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DEVELOPMENT OF ELECTRIC CHARGE GENERATOR BY APPLIED PULSE HIGH INTENSITY ELECTRIC FIELD

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Abstract

This research was presented the development of electric charge generator by applied pulse high intensity electric field. The power supply based on fly back converter comprises of a pulse generator using IC#MB3579 on the output high voltage adjustment by switching frequency adjustment at 50 Hz by using IC#TLP250 for ground isolator and signal expanding to Power MOSFET#IRFP450 driving to control high voltage transformer to generate 1 kV, 2 kV and 3 kV by using electrode cell (high intensity non-uniform electric field cell) for generate electric charge. The results showed that, when the adjustable high voltage increases the intensity of electric field, resulting in increased production of electric charge and increased respectively. The testing of electric charge quantity measuring will observation at high voltage 1 kV electric field intensity equal 5 kV/cm enables generate electric charge +1.25 kV and -1.19 kV, high voltage 2 kV electric field intensity equal 10 kV/cm enables generate electric charge +2.17 kV and -2.33 kV and high voltage 3 kV electric field intensity equal 15 kV/cm enables generate electric charge +3.37 kV and -3.15 kV. The developed in this research are design and develop of circuit generate pulse high voltage can produce positive and negative high voltage waveforms. By the power to the electric field cell by the principle of high non-uniform electric field (high intensity electric field) for application. The guidelines of this development will make the quantity of electric charge can produce both positive and negative electric charge are more quantity than the original. Therefore, this research can develop an applied research industry and innovation for commercial in the future.

Keywords*: charge generator, high voltage, non-uniform electric field.*

Introduction

At present, a large amount of electric charge (positive and negative) has been used in industrial systems. Which is in practice can be seen that electric charges are both generated to generate static electricity and eliminate static electricity on the work piece. As a result, the concept and the way to produce electric charge to create benefits and benefits for the production in the industrial system as much as possible. By such methods are the design and construction of an electric charge machine with pulsed high voltage power supply And the electric field cell is highly uneven by creating a pulsed high-voltage power source which has introduced IC MB3579 as a pulse modulator and is a control circuit for switching power MOSFET or IGBT in the converter sector. With a high-voltage switching transformer acting as an induction pulse to create a high-voltage pulse applied to the electric field cell which the energy from the electric field is a factor that directly affects efficiency and the type of electric field cell used, therefore, must be conducive to the production of electric charge.

In this research project, the electric field cells that can produce electric charges which can be both positive and negative. With ionization process by having a fan as a device to carry the electric charge to the work piece that needs to be discharged or discharged thru focusing on the

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design and the construction of an electric charge machine with a high-voltage pulse electric field Which will consist of 2 main parts. Namely Part 1, is a design Creating a pulse high-voltage power source by using the working principle of fly back converters and part 2 is the design of the construction of high stress electric field sets. These two parts are related to electric charge production. And in the experimental results, it will try to adjust the electric field stress (Pulse high voltage power supply) that is supplied to the electric field cell set because at the stress level of the electric field (Pulse high voltage) different it will make the amount of charge of the electricity produced differently (The reason for using a pulse charge both the positive and negative charges of each product are not equal Therefore, the researcher must develop the device to produce both positive and negative charges simultaneously. To adjust the electrical charge balance of that product (The pulse charge means the electric charge both positive and negative).

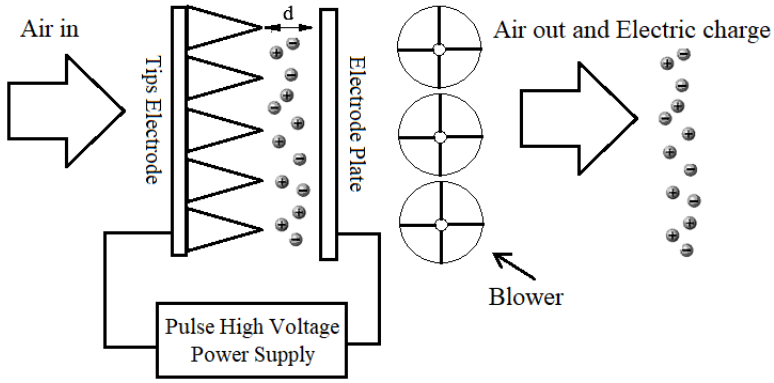


Fig. 1. The internal structure of the electric charge machine

The internal structure of the electric capacitor (Fig. 1):
1. The exhaust fan
2. The set of pulse high voltage power supply (High voltage pulse generating circuit)
3. The electrode cells (Electric field cell or electrolytic cell production)

Materials and Methods

Research objectives

The main objectives of this study are to:

- study the design and construction of a high-voltage pulsed circuit. By using the MB3579 IC to be the signal generator to control the operation of the power MOSFET or IGBT in the converter circuit.
- study of changing the electric field stress on the amount of electric charge.
- study the design and creation of the electrode cells. High stress electric field (Highly irregular).

Research methods

Pulse AC charge method

The pulse AC methods, High-voltage currents, both “positive” and “negative”, are applied to each polarity alternately so that the electrode can discharge both ions. This method can release ions in greater quantities than conventional AC methods and can change the frequency of oscillation as well (Fig. 2). Therefore, the AC pulse method is effective in eliminating static

electricity under various conditions excellency from eliminating static electricity on work pieces that move quickly until static elimination in the air.

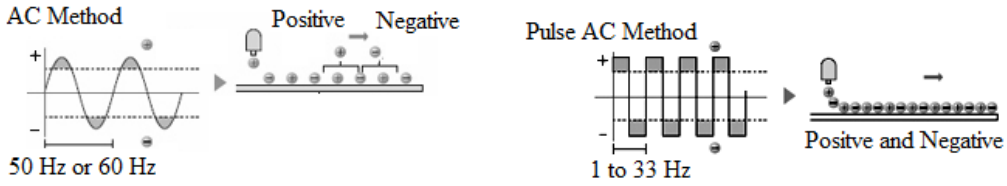


Fig. 2. How to produce an AC pulse charge

Design and construction

This research project has divided the design into 4 parts, namely the regenerator and input filter. Circuit sector (power circuit) sector, control circuit and gate driver circuit and electric field cells produce electric charges

All 4 parts of this design are used to create pulsed high-voltage AC power supply which has the overall working principle as the diagram block in Fig. 3.

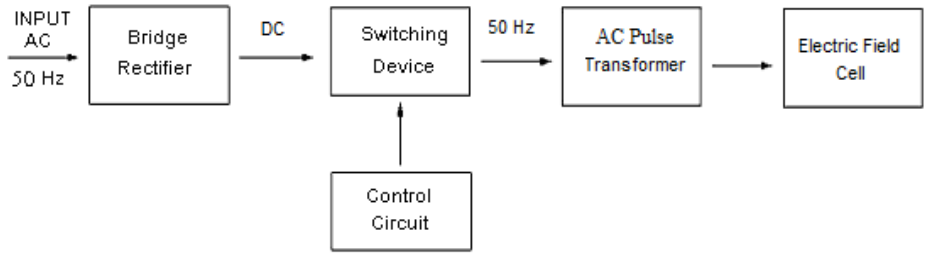


Fig. 3. Blocking the diagram of a pulse high-voltage AC power supply

From Fig. 3, when entering 220 volts, 50 Hz to 220 volts /18 volts, then through the Regulators and filters Making the DC voltage 24 volts to be supplied to the input side of the fly back circuit Which has an IC#MB3579, a PWM (Pulse Width Modulation) control circuit for Power MOSFET in the converter circuit To control the supply of high-voltage AC voltage pulses supplied to electric field cells for the production of electric charges. Pulse high voltage AC power supply circuit designed is presented in Fig. 4 and Fig. 5.

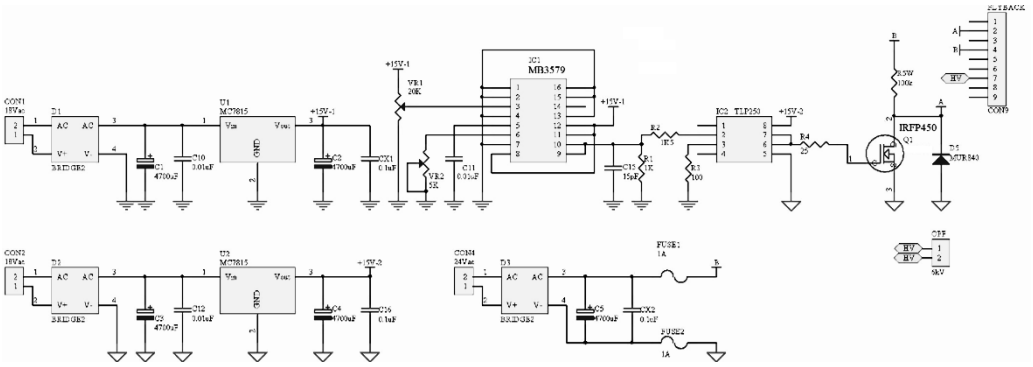


Fig. 4. High voltage switching power supply circuit of electric field cells for producing electric charge

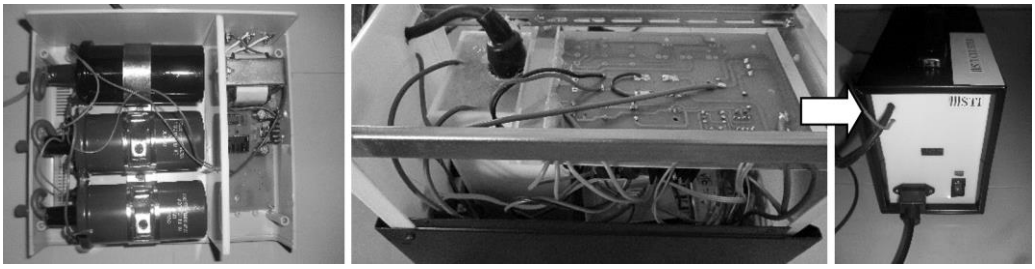


Fig. 5. Pulse-generated high-voltage power supply circuit

Electric field cells (Electrolytic cell production).

The electric field cell (Fig. 6) consists of a pointed electrode rod placed away from the stainless steel sheet or aluminum sheet which has the opposite power. If considering the intensity of the electric field, it will follow the equation:

$$E = V / (d \cdot \eta^{*}) \quad (1)$$

When E = intensity. Electric field V = voltage d = distance between the pointed electrode rod and stainless steel sheet or aluminum sheet and η^{*} = factor Electric field router.

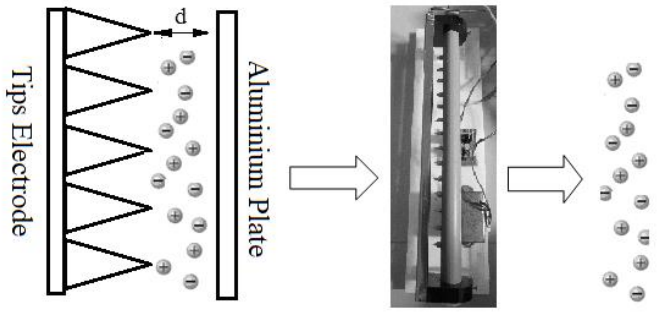


Fig. 6. Electric field cell (Electrolytic cell production) designed and built and the discharge characteristics

Hence the electric field cell Choose to use a pointed electrode rod. And placed away from stainless steel sheets or aluminum plates equal to 1 cm.

Calculation of electric field intensity

At the distance between the plates (d) = 1 cm., η^{*} = 20%;

At high voltage V = 1 kV, therefore E = 5 kV/cm;

At high voltage V = 2 kV, therefore E = 10 kV/ cm and At high voltage V = 3 kV therefore E = 15 kV/cm.

Design of the structure of the electric charge machine

Structure design of the electric charge machine which uses plastic sheets to make structures because it is strong and can prevent leakage of electricity as well along with installing various devices on the device, such as the power switch, power plug, fan, air volume adjustment device And the electric field intensity display as shown in Fig. 7.

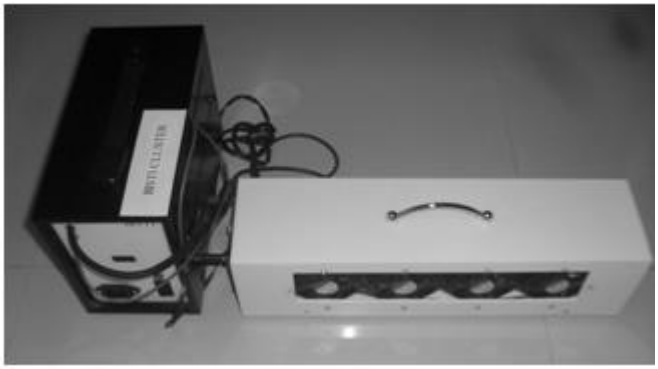
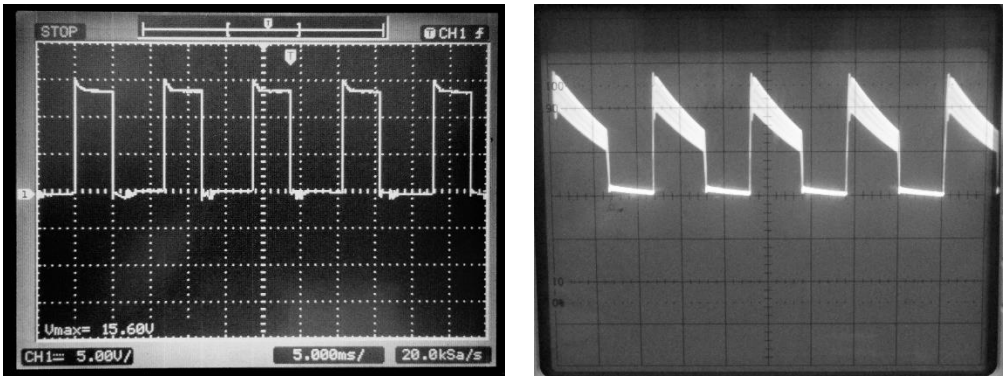


Fig. 7. The electric charge machine

Results and Discussions

Testing the output signal of the IC#TLP250 by inputting the signal to the gate pin and source pin (VGS) at Duty Cycle 40%, maintaining the frequency at 50 Hz and measuring the test. High voltage AC voltage signal Output pulse (VOUT) of high voltage transformer while connecting the electrolytic cell.



a) b)

Fig. 8. a) Output signal of the IC#TLP250 (Duty Cycle 40%);
b) Pulse high voltage AC output signal (VOUT) of the high voltage transformer

The relationship between high voltage voltage pulses and the amount of electric charge production are presented in Table 1.

Table 1. The relationship between high voltage voltage pulses and the amount of electric charge production

High voltage pulse voltage (kV)	The amount of electric charge (kV)
1	+1.25 and -1.19
2	+2.17 and -2.33
3	+3.37 and -3.15

Relationship between various electrical parameters with the amount of voltage (Static electricity) the ability to produce electric charges static elimination and the amount of ozone production (Table 2).

Table 2. Relationship between various electrical parameters with the amount of voltage

Electric field intensity (kV/cm)	High Voltage (kV)	Electro 1 (kV)	Electro 2 (kV)	Electro 3 (kV)	Percent of the reduction of static electricity (%)	Ozone gas (ppm)
5	1	- 1.73	- 0.18	- 1.55	89.59	0.01
10	2	- 1.95	- 0.31	- 1.64	84.1	0.015
15	3	- 2.33	- 0.75	- 1.58	67.81	0.018

Definition of parameters in Table 2:

High Voltage is a high voltage pulse that is connected to an electric charge cell, (kV, kV);

Electro 1 is a high voltage (Static electricity) measured from static electricity air filters, (kV, kV);

Electro 2 is a high voltage (Static electricity) measured after spraying the electrostatic charge to the static air filter, (kV, kV);

Electro 3 is a high voltage (Static electricity) that can be reduced from the calculation, (kV, kV). Note: The amount of electric charge is measured by the high voltage measured.

Conclusions

Based on the test results, it can be concluded that this electric charge machine has good performance. Because it can be used to reduce the amount of electric charge to be reduced when adjusting the pulse voltage higher, respectively. And the part developed in this research project is the design and development of high-voltage pulsed circuit to produce high-voltage, positive-negative waveforms and used to supply electrical energy to the electric field cell by adopting a highly uneven electric field principle (High stress electric field). This development approach will allow the production of electric charges both positive and negative. This research project has achieved according to the stated objectives. The features of the electric charge machine that are designed and developed are as follows.

It can produce electric charge to effectively eliminate static electricity. By using a high voltage AC alternator pulse which can produce both positive and negative charges as needed by the company and industrial factory.

Can increase the energy, intensity of static electricity for speedy production and removal of static electricity.

Cover the area of use up to 0.3 - 0.9 meters and can develop to cover more areas.

There is a display of energy levels, intensity of the electric field used.

The cell produces the electric charge of the machine without having to remove it. Just bring it clean Can then be reused without having to pay for the purchase of a new electric field cell.

The machine produces less ozone which is a special feature that needs because while the machine is working users only want to produce or eliminate static electricity. There is no need to use ozone. And can also help reduce energy consumption as well.

Can expand the machine and the cell produces easy charge in order to be suitable for the work piece.

Development guidelines in this electric charge machine has developed a high-voltage alternating current AC circuit designed to increase the voltage by increasing the duty cycle or the size of the input voltage In the future, will bring more voltage to produce more electric charge than ever before In order to further increase the efficiency of static elimination And on the part of the cell producing electricity can develop more cell size to support large industries.

Utilizing research results to be useful

Electric capacitors can be used in other industrial applications such as static elimination during the movement of liquid crystal glass. Preventing electrostatic charges in wafer containers,

preventing dust from high quality film, preventing foreign objects in the chemical packing process, preventing dust from sticking in food packaging and in the future, can be further developed into a new commercial product.

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