Volume 3 Number 3 January 1962

EE DIGEST

CURRENT DEVELOPMENTS IN ELECTRICAL ENGINEERING AND SCIENCE

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NEWS CLIPS

■ **Columbus, Ohio** . . . A zero-gravity electrolytic cell, capable of producing oxygen under the weightless conditions of space flight, has been developed at Battelle Memorial Institute.

Report said standard electrolytic cells depend on the pull of gravity on the electrolyte to separate hydrogen and oxygen from the solution. In the new experimental cell the centrifugal force of rotation makes the separation.

■ **Washington, D. C.** . . . Few women choose science as a career, a report shows. The report indicates that although women are becoming an ever larger proportion of the total labor force, science ranks far down on the list of professions that they have thus far entered. For example: only about four per cent of all federally employed scientists and engineers are women.

■ **New York, N. Y.** . . . A transistor-operated "foghorn for the blind," is now undergoing tests.

The blind person carries a humanly inaudible dog whistle. When blown, the sound of the whistle is selectively picked up by a microphone on the device, which then causes a self-contained bell to sound for a short period. The blind person can estimate his position in relation to the known location of the device by judging the direction and intensity of the sound of the bell. The special high-frequency whistle is used to prevent triggering of the device by ambient sounds. — The range of the device is about 60-yards, making it suitable for determining location within a large area. — The new equipment was developed by Standard Telephones and Cables Limited, British affiliate of International Telephone and Telegraph Corporation.

■ **Washington, D.C.** . . . A new atomic reactor for research, the "Black Void Reactor," makes possible the simultaneous presence of fast and slow neutron fluxes separated in space. Fission released fast neutrons are slowed down by the moderator. A portion of the slow neutrons go back to the fuel assembly, where they are re-converted into fast neutrons.

The reactor has been developed at the National Bureau of Standards in Washington, D. C.

■ **Palo Alto, Calif.** . . . A 2,000-year-old Chinese arithmetic theorem is being used by scientists to help make computer operations 20 times faster than now possible. — Called "modular arithmetic," numbers need not be "carried" over from one column to the next as in regular addition and subtraction. This means that calculations can go just as fast as the computer can run. With ordinary arithmetic, the computer must "wait" for the "carries" to catch up with the main calculation. The "modular arithmetic" is being developed by scientists at Lockheed Missiles and Space Co.

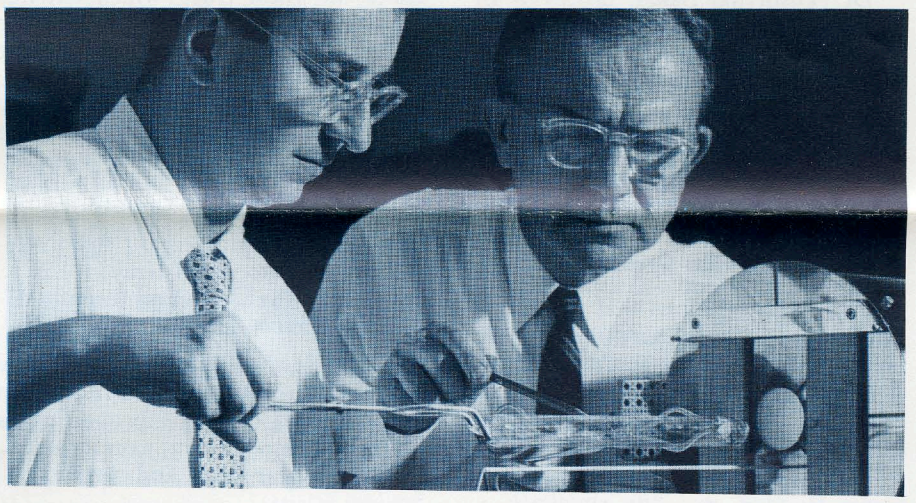
ULTRA-THIN METAL FILMS FORM MICRO-MINIATURE ELECTRONIC CIRCUITS

Creation of ultra-thin metal films has opened a fresh way to computers to operate in nanoseconds instead of millionths of second as with present machines, according to a recent report.

The metal layers form micro-miniature electronic circuits and these new circuits offer the advantages of high reliability and relatively low cost, as well as exceptional speed, lightness and smallness.

The circuits' minuscule metal strips, known as thin films, are made of aluminum, gold, tantalum or other metals with useful electrical properties. To make thin films, these metals are vaporized and the vapors are deposited through perforations in a metal sheet, onto thin wafers of an insulating material such as glass. The metals stick to the wafers like silver to the back of a mirror. Most thin films are from a millionth to ten millionths of an inch thick, dimensions which cannot be measured with conventional optical techniques.

The perforations in the mask determine the complex patterns of dots, rectangles and interconnecting lines formed by the depositing metals. The electronic functions performed by thin films depend on the kinds of metals used, the patterns in which these metals are deposited, and other factors.



Engineers examine growth of "ribbons" of silicon in a quartz tube just removed from the furnace. Thin ribbons of silicon may open way for improvements and reduction of transistors. The ribbons, typically about one micron thick, are near-perfect crystals. Because of their crystalline perfection, the ribbons are very strong mechanically. They are also quite flexible due to their extreme thinness. The crystals were discovered at Bell Telephone Labs.

The Most Promising Form of Microelectronics

Already, thin films are available which can do the jobs of resistors, capacitors and condensers, the so-called passive circuit elements which modify electric current but do not increase its power. Within one to two years, scientists expect to make available thin films which will do the amplifying and switching chores of transistors, diodes and other semiconductors.

Many engineers and scientists are optimistic about the future of the thin film. But, William F. Long, manager of Philco Corp., went further and said, "I'm sure there will be a lot of mergers and bankruptcies in the electronic industry due to thin film circuitry."

Thin Films In Commercial Products

The thin films already have won acceptance in a number of commercial products, according to reports.

At General Electric Co.'s computer laboratory in Mountain View, Calif., engineers are making thin films for use in a one-cubic-foot computer which will have the same speed and capacity as some room-sized machines, and should cost only half as much as comparable conventional models.

Lear, Inc., expects to start producing signal amplifiers employing thin films to be used in its automatic pilots for aircraft. The amplifiers will be only one-sixth as large as the present ones and are expected to be more reliable.

(Continued on page 6, col. 4)

MAGNETS

The physical nature of magnetism has been the subject of much speculation and research. Hence scientists were particularly interested in the recent 1961 International Conference on High Magnetic Fields held at the Massachusetts Institute of Technology.

MIT is the site of the National Magnet Laboratory, a research institution sponsored by the Air Force of Scientific Research and operated by the institute. The magnet laboratory came into existence on July 1, 1960, when the Air Force provided funds to construct a magnetic laboratory and conduct experiments.

Stronger Magnet Needed

For a number of years, Professor Francis Bitter of MIT has had a magnetic laboratory on the campus where continuous magnetic fields up to about 100,000 gauss were available. But the need for still stronger continuous magnetic fields and a more versatile magnet laboratory became apparent. A Lincoln Laboratory group has come to the conclusion that improved magnet design can produce continuous fields of about 250,00 gauss with a power supply of 8,000 kilowatts. Such a magnet, with a strength over 500,000 times larger than the earth's magnetic field, will be the heart of the National Magnet Laboratory. It will be completed in about two years.

As far as is known, the largest continuous magnetic field now available is that of a 126,000 gauss magnet developed by Dr. Henry H. Kolm at MIT. It operates at 10,000 amperes and requires about 1.8 megawatts of power.

Large Currents In Small Coils

At the International Conference, Dr. Bitter reported that water cooled magnets yielding fields of 100,000 gauss have been in operation at MIT

(Continued on page 6, column 2)

Top Ten Science Advances Picked For 1961

The ten top science, technological and medicine advances in 1961 were selected by Dr. Watson Davis, director of Science News Service.

Dr. Davis rated several achievements for top importance. They are: two man-carrying spaceships placed in orbit around the earth by the USSR, also the U.S. launching of two astronauts in suborbital flight, and the proving of U.S. Saturn 1,300,000-pound thrust world record space rocket.

The second and third places went to the discovery of chemical element 103, named lawrencium, and to plans to license measles vaccines from both live and killed virus in 1961.

Dr. Davis picked the brain surgery without skull opening using proton beams to fifth place and the cultivation of hepatitis virus in laboratory and

(Continued on page 8, col. 3)

AIEE–IRE WEIGH FUTURE MERGER

Two Largest Electrical, Radio Societies, With 150,000 Members Move to Explore New International Engineering Body

First steps to consider consolidation of two of the largest engineering societies in the world — the American Institute of Electrical Engineers and the Institute of Radio Engineers — have been taken.

In a resolution passed by the Boards of Directors of both Societies, a committee has been formed to determine the feasibility and form of such consolidation.

The proposed new organization would be international in scope and involve 150,000 engineers, scientists, educators and industrialists.

The announcement was made jointly by Lloyd V. Berkner, president of the Institute of Radio Engineers and Warren H. Chase, president of the American Institute of Electrical Engineers. The resolution was first approved by the Board of Directors of IRE in New York, October 18, 1961. Approval of the Board of AIEE was given at the Fall General meeting of that organization in Detroit, October 20.

The resolution pointed out that "the advancement of the theory and practice of electrical and radio engineering and the educational and scientific objectives of both Institutes may be better served by merger or consolidation . . . into one organization in which all present members would be included, and in which they would enjoy the same rights and privileges now conferred on them by their separate organizations."

The resolution further states that the Boards of Directors of both Institutes deem it advisable, in accordance with the stated objectives of each society, "to move actively toward the consolidation of the activities and organization of IRE & AIEE," by consolidation or otherwise, providing that the legal and operational problems incident to such consolidation can be satisfactorily resolved.

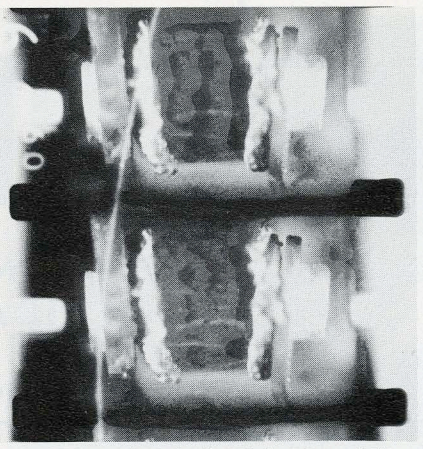
Both Societies appointed members to the Committee "which shall be authorized and directed to undertake such studies as they shall deem necessary and appropriate to determine the feasibility, practicability and form of such consolidation." The Committee is to submit a report to the Boards of both Societies not later than February 15, 1962, for their approval.

The Committee also was authorized to prepare a proposed constitution and bylaws "in consultation with representatives" of both Societies.

IRE named to the Committee Lloyd V. Berkner, Past President of IRE, President, Graduate Research Center, Dallas; Patrick E. Haggerty, IRE President-elect, President, Texas Instruments Inc., Dallas; Ronald L. McFarlan, Past IRE President, Consultant, Chestnut Hill, Mass.; and Haraden Pratt, Secretary and Past President of IRE, Pompano Beach, Fla. The AIEE members named were: Warren H. Chase, President of AIEE and Vice President of Ohio Bell Telephone Co., Cleveland; Clarence H. Linder, Past AIEE President and Vice President and Group Executive, General Electric Co., New York; Elgin B. Robertson, Past AIEE President and President, Elgin B. Robertson, Inc., Dallas; and B. Richard Teare, Jr., AIEE Director, Dean of Engineering and Science, Carnegie Institute of Technology, Pittsburgh.

AIEE was organized in 1884 and has approximately 70,000 members from the United States and Canada. IRE, organized in 1912, has a total membership of 91,000 and is international in scope. Approximately 6,000 members now belong to both Societies.

Both organizations have headquarters in New York City, AIEE in the new United Engineering Center, 345 East 47th Street, and IRE at 1 East 79th Street.



Intensive study of the behavior of low-current AC switches (20 amperes or less, 277 volts or less) has led to the discovery of a whisker-like formation which develops across the switch contacts under certain conditions. The GE photo, above, taken with a high speed 16mm film shows how silver or silver-alloy contacts develop these whisker or cobweb-like filaments.

ROBOT SECRETARY AND SYNTHETIC SPEECH MACHINE

A Japanese-made phonetic typewriter and a synthetic speech machine which can sing a simple song or say a few words, were items of major interest at a recent meeting of the Acoustical Society of America.

Dr. Toshiyuki Sakai, professor of electrical engineering, Kyoto University, Kyoto, Japan, told the engineers that he utilized some 5,000 diodes and 3,000 transistors in his research model phonetic typewriter in converting the human voice into typed symbols. He said the model has limitless possibilities.

Code-like Symbols

Dr. Sakai explained that the unit is partitioned into three main electronic subsystems—a phoneme classifier, the control system and the speech analysis system. Presently the typewriter unit tranforms the spoken word into a set of code-like symbols.

A perfected synthetic speech device was reported by M. H. L. Hecker, of Massachusetts Institute of Technology's Research Laboratories. Dr. Hecker said he added three additional nasal consonants to the usual ones in the speech machine, making it possible to produce all of the speech sounds in the English language.

Dr. Hecker explained that the development of the new consonants has been made with the use of a system of electrical transmission lines and associated control circuits.

The speech machine uses an electronic device to represent the human body's major speech parts. These include the vocal tract, which extends from the larynx (voice box) to the lips, and nasal cavities, which are linked to the vocal tract and extend to the nostrils. The device electronically simulates the sound pathways of the vocal tract and the nasal cavities.

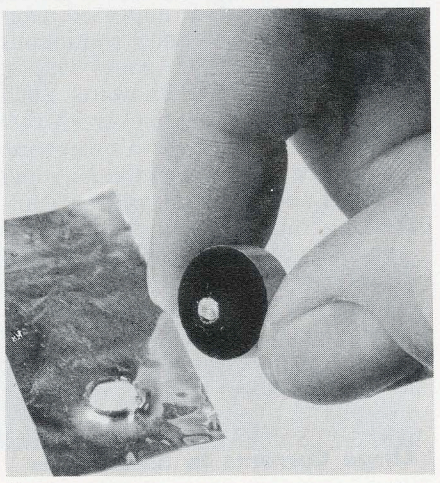
New Degree of Sensitivity

Warren P. Mason, of Bell Telephone Laboratories, Murray Hill, N.J., reported to the session on recently developed semiconductor transducers.

Mr. Mason said that a line of new semiconductor transducers have been made to measure such properties as tension, compression, acceleration, pressure, shear force and torque.

He said the new line has the static property measurement capabilities found in the wire type strain gauges but these add a new degree of sensitivity that is competitive with the magnetic, piezo-electric, electrostatic or variable carbon type transducers.

Mr. Mason said semiconductor transducers are being considered for microphone and phonograph pickup applications.



A single drop of water, shot as a jet from a compressed air "gun", easily penetrates thin pieces of aluminum and puts a sizeable dent in a sample of solid steel. The Westinghouse research, aimed at a better understanding of the wearing away of metal surfaces by high-speed drops of water, uses single "bullets" of water traveling at speed up to 3400 miles an hour.

Patent Right To U.S. Navy

A detector for infrared radiation won a patent and the rights were assigned to the U.S. Navy.

The device consists of an outer shell, which is exposed to the atmosphere, and an inner, insulated from the outer shell. The outer shell is highly transparent to infrared radiation, the inner shell being highly absorbent. A temperature-sensitive variable electronic circuit, connected to the telemetering system, is placed within the inner shell.

This detector is for use with weather balloons weighing less than half an ounce.

A New Microwave Light Modulator

An experimental microwave modulator of light was recently described by Dr. I. P. Kaminow of Bell Telephone Laboratories, Inc., Homdel, N. J.

Dr. Kaminow said interest in microwave modulation was stimulated by the possibility of using optical masers for communication purposes. He said the experimental modulator uses potassium di-hydrogen phosphate (KDP) and has been operated on a pulsed basis at 9250 kmc. About 2 kw is required to produce a peak-phase retardation of 1.9 radians.

Maser Beam Confined

The ability to confine the maser beam to a small cross section with low divergence makes low-power microwave modulation with KDP feasible.

With a KDP rod 35-cm long and 1-mm in cross section a 10-kmc modulator for 1.15μ (the helium-neon maser wave-length) could operate continuously at about 10w.

The Photocathode is Here

An experiment that involved mixing two coherent light signals to yield a coherent micro-wave output was described by A. E. Siegman of Stanford University. A phototube was used in the experiment.

A photocathode, Mr. Siegman noted, is a square-law device. It will mix two optical signals to give a difference-frequency signal in the photocurrent emitted. These microwave phototubes can be used as optical super-heterodynes, similar to those used in radio.

In the experiment the output from a ruby laser was fired at an improvised phototube consisting of a 2-4 kmc traveling-wave tube whose cathode was visible through the glass envelope.

High Direct Current Generator

Development of a new type of direct-current generator is a significant breakthrough in dynamoelectric design. The generator incorporates a liquid-metal collector system instead of sliding brushes. One important aspect of the new generator is its ability to produce extremely high direct current at low voltage, a characteristic particular matching the needs of the aluminum reduction and chlorine production industries.

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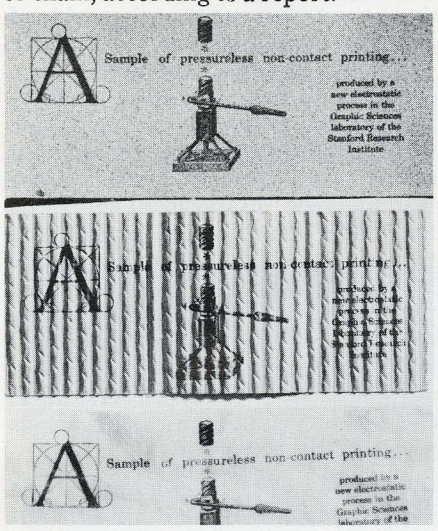
PRESSURELESS NON-CONTACT PRINTING PROCESS DESCRIBED

A boom in the newspaper business is at our door. Very soon a new pressureless non-contact printing process promises to cut the printing price in half. Moreover, the electrostatic printer would weigh 50 per cent less, while maintaing the same output as the conventional printing press.

The new process is called "pressureless printing," because no physical pressure is applied to the printing surface. With this new approach the variety of useful printing surfaces are numerous — clean, sharp images can be printed on everything from low-grade newsprint to sandpaper, glass or chalk, according to a report.



Above are sample printings with the new method on sandpaper (top), on cardboard (center) and on cotton. The images are clear, and readable.

1500 Volts!

The new method of electrostatic printing was developed in the Graphic Sciences laboratory of the Stanford Research Institute. While in operation, a 200-mesh fine stainless steel screen is charged to about 1500 volts. A stencil in which the image area is transparent and the non-image area opaque is applied to the screen. Then the desired material is placed behind the screen. Backing up the paper is a solid metal plate of opposite polarity from that of the screen. Then, a rotating brush will apply a mixture of dry-ink pigment and resin into the screen where the ink's particles acquire a charge.

The rear electrode now attracts the particles, and those in the transparent areas of the image pass through to the paper. A treatment of the ink's image fixes it permanently and firmly to the material.

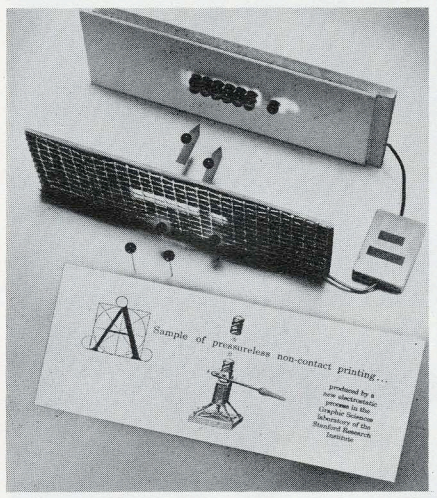
All Surfaces

According to SRI, "Electrostatic printing will appear on many items in the future. For example, advertising images can be printed on the hills-and-valleys surface of corrugated paper and boxes. Foods may have advertisements, decorations, or cooking instructions printed on the substance itself. Ceramic tiles may be adorned with designs printed rather than painted and baked on. Even cotton swabs and bandages might be printed with medical instructions. In each case, the image quality would be virtually independent of the surface characteristic."

Look Into The Future

Virgil Barta, manager of the Graphic Sciences Laboratory of S.R.I. believes that the new high speed printing method compares favorably with today's pressure printing processes, although more research is required to develop a full range of dry printing inks and rapid fixing method.

He also stated that engineering innovations can make it possible to print both sides of a surface simultaneously. "This is possible because the ink-and-resin particles can be charged to either polarity."



The theory of electrostatic printing is shown above. Two walls represent the stainless steel screen, which in operation is charged to about 1500 volts. The black balls are imaginary particles of dry-ink pigments as they pass through the screen. Behind the screen is the stencil in which the image area is transparent and the non-image area opaque. On the back wall there is the material to be printed. The wall is a solid metal plate of opposite polarity from that of the screen.

Control for H-Bomb's Fusion Reaction Patented

A device reported to be able to control the fiery energy of a hydrogen fusion reaction has been patented.

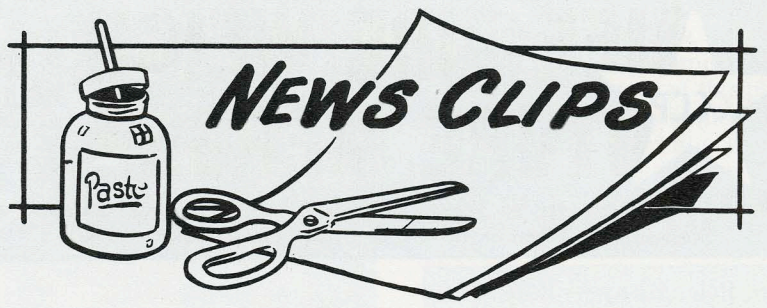
It is called a "rotating plasma device," a plasma being a gas in which the atoms have been partially ionized, or separated into positive ions and negative electrons. Although electrically neutral as a whole, a plasma can conduct an electrical current.

The rotating plasma device is expected to come into its own only after scientists have achieved "long-time" confinement of a plasma. This is the key to controlled thermonuclear fusion of such light elements as hydrogen, deuterium (double-weight hydrogen) and tritium (triple-weight hydrogen).

The patent was awarded to Drs. Keith Boyer, Conrad L. Longmire, Darragh E. Nagle, Fred L. Ribe, Jay E. Hammel and James L. Tuck who assigned rights to the Government through the U.S. Atomic Energy Commission.

Their invention relies principally on the fact that an ionized gas can be contained and heated in a region of crossed magnetic and electric fields. Both fields are applied externally, so there is no reliance on the self-generated magnetic field of the plasma current to compress and thereby heat the plasma as in the "pinch effect" approach.

The rotating plasma device is one of the methods for obtaining a high rate of thermonuclear reactions, with more energy liberated than is required to ionize the gas and bring it to the extremely high temperatures necessary for controlled fusion.



■ **Baltimore** . . . The world's first atomic-powered buoy is sending out signals from Curtis Bay, Md., southeast of Baltimore. Power for the test buoy is generated by a thermo-electric system. The buoy is powered by a SNAP-7A generator, Systems for Nuclear Auxiliary Power. The SNAP generator is fueled with strontium-90, converting the isotope's heat energy directly into electrical energy, which is then used to recharge the battery. Estimated life of the ten-watt SNAP system is ten years. It was developed for the Atomic Energy Commission by Martin Marietta Corp., Baltimore.

■ **Cleveland, Ohio** . . . A new lamp, the 5,000-watt Zenon Arc Lamp which has an ellipsoidal quartz bulb, and produces 275,000 lumens—55 lumens per watt, has been developed by General Electric Co. The lamp, it is believed, has a brightness three times that of the sun. The lamp may be employed to simulate solar conditions for testing spacecraft, and with devices for amplifying light.

■ **Denver, Colo.** . . . Although man has measured time by watching the apparent motions of the stars and planets, during the next decade the world will base time upon the "dance" vibration or frequency of an atom instead. Thus predicted Dr. John M. Richardson, chief of the National Bureau of Standards Radio Standards Laboratory, Boulder, Colo.

■ **West Germany** . . . For the first time, engineering as a career is favored by young men and women enrolled in gymnasiums, in preparation for German Universities, a recent poll has disclosed.

Medicine and law, both of which were favored above all others in the past, apparently have lost some of their attraction.

The preparatory school, called a gymnasium, is a highly selective nine-year school.

During their studies the gymnasium graduates have developed a broad background not only in language, history, literature, and the fine arts, but also in engineering, particularly mathematics. Satisfactory completion of such higher prep-schools, based upon a series of comprehensive oral and written examinations, places the graduate at a level equivalent to that attained in the U.S. after two years of college training, according to the National Science Foundation.

WHAT IS IT?

Skin of a Bengal tiger? — It's a microphotograph of a new semi-metallic bonding material named "Generalock". In the picture the "atom-to-atom bond," is so tight that electricity flows with virtually no resistance across the different materials.

In cross-section of microphotograph, above, the bonding material joins the conductor material and the thermoelectric material, lead telluride—PbTe—(white letters). Web-like network shows it locked into the lead telluride. The "Generalock" was developed by General Instruments.

■ **Washington, D. C.** . . . The first fully miniaturized electronic computer in operation has been demonstrated. It is the size of a loaf of bread. The working model was built to show that existing electronic components can be used in shrinking a commercial computer from room to desk size, and that military electronic equipment can be compressed to a convenient size for aircraft, spacecraft and missiles. — The computer has 5,500 components in a space measuring three-by-six-by-eleven-inches, weighs 12 pounds, and can perform 33,000 mathematical calculations per second. It was developed at the Burroughs Corporation's Laboratories, Paoli, Pa.

■ **Frankfurt, W. Germany** . . . The 15,000 kw Kahl Nuclear Power Station, has begun initial full power operation.

The General Electric-built reactor produced Europe's first privately financed atomic-electric power June 17, 1961.

The reactor installed at the station is a natural circulation, indirect-cycle boiling water reactor.

The Kahl plant is the first of the three G.E. built reactors going overseas. A 150,000 kw station is now under construction in Italy, and a 12,000 kw plant is being built in Japan, both for operation in 1963.

■ **Washington** . . . A patent has been granted on a new light amplifier that preserves the color distribution of the original image. It is made of narrow strips of electroluminescent materials which give off light when subjected to controlled voltage and electric current. Alternating voltages are applied to the strips, the amount of voltage being controlled by photoconductors subjected to the light of the image to be amplified. Phosphors may be chosen to emit primary colors duplicating those of any given image.

According to Radames K. H. Gebel, of Dayton, Ohio, who was granted the patent, the light amplifier can be used in combination with optical systems of high light-gathering ability for making observations above and below the light levels and wavelengths to which the human eye is sensitive.

Mr. Gebel's opinion is that the device could be used to amplify projected television images. It also has military applications for detecting enemy devices.

RUSSIANS, PENGUINS AND JAZZ—

A PHOTO JOURNEY WITH AN AIEE STUDENT MEMBER TO ANTARCTICA

FEATURETTE

South Pole, Mirny — 1961 . . . Adventure dreams came true for one Student Member of AIEE, C. Stewart Gillmore Jr., of Kansas City, Missouri, who is stationed at the Russian South Pole base called Mirny. He is the only westerner at the Russian base and represents the U.S., on a scientific team. Stewart arrived here January 1961, as a part of a 12-nation treaty program to increase the exchange of scientific information among countries.

Stewart Gillmore lacked only six weeks of receiving his electrical engineering degree from Stanford University, at Palo Alto, Calif., when he was tagged for the scientific expedition at the Russian base, in Mirny. Besides the one hundred Russians, there are three East-Germans and two Czechoslovakians.

His famous corn cob pipe dangling from his mouth and his parka ajar, grinning Stewart hugs an impatient sled-dog while he enjoys the South Pole sun.

Stewart is studying radio noise bursts from the Sun and the planet Jupiter for the Boulder, Colorado, Laboratories of the U.S. National Bureau of Standards. Data gathered by Stewart will be used to solve problems in space communications, both for earth satellites in orbit and from space to ground. He also is investigating unusual radio noises that travel along paths of the earth's magnetic field from pole to pole.

Stewart reports on his project weekly by radio to the U.S. Naval base at McMurdo Sound (near Australia), 1500 miles away. The message is relayed to Washington, and Washington re-types it and sends it to his parents. Any personal messages to the family are tacked on the tail of the official report.

The Winter Is Summer

At the Antarctic, the worst two months of the winter season are July and August, and after that there is the Antarctic spring and summer when you can stick your noise outdoors without regretting it.

Stewart sets up equipment and antenna pole for sound studies at the sunny Antarctica. He reports that he hears baseball games on a short-wave radio. This picture was taken in March, 1961, a late autumn day at the South Pole. The height of the winter is August, but the snow is always there.

According to J. H. Foote, former AIEE President who has kept in touch with Gillmore by correspondence and by newspaper clippings from his hometown, "When the wind is clocked at 200 miles per hour, Stewart usually stays in the underground shelter with the other scientific personnel."

At the base his home has been a small room with a trap door through which he descends via a ladder. He lived here during the winter while all of the equipment was covered with snow. Stewart and 7,700 pounds of scientific equipment were flown by the U.S. Government to Johannesburg, South Africa, in a plane whose interior had to be altered to accommodate the rigging. From Johannesburg he was escorted by an American Embassy representative to Capetown. These arrangements were made at the direction of the then Secretary of State Christian Herter.

The Russian ice breaker, the Ob, picked him up at Capetown on November 20, 1960, and it was well into January, 1961, before the ship finally arrived at Mirny. The Russians were eager to learn English, and therefore Gillmore packed several grammar books and set out to teach English and study Russian. Also, an old piano was taken off the Ob, and left at the base. Stewart has been playing ever since, with the result that the Russians are becoming fond of American jazz. He has the only stereophonic set at the base and it is very popular with the Russian scientists. Pictures from the U.S. also fascinate the Russians, especially those of his family and friends in typical home surroundings.

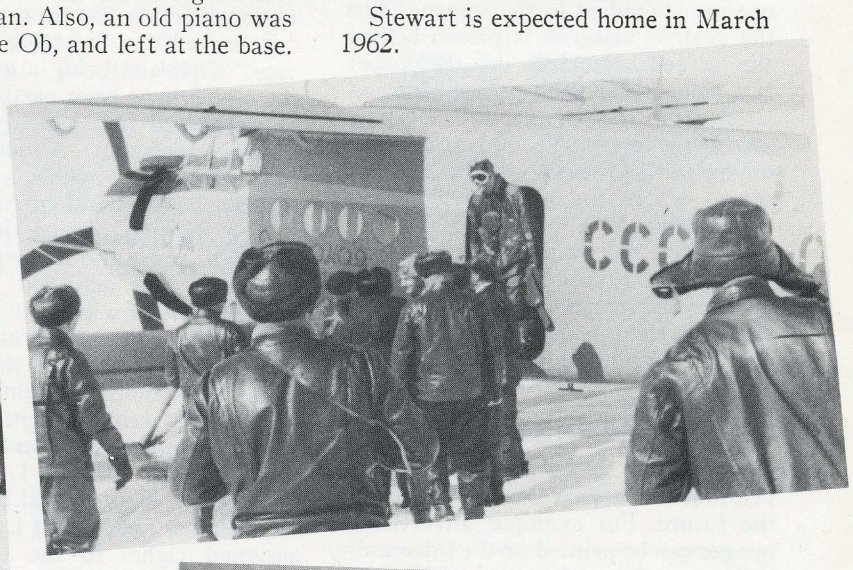
Penguin Egg Omelet

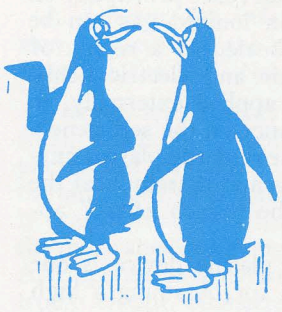
Back home, Mrs. Gillmore surmised that her son does not have as good food as he was accustomed to at home. He wrote that he made an omelet from a penguin egg, but she recalls he never liked omelet since he found they made them of powdered eggs at a Boy Scout camp. Later, Stewart himself noted that the food disappointed him. Too much fish, bread, potato, mutton, particularly "cold fish". He writes that he lives for the once a month dietary treat: fried potatoes and ham. They have a rare bath schedule which stems from a water shortage — it takes valuable fuel oil to melt ice and snow. Clean sheets, pillow cases and towels are issued once a month.

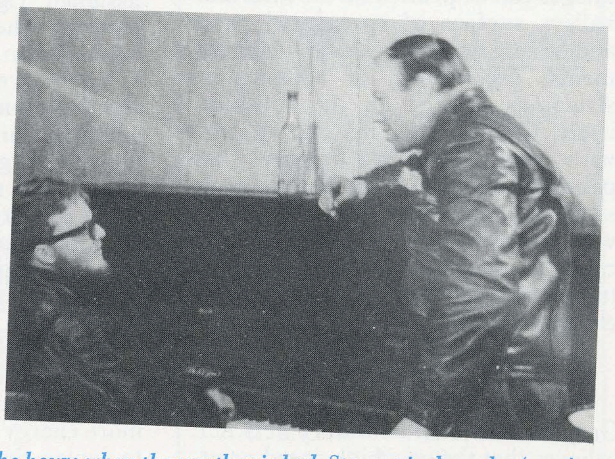
Stewart's first assignment at the base was helping to unload oil barrels from the ship. He writes the Russians put him on the barrel detail, and this is the reason the first things he learned in Russian were "Look out," or "Watch your toes."

The Dr. Stewart Gillmore family in Kansas City, in October, shipped the second 125 pound Christmas package to Stewart Jr. It is scheduled to arrive in Jan. 1962. The package consists of food, clothing, some costume jewelry and a quantity of corn cob pipes which have made a hit among Russians.

Stewart is expected home in March 1962.







Sessions at the piano help fill the hours when the weather is bad. Stewart is the only American at the 150-man Russian base. The Russians are very fond of American jazz, and Stewart plays the piano often. He also took along his cornet and flute. He has the only stereophonic set on the base, which he reports is very popular with the Russian scientists and engineers.

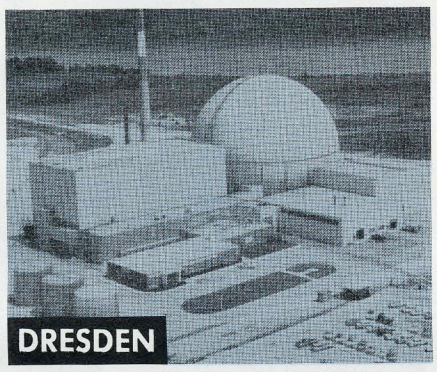
NUCLEAR POWER
PROGRESS REPORT
Experiences With the First Power Projects

Eight nuclear reactors are now producing electric power or are in the final stages of construction or testing.

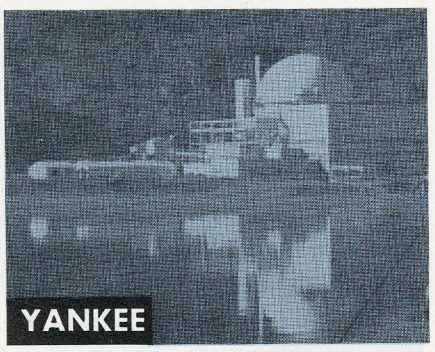
According to a report in Electric Light & Power, "Within the coming year, the electric power industry will have underway large-scale demonstrations of all the basic reactor designs considered to have prospects of producing power from nuclear fuel at a cost competitive with fossil-fueled plants."

In 1962 more and more engineers will be learning for the first time how to cope with radioactivity — as it affects materials & processes, in unusual safeguards, in remote handling, in disposing of its waste products.

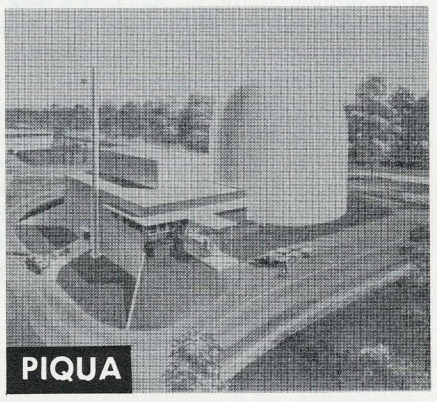
Here is a digest of activities at the different projects.



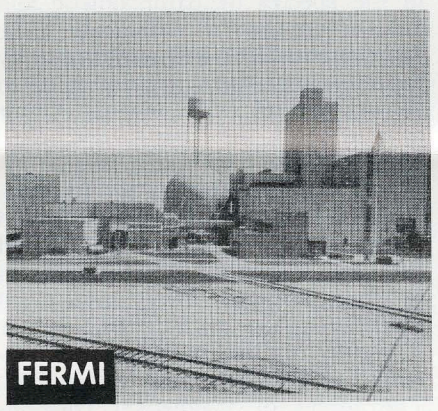
Dresden Nuclear Plant, Chicago, Ill. The Dresden reactor is the nation's first full-scale atomic plant. Dresden generated about 600-million kwh hours of electricity through 4,150 hours of operation, from May through August of 1961 with no serious trouble. The reactor's operation is very simple, and its turbine contamination has been far lower then estimated. The manpower requirements are less than originally planned, and some further reduction may be possible. The Dresden plant has been using prototype zircaloy-2 fuel in its Vallecitos Boiling Water Reactor. It will be refueled in the middle of 1962.



Yankee Plant, of the Yankee Atomic Electric Co., Rowe, Mass., New England's first atomic power plant, is now producing electricity for the region's integrated power system. The Yankee Plant has a pressurized water reactor which went critical in Aug., 1960, and electricity was first produced by the plant in Nov., 1960. The reactor did not give any trouble but there have been serious problems with valves, flanged closures, and turbines. Within the containment sphere the radiation levels are negligible. The plant's management sees opportunities for lowering overall power costs which may eventually compare favorably with fossil fuel-fired power costs in New England.



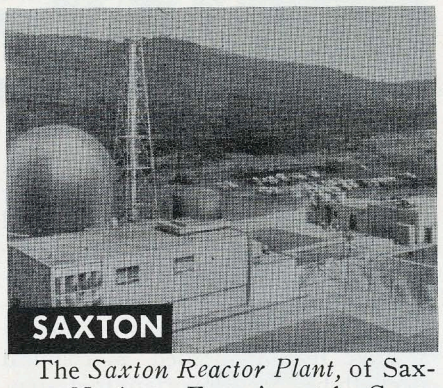
The Piqua Nuclear Power Facility, at Piqua, Ohio, will be the first central station nuclear power plant cooled and moderated by organic liquid, terphenyl. This organic coolant is noncorrosive, has a low volatility, and is not difficult to contain in piping systems. The reactor contains 13 control rods which are of the unitized type wherein the absorber elements and drive are located in a compact assembly. The entire unit is located within the reactor vessel, completely submerged in coolant.



The Enrico Fermi Atomic Power Plant, near Monroe, Mich., now is in the pre-operating phase. In a non-nuclear test program, the Fermi plant was operated for more than 2,500 hours carrying the temperatures up to 1000° F. An unexpected problem developed at that temperature, namely that substantial portions of carbon dioxide gas baked out of the canned graphite and escaped through vents into the argon cover gas. The plant will use uranium-molybdenum fuel pins. Operators said that much has been learned during the test period which will permit further advances for development of power reactors.

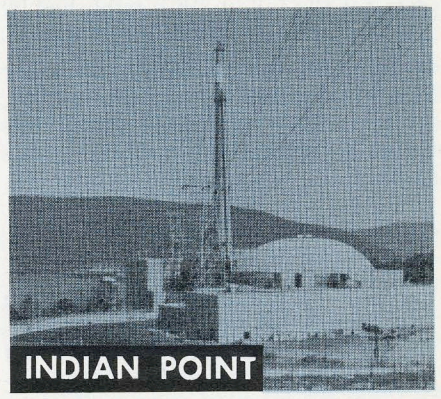
The Hallam Nuclear Power Reactor, at Hallam, Neb., is almost complete and full power operation will begin in Sept., 1962. The sodium graphite nuclear reactor was designed for operation at high temperatures, and pressures with sodium-cooled systems.

Slightly enriched uranium alloyed with molybdenum provides the initial fuel loading. The heat transfer sodium, which becomes radioactive as it is heated in the reactor core, is pumped through three separate primary loops. Each loop has a heat exchanger in which the heat is transferred from the radioactive primary sodium loop to a non-radioactive secondary sodium loop.

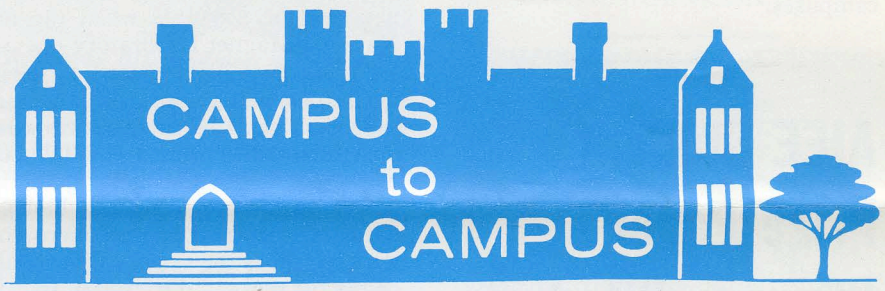


The *Saxton Reactor Plant,* of Saxton Nuclear Experimental Corp., Penn., is approaching startup for an operational type test program. The reactor received fuel for its first core loading last November. Saxton is a small pressurized water type reactor, and it is intended to carry out a five-year experimental program. Designers of the Saxton plant tried to avoid six major points of potential accidents or failures. These are: uncontrolled rod withdrawal during startup or at power; uncontrolled heat extraction; cold water introduction; loss of chemical neutron absorber; zenon burnout; and loss of coolant due to a pipe rupture. Loading and testing will take place during the first half of 1962.

The Elk River Nuclear Plant is owned by the Rural Co-op Power Association. The plant is 30 miles north of Minneapolis. The Elk River Plant was started up in late 1961. The reactor is an indirect cycle natural circulation boiling water type. It will operate at a thermal power of 58,200 kw, supplemented by a conventional 14,000 kw coal-fired superheater. Estimated power output of this plant will be 22,000 kw on an equilibrium core, and the cost of operation will be approximately 10.01 mills/kwh. This is the only plant known which can be refueled in as little as four hours.



Indian Point reactor, 24 miles north of New York City on the Hudson River, is owned by the Consolidated Edison Co. The Indian Point is a pressurized water type reactor, and is expected to go critical very early in 1962. This is the only reactor which can be adjusted either automatically or manually for changes in steam pressure. A minimum of 10½ feet of water protects personnel from radiation at the time of fuel handling. The plant has extensive equipment for removing radioactive materials from liquid and gaseous wastes.



The Daniel & Florence Guggenheim Foundation is seeking the leading young scientists and engineers in the United States and Canada, and will award 18 D.&F. Guggenheim Fellowships for graduate study in rockets, jet propulsion, space flight and flight structure.

A new electronic memory unit with a recall 5,000 times faster than the human brain is being built by the Radio Corporation of America for a **University of Illinois** computer.

The Electrical Engineering Dept. of **Merrimack College,** will establish a laboratory for precise measurement techniques associated with basic nuclear radiation.

The Engineer's Council for Professional Development, has fully accredited five engineering degree programs at **Arizona State University.**

A nuclear physics facility for basic studies of the atom and its particles as well as for teaching advanced engineering and science students will soon be erected at **Ohio State University.**

An electronic "ear" built and tested by **University of Arizona** engineers has been termed a mechanical match of human ears. The analog, which "hears" but does not "comprehend", listens through an ordinary microphone. The sounds it hears can be seen, or photographed, on a cathode ray tube screen. The lines, broken down by low and high frequency, are sampled 40 times per second. They plan to evaluate basic psycho-physical phenomena present in audition.

University of Wisconsin's station WHA-TV has become the nation's first educational broadcaster to install a "compact" television tape recorder in a mobile unit, enabling the station to program on-the-scene tape recordings of demonstrations, laboratory experiments and public events.

The **University of Notre Dame's** College of Engineering will expand and improve through a $1,000,000 grant from the Alfred P. Sloan Foundation.

Cornell University's College of Engineering announces new opportunities for Doctoral Study in Engineering. This new program, which will be financed in part by a grant from the Ford Foundation, will provide assistance for graduate students for the period of their Doctoral Study.

The National Science Foundation will support the construction of a cyclotron in the Department of Physics and Astronomy at the **Michigan State University.**

The vast laboratories of the **Oak Ridge Institute of Nuclear Studies,** can be utilized by graduate students who have successfully completed their course work, and lack only their thesis.

The **Colorado School of Mines** has a 40-acre seismograph station near Bergen Park, Colo. The seismometers record all shifts in the earth's structure, magnifying each movement up to 400,000 times.

Polytechnic Institute of Brooklyn expended $3,936,400 on academic research chiefly in the electrical engineering department.

A speedy computer system, an IBM 7090, has gone into operation at **New York University's** Courant Institute of Mathematical Sciences.

Women On College Campuses Increasing

The long-standing male predominance (in numbers that is) on the American college campus is being threatened, according to enrollment data for the fall of 1961, published by the United States Office of Education.

Men, who accounted for 68.3 per cent of all college enrollments in 1950, made up only 62.2 per cent of this year's record student body of 3,891,000.

More in the Future

The end of World War II and passage of the G.I. Bill brought up the enrollments, but primarily among men. In 1947, for example, 35.9 per cent of all males in the eighteen-to-twenty-one category were on campus, but the ratio for females had inched up to only 14.6 in 100. The male-to-female ratio jumped to 2.5 to 1.

But now, women's enrollments are beginning to regain their former place in the collegiate scheme of things. Last year, 46.3 per cent of males in the eighteen-to-twenty-one age group were in college, but the ratio for females had jumped to 27.8 in 100. The male-to-female ratio dropped to 1.7 to 1.

Theoretically, since women outnumber men in the eighteen-to-twenty-one age group, they conceivably could some day outnumber them on the campuses.

AIEE Student Prize Paper Winners Cited

The AIEE Prize Awards Committee has voted to award three Institute prizes in the Student Paper classification.

The first prize went to William J. Wilson, of the University of Washington, Seattle, Wash., for his paper, entitled, "A Statistical Analysis of a Random Signal." He won $100 and a certificate.

The second prize went to Richard F. Overmyer, of California State Polytechnic Inst. He will receive a certificate for his paper entitled: "Analysis and Synthesis of a Sampled-Data Model of a Human Operator."

The Committee found two second place papers, thus the other second prize will be presented to Dean R. Harrison, of University of Utah, for his paper, "Initial Acceleration and Detection of Charged Micro-Sized Particles." He will also receive a certificate.

The Award presentations will be made at the General Session at the Winter General Meeting, and invitations will be sent to the students to be the guests of the Institute at the Medalists' Luncheon preceding the General Session, scheduled for Monday, January 29th, 1962.

Join Your AIEE STUDENT BRANCH

MAGNETS

(Continued from page 1 column 3)

for about twenty-five years. The heart of the problem of making stronger magnets with more rigorous control for exacting new experiments is putting very large currents through relatively small coils. For most experiments with magnets, a space of about a cubic inch is needed. Mechanical strength becomes important in designing high power magnets. A strong magnetic field represents a concentration of energy in space which requires considerable mechanical strength to hold it together, as for example, the constructions to hold the core laminations of power transformers. Just as two like magnetic fields repel each other, so does any one field tend to tear apart its paramagnetic container. For 200,000 gauss, the mechanical forces are about 30,000 pounds per square inch or about the mechanical strength of hardened copper. The forces vary with the square of the field so they would be four times as great for 400,000 gauss. New structural techniques are being tested and new ways to cool coils are being explored.

In addition to stronger magnets, Dr. Bitter declared, we now need high precision magnets with strong fields to push magnetic resonance work from the present range of ten to twenty kilogauss into the one hundred to two hundred kilogauss range. These magnets will be available when the new National Magnet Laboratory opens.

"I am looking forward to seeing what they will reveal with the same eagerness that an astronomer would look forward to using a new telescope with ten times the light gathering power of his old one, or a biologist with the prospects of a new microscope with ten times the previously available resolving power," Dr. Bitter told his colleagues.

Several groups in recent months have made superconducting magnets that use special alloys operating at a few degrees above zero Kelvin. Mixtures of niobium and tin and niobium and zirconium have been used to attain for short periods of time magnetic fields of a few tens of thousands of gauss. A bright future is seen for these so-called superconducting magnets.

Dr. Bitter reported that he believes fields of well beyond a half million gauss will be achieved with a combination of all known techniques — superconductivity, long pulses of current, and water cooled coils. By contrast, the middle of atoms have fields on the order of a few million gauss.

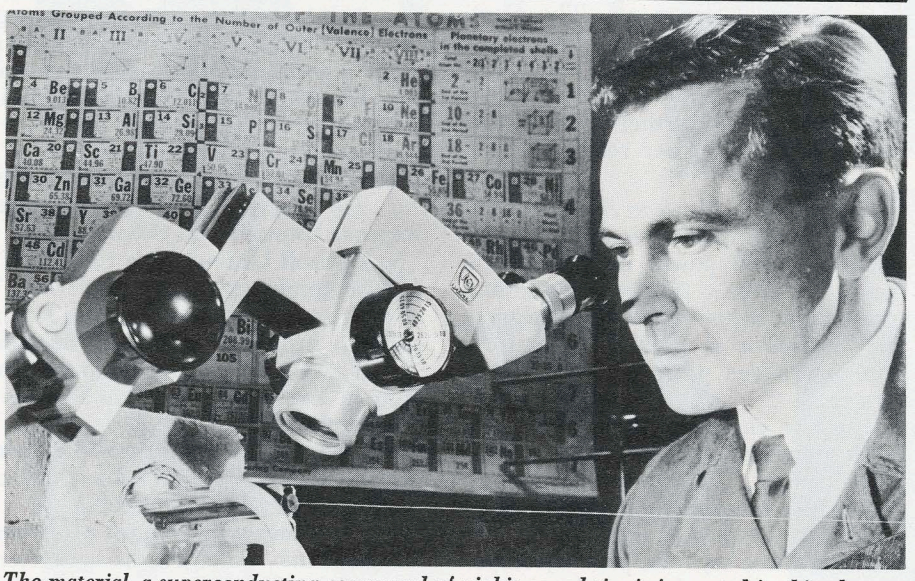
The basic scientific concept of a super-strength research magnet excites physicists, spokesmen for the MIT group have reported. Electrons, for example, in the presence of a magnetic field behave differently in solids than they do in ionized gases. Electrons circle in a magnetic field at a frequency which increases with the strength of the field. However, this frequency is higher in a solid than it is for the same electron in a gas. And the frequency changes if the direction of the applied magnetic field is changed relative to the crystalline axes of the solid.

By measuring these frequencies, using microwaves and infrared radiation, scientists are able to unlock the complexities of electrical and magnetic properties hidden with a large variety of materials. This is one type of research that can be done with the facilities in the National Magnet Laboratory.

The Zeeman Effect

Other research programs include solid state studies. A primary purpose is to explain the electronic band structure of such semi-conductors as germanium and indium antimonide. The Zeeman effect (the change in the spectrum of a beam of light produced by a strong magnetic field) is being studied in the spectra of paramagnetic and antiferromagnetic materials. The Mössbauer effect is being used to study the internal magnetic fields of atoms in various crystal arrangements. Other solid state physics studies and allied projects in very high field magnet research and development are planned.

The forces of magnetism are found everywhere — between atoms and particles, within the solar system and in space. Magnetic forces govern and can help explain much of the behavior of matter, but the real nature of magnetic forces is not fully understood. The forces of magnetism (demonstrated by the lodestone which has been known for centuries) were merged with electrical forces over a century ago to become the study of electromagnetism. A major part of contemporary engineering is based on an understanding of electromagnetism. It now appears that magnetism itself, as well as the effects it has on other substances, will become better known in the future.



The material, a superconducting compound of niobium and tin, is inspected in this photo as it emerges from the laboratory production machine in form of a crystal coating on fine wire to be wound into magnet. Engineers of RCA Laboratories have developed a mass-production technique that opens the way to widespread practical use of simple super magnets that require no power and produce enormous magnetic fields for nuclear research machines and ultrasensitive receivers used in radar and space communications.

Ultra Thin Strips Bring Nanosecond

(Continued from page 1, column 4)

Sperry Rand Corp.'s Remington Rand division already is building a commercial computer containing a thin film memory as part of its overall memory core. Remington Rand expects to deliver the first computer, called the Univac 1107, in April, 1962.

Scientists at Stanford Research Institute in Menlo Park, Calif., are developing thin film vacuum tubes costing only a few cents apiece, or less than one-hundredth of the price of a conventional tube, in which the sapphire was chosen as the insulating slab since it is able to resist the high temperatures found in missile and space applications. Scientists expect thin films to win wide acceptance in these applications not only because of their heat resistance but also because of their light weight and small size.

Three times brighter than the sun is General Electric's powerful 5000-watt xenon arc lamp. Intended for use in searchlight and projection equipment, its first application will be in a solar simulator for space vehicle investigations. The lamp produces 275,000 lumens.

Treasure Hunt With Electrical Device

The golden tombs of Lydia — land of fabled King Croesus, reputedly the richest of all men — may be uncovered next year with the help of geophysicists.

Equipment for measuring the electrical resistance in the soil is now being improved to help tell archaeologists where to dig and how deep. This could make it possible to find directly the tunnels that lead to small untouched burial chambers without digging out the entire mounds.

It was reported that Dr. David Greenewalt, of MIT, had found the electrical resistance of the surveyed area varies when objects buried in the ground are of different consistency than the surrounding soil. For example, a stone monument could be detected if buried in soil and sand. A mud-brick wall from an ancient building, however, would not show any appreciable difference from the surround soil because it would have about the same electrical conductivity.

He also found that the soil has to be fairly uniform to get good results. If areas of gravel or stone are mixed in the soil, the equipment will register a "noise" similar to interference on television.

HOW A RECRUITER SEES STUDENT INTERVIEWEES

Employment Offers Are Made to The Students . . . Not to the Company

By:
GEORGE F. GARVEY
AIEE Membership Committee and
Regional Representative
Educational Department
Westinghouse Electric Corp.

Interviewing a senior at an engineering college in New England last year, I asked the question, "What do you do outside of class?" The student was not married, and his application showed no extra-curricular activities or part time job which might offset his very poor grades. I expected the doubtful answer that the man had to spend all his waking hours with his books. His reply was, "Look, I'm twenty-five years old . . . I've got my own extra-curricular activities."

At another eastern school, I asked a senior the unfair question, "What do you think you would like to do?" His reply was, "What do you have in mind?"

When the recruiter returns home for the weekend to renew his acquaintance with his wife and family, pick up another weeks supply of clean shirts and arrange his airline reservations for the next week . . . interviews like those can add cheer to the late Friday night conversation.

Serious Activity

Recruiting has its light moments for both the recruiter and the student . . . but it is a deadly serious activity. The student must make one of the most important decisions of his life: where does he start his forty-year career. The recruiter's decision is equally important because each man hired represents a potential average investment of over a half-million dollars in salary alone.

By now, many of this year's senior class have become experienced at "being interviewed." The hundreds of companies actively recruiting on campus began their campaigns over a month ago. It is unfortunate, but very natural, that the student's attitude changes after several interviews. With a calendar, the professional recruiter can tell the current month merely by the self-assurance shown by the man he is interviewing. "Let's see what this company has to offer," is commonly heard among groups standing before the placement office bulletin board. At this time of year, it's rare to hear a student say, "I've studied this company, and I sure hope they have an opening for me."

Right now, therefore, is probably a good time to take a fresh look at the on-campus employment interview.

Be Yourself

How should the student act in the interview? He shouldn't. He should merely be himself. There are some lightweights in the business, but most recruiters are trying to do a good, honest job of evaluating the student's potential in the light of openings which exist in the companies they represent. The candidate should do all he can to help the interviewer know enough about him to form an opinion.

The recruiter needs to know some personal things like attitudes on relocation and traveling, marital status, goals and ambitions. Most of these things are on the application, but more detail is frequently necessary for a better understanding of the person's adaptability to the demands of specific job openings.

Grade point average is a factor, because it is a measure of a man's performance in the only thing he has really done to this point. It is an incomplete measure, however, because performance in an academic atmosphere is not an indication of performance in the completely different industrial environment. The recruiter will want to know more about the student's interests and performance in specific curricula areas, to relate this to his expressed job interest.

Summer Work Experience

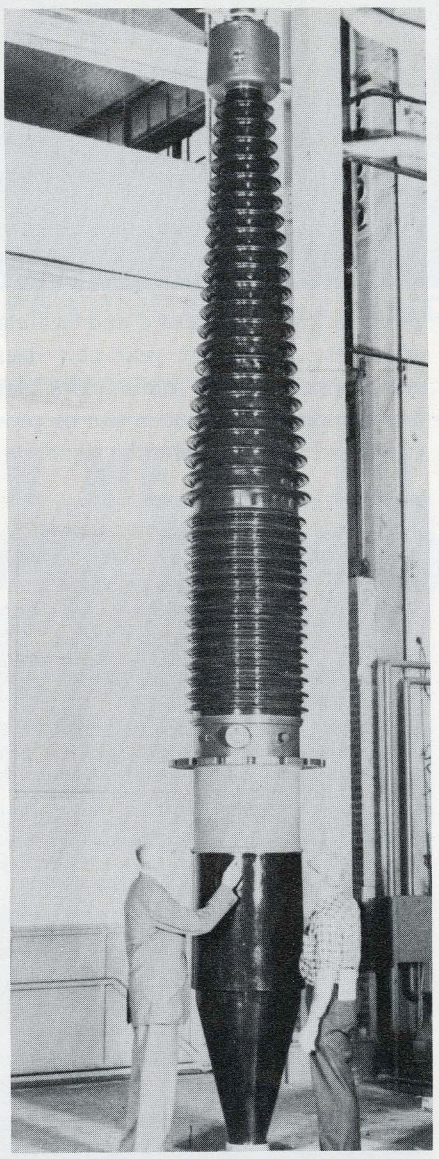
If the candidate has had summer or part time work experience, the interviewer will probably bring this into the conversation. He will do this mainly to see how clearly the student understands the requirements of the position for which he has applied.

During the interview, the recruiter is forming his estimate of the applicant's manner, appearance, expression, breadth, motivation and ability. Students, honestly interested in obtaining employment, follow the interviewer's lead and give him everything he needs to shape the basis for his judgment.

Preparation is Important

Toward the end of the interview, the recruiter usually asks for questions. As we move deeper into the recruiter season, it is this part of the interview that begins to fall apart. Here, the recruiter is offering to clear up points about the company or the job which may be hazy in published literature available in the Placement Office. Questions like, "What does your company do?" or "Does your company have a training program?" indicate a complete lack of preparation . . . and sometimes interest, on the part of the student.

Most recruiters have interviewed thousands of graduating seniors. It isn't difficult to separate those candidates who are "interviewing companies" from those who want consideration as half-million dollar investments. It is important, at this time of year, to emphasize a very basic truth: employment offers are made to the student, not to the company. The student who remembers this while being interviewed has a definite advantage.



This 1800-kv BIL condenser bushing which weighs 6850 pounds and is 23½ feet high was built for use on transformers with high-voltage rating up to 750,000 volts. The bushing brings the high voltage through the transformer cover and connects the transformer windings to the high voltage lines.

New Manpower Inventory Program Launched

A new program, Employer's Inventory of Critical Manpower, developed by the Engineering and Scientific Manpower Commission, is designed to provide a method by which an employer may analyze his own manpower situation in light of the latest Selective Service and Military Reserve Regulations.

The program is to provide information from the company to the State Director of Selective Service which will be available in the event of national emergency in order that withdrawal of personnel from industry may be accomplished with minimum disruption.

The Inventory contains forms and instructions through which employers can make a quick analysis of the probable liability of their male employees, especially those having critical occupations, for military service in the event of a national emergency and mobilization.

According to the Chairman of EMC, present safeguards are inadequate to prevent the wholesale withdrawal of engineering and scientific manpower from industry in a national emergency.

During past national emergencies, the U.S. has not had an optimum utilization of skilled manpower. Since 1953 vast technological strides have made it increasingly important that the country should avoid unnecessary and sudden disruption of engineering and scientific personnel. Adequate manpower planning can only be accomplished before the onset of crisis conditions, resulting from national emergency, the Commission feels.

Elevators Extraordinary

Four of the world's most powerful elevators are ready to speed airplanes to the flight deck of the USS Enterprise, Navy's first nuclear-powered carrier.

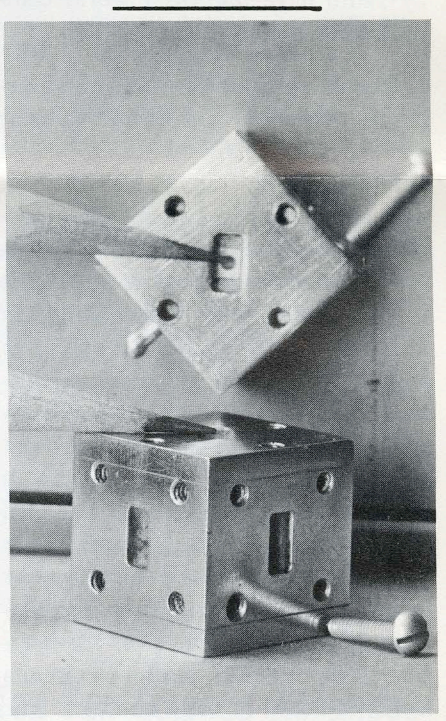
Capable of delivering aircraft from hangar to flight deck at a rate of one every minute, each of these elevators will carry an 82,000-pound plane, its crew, and towing gear — a total of 91,000 pounds.

The cars are equipped with aluminum lifting platforms that weight approximately 265,000 pounds and cover an area of about 3,880 square feet. Three of the elevators are located to starboard of the ship, and one to port.

Designed and built for the Navy by the Westinghouse Electric Corp., the elevators have a new valve control system which operates them as smoothly as passenger cars in an office building.

A 60-foot long hydraulic engine with a horizontally-positioned plunger more than three feet in diameter and over 18 feet in length moves the suspension cables of the elevator up and down through a pulley arrangement.

A fire-resistant, hydraulic fluid supplied by pressure tanks develops a force on the plunger of 1,300,000 pounds. The pressure is maintained in these tanks by four hydraulic pumps which in turn are driven by four 225-horsepower electric motors.



A new dual-mode transmission-type discriminator cavity shown above has been developed as a rugged, frequency stabilizing device for such applications as parametic amplifier pumps, navigation systems, and beacon radars requiring a highly stable frequency source. A cavity already in production—the WX 4334—is designed to operate at 35,000 megacycles but designs for other fixed frequencies are available. To minimize the influence of change in ambient temperature on frequency drift, the cavity is vacuum sealed and employs Invar construction. A change in resonant frequency of plus or minus 8 megacycles is typical for a temperature change of 25 to 100 degrees centigrade.

Typical operating characteristics include an ambient temperature range of minus 55 to plus 100 degrees C, a loaded Q for each output of 3000, and a frequency difference between outputs of 10 megacycles. Insertion loss input to each output is ten decibels maximum, and insertion loss difference between outputs is one decibel maximum. Mechanically, the cavity is a cube measuring 0.900 inches on each side and weighing 3.1 ounces. It can be mounted in any position using an RG-96U wave-guide wtih UG599/6 cover flanges. It will function properly under extreme conditions of shock and vibration and at high altitudes or in a pressurized wave-guide system. It has been developed by Westinghouse.

RADIO COMMUNICATION SYSTEMS

L. G. ABRAHAM

(This discussion with bibliography is the sixth of a series.)

Radio is becoming an increasingly important part of all communications. Where one or both ends of a communication link is mobile, radio is the only possible solution but even for fixed point to point communications, radio is so economical and well adapted that its growth has been phenomenal.

Radio might be said to have started with Maxwell's equations, confirmed and demonstrated by Hertz' experiments. Many early pioneers such as Marconi helped push radio into the beginnings of commercial use.

Starting in the 1920s, broadcasting sound programs grew tremendously and in the last 15 years television has grown even more. The engineering activity in the radio and television broadcasting area is so extensive that a separate AIEE technical committee now exists in that field.

Overseas telegraphy and telephony by radio have improved world communications tremendously.

Mobile radio to cars, boats and airplanes has been extremely valuable and the defense forces would be lost without mobile radio. Navigational aids and guidance systems of a precision otherwise impossible are commonplace today. Radar provides greater safety and dependability in military and civilian aircraft operation and in forecasting weather, particularly hurricanes. But the most astounding commercial use has been for point to point radio relay systems which in the last 10 years have been installed for long haul circuits in much larger quantities than have wire circuits. For certain specialized conditions, particularly in the far North, over-the-horizon (tropospheric scatter) circuits have been used in large numbers. For small numbers of circuits over distances up to 1000 miles, ionospheric scatter can be used.

The future of radio is even brighter. Radio astronomy is reaching out for secrets of the universe that seemed indeterminable a short time ago. The use of waveguides as a long distance transmission medium promises unlimited communication through little radio universes immune from weather effects and other interferences. Satellite communications around the world and other aspects of space communication are being studied and demonstrated in a tremendous way with every expectation of both military and civilian application on a large scale in the near future. Information about the upper atmosphere and space itself is being accumulated at a great rate by means of radio. Medical applications promise great diagnostic and healing advances. And every year new uses and applications of radio principles and equipment are put in use or proposed such as personal radio signaling.

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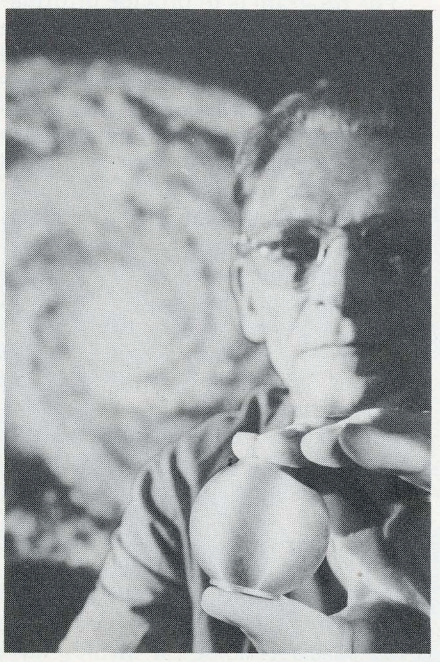

Worth 30 times its weight in gold, this GE metal sphere will become part of a super-accurate guidance system as a new-type of gyroscope, which could help future astronauts find their way around the universe. It will be suspended and rotated in a vacuum at temperatures near 460 degrees below zero F.

Development model of a communication satellite is readied for transmission experiments in a specially constructed test chamber. The chamber is simulating the radio environment of space. The satellite, intended for experiments in relaying of telephone calls, television and other communications overseas, is scheduled for launching next spring. The sphere is covered with arrays of solar cells, covered with strips of man-made sapphire for protection against radiation. Microwave radio receiving and transmitting antennas are in the mid section. In the chamber Bell Telephone Laboratories' engineers prepare to take measurements of antenna characteristics.

Gas Protects Gas

A thermoelectric generator has been put into service to protect a mile-deep Texas gas well.

The generator, installed in a remote region of the San Juan Basin, Farmington, N. Mexico, supplies the electric power needed to prevent self-corrosion of the well's steel casing.

The technique, known as cathodic protection, keeps the casing from being eaten away through an electrochemical reaction that attacks metal objects buried in the ground in certain localities.

The thermoelectric generator, which was developed by Westinghouse Electric Corporation, taps a small amount of the gas coming from the well, burns it, and converts the heat directly into electricity that safeguards the well.

The generator is connected between the 5,000-foot gas well casing and a ground bed consisting of silicon cast iron anodes packed vertically in a hole 200 feet deep. It reverses the normal flow of current set up by the casing as it chemically reacts with the soil. Thus, the easily replaceable ground bed is slowly eaten away instead of the casing itself.

Protection of the well casing is accomplished with about six amperes of current at eight volts DC. This power is generated by raising the temperature of the hot side of the generator to 800 degrees Fahrenheit. The cool side of the unit operates at 200 degrees F., higher than the boiling point of water at the 6100 foot elevation at which the generator operates.

Science Advancements

(Continued from page 1, col. 4)

the method of relighting solid rocket fuels were rated 6th and 7th in importance.

Place eight, nine and ten were respectively the process of strontium-90 removal from milk, the inexpensive freezing method of converting salt to fresh water using butane gas as refrigerant, and finding the age of a man like creature, Zinjantropus, dated atomatically at about 1,750,000 years.

Army Offers Commissions

Are you an engineer, chemist, or bacteriologist? College graduates with degrees in some 140 technical specialties, may apply for a direct appointment in the Regular Army if they meet the eligibility requirements outlined in the Army Regulation 601-100, Section VI.

The Regular Army commissions are open to all qualified persons under this program. An individual who is not presently a member of the Army, if appointed to the Regular Army under the provisions of the program, will attend a special course of training in military knowledge at one of the combat arms schools.

Soon after completion of this training the individual will attend a basic course of the branch in which he is appointed or detailed.

Interested persons may contact the Professor of Military Science at the nearest college, their nearest Recruiting Station, nearest Reserve Center or the Adjutant General Section, Officer Branch, First U.S. Army, Governors Island, New York 4, N. Y.

German Overwhelming Language Choice

Foreign language proficiency is good among U.S. scientists, according to a report in the Scientific Manpower Bulletin.

The report was based on 116,553 returns. It shows that almost 90 per cent of the registered scientists have some knowledge of a foreign language.

German was the overwhelming choice for 45 per cent of the U.S. scientists, while French and Spanish were placed second. Only two per cent know Russian, and less than one per cent indicated knowledge of Japanese or Chinese.