Notice

DESCRIPTION FR1000537A

Limited-output, high-voltage DC generator

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service22,__5 of the INDUSTRIAL PROPERTY High voltage direct current generator with limited flow rate.

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.,:^e ûGeorges TRUFFAUT and Pierre HAMPE residing in France (Seine-et-Oise).

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Requested on February 25, 1946, at 4:32 PM, in Paris.

Issued on October 17, 1951. — Published on February 13, 1952.

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§The production of high voltage direct current under low flow is a problem which is increasingly occurring in laboratories and in industry. Radiology, dust removal, and electrical dusting, in particular, require such current sources. The required current is generally in the milliampere range, and devices that are to be entrusted to inexperienced hands should not be able to exceed this current much in order to avoid the risk of electrocution. The required voltage generally varies between 30 and 200 kilovolts. The most classic solution to this problem is autonomous generators that produce their own primary current. The invention consists of a rotating device attached to a synchronous motor or an alternator giving one period per revolution in the most ordinary case. This device recharges a bank of capacitors connected in parallel by moving links, these links being themselves connected to the secondary of a transformer giving 10 to 20 kilovolts.

Recharging takes place twice per period using the peak voltage, i.e. at the instants consists of raising the voltage of an alternating current source using a transformer, then performing rectification using a kenotron or a rotary switch. Unfortunately, for small power levels, the cost price of the transformer and the kenotron becomes prohibitive as soon as it is necessary to exceed about twenty kilovolts. The same applies to induction coil appliances. High continuous voltages can also be obtained using so-called electrostatic machines in which charges are transported by insulating plates, moving metal sectors, belts or even an aerosol. Finally, it should be noted that for the production of very high voltages, capacitors were connected in series by spark gaps, which makes it possible to obtain short-duration pulses.

We also charged capacitors in series using cascaded kenotrons with special filament heating devices. In the current state of technology these devices are complicated and expensive. The present invention makes it possible to avoid the use of very high voltage transformers and kenotrons. It lends itself to the realization of small and — by designating by T the duration of a period beginning at time zero. T In the interval of these two times the rotating device reverses the connections with the alternating current source so that the capacitors are always charged in the same direction, which is essential due to the existence of significant residual charges. At times T and T, the rotation of the system disables the parallel connections of the capacitors and brings into play other connections which put said capacitors in series, thus producing a voltage equal to the sum of the voltages of each partial capacitor.

In addition, other connections are made at this point to link the ends of the capacitor chain thus formed to the high voltage operating terminals. The invention will now be described with reference to the attached drawing which schematically represents, by way of example, one embodiment of the invention.

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"Price of the booklet: 100 francs [1,000,5371— Figure 1 is an overview of the transformer generator and rectifier system.

Figures 2 to 5 show the connections made in the rectifier system at the different • , . T ï 3 T , _ instants, •and 1. /[Figure 6 is a front view of a rotating plate establishing the links in the rectifier system. Figure 1 represents the assembly of a generator according to the invention. In A is represented an alternator rotating for example at 3,000 revolutions per minute and producing an alternating current of 110 volts at 50 periods which is sent into the primary of the transformer B. An alternating voltage of 15,000 volts is obtained at the secondary of this transformer which is sent into the rings D ensuring the passage of the current to the parallel bars of the capacitors. The capacitors have been represented as Cj, C, C, C, C, C... and each of the capacitors is connected to two contacts arranged symmetrically with respect to the axis of rotation of the rotating switch, respectively Ej Fj pp pp pp pp n^F;,, cr, r^Fj, £.r.

Figures 2 and 3 represent the arrangement of the connections occurring at times - and---- The capacitors are then put in parallel and charged by the transformer. Figure 4 shows what is happening at time T — The capacitors are connected in series and connected to the load by connections Y and Z. Figure 5 shows what is happening at time T. The connections have made a half-turn and produce the same effect as at time T — At the load terminals Uj, a capacitor can be placed to collect the discharge of the partial capacitors. Impedances or resistors can also be used to filter the high DC voltage and limit the instantaneous flow rate of the generator. As for the continuous flow rate, it will be limited by the capacity of the partial capacitors. The capacity of these partial capacitors is on the order of a thousandth of a microfarad, for small installations delivering less than 1 milliampere.

When no flow is requested from the device, all capacitors remain charged, and the transformer sends no current into the capacitors except to compensate for leakage and potential variations in the vicinity of the peak voltage. When a certain high-voltage flow rate is required, the transformer must supply the same flow rate to each of the partial capacitors. If the flow rate is high, the sudden recharging of the capacities can lead to oscillations that may cause insulation breakdowns. This drawback can be avoided by placing the protection resistors in series with the capacitors or with the secondary of the transformer. Note that the partial capacitors have their two poles isolated at the time of recharging. There is no problem with the transformer's secondary winding having its center point connected to ground, which greatly simplifies the insulation of the windings.

Any suitable means may be employed for the implementation of the switching device. One of the methods under consideration involves fixing the moving contacts onto insulating discs whose center is traversed by the shaft coupled with the alternator. Each disc has four contacts on its periphery, two of which are opposite and communicate with the secondary of the transformer, via the rings arranged at the end of the device. The other two contacts, in quadrature with the first ones, are used for connecting the capacitors in series and communicate with the contacts of the neighboring disks. There are as many discs as there are partial capacitors, plus two more located at each end of the assembly, which serve as support for the Y and Z connections in Figure 4. Figure 6 shows the layout of a disk. Ej and F are the fixed contacts connected to the capacitor C. Contacts Gj and G serve for connecting the capacitors in parallel and are connected to the secondary of the transformer by connections passing through the disks in the vicinity of Gj and G. Contacts Kj and K serve for connecting in series.

The above discs can be replaced by an insulating cylinder. The steel shaft passing through the discs can be replaced by an insulating material, or even removed entirely, the discs then being made to work together by the parallel connections. The device described above uses a single-phase alternating current. A more constant high voltage current could be obtained by combining two or three similar switches with a two-phase or three-phase alternator. For certain uses, one of the high voltage terminals can be connected to ground, which also simplifies the device connections.

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The isolated pole can then be positive or negative depending on the direction of the switching.

Simply placing an inverter on the primary of the transformer is enough to obtain either polarity at will. The present invention is not limited to the mounting examples indicated above. In particular, the same result would be obtained by keeping fixed the various contacts considered mobile in the example above, and conversely - by rotating the capacitors and the contacts that correspond to them. Furthermore, instead of using an alternator, alternating current could be obtained from a light ordinary distribution system, with the rotation of the rotating system being ensured by a synchronous motor. The minimum size of the switch is determined by 1? the need to avoid sparks between components at different potentials. To avoid excessive bulk, it is envisaged to enclose the device in a sealed enclosure containing a gas with high disruption voltage. Carbon tetrachloride, freon, or compressed gases (air, carbon dioxide, etc.) are used for this purpose.

It is also recommended to have drying products such as quicklime, soda lime, silica gel, phosphoric anhydride, etc. in the sealed enclosure. Summary: 1° The invention relates to an apparatus providing a high-voltage direct current at a limited flow rate and is characterized by a rotating system ensuring both the rectification of an alternating current and the connection alternately in series and then in parallel of a set of capacitors; 2° Apparatus according to 1° also comprising the following characteristics considered separately or in combination: a. Alternating current is produced by an alternator rotating at the same speed as the switch; the alternating current is sent into a step-up transformer whose secondary midpoint can be grounded; c. The secondary winding of the transformer is connected by rotating rings to the parallel bars of the capacitors; An inverter placed on the primary circuit of the transformer allows the high voltage polarity to be changed; e.

One of the high voltage terminals is connected to ground; /. We use a single-phase, two-phase, three-phase or polyphase current; g. Resistors are used to counteract sudden changes in the charge of the capacitors; the moving contacts are supported by discs or a cylinder made of insulating material; at the high-voltage output terminals, a capacitor, a filtering device, or a current limiter is placed; /'. The device is enclosed in a sealed casing containing a high-disruptive-voltage gas and is perfectly dried; Alternating current is obtained from a distribution network line and the rotation of the rotating rectifier system is ensured by means of a synchronous motor. Messrs. Georges TRUFFAUT and Pierre HAMPE. By proxy: Josse Office.

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For the sale of booklets, contact the Imprimerie Nationale, 27, rue de la Convention, Paris (15°).

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