
ELECTRONICS–A NEW SCIENCE FOR A NEW WORLD

REACHING FOR THE SKY

This is Aladdin and a lamp. This is Icarus, rising to the sun. This is Midas, and Mercurius, and Paul Bunyan. This is a boy on stilts.

Again, this is Herschel, scanning the clustered skies; Marco Polo, Priestley, Lister. This is Edison. This is Steinmetz. This is astronomer, physicist, chemist, surgeon, engineer, adventurer. *This is a striving in the heart.*

This is electronics.

Since far back in remembered time, man has sought to escape the limitations of the body. His feet are planted on earth. But he will climb to the sun, run with the wind, stride from mountain to mountain!

Today, harnessing the power of the infinitesimal electron, science has extended the range of intellect and senses to a degree undreamed of in history.

You and your children, heirs of the golden Electronic Era, can see what eyes have never seen, hear what ears have never heard. You can accomplish what has never before been accomplished.

What is electronics?

Electronics is the science of the electron—a tiny, invisible particle of pure electricity, the basis of all familiar matter. A rose-bush, the planet Jupiter, a child's blue dress—everything in the universe—is formed of an incomprehensibly vast number of electrons, whirling around their nuclei.

Only within the last two generations has science discovered how to control electrons by the vacuum tube, and put them to work for the good of mankind. Today, through electronics, tiny marks on a strip of film become the voice of the Hollywood

Electronics Department
ENERAL ELECTRIC COMPANY
Schenectady, New York

actor on the screen. A song in New York travels across Iowa, Utah, and Nevada's Great Basin to California, through electronics, in less than the fiftieth part of a second. Astronomers, calculating by electronics, can measure iron in the dust of interstellar space; and the 1,000,000-volt X-ray tube, an electronic device, bombards malignant cells with radiation equivalent to $95,000,000 worth of radium.

Yet this is only the edge of the fenceless electronic land. Each application invites another application. Today in industry, in medicine and public health, in radio, television, and in the fighting forces of the nation, electronics reveals new worlds of wonder and surprise.

Only a short time ago, scientists at General Electric built a 20,000,000-volt induction electron accelerator — a research tool that whirls electrons to the highest speed ever produced by man, virtually the speed of light. And General Electric, headquarters for electronic research, already is building an accelerator of 100,000,000 volts.

The electron microscope opens breath-taking vistas on an infinitesimal world. Science now can magnify 100,000 times the image of a mosquito larva's windpipe; photograph the influenza virus; peer at crystals and microbes that weigh only a few quadrillionths of an ounce. New General Electric developments in electron microscopy now promise even wider use of this instrument that goes far beyond the limits of optic microscopy—in medicine, metallurgy, almost every field of science.

Patient electronic research has brought man to the edge of Nature's mysteries. He has reached for the stars, and discovered the Electronic Era.

The ancient alchemist dreamed of a day when gold could be wrought of earth's coarsest metals. Woodcut by Hans Weiditz, 1519. Today electronic transmutations produce elements a thousand times more valuable than gold.

Galileo presents before the scientists of his day a new instrument for searching the heavens. From "Memorials of Galileo," by J. J. Fabre. Today electronics counts the stars.

"Flying Machine"—man's dream of rising from the earth to soar over trees and mountains and the hindering sea. From "Histoire Aeronautique," by Francois-Louis Bruel, Paris, 1909. Today electronic tubes guide transport and fighter on missions through the skies.

A scientist in the General Electric Research Laboratory adjusts the electron accelerator, a device that may open vast new fields of electronic progress.

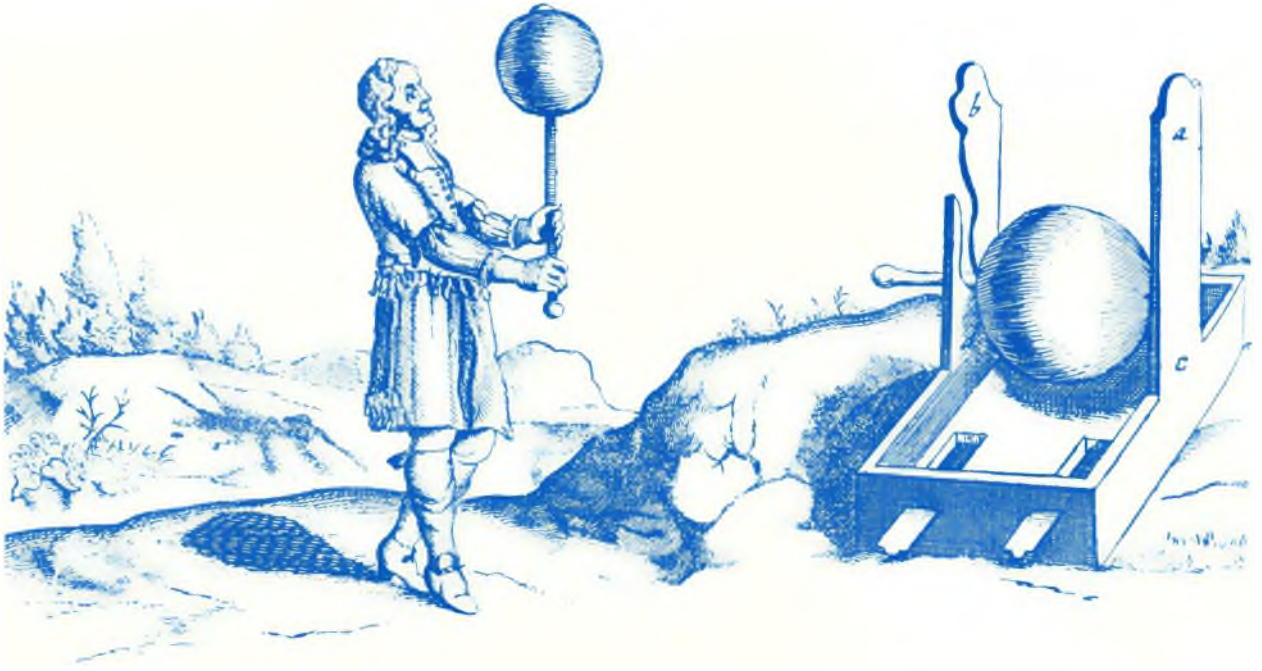
From the shores of the Baltic Sea, centuries ago, traders shipped overland a fossilized resin called amber. Ancient Greeks discovered that this clear, yellow-brown material, rubbed vigorously, attracted to it bits of straw or feathers—a phenomenon which we recognize as electrical.

A great many substances, we now know, become charged with electricity when rubbed. Shuffle across a rug to touch the light switch, and sparks leap out. Run a comb through your hair, and electricity appears. But not until 1600 did William Gilbert, physician to the English Queen, Elizabeth, announce that other substances like glass, sulphur, and rock crystal also possessed the power when rubbed to generate *electricity*.

Gilbert's discovery excited the learned men of Europe. One, Otto von Guericke, in 1650, built a curious machine that could generate electricity. Francis Hauksbee, in 1709, successfully filled a glass globe with light "so great that large print could be read." Benjamin Franklin proved that lightning was a giant spark of electricity. But no one put electricity to work.

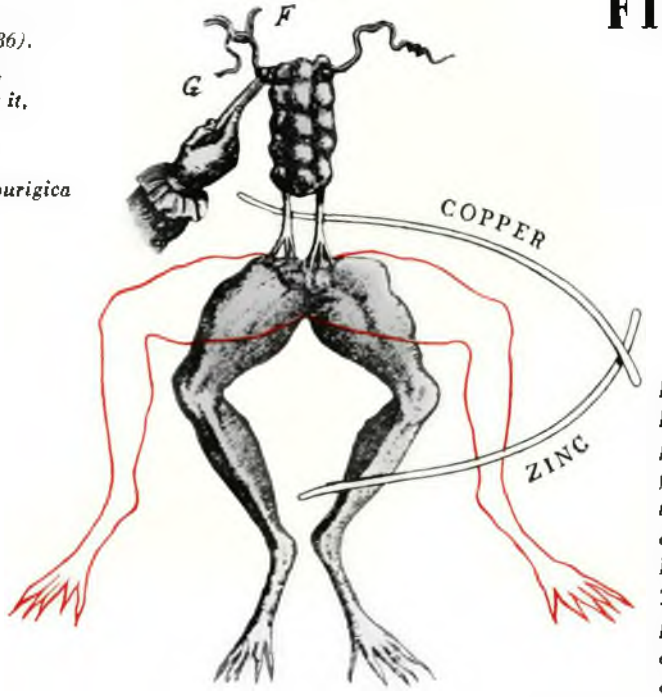
Then an Italian professor of anatomy, Luigi Galvani, stumbled on a strange fact. Dissecting a frog, he discovered that the legs, hung on copper hooks, *twitched* when touched with steel. Repeating Galvani's experiment, Alessandro Volta concluded that the contact of two different metals caused the "electrical charge." Volta stacked alternate zinc and copper discs with salt-soaked cloth between every other one—the first battery.

When the two ends were connected, a spark crackled. Volta had discovered the electric current.



Sulphur ball machine of Otto von Guericke (1602-1686). When the ball was revolved, and the hand rubbed against it, electricity sparked. From the inventor's "Experimenta Nova Magdeburgica de Vacuo Spatio."

FIRST COMES



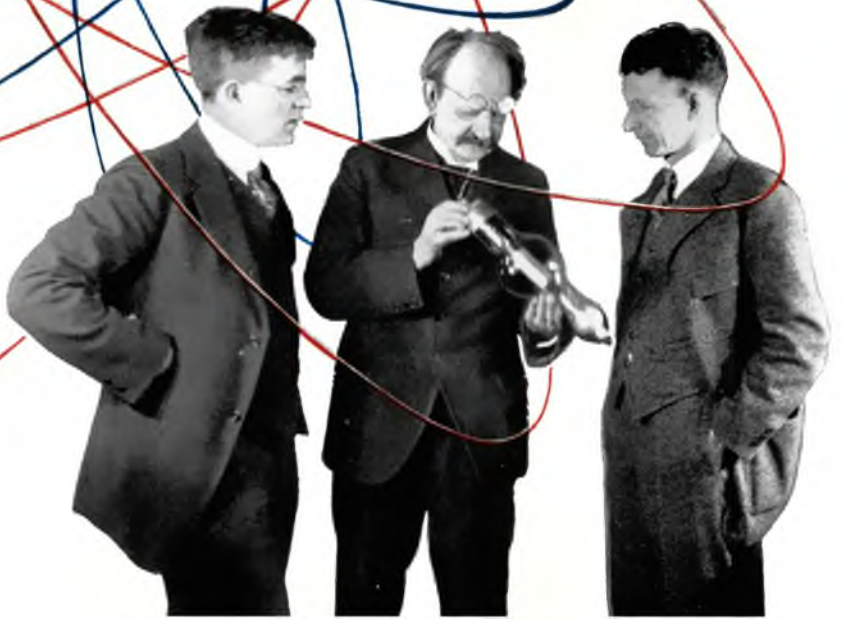
Electricity in a frog's legs. Luigi Galvani performs his famous experiment in 1780, from which Volta later deduced the fact of electrical current. From "De Viribus Electricitates," by Galvani, 1792. Today, with electronic instruments, physicians study nervous disorders by measuring electric currents in the human brain.

ELECTRICITY

A candle-maker's son becomes the foremost scientist in America. Benjamin Franklin draws electricity from the clouds.

Charles P. Steinmetz, General Electric pioneer in alternating current, creator of man-made lightning, teacher of a generation of electrical engineers.

ENTER THE ELECTRON



Dr. Irving Langmuir, Sir J. J. Thomson, and Dr. William D. Coolidge, at the General Electric laboratories, when Thomson, the famous discoverer of the electron, visited America in 1923.

Two long centuries followed Volta's great discovery. Slowly at first, then faster and faster came applications of the electric current — the electric light, the telephone, the motion picture, the turbines of industry. But it is only in the last half century or so that science has begun to know what electricity really is.

All the world of matter is composed of molecules. Molecules, in turn, are combinations of the 92 established elements, or kinds of atoms — sodium, iron, oxygen, uranium, and the rest.

But if the world of substance is built of molecules, and the molecular world is built of atoms, what are atoms built of?

In 1897, the great English physicist, Sir J. J. Thomson, gave his answer. Atoms, Thomson said, are made of tiny, unseen particles of electricity, now called electrons. Science today knows that there are other constituents of the atom — neutrons and protons — clustered together in the nucleus. Around this nucleus, the negatively charged electrons revolve as earth and planets revolve around the sun.

This is a simplified idea of the structure of matter, and omits the possibility of other particles, like the mesotron and the neutrino. But the picture is accurate enough, if you remember that whirling electrons can be divorced from the influence of the nucleus and put to useful work.

How is this accomplished? Through the amazing medium of the vacuum tube, the foundation of the Electronic Age!

By this magic tube, doors open automatically as you pass, machines match fabric shades, the eyesight of children is guarded, and engineers reclaim sulphur that formerly vanished up factory chimneys.

One day in 1883, Thomas Edison, experimenting with his newly invented electric light bulb, observed a glow inside the horseshoe-shaped carbon filament, accompanied by a rapid disintegration of the filament.

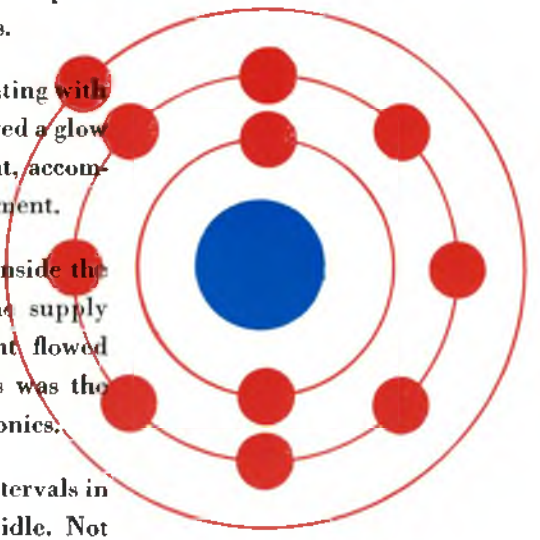
Investigating, Edison sealed a metal plate inside the tube. When plate and positive side of the supply circuit were connected, an electric current flowed across space from filament to plate! This was the "Edison Effect," the basis of modern electronics.

Thereupon occurred one of those curious intervals in the history of science. A great discovery lay idle. Not until years later did any one begin to build upon the foundation that Edison unknowingly had erected.

Professor J. A. Fleming, an English physicist, in 1904 found an application of the Edison Effect — a detector for wireless telegraphy, called the Fleming Valve.

Soon after this, Dr. Lee de Forest, also studying the Edison Effect, added a grid to Fleming's Valve. This small wire screen, electrically charged, controlled the amount of current flowing through the valve. De Forest's tube, the "audion," pointed the way to all radio telephony and radio broadcasting, and when E. H. Armstrong discovered how to use the audion to amplify radio frequency waves, the "cat's whisker" earphone era had come to an end.

Meanwhile, at the General Electric laboratories in Schenectady arrived a young man from the Stevens Institute of Technology. He was Dr. Irving Langmuir, with a gifted mind and an unsatisfied curiosity about the secrets of the universe.



Two of the fourteen sections of the giant General Electric X-ray tube, 1,400,000 volts—a unit built for the National Bureau of Standards in Washington.

Langmuir's interest in the Edison Effect arose out of systematic study of tungsten, used for lamp filaments. He found that gas in the tubes of that day prevented their operation at high voltage. Removing the gas, Langmuir discovered the "space-charge" law governing the flow of electrons in a high vacuum. The result was a vacuum tube that worked dependably at 250 volts. The old audion tube had been limited to 30 volts! Thus originated the true high-vacuum power tube, destined to handle many kilowatts of power, and to amplify the impulse of a microphone for long distance radiation, as waves from an antenna.

It was a new goal in the fascinating search for electronic knowledge!

Through the ages electrons had pursued their course without once being segregated and put to work. Into that invisible world, Langmuir now entered, and made the "big little things" do man's bidding. He harnessed the power of the electron for as long as mankind endures.

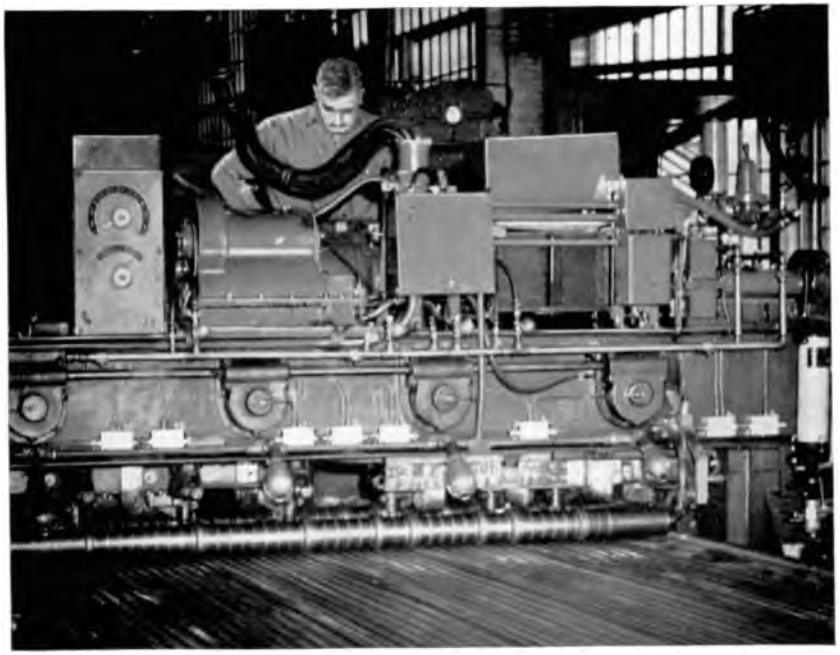
Following Langmuir's discovery, Dr. A. W. Hull and his colleagues in the General Electric laboratories devised many new types of electronic tubes — including the screen grid tube now used in all modern radio reception, the magnetron, the dynatron, and the thyratron.

Today, across the world, hundreds of types of electronic tubes serve man's command. They range in size from tiny globes to long cylinder tubes, twenty-five feet tall. They work for the doctor, the fireman, the artist, the fruit packer, the sea captain, the air pilot, the policeman. They have wrought a revolution — not by force of arms, not by might, but by the will and intelligence of man.

The electron microscope . . . portable, versatile new tool of science . . . opens new windows on an infinitesimal world.

Electronic tube manufacture calls forth the resourcefulness of scientist, engineer, craftsman.

Electronic controls regulate the stitches by which resistance-welding joins metals in hundreds of useful shapes.




THIS ELECTRONIC WORLD

ELECTRONS IN INDUSTRY

In great sprawling factories busy on arms production, in cotton mill, printing plant, fruit-packing house, steel mill, railroad and knitting mill, the magic electronic tube is working miracles for American industry.

General Electric now manufactures many types of electronic tubes, from the husky ignitron and thyratron used in welding metals of war; to photo tubes that measure light; to amplifier tubes that amplify sounds. They are of all sizes, and ratings range up to a million volts.

They are stepping up production, increasing human efficiency with a speed and accuracy undreamed of only a few short years ago!

A recording spectrophotometer, utilizing a photoelectric cell, now provides the most reliable method of analyzing color ever devised. The human eye can detect some ten thousand tints of reds, blues, greens, browns, yellows. But this amazing tool of the Electronic Age defines two million different shades! It is already used profitably in the chemical, paper, textile, and paint industries.

In weaving, an electronic device automatically squares the lengthwise and crosswise threads, the warp and the weft. Electronic eyes inspect sheets of metal gliding swiftly from the rolls, spot pinhole defects, and mark them for later discard. Electronic tubes turn on highway lights as the sky darkens, and turn them off when morning comes.

Stir one of two cups of boiling water with a strip of metal. An industrial engineer can tell you which one! The "electric eye," an electronic device, readily detects the infinitesimal amount of metal dissolved during the brief stirring.

Electronic devices control the high-speed wrapping of packages, fill ginger ale bottles to the proper level. Electronic rectifiers furnish power to produce vital war metals like aluminum. . . . And electronic tubes, through carrier current, enable power station operators to carry on conversations over the same lines that carry the electric power; or to control distant apparatus in the same way.

X rays, too, are electronic in origin. Long indispensable to physician and dentist, they now aid modern industry. Across the country, General Electric X-ray units of many types and sizes examine heavy castings for imperfections.

The new million-volt X-ray unit photographs in 16 minutes the internal structure of heavy metal thicknesses which formerly required exposures of 60 hours. X rays detect porosities and fissures in welded metal seams; and locate potential blow-outs in tires — on the wheel, before they happen.

In the food industries, too, electronics plays a part. X rays inspect candy to detect intrusive foreign materials, and check packaged goods for deficiencies in fill. X-ray examination of oranges saved California citrus packers $7,000,000 in one record year, when frost made every good orange count heavily. Similar fluoroscopic X-ray inspection checks golf balls, molded plastics, rubber heels and wire insulation.

One of the most fascinating applications of electronics is the analysis of crystalline substances — metals, fibres, paints, ceramics — by X-ray "diffraction."

The physicist places in a "camera" a sample of the material to be studied, and directs at it a stream of X rays. The sample diffracts the rays, and the diffracted radiation creates a pattern on sensitized film. The

Probing the internal structure of a giant turbine casting with the million-volt X-ray unit, to detect hidden flaws.

physicist simply reads the diffraction pattern, and by calculation can determine what structural changes occur when metal is rolled; can classify cotton, wool, silk and other natural and synthetic fibres according to strength; and even identify the minerals in rhubarb!

The tiny electron, partner of business in a thousand ways, is also mobilized to gigantic tasks set by industry's *power* machinery.

Steel companies must match the power frequency of huge driving motors to the frequency of the utility lines. Once the only way would have been with great rotating converters. Today, the magic electron can do this work.

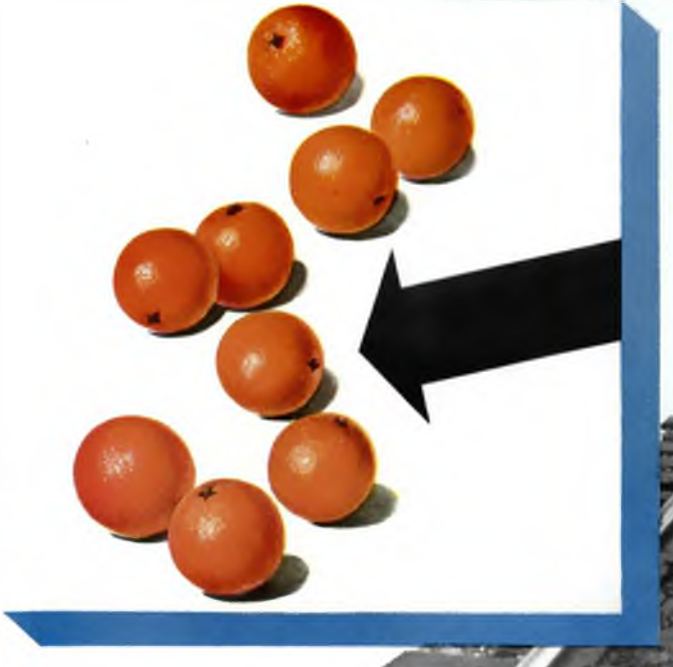
Once the manufacturer of plywood kept heavy thicknesses of material under pressure for hours while the glue dried. Now, through induced heat produced by electronic tubes, the same thicknesses dry in two or three minutes.

Garages and filling stations depend upon Tungar electronic rectifier tubes to charge batteries on millions of private cars and trucks; and industrial plants, with tractors driven by silent electric motors, put Tungar tubes to work nightly recharging batteries, while tractors and men rest.

Only imagination now limits the use of the electronic tube in industry. The magic tube that levels elevators in skyscrapers, counts traffic, and controls the flow of power in electric furnaces, will double and triple its industrial deeds in the future. The money that the electronic tube will save, the burdens it will lift, the inventions it will stimulate, no man can now foresee.

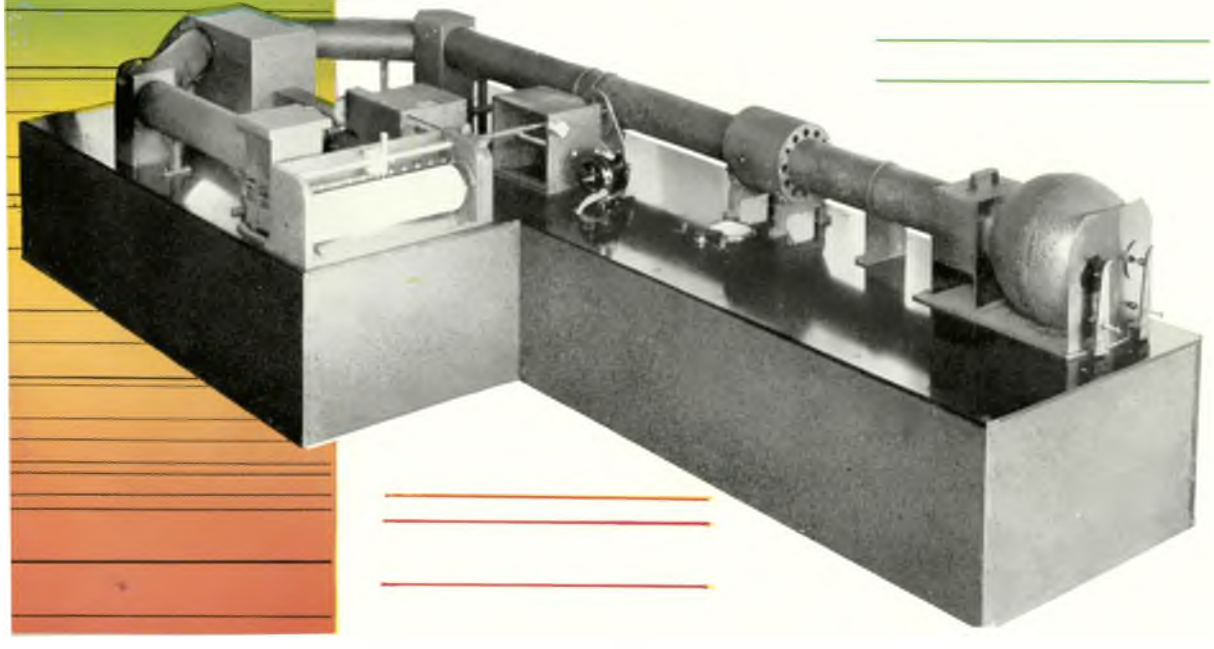
The picture at the left is "out of register." Electronic tubes prevent mistakes like this — hold color plates in register and reduce gravure printing costs thousands of dollars a year.

Orange packers save many dollars yearly inspecting fruit by X ray.



Electronic devices roll over railroad tracks, spray white paint where defects are located. Other electronic devices bring the railroad block signal system right into the locomotive cab.

The spectrophotometer, *a magic electronic device that can detect 2,000,000 different shades of color—and produce for permanent records a chart of each color. Thus, a Pennsylvania manufacturer of chinaware could match exactly, if necessary, the tint desired by a customer in England, if spectrophotometer specifications were available.*



OTHER INDUSTRIAL USES

Counting traffic in tunnels
Matching false teeth
Recording beats of a master clock
Boiler gauge level alarm
Comparing tire noises
Reversing rolls in steel mill
Furnace temperature control
Fuse testing
Coating sandpaper
Leveling elevators
Prospecting for oil and ore
Humidity control
Aiding ships to dock
Adjusting automobile headlights
Loud speakers and calling systems
Lighting air-beacons and air-fields
Facsimile reproduction of news pictures
Lighting stores and offices
Circuit breakers
Synchronizing power circuits
Safety doors in mines
Detection of gases in tunnels
Hold-up protection in banks
Bleaching process control
Filling tooth paste tubes
Sterilizing foods
Moth-control in orchards
Inspecting razor blades

ELECTRONS IN RADIO AND TELEVISION

Tonight, a soldier in the South Pacific speaks to a mother in Illinois. A farmer in New England settles down to war news from London. A band plays, and three thousand miles away a boy and a girl dance. A bank president, an actor, a Texas ranger talk through the still night air.

The miracle of the electron!

Tonight, air raid wardens gather in fire houses and police stations. In a television studio, instructors warn of incendiary bombs, describe fire-fighting techniques. Thirty thousand air raid wardens thus completed training courses in New York City—the first instance of mass education by television—through receivers in 81 precinct police stations.

The miracle of the electron!

It is almost half a century now since Marconi proved to an astonished world that messages could be transmitted without wires. Today, electronic transmitting tubes flash the music and pageantry of the world through space at the rate of 186,000 miles a second. From microphone and electron oscillator, through which course millions of free electrons, radio waves ripple out over city, forest, and sea.

There is no part of earth where radio cannot now reach. In the electronic tomorrow, sound *and* sight will travel the air waves. You will relax at home in your armchair, and watch a ball game, a stage show in full and glorious color. You will see a red robin sing as you hear it, wander with explorer through greening wilderness, follow with your eyes a plane soaring over the Andes. This is not far in the distant future. General Electric research is building for a day when your home will be a window on the world.

"The President of the United States." A voice speaks into the microphone. Sound waves are changed into electrical waves by electronic tubes, radiated into space, and picked up by your radio receiver, which changes electrical waves again to sound. "The President of the United States." You, in Kansas, Uruguay, or Sweden, have heard the words sooner than people across the room in the White House!

Miraculous as is the fact of radio today, tomorrow's radio will be vastly improved. A new radio system, Frequency Modulation—known as FM—already has revolutionized the world of transmitted sound.

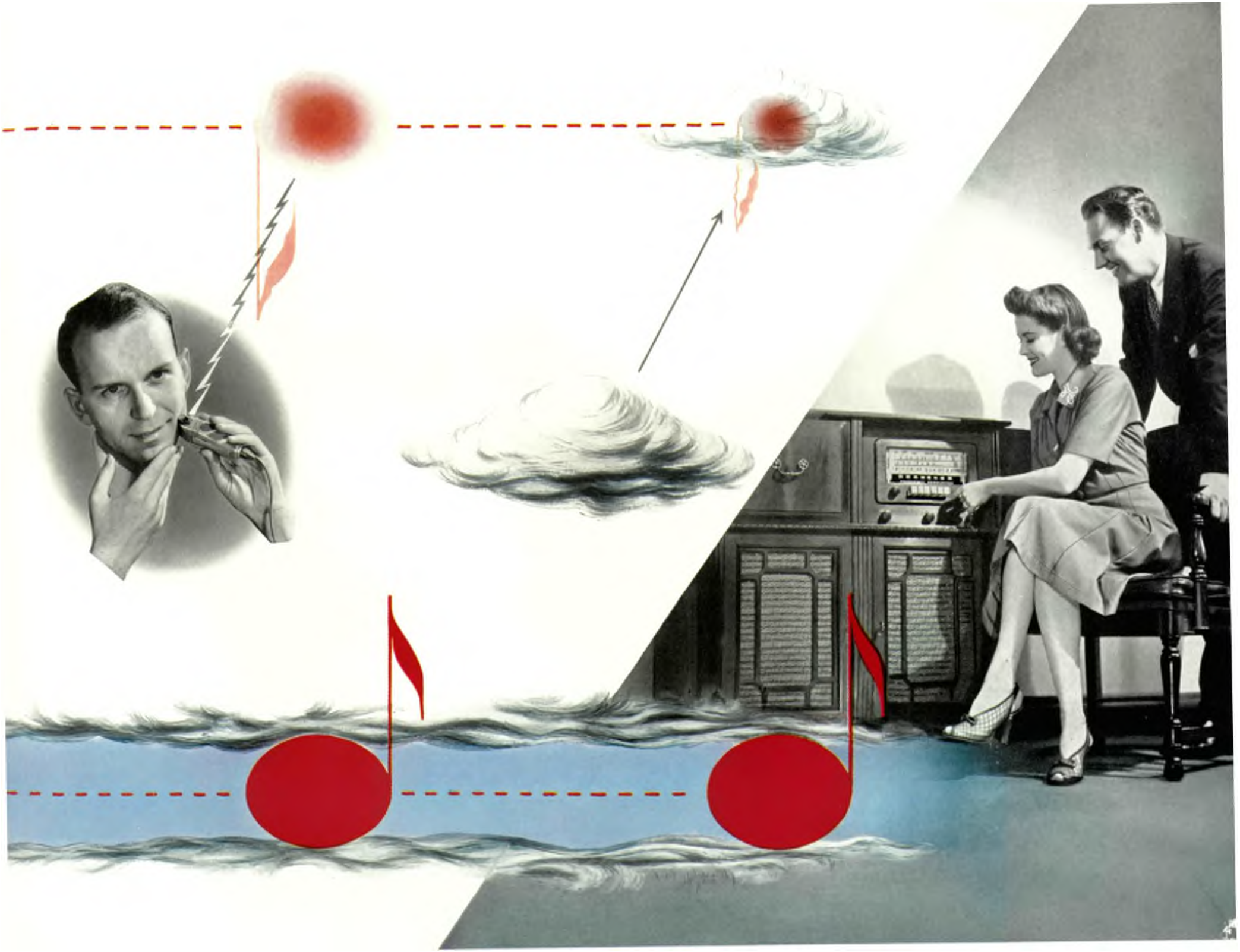
FM reception, developed by Major E. H. Armstrong, abolishes the imperfections of present-day radio. One of these is static, caused by Nature's lightning and sunspots, by man's electric razors or dial telephones. FM reception is clear and unmarred.

RADIO

The human ear is sensitive to a range of sound from 16 to 16,000 vibrations or cycles per second. Conventional radio does not reproduce sounds higher than 5000 cycles. But FM radio opens up the full highway—the range of piano, violin, voice—with all the delicate overtones that give music color and life.

FM eliminates interference, the hum and cross-talk on the same channel. Even when two or more stations are near, FM selects only the one you wish.

General Electric builds FM receivers, and transmitting apparatus for commercial, police, and military purposes. General Electric also operates international short-wave radio stations WGEA and WGEO in Schenectady, and station KGEI in San Francisco. Only the war defers a wholly new conception of radio performance in your home.



TELEVISION

Voices have spanned the miles for years, and signals have journeyed across the Atlantic since the War between the States. Man *still* dreamed of bridging distance by pictures.

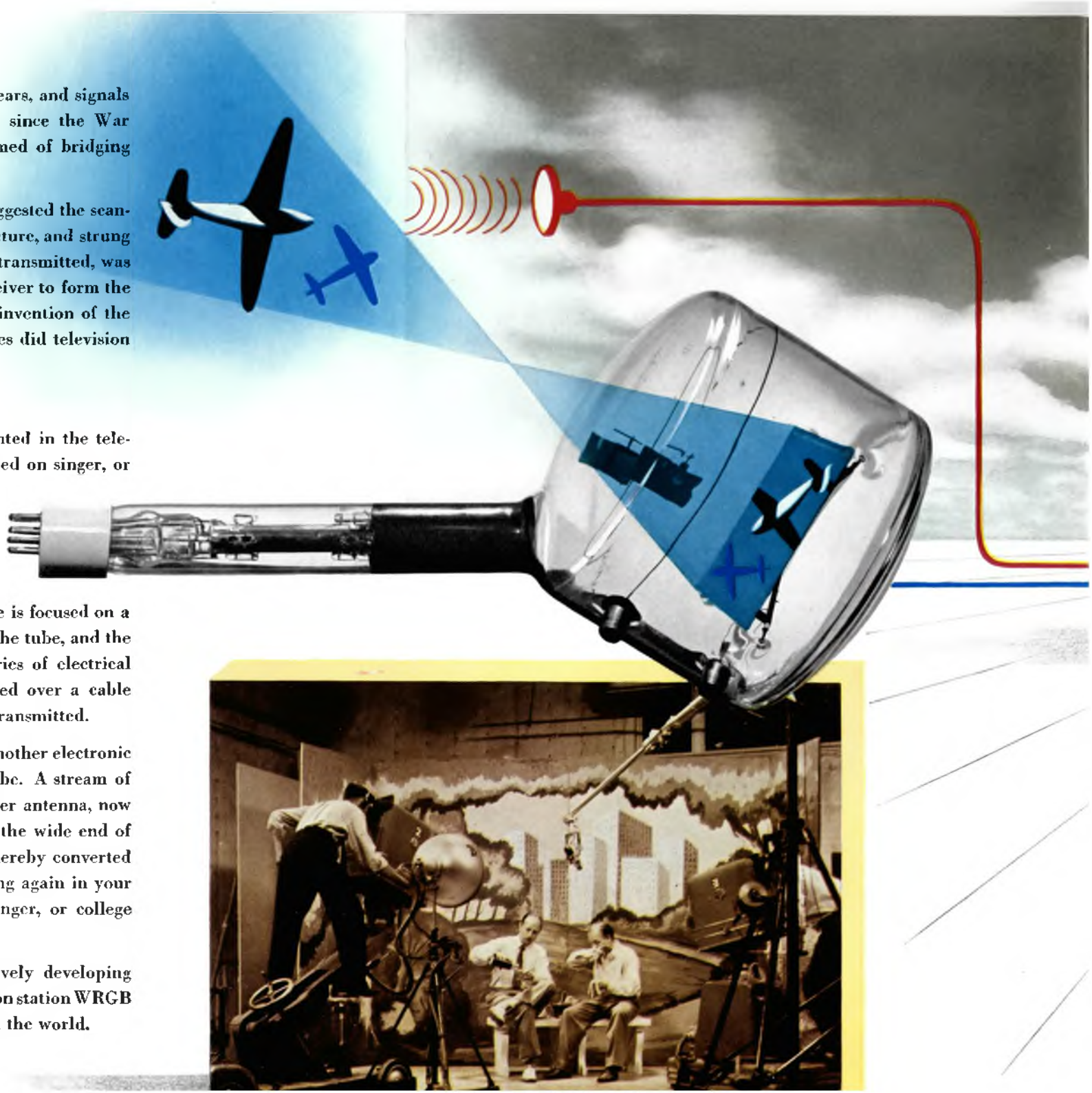
In 1884 the inventor Nipkow first suggested the scanning disc—a device that divided a picture, and strung it into one long line of light which, transmitted, was divided again in many lines by a receiver to form the original picture. But not until the invention of the cathode-ray camera and picture tubes did television become a rich promise for the home.

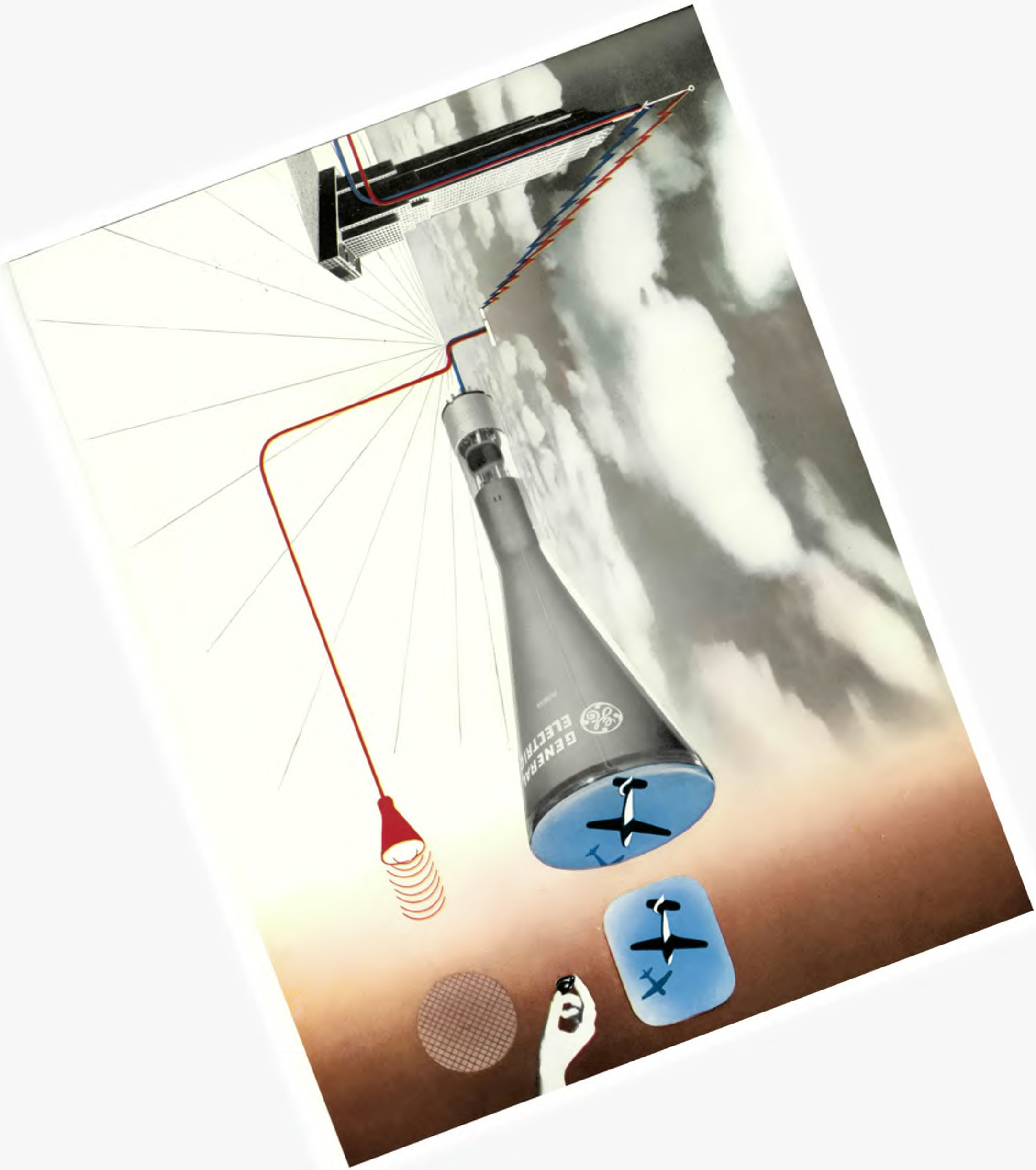
How does television work?

The electronic camera tube is mounted in the television camera, and the camera trained on singer, or football field, or airplane. The image is focused on a photo-sensitive plate at the back of the tube, and the tube converts that image into a series of electrical impulses. These impulses are carried over a cable to a skyscraper antenna, and there transmitted.

In the receiving set in your home is another electronic marvel — the cathode-ray picture tube. A stream of electrons, controlled at the skyscraper antenna, now plays across a fluorescent screen in the wide end of the tube. Electrical impulses are thereby converted into varying degrees of light, forming again in your television set the clear image of singer, or college football field, or airplane!

General Electric engineers are actively developing television in General Electric television station WRGB in Schenectady, one of the largest in the world.




GENERAL ELECTRIC

ELECTRONS ON GUARD

Stealthily the intruder crosses the dark arsenal grounds. Lights are out. No one sees. Then, out of the night, comes a sudden shrill alarm. A saboteur trapped -- by electronics!

Fences of invisible light rays, electrically controlled, now guard many of America's factories, war plants, shipyards, railroads. The beam is broken, the signal sounds, and life and property are safe.

Greater miracles than this are the acts of electrons on the world's war fronts. On desert and continental land, in the blue ocean of the air, on the turbulent sea as ships ride to battle, the electron serves the cause of freedom. How, is a secret that may not now be divulged, but the revelation later will be one of the dramatic records of the war.

Electrons stand on guard in other ways and places. Fog is an ancient foe. Ships reduce speed, wary of oncoming vessels. Airplanes are grounded, and cars crawl along. But now, through astonishing electronic devices, captain and pilot can "see" through the murky whiteness, and even detect the position of reefs. Tomorrow, airplanes will land blind, as safe in fog as in sunlight.

In the police departments of the nation the electron wars on crime. Police cars, equipped with two-way FM radio, cruise the streets. A brisk command orders the squad car to the scene of accident or violence. There in seconds, police act, and the culprit is taken.

Electrons fight fire. Insulation smoulders in an unattended power station. Smoke rises, unseen. A beam of light is interrupted, an electronic "fire-warden" smells the smoke, and a signal sounds....There is even an electronic "traffic cop" to warn speeding motorists.

The electron, servant of man, is man's protector also!

ELECTRONS IN AGRICULTURE

Early this year, after a long period of experiment, an enterprising seedsman in Philadelphia offered American gardeners two new calendulas. One flower is golden, double petaled, the other orange and semi-double. Both were created by the genetic effect of X rays on seeds.

Thus does the electron enter the world of growing things!

Scientists for years have experimented in this fascinating realm. At the General Electric laboratories, apple and fruit trees, berry bushes, tomato seeds, and string beans have been bombarded with 1,000,000-volt X rays.

Cannot the action that produces different strains of flowers also produce grains and vegetables and cotton and fruits of higher yield and finer quality than before?

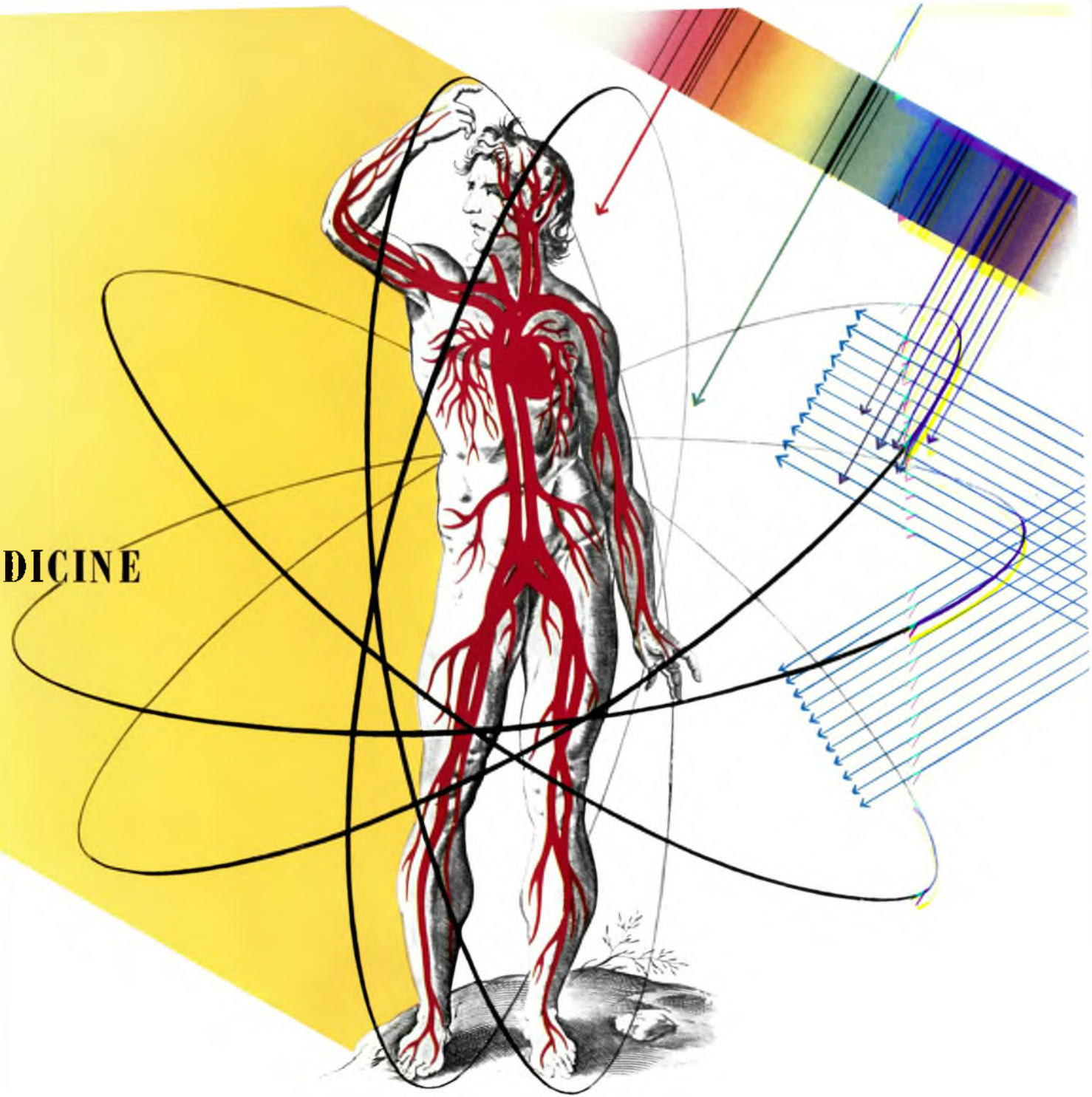
Science is looking to friendly Nature to see.

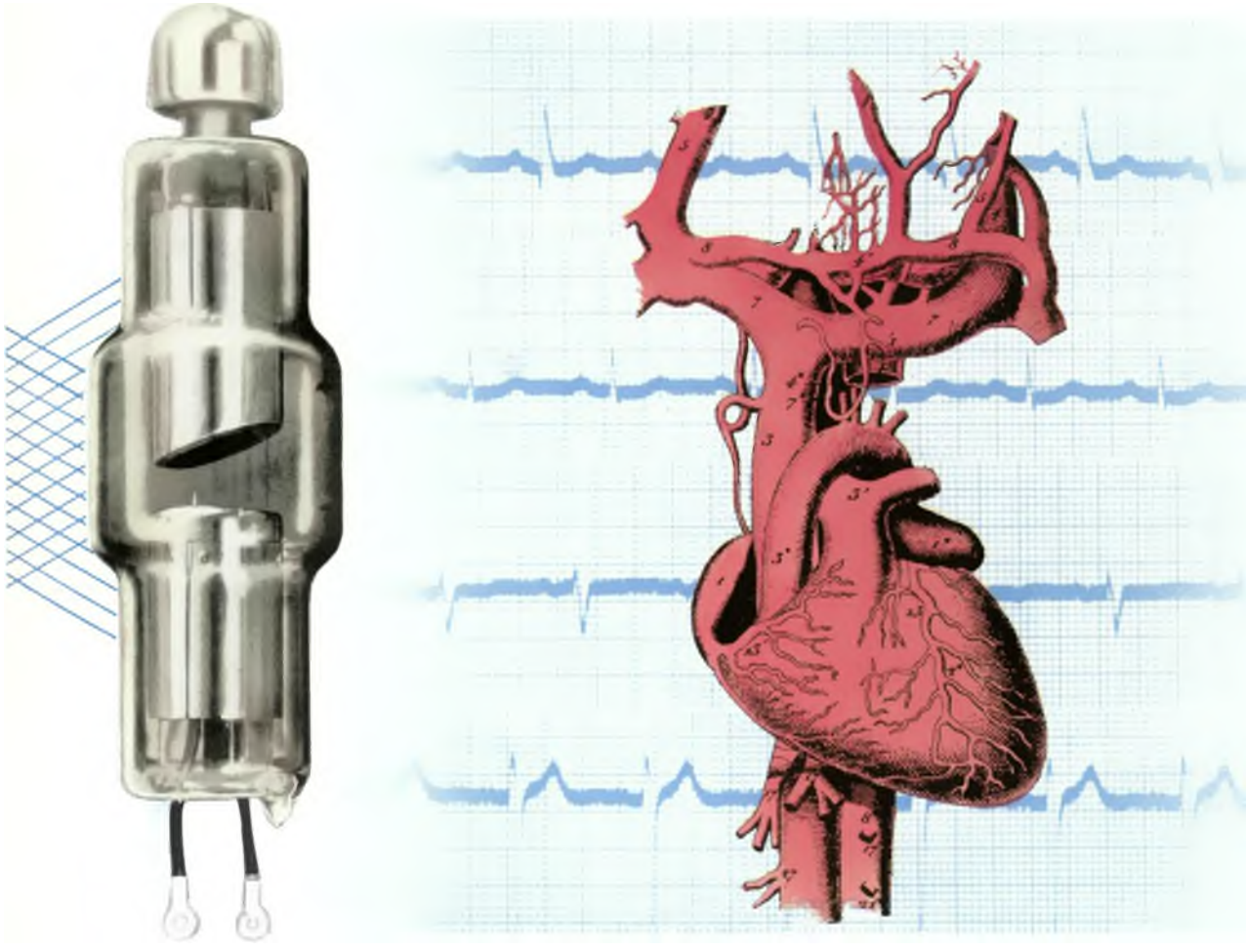
The electronic microscope has revealed already to biologists the character of the tobacco mosaic virus —a deadly crop disease, costing growers millions of dollars yearly. Perhaps that knowledge is the beginning of the cure. Tomato growers in the great garden states of the Union ask how soil fertility can be increased. The electron may reveal it — to the benefit of farmer and consumer.

The electron may some day develop a cold-resistant strain of corn; breed a superior stock of cattle; develop fruit untouched by the fly *drosophila*; create for the poorer peoples of the world, in their own soil, the elements of robust health. Nature and earth are willing.

All that is lacking is the imagination of man, and already, on the electronic horizon, a light is shining.

ELECTRONS IN MEDICINE





Tie a stocking around the throat for fever. . . . Bleed with a leech. . . . Sleep with the window open. . . . Sleep with the window closed. . . . This tonic and this powder and this formula will cure you. . . . An apple a day keeps the doctor away.

Man's health is man's priceless possession. He guards it, nurses it, talks about it. Health is his business, and his country's. Today the American is one of the healthiest persons in history, and tomorrow, by electronics, medicine will conquer still other diseases and ravages of mind and body.

It was November 8, 1895, that Professor Wilhelm Roentgen, at the University of Würzburg, first observed the effects of a mysterious form of radiation. Aptly he named it for the unknown — the X ray.

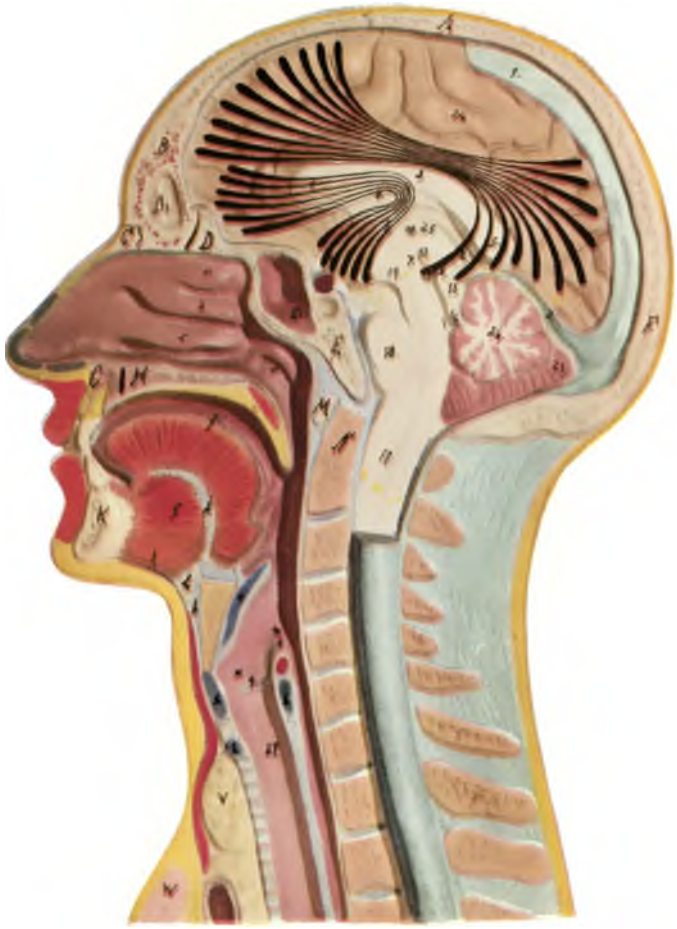
Science was stirred. For the first time, man might now see the structures within his own living body. Dr. William D. Coolidge, today director of General Electric research, was one who foresaw the X ray's possibilities for human good. Equipped with a new knowledge of electron behavior, he developed the Coolidge hot-cathode X-ray tube — the basis of modern X-ray practice.

By radiography, the recording of X-ray images on a sensitized film, physicians and surgeons examine the skull, the bones of the hand, spine and chest. By fluoroscopy they study internal organs in motion. And dentists can see hidden cavities, or trouble at the roots of teeth.

Medical men can make stop-motion radiographic "snapshots" of the heart in a fraction of a second. They can see that a leg bone is set properly, and how a rib is knitting. They can find gall stones, kidney stones, bladder stones; detect tuberculosis

Inductothermy, which produces heat within human tissues, used successfully to relieve pain in sinus conditions, and in treating joints, back, chest and sore muscles.

A patient under treatment with the 1,000,000-volt X-ray therapy unit in one of the nation's large hospitals.



Science now knows that the human brain generates electrical thought patterns. By encephalography, diseases of the brain may some day write a record on film to facilitate accurate diagnosis and treatment.

and silicosis in the early stages; discover ulcers and tumors that might not otherwise be discovered until too late. And the X ray is the one satisfactory method of locating bullets, metal splinters and other foreign bodies embedded in the flesh.

In therapy, X rays treat skin disorders, acute infections, inflammations, gas gangrene. Newest weapon in the fight against deep-seated malignancies is the giant 1,000,000-volt X-ray generator.

By inductothermy, or artificial fever, medicine again works hand in hand with Nature. Here, electronic tubes produce high-frequency currents that generate therapeutic heat deep in human tissues. The Inductotherm can be used in local treatments also. Coils of insulated cable are placed around the part to be treated, and heat soothes and speeds the healing of sprains and fractures — if heat is indicated.

In the war against heart disease, an electronic instrument — the electrocardiograph — detects and amplifies electric currents generated by heart actions, and records their variations on photographic paper. From this record, the physician may learn much about the heart, to free the patient from worry.

With the electron microscope, newest electronic instrument to come to medicine's aid, physicians can look at typhoid and anthrax germs in structural form. It is possible that science will next reveal the life processes of these germs—what they feed on, how they reproduce.

The electronic science marches on. New discoveries in preventive medicine are no longer rare. Man's old dream of a world free from sickness and pain is not yet here, but we are nearer to it, by far, than man has yet been.

THE ELECTRONIC WORLD OF THE FUTURE

Out beyond the range of sight is a vast world, dwelling place of a hundred million universes. Here the stars wander in solitary splendor. Earth and moon and sun are sands on a limitless shore.

Infinitely small is another world, the realm of the electron. And midway between the stars and the electron stands man.

What will man do with this new knowledge of the universe? How will the American scientist, surgeon, farmer, housewife, business man put to constructive use the secrets wrested from Nature?

"I would not dare say what I think electricity may do in the future," said Dr. W. R. Whitney, first director of the General Electric Research Laboratory. "We are always supposing we have exhausted our knowledge in many directions. Discoveries are not terminals—they are fresh starting points from which we can climb to new knowledge."

That is the outlook of the General Electric Company. Tomorrow is unknown, and science can only surmise the electronic future. But the possibilities are vast and inspiring! One instance alone: The frontiers of high frequency waves are being pushed back and back, until today we see, however faintly, the hitherto darkened ground between the characteristics of light and of radio. Some day, extremely high frequencies of the spectrum may be applied to the wireless transmission of power. No one dares say otherwise!

Thus research goes on steadily, in the tradition of Steinmetz, Whitney, Alexanderson, Coolidge, and Langmuir, and their associates. The electronic tomorrow will be a healthier, more comfortable, more secure world for you and for all America.

Herbert Dayer

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GED-1028-A Printed in U. S. A.

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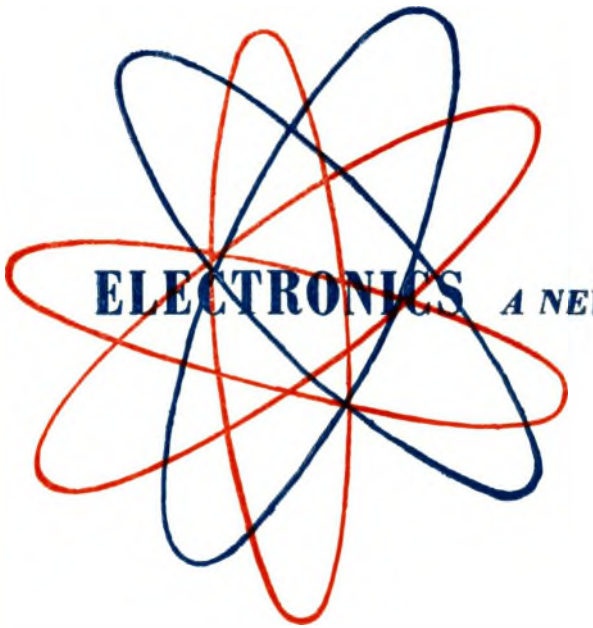

A NEW SCIENCE FOR A NEW WORLD