

## ELECTRICITY

# Disks Spinning in Vacuum May Replace Present Generators

## Young American Physicist Tells British Colleagues Of Plans for High Voltage Electrostatic Machines

**E**NORMOUS disks, spinning at high speed in an almost perfect vacuum, will replace the familiar generators and motors of modern electrical plants. Thus Dr. R. J. Van de Graaff, brilliant young physicist of the Massachusetts Institute of Technology, prophesied before the meeting of the British Association for the Advancement of Science at Leicester.

These disks would be great electrostatic machines, producing direct current electricity at tremendously high voltage. The vacuum would be necessary in order to prevent the production of tremendous sparks that might wreck the whole machine and would in any case prevent the electricity from being led out on wires to be usefully employed. Dr. Van de Graaff believes that vacua sufficiently high to insulate the machines against such electrical breakdown can be produced, even in the large housings that would be required for the industrial production of current by electrostatic machines. He exhibited designs for such machinery.

If Dr. Van de Graaff's prophecy is realized, it will be, in a sense, progress made by setting the clock back. For the electrical machines that were used by the eighteenth-century school of "natural philosophers," of which our own Dr. Benjamin Franklin was a brilliant member, were all of the electrostatic type. They generated electricity by friction on large disks. Instruments of the same kind are still used for special purposes in laboratories.

The trouble with such machines has always been that the air was not a sufficient insulator to prevent sparks, after a certain potential had been built up. For this reason the development of the electric age had to await the discovery that electricity could be generated in another way, by the moving of a conductor in the field of a magnet. All our present generators are elaborate arrangements of magnets, past which systems of wire coils are rapidly moved, with arrangements for capturing and leading off the current thus produced. They are

the best we have; but their working efficiency is admittedly not as high as could be attained, at least in theory, by properly arranged and insulated electrostatic machines. Dr. Van de Graaff believes that such theoretically possible machines can actually be built.

Dr. Van de Graaff has attracted much attention among physicists by the simple but tremendously powerful electrostatic machines he has already built, first at Princeton and latterly at the Massachusetts Institute of Technology. These have produced "artificial lightning" measured in hundreds of thousands of volts, used in atom-smashing experiments.

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## BIOLOGY

## Father Supplies Young Lungfish With Oxygen

**U**NIQUE among all known animals is one function performed by the male lungfish of South America, known to zoologists as *Lepidosiren*. He supplies his offspring with oxygen to breathe, much as mammalian mothers give them milk to drink. At the meeting of the British Association for the Advancement of Science, J. T. Cunningham, veteran zoologist, told how it is done.

*Lepidosiren* belongs to that strange group of fishes that breathe at least part of the time with a primitive kind of lung, and during the dry season burrow into the mud of their shallow lakes or swamps, there to live through the hard times on their accumulated fat.

During this rest period, Mr. Cunningham stated, the eggs are laid and the young hatch. The little lungfish are equipped with external gills, like tadpoles. But there is no oxygen in the muddy water at the bottom of the burrow. How do the young fish get anything to breathe?

The answer seems to lie in some peculiar string-like growths that grow on

the pelvic limbs of the male fish. These are filled with blood vessels; and in an experiment Mr. Cunningham found that oxygen came out of them when the water was lacking in that necessary element.

The male fish remain in the burrow with their offspring; and Mr. Cunningham considers that "it must be concluded that the respiration, and therefore the life of the eggs and the larvae, depend on the oxygen given off by the filaments of the male parent. This is the first case in which evidence has been obtained of the emission of oxygen to the external medium as the normal function of special organs in any animal."

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## PLANT PHYSIOLOGY

## Plants Apparently Use Complex Nitrogen Forms

**G**REEN PLANTS apparently are able to make direct use of complex organic compounds containing nitrogen, without waiting for them to be reduced to nitrates. Evidence to this effect, which is diametrically opposed to present orthodoxy in plant physiology, has been obtained by Prof. A. I. Virtanen of the University of Helsingfors.

Ever since the days of the great pioneer German chemist, Justus von Liebig, it has been held that higher plants cannot make direct use of the complex nitrogenous compounds contained in such organic fertilizers as common manure, bone meal and cottonseed cake, but must wait for soil bacteria and other microorganisms to convert these into ammonia and then into nitrates.

Prof. Virtanen, however, has succeeded in growing plants in a soil composed of sterile quartz sand, their only possible source of nitrogen being complex organic compounds extracted from the roots of plants of the pea and clover family, or from a water extract of a low moorland soil that contained no ammonia or nitrates.

If Prof. Virtanen's results are proved correct for other nitrogen-containing organic compounds, the eventual effect may be a complete revolution in farm fertilizer practice and hence in the commercial fertilizer industry.

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The national president of the Audubon Societies says that song birds are probably more numerous in America now than when the Pilgrims landed.