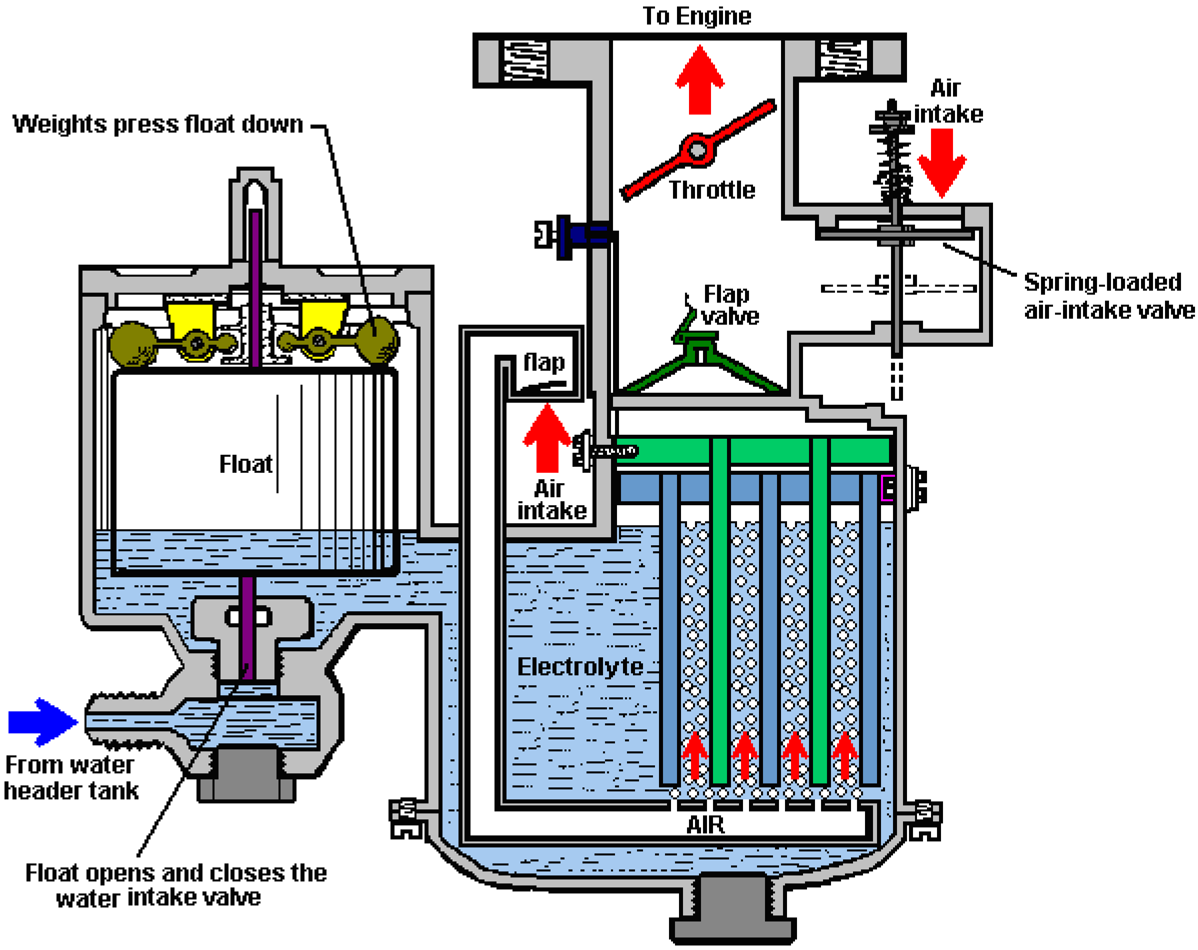
# The Electrolysers of Charles Garrett and Archie Blue

Here are two electrolysers which could run cars on water alone. Charles Garrett was granted US Patent 2,006,676 on 2nd July 1935 in which he shows some impressive details. Firstly, he generated an extra electrical supply by fitting a second (6 volt) alternator to his car. While the drawing shows the applied voltage swapping over in polarity, this was not done rapidly, just occasionally to even up any deterioration of the electrodes.

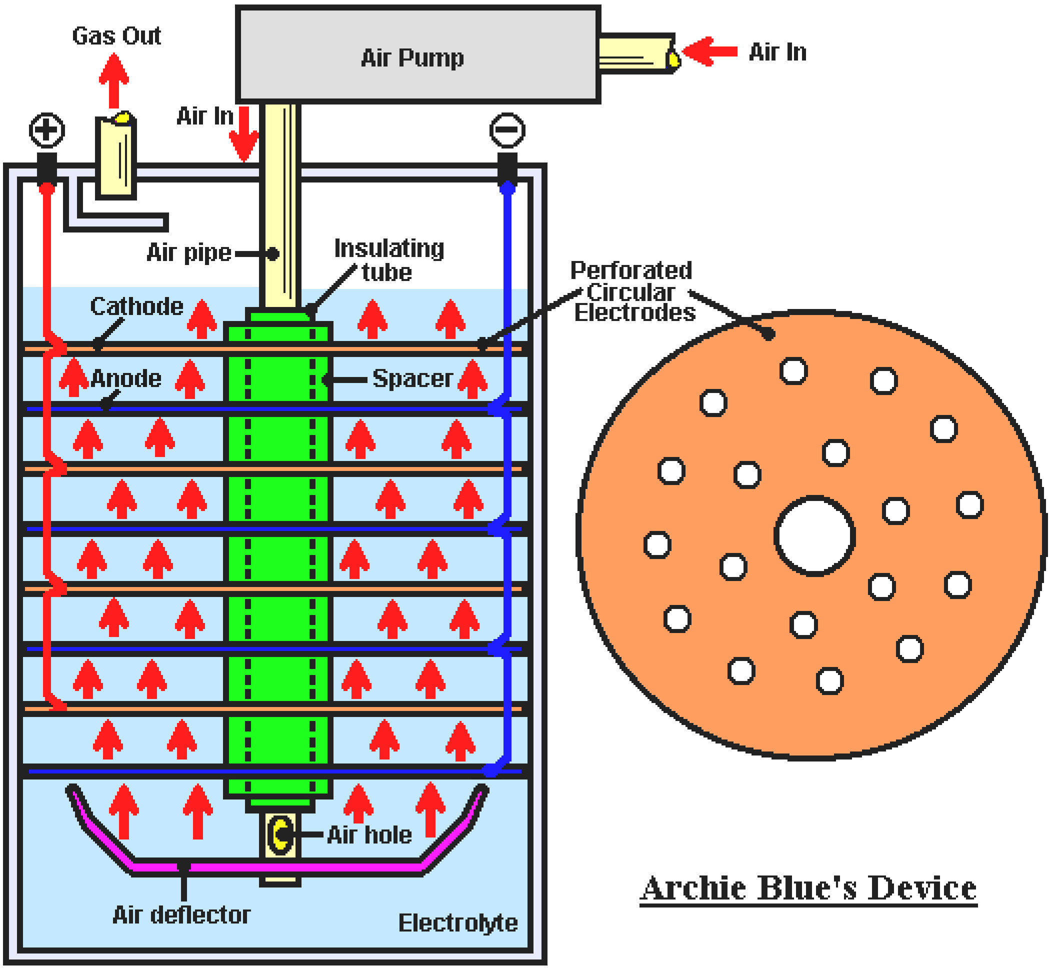



Charles maintained the water level in the electrolysis chamber with a neat carburettor-style float and pin valve arrangement. He improved the electrolysis by introducing a perforated tube below the electrode plates which allows the engine to suck air up past the plates. This cools the electrolyte (water with a few drops of hydrochloric acid) introduces water vapour to the gas mix and dislodges any bubbles on the plates, without the need for any extra mechanical device. Considering that he did this seventy-five years ago, it is an impressive piece of work. Please note that while only five electrode plates are shown in the diagram, in reality it is probable that many such plates were used.

One point which should be noted is that the cars of that time had very much smaller capacity engines and so they will have needed far less HHO gas mixture in order to run adequately.

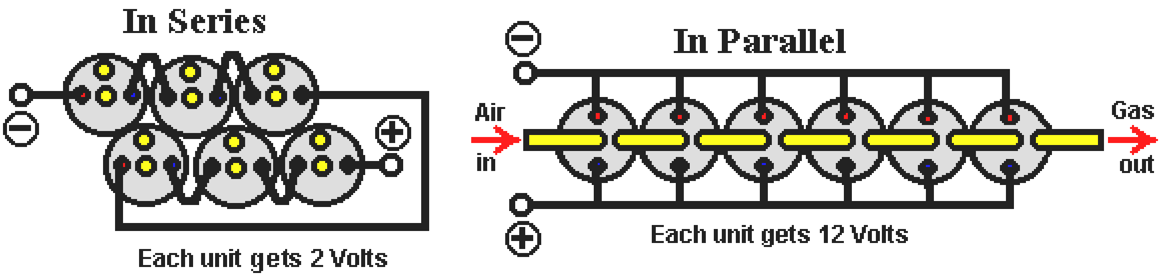
## The Archie Blue Electrolyser.

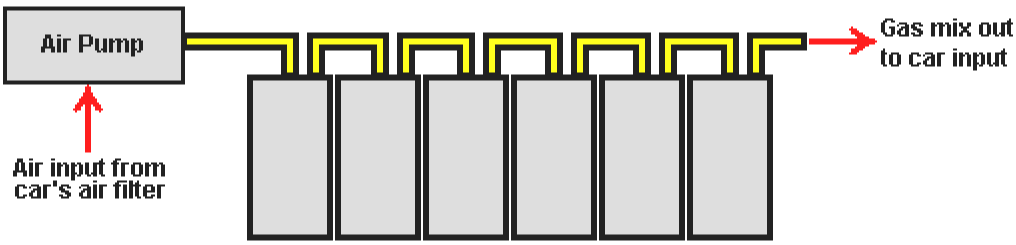
More than fifty years after Charles Garrett was granted his patent, another one 4,124,463 was granted to Archie Blue. The equipment described in the two patents operates in more or less the same way. Archie's equipment is very simple to construct and uses straight electrolysis with no attempt at pulsing the electrical supply. Like Charles Garrett, Archie Blue claimed to have run a car on water alone, using his electrolyser design, which is shown here:




With this unit, air is sucked out of the exit pipe by the vehicle engine, while being pumped into the electrolyser by an air pump. The air flows down through the central pipe and is forced up through the non-aligned holes in the electrode plates, causing turbulence and probably, the formation of water-gas clusters. The air bubbles also stir the electrolyte into vigorous motion, dislodging the hydrogen and oxygen bubbles which form on the plates as a result of the electrolysis current flow through the electrolyte.

It is said that six of these electrolysis units are sufficient to run a car using just water as the fuel. It has been stated that electrolysis of water is optimum at 1.5 Volts, so it might be more efficient to connect the units in series where each units receives 2 Volts rather than in parallel where each unit receives 12 Volts (unless, of course, the heating caused by connecting them in parallel is a factor in the very high efficiency of Archie Blue's system):




The air connection is the same for either method of wiring the cells. If wired in series, the voltage drop across each cell may not be the same although they were constructed in an identical fashion.

Please bear in mind that should you modify a vehicle to run on hydrogen, either as an additive or as a replacement for petrol, you need to clear it with your insurance company before using it on a public road, otherwise, you will be driving without insurance since any alteration to the vehicle automatically invalidates the insurance if the insurer is not notified and agrees the change. You may, of course, modify any stationary engine or any vehicle which you only run on private property. In the USA, the oil companies have influenced the local courts to such a degree that in some States, it is an offence to "run a vehicle on a non-approved fuel".

In passing, you may be interested to hear that I have been told that the Prohibition era in America had nothing at all to do with people drinking alcohol. The reality was that in the early days, Henry Ford was going to have his Model-T car running fuel-less by using a Nikola Tesla designed magneto system and an electric engine, but he was pressured into using an internal combustion engine to burn the gasoline which was an unwanted component of the local oil industry. This caused a problem for people on long journeys as there were very few gasoline filling stations at that time. To overcome the problem, the early cars were set up so that they could run on either gasoline or on alcohol produced by some 50,000 farmers scattered around the country. When the oil industry discovered how profitable it was selling gasoline, they opened many gasoline filling stations. They then wanted to exclude the farmers and have all of the profits for themselves and so Prohibition was introduced, not to stop people drinking alcohol (although that was the pretext), but in reality, to shut down the 50,000 alcohol stills which were their competition. When the stills were gone, then Prohibition was dropped as it had achieved it's goal of a vehicle fuel monopoly.

The patents of Charles Garrett and Archie Blue are attached below.

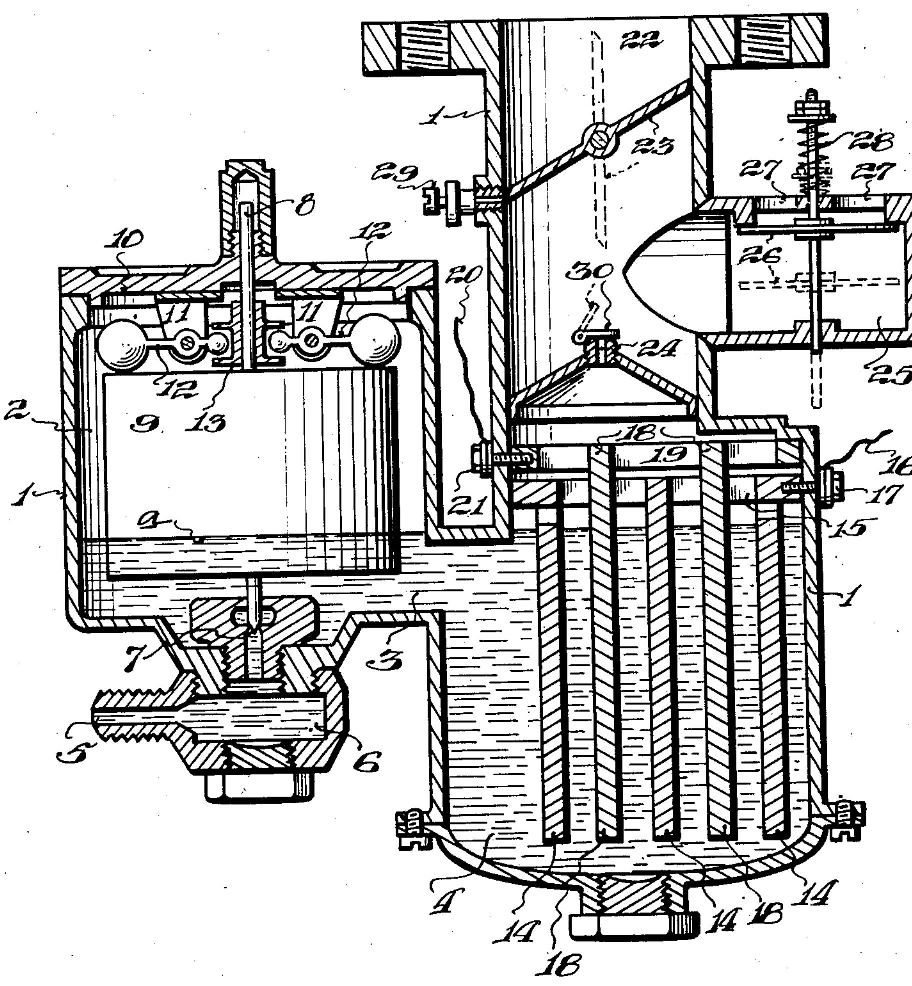
Patrick Kelly
http://www.free-energy-info.com
http://www.free-energy-info.co.uk

July 2, 1935. C. H. GARRETT 2,006,676

ELECTROLYTIC CARBURETOR

Original Filed July 1, 1932 2 Sheets-Sheet 1

FIG. 1.




Charles H. Garrett
INVENTOR

BY [signature]
ATTORNEY

ELECTROLYTIC CARBURETOR

Original Filed July 1, 1932 2 Sheets-Sheet 2

FIG. 2.

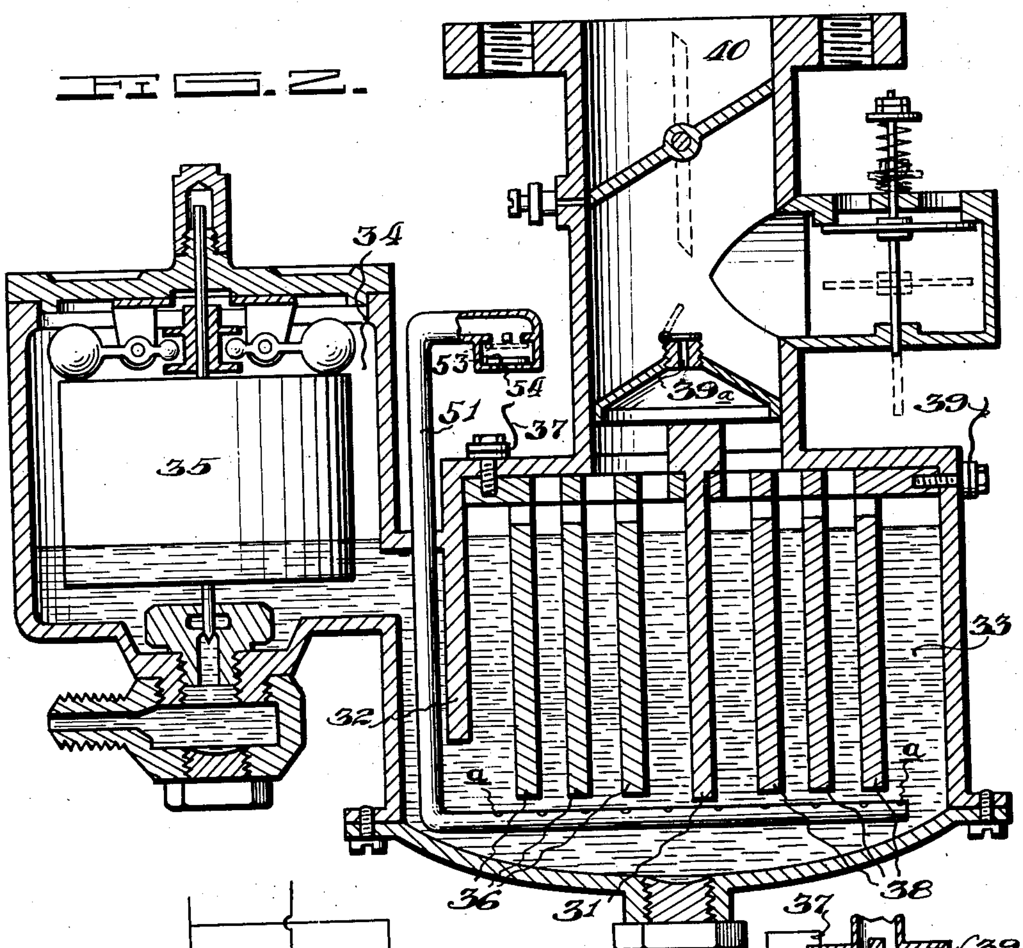



FIG. 3.

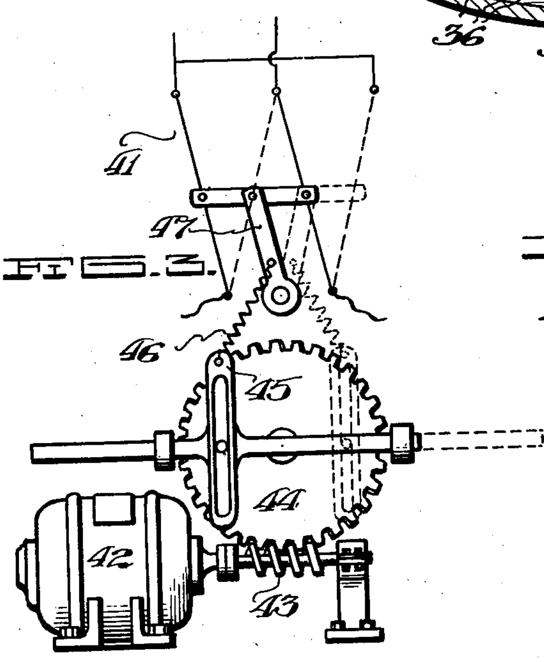
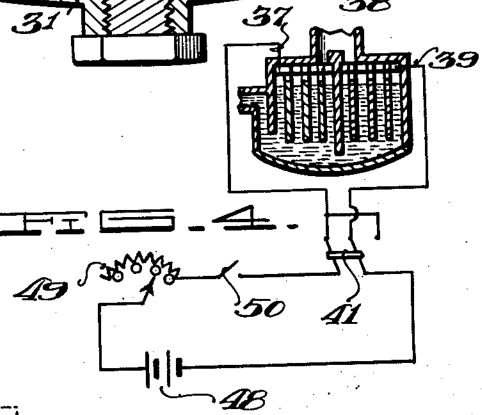



FIG. 4.




Charles H. Garrett
INVENTOR

BY [signature]
ATTORNEY

# UNITED STATES PATENT OFFICE

2,006,676

## ELECTROLYTIC CARBURETOR

Charles H. Garrett, Dallas, Tex.

Application July 1, 1932, Serial No. 620,364
Renewed November 30, 1934

5 Claims. (Cl. 204—5)

This invention relates to carburetors and it has particular reference to an electrolytic carburetor by means of which water may be broken up into its hydrogen and oxygen constituents and the gases so formed suitably mixed with air.

The principal object of the invention is to provide in a device of the character described, a mechanism by means of which water may be readily decomposed into its constituents, and the constituents intimately mixed with each other and with air.

Another object of the invention is to provide means whereby the electrolyte level in the carburetor may be maintained at a more or less constant level regardless of fluctuations in fluid pressure at the fluid inlet of the carburetor.

Another object of the invention is to provide means whereby the relative amount of air mixed with the hydrogen and oxygen may be regulated as desired.

Still another object of the invention is the provision of means to prevent loss of hydrogen and oxygen gases during periods in which these gases are not being drawn from the carburetor.

Still another object of the invention is the provision of means whereby the hydrogen and oxygen resulting from electrolysis may be formed in separate compartments, and a further object of the invention is the provision of means to periodically reverse the direction of current flow and thereby alternate the evolution of the gases in the separate compartments, to be later intermingled.

With the foregoing objects as paramount, the invention has particular reference to its salient features of construction and arrangement of parts, taken in connection with the accompanying drawings, wherein:—

Figure 1 is a view in vertical section of one form of carburetor.

Figure 2 is a modified form.

Figure 3 is a diagrammatic view of a pole changer, showing its actuating mechanism, and

Figure 4 is a wiring diagram for the modified form of carburetor shown in Figure 2.

Continuing more in detail with the drawings, reference is primarily directed to Figure 1 in which the reference numeral 1 designates the carburetor housing, which is preferably constructed of bakelite or other suitable insulating material. The housing 1 is so designed as to divide the carburetor into a float chamber 2 and gas generating chamber 4, connected by a fluid passage 3.

Water under pressure is forced into the carburetor through an opening 5 which communicates with the float chamber 2 through the medium of the sediment chamber 6 and the needle valve orifice 7, which is closed by a needle valve 8 when the device is not in operation. A float 9 surrounds the needle valve 8 and is free to move vertically relative thereto. Depending from the cover 10 to the float chamber 2 are two ears 11, located at spaced intervals on opposite sides of the needle valve 8. The members 12 are pivoted to the ears 11, as shown. The weighted outer ends of the members 12 rest on top of the float 9, and their inner ends are received in an annular groove in the collar 13 which is rigidly attached to the needle valve 8.

Within the gas generating chamber 4, a series of spaced, depending plates 14 are suspended from a horizontal member 15 to which a wire 16 has electrical contact through the medium of the bolt 17, which extends inwardly through the housing 1 and is threaded into the horizontal member 15.

A second series of plates 18 is located intermediate the plates 14 and attached to the horizontal member 19, and has electrical contact with the wire 20 through the bolt 21.

A gas passageway 22, in which a butterfly valve 23 is located, communicates with the gas generating chamber 4 through an orifice 24. An air inlet chamber 25 has communication with the gas passageway 22 above the orifice 24. A downwardly opening check valve 26 is in control of the openings 27, and is held inoperatively closed by means of light spring 28.

An adjustable auxiliary air valve 29 is provided in the wall of the gas passageway 22, which air valve is closed by the butterfly valve 23 when the butterfly valve is closed, but communicates with the outside air when the butterfly valve is open.

The operation of the device is as follows:

The chambers 2 and 4 are first filled to the level *a* with a solution of weak sulphuric acid or other electrolyte not changed by the passage of current therethrough, and the opening 5 is connected to a tank of water, not shown.

The wire 16 is next connected to the positive pole of a storage battery or other source of direct current and the wire 20 to the negative pole. Since the solution within the carburetor is a conductor of electricity, current will flow therethrough and hydrogen will be given off from the negative or cathode plates 18 and oxygen from the positive or anode plates 14.

The butterfly valve 23 is opened and the gas passageway 22 brought into communication with a partial vacuum. Atmospheric pressure acting on the top of the check valve 26 causes it to be forced downwardly as shown in dotted lines. The hydrogen and oxygen liberated from the water at the plates 18 and 14 are drawn upwardly through the orifice 24 covered by the check valve 30 where they are subsequently mixed with air entering through the openings 27 and through the auxiliary air valve 29.

When it is desired to reduce the flow of hydrogen and oxygen from the plates 18 and 14, the current flowing through the device is reduced, and when the current is interrupted the flow ceases. When the butterfly valve 23 is moved to closed position, the check valve 26 is automatically closed by the spring 28. Any excess gas given off during these operations is stored in the space above the fluid where it is ready for subsequent use.

Water is converted into its gaseous constituents by the device herein described, but the dilute sulphuric acid or other suitable electrolyte in the carburetor remains unchanged, since it is not destroyed by electrolysis, and the parts in contact therewith are made of bakelite and lead or other material not attacked by the electrolyte.

The structure shown in Figure 2 is substantially the same as that shown in Figure 1 with the exception that the modified structure embraces a larger gas generating chamber which is divided by means of an insulating plate 31 and is further provided with a depending baffle plate 32 which separates the gas generating chamber 33 from the float chamber 34 in which the float 35 operates in the same manner as in Figure 1. Moreover, the structure shown in Figure 2 provides a series of spaced depending plates 36 which are electrically connected to the wire 37, and a second series of similar plates 38 which are electrically connected to the wire 39 and are spaced apart from the plates 36 by the insulating plate 31. Gases generated on the surfaces of the plates 36 and 38 pass upward through the orifice 39*a* into the gas passageway 40 where they are mixed with air as explained in the description of Figure 1.

A pipe 51 bent as shown in Figure 2 passes downwardly through the housing of the carburetor and has a series of spaced apertures *a* in its horizontal portion beneath the plates 36 and 38. An upwardly opening check valve 53 is in control of the air inlet 54. When a partial vacuum exists in the chamber 33, air is drawn in through the opening 54 and subsequently passes upwardly through the apertures *a*. This air tends to remove any bubbles of gas collecting on the plates 36 and 38 and also tends to cool the electrolyte. The check valve 53 automatically closes when a gas pressure exists within the carburetor and thereby prevents the electrolyte from being forced out of the opening 54.

In order to provide for alternate evolution of the gases from the plates 36 and 38, a pole changer 41 shown in Figure 3 is provided, which is actuated periodically by the motor 42 which drives the worm 43 and the gear 44 and causes oscillations of the member 45 which is connected by a spring 46 to the arm 47, thereby causing the pole changer to snap from one position to the other.

In operation, the carburetor shown in Figure 2 is connected as shown in the wiring diagram of Figure 4. A storage battery 48 or other suitable source of direct current is connected to a variable rheostat 49, switch 50, pole changer 41 and to the carburetor as shown. Thus the rate of evolution of the gases can be controlled by the setting of the rheostat 49 and the desired alternate evolution of the gases in the compartments of the carburetor is accomplished by means of the periodically operated pole changer 41.

Manifestly, the construction shown is capable of considerable modification and such modification as is considered within the scope and meaning of the appended claims is also considered within the spirit and intent of the invention.

What is claimed is:

1. An electrolytic carburetor including an anode and a cathode, float means to control the level of the electrolyte within said carburetor, means to mix the gases resulting from electrolysis with air, and a check valve independent of said float means to control ingress of air to said carburetor.

2. An electrolytic carburetor including anode and cathode plates, a float actuated valve in control of the electrolyte level within said carburetor, means to mix the gases resulting from electrolysis with air, a check valve in control of said means, a second check valve independent of said float actuated valve to prevent loss of gases from said carburetor.

3. An electrolytic carburetor for producing mixtures of hydrogen, oxygen and air, including a series of spaced and electrically connected anode plates partially immersed in the electrolyte within said carburetor, a series of electrically connected cathode plates spaced between said anode plates, a float operated valve in control of the electrolyte level within said carburetor, an air inlet to said carburetor and a check valve in control of said air inlet.

4. An electrolytic carburetor for generating hydrogen and oxygen gases from water and for mixing the said gases with air, including an anode and a cathode partially immersed in an electrolyte within said carburetor, float actuated means to replace the water consumed whereby to maintain a constant fluid level within said device, means for mixing the said gases with air, and a check valve in control of said latter means.

5. An electrolytic carburetor including an anode and a cathode, float actuated means to control the level of the electrolyte within said carburetor, means to mix the gases resulting from electrolysis with air, a check valve in control of said latter means and means to periodically reverse the direction of current through said carburetor.

CHARLES H. GARRETT.

# United States Patent [19]

**Blue**

[11] **4,124,463**

[45] **Nov. 7, 1978**


[54] **ELECTROLYTIC CELL**


[75] Inventor: **Archie H. Blue,** Christchurch, New Zealand

[73] Assignees: **Ross Derisley Wood; Roland Edgar; Alec Henry Taylor,** all of St. Martin's Guernsey, Channel Islands; **Margaret Elizabeth Pyke,** Essex, England



[21] Appl. No.: **755,608**

[22] Filed: **Dec. 29, 1976**

[51] **Int. Cl.**[2] .......................... **C25B 1/02;** C25B 9/00; C25B 9/02

[52] **U.S. Cl.** .................................... **204/129;** 204/265; 204/277; 204/288

[58] **Field of Search** ............... 204/129, 246, 263, 265, 204/266, 269, 270, 277, 278, 275, 288, 289



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*Primary Examiner*—Arthur C. Prescott
*Attorney, Agent, or Firm*—Haseltine, Lake & Waters



[57] **ABSTRACT**

In the electrolytic production of hydrogen and oxygen, air is pumped through the cell while the electrolysis is in progress so as to obtain a mixture of air with the electrolytically produced hydrogen and oxygen.

**5 Claims, 3 Drawing Figures**

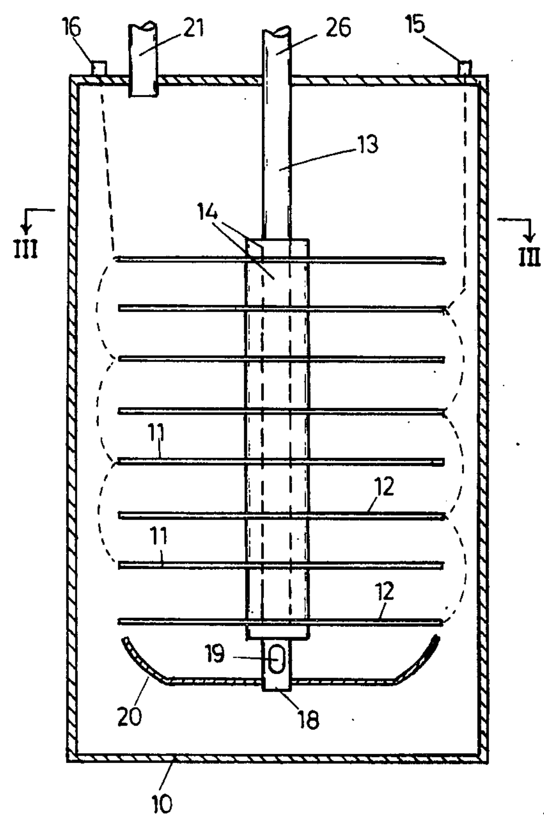



FIG. 1

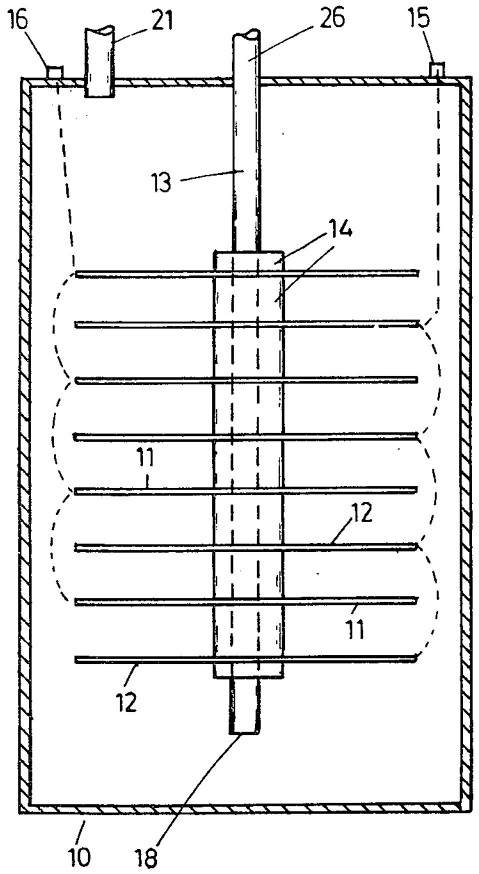



FIG 2

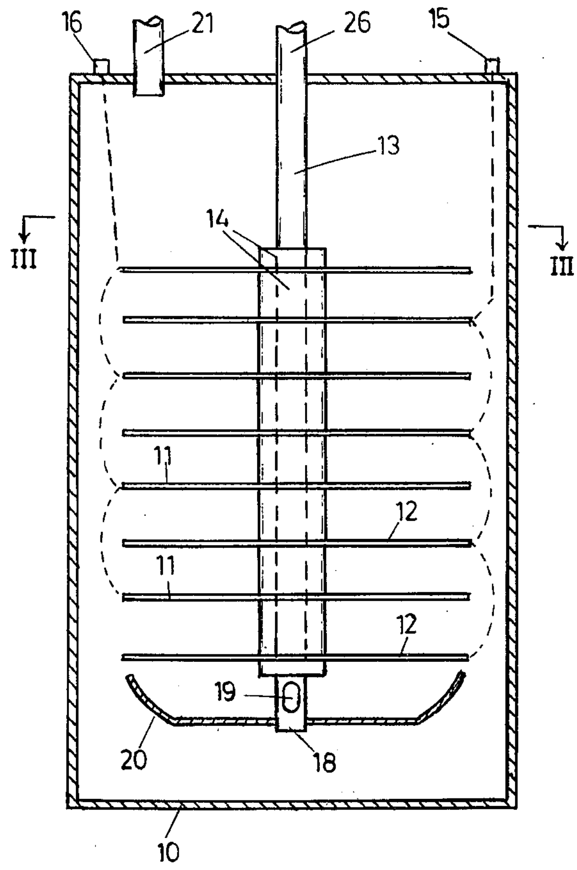
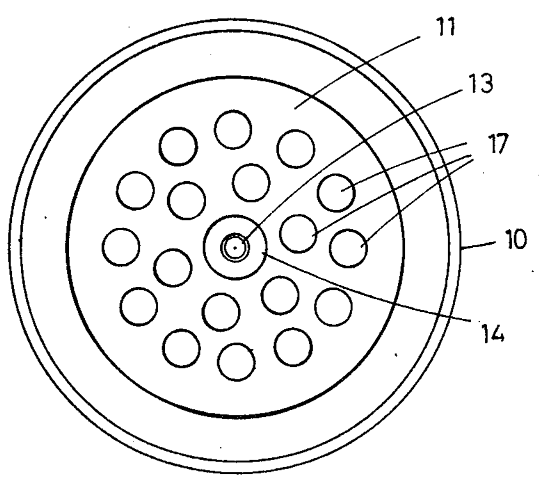



FIG. 3



# ELECTROLYTIC CELL

## BACKGROUND AND BRIEF DESCRIPTION OF THE INVENTION

This invention relates to the production of gases which can be utilized primarily but not necessarily as a fuel.

To electrically decompose water it is necessary to pass direct current between a pair of electrodes which are immersed in a suitable electrolyte. It is normal in such electrolysis to place some form of gas barrier between the two electrodes in order to prevent the gases evolved during the electrolysis from forming an explosive mixture. However provided suitable precautions are taken it has been found that the gases can be allowed to mix and can be fed into a storage tank for subsequent use. Because the gases when mixed form an explosive mixture, it is possible for the mixture to be utilized for instance as a fuel for an internal combustion engine. In such circumstances it is desirable that the gases should also be mixed with a certain proportion of air in order to control the explosive force which results when the gases are ignited.

One of the difficulties encountered with electrolysis is that bubbles of gas are liable to remain on the electrodes during the electrolysis thus effectively limiting the area of electrode which is in contact with the electrolyte and preventing optimum current flow between the electrodes. Because in accordance with the present invention it is desirable that the gases evolved during the electrolysis be mixed with air, then it is possible for air to be passed through the cell while the electrolysis is in progress. The passage of air through the cell can be directed past the electrodes so as to entrain in the passage of air any bubbles of gas remaining on the electrodes.

Accordingly the invention comprises an electrolytic cell including a gas tight casing, a plurality of electrodes adapted to be supported on a central post within the cell in a spaced apart relationship and to be electrically insulated from each other, each alternative electrode being adapted to be connected to a positive direct current source or a negative direct current source respectively and wherein the central post is in the form of a tube, one end of which is extended out of the cell and is adapted to be connected to a source of air under pressure, with the other end of the central post terminating in an air outlet below the said electrodes, the said cell including a gas outlet to exhaust air forced into the cell through the central post and to exhaust the electrolytically produced gases mixed with the said air.

## DETAILED DESCRIPTION OF THE INVENTION

Various forms of the invention will now be described with the aid of the accompanying drawings wherein:

FIG. **1** is a diagrammatic elevational view partly in section of one form of the invention,

FIG. **2** is a diagrammatic elevational view partly in section of a modified form of the invention,

FIG. **3** is a section along the line III—III of FIG. **2**.

The cell as shown in FIG. **1** comprises a gas-tight casing **11** which is formed from a non-corrodible material such as a plastics material as is known in the art. A plurality of cathodes **11** and a plurality of anodes **12** are supported within the cell by means of an electrically insulating central post **13**, with the cathodes and anodes being spaced apart by means of insulating spacers **14**. The anodes **12** are all connected in parallel to a positive terminal post **15** while the cathodes are all connected in parallel to the negative terminal post **16**, these connections being indicated in dotted lines in the drawings. The cathodes and the anodes are preferably in the form of disc like plates of a suitable metal which is consistent with the composition of the electrolyte utilized so as to ensure a satisfactory life to the cell. The plates may be shaped to conform with the shape of the walls of the cell which may be circular in cross section as indicated or any other desired shape.



The central post **13** is preferably in the form of a tube which extends out of the cell as at **13***a*. The lower end **18** of the tube is open so that air can be pumped into the cell through the central post **13** and enter the cell via the lower end **18** where it will pass up through the electrolyte. This will keep the electrolyte constantly in motion and thereby assist in the rapid removal from the electrodes of any gases that might be adhering thereto.

In the modification shown in FIG. **2** and **3**, the electrodes are each provided with holes **17** and in such a case the central post **13** is preferably formed with at least one air hole **19** adjacent the lower end **18** thereof. A deflector plate **20** is also supported by the central post **13**, this plate being dish shaped so as to deflect air issuing out of the air hole **19** up through the holes **17** in the electrodes. Such action further assists in dislodging any bubbles of gas clinging to the electrodes.

The cell also includes a gas outlet **21** so that the air which enters the cell together with the gases produced by the electrolysis can be exhausted out of the cell into a suitable storage tank (not shown in the drawings). If desired such storage tank can be arranged to accept the gases under pressure and for this purpose the air pumped into the cell will be pumped in under the required pressure. A gas drier (not shown in the drawings) can also be interposed between the gas outlet **21** and the storage tank.

Although the electrolysis will naturally produce considerable heat, nevertheless it can be found advantageous to install a heater in the cell, preferably in the bottom of the cell, to assist and facilitate the warming up of the electrolyte so that the cell reaches its most efficient operating conditions as quickly as possible.

Preferably also, current limiting means as is known in the art are employed so that the intensity of the electrolytic action can be controlled.

Means may also be provided for the automatic replenishment of water within the cell as the level of the electrolytic drops during use.

While it is recognized that the mixing of hydrogen and oxygen will create a dangerous explosive mixture, nevertheless by carrying out the invention as hereinbefore described the risk of explosion is minimized. The gases produced can be utilized for instance as a fuel to power an internal combustion engine and for this purpose it is desirable, as beforementioned, to mix with the gases evolved during the electrolysis a proportion of air so that when the mixture is ignited within the cylinder or cylinders of the engine, the explosive force so created can be of the desired amount.

While in the foregoing description reference is made to the utilization of the mixed gases as a fuel, it will of course be understood that the gases can be separated for individual use by techniques as known in the art.

What is claimed is:

1. A process for producing by electrolysis of an aqueous liquid a combustible mixture of hydrogen and oxygen, comprising: electrolyzing the aqueous liquid into hydrogen and oxygen in an electrolytic cell having a gas-tight casing, a substantially central tubular post mounted in the casing and having an air inlet at its upper end, and a plurality of electrodes supported on the post and axially spaced therealong, alternate electrodes being connected to a first electrical terminal and to a second electrical terminal respectively connected to a respective poles of a current source and being mutually insulated, the post having an air outlet below the electrodes out of which flows air from the air inlet into the cell and over the electrodes; and a source of air under pressure connected to the said air inlet forcing a flow of air through the aqueous liquid contained in the cell in operation thereof; the cell having in its upper region a common outlet exhausting the combustible mixture comprising air forced through the cell and hydrogen produced by electrolysis of said liquid in said cell.

2. The process according to claim 1 wherein the electrodes are discs each having a plurality of holes therethrough.

3. The process according to claim 1 further including a dish-shaped air deflector plate supported on the said post below the said air outlet.

4. Apparatus for producing by electrolysis of an aqueous liquid a combustible mixture of hydrogen and oxygen, comprising: an electrolytic cell having a gas-tight casing, a substantially central tubular post mounted in the casing and having an air inlet at its upper end, and a plurality of electrodes supported on the post and axially spaced therealong, alternate electrodes being connected to a first electrical terminal and to a second electrical terminal respectively for connection to respective poles of a current source and being mutually insulated, the post having an air outlet below the electrodes for flow of air from the air inlet into the cell and over the electrodes; a dish-shaped air deflector supported on said post below said air outlet; and a source of air under pressure connected to the said air inlet for forcing a flow of air through the aqueous liquid contained in the cell in operation thereof; the cell having in its upper region a common outlet for exhausting the combustible mixture comprising air forced through the cell and hydrogen and oxygen produced by electrolysis of said liquid in said cell.

5. The apparatus according to claim 4 wherein the electrodes are discs each having a plurality of holes therethrough.

* * * * *