

**Reduce Air pollution of CO_2 in Chimney using DC High Voltage (4 kV)**Maradiya Nikunj¹, Kyada Navnit², Khokhariya Gaurav³, Dr. Dipesh Patel⁴¹Electrical Engineering, Babaria institute of technology,²Electrical Engineering, Babaria institute of technology,³Electrical Engineering, Babaria institute of technology,⁴Electrical Engineering, Babaria institute of technology

Abstract — The project is designed to develop High Voltage dc around 4kv from supply source of 230 V AC using capacitors and diodes in Karl Marx circuit. The output from this circuit is used to separate carbon and oxygen from its molecule compound from CO_2 , which was being emitted to atmosphere through Chimney.

The design of the circuit involves Voltage Multiplier, whose principle is to go on doubling the voltage for each stage. Potential divider of 10:1 is measuring the output of Karl Marx circuit i.e. if output is 4kv it shows 400 V in multimeter. This concept of generation is used in electronic appliances like the cathode rays tubes, TV picture tubes, and oscilloscope and used in Industrial application

Keywords- High voltage generation method, Voltage multiplier, potential divider, Karl mark circuit, Separation method of CO_2 .

I. INTRODUCTION

There are various methods of high voltage generation. Most of them are not prefer for small-scale use. Karl mark can be considered as cheaper as and safer than other two methods. Only restriction of using tesla coil and van de graph generator does not use for our project application because of very high voltage and safety. Hence, we can use Karl mark high voltage dc circuit.

The Design of the circuit involves voltage multiplier, whose principle is to go on doubling the voltage for each stage. This High voltage is not possible to be measured by a standard multimeter, a potential divider of 10:1 is used at output such that 400V reading can be consider as 4KV. Due to low impedance of the multimeter, the reading would actually be approximately 14 times input AC voltage. Further, the project can be enhanced to generate the high voltage DC up to the range of 30-50 KV by increasing the number of stages.

Here Karl marks circuit use to generate high voltage dc from 230AC. The output of this circuit is connect with two metals plate and connected with HVDC voltage by which a carbon particle are neutralized and got collect bottom of chimney

II. HIGH VOLTAGE METHODS**1. TESLA COIL**

Tesla coil output is very high 16kv, 18kv, 32kv and more. when working with tesla coil's it's likely to very high voltage and current, charge capacitor, exposed winding, strong electrical field, induced current, fire dangers, ozone, ultraviolet light and noise.

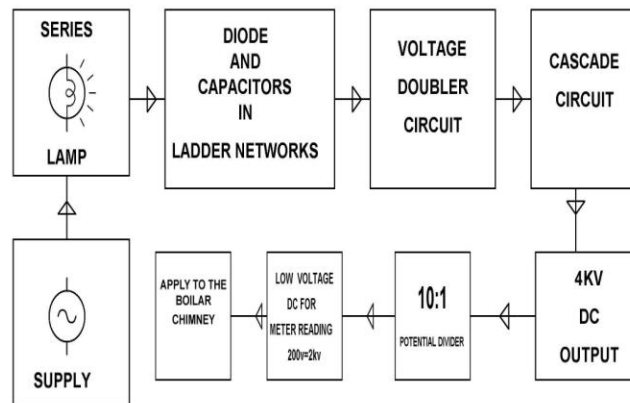
2. VAN DE GRAFF GENERATOR

The Van de Graff generator is a device which produces and stores a large electrostatic charge on a metal dome. It discharges to a smaller sphere and, in ideal conditions, it can produce a voltage of 400,000 volts with a short circuit current of 20 micro-amps.

3. KARL MARX CIRCUIT

The stage capacitors charge through the charging resistors (R_c) A Marx Generator is a clever way of charging a number of capacitors in parallel, then discharging them in series. It is easy to handle and control as compare to other and for low level high voltage. in the range of (2, 4, 8...24kv)

III. BLOCK DIAGRAM

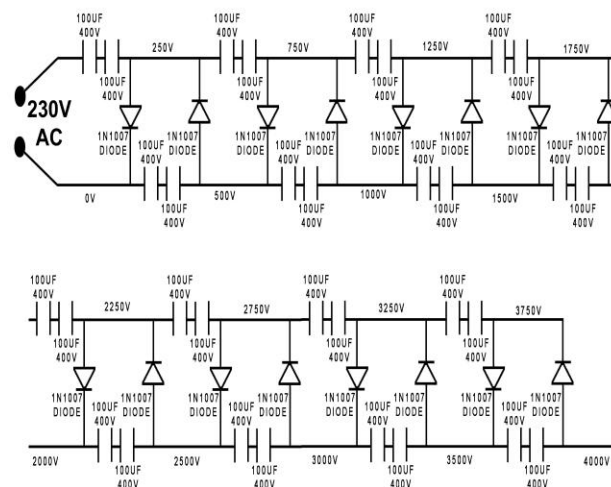


The description of this block diagram is the 230v AC from supply to the karl marx circuit.this circuit have a number of diode and capacitors are connected in ladder networks with number of stage .the voltage level increasing with stage. every stage voltage is double circuit. This circuit voltage is very high so it is not possible to measure directly so potentiometer is use to measure. potential ratio is 10:1 which saw the output 400v is can be consider as the 4kv.this high voltage dc is given to copper plate. This high voltage is separate the co2 molecules into carbon and oxygen.

IV. CIRCUIT DIAGRAM

Here we use diode and capacitor in ladder network. Here 400v and 100microfarade capacitors are use in this circuit for producing 4 KV. The 1N5400 series is a similarly popular series for higher current applications, up to 3 A. These diodes come in the larger DO-201 axial package. These are fairly low-speed rectifier diodes, being inefficient for square waves of more than 15 kHz. The series was second sourced by many manufacturers. The 1N4000 series were in the Motorola *Silicon Rectifier Handbook* in 1966, as replacements for 1N2609 through 1N2617. The 1N5400 series were announced in *Electrical Design News* in 1968, along with the now lesser known 1.5 A 1N5391 series. The table below shows the maximum repetitive reverse blocking voltages of each of the members of the 1N4000 and 1N5400 series.

KARL MARX CIRCUIT FOR 4000V DC FROM 230V AC



1) Main input power

2) Series lamp

3) Capacitor connection

4) Series diode connection

5) potential divided resistance

6) final output voltage measurement

V. CIRCUIT MODEL



stability and attachment of compounds for particular applications.

VI. CO₂ capture/separation technologies

1. *Solvent* absorption involves a cyclical process in which CO₂ is absorbed from a gas stream directed into a liquid, typically an amine. The gas stream, with most of the CO₂ removed, is then emitted to the atmosphere. This technique is fairly widely used in a range of applications. It needs a large amount of power to regenerate the solvent.

2. Membranes made of polymers or ceramics, can be used to effectively sieve out CO₂ from gas streams. The membrane material is specifically designed to preferentially separate the molecules in the mixture. A range of configurations exists either simply as gas separation devices or incorporating liquid absorption stages. It has not yet been applied on a large scale and there are challenges related to the composition and temperature of the flue gases.

3. Cryogenic techniques use low temperatures to cool, condense and purify CO₂ from gas streams. They have been applied to moderately concentrated carbon-dioxide streams.

VII. CHIMNEY MODEL



VIII. WORKING OF CHIMNEY MODEL

Here Two copper plates are connected in parallel in chimney above some height of the base of the chimney. At bottom of the plates, there are two point connection which is connected with the output of the Karl Marx circuit. When the CO₂ are get in all other gases in chimney then this type of chimney model are use in industries. Then this carbon dioxide passes through the two copper plate which is arranged in chimney as shown in model.

The positive point of the supply is connected with one copper plate and negative point of the supply is connected with other plate. The result is carbon and oxygen are separated to each other and only oxygen gas passes to the atmosphere through chimney. And the other part of carbon is attracted with copper plates and after we collect this carbon particles at the bottom of the chimney. After the collection of carbon particles which is used in various application and oxygen does not pollute the atmosphere so reduce the pollution.

IX. APPLICATION

This project is mainly used in the dyeing and printing mill in which a boiler is used for the high pressure application. mainly boiler contain a protection part as named ESP plant. In a boiler chimney, there are mainly two metal plates are arranged and connected with the HVDC voltage by which carbon particles are neutralized and got collected on the bottom of the chimney. Thus this project is mainly applicable for to save the environment due to the industrial smokes.

X. CONCLUSION:

this project states the application of Karl Marx high voltage Dc generation method. In this circuit capacitor and diode are connected in ladder network. Capacitor is energy storing device and diode is used as rectifier to convert the ac to dc voltage. In Each stage of the circuit, we get various dc voltages. This high voltage is used to separate the CO₂ molecules

into carbon and oxygen. So CO₂ pollutant content which is emitted by the chimney will reduce. So that's way we control the content of CO₂ pollutants emitted from the chimney and control the pollution which is harmful to the environment. As emission of co₂ results into increase in global warming. so by our project the extent of co₂ pollutant emitting from chimney will reduce.

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