P. A. EMANUEL.

GAS BATTERY.

APPLICATION FILED MAY 15, 1920.

1,359,881. **Patented Nov. 23, 1920.**

2 SHEETS—SHEET 1.

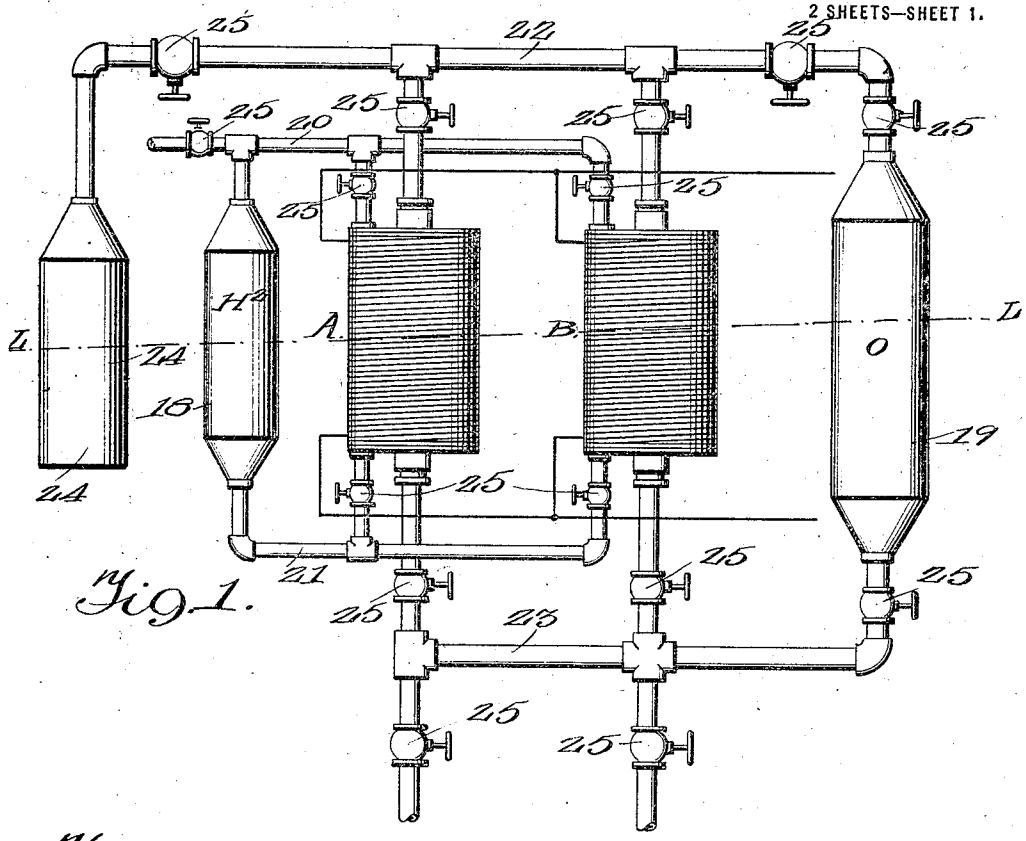


Fig. 1.

Fig. 4.

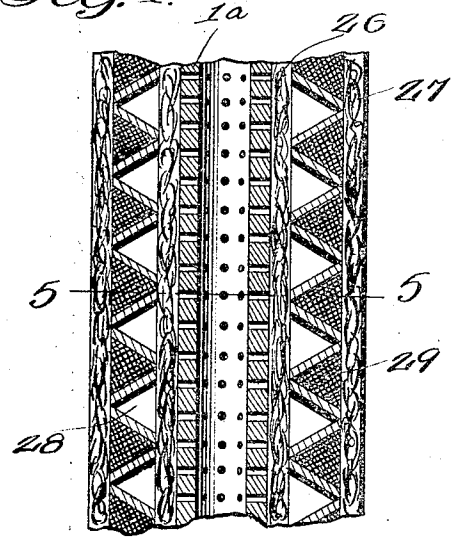
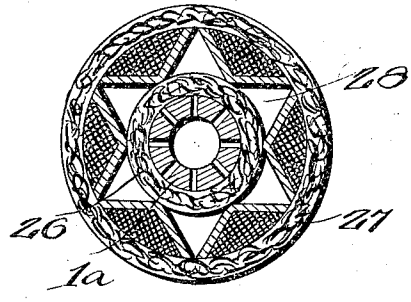


Fig. 5.



WITNESSES

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2 SHEETS—SHEET 2.

Fig. 2.

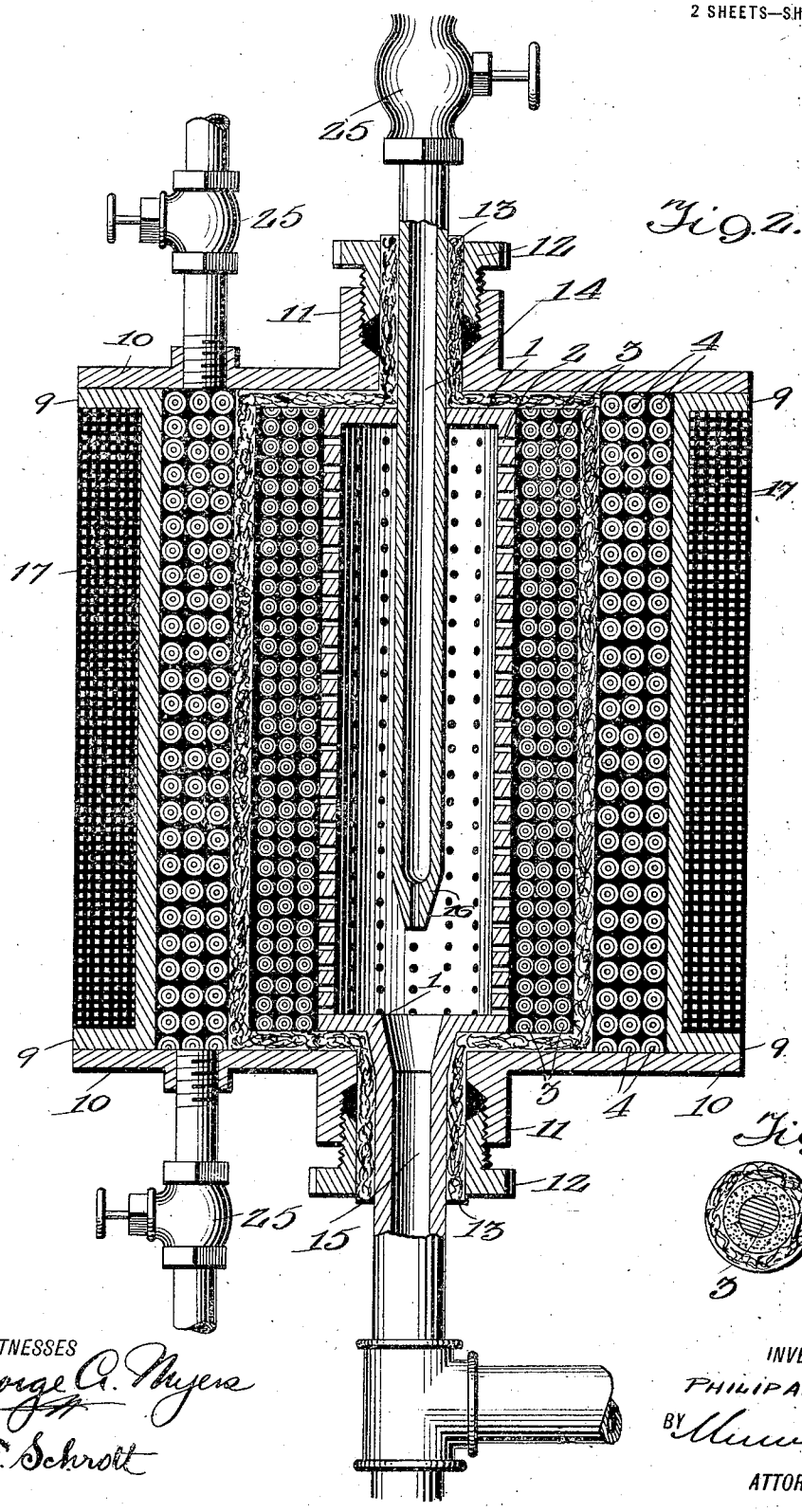


Fig. 3.

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GAS-BATTERY.

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To all whom it may concern:

Be it known that I, PHILIP ALBERT EMANUEL, a citizen of the United States, and a resident of Aiken, in the county of Aiken and State of South Carolina, have invented certain new and useful Improvements in Gas-Batteries, of which the following is a specification.

My invention relates to improvements in gas batteries, and it consists in the constructions, combinations and arrangements herein described and claimed.

One of the foremost objects of the invention is to provide an improvement on the Grove gas battery, the principal departure being that the platinum electrodes of the Grove cell are displaced or substituted by electrodes of an entirely different and cheaper material.

A further object of the invention is to provide an improved gas battery, based on the principle of the Grove battery, but embodying means by which the water which forms at the cathode is disposed of as rapidly as it is formed, thereby rendering the operation of the battery continuous and avoiding the ultimate "choking" which occurs in the Grove battery by the water gradually rising around the cathode.

A further object of the invention is to provide a gas cell having a specially prepared iron anode and cathode, suitably separated to segregate the dissimilar electrolytes in which the two electrodes are respectively immersed.

A furtner object of the invention is to provide an improved gas cell wherein alternating currents of high potential are induced in a helix surrounding the low potential alternating current producing elements.

Other objects and advantages will appear in the following specification, reference being had to the accompanying drawings, in which:—

Figure 1 is a diagram illustrating the arrangement of a plurality of the herein disclosed improved gas cells composing a battery more fully described below,

Fig. 2 is a detail section of one of the cells,

Fig. 3 is a detail enlarged section of the iron wire employed in winding the oxygen and hydrogen electrodes,

Fig. 4 is a detail section of a modified construction in the oxygen electrodes, and

Fig. 5 is a detail cross section on the line 5—5 of Fig. 4.

The general construction of the cell in Fig. 2 is first described, this description being followed by that of the entire battery, the chemical action taking place in one of the cells, and the advantages gained by using the particular material herein employed. The hollow cylinder 1, made of iron or other suitable material and perforated by a great number of small holes 2, constitutes the foundation on which the iron wire 3 of the oxygen electrode of the cell is wound.

This wire 3 of the oxygen electrode, as well as the iron wire 4 of the hydrogen electrode, is of a special formation as particularly illustrated in Fig. 3. Here the iron wire is illustrated as being coated with a layer of iron oxid 5, this in turn having an asbestos covering 6 serving the dual function of insulating one wire layer from the other and assisting in keeping the iron oxid on the iron wire core.

The oxygen electrode, which it may be here stated is the anode of the cell, is completely inclosed by an asbestos or other jacket 7 on which the iron wires 4 of the hydrogen electrode are wound as clearly shown in Fig. 2. This wire is the cathode of the cell.

Both elements of the cell are securely fitted in the casing 8, which is flanged at 9 at both ends, so that the upper and lower covers 10 may be securely bolted or otherwise fitted in place so as to form a gas-tight inclosure. Bosses 11 on the upper and lower covers, have packing glands 12 by means of which gas-tight joints may be maintained around the sleeve 13 of the asbestos jacket 7, which sleeve respectively surrounds the jet 14, entering at the top, and the vent 15 extending from the bottom of the perforated cylinder 1.

The jet 14 is welded in place in the aperture in the upper wall of the cylinder 1, the vent 15 being similarly welded at the outlet of the cylinder. It is to be observed that the jet 14 terminates in a nozzle 16, the purpose of which is to direct a fine but extremely powerful stream of air into the vent 15.

This moving stream of air, as will become even more fully apparent from the description below, serves to carry out the water which tends to collect at the bottom of the cylinder 1 by virtue of the chemical action taking place within the cell. It is here that the distinguishing feature of this cell over the Grove cell should be emphasized. As is well known, the Grove cell operates on the principle of condensing gases and platinum electrodes in such a manner that a flow of electric current is obtained. It is unnecessary to describe the action of the Grove cell in detail, it being sufficient to say that water is formed so rapidly around the negative pole or cathode, that all of the gas is caused to soon disappear and therefore require recharging of the cell from an independent source.

This contingency, namely, the rising of a column of water to take the place of the gas, can never occur in the herein disclosed cell, because, as just stated, the water is carried away as soon as it is formed, by the rapidly moving stream of air from the jet 14.

A suitably insulated copper wire 17 is wound on the casing 8 so as to fill the space defined by the flanges 9, substantially as shown in Fig. 2. This copper wire coil has no connection with the iron wire coils on the inside. It is intended that the chemical action taking place on the inside of the cell shall produce low potential alternating current which will induce alternating currents of high potential in the helix 17, that current of course being led off to be used as may be desired.

The gas battery in Fig. 1 is shown to consist of two of the improved gas cells A, B, but of course it is obvious to the reader that as many of the cells may be employed in connection with each other, as may be desired. At one side there is a suitable container 18 of hydrogen gas, while on the other side there is a similarly suitable container 19 of oxygen gas. End connections 20, 21 and 22, 23 respectively offer communication between the tops and bottoms of the two containers and cells, as clearly shown. The connections 20, 21 communicate with the hydrogen electrodes of the cell, while the connections 22, 23 communicate with the oxygen electrodes through the jets 14.

A container 24 of compressed air, has connection with the pipe 22, which as has already been seen, is common to the container 19 and jets 14 of both cells. All pipe connections have valves 25 of either the globe or back-check types.

A modification in the construction of the oxygen electrode is illustrated in Fig. 4. Here the jet 14 in Fig. 2 is omitted, the perforated cylinder 1^a being of considerable lesser diameter than the perforated cylinder 1 in Fig. 2. An asbestos sleeve 26 is applied directly to the cylinder 1^a, another asbestos sleeve 27 being concentrically rotated in respect to the first sleeve as clearly shown in Fig. 5.

Superposed series of radiating cones 28 are placed in the space between the two asbestos sleeves, the remaining space being filled with iron oxid 29. The reader can readily see that all of the elements of the principal construction are embodied in the modified construction in Fig. 4, even though the arrangement is materially different. It is conceivable that even other modifications may be carried out without departing from the use of the proposed material hereinbefore specified.

The chemical action taking place within the cell in Fig. 2, should now be carefully followed. Water is first separated by electrolysis into its constituent elements hydrogen and oxygen, both gases being compressed and stored in the containers 18 and 19. These gases are re-united in the improved gas cell but the reunion causes no explosion but are prevented from so doing, by the porous asbestos jacket 7 which forms the weld between the two compartments into which the gases are respectively discharged.

It is proposed that any one of a number of different electrolytes may be employed in the cell. For example, an electrolyte composed of a solution of alkali 2NaOH is poured in until the level indicated LL in Fig. 1 is approximately reached. Upon opening the proper valve 25, the gases in the respective container 18 and 19 force the electrolyte through the lowermost connections 21 and 23 and upwardly in the cells, saturating the asbestos wire coverings up to the covers of the cells.

An electric current from a charging dynamo may initially be passed through the electrolyte in alternately opposite directions, to convert the iron oxid covering on the wire of one of the electrodes, into pure iron, this being identical in principle to the manner in charging the ordinary lead storage cell. The subsequent action of the electrolyte on the dissimilar materials which compose the two electrodes, sets up a flow of current at low voltage in the coils of the respective electrodes, and thereby inducing a current to flow in the copper helix 17, which current will be of a much higher voltage.

It depends mainly on the type of electrolyte employed, whether large or small amounts of water will collect at the bottom of the perforated cylinder 1. Of course any accumulation of water will tend to run out by gravity, but instances may occur wherein water forms so rapidly that it may be found desirable to turn on the compressed air from the container 24 to

eject the water at the vent 15. Ordinarily, the compressed air is not employed in the operation of a cell, but when it is employed, the supply of oxygen from the container 19 is diminished by suitably regulating the intervening valve, the oxygen and nitrogen constituents of the air then forming their own chemical combinations within the cell.

The advantages may be briefly summarized. It is regarded as being very important to point out that the union of the hydrogen and oxygen gases in the liquid or electrolyte of the cell, is accomplished with the production of little or no heat. Much depends upon the speed at which the gases are admitted into the cell.

If admitted at comparatively low speeds, the chemical combinations take place gradually so that a flow of electric current is established in the manner described above, by virtue of the chemical action which takes place. On the contrary, if the gases are admitted at high speed, a motive fluid will be created, which fluid can be led off to operate some suitable type of engine for example, a turbine.

It is important that the compressed air jet 14 be directed downwardly within the cell. When compressed air is employed, its motion tends to create a partial vacuum at the top of the cell, and thereby induce the hydrogen to enter and permeate the saturated asbestos coverings of the coils in the cathode electrode and reach either the metal or its oxid thereunder. The hydrogen gas also assists in cooling the cell, thereby making the apparatus extremely valuable for use in dirigible ballooning.

While the construction and arrangement of the improved gas cell as herein described and claimed, is that of a generally preferred form, obviously modifications and changes may be made without departing from the spirit of the invention or the scope of the claims.

I claim:—

1. A gas cell, comprising an anode and a cathode immersed in an electrolyte, and means for disposing of any water formed by chemical action between the above elements.

2. A gas cell, comprising an anode and a cathode immersed in an electrolyte, and means for dispelling any water as rapidly as it is formed by the chemical action between the above elements.

3. A gas cell, comprising a separated anode and cathode, both immersed in one electrolyte; and means for introducing gases of dissimilar natures to the respective electrodes.

4. A gas cell, comprising a separated anode and cathode, both immersed in one electrolyte; means for introducing gases of dissimilar natures to the respective electrodes, and means for disposing of any water produced by the chemical action within the cell.

5. A gas cell, comprising an anode and a cathode, respectively consisting of a metal and its oxid, with means separating one from the other, both being immersed in a common electrolyte; means for introducing dissimilar gases to the respective electrodes, and means, including a helix, in which an electric current is induced by the flowing currents engendered by the chemical action within the cell.

6. A gas cell, comprising an anode and a cathode, respectively consisting of a winding with the pure metal exposed and a winding with the oxid of the same metal exposed, a porous partition separating the electrodes, a porous covering for the respective electrodes, all being immersed in a common electrolyte; and means for introducing dissimilar gases to the respective electrodes to produce chemical changes alternating between the electrodes and consequently setting up electric current in the electrodes, flowing in alternately opposite directions.

7. A gas cell, comprising an anode and a cathode, respectively consisting of a winding with the pure metal exposed and a winding with the oxid of the same metal exposed, a porous partition separating the electrodes, a porous covering for the respective electrodes, all being immersed in a common electrolyte; means for introducing dissimilar gases to the respective electrodes to produce chemical changes alternating between the electrodes and consequently setting up electric current in the electrodes, flowing in alternately opposite directions, and a surrounding helix in which alternating currents of high potential are induced by the aforesaid currents within the cell.

8. The combination in a gas cell, of a casing, positive and negative electrodes contained thereby, separated by a porous partition, each having a porous covering; and containers of dissimilar gases in communication with the respective electrodes and also containing a common electrolyte, the pressures of the gases causing the electrolyte to permeate the partition and said coverings to the top of the casing.

9. A gas cell, comprising a perforated cylinder, with a jet at the inlet directed toward a vent at the outlet; a porous partition spaced from the cylinder, and a casing spaced from the partition; electrodes disposed on the cylinder and partition respectively, one having a coating of the metal in its pure state and the other a coating of the oxid of the same metal, each having a porous covering; a container of one gas having top and bottom communication with the outer electrode, a container of another gas having top and bottom communication with the inner electrodes through the jet and vent, a

common electrolyte standing at a substantially normal level in the containers and electrode compartments, the gas pressures forcing the electrolyte upwardly to permeate the partition and said porous covering to the top of the casing, alternating electric currents being set up in the respective electrodes by virtue of the chemical action; and a helix surrounding the casing, in which alternating electric currents are induced by the flow of current within the cell.

10. In a cell, an electrode composed of a metal core, with a coating on the outside of that metal, susceptible to conversion to the metal in its true state; and a porous covering serving as insulation and means to retain said coating.

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