

## **Metallic Glow Discharge Diode and Triode Devices with Large Cold Cathode as Efficient Charge Generator - A Power Cell**

The invention describes a metal container that comprises a cathode containing an insulated anode with gases at pressures less than a fraction (0.1 - 0.9) of a mmHg. The metallic container provides for basic glow discharge devices. Even though gas molecules are continuously moving following Brownian motion, since they are neutral the gases don't carry electrical current. If an electron is generated by cosmic rays or the photoelectric effect at this low pressure of the confined gas, the electron will have a mean free path of approximately a cm or so. Under the action of an electric field, the electron will gain sufficient energy to ionize further neutral gas molecules. Creating an electron and an ion pair, which

under the influence of the electric field will further ionize the gas. In gaseous discharge ionization, recombination or meta-stable states occurs generating photons which trigger photo-electrons from a cathode. This process generates electrons, ions and neutral molecules continuously. The low pressure of the gas and the low mass electrons migrate towards the anode rapidly, while the heavier positively charged ions migrate towards the cathode slowly. By virtue of this a plasma of electrons and ions surrounds the anode. This is a typical characteristic of glow discharge. A glow discharge is considered to be normal until the glow covers the whole cathode area.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1a. A current-voltage (I-V) graph showing an exemplification of Normal Glow Discharge. At low voltage there is microampere current, then at striking voltage an increase current occurs without a requiring a corresponding increase in voltage. Normal glow discharge.

Figure 1b. A characteristic circuit configuration, wherein a D.C. bias supply source, a series resistor, which controls the current and the diode device connected to an external load.

Figure 2. Radial Field Configuration of the cold cathode metal normal glow discharge device. A cylindrical cathode and a coaxial insulated anode containing gas at very low pressure. The distance between the anode and cathode illustrated is 3 cm. Therefore, the

diameter of the cylinder would be about 6 cm. The length is variable.

Figure 3. Planar Configuration of the cold cathode metal normal glow discharge device. The distance between the anode and cathode would be approximately 4 cm. The height of the planar box would be approximately 8 cm. The area could can be 1 sq meter or greater.

### **Detailed Description**

Figure 1 shows the characteristic circuit configuration of such devices. A D.C. bias supply source, a series resistor which controls the current and the diode device. The larger the cathode area the larger the plasma density at the anode. A small fraction of these charges are required to sustain the glow discharge phenomenon,

while the rest of the charges which are generated due to the electrical field working on gas molecules are available to drive an extra load and not draining from the bias supply. The ratio of sustaining glow discharge current to the current supplied to load could be as high as 10 times.

Two (2) configurations for making such devices are disclosed by Figures 2 and 3. A cylindrical cathode and a coaxial insulated anode containing gas at very low pressure utilizing radial electric field approximately 1 meter in length. The glow discharge phenomenon occurs at voltages which are multiples of the first ionization potential of the gas mixture. That can be between 70 - 300 volts depending upon the geometry and the nature of the gas. The other configuration is planar. Where normal electric field will

be effective. Here a plane parallel to the broad side of the container which is insulated forms the anode, while the container acts as the cathode. In both configurations the distance between the anode and cathode would be approximately 3 - 4 cm.

Therefore the diameter of the cylinder would be about 6-8 cm. The height of the planar box would be approximately 6-8 cm. In the cylindrical configuration a practical length would be approximately 1 m. For the planar configuration the area can be 1 sq meter or greater.

This invention of generating a power cell opens opportunity for small or large scale electrical efficient power generation. The concept is very simple to execute and would provide units at very low costs as well as being non-polluting. Since the gas is at very

low pressures the structural strength of the units would be very light and there would be low chance of leakage of the gas. The small scale application one could use both in developed as well as developing countries for charging items which use lithium ion or NiCAD batteries. The batteries in a series configuration are charged. The charged cells operating at low voltage (3.2 V) could operate light emitting diode devices efficiently and further a new concept of home wiring could be used at low DC voltage.

From the foregoing description, it will be apparent that variations and modifications may be made to the invention described herein to adopt it to various usages and conditions. Such embodiments are also within the scope of the following claims.

I claim:

1. A metallic glow discharge device comprising a cold cathode containing an insulated anode with gases at pressures less than a fraction (0.1 - 0.9) of a mmHg.
2. The metallic glow discharge device of claim 1, containing a cylindrical cathode and a coaxial insulated anode containing gas at very low pressure utilizing radial electric field.
3. The metallic glow discharge device of claim 2, wherein the length is 1 meter.
4. The metallic glow discharge device of claim 1, containing a planar geometry, wherein the plane parallel to the broad



side of the container which is insulated forms the anode, while the container acts as the cathode.

5. The metallic glow discharge device of claim 4, wherein the area can be 1 square meter or greater.
6. The metallic glow discharge device of claim 1, wherein the distance between the anode and cathode would be approximately 3 - 4 cm.

## **Abstract**

The invention describes a metal container that comprises a cathode containing an insulated anode with gases at pressures less than a fraction (0.1 - 0.9) of a mmHg. Metallic glow discharge diode and triode devices with large cold cathode as efficient charge generator to function as a power cell. A metallic glow discharge device containing a cylindrical cathode and a coaxial insulated anode containing gas at very low pressure utilizing radial electric field. A metallic glow discharge device containing a planar geometry, wherein the plane parallel to the broad side of the container which is insulated forms the anode, while the container acts as the cathode.

Figure 1a

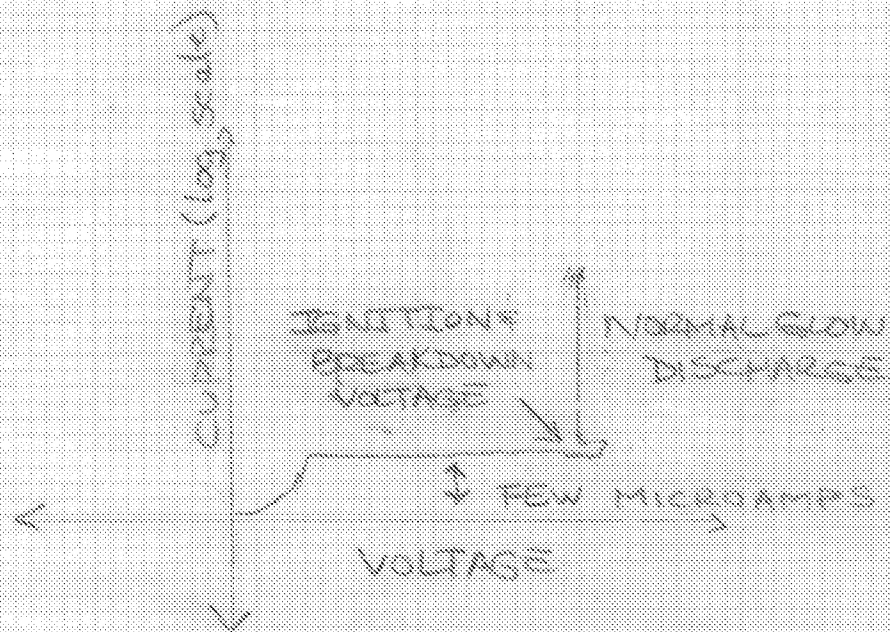
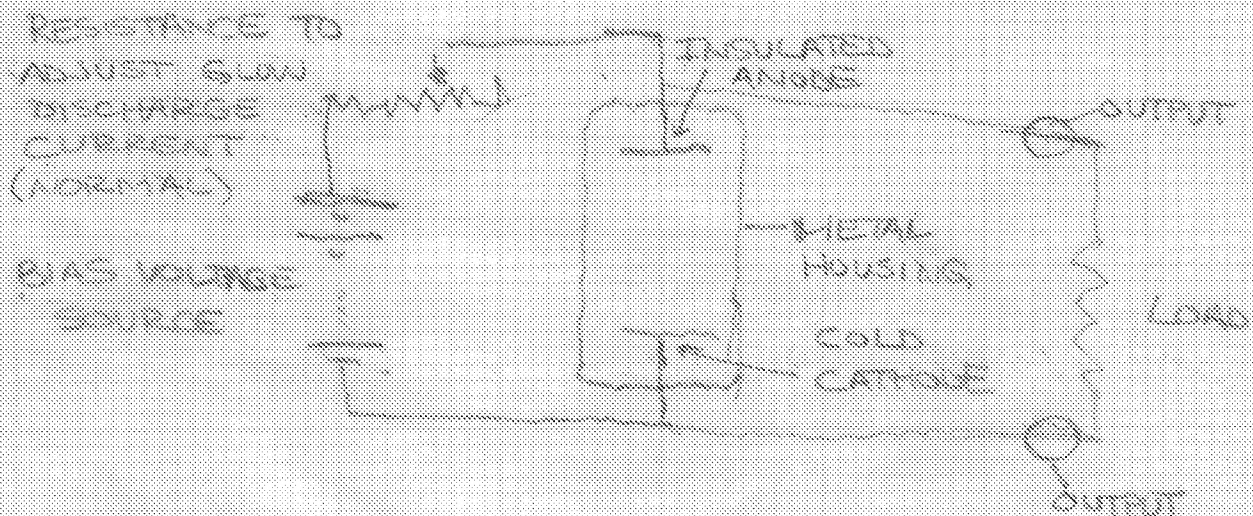


Figure 1b



# TWO COLD CATHODE METAL NORMAL GLOW DISCHARGE DEVICES

DIMENSIONS DISCUSSED IN TEXT

Fig 2. RADIAL FIELD CONFIGURATION:

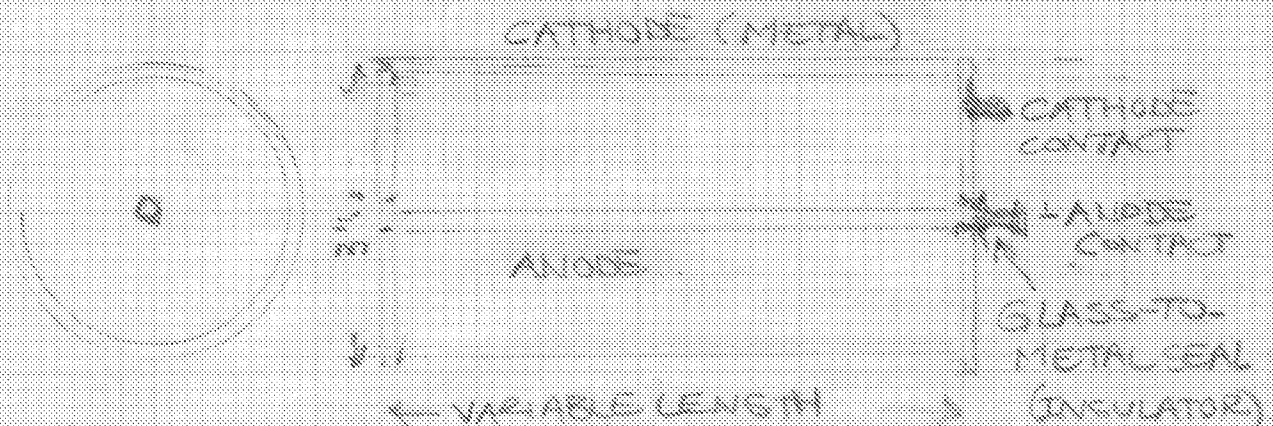


Figure 3.

UNIFORM FIELD CONFIGURATION:

