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Van De graaff Generator for High Voltage DC

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ABSTRACT

This paper proposes a design and operation of high voltage van de graaff DC generator whose output is 81.506KV so we can see the corona discharge with enter voltage 10 volt. A Van de Graaff generator that we design and built and that is supposed for use in college assignment paintings for demonstrating basic ideas of electrostatics and use of high voltage in Electrostatic precipitator, Radiotherapy as well as a number of different applications.

Keywords : Van De Graaff Generator, Electrostatics, Demonstration

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I. INTRODUCTION

Electrostatics The Van de Graaff generator, which became developed from the quit of the 1920, derives from a series 18th century electrostatic machines. In our task we use single phase ceiling fan that may run our nylon belt that's held by using two pully. The material which might be used for our dome, is Steel also the release dome is made from steel. We give the enter voltage of 10 volt Dc source and we get 80KV which can be use for air purification and in cable testing. For calculating that huge high DC voltage, we used Sphere gap method. In this method, we've got taken that two reading, this is of temperature and pressure of our running area. For showing the application of the van de graaff generator as Electrostatic precipitator, we create a smoke in between two dome and this is major dome and discharge dome and get surprising result that quantity of smoke is decreased after passing thru that hole.

Electrostatics become first observed someday in 600 B.C. When Greek truth seeker Thales located amber attracted light gadgets whilst rubbed. The phenomenon tested a fundamental idea of electrostatics. It is an primary physical reality that's extremely excessive voltages can generated via the friction. That fact is the base idea of functioning of Van de Graff generator. The Van de Graff generator which is known as after Dr. Robert J. Van de Graaff whopatented, his electrostatic generator in 1935. He had evolved this generator for analyzing the acceleration of charged debris to discover the atom. Our generator is an outstanding electrostatic generator, this is capable of generating the enormously large static electric potentials .More modest that is "magnificence room" sized Van de Graaff generators produce 100,000 V to 500,000 V. The output of that device, applied in numerous fields of physics, astrophysics, clinical and industry. In the same manner is very beneficial in coaching corona discharge and electrostatics phenomenon.

II. LITERATURE SURVEY

The "Van de Graaff generator for high voltage dc source and its application Publisher" Our paper proposes a design and operation of high voltage van de graaff, DC generator, whose output is 81.506KV, so we can see the corona discharge within the input voltage of 10 volt.[1] Electrostatic machine, Van de Graaff generator, tribe electric series and Electrostatic precipitator. Basic Operation & Applications of the Van de Graaff generator. Publisher In this observes that the static electric charges using Van de Graaff generator. [2] In this project we explain how the Van de Graaff works, and explain the electrostatics principles behind its operation."Spark Length and the Van de Graaff generator" Observe the spark length of Van de Graaff generator. [3] It is expected that the relationship between the speed of the belt and the maximum distance is a power law

relationship with exponent of less than one. [3] Problem encountered was that the black marker pen used to mark the dot on the belt increased the conductivity of the insulator, and reduced the ability of the belt to convey charges. Planar MEMS Van de Graaff generator Publisher", This paper discusses a MEMS implementation of a planar Van de Graaff generator in a standard MUMPs process [4] MEMS power conversion uses the resonance of such structures to achieve voltage conversion. It has certain disadvantages such as the dynamic use of electromechanical contacts, the lack of insulating structural layers in MUMPs, and the friction losses from moving the shuttle [4]. Robert Jemison Van de Graaff, 1928-1948 MC.0045 Publisher" This series consists of the records of major projects Van de Graaff worked on during his tenure at MIT. Included are correspondence as well as lecture and technical notes, photographs, drawings, patents, and reports.[5] Van de Graaff supervised the construction of the 5 MeV electrostatic generator at Round Hill for MIT. Limitation - Access to collections in the Institute Archives and Special Collections is not authorization to publish.

III. METHODOLOGY

To apprehend that the bases of the Van de Graaff generator, it's miles verry critical to understand the static energy. Static strength which is an imbalance inside the amounts of tremendous and negative charges within the surface of an the object. Some atoms preserve on to their electrons more tightly than others do. How strongly depend holds directly to its electrons determines its place inside the tribo electric series. A cloth is more high quality in this collection if is more apt to surrender electrons and greater poor if is extra apt to capture electrons when in touch with other materials.
The following table shows the tribo-electric series for many materials:-

- Human hands -Very positive
- Glass
- Human ha
- Silk
- Paper
- Steel - Neutral
- Wood
- Hard rubber
- Nickel, Copper
- Gold, Platinum
- Silicon
- Teflon - Very negative

The generator includes a well-rounded high-voltage terminal supported from ground on an insulating column, and of a charge-conveying system consisting of one belt of insulating material jogging in two rollers among this terminal and floor.

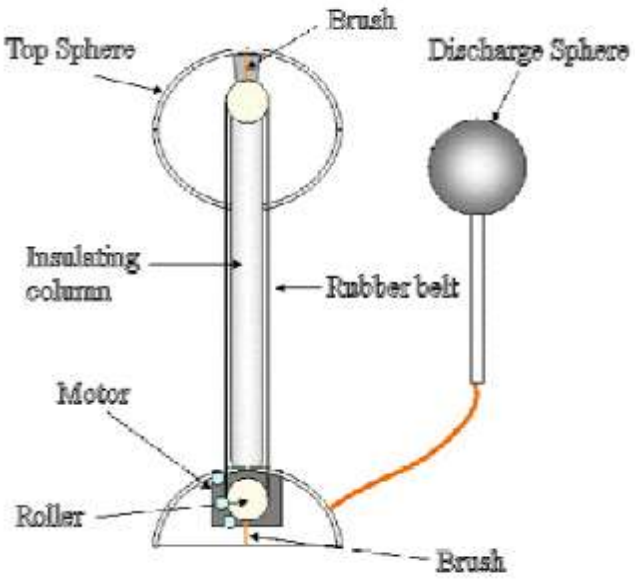

Fig 1. Design of Van de Graaff Generator

Legend: -
A – Output terminal (collector) B – Upper brush C – Upper roller D – Belt E – Motor F – Lower Brush G – Lower roller.

When the motor is turned on, the lower curler starts turning the belt. Since the belt is manufactured from rubber, the lower roller starts offevolved to construct a negative rate and with the aid of induction the belt
builds a positive charge on the outdoor surface. This price imbalance occurs because of the triboelectric effect: the decrease curler is capturing electrons from the belt because it passes over the curler.
A conducting brush at the top of a belt is connected to the "collector". By this comb the positive charge of the belt goes to the collector while the rubber is moving. At the base of the roller is a comb which drains the negative charges on the outside of the belt to ground.
At any instant the terminal potential is V = Q/C, where Q is the stored charge and C the capacitance of the terminal to ground.

Due to the geometry of the outer sphere the free charge can be uniformly disbursed approximately its surface. As the generator keeps to charge, a capacity distinction between the field and the grounded base of the Van de Graaff can reach almost one-half of of one million volts. In fact, the sphere will continue to accumulate fee until a voltage damage down occurs in the air. Prior to the breakdown, the air around the field turns into ionized. The air turns from an insulator to a conductor. With the air ionized the electrons jump off the collector creating a amazing spark.

IV. SPECIFICATION

Material and Specification:

Sr. No.	Component	Material	Specification
1.	1 phase induction motor	-	Type - PSC, Amp - 0.2, Vtg - 220, HP - ¼, RPM - 2800, INS – F
2.	Dome (charge collector)	Stainless Steel	Diameter -
3.	Belt	Rubber	Length – Width – Thickness -
4.	Upper & lower brush	Copper	
5.	Supporting pipe	Acrylic	Length – 4ft
6.	Upper pulley	Nylon	
7.	Lower pulley	Aluminium	
8.	Metal box	Metal plate (MS)	

V. CONCLUSION

The finally conclude design van de graaff generator is used for electrostatic generator which uses a moving belt to accumulate electric charge on a hollow metal globe on the top of an insulated column, creating very high electric potentials. It produces very high voltage direct current electricity at low current levels.

REFERENCES

[1] M. G. Hoog, I. V. Timoshkin, S. J. Macgregor, M. P. Wilson, M. J. Given, and T. Wang, “Breakdown of short gaps at atmospheric pressure,” in Proceedings of the IEEE International Conference on Plasma Science (ICOPS '13), p. 1, IEEE, San Francisco, Calif, USA, June 2013.7

[2] N. K. Kishore, G. S. Punekar, and H. S. Y. Shastry, “Affect of height of HV sphere above the ground in HV measuring sphere gap,” in Proceedings of the Conference on Electrical Insulation and Dielectric Phenomena (CEIDP '07), pp. 755–758, October 20078

[3] M. S. Naidu and V. Kamaraju, High Voltage Enginnering, Tata McGraw-Hill, 2004

[4] M. G. Hogg, I. V. Timoshkin, S. J. Macgregor, M. P. Wilson, M. J. Given, and T. Wang, “Electrical breakdown of short non-uniform air gaps,” in Proceedings of the 19th IEEE Pulsed Power Conference (PPC '13), pp. 1–4, San Francisco, Calif, USA, June 2013.

[5] J. H. Cloete and J. van der Merwe, “The breakdown electric field between two conducting spheres by the method of images,” IEEE Transactions on Education, vol. 41, no. 2, pp. 141–145, 1998.

