

Neutralization of carbon particles in boiler chimney using high voltage dc

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Abstract— This paper 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 design of the circuit involves voltage multiplier; whose principle is to go on doubling the voltage for each stage. The output from a 16 stage voltage multiplier can generate up to 4KV. The output from this circuit is used to separate carbon and oxygen from its molecule compound from co₂, which was being emitted to atmosphere through Chimney.

Keywords— HVDC generation method, Voltage multiplier circuit, Voltage divider, Karl mark circuit, Separation method of co₂.

I. INTRODUCTION

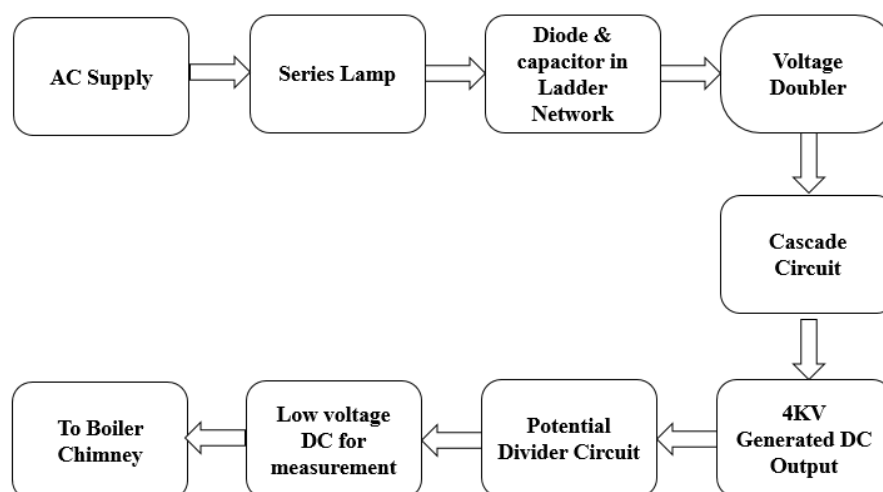
There are various methods available for generation of high voltage. But most of method are not prefer for small-scale purpose. Karl mark can be considered as cheaper and safer than other two methods. Only restriction of using tesla coil and van de graph generator does not use for application because of very high voltage and safety.

The voltage multiplier, principle is that to double the voltage for each stage. Further, this circuit can be enhanced to generate the high voltage DC up to the range of 30-50 KV by increasing the number of stages.

II. VARIOUS HIGH VOLTAGE METHOD

- A. **KARL MARX CIRCUIT**- Its principle is to generate a high voltage pulse using a number of capacitors in parallel to charge up during the on time and then connected in series to develop higher voltage during the off period. 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)
- B. **VAN DE GRAFF GENERATOR**- A Van de Graaff generator is an 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 (DC) electricity at low current levels.
- C. **TESLA COIL**- A Tesla coil consists of two parts: a primary coil and secondary coil, each with its own capacitor. The two coils and capacitors are connected by a spark gap. An outside source hooked up to a transformer powers the whole system. 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.

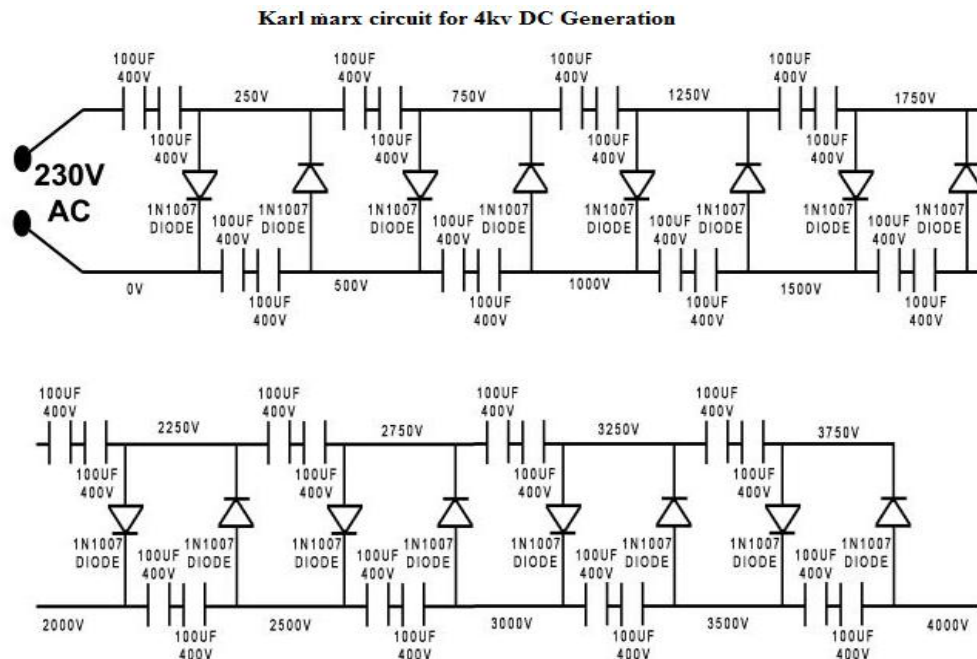
III. BLOCK DIAGRAM



In this block diagram 4kv DC generated from 230v AC supply by using the karl marx circuit. The circuit have a number of diode and capacitors are connected in ladder networks with number of stage. The level of voltage is double in every stage. The output of circuit is very high so it is not possible to measure voltage directly by multimeter. Therefore,

by using potential divider (ratio 10:1) output voltage is measured. If the output show 400 volt, which can be consider as the 4kv. This high voltage dc is given to copper plate, which separate the co2 molecules into carbon and oxygen.

IV. CIRCUIT DIAGRAM



In this circuit diode and capacitor in ladder network. 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 are fairly low-speed rectifier diodes, being inefficient for square waves of more than 15 kHz.

V. OVERALL MODEL



This is the complete model with circuit diagram. Here two copper plates are connected in parallel in chimney. At bottom of the plates, there are two point connections 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 is use in industries. Then this carbon dioxide passes through the two copper plates which is arrange 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 other particles of carbon are attracted with copper plates. After the collection of carbon particles which is used in various application and oxygen does not pollute the atmosphere so reduce the pollution.

VI. APPLICATION

This model is mainly used in the dying and printing mill in which a boiler is used for the high-pressure application. Mainly boiler contains a protection part as named ESP plant. In a boiler chimney, two metal plates are arranged and connected with the HVDC voltage. This plate absorbed the carbon particles from the flue gases. Thus, this project is applicable for to save the environment due to the industrial smokes.

VII. CONCLUSIONS

This model is produced high voltage using Karl make method. Due to high voltage, the CO₂ molecules separated into carbon and oxygen. Carbon molecules is collected by copper plate, which is charged by high voltage DC. So that's way we control the pollution, because of carbon particle collect on the plate and only O₂ is fed in atmosphere. By this method global warming effect can be reduced.

REFERENCES

1. http://nptel.ac.in/courses/108104048/ui/Course_home5_26.htm
2. <http://www.edaboard.com/thread205285.html>
3. http://en.wikipedia.org/wiki/Cockcroft%E2%80%93Walton_generator
4. <https://www.youtube.com/watch?V=geuk1odyxhk>
5. High Voltage Engineering by Nagrath Kothari
6. High Voltage Engineering by S.K.Singh