PHYSICS

Electrons in Harness

We Are in the Midst of a Revolution in Human Affairs Caused by the Increasing Use of the Vacuum Tube

By **O. H. CALDWELL, Editor of the magazine, Electronics, and former Federal Radio Commissioner.**

Editor's Note: This article has been given as a Science Service radio talk over a nation-wide network of the Columbia Broadcasting System. Other interesting talks on scientific subjects presented in popular language by men prominent in the various science fields are broadcast from stations of the Columbia system every Friday afternoon at 3:45 P. M., Eastern Standard Time.

THE past five years have been momentous ones in the history of the tiny electron and its prodigious influence on human affairs. But the five years ahead seem destined to bring even more revolutionizing influences into everyday life.

Since 1925 the electron tube, through radio broadcasting, has reconstructed American home life and home entertainment; it has brought us "sound movies," with doubled box-office receipts; it has linked together by telephony the continents of the antipodes; it has created bloodless surgery and healing artificial fevers; it has effected new control of power, motors, lights and heat; it has wrought miracles of might and of delicacy in every department of science.

And the next five years undoubtedly will witness even more sweeping advances of this electron host. Perhaps one of the most striking of these changes will be the development of new electronic light sources to replace our present electrical illuminants. Already electronic or gaseous signs are replacing the older incandescent-lamp displays, and saving two-thirds of the electricity consumed by the former signs. And now these same neon tubes and helium envelopes are being employed to light interiors, art galleries, homes and offices. Meanwhile new hot-cathode neon lamps are being developed in Europe and America, which may make possible new efficiencies of light, three to five times as economical as any we have today.

With the photoelectric cell or "electric eye," which is sensitive to light and darkness and through relays can operate switches, our factories, buildings, schools and homes will eventually all be lighted automatically at the approach of darkness. Our heating systems have thermostats that turn on the steam when the room gets chilly; why not "light-o-stats" that will turn on the lights when it gets dark?

The powers of radio broadcast stations will progressively increase, until even 500 kw. or 1000 kw., 10 to 20 times the power of the present largest station, will seem commonplace. Meanwhile our telephone and electric light wires will bring us broadcast music and entertainment, eliminating the fading, static and interference that seem to be inherent in ether broadcasting. Television will be an accomplished thing, but will come perhaps over wires. Probably even seeing across the Atlantic by cable will not be an impossibility.

Aid for Astronomy

With our new electronic aids we shall be sounding the depths of the universe with new types of telescopes—simple, inexpensive, and much more powerful than the crude and massive monsters of modern observatories, which have had no fundamental technical improvement since Galileo. In the direction of the minute and infinitesimal, also, we shall undoubtedly extend our present scale of electronic measurements, which today can caliper a faint star and detect its transmitted heat, or can indicate electric current down to the one-quintillionth part of an ampere!

Our future movies—all talking, all in colors, and all "wide screen," will also have "binaural sound," that is double sound tracks, giving us true acoustic depth and reality as we listen to sounds from different sides of the picture!

Elaborate new musical instruments will employ either photo-cell sound tracks, or electronic-tube oscillators, combining frequencies to produce harmonies, timbres, and qualities sweeter than any product of our present-day instruments, which depend upon mere accidental vibrations of strings, hammers, cat gut, horse-hair, brass tubes.

Undoubtedly in the power field we shall be transmitting high-tension direct-current instead of alternating current, and thus increasing line efficiencies and capacities three- to six-fold. Tubes will convert from a.c. to d.c. for transmission, and thence "invert" to any desired alternating-current frequency best suited to the load. Tubes will replace high-tension switches, circuit breakers and lightning arresters. Within twice five years we may even be transmitting our energy over high-frequency radio beams in the ether, entirely without wires. Who can say no?

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Courtesy General Electric Company.

VACUUM TUBES OF MANY DIFFERENT TYPES

Airplanes may be taking their power supply from such beams of radiated energy, which will also guide them. This may sound the height of absurdity in February, 1931, and I would not seriously mention it here, were it not for the fact I have recently heard two of the sanest and most fruitful engineers in the country, each with world miracles to his credit, independently and confidentially propose the early possibility of this very thing!

Electron tubes will effect revolutionary changes in our food supplies. Tubes form the heart of our new therapeutic aids. Tubes will be major factors in eliminating certain diseases from the human family. We know already that tubes seem to effect hereditary changes and the creation of new species, and possibly they may even predetermine sex.

In fact the sweeping changes which the vacuum tube will effect upon the life of the human race within the next five years and the next few decades may very likely cause this century and period to be known as "The Electronic Age."

Science News Letter, February 14, 1931

CHEMISTRY-GEOLOGY

Synthetic Petroleum Teaches About Oil Formation in Earth

High Temperatures and Pressures, Alpha Rays and Electric Discharges Make Complicated Oil of Simple Hydrocarbons

A CLUE to the way in which the earth formed the riches of petroleum held within its crust has been made known by Dr. S. C. Lind, director of the School of Chemistry of the University of Minnesota.

The origin of oil is one of the major scientific mysteries of today. While oil supplies are overabundant to fill current demands of autos and the many other consuming needs of modern civilization, scientists have looked forward with fear to an oilless future when the oil of the earth is exhausted.

Dr. Lind explains that he and other chemists have found ways of making synthetic petroleum identical in complexity with the natural oil.

Starting with a simple hydrocarbon, such as the familiar methane or marsh gas, ordinary chemical actions at high temperatures and pressures are able to make synthetic petroleum. Dr. Lind found that the alpha rays of radium, which are speeding hearts of helium atoms, can also change simple hydrocarbons into highly complicated ones. Even electrical discharges produce the same effect.

Since the growth of the earth with its twistings of the rock layers and its immense pressures in the depths of its crust must have produced high heats and intense compressions, this suggests one way the natural petroleums could have been formed. Radium and radioactive compounds occur in the crust of the earth and they too might have been the means of making petroleum.

One question remains that is as yet unanswered. What was the raw material used by the earth in the manufacture of its petroleum. Was it vegetable, animal or inorganic? Is our gasoline distilled essence from the luxurious vegetation such as that which made our coal, or from the bodies of millions upon millions of minute animals of past ages. Or is it a synthesis from mere combinations of carbon and hydrogen that never were alive?

Science News Letter, February 14, 1931

BIOLOGY

African Fish Dies If Kept Under Water

AN AFRICAN fish that must come to the surface to get air, just as a whale must come, and that will suffocate if kept under water where ordinary fish get along easily with their gills, is the astonishing creature described by Prof. Homer W. Smith of the University of Virginia. Prof. Smith has recently returned from Africa, where he collected a considerable number of these fish and brought them back alive to America.

The fish is known colloquially as a lungfish and technically as *Protopterus aethiopicus*. It lives in the shallow waters along the edges of central African lakes, that dry up during the rainless season, leaving the fish stranded. It burrows into the mud, curls up in a sort of cocoon, and sleeps through the hard times, maintaining connection with the world only through an air channel to the surface.

It is probable that its air-breathing habit has developed as an evolutionary necessity in response to this periodic crisis of waterlessness. At any rate, the fish now lose the use of their gills early in life, and depend for air on relatively simple lungs, coming to the surface every quarter-hour or so.

Prof. Smith found that fish prevented from coming to the surface by being kept down with a wire screen showed signs of great distress. They made more and more frequent attempts to swim to the top, fighting against the barrier and trying anxiously to find some way around its edge. After about an hour they would lose control of their movements, swimming on their sides or looping aimlessly about. In from two to eight hours they were dead of asphyxiation. If partially asphyxiated fish were released they eagerly sought the surface and remained there for longer than their usual breathing period, eagerly gulping air.

The full technical report of Prof. Smith's physiological studies on Protopterus is published in the current issue of *Ecology*.

Science News Letter, February 14, 1931

MILITARY SCIENCE

New Type of Aerial Bomb Developed by Army

CAREFULLY guarded from the eyes of the curious, the U. S. War Department's chemical warfare service has been concentrating its experimental work in gas offensive on the development of a combination gas-high explosive aerial bomb.

During the World War gas was used with telling effect by the Germans, and towards the close of the war the U. S. Army chemists were pouring deadly fumes into the German defense, too. Gas attacks from airplanes, however, are strictly a post-war development.

Army chemists consider the perfection of a bomb, which when dropped from the air will spread a gas blanket over the surrounding terrain, to be one of their most important jobs.

Efforts are also being made to cut down the weight of gas masks, and new types which are safer and permit more