Global Journal of Science Frontier Research: a
Physics and Space Science
Volume 20 Issue 10 Version 1.0 Year 2020
Type : Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

The Electrostatic Generator of Mende

By F. F. Mende

Abstract- The survey of the methods of separation and accumulation of charges is carried out and the existing constructions of electrostatic generators are examined. Is proposed the new method of the separation of electric charges in the liquids, which flow in the magnetic field. Is given the schematic of the electrostatic generator, based on the application of a method of the magnetic separation of charges, and they are represented the results of experimental studies.

GJSFR-A Classification: *FOR Code: 020302*

Strictly as per the compliance and regulations of:

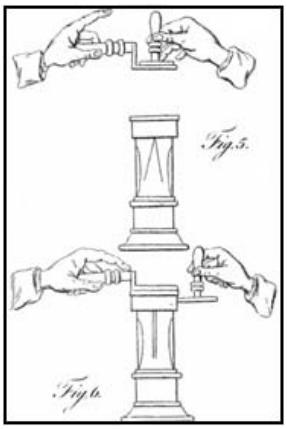
The Electrostatic Generator of Mende

F. F. Mende

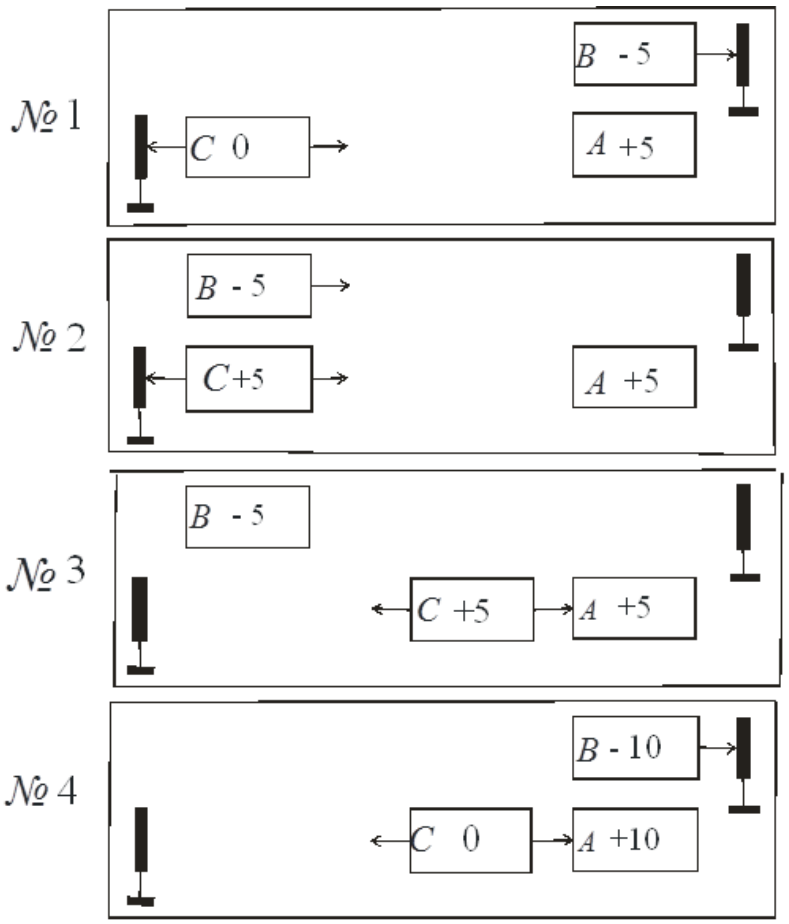
Abstract- The survey of the methods of separation and accumulation of charges is carried out and the existing constructions of electrostatic generators are examined. Is proposed the new method of the separation of electric charges in the liquids, which flow in the magnetic field. Is given the schematic of the electrostatic generator, based on the application of a method of the magnetic separation of charges, and they are represented the results of experimental studies.

I. Methods of Separation and Accumulation of the Charges

All existing types of electrostatic generators are based on the electrical method of the separation of charges. Manual the method of the accumulation of charges was proposed by the unknown author still in the end of the 14th century and depicted on the engraving



The sequence of operations of the accumulation of charge according to this diagram can be presented as follows



Author: *e-mail: fedormende@gmail.com*

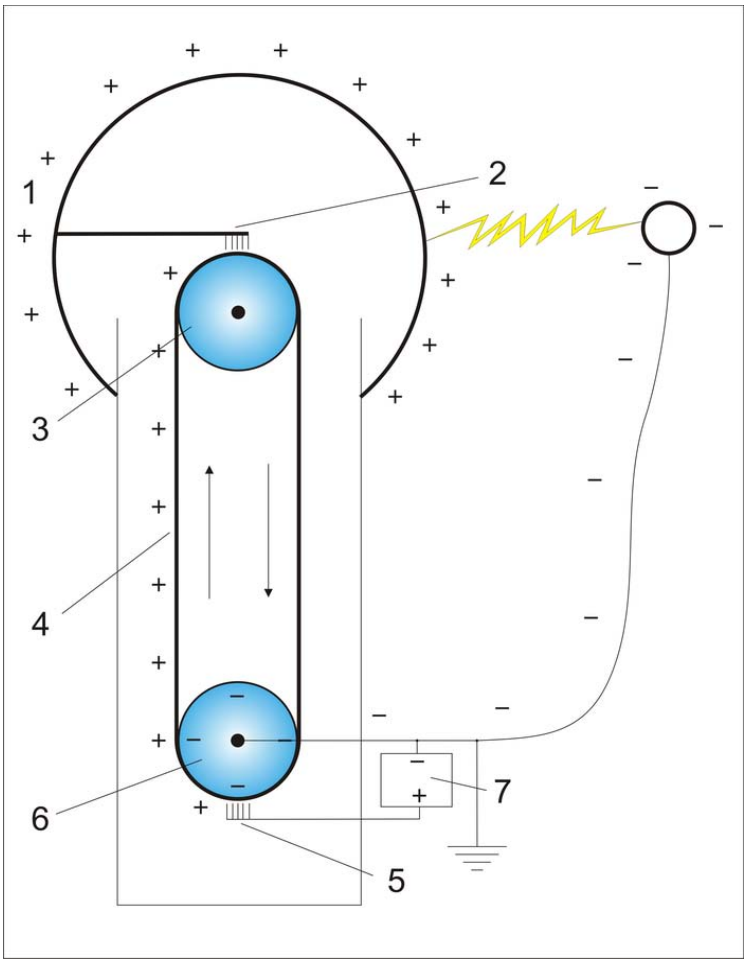
In the position №1 the initial charge of body A comprises +5 ones, body B is grounded and its charge -5 of ones. Body C is also grounded and its charge is equal 0.

In the position №2 the body B located above the body C directs in it the charge +5 ones.

In the position №3 the body B is located on the previous place, and body C is torn off from the earth and is moved to the body A to the contact with it. In the position №4 the body B returns to the initial position and it is grounded. In this case the charge of body A grows to +10 ones, and body B acquires the charge of -10 ones. The body C returns to the foothold and is grounded after this, and cycle is repeated. With the following cycle the charge in the body A will be doubled and will comprise + 20 ones.

Three are today known basic of the type of the electrostatic generators, utilized for obtaining the high voltages. These are belt generator [1], electroform generator [2] and Calvin's dropper [3].

The electrical oscillator circuit of Van de Graaf is represented in Fig. 1.



Ris.1: Electrical oscillator circuit of van de Graaf

Belt generator consists of the dielectric (silk or rubber) tape 4, of that revolving on the rollers 3 and 6, moreover upper roller dielectric, and lower metallic and is connected by the earth . One it goes from the parts of the tape during the rotation of rollers in the metallic sphere 1. Two electrodes 2 and 5 in the form brushes are located at small distance from the tape on top and from below, moreover electrode 2 is connected with the internal surface of the sphere 1. Through the brush 5 air is ionized from the source of the high voltage 7. Resultant positive ions under the action Coulomb force they move to the grounded 6 roller and they settle on the tape. The moving tape transfers charge inside the sphere 1, where it is removed by brush 2, , also, under the action Coulomb force charges are pushed out to the surface of sphere and field inside the sphere is created only by booster charge on the tape. Thus, on the external surface of sphere is accumulated electric charge. The possibility of obtaining the high voltage in this generator is limited by the corona discharge, appearing with the ionization air around the sphere.

In Fig. 3 it is shown the common form of Van de Graff's generator.

Fig. 3: Belt generator for the first in Hungary the linear accelerator, on which in 1952 the year stress MV was 1 obtained

Electroform generator developed by German scientist Wimshurst, is depicted in Fig. 4.

Fig. 4: Electrophorus the generator Wimshurst

In the generator there are two revolving in the opposite direction disks, made from a good insulator, for example ebonite. To the disks the conducting plates, which form capacitors, are stuck with the plates of opposite disk. In the process of rotating the disks the capacitance of these capacitors changes, since. the area of the overlap of the conducting plates changes. In the process of rotating the disks along the conducting plates the brushes, which connect the oppositely placed plates on both disks, slide. On both sides disks are two pairs of point contacts, located on the appropriate holders. These contacts during the rotation of disks do not concern the conducting plates, but charges on these contacts appear with the electrical breakdown between the contacts and the conducting plates. On the contacts indicated are collected the charges of the opposite signs, with the aid of which are charged Leyden jars. The holders of ball-shaped discharger are located on the Leyden jars. The Electroform generator operation diagramoccurs according to the diagram represented below, where the conducting plates, which gather the charges of different signs are depicted as red and green color.

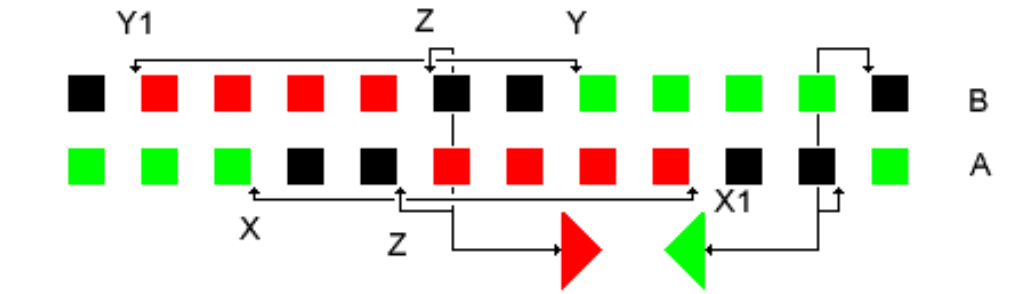


Fig. 5: Electroform generator operation diagram

Let us examine how the accumulation of charges in the generator occurs. Let us assume that the first circle has a deficiency in the free charges, which in our case indicates a deficiency in the free electrons in the metallic plates. During the motion of the second disk its plates will alternately come into contact with brushes and on them will be, correspondingly, formed the surplus of free charge carriers. This occurs because the plates from both sides, between which is located the dielectric (material of disks), are the parallel-plate capacitor, whose facings move.

The following further occurs. Plates, the second disk, after reaching the brushes, will return their electrons into the capacitor in the form of Leyden jar. This jar will accumulate the charge -Q. Then will come the turn of the plates following after them and so on. Analogous process occurs also on the first disk, since it so revolves, but in other direction. In this case free carriers pump out themselves from another Leyden jar, thus forming on it a deficiency in the electrons, and it means, by it is acquired the charge Q.

The more frequent the plate of both disks they come into contact with brushes on the conductors, the greater the quantity of charges is accumulated on them. Leyden jars will be charged, to those times, thus far the Coulomb forces they will not begin to counteract further accumulation of charges. This means that there is a limit of accumulation, which represents a potential difference between the Leyden jars.

The dropper is the simplest electrostatic generator Calvin, its diagram is depicted in Fig. 6.

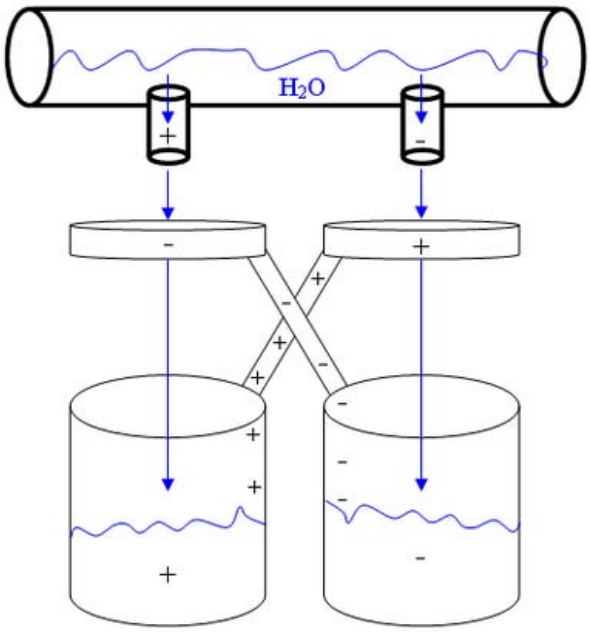


Fig. 6: Schematic of Calvin's dropper

Originally entire installation has neutral charge. It is unknown in view of the symmetry of installation and absence of charge, on which of the jars positive or negative charge will be accumulated. A small potential difference always is present because of different external actions between the left and right side of the installation, therefore the installation requires no starting charging of jars for the starting of system. By the force electrostatic induction ferrules direct in the reservoir

with the water in that place, under which they are located, opposite charges. As a result a quantity of charges on the opposite edges of reservoir becomes different. After falling, drop they fall into the jar, which corresponds to its charge, thus increasing its charge, which creates still larger electric field near the rings, strengthening the separation of static charge and a potential difference it grows. Thus Calvin's dropper accumulates the electric charges of opposite signs in its lower banks

Generators for separation and accumulation examined above of charges are used the laws of electrostatic induction, and magnetic fields in this process of participation do not assume. Hall's law is at the same time known, who gives the possibility to separate the moving charges.

In the simplest examination the Hall effect is represented in Fig. 7.A magnetic field B passes through the conducting plate in the normal direction with induction and through the same plate an electric current flows with density j under the action of the electric field E. The magnetic field will deflect charge carriers of opposite signs to one of the plate faces.

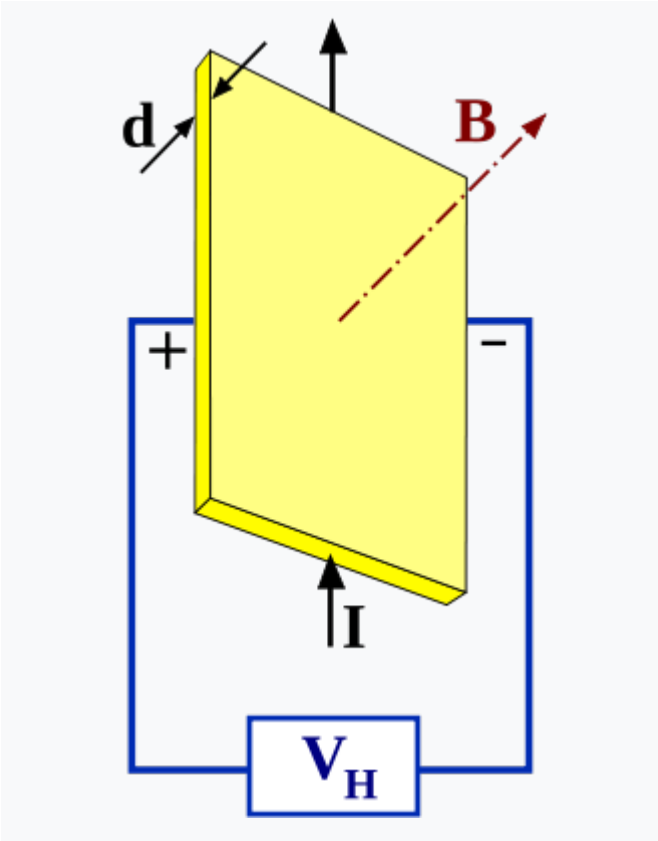


Fig. 7: Diagram of Hall effect

Thus, Lorentz force it will lead to the accumulation of negative charge near one face of plate, and positive- near the opposite. The accumulation of charge will continue to those times, thus far arisen the electric field the charges E_1 it does not compensate for Lorentz force:

$$eE_1 = evB \text{ or } E_1 = vB,$$

where e - electric charge.

Hall effect can be used not only for measuring the magnetic field, but also for the separation of charges in the fluxion, for example to water. In the water (if we exclude the distilled water), are always ions the dissolved in it salts. Their that it is possible to divide with the aid of the Hall effect. If water will move normal to the direction magnetic field, then the ions of different signs will be accumulated on the different sides of flow. Dividing further flow to two parts, it is possible to obtain two separate flows, in which will be concentrated the ions of different signs. The circuit of separation of charges the method indicated is Fig. 8.

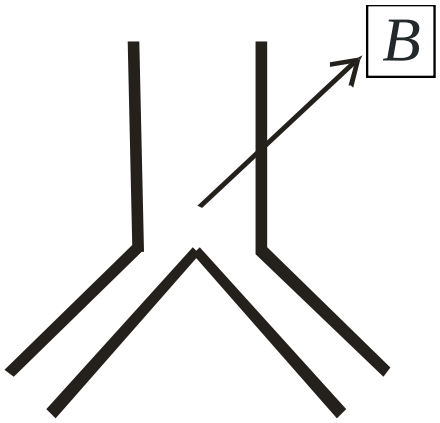


Fig. 8: Circuit of separation of charges with the magnetic separation

Gathering these flows into the different capacities, as is done in Calvin's dropper, it is possible to create the electrostatic generator (Fig. 9).

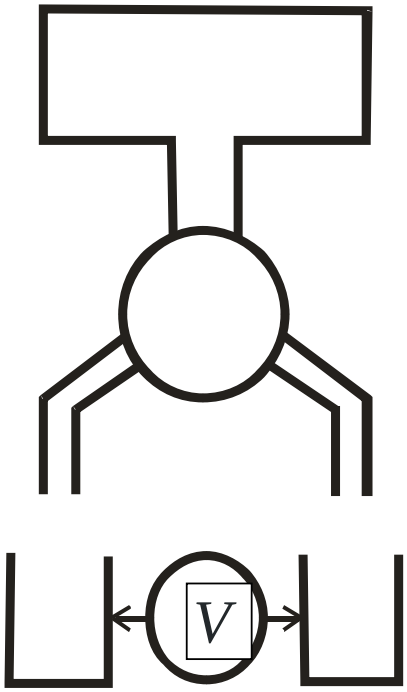


Fig. 9: Schematic of electrostatic generator with the magnetic separation of the charges

Water from the upper capacity flows along the flat duct between two annular magnets. In the area of action of the magnetic field, created by the annular magnets, the channel is divided on two channels and waters, which flows of them, it falls into two lower capacities, between which is created a potential difference. On the experimental installation with the use of two annular samarium magnets, between which the tension of magnetic field composed 0.5T was obtained a potential difference 50 kV.

Since this method of the separation of charges in the scientific publications earlier is not represented, let us name this generator Mende generator.

The general view of the experimental model of the Mende generator is shown in Fig.10.

Puc. 10: General view of the experimental layout of the Mende electrostatic generator

II. Conclusion

The survey of the methods of separation and accumulation of charges is carried out and the existing constructions of electrostatic generators are examined. Is proposed the new method of the separation of electric charges in the liquids, which flow in the magnetic field. Is given the schematic of the electrostatic generator, based on the application of a method of the magnetic separation of charges, and they are represented the results of experimental studies.

References Références Referencias

1. *Darryl J. Leiter.* Van de Graaff, Robert Jemison // A to Z of Physicists. — 2003. — C. 312.
2. http://hypertextbook.com/facts/2005/kelvin.shtml.
3. Калашников С. Г., Электричество, М., ГИТТЛ, 1956.