CLASSIFICATION CONFIDENTIAL CONFIDENTIAL

STELLOFAX 2 CENTRAL INTELLIGENCE AGENCY
INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS

REPORT
CD NO.

50X1-HUM

COUNTRY	USSR	DATE OF INFORMATION	1948
SUBJECT	Scientific - Electricity		
HOW PUBLISHED	Monthly periodical	DATE DIST.	21 Nov 1950
WHERE PUBLISHED	Moscow	NO. OF PAGES	2
DATE PUBLISHED	Nov 1948		
LANGUAGE	Russian	SUPPLEMENT TO REPORT NO.	

THIS IS UNEVALUATED INFORMATION

REFERENCE COPY

DO NOT CIRCULATE

SOURCE Elektrichestvo, No 11, 1948, pp 80-81,

50X1-HUM

ELECTROSTATIC GENERATORS - A REVIEW

Ya. M. Chervonenkis
Cand Tech Sci

[The following is a digest of an article representing mainly a discussion of the use of compressed dielectric gases in electrostatic generators.]

Interest in electrostatic energy sources has increased recently in connection with the need in nuclear physics for high-voltage generators to obtain homogeneous streams of high-energy elementary particles. Van de Graaf generators, which are capable of producing up to 10 megavolts (Mv) dc with very low currents of several ma, are used for this purpose. These generators are also used in high-voltage studies and in obtaining hard X-rays for therapy and industrial roentgenography.

In Van de Graaf generators, a fast-moving belt continuously carries electric charges from the earth's potential to a conducting sphere insulated from the earth.

The maximum charge density on the belt surface is determined mainly by the dielectric strength of the surrounding medium and is theoretically 5.3×10^{-9} coulomb sq/cm for air at atmospheric pressure. In practice, it is about half as much. The speed of the belt is 20-30 m/sec. Thus, a belt 300 mm wide operating in air can supply current loads up to 0.5 ma.

For the given current and voltage, the linear dimensions of the generator are approximately inversely proportional to the dielectric strength of the medium, while its volume is inversely proportional to the cube of the dielectric strength. Two directly opposite methods can be used to increase the dielectric strength of the medium, namely, filling the generator with gas under high pressure or using a high vacuum inside the generator. A highly compact Van de Graaf generator operates in air or nitrogen at 27 atm pressure. It is designed for 2 Mv and 0.5 ma, and has a housing diameter of 750 mm with an insulating column 600 mm high. At atmospheric pressure, it could put out at least 250 kv (1).

50X1-HUM

CLASSIFICATION CONFIDENTIAL CONFIDENTIAL

STATE	X	NAVY	X	NSRB		DISTRIBUTION					
ARMY	X	AIR	X	FBI		AEC X					

Sanitized Copy Approved for Release 2011/07/22 : CIA-RDP80-00809A000600360110-9

CONFIDENTIAL

CONFIDENTIAL

50X1-HUM

Still more promising is the use of some other gases, in particular freon (CCl_2F_2) and sulfur hexafluoride (SF_6), whose high electric strength was first discovered in the USSR by B. M. Gokhberg (1), and is called "elegas" in the USSR. These two gases provide a given electrical strength with only half the pressure required when air is used. As studies (1, 2, 4) made in the Leningrad Physico-Technical Institute showed, elegas is slightly better than freon because it is chemically more stable and has considerably higher vapor tension at room temperature.

In a compressed gas, the breakdown voltage between the electrodes is directly proportional to distance over a wide interval of distances. In a vacuum, however, the breakdown gradient drops from 2-3 Mv/cm for distances of 1/100 mm, to 100 kv/cm for distances of 50 to 100 mm (5). A vacuum has unexcelled insulating properties for moderate voltages but is surpassed by compressed gases for very high potential differences. If future gradients of the order of several Mv/cm are obtained at high voltages, electrostatic effects could be used not only for low-power units of the type described above, but also for a new type of powerful electrical machines, i.e., electrostatic generators and motors.

The principles of construction of electrostatic machines have been studied by Soviet physicists and engineers since long before the war. In 1933, N. D. Papaleksi constructed a high-voltage electrostatic generator of the parametric type to obtain audio-frequency currents. This generator developed power above 500 w in an atmosphere of compressed air. Papaleksi pointed out that the operating conditions of electrostatic machines are particularly favorable in a high vacuum (3). A. F. Ioffe and his students in the Leningrad Physico-Technical Institute constructed a number of dc electrical generators of various types for voltages from 700 to 900 kv. These machines operated in compressed gas or in liquids with high electrical strength (2, 4).

A. Ye. Kaplyanskiy worked out the general theory of electrostatic machines and proved that one could create, by the capacitance principle, a number of machines similar to all types of inductive, synchronous collectors of dc and ac, parametric, etc. He also gave methods for the calculation of high-vacuum electrostatic generators.

It is possible in principle to use electrostatic units for direct transformation of atomic energy into electrical energy without going through the stage of transformation into heat.

BIBLIOGRAPHY

1. B. M. Gokhberg, "Elegas - Electrical Gas Insulation," Elektrichestvo, No 3, pp 15-19, 1947 [FDB Per Abs 1T28].

2. B. M. Gokhberg, "High-Voltage DC Electrostatic Generators," ZhTF, No 3, pp 177-198, 1940.

3. N. D. Papaleksi, "Parametric Generation of Alternating Currents," Elektrichestvo, No 11, pp 67-76, 1938.

4. A. F. Ioffe. "The Electrostatic Generator," ZhTF, Vol IX, No 23, pp 2071-2080, 1939.

5. J. G. Trump, R. J. Van de Graaf, J. Appl. Phys., Vol XVIII, No 3, pp 327-342, 1947.

- E N D -

CONFIDENTIAL

CONFIDENTIAL

Sanitized Copy Approved for Release 2011/07/22 : CIA-RDP80-00809A000600360110-9