PHYSICS

Edison, the Experimenter

On Feb. 11, the country will celebrate the 110th birthday of Thomas A. Edison who, with his inventions, has contributed in many ways to the comfort and well being of man.

➤ THE TREMENDOUS contributions of Thomas Alva Edison to the comforts and conveniences of modern life can be traced directly to his fondness for experimenting.

When Edison did not understand how or why something worked or failed to work, he did not rest until he had tried experiment after experiment to find the answers.

He began this habit as a young boy. He built his own experimental laboratory. Saving every penny that he could earn for the purpose, he purchased chemicals and books about science. He made his own simple apparatus. And it was not expensive!

Born in Milan, Ohio, February 11, 1847, Thomas Alva Edison "lighted the world" with incandescent lamps, reproduced voices and sounds with the phonograph, pioneered in motion pictures and radio, and developed over 1,100 inventions through his experimental approach to nature.

Today, many of the achievements of science—new methods for better communication and greater enjoyment, devices for industrial triumph and human progress—are being built on the foundations laid by the man whose birthday will be honored February 11.

During his life and since his death in 1931, Edison has been best known for the incandescent lamp which has lighted homes, businesses and most of civilization since its invention in 1879. Next in fame is probably the phonograph, produced when the inventor was 30 and probably his favorite invention. A less well-known experiment by Edison, which he himself made little use of, may loom more important to historians of science in the future than either the lamp or phonograph. This was "the Edison effect."

Birth of Electronics

In 1883, Thomas Edison put a cold piece of metal opposite the metal wire filament inside an electric light bulb. Electrons flowing along the wire created an electrical current. The filament, heated by the flow of electric current through it, emitted electrons and a minute electric current flowed along an external wire connecting the plate and filament. Edison showed that this current would always flow in the same direction. The discovery became known as the "Edison effect." Edison tried to put this discovery to work and secured the first electronics patent. The device was to control the output of dynamos or electric generators, but it did not prove satisfactory for this purpose.

When many years later Sir J. Ambrose Fleming and Dr. Lee De Forest modified the tube and it was used to detect radio waves, the modern electronics industry was born. Radio, television, radar and other electronic devices came into being.

The first of many patents granted Edison was one in 1868 for an electric vote recorder for the U. S. House of Representatives. The device, similar to many now used by legislative bodies, worked too well to suit a committee of the House, because it would have put an end to filibustering on votes.

Thus, although his first invention failed, political science rather than natural science was to blame.

Stock Ticker Invented

The next year the young inventor devised a stock ticker. For his improvements and inventions simplifying the transmitting devices of the stock exchange, he expected to receive at least $3,000. Instead, he was offered $40,000.

With this money, as with the fortunes he later gained from his work, he turned to new experiments and inventions. A mere list of the more than 1,100 inventions made by Edison, tells only part of the story of his accomplishments. Machines for multiple telegraph transmission, the electric pen and the mimeograph, the microphone and the megaphone are illustrative of his industry. The phonograph was revolutionary. Never before Edison had the idea for an apparatus to reproduce the human voice been put into a patent application.

Edison always said that the phonograph was his favorite invention. Perhaps this was because of his deafness, which made him place an unusual value on sound. In his pioneer work in motion pictures, he created the first motion picture studio, and used the phonograph with the Edison-perfected motion picture to make the first sound movies.

Many wonderful stories surround the life of Edison. He began each working day by exchanging humorous stories with his laboratory associates. He always did research on many different problems at the same time, and would shift from one to another as he ran into obstacles to which he could not see any solution at that moment.

As he said, "I never allow myself to become discouraged under any circumstances."

Before Edison began actual experimentation on a new problem, he carefully studied what had been accomplished previously. As Edison himself said:

"When I want to discover something, I begin by reading up everything that has been done along that line in the past—that's what all these books in the library are for. I see what has been accomplished at great labor and expense in the past. I gather the data of many thousands of experiments as a starting point, and then I make thousands more."

Edison's experiments were carefully recorded in a series of notebooks. He used books containing from 250 to 300 pages.

Altogether about 2,500 of these note books are now preserved in an air-conditioned steel and concrete underground vault on the grounds of Edison's laboratory at West Orange, New Jersey. This is now part of the Edison Laboratory National Monument which is open to the public.

The oldest book in the collection is dated 1878. About 200 of them are filled with experiments leading to development of the incandescent electric light. Notations, most of which are in pencil, record results of experiments or instructions for new experiments that would provide a fresh attack on a problem.

Edison's long hours of work with only four to six hours of sleep at night amazed his friends. Asked about his philosophy of life a few years before his death, Edison said it was, "Work—bringing out the secrets of nature and applying them for the happiness of man."

Edison's laboratory has been called "the cradle of American industry" because of the many new industries that his inventions

YOUNG EDISON—As a young boy, he began his habit of experimenting. He carefully saved to buy books about science and chemicals for use in his self-built laboratory.

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fostered. For example, he created the electric power industry by inventing not only the lamp, but also meters, conductors, the power plant electric generators, fuses, etc., to distribute electricity over large areas through the streets of a city to individual homes, factories, and offices.

The energy unleashed by electric power was made a servant in the home through vacuum cleaners, electric stoves, washing machines, refrigerators. Radio, television and the phonograph added to the pleasure of millions of people.

Edison's invention, thus, not only created new industries and new jobs but made everyday living more comfortable and more enjoyable.

Edison invented the industrial research laboratory. His was the first one of the 4,000 in America today. From these research laboratories, and others that will be founded in the future, a whole new world of science and technology is emerging.

Science News Letter, February 9, 1957

TECHNOLOGY

World Going Down to Sea in Atomic Ships

➤ THE WORLD is going down to the sea in atomic ships.

The United States already has two seagoing atomic submarines, the Nautilus and the Seawolf. Thirteen more nuclear subs are planned. Plans are complete for an 85,000-ton atom-powered aircraft carrier to be built by the Navy. The largest ship in the world, it will be driven by eight atomic engines. Now, a joint AEC-Maritime Administration program calls for the development of nuclear powered merchant ships.

Japan has announced plans to build the world's largest submarine, an atomic-propelled oil tanker. Designed to cruise at 22 knots, the Japanese underwater cargo vessel will weigh 30,000 tons.

Russia is already building an atomic icebreaker and hopes to launch it from a Leningrad shipbuilding yard sometime this year. The first Russian ship to be atomic-powered, the ice breaker will displace 16,000 tons and, like the Japanese sub, will travel along at 22 knots.

Great Britain has jumped into the atomic ocean and is completing plans on the drawing board for the Royal Navy's first atomic submarine.

But like the slogan of the U. S. Naval hero, John Paul Jones, the world's ship designers and builders "have not yet begun to fight."

Experts foresee the atomic merchant fleet of tomorrow that includes fishing vessels that are floating factories, sending finished products from ship to market; mining ships for drilling underwater oil; and atomic ships that can "duck" under water in rough weather.

The experts point out that atomic ships will be faster, larger and more economical. They think the pioneer atomic ship may be either a large tanker, a dry cargo ship or a combined passenger-cargo ship.

Science News Letter, February 9, 1957

CHEMISTRY

Some Body Waste Is Reused by Body

➤ A SIGNIFICANT portion of one of the body's waste products, uric acid, is reused by the body.

Until recently it was generally believed that uric acid was strictly a waste product excreted in the urine. Then scientists found they could account for only about 85% of the daily uric acid output in the urine.

Using radioactive carbon as a tracer, a group of University of California scientists have found that 10% to 16% of uric acid output is channeled back into the body's metabolism.

The uric acid apparently takes part in normal body processes, the scientists found.

The researchers injected radioactive carbon dioxide into normal people and people with gout and polycythemia. In polycythemia, a blood disease, there is an increase in uric acid in the body, and it is lodged in the joints. Polycythemia patients, as a result, often have gout.

The radioactive carbon missing from the urine was found in exhaled carbon dioxide. This meant that 10% to 16% of the uric acid was broken down by the body, one product being radioactive carbon dioxide.

The findings were reported to the meeting of the American Federation for Clinical Research in Carmel, Calif., by Drs. M. Pollycove, B. M. Tolbert, J. H. Lawrence, and D. Harman of the University's Donner Laboratory.

Science News Letter, February 9, 1957

MEDICINE

Small Radiation Doses Cause Blood Changes

➤ RADIATION doses smaller than those officially permitted in atomic installations and research laboratories can produce detectable, although not necessarily harmful, changes in the blood.

This was reported to the American Federation for Clinical Medicine meeting in Carmel, Calif., by Dr. R. Lowry Dobson of the University of California's Donner Laboratory.

Dr. Dobson's results came from a more extensive investigation of an observation first made at the University of Rochester in 1949. Rochester scientists found that in researchers receiving permissible, although unmeasured, doses of radiation there was an increase in an anomalous type of lymphocyte, a kind of white cell.

The anomalous cells have two nuclei instead of the normal one, and are called binucleated cells. The binucleated variety occur in normal individuals at a rate of about one in 50,000.

Dr. Dobson found that an increase—to an average of six binucleated lymphocyte cells in 50,000—occurred in 17 scientists exposed to an average of 200 milliroentgens (mr) of gamma and X-radiation per week for short periods. The permissible dose is 300 mr per week.

This increase appears to be small, and can be detected only by elaborate statistical methods, Dr. Dobson said.

The scientist stated that there is no present evidence that this increase is a hazard to health.

The main object of the study is to determine the smallest amounts of radiation that can cause physiological changes, what these changes are, and whether over a long period of time small radiation exposures—such as those incurred by atomic workers and by people receiving X-rays—pose any hazard.

Binucleated cell increases are also observed in certain diseases, such as hepatitis and mononucleosis and possibly in carbon tetrachloride and other poisonings.

Hazards from the small increases in binucleated cells appear to be minor when compared to those incurred by smoking, dietary indiscretions, automobile travel, etc., Dr. Dobson said.

Science News Letter, February 9, 1957

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