Correa Discharge Tubes for Part 1 – the basics by Pomodoro 2014

Basic Description

Paulo Correra and his wife Alexandra announced in 1995, that they created a discharge tube which produced more energy than it consumed. Three patents were released covering this invention.

In their first patent (US 5,416,391) the simple discharge system was announced as a means of converting DC into pulses which could drive and AC motor. The central part of system being a simple gas filled discharge tube .No over-unity (OU) claims were made .

A few months later a second patent (US 5,449,989) was released claiming that they detected OU from the system. In this patent batteries were used for the DC input and the pulses were passed through a diode bridge to charge another set of batteries. They showed that much less input power was required compared to the power required to charge the batteries.

A third patent in 1996 described in detail the discharge tubes.

They called their technology PAGD (pulsed abnormal glow discharge) and also had some trademarked names such as LGEN ,XS NRG. Their business was called LABOFLEX. Correa is known to follow Wilhelm Reich's work , which studies orgone—an energy all around us, that Reich strongly believed gave rise to orgasms! Reich created VACCOR tubes and Correa has been accused (Douglas Maret) of ripping ideas from Reich, without giving him any credit in his patents. He currently has a web site called Aetherometry, and is a very prolific writer or the topic of Orgone energy. He also released a patent utilizing a mixture of ideas from Reich, and Tesla , culminating in an Orgone Box which apparently spins a motor utilizing Orgone energy. According to other Orgone researchers (DeMeo) , Correa did not allow this invention to be tested for overunity thoroughly enough.

At time of writing, 2014, it seems that the Correas had no luck in commercializing the technology. An incredible 320 of the worlds largest multinationals showed no interest according to Correa in this interview titled "Follow up on Laboflex' taken on 2001.

About this Document

This document is an attempt to give the reader the basic and essential information required to understand the Correa PAGD invention. The invention itself and the underlying science are quite simple to understand.

The patents are quite lengthy and need to be read a few times over to fully understand their content and implications.

In order to fully understand the claims, the operation and terminology of gas filled discharge tubes will first be covered, but only to the minimum extent required. The reader is welcome to read further references to learn more about gas discharge tubes. Because these discharge tubes develop a plasma discharge, there is a vast amount of information available for those seeking more knowledge. The mathematics and physics can get very advanced but thankfully, for most of us, it is not required to understand this invention.

Gas Discharge Tubes

Basics

Fluorescent lights, camera flashes, and neon sign are examples of gas filled discharge tubes still used today. Most of the others have all disappeared. Two electrodes separated from each other in a vessel or tube is all you need to make a simple gas discharge tube. The space in the tube is filled with a gas or vapour such as air, helium, argon , hydrogen, water vapour, mercury vapour or any of a multitude of other pure gases or mixtures. The pressure in the container is often lower than atmospheric, but sometimes higher.

Countless types of gas tubes have been invented, their peak was in the 1920's but most are no longer used, they were replaced by vacuum tubes from the 1930's, and these, inturn , have been mostly replaced by semiconductors since the 60's.

A quick look at 'Gas–filled Tube' on Wikipedia will give you a small list of these devices.

Considering that both gas tubes and plasma discharges have been studied for over 100 years, its quite amazing that the Correas were able to discover a new type of discharge and that they were able to patent their tube.

Gas tubes work by applying a high voltage across the two electrodes. The Anode is the name given to the positive electrode and the Cathode to the negative electrode. The tube will not conduct until a critical voltage is applied, then ,any of a variety of different types of discharges can occur. It is important to know the different types of discharges. There are only two ways in which a current can pass between the electrode with considerable current—Glow discharge and Arc discharge. Other discharges occur, but are very weak in current.

The glow discharges occur at the lower current flows and there is normally a high voltage between the plates.
The arc discharges occur at higher currents and develop a low voltage between the plates.

Conduction

Conduction through the gas can only occur if charged particles such as electrons or charged atoms/molecules (ions) exist in the gas. Without these ions, the gas is mostly a perfect insulator. Conduction always involves electrons being generated at the cathode and moving towards the anode There are only a few mechanisms for the release of electrons from the cathode.

1) An electron is released from the cathode by bombarding it with a positively charged ion which has enough kinetic energy. This is what occurs at lower currents. Small neon bulbs are operated in this way. The initial positive ion needs to be created by a natural process such as radiation from cosmic rays. The applied potential between the plates accelerates this positive ion towards the cathode. With enough kinetic energy an electron is released from the cathode material. A neon bulb utilises this type of emission.

2) The cathode is hot and it begins to 'boil off' some electrons by thermionic emission. A fluorescent light tube operates with this type of emission. An arc often occurs, rather than a glow discharge.

3) The third way is when a photon of enough energy hits the cathode and releases an electron.

4) Electrons are released from the cathode by 'field emission' . A 'cathode spot' occurs, rather than the whole surface releasing electrons, due to a very strong localized electric field heating the spot, attracting the electron from the surface. Once again an arc is formed.

The Correa invention claims that their cathodes exhibited field emission but at a field much weaker than that required by theory. They do not believe that their tube was arcing.

These are just the basics and more detail is found in the references.

Amplification

When the electron is released from the cathode surface, the applied voltage between the electrodes accelerates it towards the anode. In doing so, and provided the electron has enough energy (enough applied voltage) it will knock off an electron from some gas molecules it collides with, generating more electron(s) and new positive ions. This is called the avalanche effect or gas amplification. One electron could give rise to millions. The gas tube can now conduct electricity and is called self sustaining. In arc discharge there is NO amplification as the voltage drop is too small—enough electrons are released directly from the cathode.

Work Function

The material from which the cathode is made is important. If it has a low work function , electrons are easily knocked off by bombardment from a positive gas ion. Aluminum is used by the Correas as it has a low work function. Similarly a strong local voltage field will be able to strip an electron away more easily than from a metal with a higher work function.

Aluminum has a work function of 4.08eV , Copper 4.7eV Silver 4.73eV, Magnesium 3.68eV.

It is also an excellent choice as it does not sputter as much as many other metals. Sputtering occurs when atoms of the metal are forcibly removed from the surface when a positive gas ion bombards its surface.

Gas fill

The gas in the tube is what gives rise to electron amplification, or the electron avalanche, as it gets ionized by the fast electrons. The Correas experimented with argon and air. Some of the ionization of molecular gases are : H_2 15.4eV, O_2 12.07eV, N_2 15.58eV, Ar 15.76eV.

If even a small amount of electronegative gas or vapour such as oxygen or water is present, many of the electrons making their way to the anode will be captured to create a negative ion. This makes the tube less efficient and for the same current flow, the tube with the electronegative gas will require a higher voltage and will heat up more.

Hydrogen has the peculiar property of disassociating into atomic hydrogen and according to one of the references should not be used with cathodes that have a higher work function than 4.2eV. Hydrogen is very useful in tubes that need to deionize very quickly after the voltage source is switched off.

Current / Voltage characteristics

Gas tubes are current controlled devices. If we try to control a tube by voltage we will find that one voltage can give rise to many different currents. But by using a large resistor in series with a high voltage source we can control the current flow through the tube and study its voltage drop (tube drop). On the right is a picture straight out of Correas patent . It shows the applied current on the Y axis and the voltage measured across the tube on the X axis. It's a generic plotof any gas tube with large electrodes which do not heat quickly. Note the logarithmic scale for the current.

There is a small mistake on the graph, instead of zero (10^0)they have a 1.

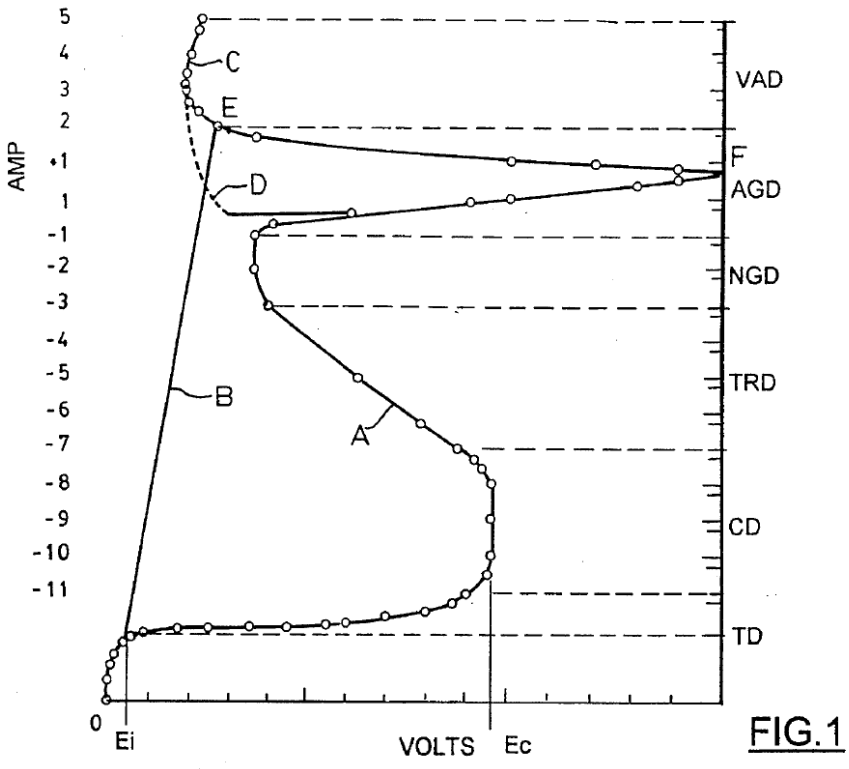


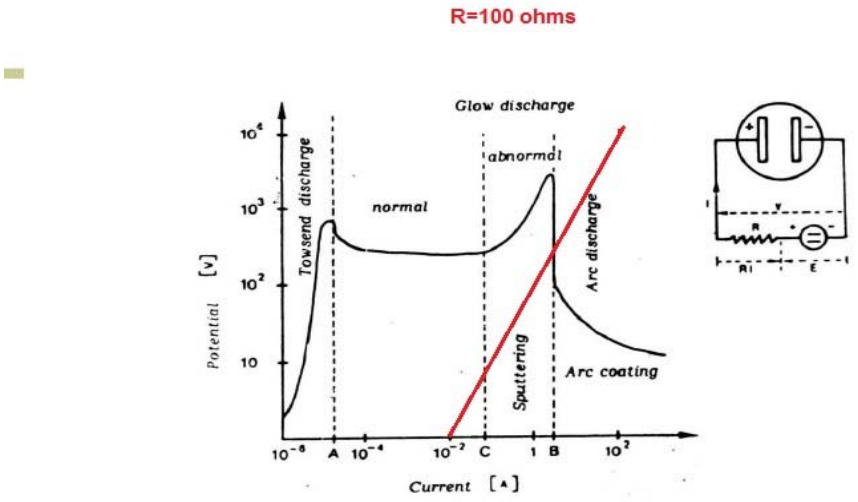
FIG.1

All the different modes of discharge are shown, starting from Townsend Discharge (TD) at very low currents to vacuum arc discharge (VAD) at high currents. In the Corona Discharge (CD) current region the tube can be used as a high voltage zener diode, similarly in the millamp region where we have Normal Glow, it can be used as a zener diode but for a smaller voltage. Notice how in the arc region the tube drop is quite small, mostly in the 10s of volts, not 100s. The Correa tubes are made to oscillate between F-E. This area is unstable as it is a negative resistance zone. Similarly the 'A 'area is unstable.

The diagram also shows how a tube with small electrodes might react. Line D shows how instead of the voltage rising as the current is made to increase, the tube breaks down into the arc discharge mode prematurely. This is sometimes caused by the cathode overheating and causing thermionic emissions, which develop into cathode spots and arc. Rough surfaces can also cause this. Line B is for a purely thermionic emission (heated cathode). Ec is the Breakdown voltage.

In the Normal Glow Discharge region, an increase in current is accompanied by a spread of the glow to more of the cathode surface. When the glow covers the surface completely, it becomes an Abnormal Glow discharge. The Correa's invented abbreviation 'PAGD ' stands for Pulsed Abnormal Glow Discharge. However, the pulsing is not simply in the AGD region of the graph, as this simply looks like a glowing surface, but includes the region after the peak at F, where some arc llike discharge occurs (cathode spots, visible discharge channel) but is apparently not a true arc.

A similar graph from the internet is shown below. This time voltage is shown on the Y axis. Both axes are logarithmic, allowing a familiar resistor I/V curve to be drawn. It is **not** meant to be the resistor in the circuit, but simply a 100 ohms resistor which we treat in the same way as the tube. As we increase the current, the voltage drop increases in a linear fashion. The very sharp drop in voltage when going from abnormal to arc discharge is more realistic for most tubes, unlike the one in the Correa patent which shows a nice smooth drop into the arc region.



Note how the tube is only controllable by current and not voltage across its plates. The resistor shown in the circuit must be a lot higher than the resistance of the tube. Then , with a high enough voltage supply, it acts a current source

Gas pressure

The Pashen curve shows us how it becomes easier for the tube to start conducting at a lower voltage (breakdown voltage), until a critical vacuum is reached, then it becomes harder and more voltage is required. In theory, changing the area of the plates should make no difference on the breakdown voltage, however Correa found that making the area of the plates very large lowers the breakdown potential!

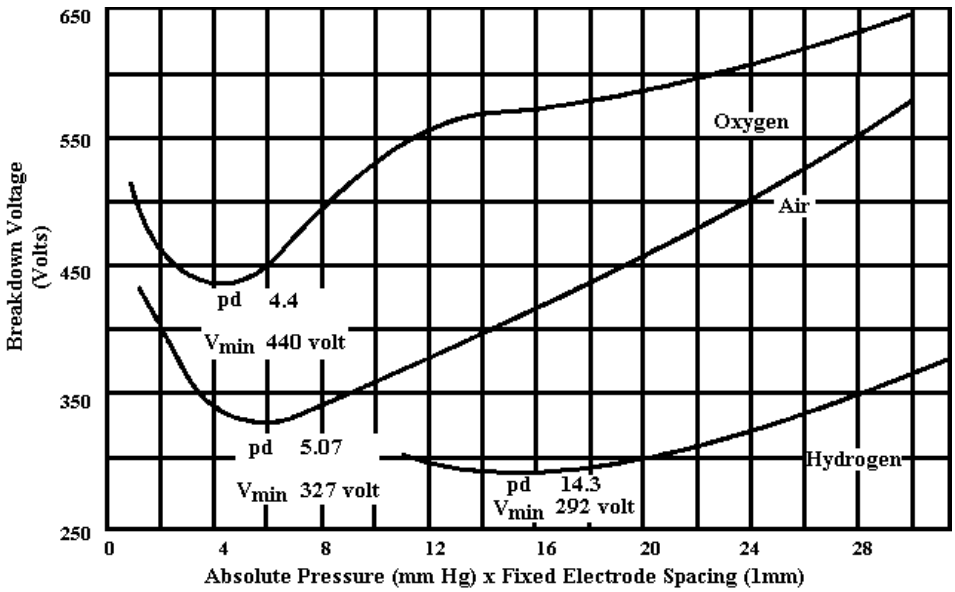


Figure 4.1-1. Pashen's Law Curves for Oxygen, Air, and Hydrogen with Electrode Spacing Fixed at 1mm

Summary

The Correa invention uses a glass tube filled with a gas kept below atmospheric pressure. The tube has an anode and a cathode. Such tubes have been studied and used for over 100 years.

When a rising voltage is applied to the tube, there will come a time when the voltage is enough to cause a substantial current to flow between the cathode and anode. This voltage is called 'Breakdown Voltage' and its value depends on the type of gas, the vacuum and electrode gap. Pashen's law describes this process. Once the gas has broken down, the tube can keep conducting at a lower voltage 'the sustaining voltage'. Below this voltage it will stop conducting.

To conduct, electrons must flow from the cathode to the anode. With enough voltage, randomly created gas positive ions can accelerate towards the cathode and release electrons from the cathode on impact. These electrons accelerate towards the anode, creating more ionsas they hit gas molecules. The new ions repeat the process. Amplification of electrons occur. The current is generally quite low and the cathode is surrounded by a glow. The kinetic energy of the ions is much higher than the electrons and the cathode gets much hotter than the anode.

The other way electrons can flow to the anode is by an arc. In this case no amplification is required. All electrons are generated at the cathode at a spot, which has a very high electric field because of its miniscule size. The cathode material is microscopically vapourized at the 'cathode spot'. The arc forms a channel to the anode. This arc can occur even in perfect vacuum. Once the arc is formed, the voltage drop is quite low, in the 10s of volts for most gasses, but the current is high. The sharper and smaller the cathode, the more likely an arc will develop.

The current / voltage graph for a gas tube is non linear but follows the same shape for most gas filled tubes.

References

You must read this book '**Cold Cathode Tubes by J.B. Dance'**, which at the time of writing was available here :

*www.elinux.org/images/4/4c/**Dance**-ColdCathode**Tubes**.pdf*

Its very basic but great for beginners. Read especially chapter one.

The actual Correa patents will be summarized in a separate document titled:

"Correa Discharge Tubes Part 2—the patents by Pomodoro 2014".

In that publication the Correa Invention will be discussed including the claim of over unity. The patents will the scrutinized and other documents including Orgone 'experts' criticisms will be included. The experimental setup will be shown and ideas of detecting OU pulses will be presented.