3 Sheets--Sheet 1.

S. C. SALISBURY.

Improvement in Gas-Generators.

No. 130,318. Patented Aug. 6, 1872.

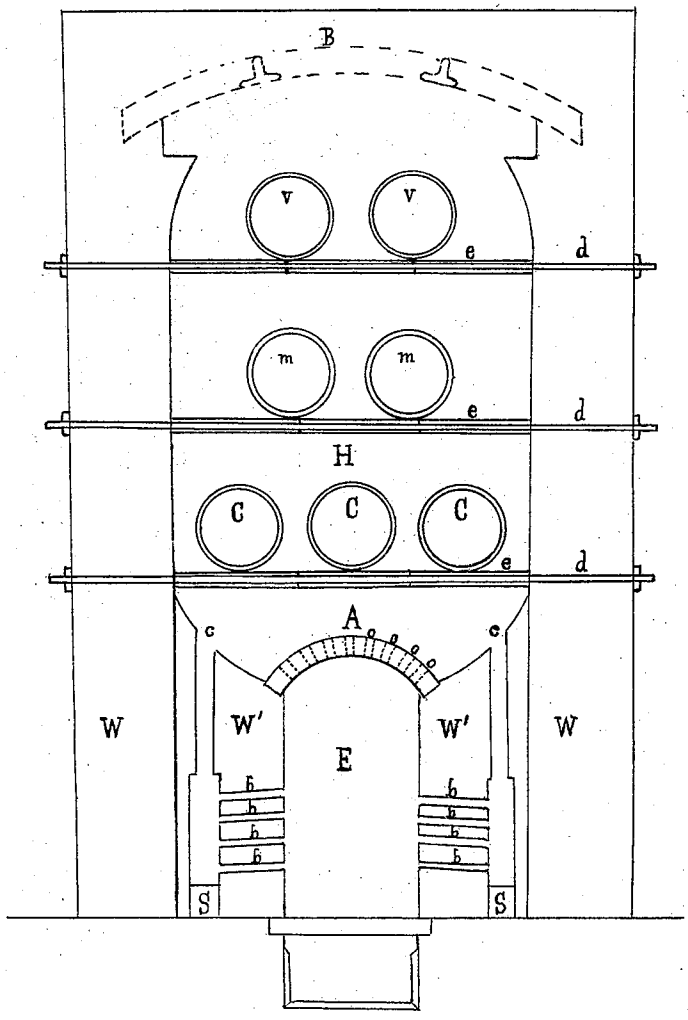
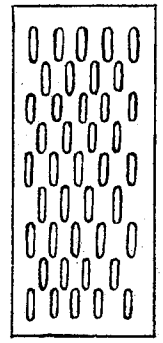


Fig. 4.



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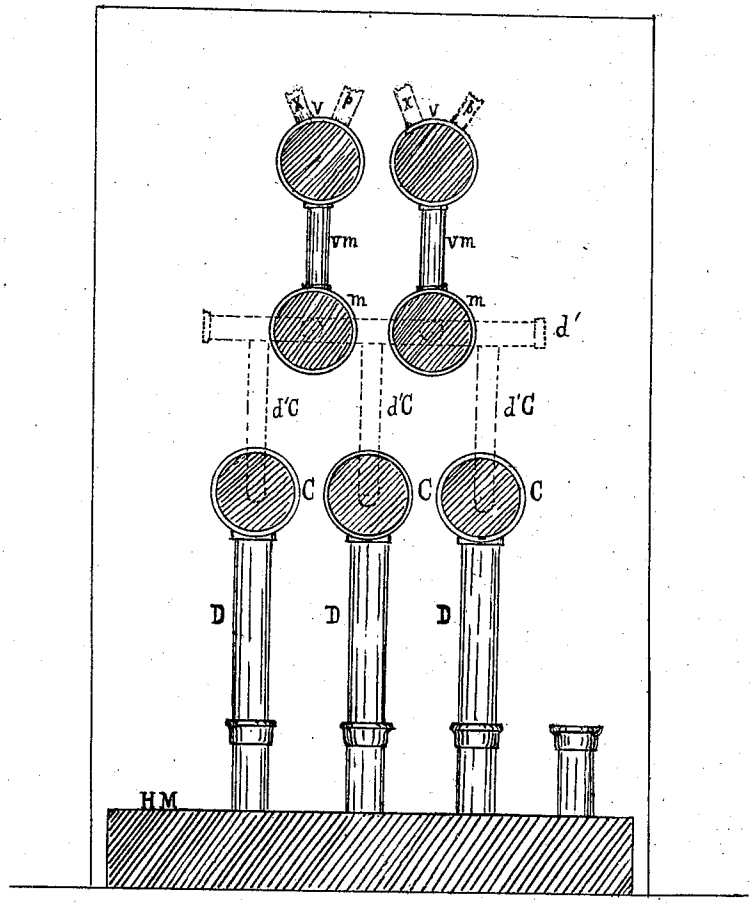
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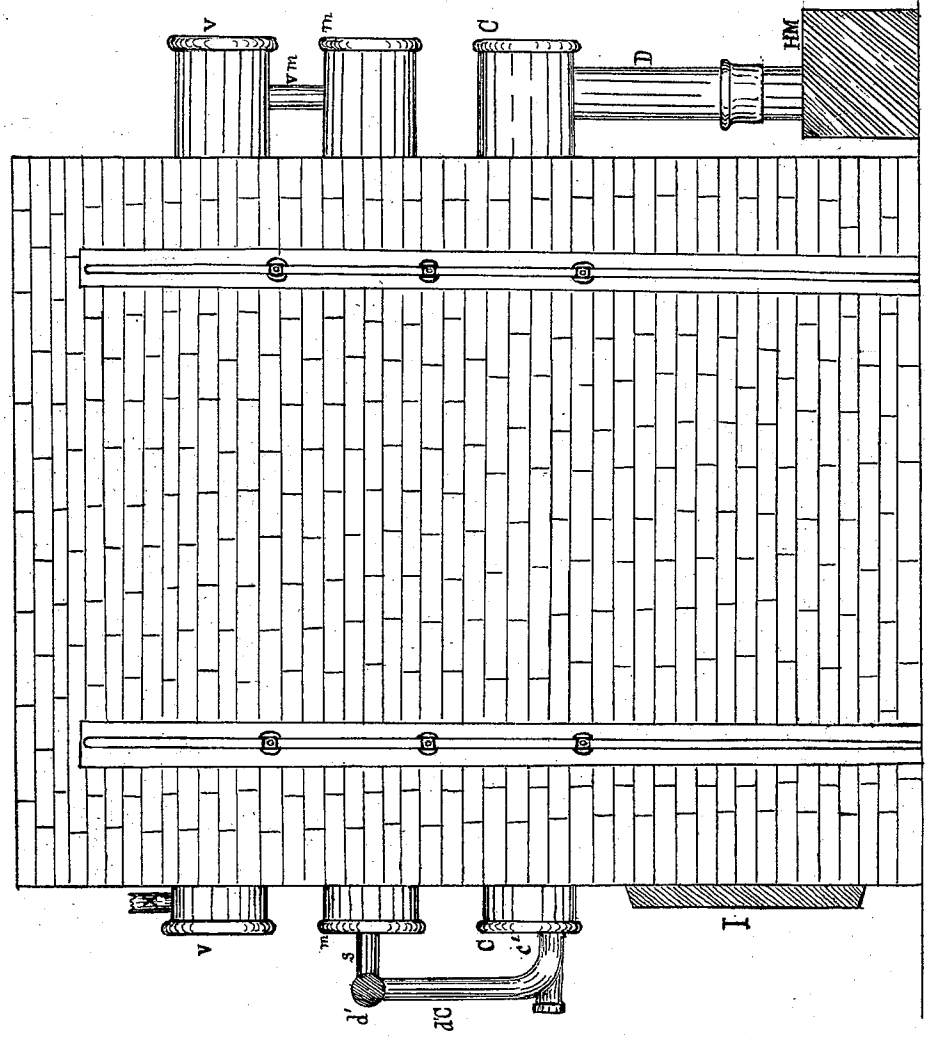
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UNITED STATES PATENT OFFICE.

SILAS C. SALISBURY, OF NEW YORK, N. Y.

IMPROVEMENT IN GAS-GENERATORS.

Specification forming part of Letters Patent No. **130,318**, dated August 6, 1872.

To all whom it may concern:

Be it known that I, SILAS C. SALISBURY, of the city, county, and State of New York, have invented certain new and useful Improvements in Apparatus for Generating Gas; and I do hereby declare that the following is a full, true, and exact description thereof and of the mode of their operation, reference being had to the accompanying drawing making part of this specification.

This invention is an improvement upon that portion of an invention for which Letters Patent No. 88,079, dated March 23, A. D. 1869, were issued to me for "improved apparatus for generating gas and heating dwellings and other buildings," which relates to the apparatus for generating gas; and consists, first, of a furnace with an inner fire-chamber so constructed that air shall be admitted in divided currents through the grate-bar upwardly to the fuel, and, through the inner walls of the sides of the fire-chamber, upon and against the sides of the fuel therein, and having an arched roof over said fire-chamber, with series of apertures in said roof for the passage of the carbonic oxides and products of combustion of the fuel burning therein upwardly into a combustion-chamber constructed above and with such fire-chamber, with like provision for the admission of air in divided currents into it, and in the shape of a parallelogram on its horizontal plane, instead of a furnace circular in form, with a fire-chamber of like form with like provision for the admission of air through the grate upwardly to the fuel therein, and with provision for the admission of air in divided currents through the inner wall of such fire-chamber upon and against the fuel therein, with a dome-shaped roof with apertures therein for the escape of the flames and gases of the fuel burning therein upwardly into a combustion-chamber constructed above and with said fire-chamber, and with like provision for the admission of air in divided currents into such combustion-chamber, as is set forth in the Letters Patent aforesaid, whereby it will be perceived that the furnace in this invention will be constructed upon the theory and will operate upon the principle of that before mentioned, and differs from it merely in form; and, secondly, in the combination therewith of straight horizontal vaporizers and retorts with their pipes and connections, for the vaporization and conversion of water and hydrocarbon or other oils into a carbonized hydro-oxygen fixed gas for illumination, instead of a closed vessel with a conical bottom, and having a cup at its apex for vaporizing the gas-stock, and ring-shaped retorts for the production from such vapors of a perfect fixed gas, as is set forth in said Letters Patent, and they may be more particularly set forth as follows:

Figure No. 1, Sheet 1, represents a sectional interior view of my furnace, with seven closed tubes therein, the two upper ones of which, V V, are used as vaporizers for vaporizing the gas-stock therein, and those below them, *m m* and C C C, as retorts for thoroughly mixing the vapors created in the vaporizers and the conversion of them into a fixed gas. The recess below the fire-chamber is the ash-pit. Fig. No. 2, Sheet 2, represents the connecting-pipes *vm vm* between the vaporizers and retorts *m m*, and the delivery-pipes D D D from the lower retorts connect them with the hydraulic main H M; and in dotted lines the distributing-pipe *d'*, which receives the mixed vapors from the retorts *m m* at the front of the furnace; and the connecting-pipes *d'* C connecting the distributing-pipe *d'* with the three lower retorts. Fig. No. 3, Sheet 3, represents a side view of my improved apparatus, showing the projections of the vaporizers V V and the retorts *m m* and C C C, and the several pipes connecting them; and the letter I represents the door of the fire-chamber. Two closed vaporizing-tubes, V V, and five retorts are placed in the combustion-chamber, and are indicated by the letters *m m* and C C C; and the letters *d d d* represent iron rods, while the letters *e e e* represent fire-brick tubular tiles, which cover so much of these rods as are in the combustion-chamber, and, as they pass not only through the walls of the furnace but through buck-stays on either side of it, and are secured in position at either end, they not only protect the walls of the furnace from too great expansion by the heat to be created in it, but they also support the several series of retorts when most expanded by heat, and are themselves protected from the heat by the fire-brick tiles which cover them. The vaporizing-tubes have receiving-pipes X and *p* for the reception of gas-stock, and the said vaporizers are

connected with the retorts *m m* by the pipes *vm vm* at their rear ends, and at their front ends the retorts *m m* are connected with the retorts C C C by the pipes S S, *d'*, and *d'* C. Two closed iron tubes, V V, used as vaporizers, as heretofore set forth, are placed near the top of the combustion-chamber H, and they each have two small pipes, represented as entering therein in cross-section, and to one of these small pipes in each vaporizer is to be attached a horizontal pipe of equal size extending into the vaporizer, and has at its end a cone-shaped orifice, through which some hydrocarbon or other oil is to pass into said vaporizer; and to the end of the other pipe entering such vaporizers in cross-sections is attached another shorter pipe, perforated with small holes for the passage through it of hot water into said vaporizer, and the pipe conveying the hot water will be shorter than the one conveying the oil; and the vaporizers are united to two similar tubes or retorts placed below them, and marked *m m*, by pipes *vm vm* at their rear ends; and these are connected with the three retorts C C C below them by the pipes S S, *d'*, and *d'* C, and the three retorts C C C are connected with the hydraulic main H M by the delivery-pipes D D D.

The fire-chamber of my furnace and the inner portion of the walls of the combustion-chamber thereof are constructed of fire-brick, suitably formed therefor; and the operation of my apparatus may be stated as follows: By the admission of air in divided jets upwardly, for the length of the fire-chamber, against the fuel therein, and from each side thereof through the air-passages *b b*, for the length of said chamber, upon and against the fuel therein, large quantities of air are not only supplied to said chamber, but it is presented to and distributed through the burning mass; and as in the course of combustion the walls of such fire-chamber become highly heated by the fire therein, the air coming in through the passages *b b* is also thereby highly heated, whence, to this extent, such chamber is supplied with a hot-air blast. By thus supplying the fire-chamber with jets of heated air on the top and at different points of the burning fuel the decarbonization of the fuel commences, or is carried on from the top and from the outside, instead of from the bottom and center, as is usual, and an intense heat is produced, while the combustion is slower; and the combustion being carried on most actively at the top and sides of the fuel, the grate-bars remain comparatively cool, and are made thereby more durable. Such fire-chamber is wholly arched over with fire-brick, as is shown in Fig. No. 1, Sheet 1, in section, and numerous openings or perforations, *o o o o*, therein, about a half inch in diameter, allow the carbonic oxides and products of combustion generated therein to pass into the combustion-chamber, which is also supplied with air from below through the circular openings *c c*, coming up between the inner and outer walls of the fire-chamber alternately with the openings which supply air to the fire-chamber, and in coming through such openings the air becomes highly heated. The air supplied to the combustion-chamber, becoming heated while passing thereto, is rendered lighter than the carbonic oxides continually entering the combustion-chamber from the fire-chamber, and an intimate union of the air and gases takes place, utilizing the whole, and produces their complete and perfect combustion. The heating power of the chambers E and H may be much increased, and the combustion of the fuel rendered more complete, by admitting into said chambers through their several tubes or passages heated or superheated steam. In the combustion-chamber H I place two straight closed tubular vaporizers and five straight retorts instead of the closed pan with a conical bottom, a cup at its apex, and ring-shaped retorts. As ring-shaped retorts necessarily have to be cast in sections, which in use are liable to become loosened and leak, therefore, as improvements upon them, I substitute the devices before, and they are described as follows: The two in the upper line are vaporizers and are marked V V; the two below them are marked *m m;* and the three in the lower line are marked C C C; and the vaporizers V V are connected to the retorts *m m* at their rear ends by the pipes *vm vm*, and the retorts *m m* are united to the retorts C C C at their front ends by the pipes S S, the pipes *d'*, and the pipes *d'* C *d'* C and their connections *c' c';* and the retorts C C C are connected to the hydraulic main H M by their delivery-pipes D D D, whereby the vaporizers and retorts are so arranged that the oil, gas, or vapor hereafter referred to passes through the entire circuit of the vaporizers and the retorts *m m* and C C C before passing into the hydraulic main H M. Having lighted the fire in the fire-chamber and continued the same until the requisite degree of heat shall have been produced in the combustion-chamber, I let on oil through its appropriate pipes into the vaporizers V V, and as it strikes the inner side thereof it is converted into a vapor-gas; and as soon as this operation is commenced I also turn the hot water into said vaporizers, and as it strikes the heated sides of such vaporizers it is instantly converted into steam and is decomposed with hydrogen and oxygen, which become united with the vapor of the oil therein. The several gases of the hot water and the oil thus produced are conducted by the pipes *vm vm* to the retorts *m m*, through which and the succeeding retorts they are passed, as above mentioned, and in so passing through become fully mixed and united and are converted into a perfect fixed gas. By this combination and mixture of hydrocarbon vapor and the gases of decomposed water I make both a more perfect and a cheaper gas. Enough water should be supplied to furnish sufficient hydrogen to take up or mix with the carbon of the oil and pre-

vent all smoking as the gas is burned, but not enough to so much reduce the gas as to impair its illuminating properties or qualities. I have found from actual trial that a proportion of water about one-third in bulk, compared with the oil, furnished highly satisfactory results.

The arrangement of the closed tubular vaporizers and their hot-water pipes with the retorts *m m* and C C C furnishes a simple and effective means of cleaning the several pipes and retorts, as, after making a sufficient or any desired quantity of gas, the supply of oil may be turned off and a larger supply of water admitted through the water-pipes, and is at once converted into steam, which, as it passes through the vaporizers, pipes, and retorts, decarbonizes all the carbon that may have been left therein, and conveys the same to the hydraulic main; the effect of which is that the several pipes and retorts of my apparatus are cleaned and hard incrustations prevented, and thereby the time of the usefulness of the retorts is much protracted.

What I claim as new, and for which I seek Letters Patent, is—

In combination with apparatus or retorts for the manufacture of gas, the heating-furnace, consisting of an inner fire-chamber and an outer combustion-chamber, combined and constructed, substantially as described, with air tubes and spaces between the outer and inner walls of the fire-chamber, to supply air, or air and steam, to both such chambers, the inner chamber being covered with or separated from the combustion-chamber by a perforated arch or top, substantially as set forth.

SILAS C. SALISBURY.

Witnesses:
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