

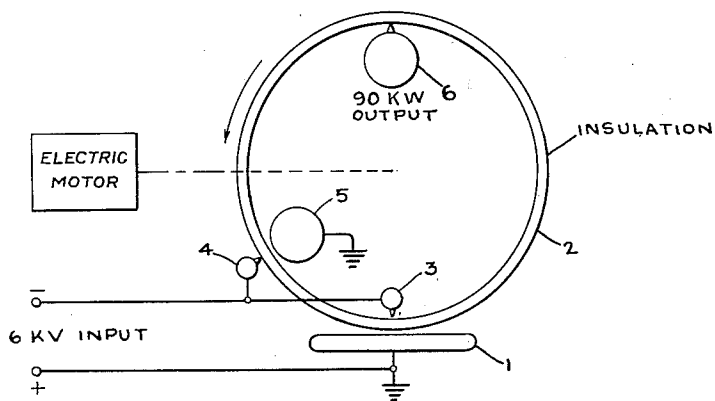
March 13, 1951

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2,545,354

ELECTROSTATIC GENERATOR

Filed March 16, 1950



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UNITED STATES PATENT OFFICE

2,545,354

ELECTROSTATIC GENERATOR

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Application March 16, 1950, Serial No. 150,083

3 Claims. (Cl. 171—329)

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My invention relates to an electrostatic generator and more particularly to those generators having a constant no load direct voltage output.

Cathode ray tubes which are used for projection television require a direct supply of high voltage and low current, and my invention is for an electrostatic generator of the Van de Graff type embodying certain improvements which make it applicable for use with such cathode ray tubes. Because my machine has an output voltage which is directly proportional to the input voltage, and because it has a constant no load direct voltage output, it may be used in conjunction with a voltage regulator circuit to provide a constant output voltage as the load on the generator varies.

Very briefly, I accomplish this by means of a high electrical resistance drum which is revolved by means such, for example, as an electric motor through a corona discharge. As the surface of the drum passes through this corona, it acquires a charge which is carried away from the corona to an output brush. The output voltage is considerably higher than the input voltage producing the corona, and provided that the current taken from the generator is low this high voltage will be substantially constant.

Therefore, it is an object of my invention to provide an electrostatic generator of the Van de Graff type which may be used in conjunction with cathode ray tubes.

It is a further object of my invention to provide a high voltage generator which will have a constant high voltage output while supplying a low current output.

It is a still further object of my invention to provide an electrostatic generator in which the output voltage is constant under the no load condition and which voltage does not depend upon the leakage of charge from the generator.

It is a still further object of my invention to provide an electrostatic generator which has a regulated output and thus may provide a constant high voltage output under various load conditions.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation may best be understood by reference to the following description taken in connection with the accompanying drawing which is a schematic diagram used to facilitate an understanding of the operation of my invention.

Referring to the drawing, a metallic conducting plate 1, which may be of a rectangular shape, is in close proximity to a cylindrical drum 2, is of a length comparable to the length of drum 2 and is electrically connected to ground. A con-

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ventional type corona brush 3 which is placed within the drum at a point directly opposite plate 1, is likewise positioned in close proximity with the wall of drum 2. Drum 2, which is insulated from ground, is constructed of a dielectric material such, for example, as the material sold under the trade-mark Herkolite. An input voltage is applied between ground and corona brush 3 and thus supplies voltage to corona brush 3 and also to a corona brush 4 which is electrically connected to brush 3 and is placed outside drum 2 at a point directly opposite a grounded cylinder 5 which is within the drum and in close proximity to its periphery. Another conventional corona brush 6 is placed within the drum at a point diametrically opposite brush 3. The output voltage is taken off between the point 6 and ground. The longitudinal axes of the parts recited lie in parallel planes.

The input voltage which is of the order of magnitude of kilovolts is applied to corona brushes 3 and 4 and produces a corona discharge between brush 3 and plate 1. This corona discharge deposits a charge on drum 2, and as drum 2 is rotated by perhaps an electric motor it passes through this corona in the direction of the arrow and transports charge from brush 3 to brush 6. A load circuit may be connected between brush 6 and ground such that the charge from drum 2 passing through this circuit to ground provides energy to this circuit.

The output voltage V_{out} existing between brush 6 and ground is equal to the product of the input voltage V_{in} and the ratio of the capacitance C_{in} between an elementary area of drum 2 opposite brush 3 and ground to that of the capacitance C_{out} between an equal elementary area of drum 2 opposite brush 6 and ground. In symbolic form:

$$V_{out} = \frac{C_{in}}{C_{out}} V_{in}$$

Because C_{in} may be chosen much higher than C_{out} the output voltage may be much larger than the input voltage.

As drum 2 is revolved through the corona discharge of brush 3 and across brush 6, the output voltage immediately rises to the voltage ascertained by the previous equation, but after a short period of time has elapsed this output voltage decreases to a much lower value.

This drop in output voltage probably occurs because the highly charged inner surface of drum 2 attracts to the outer surface an opposite charge from the surroundings. A corona brush 4 is, therefore, electrically connected to corona brush 3 and is placed opposite cylinder 5 so as to produce a corona discharge between brush 4 and cylinder 5. The diameter of cylinder 5 determines the amount of corona discharge which

takes place between itself and brush 4 and, therefore, by the proper selection of the dimensions of cylinder 5 and the proper selection of the distance separating it from brush 4 the corona discharge which takes place on the outer surface of drum 2 will be of the proper magnitude to remove or neutralize the induced charge from the surroundings which collects on the outer surface of drum 2. The dimensions of cylinder 5 are dependent upon the voltage output of the particular generator and also dependent upon the conditions, such as temperature and humidity, under which the machine operates.

Thus with the addition of auxiliary brush 4 and cylinder 5 the voltage appearing between brush 6 and ground remains constant in the no load condition and equal to that expected from the previously cited equation. Therefore, this generator has the major advantage of a Van de Graff generator, i. e., very high direct voltage output, while also having a constant no load voltage output.

While it will be understood that circuit operation of the electrostatic generator shown in the drawing, may vary according to the design for any particular application, the following dimensions which are suitable for an electrostatic generator having an output of 90 kilovolts, an input of 6 kilovolts and an output current of the order of 90 microamps are included by way of example only.

Cylindrical drum diameter, 12"
Drum material, Herkolite
Thickness of drum surface, $\frac{1}{8}$ "
Length of drum, 12"
Length of brushes, 9"
Speed of rotation of drum, 1,800 R. P. M.
Input voltage, 6 kilovolts
Output voltage, 90 kilovolts

It is often desirable that the output voltage of a high voltage generator remain constant as the load varies. It is possible, as will be well understood by those skilled in the art from the foregoing description, to provide this generator with a voltage regulator circuit interconnected between the source of supply of the input voltage and the input corona brushes of the generator to control the output voltage appearing between brush 6 and ground.

While the present invention has been described by reference to a particular embodiment thereof, it will be understood that this is by way of illustration of the principles involved and that those skilled in the art may make many modifications in the arrangement and mode of operation. Therefore, I contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of this invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In an electrostatic generator, a cylindrically shaped drum being constructed of a dielectric material, a first corona brush being positioned within said drum in close proximity thereto, an electron conducting member being electrically grounded and being positioned outside of said drum in close proximity thereto and apposite said first brush, a second corona brush being positioned outside of said drum in close proximity thereto and being electrically connected to said first brush, an electron conducting cylinder being positioned within said drum in close proximity thereto and opposite said second

brush, a third corona brush being positioned within said drum close to the inner side thereof, a direct voltage source being connected between said first and second corona brushes and ground, and an electric motor for rotating said drum about its longitudinal axis.

2. An electrostatic generator comprising a cylindrically shaped drum being constructed of an insulating material, said drum being electrically isolated from ground, an electron conducting, metallic plate being electrically connected to ground and being positioned with its longitudinal axis parallel to the longitudinal axis of said drum, said plate being positioned close to, but not touching, said drum, a first corona brush being positioned within said drum in close proximity thereto and directly opposite said plate, a second corona brush being positioned outside of said cylinder in close proximity thereto but not touching said drum, an electron conducting metallic cylinder being positioned within said drum in close proximity thereto opposite said second corona brush but not touching said drum, a third corona brush being positioned within said drum diametrically opposite said first corona brush, said third corona brush being positioned within said drum in close proximity but not touching the wall thereof, a direct voltage source having a negative and a positive terminal, said positive terminal being electrically connected to ground and said negative terminal being electrically connected to each of said first and second corona brushes, and an electric motor for rotating said drum about its longitudinal axis, whereby an amplified direct voltage is produced between said third corona brush and ground.

3. An electrostatic generator comprising a cylindrically shaped drum being constructed of a dielectric material, said drum being isolated from ground, a plane shaped, electron conducting, metallic plate being electrically connected to ground and being positioned with its longitudinal axis parallel to the longitudinal axis of said drum, said plate being positioned close to but not touching said drum, a first corona brush being positioned within said drum in close proximity thereto and directly opposite said plate, a second corona brush being positioned at a distance from said plate outside of said drum and in close proximity thereto but not touching said drum, an electron conducting metallic cylinder being positioned within said drum in close proximity to the inner wall thereof and opposite said second corona brush, a third corona brush being positioned within said drum diametrically opposite said first corona brush and also being positioned in close proximity to the inner surface of said drum, a direct voltage source electrically connected to each of said first and second corona brushes, and means for rotating said drum about its longitudinal axis, whereby a high direct voltage is produced between said third corona brush and ground.

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