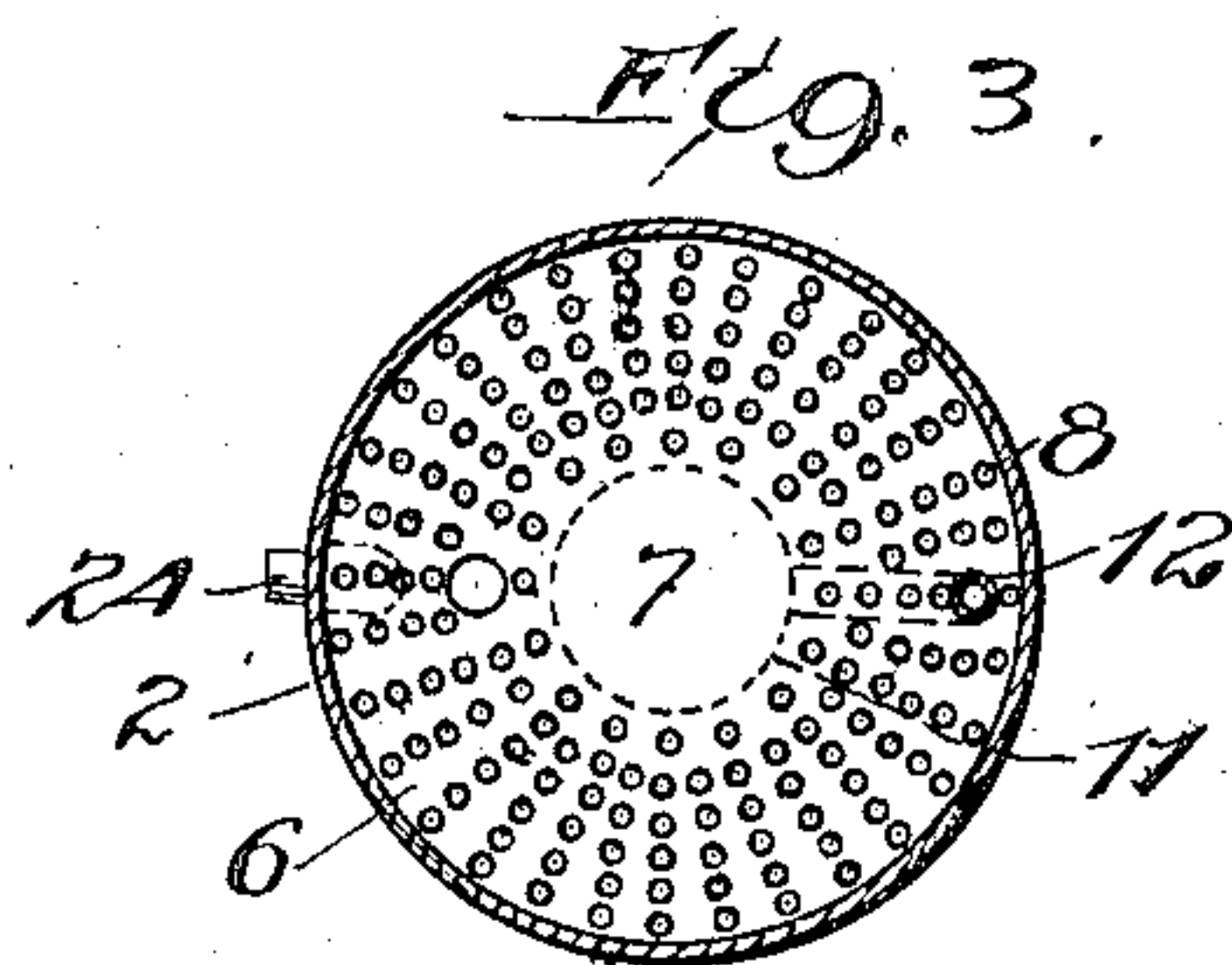
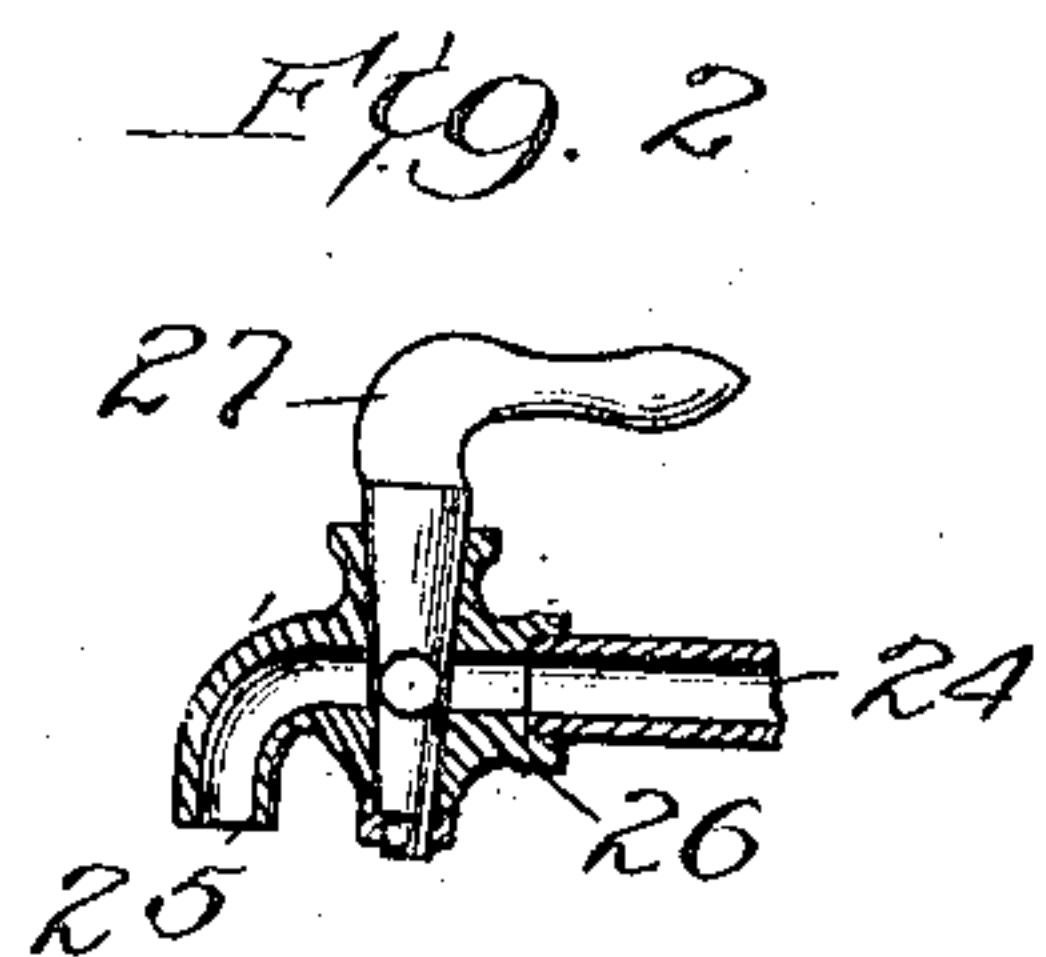
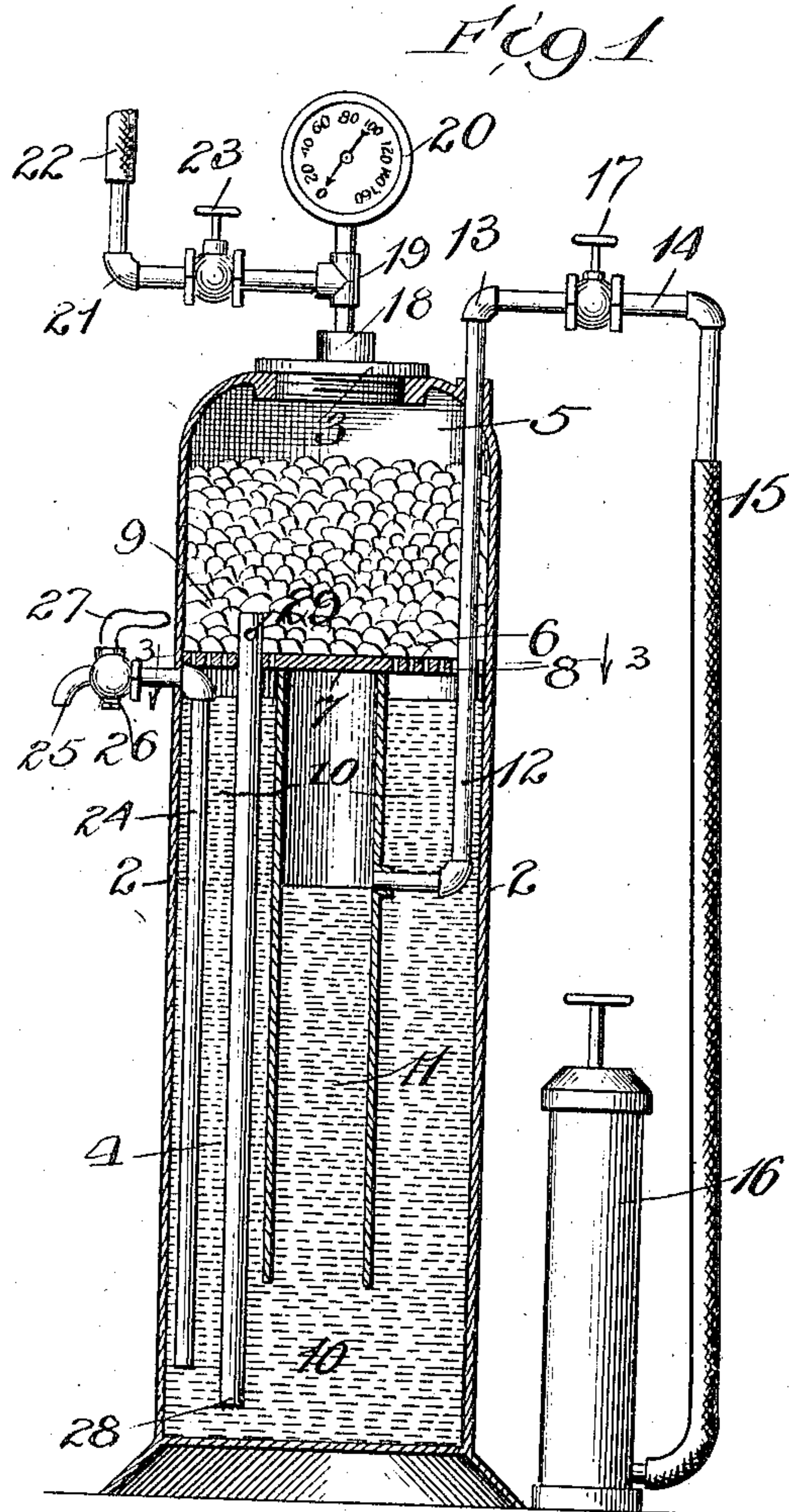


No. 875,186.

PATENTED DEC. 31, 1907.

W. KIRKWOOD.
GAS GENERATOR.
APPLICATION FILED MAY 20, 1907.



Witnesses;

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UNITED STATES PATENT OFFICE.

WILLIAM KIRKWOOD, OF CHICAGO, ILLINOIS.

GAS-GENERATOR.

No. 875,186.

Specification of Letters Patent.

Patented Dec. 31, 1907.

Application filed May 20, 1907. Serial No. 374,540.

To all whom it may concern:

Be it known that I, WILLIAM KIRKWOOD, a citizen of the United States, and resident of 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 full, clear, and exact specification.

My invention relates to gas generators and particularly that class which are portable and wherein an acid solution is introduced in 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 other analogous uses.

In generators heretofore employed, communication between the acid chamber and the gas generating chamber has been solely by means of a pipe projecting through an air compression chamber into the liquid of the acid chamber to such a point below the surface of the acid solution, that the volume of such solution above the free end of this pipe is greater than the capacity of the generating chamber therefor, with the result that the generating chamber is entirely discharged of its gas and the acid solution overflows into the discharging-hose. Furthermore in such structures, the spent acid solution in the generating chamber is stagnant with reference to the acid solution in the acid reservoir so long as the supply from the latter thereto is continuous, and until the pressure of the gas exceeds that of the air pressure and the spent acid is thereby forced through the pipe connection into the acid reservoir and followed by the gas, which rising up from the reservoir, acid-solution is discharged out of the air compression chamber through the relief-valve in the air supply passage thereto.

The prime object of my invention is to provide during the generation of gas, for a continuous circulation of the acid solution through the gas generating chamber, the materials therein and the reservoir solution.

Further objects of my invention are to provide means automatically preventing spent acid in the gas generating chamber from entering the gas discharge pipes or passage therefrom; and also for automatically preventing a pressure of the gas in excess of the air pressure and to thereby dispense with any necessity for a relief in the supply passage to the air compression chamber.

A further object of my invention is to re-

duce the size of the gas generating apparatus and accordingly the weight, size, and cost of the apparatus as a whole without reducing in volume the generation of gas therein.

With these ends in view, my invention consists in certain features of novelty in the construction, combination and arrangement of parts, by which the said objects and certain other objects hereinafter appearing are attained, all as fully described with reference to the accompanying drawings, and more particularly pointed out in the claims.

In the said drawings: Figure 1 illustrates in longitudinal vertical section, a gas generating apparatus embodying my invention, Fig. 2, a sectional view showing the internal construction of the pet-cocks used in connection therewith, and Fig. 3, a transverse section on the line 3—3 of Fig. 1.

Similar characters of reference indicate the same parts in the figures of the drawings.

2 designates an upright tank or vessel which may be of any form but is preferably cylindrical and either lined with or composed of lead or other acid resisting material, which tank is provided with a filling opening closed by a screw-threaded cover 3, the tank being divided into an acid reservoir 4 and gas generating chamber 5 by a plate or other form of diaphragm 6 having a closed portion 7 surrounded by a series of perforations 8, which perforations are of sufficient size and numbers for a free and rapid circulation of the acid solution and spent acids therethrough, but small enough to prevent the solid gas generating substance 9 supported thereon from dropping into the solution 10 in the reservoir 4.

Opposing and suspended beneath the closed portion 7 of the diaphragm 6 by any suitable means, as for example by burning to the diaphragm, is a tube 11 closed at its upper end and open at its lower end, which tube projects downwardly into the liquid for about three-fourths of its depth, and has at a point about one-third its length from its closed end, an opening into which is burned an air-supply pipe 12.

The air-supply pipe 12 has a short horizontal portion extending well towards the side of the receptacle whence it projects upwardly through the diaphragm and the top of the receptacle and at its outer end by a coupling 13 is connected with a pipe 14 to the end of which is coupled a rubber hose 15 connected with a force-pump 16 or other

source of supply for compressed air, the pipe 14 being provided with a cock 17 for controlling the supply of air to the tube 11.

Opening into the gas generating chamber 5 is a discharge pipe 18 on which is a three-way coupling 19 by which a pressure-gage 20 is connected and also a pipe 21, which forms an extension of the discharge passage, to which pipe is coupled a hose 22 for convenience in conducting the discharged gas to its destination for use, the pipe 21 being provided with a cock 23 for turning off and on, and regulating the supply of gas through the hose.

15 Projecting through the side of the receptacle and in a plane between the normal level of the acid solution and the diaphragm 6, is a pipe 24, the inner end of which extends downwardly through the liquid to a point a short distance above the bottom of the receptacle.

To the outer end of the pipe 24 is secured a nipple 25 by means of a coupling 26 in which is a valve 27.

25 In operation the cover 3 is removed and the acid is first introduced into the reservoir until a normal level thereof is but a short distance below the diaphragm 6, which level when reached is indicated by the overflow 30 of the solution from the pipe 24, the valve 27 of which for the time being is left open for this purpose, but the rise of the liquid in the tube 11 will cease the moment it rises above the opening in the air-supply pipe 12 or as soon thereafter as the pressure of the column of solution above that level ceases to further compress the air in the air chamber of the tube. When the proper amount of acid solution has been introduced, the valve 27 is closed and after the desired amount of zinc or other solid gas producing material is introduced into the gas generating chamber, the cover 3 is screwed to place, and air is forced into the tube 11 through the pipe 12 45 from the air-pump 16 or other suitable source until the acid solution has been forced out of the tube and the level of the solution in the reservoir raised until the solid materials, which nearly fill the gas generating 50 chamber, are entirely submerged.

The chemical action of the acid solution upon the metallic substance charges the solution with the salt of that substance, and therefore increases its specific gravity, with the result that the charged solution will descend through the solution in the reservoir and thereby maintain a continuous circulation from one chamber to the other, notwithstanding that the solution in the upper part 60 of the receptacle is hot as compared with that at its lower end, and that a heated liquid descends through a cooler liquid, and this circulation will continue quite rapidly until the acid becomes spent and which it 65 does much more quickly than when any por-

tion of the acid solution is stagnant, as it is in prior structures, and with the result that a more rapid generation of gas is obtained.

As soon as the proper amount of air has been forced into the tube 11 to drive the acid 70 solution therefrom and submerge the metallic substance in the gas chamber, the cock 17 is closed and if there is immediate use for the gas, the cock 23 is opened, but otherwise the materials in the gas generating chamber remain submerged until the pressure of the gas exceeds that of the air, when this gas pressure will immediately commence forcing the solution out of the metallic substances and into the tube 11 until by the opposing air 80 pressure in the tube a uniform pressure is established throughout the receptacle, and if no gas is being used, this excess of pressure will continue until all of the liquid is forced not only out of the materials, but to the 85 level below the plate 6 which is the level the acid solution is indicated to have when no generation of gas is desired, or can occur except possibly so much as may be due for a few moments to acids still remaining in the 90 metallic substances. When however the cock 23 is opened and the gas begins to discharge from the pipe 21 into the hose 22, the pressure of the gas will be reduced and when so reduced below the pressure of the air in 95 the tube 11, the solution will again rise into the metal substances and the generation of gas continue as before described.

By my invention the tube 11 not only provides for measurably filling and fixing the 100 water level below the upper end of the gas generating chamber at a fixed and unvarying level therein, but a means by which the generation of gas is automatically suspended before there is any pressure thereof liable to explode the receptacle or any of the pipes therefor, and this in the entire absence of the necessity of relief-valves of any kind or at any point.

In practice as soon as the pressure of air 110 supplied to the tube 11 is sufficient to discharge all of the liquid therein and submerge the metallic substances, the cock 17 is closed and maintained closed until the generation of gas ceases or the materials are neutralized, 115 whereupon the cocks 17 and 27 are opened and a further supply of air is forced into the receptacle until the acid solution therein is discharged out of the receptacle through the pipe 24, after which time the cover may be 120 removed, and the diaphragm 6 cleansed of any salts that may be adhering thereto.

For the purposes of promoting the rapidity of the circulation of the acid solution and in order to conduct the heavy liquid directly to 125 the bottom of the reservoir before mixing with the lighter solution, there may be employed one or more pipes 28 projecting a short distance above the plate 6 and to a point near the bottom of the reservoir.

The pipe 28 may have both its ends open but in practice the upper end is closed and the pipe provided with side openings as indicated at 29 to better exclude the solid substance from entering and clogging the passage for the liquid. By this pipe connection between the generating chamber and the reservoir, the solution passing through the pipe is so much heavier than that below the lower end of the pipe, that the rapidity of circulation throughout both the reservoir and the gas generating chamber is correspondingly increased.

Having described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a gas generator apparatus, the combination of a liquid-holding reservoir, a gas-generating chamber, means for supporting gas producing solids in said generating chamber, means maintaining a continuous return circulation of the liquid throughout said reservoir and chamber, and means whereby an excess of pressure of gas is automatically neutralized by an opposing pressure of air, substantially as described.

2. In a gas generator apparatus, the combination of a liquid-holding reservoir, a gas-generating chamber, a separating diaphragm therefor provided with perforations in open communication with said reservoir and chamber and adapted to support solid substances, and means whereby air under pressure is utilized to move the surface of the main body of the liquid upward to contact with said substances, substantially as described.

3. In a gas-generator apparatus, the combination of a liquid-holding reservoir, a gas-generating chamber, a separating diaphragm provided with perforations in open communication with said reservoir and chamber, and supporting solid substances, a tube closed at one end, submerged in said liquid, and provided with an air chamber in the upper part

thereof, and means supplying air under pressure to said tube at or towards the lower end of said air chamber, whereby liquids entering said tube are forced therefrom and the normal level of the liquid in the reservoir is shifted to a point submerging said solid substances but not above the upper end of the gas-chamber.

4. In a gas-generator apparatus, the combination of a liquid-holding reservoir, a gas-generating chamber, a pipe in and extending well towards the bottom of said reservoir provided with a discharge opening in a plane with the normal level of the liquid in said reservoir, means for opening and closing said opening, whereby in filling the reservoir, the normal level of the liquid is automatically indicated by its discharge out of said pipe, and means for supplying air under pressure to the reservoir whereby the reservoir may be substantially discharged of its liquid contents by air pressure above atmospheric pressure, substantially as described.

5. In a gas generator-apparatus, the combination of a liquid holding reservoir, a gas-generating chamber, a separating diaphragm therefor provided with perforations, a tube located below the diaphragm closed at its upper end, means for supplying air thereto, and a pipe open at both ends and projecting therefrom into the liquid of the reservoir and above the diaphragm and forming a passage, whereby heavy liquid is conducted directly from the generating-chamber to near the bottom of the reservoir before mixing with the contents of the reservoir.

In witness whereof, I have hereunto set my hand and affixed my seal, this 15th day of May A. D. 1907.

WILLIAM KIRKWOOD. [L. S.]

Witnesses:

M. S. REEDER,
JNO. G. ELLIOTT.