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Plasma and its Application in Magneto-hydro-dynamical Generators

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ABSTRACT

The increasing growth of the population around the world during 20th century and fast consumption of energy, now, is considered as the basic reasons of raising energy problems. This issue has affected all human life aspects. That is why we need energy to replace it with older and ending sources such as oil. Meanwhile, it is easy and less-expensive to obtain it. In this direction and following widespread and continuous studies by scientists and researchers, the electricity generation by using plasma (Magneto-Hydro-Dynamical generators) has been considered to achieve higher efficiency in production and less pollution. The present research is to make readers get familiar briefly with MHD generators and express that applying this generator, it is possible to offer an electric energy with high and, first of all, pollution-free efficiency to the society, if and only to get access to its technology. In fact, MHD is a process to convert energy directly into electricity with no need to a turbine or normal generator.

Keyword:
plasma, generators, MHD, electricity generation

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INTRODUCTION

By 1940, the study of ionization gas was utterly related to electrical discharge in gases and the physicists who were working in this field were often introduced as those who were investigating on the relatively old topics of physics. Since the phenomenon occurring inside the electrical discharge tubes is sufficiently intricate and really hard to recreate it, thus, the scientists focused on studying some luminescence effects as their earlier observations from the early days of exploring this phenomenon to the late 19th century. However, these studies obtained less accurate data on the gases and this means that measuring methods of basic characteristics of plasma were not available.

There was a great evolution between 1940 and 1950. Since that time applying hyper-frequency techniques diffused from radar began to study ionized gases' properties.

These techniques not only allowed the ionized gases inside the old discharge tubes are examined, but also all plasmas around the world were studied by them. Thereby, using this technique and studying radio-electric waves diffused from stars during these years, useful information was gathered about density, temperature, different parameters, magnetic fields and currents, which were specifying the atmosphere of stars, clouds and halo around sun.

Regarding the empirical results the physicists who are working on ionized gases tell that about 99% of the universe is in the form of plasma. Eventually, shortly after 1950 few physicists working on the plasma physic found that their number and credit were increased, firstly, in the United States of America and United Republics of Soviet, then in the other vast countries. At present, in all of these countries, all scientists follow two important objectives that are significantly important for human future: inhibiting mean fusion energy and electricity generation by magneto-hydro-dynamical generators (MHD).

What is plasma?

Up to date, we have known three states of material: solid, liquid and gas. There is also the fourth state which is called "plasma". The most common state in the world is plasma. In fact, more than 99% of the whole world is comprised of plasma and the space among stars and planets, inside the sun and the stars all are covered in plasma.

If you heat a solid material, it will be turned into a liquid. If you heat a liquid, it will be converted into a gas and, finally, if you heat a gas, it will make plasma. Therefore, plasma is a kind of gas with higher heat degree. However, its physical traits are completely different from that of normal gas. For example, the normal gas is electricity insulator, while plasma is a good electrical conductor and it can even be of more electrical conduction than copper and silver. Moreover, the properties of plasma are different from those of normal gas including electrical and magnetic permeability. Due to these, physicists regard plasma as the fourth state of the material which has occupied the highest place in temperature scale.

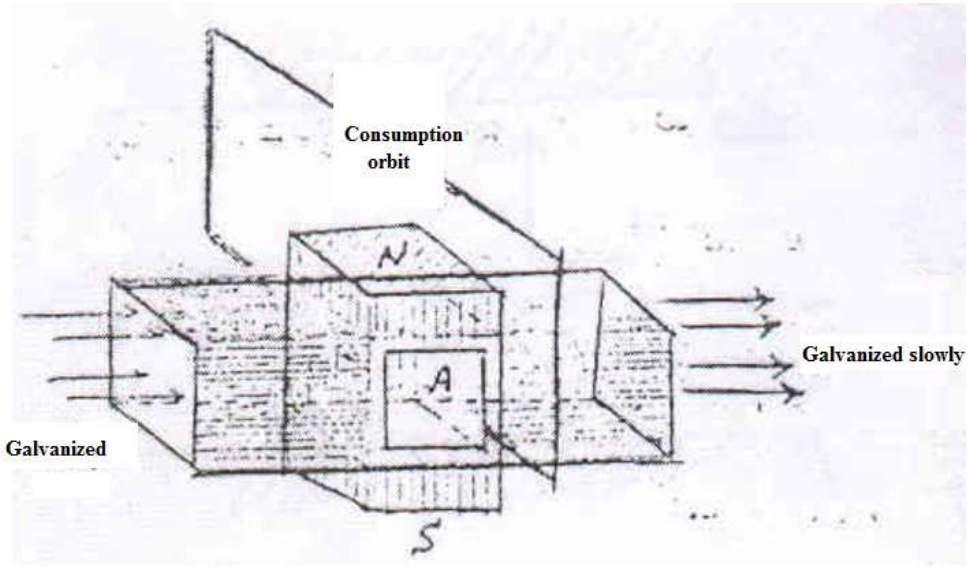
A definition of plasma can be as following:

"Plasma is a quasi-neutral gas of charged and neutral particles which exhibit an integrated behavior and its physical properties are quite different from those of normal gas".

The word "quasi-neutral" means that the number of electrons equals the number of ions within plasma in a relatively macroscopic volume. Due to its integrated behavior, plasma has no tendency to be influenced by external factors and often acts in such a way as though it has own respective behavior.

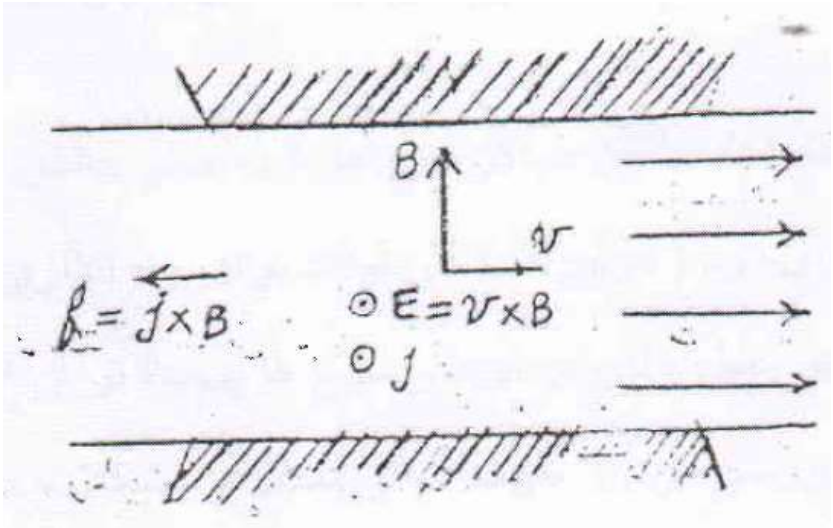
Magneto-hydro-dynamical Engines and Generators:

Since many years ago, inductive systems which are in principle similar to classical electromagnetic machines, but, in which an ionized gas plays the role of mobile conductor have been studied in many laboratories. A very simple figure of this machine is shown as following:



The central part of the machine includes ASBN tube inside which an ionized gas flows with high speed. In practice, this gas is obtained by entering a little vapor of alkaline metal into a combustible gas with over 2500 degree temperature. Experience and theory show that ionizing the alkaline atoms in the form of exclusively thermal with sufficient efficiency was successful in this way. The tube is horizontally placed in a magnetic field generated between N and S poles of an electro magnet. Two opposite walls of the magnetic poles are covered from an electric insulator. While two surface A and B, as conducting electrode, allow the electric current pass through the plasma and outer consuming circuit.

Considering what has been said, firstly, it may be assumed that outer circuit is connected to relatively big and exclusively inactive impedance. Plasma movement generates the electric field E= U*B with the speed V between two electrodes A and B and the system works like a generator as in figure below:



If there is a current passing in the outer circuit, an electric current will be appeared in plasma with density and volume force F= J*B which wants to slow down the movement of plasma. Conversely, it can be presumed that the outer circuit contains a generator that generates an electric field E between A*B on the opposite direction and more than V*B. In these conditions, a contrary current appears in the plasma. Electromagnetic force J*B being adverse leading to acceleration of plasma, so the system start acting as an engine.

Conclusion:

Magneto-hydro-dynamic generators and engines can play a significant role in the future.

The first group (generators) led us to build force centers with efficiency higher than present centers and the second group (engines) can be used to launch rockets. But, in practice, the theory of these subjects is too complex to be able to study it by previous explanations. On the other hand, problems related to technology are to be considered. The developments obtained in the field of material technology allows applicability of above plans at higher temperatures around recent 40 years, and provides inhibition of mean ionization energy and electricity generation by magneto-hydro-dynamic generators (MHD) for human future.

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