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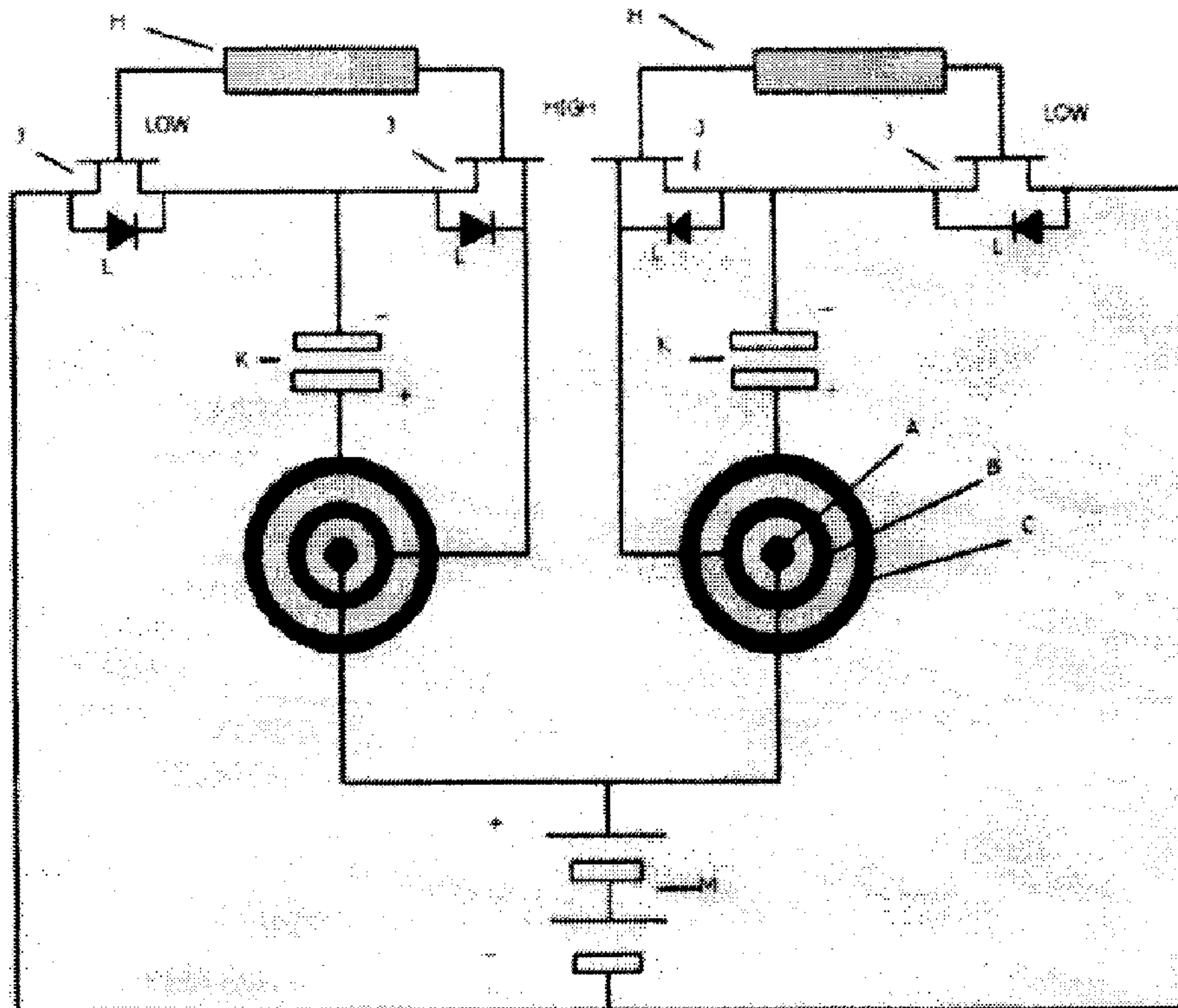
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(54) **Titre : SYSTEME D'ELECTROLYSE HAUTEMENT EFFICACE APPELE « ELECTROLYSE D'ENTRAINEMENT PAR DECOUPAGE » (ELECTROLYSE SMD) UTILISANT LE COMPLEXE DE TRANSFERT DE CHARGE D'UNE MANIERE SPECIALE**
(54) **Title: HIGHLY EFFICIENT SYSTEM OF ELECTROLYSIS CALLED SMD ELECTROLYSIS, "SWITCHMODE DRIVE ELECTROLYSIS" USING CHARGE-TRANSFER COMPLEX IN A SPECIAL WAY**



(57) Abrégé/Abstract:

Disclosed is a highly efficient method of electrolysis which can be used for the splitting of the water molecule for the creation of hydrogen and oxygen, or any other liquid electrolyte which can be electrolysed, such as sodium acetate, but not limited to sodium acetate, into other gases. The name of SMD electrolysis has been given to this type of electrolysis which has a unique charge-transfer complex (CT complex) at one electrode.

**Canada & World
Patent Application
Nunnerley, Michael John**

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Inventor: Michael John Nunnerley

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FIELD OF THE INVENTION

[0001] This disclosure relates to a type of electrolysis which is considerably more efficient than normal Faraday direct current electrolysis, where the amount of electrical energy added is equal to the Gibbs free energy of the reaction.

BACKGROUND

[0002] Electrolysis using a direct current to positive and negative electrodes immersed in an electrolyte has been around and used since the day when Michael Faraday invented the system of electrolysing water, breaking the molecular bond, and so creating hydrogen and oxygen. This brute force system of electrolysing is not very energy efficient, and is why for the production of hydrogen it is not used to a great extent, and is preferred the reforming of hydrocarbons, which gives more gas for the energy consumed.

[0003] By disclosing here this energy efficient system of SMD electrolysis, hydrogen from water becomes a more interesting prospect for hydrogen production, but also for other electrolysis uses.

SUMMARY

[0004] In accordance with the purpose(s) of the invention, as embodied and broadly described herein, the invention, in one aspect relates to a system of electrolysis.

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SUMMARY

[0004] In accordance with the purpose(s) of the invention, as embodied and broadly described herein, the invention, in one aspect relates to a system of electrolysis.

[0005] In another aspect, the present disclosure provides the means of collecting electrons from a charge-transfer complex at one electrode of the system.

[0006] In another aspect, the present disclosure provides for storage of electron charge.

[0007] In another aspect, the present invention provides for reuse of stored electron charge.

[0008] In another aspect, the present disclosure provides for more than one set of collection electrodes.

[0009] In another aspect, the present disclosure provides for different types of electrode design.

[0010] In another aspect, the present disclosure provides for different types of electrode symmetry.

[0011] In another aspect, the present disclosure provides for different electrolytes.

[0012] In another aspect, the present disclosure provides for an external system of control.

[0013] In another aspect, the present disclosure provides for an excited electronic state or resonance in the cell.

[0014] In another aspect, the present disclosure provides for a plating of an electrode.

[0015] In another aspect, the present disclosure provides for an external circuit of control of the system.

[0016] Yet another aspect, the present disclosure provides a method of electrolysis with a considerably reduced energy consumption.

[0017] While aspects of the disclosed invention can be described and claimed in a particular statutory class, such as the system statutory class, this is for convenience only and one of skill in the art will understand that each aspect of the disclosed invention can be described and claimed in any statutory class.

[0018] Unless by otherwise expressly stated, it is in no way intended that any method or aspect placed herein be construed as requiring that its steps be performed in a specific order. Accordingly, where a method claim does not specifically state in the claims or descriptions that the steps are to be limited to a specific order, it is in no way intended that an order be inferred, in any respect. This holds for any possible non-express basis for interpretation, including matters of logic with respect to arrangement of steps or operational flow, plain meaning derived from grammatical organization or punctuation, or number or type of aspects described in the specification.

BRIEF DESCRIPTION OF THE FIGURES

[0019] The accompanying figures, incorporated in and constitute part of this specification, illustrates several aspects, and together with the description serve to explain the principles of the invention.

[0020] Fig. 1 Schematic illustration of two electrode sets of the SMD electrolysis system.

[0021] Fig. 2 Example of a tubular electrode set.

[0022] Fig. 3 Example of a six tubular electrode set configuration.

[0023] Additional advantages of the invention will be partly set out in the detailed description which follows, and in part will be obvious from the description, or can be learned by use of the invention. The advantages of the invention will be realized and gained by means of the elements and combinations particularly pointed out in the appended claims. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

DETAILED DESCRIPTION

[0024] Here in is given a detailed description, to be read with reference to the accompanying figures 1, 2, 3, but must be understood that the present compounds, reagents, compositions, articles, systems, devices and or methods are not limited to specific methods unless specified otherwise, as they may be in due course, varied without taking away the true intention of the invention. Also it should be understood that the terminology used is for the purpose of describing particular aspects only and is not deemed to be limiting.

[0025] In Fig:1 of the present disclosure of SMD electrolysis, there is utilized a special alternating dc current which alternates between the main supply (M) 24vdc, but not limited to this voltage, and super capacitors (K), with a low ESR and a minimum voltage rating of 24v, 10amps@ 1 Farad or more. Collected electrons from electrode (C), generated by a special electron doner-acceptor complex, are stored in super capacitors (K), for reuse in the system.

[0026] In Fig:1 items (H) are half bridge controllers, which along with N type mosfets (J) and their internal diodes (L), form the switching circuit to alternate from the main supply (M) and the collected supply (K). The half bridge controllers (H) have variable frequency, duty cycle and dead time between switching mosfet pairs, those of the art will know how to build such a controller and as so is not covered within this present disclosure, apart from the ranges which are required (frequency 1-20hz, duty cycle 30-50% and dead time between mosfets switching on and off 50msec-500msec). Each electrode set consisting of (A), (B), (C), have their own controller (H), mosfet (J) "pair" and super capacitor (K). Main supply (M) is common to all electrode sets from one set to six sets, but not limited to six if voltages are increased at the main supply (M) and the super capacitor (K) voltage rating.

[0027] Fig:2 shows the construction of one three electrode set as is disclosed here in, but not limited to three electrodes, as those in the art will know that more electrodes can be added, and that the electrodes can be configured as plate electrodes as opposed to tubular electrodes. Outer electrode (C) is connected to the positive terminal of super capacitor (K). Mosfet (J) high side drain is connected to electrode (B) and electrode (A) is connected to the positive of the main supply (M). The internal distance of the electrodes from one another should be a minimum of one centimetre to allow sufficient room for gas escape. Apertures (F) are for entry of electrolyte and exits (E) are for gas exit and should be sized accordingly. End caps (D) should be made of a none conducting material and are used to a line and maintain the electrodes, those of the art will also know that sealing the ends of the electrodes will stop electric current from passing at those points.

[0028] Fig:3 shows in this disclosure, a typical six electrodes sets arrangement inside a conducting container (G). Electrode diameter and height can be from 10 centimetres to 50 centimetres, but not limited to these measurements. Cell container (G) should be larger than the electrode sets and those of the art will know how to construct a cell container. Those of the art

will also know how to enter the electrolyte and exit the gases from the cell container (G).

[0029] Electrodes (A), (B) and (C) in this disclosure are made of 316 grade stainless steel, but not limited to using stainless steel, and the cell enclosure (G) of any conducting material which will not react with the electrolyte used, in this disclosure 304 or 316 stainless steel can be used but must be insulated from direct contact with the tube sets. Even though cell container (G) has no direct electrical connection, it is important that it is conductive for the overall efficiency of the system.

[0030] A typical electrolyte used in this system is sodium hydroxide in distilled water, but those of the art may want to use others and does not change this disclosure of the invention.

System operation

[0031] When the system is switched on the low side mosfets switch on, electrodes (A) and electrodes (C) “now negative”, as well as super capacitors (K), are in circuit, electrode (B) is a neutral path. When controllers (H) switch off the low side mosfets and switch on the high side mosfets, electrodes (C) “now positive”, and (B) are in circuit with super capacitors (K), electrode (A) is permanently connected to main supply positive.

[0032] With the system running the frequency of change over of each cycle can be set along with the duty cycle and down time between each half cycle. A typical frequency is between 1-2hz and a typical duty cycle is between 30-40% on time of main supply (M), so making the super capacitors (K) do more work than the main supply. A current sensing resistor and suitable oscilloscope can be placed between electrode (C) and the super capacitor (K) positive terminal, the frequency and duty can be adjusted to maintain the maximum voltage charge in the super capacitors (K). A large voltage and current spike will be seen on the oscilloscope which has a path back to the main supply (M) via the internal diode of the low side mosfets and the electrodes (A), the cell container plays a role of accumulating current path. These current spikes supply charge to the main supply (M).

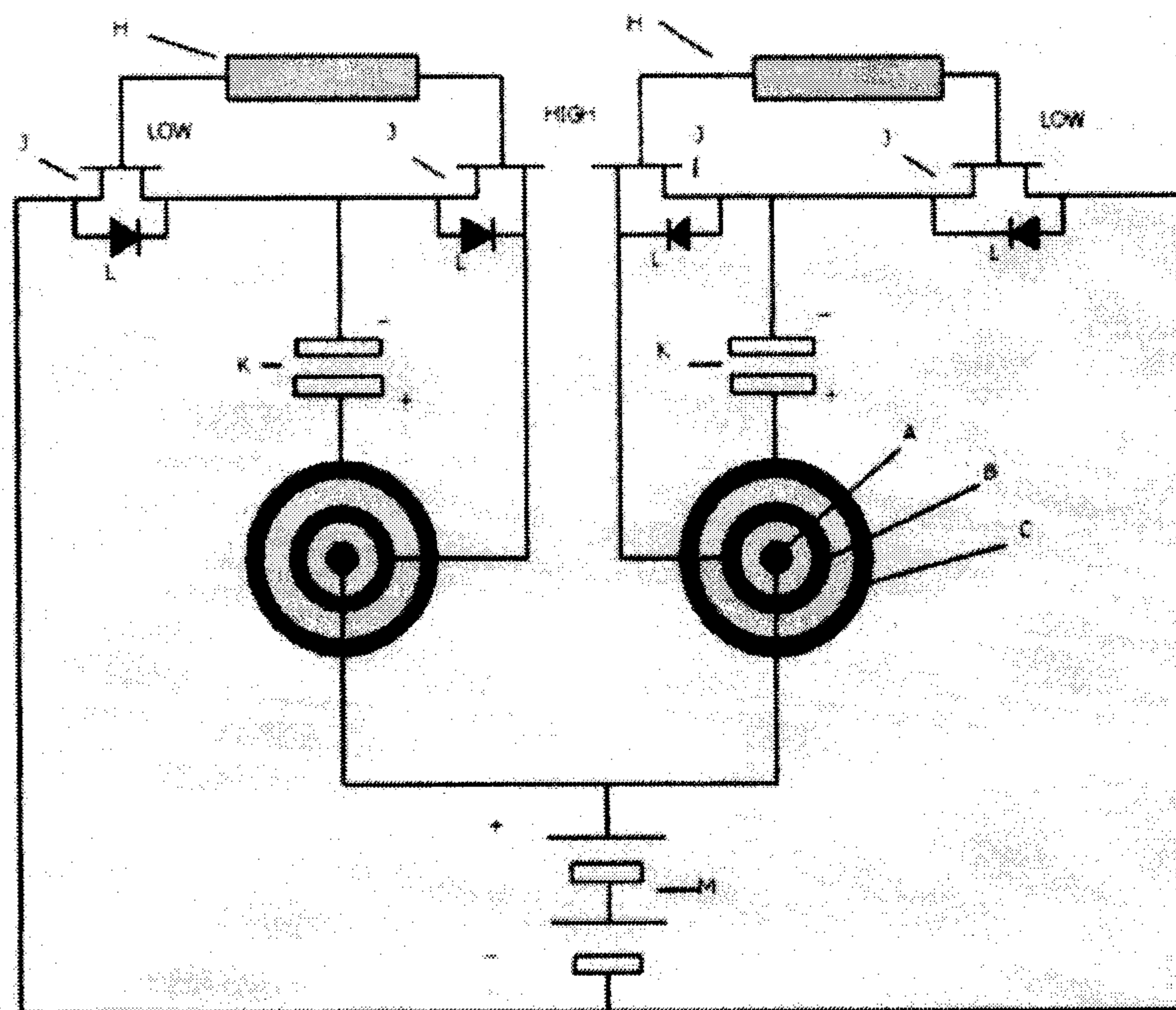
[0033] Those of the art will see on the oscilloscope that less energy goes into the super capacitors than is being used in the circuit when the main current supply (M) is not being used, but the super capacitors maintain their charge. This is due to the complicated electron-doner-acceptor-complex taking place at electrode (C), where current is now being chemically generated and is in series with super capacitors (K).

CLAIMS

- 1.** A method of electrolysis with a high electrical efficiency.
- 2.** A method of claim 1, where an alternating direct current is applied to electrodes (C) inside an electrolytic cell (G).
- 3.** A method of claim 1, where various electrolytes can be used.
- 4.** A method of claim 3, where the electrolyte can be made up of, but not limited to, sodium hydroxide in distilled water.
- 5.** A method of claim 2, where two other electrodes (A) and (B) are placed inside electrolytic cell (G).
- 6.** A method of claim 5, where the electrodes (A), (B) and (C) are arranged as in Fig:2, forming three electrode sets.

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- 7.** A method of claim 6, where these electrode sets are arranged in cell (G) as in Fig:3.
- 8.** A method of claim 7, where these electrode sets are connected as in Fig:1 to the electronic control system (H).
- 9.** A method of claim 2, where electrodes (C) are connected to super capacitors (K).
- 10.** A method of claim 9, where the super capacitors (K) are charged.
- 11.** A method of claim 10, where the super capacitors (K) supply power to part of the system.
- 12.** A method of claim 11, where super capacitors (K) supply more power to the system than the main supply (M).
- 13.** A method of claim 3, where the electrolyte fills cell (G) and covers completely the electrode sets.
- 14.** A method of claim 1, where part of the electrical energy goes back to the main supply (M).
- 15.** A method of claim 14 where this electrical energy comes from a complicated electron-doner-acceptor complex at electrodes (C) in relation to electrodes (A), (B) and the conducting cell wall (G).
- 16.** A method of claim 8 where each electrode set has it's own control (H), mosfet pairs (J) and super capacitor (K).
- 17.** A method of claim 16 where the main supply (M) is common to all tube sets inside cell (G).

**FIG: 1**

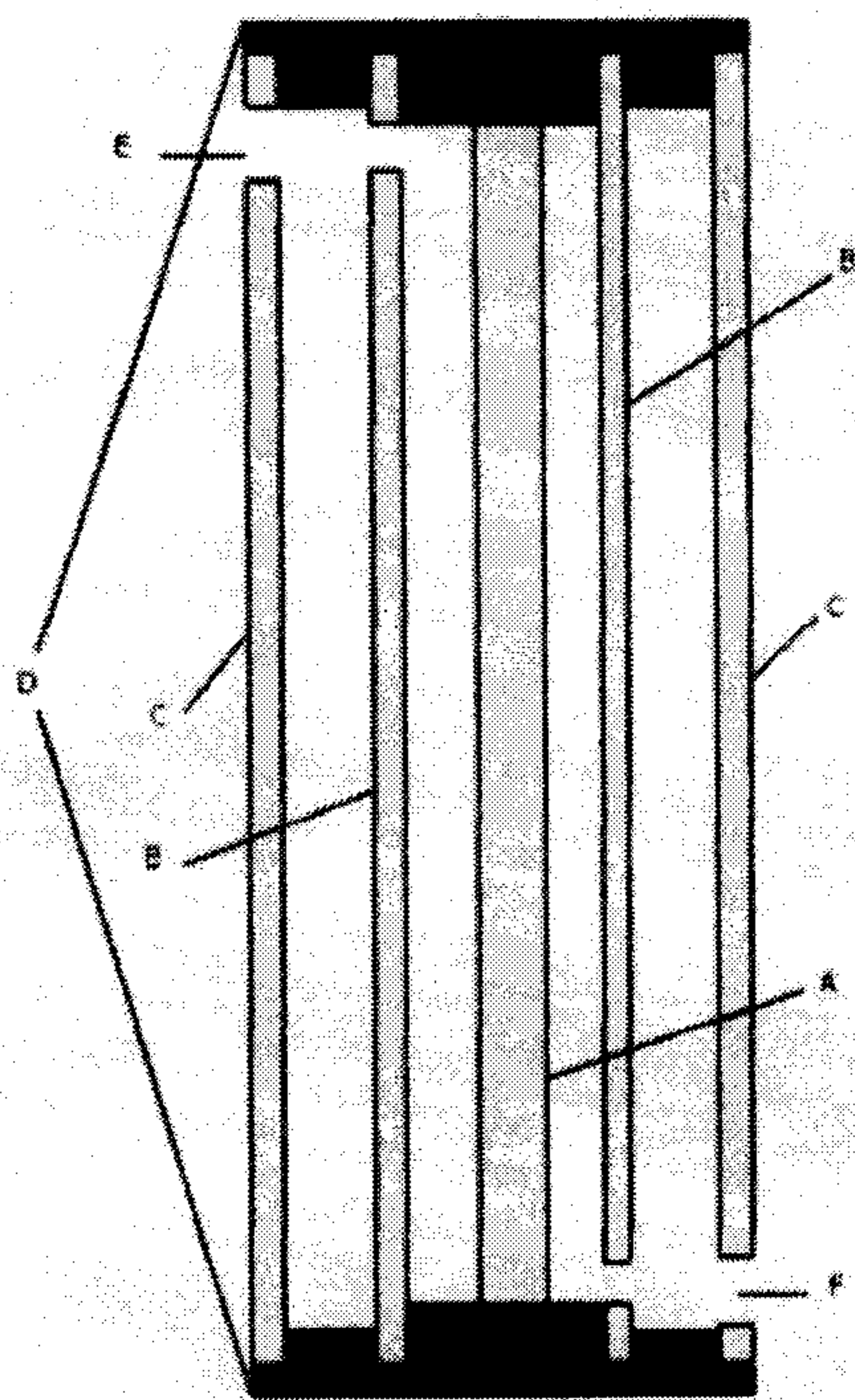


FIG:2

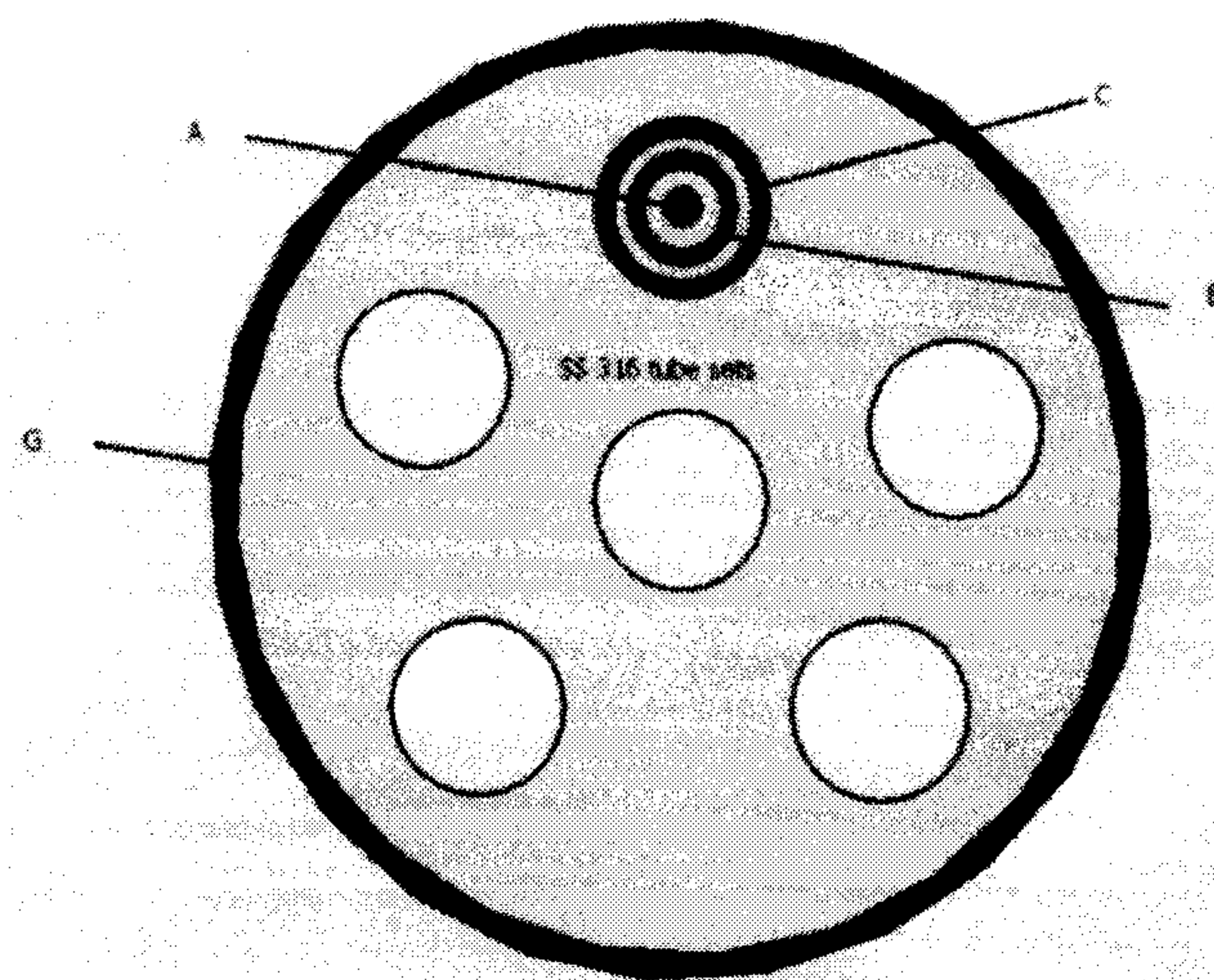


FIG:3

