(No Model.)

T. B. FOGARTY.

APPARATUS FOR AND PROCESS OF OBTAINING COMBINED NITROGEN AND FUEL GASES.

No. 500,650. Patented July 4, 1893.

Fig. 1.

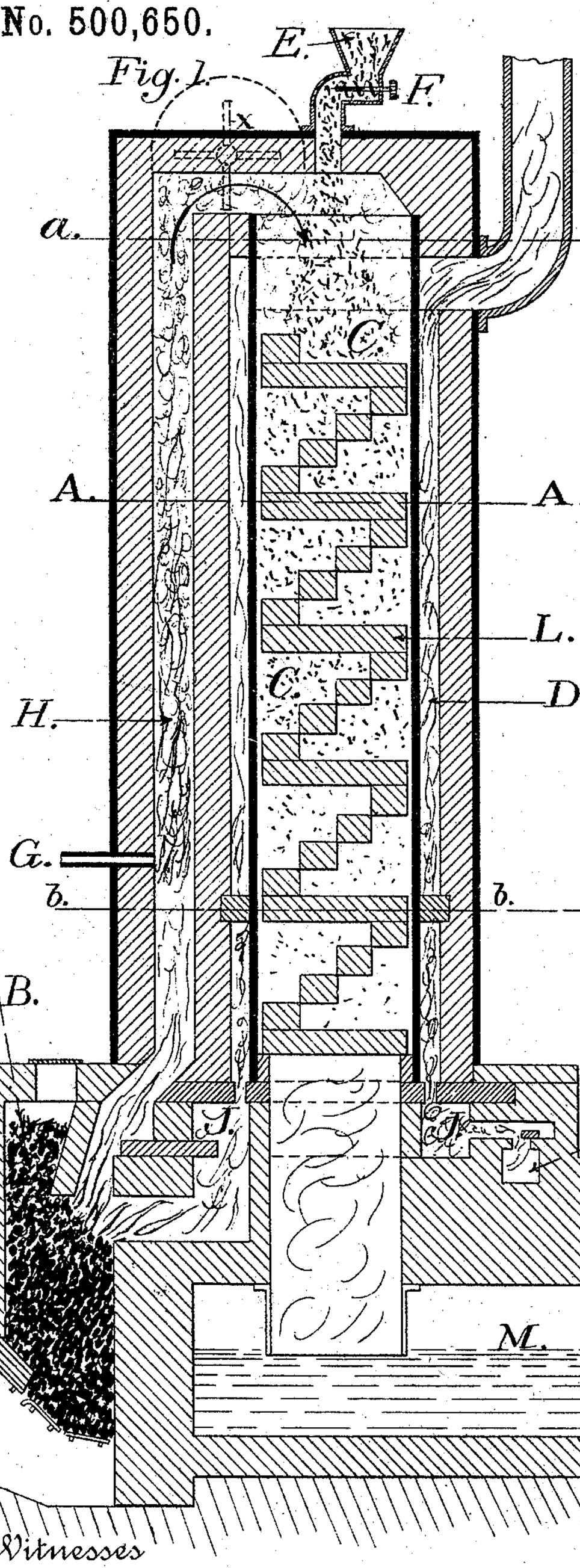


Fig. 2.

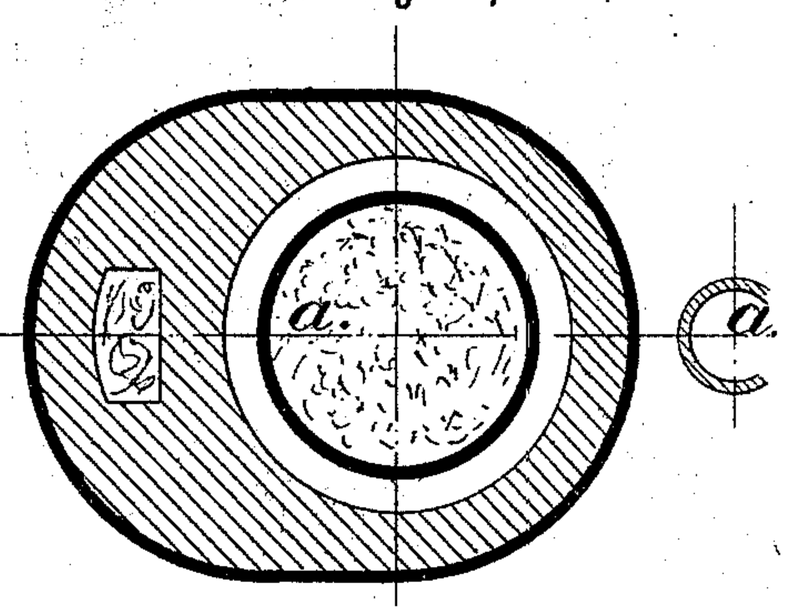
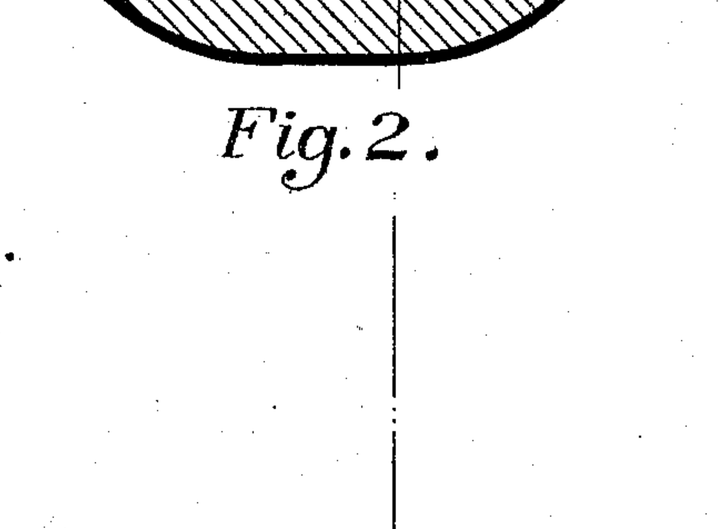


Fig. 3.



Witnesses
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THOMAS B. FOGARTY, OF LONG ISLAND CITY, ASSIGNOR OF ONE-TWENTIETH TO ESEK COWEN, OF NEW YORK, N. Y.

APPARATUS FOR AND PROCESS OF OBTAINING COMBINED NITROGEN AND FUEL GASES.

SPECIFICATION forming part of Letters Patent No. 500,650, dated July 4, 1893.

Application filed April 18, 1891. Renewed March 18, 1892. Again renewed December 9, 1892. Serial No. 454,582. (No model.)

To all whom it may concern:

Be it known that I, THOMAS B. FOGARTY, a citizen of the United States, residing at Long Island City, Queens county, State of New York, have invented certain new and useful Improvements in Apparatus for and Process of Obtaining Combined Nitrogen and Fuel Gases, of which the following is a specification.

The object of my invention is to produce a cheap, simple and rapid process of obtaining combined nitrogen in a form available for the needs of agriculture and of the industrial arts, or capable of being rendered so by some simple secondary process.

The nitrogen most available for the purposes of my invention is that contained in atmosphere, four-fifths of which are composed of this gas. One of the most valuable forms of combined nitrogen is cyanogen, from which cyanides and other nitrogenous compounds are readily produced at will, and the object of my invention is its rapid and economical production.

It is well known that cyanogen may be produced by the combination of nitrogen and carbon, at high temperature, and in the presence of an alkali; but, the process has heretofore proved a practical failure, owing, chiefly, to the extremely negative nature of the materials employed. I obviate this difficulty by reducing the carbon to a highly active and energetic condition previous to bringing it into contact with the nitrogen and alkali, by means of suitable appliances such for instance as are described hereinafter and illustrated in the accompanying drawings, in which:—

Figure 1 is a vertical elevation of an apparatus, in which to carry out my process. Fig. 2 is a section of Fig. 1, upon the line *a*—*a*. Fig. 3 is a section of Fig. 1, upon the line *b*—*b*.

A, A, is a furnace for the production of cyanides and fuel gases. This furnace is suitably connected with a gas generator B, and incloses a suitably constructed retort C, which is externally heated by means of a volume of flame passing through the surrounding flue or fire-chamber D. The retort is also shown as suitably provided with a hopper E, and feeding mechanism F.

G, shows a suitably located pipe or other suitable duct by means of which a suitable hydro-carbon either solid, liquid or gaseous, is introduced into the flue H.

L, are refractory bafflers or shelves for the purpose of retarding the fall of pulverized material, when such is used, through the retort, and M, is a tank containing water for collecting or decomposing the cyanides.

By the combustion of carbonaceous fuel of any sort, whether solid, liquid, or gaseous, in a suitably adjusted volume of air, or of air and steam mixed I produce in a furnace B (constructed suitably to the character of the fuel used) a volume of generator or producer gas; and, by means of a secondary volume of air supplied through a flue I, or its equivalent I burn part of the generator or producer gas in the combustion flues or chambers J, and by means thereof I raise the retort C, to a high temperature. As soon as the retort C, has reached a working heat, I suck, draw or force, by means of a suitable fan, blower, aspirator, exhauster or other suitable apparatus, a suitably adjusted volume of the generator gas produced in B, up through the flue H, and thence down through the retort C, and through or over the water in the tank M, whence the gas is drawn through suitable washers or scrubbers or other suitably constructed apparatus whereby the cyanides and other nitrogenous compounds produced may be collected. For purpose of illustration, I show a blower X, dotted lines Fig. 1, for impelling the gas. I now by means of the hopper E, and the feeder F, feed a suitable volume of an alkali or of a suitable compound or admixture thereof into the retort C, through which it falls and wherein it is brought into intimate contact and admixture with the generator gas passing through the retort. I usually prefer to use the alkali in the form of a powder, but, it is sometimes preferable to introduce it into the retort in a vaporized condition. Also when it is introduced into the retort in a pulverized condition, and is inclined to be rendered pasty by the heat or from any other cause to clog the feeder, there is frequently an advantage in mixing with it some inert, infusible substance such as pulverized carbon whereby the pastiness of the

alkali may be compensated for and corrected. The carbon used will not be lost for it may be caused to decompose a volume of steam, preferably superheated, admitted into the lower part of the retort and may thus be caused to produce a large volume of fuel gas. I, also, by means of the pipe G, introduce a suitable volume of hydro-carbonaceous matter into the flue H. This hydrocarbon may be in either the solid, liquid, gaseous or vaporous condition, in any of which cases it will be decomposed by the heat, the volatile portion of its solid or liquid matter into gases and vapors, and its gaseous and vaporous constituents into simpler products, so that, in any case its constituent volatile matter will be certain to reach the retort in the form of gas or vapor. When a liquid gaseous or vaporous hydro-carbon is used it may be caused to flow through the pipe G, by simple gravity or pressure; but when the hydro-carbon used is in a solid form it will be necessary to force it through by means of some suitable mechanism. I now cause the mixed generator and hydro-carbon gases to enter the retort C, but as it is most desirable that they should be practically free from free oxygen and carbonic acid, under the influence of the high temperature I cause such oxygen as may be present in the generator gas to combine with the hydro-carbons, and its carbonic acid, also, to be reduced by them with the production of carbonic oxide and free hydrogen. The mixed gases and vapors introduced into the retort C, are there subjected to a high temperature, and the contained hydro-carbons finally become "cracked" or reduced to simpler compounds, and, under sufficient exposure to the high temperature, become finally resolved into nascent carbon and hydrogen; and, there are thus produced compound and simple bodies which are possessed of strong chemical affinities, and which combine readily with free nitrogen in the presence of an alkali, and under the influence of a high temperature; while some, notably nascent hydrogen and acetylene, are endowed with such strong affinities that they are capable of combining directly with nitrogen, thus:

1. $C_2H_2+N_2=2HCN$
2. $Na_2CO_3+2C_2H_2=3CO+2Na,NC+H_2$.
3. $Na_2CO_3+4C(nascent)+N_2=3CO+2Na$, CN.
4. $3H_2(nascent)+N_2=2NH_3$.

Around these metamorphoses revolves an endless train of intermediate, analogous, and secondary reactions, all of which tend and gravitate to, and rest upon the common basis of the intense chemical energy and strong affinities of acetylene and nascent carbon and hydrogen, and the same holds good, but in a much less degree of olefiant gas.

Among the above reactions may be included the analogous results obtained by the use of the other alkalies such as potassium, calcium, barium, magnesium and strontium; and, of their carbonates, oxides and hydrates, all of which are available, in a greater or less degree for the purposes of my invention.

The cyanides produced are received in the tank M, where they may be treated by any of the usual processes. When the chief object is to produce ammonia the cyanides may be decomposed, before falling into M, by means of a suitably regulated volume of steam, preferably superheated, admitted to the retort at such a height above the water as to insure their decomposition before reaching it. When pulverized carbon is introduced into the retort through the hopper E, steam sufficient for its gasification should be admitted over and above that required for the decomposition of the cyanides and the production of ammonia.

I do not bind or confine myself to the exact reaction or reactions or succession of reactions described, nor to the exact form or arrangement of the apparatus for it must be evident that the several details and reactions, and the exact order and succession of the same, as well as the form, construction and arrangement of the apparatus may be varied indefinitely.

I claim—

1. The process herein described of producing alkaline cyanides and ammonia by burning carbonaceous matter in a limited supply of air alone or air and steam mixed, producing a generator or producer gas, consisting, chiefly, of the oxides of carbon, and free nitrogen and hydrogen, causing said gas to meet and mingle with hydrocarbon gases or vapors, and the mixed gases and vapors to pass through a heated chamber and then bringing them into admixture with a pulverized mixture of alkali and an infusible substance, as carbon and moving or falling through the chamber in the same direction as the gases, causing the hydro-carbons to be decomposed by heat into simpler and elemental products and these to combine with the nitrogen and alkali producing alkali cyanides, ammonia, and fuel gases substantially as described.

2. In an apparatus for generating alkaline cyanides, the combination of the mixing or decomposing chamber H, retort C, means for supplying hydrocarbon and a pipe arranged to conduct the said hydrocarbon to the flue or chamber H, above the point where the latter communicates with the furnace, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

THOMAS B. FOGARTY.

Witnesses:
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