No. 767,289. PATENTED AUG. 9, 1904.

W. KIRKWOOD.

HYDROGEN GAS GENERATOR.

APPLICATION FILED NOV. 7, 1903.

NO MODEL.

Fig. 1.

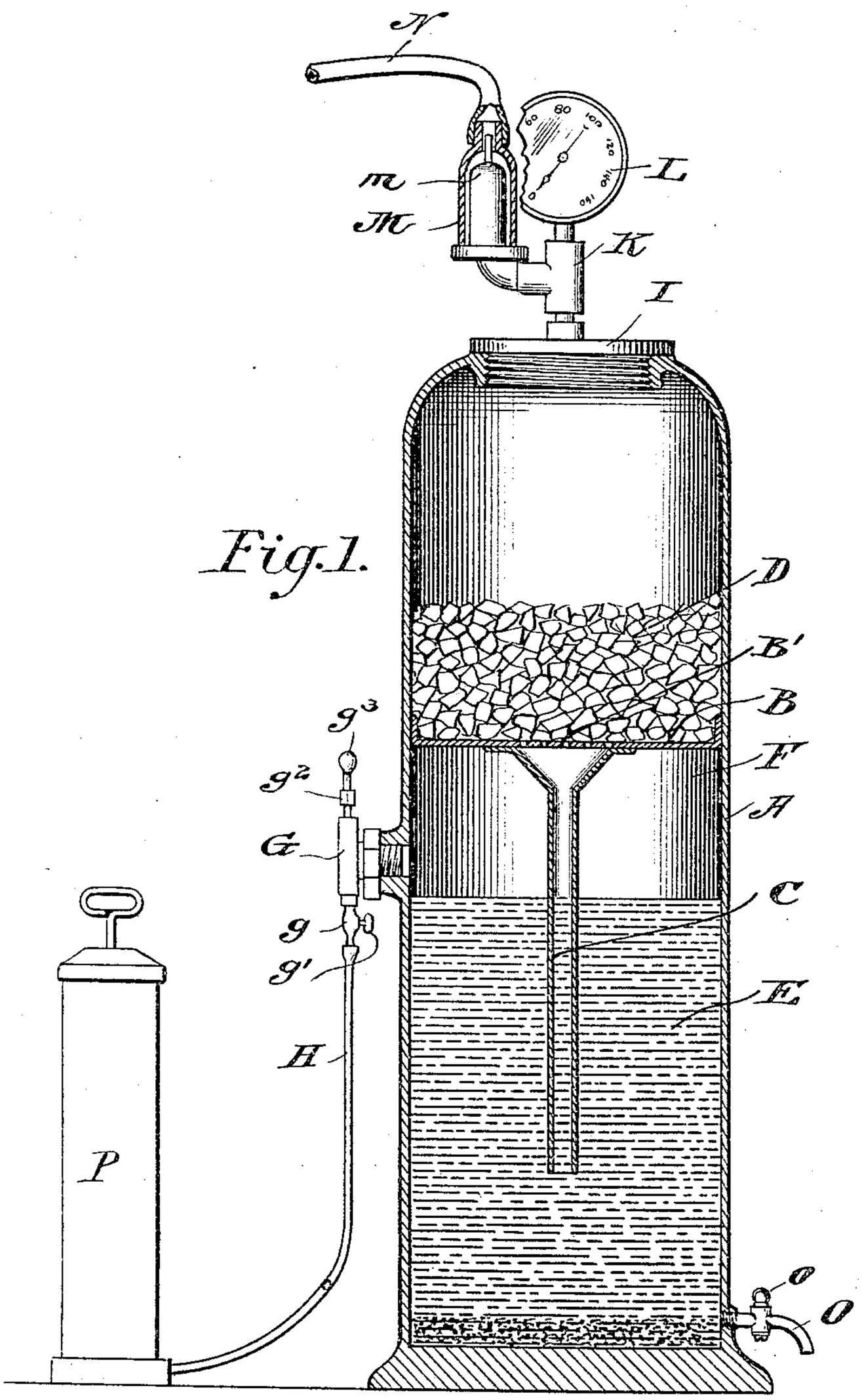
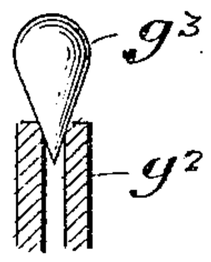


Fig. 2.



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No. 767,289. Patented August 9, 1904.

UNITED STATES PATENT OFFICE.

WILLIAM KIRKWOOD, OF CHICAGO, ILLINOIS.

HYDROGEN-GAS GENERATOR.

SPECIFICATION forming part of Letters Patent No. 767,289, dated August 9, 1904.

Application filed November 7, 1903. Serial No. 180,168. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM KIRKWOOD, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Gas-Generators, of which the following is a specification.

My invention relates to gas-generators, having reference more particularly to a portable type of generator of that class wherein an acid solution is introduced into the presence of a metallic body to act chemically thereon and generate and liberate a gas which may be used to supply burners for calcium lights, lead-burning, brazing, hard-soldering, and analogous purposes.

To these ends my invention as to its principal and essential features comprises a vessel composed of or lined with some substance capable of resisting the corrosive and destructive action of an acid solution and divided into two chambers, one to contain the metallic body or bodies and the other to contain the acid solution, with a communicating passage between the two, and means for applying pressure to the surface of the acid solution to force the latter into contact with the metal when it is desired to start the generation of the gas.

Other minor features of the invention will be fully explained in the detailed description of the invention when taken in connection with the accompanying drawings, which illustrate a preferred mechanical embodiment of the principle of the invention.

Figure 1 of the drawings is a vertical mid-section view through the main vessel or chamber of the apparatus with the several connections thereto and therefrom illustrated in elevation, partly broken out in section to disclose interior mechanism, and Fig. 2 being an enlarged detail view of the safety-valve.

Referring to the drawings, A designates an upright, preferably cylindrical, tank or vessel, which is preferably made of lead or other acid-resisting material. Interiorly of the tank and approximately midway thereof is secured a transverse partition or diaphragm B, which is solid excepting at the center thereof, where it is perforated, as shown at B′, for the purpose hereinafter described. Pendent from the under side of the diaphragm B and directly beneath the apertured portion thereof is a tube C, which extends downwardly and terminates at a point some distance above the base of the tank, as shown. The upper of the two chambers thus created by the partition B is designed to be partially or wholly filled with broken particles of zinc D or similar material which when acted upon by an acid solution, such as sulfuric acid, is capable of liberating a gas, the gas more particularly designed to be created by the present apparatus being hydrogen gas to be subsequently burned. The lower portion of the tank is designed to be filled to about the height indicated with a dilute sulfuric-acid solution, (indicated by E.) The space between the upper surface of the acid solution and the under side of the diaphragm B forms a compressed-air chamber F. Tapping the wall of the tank and leading into this compressed-air chamber is a threaded T-coupling G, the lower connection g of which has a cut-off valve g' and a hose connection H, leading to an air-pump P or other source of compressed air, while the upper connection g^2 of the T-coupling G has seated in its upper end a weighted safety-valve g^3, which may consist simply of an inverted lead bob with its pointed end inserted in the open upper end of the connection, as more particularly shown in the detail view Fig. 2.

The upper end of the tank has a screw-threaded closure I, rising from which is a T-coupling K, carrying at its upper end a pressure-gage L and having a lateral connection leading to a float-valve casing M, containing a float-valve m, adapted when raised to close the eduction-port from the upper end of said valve-casing, to which latter is connected a gas-delivery hose N, which may lead to a burner.

In operation the tank is charged with a dilute sulfuric-acid solution, which is preferably inserted by withdrawing the T-coupling G and pouring the acid in through the opening which receives said T-coupling. The upper chamber is charged through the opening in the upper end of the tank with broken pieces or scraps of zinc or other material, according to the particular gas to be generated. The closures G and I having been applied to the ves-

sel thus charged, when the device is to be used compressed air is forced through the hose H and coupling G into the air-chamber F, which body of compressed air in turn forces the acid solution up through the pipe C and the perforated portion of the diaphragm into the zinc-chamber, where the acid reacts chemically with the zinc, releasing pure hydrogen gas, which under its spontaneous pressure passes through the coupling K, around the float-valve *m*, and through the hose N to the burner-nozzle (not shown) or other instrument of its utilization. In order to maintain the continuous and uniform generation of hydrogen gas, it is necessary only to maintain a sufficient air-pressure in the compressed-air chamber to continuously force the acid solution up into the zinc-chamber. If the pressure of hydrogen gas in the zinc-chamber becomes at any time abnormal or dangerous, exceeding the pressure of air in the compressed-air chamber, the gas will descend through the tube C, bubble up through the acid solution, and mingling with the air find escape through the safety-valve g^3. The purpose of the float-valve *m*, located as described, is to prevent the possibility or danger of the sulfuric-acid solution under a too high air-pressure completely flooding the zinc-chamber and overflowing into the gas-discharge hose N, this float permitting the gas to pass therearound, but rising and closing the discharge-port of its casing under the presence of the liquid solution.

When it is desired to discontinue the use of the apparatus or to charge the same with zinc, the hose H is removed and the compressed-air chamber vented by opening the cock g', which obviously permits the acid in the zinc-chamber to flow back by gravity through the tube C into the acid-chamber, thus interrupting and checking the further generation of hydrogen. The purpose of terminating the tube C at some little distance above the base of the vessel is to provide for a limited space at the bottom of the vessel for the settling and accumulation of the zinc-sulfate crystals which form when the acid is partially spent and cooled, the zinc-sulfate crystals not interfering with or clogging the lower end of the tube.

o designates a faucet tapping the lower end of the vessel and provided with a stop-cock *o*, through which the spent acid solution may be withdrawn when necessary. The pressure-gage L affords a means of constant indication of the gas-pressure and the air-pressure existing at any time in the vessel.

From the foregoing it will be seen that the apparatus is capable of being charged with acid without interrupting the zinc in the zinc-chamber or admitting air into said chamber and also the zinc-chamber may be charged without disturbing the condition of the acid-chamber. The apparatus is exceedingly compact and self-contained and is of an easily portable nature, whereby it is especially adapted for use in connection with soldering and brazing operations wherein it may be necessary to apply the burner at different and more or less separated points or continuously over a considerable surface or linear extent.

The air-pressure employed to force the acid solution upwardly into contact with the gas-yielding solid also effects an important advantage in that it causes the gas to be delivered under a considerable pressure, which insures a steady and very hot flame.

I claim—

1. In a gas-generator, the combination with an upright vessel of substantially uniform diameter throughout and having an internal surface of acid-resisting metal and an apertured transverse partition dividing the same into an upper receptacle constituting a gas-generation chamber and a lower receptacle constituting in its lower part an acid-solution chamber and in its upper part a closed compressed-air chamber, of a tube secured to the apertured part of said partition and depending into said acid-solution chamber, a gas-discharge connection tapping said gas-generation chamber, a liquid-check valve in said connection, a compressed-air-inlet connection tapping said compressed-air chamber, and a safety-valve also communicating with said compressed-air chamber, substantially as described.

2. In a gas-generator, the combination with an upright vessel of substantially uniform diameter throughout and having an internal surface of acid-resisting metal and an apertured partition dividing the same into an upper receptacle constituting a gas-generation chamber and a lower receptacle constituting in its lower part an acid-solution chamber and in its upper part a closed compressed-air chamber, of a tube secured to the apertured part of said partition and depending through said compressed-air chamber into said acid-solution chamber and terminating at some distance above the bottom of the latter, a gas-discharge connection tapping said generation-chamber, a pressure-gage and a fluid-check valve on said gas-discharge connection, a compressed-air-inlet connection tapping said compressed-air chamber, and a safety-valve on said compressed-air-inlet connection, substantially as described.

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