P. W. MACKENZIE.

Gas-Apparatus.

No. 168,265. Patented Sept. 28, 1875.

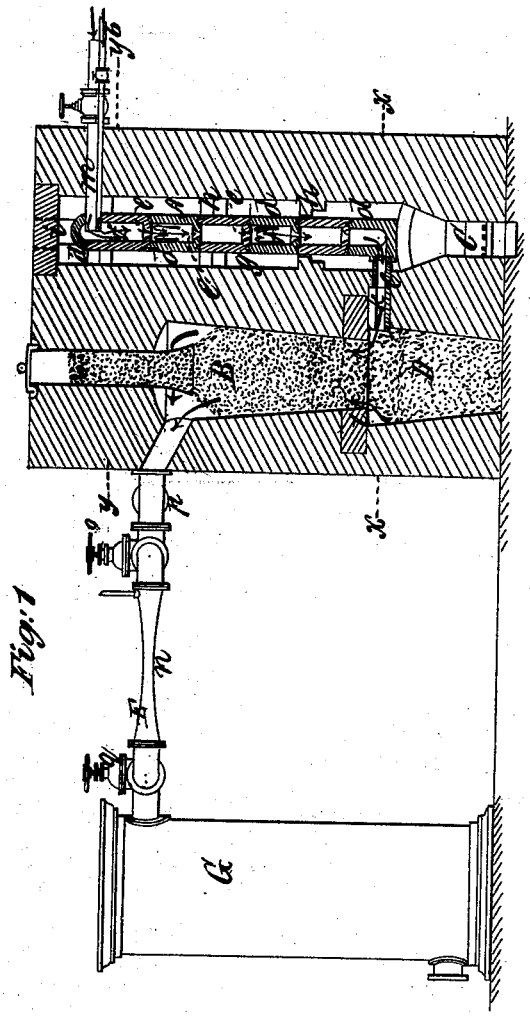

Fig. 1

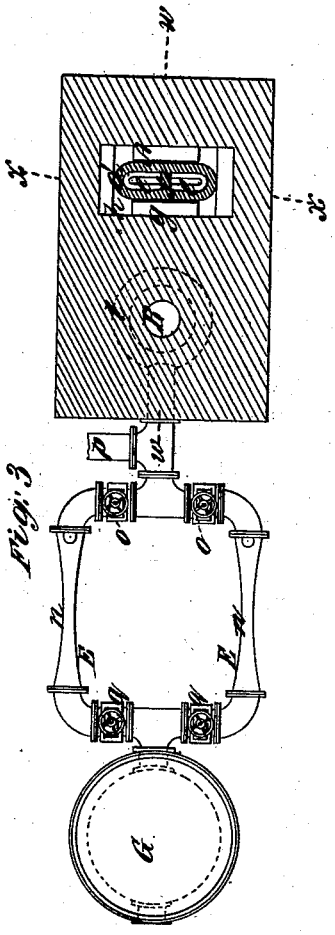

Fig. 3

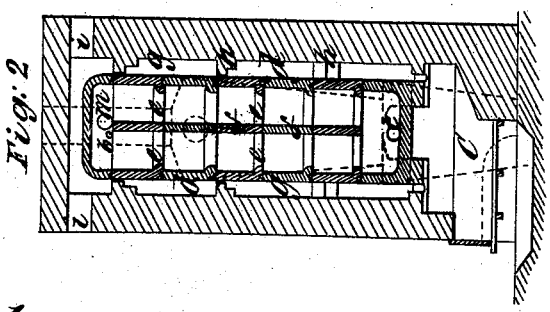

Fig. 2

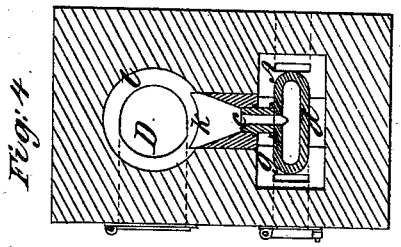

Fig. 4

Witnesses
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UNITED STATES PATENT OFFICE.

PHILIP W. MACKENZIE, OF BLAUVELTVILLE, NEW YORK.

IMPROVEMENT IN GAS APPARATUS.

Specification forming part of Letters Patent No. **168,265**, dated September 28, 1875; application filed November 7, 1874.

CASE A.

To all whom it may concern:

Be it known that I, PHILIP W. MACKENZIE, of Blauveltville, in the county of Rockland and State of New York, have invented certain Improvements in Apparatus for the Manufacture of Gas by the combustion of water with carbon, of which the following is a specification:

This invention relates to an apparatus for the production of hydrogen and carbonic-oxide gases, but is more particularly designed to be applied to the production of a mixture of hydrogen and carbonic-oxide gas in accordance with a continuous process for which Letters Patent were issued to me on July 6, 1875, and which consists in a combustion of coal, coke, or other carbonaceous material, with steam which has been previously heated to the point at which its oxygen will enter into combustion.

The invention consists, first, in a novel construction of the retort in which the steam is heated before passing to the decomposing-chamber, said retort being composed of a series of compartments mounted one upon the other, and communicating with each other by contracted openings in their bottoms, or tops of the compartments immediately beneath them, whereby the vapor is intensely heated before passing to the decomposing-chamber. The invention also consists in a construction of the decomposing-chamber without a grate, and with its cinder or ash pit of larger dimensions at its top than the lower end of the decomposing-chamber, whereby a free circulation of the heated steam from the retort around the burning fuel and uninterrupted admission of the same to the decomposing-chamber are obtained, and loss by radiation from below avoided.

Figure 1 represents a vertical section, mainly on the line *w w* in Fig. 3, through the retort and decomposing-chamber of the apparatus, in combination with a condenser and steam-jets connecting the decomposing-chamber with the condenser. Fig. 2 is a vertical section of the retort on the line *x x* in Fig. 3; Fig. 3, a horizontal section on the line *y y* in Fig. 1; and Fig. 4, a further horizontal section, in part, on the line *x x* in Fig. 1.

A is the retort, down and through which the steam, introduced by a pipe, *b*, from above, is made to circulate and pass and finally escape by a pipe or passage, *c*, to the decomposing-chamber B. This retort A, which is of vertical form, is made up of a series of sections or compartments, *d d*, mounted one upon the other, and for the most part, or all excepting the upper or cap one and lower one, contracted at their bottoms by an aperture or openings, *e*, on reverse sides of vertical partitions *f*, whereby a direct circulation throughout the length of the retort is prevented, and the steam entering the retort at the top caused to circulate up and down within each section *d* in succession, by reason of the superior heat on the outside to that at the center of the retort, before the steam, as it descends from section to section through the contracted apertures *e*, ultimately passes off below. This enables me to impart a very high temperature to the steam before it enters the decomposing-chamber. C is the fireplace for heating the retort A, and from which the gaseous products of combustion pass up through a flue, *g*, subject to the usual embarrassment by bridges or partitions *h* on the sides and ends of the retort, and ultimately escape by the outlet *i*, the steam from the pipe *b* having its heat gradually increased as it successively circulates within the sections *d* until it reaches the lower section of the retort, where it is in communication with the decomposing-chamber. By the time the steam reaches the lowest section *d* it, by the hereinbefore-described construction of the retort, attains a heat which is limited only by the capability of the materials to withstand the fire. From the lower one of the sections *d* of the retort the highly-superheated steam passes immediately into the decomposing-chamber B, and before it suffers any loss in its temperature, and while it is very nearly or quite at the temperature of the decomposing-chamber, so that the liberated hydrogen will not reduce the temperature of the latter. This is very important, and the construction of the retort as described facilitates such results. The decomposing-chamber B is constructed of the most refractory and non-conducting materials which are conveniently attainable, and may vary in its general contour; but I prefer to make it of rounded, oblong, or oval shape in its horizontal section. Furthermore, said decomposing-chamber,

which is a self-feeder, is made without a grate, and the cinder and ash pit D of larger dimensions at its top than the base or lower end of the decomposing-chamber, to admit of the free circulation of the intensely-heated steam over the spreading arch *k* and through an encircling channel, *l*, around the burning fuel, and to insure its entering the decomposing-chamber at all points.

By dispensing with a grate to the decomposing-chamber I do away with loss by radiation below and utilize the full heat of the steam. The ash-pit D is also made unusually deep, to prevent radiation from below. The coke, when coking-coal is used, together with the cinder and ash, are removed from below.

When it is required to produce hydrogen, then the fuel in the decomposing-chamber, which is supplied through the throat from above, need not be more than from twelve to fifteen inches, or thereabout, above the point of entrance of the steam to be decomposed. The product being hydrogen and carbonic acid, the latter is removed by the usual well-known or any other suitable means.

When hydrogen and carbonic oxide are required to be produced, the decomposing-chamber B should be kept full, or nearly so, of fuel.

To kindle the apparatus, air is admitted to the top of the retort A by a pipe, *m*, of larger area than the steam-pipe *b*, and the furnace below the retort started at the same time, and when the temperature of the retort has reached the proper point the air is excluded from the pipe *m* and the combustion or decomposition is continued by the oxygen of the steam.

The steam-jet exhausters E E, which it is proposed to arrange in duplicate in case of accident happening to either one, may be of any suitable construction, *n n* being the contracted steam-jet pipes; *o o*, the valves controlling the admission of steam thereto from a common inlet, *p;* and *q q*, the outlet-regulating valves. These steam-jet exhausters E E, or either of them, perform a double duty, the one being to produce a draft to overcome the resistance of pipes in the passage of the gas or gases to the condenser G, and of the material in the decomposing-chamber B and in the wet or dry lime-purifiers. The other function of the steam jet or jets is to cause the steam to combine with and take up the ammonia which is developed from most fuels, and also a part of the sulphureted hydrogen, such union being insured by the passage of the whole through the contracted portion of the steam-jet pipes. The combined steam and gas is passed through the condenser, which may be of any suitable construction, and which removes the steam and other impurities combined with the gas.

I claim—

1. The sectionally-constructed retort A, encompassed by a flue, *g*, and composed of compartments *d*, mounted one upon the other, in combination with the contracted apertures *e*, connecting said compartments, a steam-inlet, *b*, in communication with the upper one of said compartments, and a steam-outlet, *c*, below, connecting said retort with the decomposing-chamber of the apparatus, substantially as and for the purposes herein set forth.

2. The decomposing-chamber B, constructed with a free open bottom, and having its cinder or ash pit D of greater area at its top than the base of the decomposing-chamber, in combination with the retort, essentially as described.

P. W. MACKENZIE.

Witnesses:
FRED. HAYNES,
FERD TUSCH.