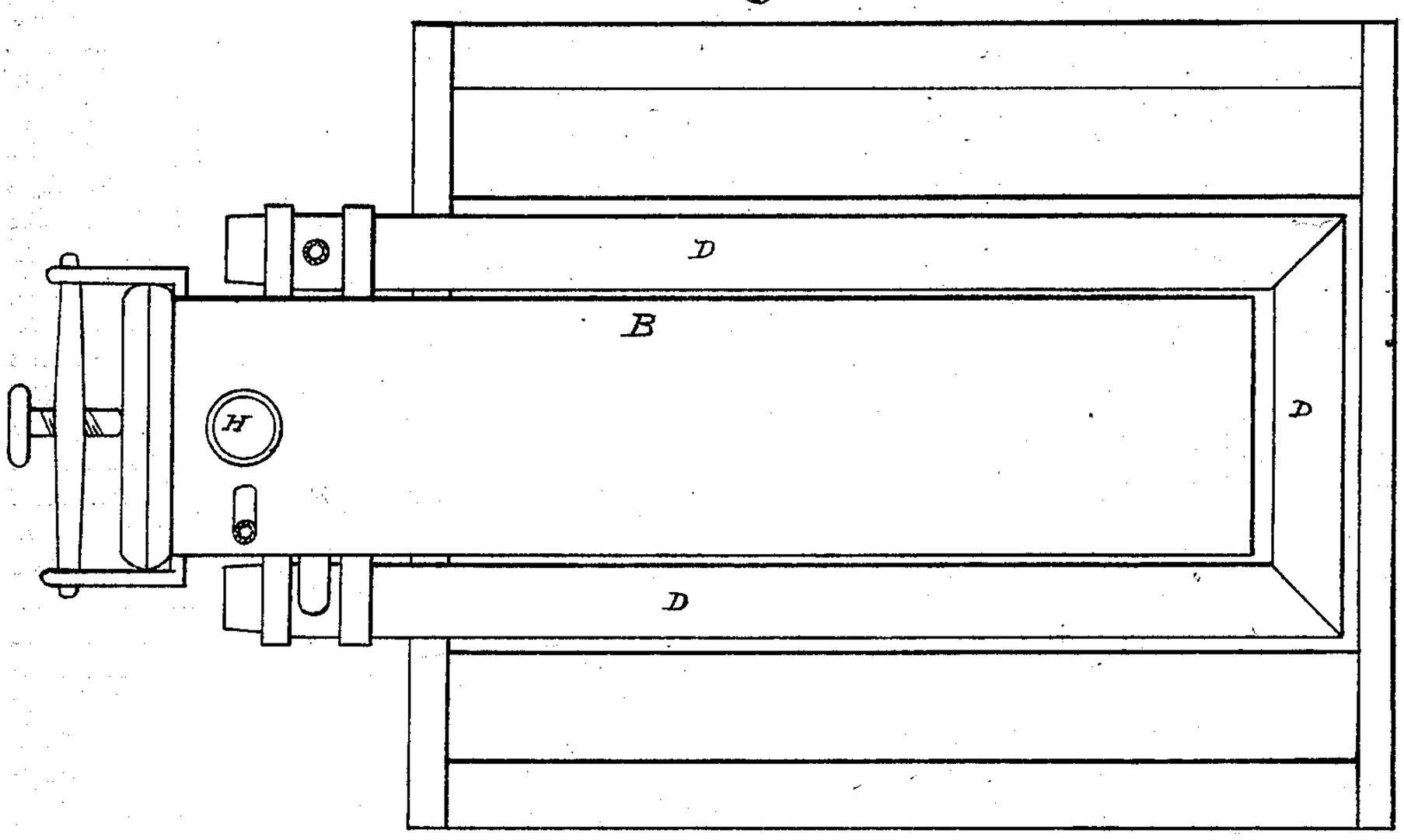


Fig. 4.



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123,052

UNITED STATES PATENT OFFICE.

BYRON SLOPER, OF NEW YORK, N. Y., AND ROBERT M. POTTER, OF JERSEY CITY, NEW JERSEY.

IMPROVEMENT IN THE MANUFACTURE OF ILLUMINATING GAS.

Specification forming part of Letters Patent No. 123,052, dated January 23, 1872.

SPECIFICATION.

To all whom it may concern:

Be it known that we, BYRON SLOPER, of New York city, New York, and ROBERT M. POTTER, of Jersey City, New Jersey, have invented a new and useful Improvement in the Manufacture of Illuminating Gas; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing.

Our invention relates to the manufacture of illuminating gas from petroleum or other liquid hydrocarbon and water by decomposing the vapors thereof and combining their products, thereby producing about double the volume of illuminating gas that can be produced by the decomposition of hydrocarbon alone. It has been ascertained heretofore that to manufacture illuminating gas from these materials with any degree of success the water, vapor, or steam must be decomposed in a retort charged with coke or other carbonaceous matter of much higher temperature than that in which hydrocarbon is vaporized and decomposed, after which the contents of both retorts must be brought together in and passed through a super-heating retort; for when steam is decomposed by passing it through a retort charged with coke or similar carbonaceous matter, unless the retort be highly heated the products will be hydrogen and carbonic acid, which latter is detrimental to combustion; but when decomposed in a retort charged as aforesaid and heated to an incipient white heat, the products will be hydrogen and carbonic oxide, (both of which are inflammable and conducive to proper combustion,) with more or less carbonic acid, according to the degree to which the retort is heated. In fact it is possible to decompose steam almost if not entirely into hydrogen and carbonic oxide by passing it through an intensely heated retort charged as aforesaid; but to do this the retort must be heated to such a degree as to burn it out in a short time. Steam may also be decomposed by passing it through a highly heated retort charged with iron turnings or the like, in which case the products will be pure hydrogen; but this has been ascertained to be objectionable because the iron soon becomes oxidized and ceases to have any further effect, the steam then passing through the retort undecomposed. If the hydrocarbon should be treated in a retort of equal temperature to the water-retort the carbon would be destroyed for illuminating purposes.

In all attempts heretofore made, of which we are aware, to decompose steam and a hydrocarbon in separate retorts and then bring the products together in a third retort, it has been found impossible to free the products of the steam from carbonic-acid gas without heating the steam retort to an impracticably high temperature. We have discovered, however, that by introducing the products of the decomposed steam (though decomposed at so low a temperature as to contain a considerable quantity of carbonic acid) into the retort in which the hydrocarbon is being vaporized, and passing them through the same in contact with the vapors and gases there being generated, the products of the steam and the hydrocarbon will react upon each other in a most salutary manner. The hydrogen of the former exerts a conservative influence upon the latter to prevent destructive decomposition and the precipitation of the carbon in the form of tar and lampblack, while the lighter and more volatile gases resulting from the decomposition of the steam tend to sweep the heavier products of the hydrocarbon rapidly forward, thus obviating their tendency to condense in the retort. At the same time whatever carbonic acid there may be in the steam products by being brought in contact with the hydrocarbon vapor at the instant its decomposition commences will take up another equivalent of carbon in its nascent state and thus be converted into carbonic oxide of double its former volume. We have found that the best results are obtained by decomposing the steam in one or more retorts filled with coke, coal, or some equivalent substance, and heated to a bright cherry red or an incipient white heat, then passing the products through the same retort in which the hydrocarbon is being vaporized, which retort, filled as aforesaid, is heated to a dull red heat, and finally passing the whole through a superheating retort, charged as aforesaid, and heated to a temperature equal at least to that of the retort in which the steam has been decomposed. We have found, also, that by vaporizing the oil at a comparatively low heat, and

introducing the more highly heated products of the decomposed steam into the same retort, as aforesaid, we are enabled to carry the combined gases and vapors into and through a superheating retort of high temperature without destroying the carbon or causing it to be precipitated in said superheating retort. We prefer to carry this process into effect by an apparatus of novel construction, in which we decompose the steam, vaporize the oil, mix the products, and afterwards superheat them in one compound retort, divided into several compartments, as hereinafter described.

In the accompanying drawing Figure 1 is a front end view of our apparatus with the furnace-front and retort-head removed. Fig. 2 is a rear end view of the compound retort with the cap removed. Fig. 3 is a vertical longitudinal section of our apparatus; and Fig 4 is a top or plan view of the same.

A is the furnace, B the outer cylinder of the compound retort located therein, and B′ an inner concentric cylinder, in which the oil is vaporized. The annular space between these two cylinders is divided by three longitudinal partitions *e*, *f*, and *g*, into three chambers e^1, f', and g', and all of said chambers are charged with coke, coal, or other equivalent substance, as shown at E E E E. D D D represent a steam-pipe in the furnace, and surrounding both sides and the rear end of the compound retort. C is a water-tank, and *c* a siphon-pipe for conveying the water into said steam-pipe D, where it is immediately converted into steam, which passes round to the other end of said pipe, becoming superheated on its way, and finally enters the chamber e^1 through the induction-pipe *h*. C′ is the oil-tank, and *c′* is a siphon-pipe for conveying the oil through the outer and inner cylinders into the central chamber, in which it is vaporized. The superheated steam enters chamber e^1 at its front end; thence passes back to the rear end thereof, and through an opening, e^2, into the chamber f'; thence forward to the front end thereof, becoming completely decomposed on its way, when these gases pass into the inner cylinder B′ through an opening, *d*, and there come in contact with the vaporizing and decomposing oil, sweeping the heavier products of the oil forward, preserving the carbon in the products of the oil from destruction or precipitation, while the carbonic acid in the water gas coming in contact with an excess of carbon in its nascent state in the decomposing oil vapor, combines with a portion thereof, and thus becomes converted into carbonic oxide, as hereinbefore mentioned. The combined products of the steam and oil pass from the rear end of the cylinder B′ through an opening, *d′*, into the superheating chamber *g′*, which, from its higher location in the furnace, will become more highly heated than either of the other chambers, and are there converted into a brilliant, fixed, and permanent gas, which passes out through the stand-pipe H. It is manifest that the oil-vaporizing chamber will be protected from the intense heat of the furnace by being surrounded by the outer cylinder and intervening chambers e^1, f', and g', and will not, therefore, become as highly heated as said surrounding chambers, and that the relative temperature of the outer and inner chambers will always be preserved to whatever degree the furnace may be heated.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The process of combining the mixed gases generated by the decomposition of water or steam with the vapor of oil while it is being decomposed, for the purpose of converting the carbonic acid contained in the mixed water gases into carbonic oxide by the agency of the fuliginous matter contained in the hydrocarbon vapor during decomposition, substantially as described.

2. The process of superheating the rich hydrocarbon gases from oil at a very high temperature by previously mixing them in their nascent state with water gases, as described, thereby preserving the carbon and preventing the destructive decomposition thereof, and making a permanent fixed gas, substantially as set forth.

3. We also claim a compound retort, in which steam is decomposed, and the gases therefrom are brought in contact, in a separate chamber of the same retort, with the vapor of petroleum or other hydrocarbon liquid undergoing the process of decomposition, substantially as above described.

4. We also claim a compound retort, consisting of separate chambers, so constructed that the inner chamber, in which the hydrocarbon liquid is vaporized, shall be protected from the high heat required by the outer chambers in which the water gases are being generated, substantially as and for the purpose above described.

5. We also claim a compound retort, with the chambers so constructed that the gases generated from the water and the oil, after mixing together, may pass into a superheating chamber of the retort for the purpose of being converted into a permanent, fixed gas.

6. We also claim, in combination with a compound oil-and-water retort, as described, an outside pipe, placed in the same furnace for the purpose of converting the water into superheated steam before it enters into the retort.

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