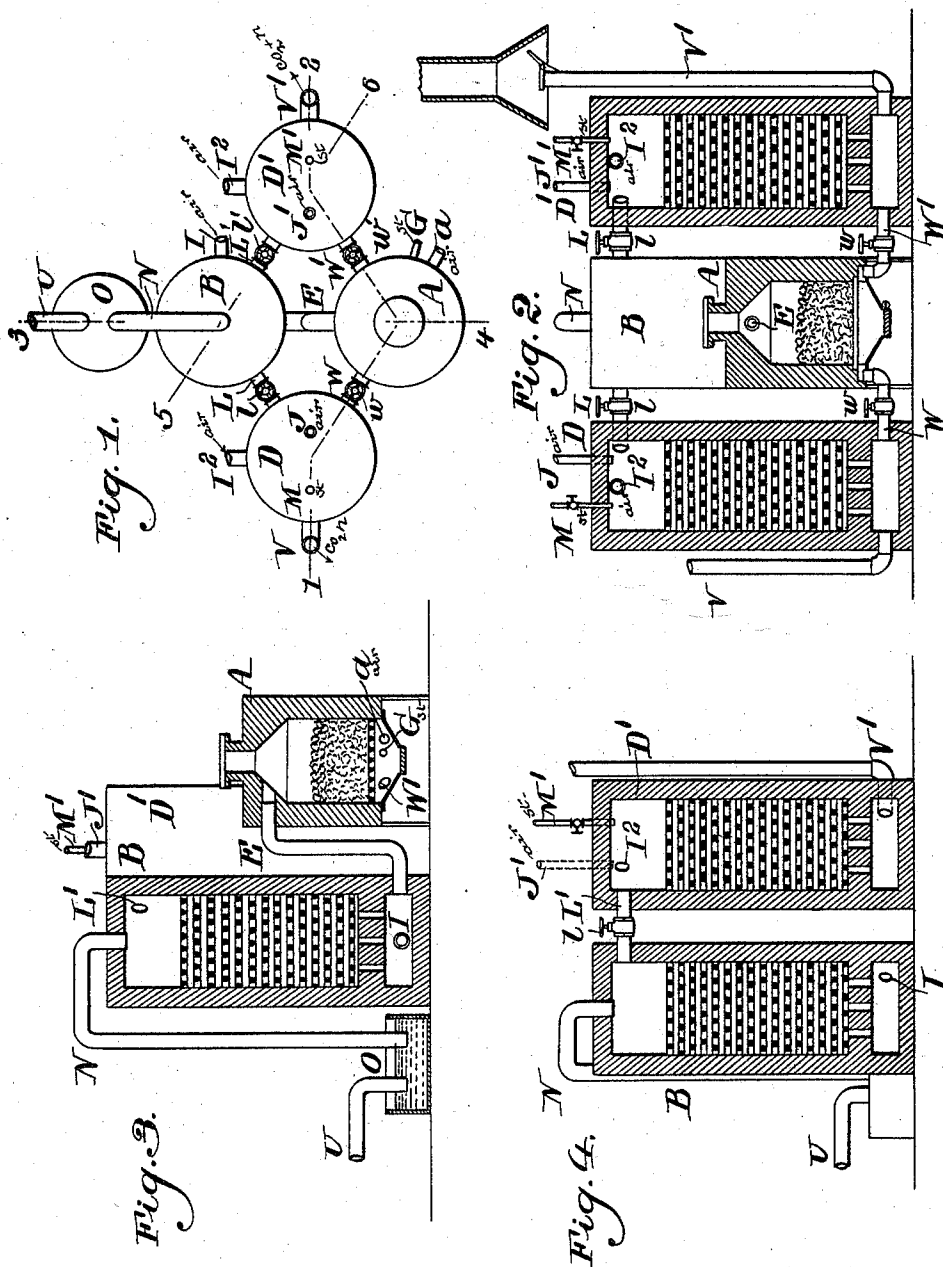


(No Model.)

2 Sheets—Sheet 1.

A. C. HUMPHREYS & A. G. GLASGOW.
PROCESS OF AND APPARATUS FOR MAKING CARBURETED WATER GAS.
No. 581,911.

Patented May 4, 1897.



WITNESSES:

Henry Drury
N. J. Pack

INVENTORS

Alexander C. Humphreys
Arthur G. Glasgow
by their attorneys
Francis J. Chambers

(No Model.)

2 Sheets—Sheet 2.

A. C. HUMPHREYS & A. G. GLASGOW.
PROCESS OF AND APPARATUS FOR MAKING CARBURETED WATER GAS.
No. 581,911.

Patented May 4, 1897.

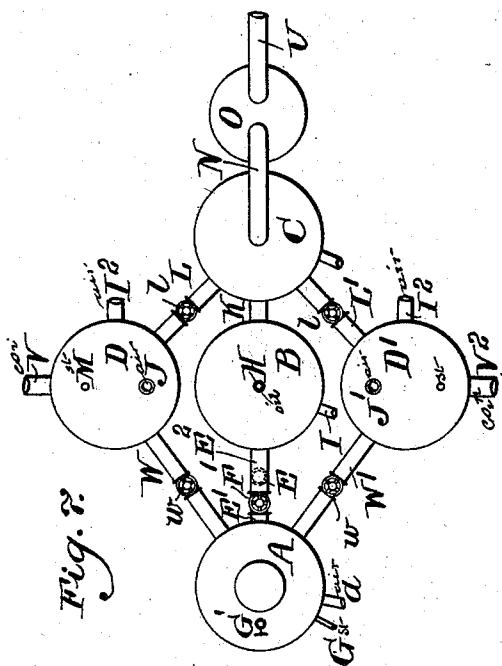


Fig. 2.

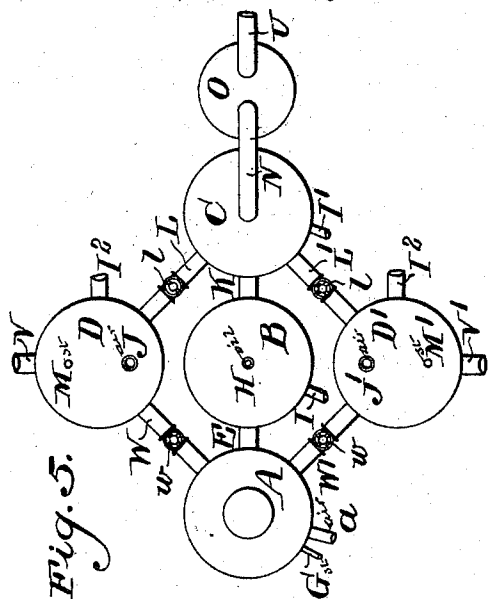


Fig. 5.

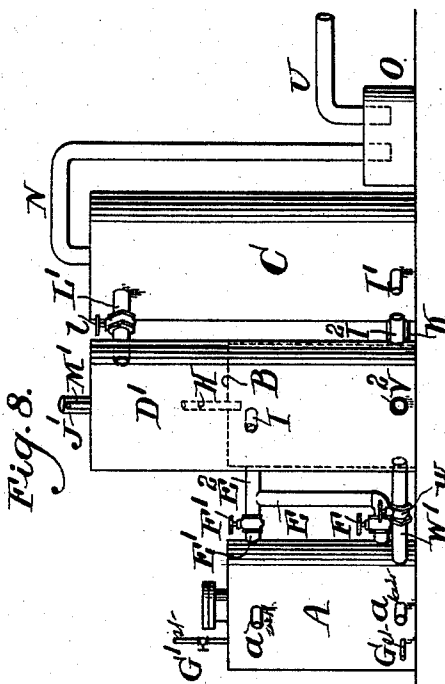


Fig. 8.

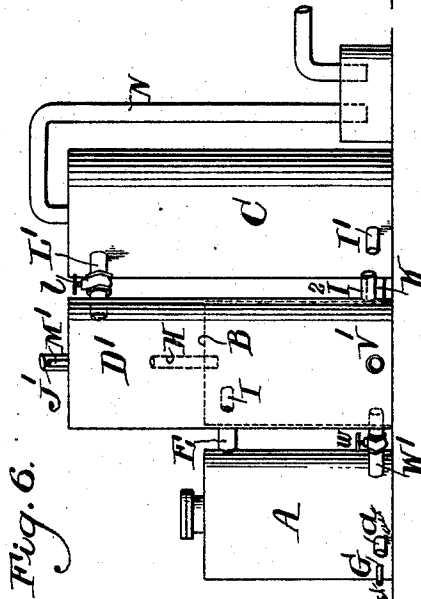


Fig. 6.

WITNESSES:

Henry Denny
H. J. Pack

INVENTORS

Alexander C. Humphreys
Arthur G. Glasgow
by their atty,
James T. Chambers

UNITED STATES PATENT OFFICE.

ALEXANDER CROMBIE HUMPHREYS AND ARTHUR GRAHAM GLASGOW, OF
NEW YORK, N. Y.

PROCESS OF AND APPARATUS FOR MAKING CARBURETED WATER-GAS.

SPECIFICATION forming part of Letters Patent No. 581,911, dated May 4, 1897.

Application filed July 10, 1895. Serial No. 555,489. (No model.)

To all whom it may concern:

Be it known that we, ALEXANDER CROMBIE HUMPHREYS and ARTHUR GRAHAM GLASGOW, citizens of the United States, and residents of the city of New York, county and State of New York, (said GLASGOW temporarily residing in London, England,) have invented certain new and useful Improvements in Processes of and Apparatus for Making Carbureted Water-Gas, of which the following specification is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

Our invention relates to the manufacture of carbureted water-gas, and has for its object to provide an apparatus and a method of manufacturing such gas which will enable us to utilize the heat generated in the blowing-up stage of the process more thoroughly than has heretofore been practicable.

The desirability of preheating the air-blast used to promote the combustion of fuel in a water-gas generator has been generally recognized, but the various plans that have been devised for heating the air have failed to attain practical success or to go into general use. We have ascertained, however, that in the manufacture of carbureted water-gas the products of combustion given off from the generator during the operation of blowing up contain, after passing through the carbureting and fixing chambers, sufficient sensible and potential heat to impart to the air-blast a temperature so high as to materially shorten the time required in blowing up the generator and heating the regenerative chambers, and we have discovered that this waste heat can be utilized for preheating air, and superheating steam as well, by providing, in addition to the regenerative chambers used for carbureting and fixing the gases, two supplemental regenerative chambers connected in series with the fixing-chambers, so that the products of combustion will pass from the fixing-chamber through either supplemental chamber at will, said supplemental chambers being also independently connected to a source of air-supply and to the generator, so that air can be forced through either of them to the generator, steam-pipes being also preferably provided,

so that steam can be forced through either supplemental chamber to the generator.

Our method of operation will be best understood, as will also the details of the apparatus, by describing them in connection with the drawings, in which the apparatus is illustrated, and in which—

Figure 1 is a plan view of our improved apparatus; Fig. 2, a front elevation on the irregular section-line 1 2 of Fig. 1; Fig. 3, a sectional elevation on the line 3 4 of Fig. 1; Fig. 4, a sectional elevation on the line 5 6 of Fig. 1; Fig. 5, a plan view of a modified form of apparatus; Fig. 6, a side elevation of the same; Fig. 7, a plan view of still another modification, and Fig. 8 a side elevation thereof.

A in each view is the water-gas generator, which we prefer to provide with a cold-blast connection, as indicated at *a*, Figs. 1, 3, 5, 6, 7, and 8, and also with saturated-steam connections, as shown at *G* and *G'*, the use of these connections being at times desirable in trimming and adjusting the fire and heats throughout the apparatus.

B, Figs. 1 to 4, indicates a regenerative carbureting and fixing chamber connected by conduit *E* with the generator. In Figs. 5 to 8 we show also a second regenerative chamber *C*, used as a fixing-chamber, and as chamber *B* is then primarily a carbureting-chamber it may be smaller, as shown in those figures.

K is a conduit connecting chambers *B* and *C*, and *N* is a gas-take-off conduit leading from the carbureting and fixing chamber or chambers to a seal-box *O*, and thence through a conduit *U* to any convenient place of use or storage.

D and *D'* are supplemental regenerative chambers connected by conduits *L* and *L'* with the carbureting and fixing chambers and having a gas-escape, as *V* and *V'*.

V and *V'* are valves in pipes *L* and *L'*.

W and *W'* are conduits leading from chambers *D* and *D'* to the generator; *w* and *w'*, valves in said conduits. To keep such a heat in top as not to condense steam, we will probably have to admit blast in several points along height of *D* *D'*.

J and *J'* are air-blast conduits leading into *D* and *D'*, and *I* *I'* *I*² are air-blast conduits

leading from a source of supply to each of the regenerative chambers for the purpose of promoting combustion of fuel-gas during the blowing-up operation.

5 M and M' are steam-pipes leading into chambers D and D'; H, an oil-conduit leading into the carbureter.

In Figs. 7 and 8 we have arranged the generator for a reversal at will of the direction
10 in which the steam passes through the fuel-bed, in which case the steam when introduced at the top will be saturated unless specially preheated. E and E' are pipes leading from its bottom and top to a conduit E², which in turn
15 leads to the chamber B, valves F and F' being provided for cutting off either take-off.

The operation carried on in this apparatus, assuming it to be preheated to operative temperatures, consists in blowing up the generator
20 by passing air from J into supplemental chamber D, the heated blast passing through conduit W to the generator, valve *w* being, of course, open and valve *w'* in conduit W' closed. The products of combustion from
25 the generator pass through conduit E to and through the carbureting and fixing chamber B or B and C to the other supplemental regenerative chamber D', valve *l'* in pipe L' being opened and the valve in pipe L closed.
30 The potential heat of the products of combustion is utilized by introducing air in the various regenerative chambers through which the gases pass by conduits I I² I³, and we may say here that obviously the air so introduced
35 may be a part of that preheated in the supplemental regenerative chamber. The apparatus being sufficiently hot, the air-blast is cut off and steam is introduced, preferably through pipes M, to the supplemental chambers
40 D, and having been superheated therein it enters the generator, from which the water-gas passes to the carbureting and fixing chambers, where it is enriched by oil, the carbureted gas passing off through conduit N. Then
45 air is forced in from, say, conduit J' to supplemental chamber D', passing thence heated to the generator, while the products of combustion are led off through the carbureting and fixing chamber or chambers to the chamber
50 D and escape thence by flue V. Afterward steam is forced through chamber D' to the generator, the gas carbureted and fixed as before, and the alternating operation continued indefinitely, or the sequence of operations may be manifestly varied—for instance,
55 the steam may be introduced into the chamber which has last been heated.

In another application, filed August 6, 1895, Serial No. 558,391, we have shown and
60 described particularly the employment of the two supplemental regenerative chambers in connection with two sets of carbureting and fixing chambers independently connected to the same generator or pair of generators, each
65 set connected with one of the supplemental chambers, and our present case is therefore specifically for a construction in which a sin-

gle chamber or set of chambers adapted for carbureting and fixing gas is connected with the two supplemental chambers, which are
70 in turn each independently connected with the generator, and of course instead of a single generator a pair of generators, such as are commonly employed, may be used.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In the manufacture of carbureted water-gas for illuminating purposes, the method which consists of passing the products of combustion produced in blowing up the generator through one or more carbureting and fixing chambers, and thence alternately through one of two internally-heated supplemental regenerative chambers, passing air through
80 the one of the two supplemental regenerative chambers aforesaid which is not being heated, and conducting it to the apparatus to maintain combustion in the generator or elsewhere while the blowing-up operation continues, shutting off the air-blast and passing steam
90 into the same supplemental chamber through which the air-blast passed and through it in the same direction to the generator to generate water-gas and passing said water-gas through the carbureting and fixing chamber
95 or chambers to enrich it or to fix the enriching hydrocarbons in the usual way leading said gas off from said chambers without passing through the supplemental regenerative chambers connected therewith.

2. In the manufacture of carbureted water-gas for illuminating purposes, the method which consists of passing the products of combustion produced in blowing up the generator through one or more carbureting and fixing chambers, and thence alternately through one of two supplemental regenerative chambers, passing air through the one of the two supplemental regenerative chambers aforesaid which is not being heated and conducting it to the apparatus to maintain combustion in the generator or elsewhere while the blowing-up operation continues, shutting off the air-blast and passing steam into the same supplemental chamber through which the air-blast passed and through it in the same direction to the generator to generate water-gas and passing said water-gas through the carbureting and fixing chamber or chambers to enrich it or to fix the enriching hydrocarbons, leading said enriched gas off from said chambers without passing it through the supplemental regenerative chamber and then again blowing up the generator by an air-blast passing through the supplemental regenerative chamber last heated and conducting the gases through the carbureting and fixing chambers to the other supplemental regenerative chamber.

3. The combination of a water-gas generator with one or more carbureting and fixing chambers and with two supplemental regenerative chambers filled with refractory checker-

work, said supplemental chambers being connected with the carbureting and fixing chamber or chambers as described and so that the products of combustion from the generator will traverse first the carbureting and fixing chambers and then either of the supplemental chambers at will, and being connected with the generator as described so that a supply of air or steam can be forced through the supplemental chamber traversed by the products of combustion and in the same direction into the generator the carbureting and fixing chambers having an outlet for water-gas independent of their connections to the supplementary regenerative chambers.

4. The combination with a water-gas generator of one or more carbureting and fixing chambers set back thereof and forming a conduit for gases therefrom, said chambers having an outlet for the carbureted water-gas, two supplemental regenerative chambers

filled with refractory checker-work set one on each side of the generator conduits for blast-gases leading from the final carbureting and fixing chamber to each of the supplemental chambers, an outlet for blast-gases in each of said supplemental chambers conduits leading from each supplemental chamber to the generator and means for forcing air or steam into and through the supplemental chamber opposite the one traversed by the blast-gases to the generator.

ALEXANDER CROMBIE HUMPHREYS.
ARTHUR GRAHAM GLASGOW.

Witnesses to signature of Alex. C. Humphreys:

FRANCIS T. CHAMBERS,
FRANK H. BUCKLIN.

Witnesses to signature of A. G. Glasgow:
F. HUEMAN,
FRANCIS T. CHAMBERS.