Disclaimer: Archived issues of the Rose-Hulman yearbook, which were compiled by students, may contain stereotyped, insensitive or inappropriate content, such as images, that reflected prejudicial attitudes of their day—attitudes that should not have been acceptable then, and which would be widely condemned by today's standards. Rose-Hulman is presenting the yearbooks as originally published because they are an archival record of a point in time. To remove offensive material now would, in essence, sanitize history by erasing the stereotypes and prejudices from historical record as if they never existed.
THE OBSERVATION OF LUMINESCENCE
FROM THE CRIB TO THE MAIN
THE ATOMIC AGE
Moon shot rehearsal: when the Gemini spacecraft meets its target

Westinghouse radar will guide the astronauts to this meeting in outer space

When the Gemini two-man spacecraft lifts off, a dramatic dress rehearsal for the first moon trip will begin. The astronauts' mission: to maneuver their spacecraft and join it with an Agena rocket already orbiting the earth at more than 17,500 miles per hour.

A new Westinghouse radar system will guide the chase. Locating the target, the spacecraft will send out radar pulses. Computer-translated responses will guide the astronauts until the target is reached. A vital prelude to future space travel, the rendezvous experiment will one day be routine. Meanwhile, Westinghouse is already working on other advanced radar systems for lunar landings, planet exploration, space station support and deep space missions.

You can be sure if it's Westinghouse

For information on a career at Westinghouse, an equal opportunity employer, write L. H. Noggle, Westinghouse Educational Department, Pittsburgh, Pa. 15221.
That's Bill Emrich immersed in his work behind that Lincoln engine. He's testing new oil additive formulations, designed to make new engines produce to their potential. Yet, whatever he develops has to meet the needs of older engine models, too. You might say it's a matter of enginuity.

Bill uses several test engines: among these are a Labeco one-cylinder, a Caterpillar one-cylinder and special Lincoln and Oldsmobile engines. He tests oil additives and formulations for sludge, rust, wear and reaction to high-temperatures under severe operating conditions. His findings will help car owners to get greater mileage between oil changes, longer engine life. A most important project. Yet, Bill is only 24 years old. Just last year, he came to American Oil and is now working for Amoco Chemicals, a sister company. Bill graduated from the University of Illinois with a B.S. degree in mechanical engineering.

The need for young professional people in positions of responsibility and creativity is great. Bill happens to be an automotive engineer, but he still might be working for us had he chosen a different field—mathematics, physics, chemistry. A variety of opportunities exist here at American Oil Company.

For information, write to J. H. Strange, American Oil Company, P.O. Box 431, Whiting, Indiana.

STANDARD OIL DIVISION
AMERICAN OIL COMPANY
Pete Taylor expounds on the phenomenon known as luminescence in his article, "The Observation of Luminescence." He discusses the various kinds of luminescence, their causes, and their properties. See page 8.

The problem of supplying the city of Chicago with water has produced a modern, efficient system for filtration and distribution. John Howlett outlines it in "From the Crib to the Main: Water for Chicago," beginning on page 12.

"The Atomic Age," by Skip Szilagyi, is a review of the development of the first atomic bomb, and a survey of some of the peaceful applications of atomic energy which have come as a result. Turn to page 18.

COVER NOTE

This month's cover is by Howard Alm, a senior in electrical engineering.
The President Comments

The Observation of Luminescence .................................................. Pete Taylor

From the Crib to the Main:
Water for Chicago ........................................................................... John Howlett

The Atomic Age .............................................................................. Skip Szilagyi

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Editorial

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Library Notes

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ROSE POLYTECHNIC INSTITUTE
TERRE HAUTE, INDIANA

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Office of Admissions
ROSE POLYTECHNIC INSTITUTE
TERRE HAUTE, INDIANA
As Rose approaches its centennial, we are entering perhaps the most exciting and undoubtedly the most significant period in the ninety-year history of the Institute. The decision to double our enrollment and to achieve national recognition for excellence in undergraduate education imposes new demands as regards facilities, faculty, curricula and the overall development of the Rose program.

Vigorous steps have been taken by the Board of Managers to make our objectives a reality and a Centennial Committee will shortly be announced to help us develop our plans for the next decade. It has been suggested that the Centennial program be initiated by a Great Convocation with nationally recognized participants to be held on the campus during Parents Day, April 30 and May 1.

There has perhaps never been a time in the history of the United States when a new kind of education in science and engineering was so vitally necessary. Rose can and must play a leadership role in providing this new kind of education and this will be developed as a central theme of the centennial program.

The cooperation, assistance and good will of the student body, administration, staff and faculty in assuring the success of our program will be urgently needed.
Commenting on the recent sit-in demonstration at the Berkeley campus of the University of California, a news commentator contrasted student political activities of today with the goldfish-swallowing of our fathers' college days. In examining the issues surrounding the Berkeley fracas, one might conclude that those students at Berkeley would be well-advised to try goldfish. Few people have been harmed by swallowing a goldfish. Almost certainly no one has acquired a police record from such a deed. And, although it may, in itself, be a rather silly thing to do, goldfish-swallowing offers little danger to the bulwarks of law and order or to student discipline on campuses across the nation.

By allowing themselves to become involved in such activities as the Berkeley demonstration, hundreds of students who in all likelihood know very little about the issues at stake, but instead have fallen in with demagogic orators and professional agitators, have now acquired a police record and a label reading “troublemaker.”

The issue at Berkeley nominally centers around something called the Free Speech Movement. (Four members of the F.S.M.’s executive board have reportedly described themselves as “revolutionary socialists.”) The Free Speech Movement seeks to change the University’s policy toward political activities so that students may not be disciplined by the University for any off-campus political activities, legal or illegal.

The real issue, though, is this question: Who runs the University of California—the students or the faculty and administration? University President Clark Kerr has taken the stand that the faculty and administration shall determine policy, and not the students. For this stand he is to be commended. The faculty, on the other hand, voted overwhelmingly to yield to the pressure of the students. This is regrettable, for they may well have voted to turn the campus over to students more interested in “causes,” real and phoney, than in education or peace and order on the campus.

It would be worthwhile for Rose students and faculty to consider what their reactions would have been if such an incident had happened at, say, Indiana State College. Whose side would you have taken?
INBOARD WITH AN OUTDRIVE. This new Chrysler-Dana Drive 90° offers boating buffs big power in a small space. Dock your boat at home? The outdrive tilts up 55° for easy trailering. Timken® bearings keep the prop and drive shafts rigid as a Marine.

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FORE? NO, THREE. Three wheels for the golfer who’d rather swing than walk. This new Cushman Golfster is a smart way to cover the links. Eight Timken bearings were chosen for the drive, axle and wheel applications. They’re precision-made and case-hardened to take shock loads. The Timken Roller Bearing Company, Canton, Ohio. Also makers of Fine Alloy Steel and Rock Bits.

Tales about precious stones shining in the dark stretch back into antiquity. They are supposed to have adorned the temples of the Gods and crowns of princes. This might have been the first technical application of luminescent material. The legends and fables of the Near and the Far East are full of such marvelous jewels. From there they return to the fairy tales of medieval Europe. Benvenuto Cellini, a story teller, not only knew many of these tales, but at Ragusa in a merchant’s shop he saw with his own eyes a white sapphire which spread from its interior a sparkle so beautiful and bright that it illuminated a perfectly dark room.

What are the causes of the phenomenon known as luminescence, and what are its properties?

There are hundreds of individual uses for luminescence. Luminescence began to play a rather important part in the technique of scientific research in the last decades of the nineteenth century. Fluorescent screens were used in ultraviolet spectroscopy: cathode rays and canal rays were investigated with their help. Fluorescence of such a screen led to the discovery of x-rays and more indirectly of radioactivity. Cathodoluminescence was the most important method by which Crooks, Bois Baudran, and others succeeded in discovering and ultimately separating the rare earth metals.

It took much longer before any important applications of luminescence were found useful outside of research laboratories of pure science. It is true that as early as 1625 a man called Peter Potterius made little animals from phosphorescent material “which were a very lovely sight at night.” The manufacture of such phosphorescent novelties has become a fast growing industry lately. However, it is also true that at one time it was asserted in an article in “Handbuch der Physik” that fluorescent lamps had no future for illumination. They were considered to be inefficient. This was probably correct for the only type of fluorescent tubes then existing. The ever increasing number of fields in which luminescence is applied to practical purposes is capable of being the principle contents of future books.

Light is a form of energy and energy must be put into a system before it will act as a source of light. Generally, the energy supplied is thermal energy and this causes electrons within molecules to be found in excited states (higher energy levels). The higher the temperature to which the system is raised, the more molecules are found in an excited state and the higher the intensity of light emitted. In some cases, however, light can be produced without increasing the average kinetic energy of the system, i.e., without heating it. This type of light is known as luminescence.

There are two types of luminescence, fluorescence and phosphorescence. Fluorescence is due to the spontaneous transition of an electron in a molecule from an excited state to lower energy level. The time required for this is usually very short (10⁻⁷ seconds) and practically never exceeds one second. Also, fluorescence is practically temperature independent. Phosphorescence, on the other hand, is characterized by an afterglow where the electron does not return immediately to a ground state (E₀) after being excited, but moves to a slightly lower energy level (E₁) where it remains until it again acquires enough energy to return to the excited level (E₂) and then returns to E₀. The energy required to re-excite the electron to
E₂ is obtained from the thermal energy of the surroundings. At very high temperatures, the return time is very short, if the temperature is low enough, the electron may be trapped in E₁ and will remain there until the energy difference (E₂ − E₁ = E) needed is acquired at which time the electron will return to the ground state E₀ (see Figure 1).

A type of luminescence which fits neither of the descriptions of fluorescence or phosphorescence is the situation in which the electron acquires enough energy to completely remove itself from the molecule. Upon rejoining another excited molecule, light is emitted. The time required for this phenomenon is also rather short, usually a fraction of a second. This recombination afterglow type of luminescence is a bimolecular situation, whereas fluorescence and phosphorescence are monomolecular.

The type of energy usually emitted during luminescence and the excitation of electrons in a molecule is light energy. The part of the spectrum which is generally associated with luminescence is the visible and ultraviolet portion, visible light extending from about 7000 Å, the near ultraviolet (UV) from 4000 Å to 3000 Å, the far UV from 3000 to 2000 Å, and the Schumann UV from 2000 Å to 1200 Å. X-rays are sometimes used to cause luminescence and its range is from 100 Å to 0.01 Å.

As far as the method of excitation is concerned, there are only two important types of luminescence: photoluminescence, produced by the absorption of light, and electroluminescence, which is produced by the impacts of electrically charged particles (electrons, alpha-particles, canal or positive ion particles, others). Other types of luminescence are chemiluminescence, bioluminescence, thermoluminescence, tribo-luminescence, crystallo-luminescence, and sonoluminescence, but these are relatively minor types.

In order to excite photoluminescence, light must be absorbed. Since light is absorbed and re-emitted in quanta of energy (hν) (product of Boltzmann’s constant and frequency) according to quantum theory as established by Planck and Einstein, and since no more energy can be emitted by the individual molecule than that it has absorbed, luminescence can have no greater frequency or shorter wavelength than the exciting light. The emitted may be of smaller frequency or greater wavelength if the total amount of absorbed energy is not given out in the emission process. In condensed systems (liquid or solid) this will generally be the rule, since the excited molecules are apt to transfer at least that part of the absorbed energy which is contained in the oscillation of the nuclei to neighboring molecules in the form of heat before the emission of light occurs. A law found empirically by Stokes states that fluorescent light always has a greater wavelength than the exciting light and its corresponding absorption bands. This law was explained by Einstein on the basis of quantum theory. Minor exception to Stokes’ law are possible if at higher temperatures heat energy is transferred from the surrounding molecules to the fluorescent molecule during the time it stays in the excited state.

A substance perfectly transparent to visible light can never be excited to luminescence under the action of visible light only. It can, however, (Continued on Page 26)
Stability

The stability of a body in motion can best be evaluated when interfering forces are severe enough to test its structure or divert it from a pre-established direction. A corporation is a body of people in motion and its stability is measured by planned achievement.

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BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

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In supplying water to a population of about 4,500,000 in Chicago and 61 adjacent suburbs, the Chicago Water System has in operation two of the largest filtration plants in the world. The completion of Chicago's Central District Filtration Plant is but the latest in the many improvements which have been made in the Chicago Water System since its beginning in 1854. The Water System presently consists of four intake cribs, two filtration plants, and eleven pumping stations. In 1963, the Chicago Water System pumped 381,046,000,000 gallons of water to Chicago and the adjacent suburbs.

The early Chicago settlers received their water supply from the Chicago river or from shallow wells. When these two sources became contaminated they had to turn to the lake for their water. This was first provided by water peddlers and eventually in 1842 by a privately owned pumping station. The beginning of the present municipally owned water system came about in 1852 when the city of Chicago took over the franchises of this private company. The original pumping station consisted of a 25 horsepower pump capable of pumping 1.8 mgd (million gallons per day). After the city began operating the water system any new pipe installed was of cast iron rather than being of bored out cedar logs as the previous pipe had been. Because of the growing population the first water commission had to begin the project of enlarging the system. The first project consisted of placing a crib as an offshore intake and installing a pump with an 8-mgd capacity. In succeeding years this shore supply also became contaminated by direct sewer discharges into the lake and from the sewage laden Chicago river flowing into the lake. This led to the construction in 1867 of Chicago's first water tunnel and thus the beginning of the Chicago Water System of today.

The years following the Chicago fire saw the addition of more pumping stations and distribution facilities. In 1889, with the formation of the Chicago Sanitary District a move was made to avoid contamina-
tion of the lake. All sewers leading into Lake Michigan were blocked, the direction of the Chicago River was reversed, and the Chicago Drainage Canal was constructed to carry all sewage treatment plant effluents to the Des Plaines River.

John E. Ericson, city engineer for many years, built a large experimental filtration plant and John R. Baylis, famed water chemist, conducted many experiments there which were the basis for the design of the South District Filtration Plant. The plant was completed in 1945 and was Chicago's first source of completely filtered water.

The most recent additions to the Chicago Water System are the Central District Filtration Plant and the Southwest Pumping Station. The Central District Filtration Plant officially started furnishing filtered water to the central and north water districts on October 29, 1964.

There are essentially three phases the water must pass through in its trip from the intake cribs to Chicago homes. This path may be followed in Figure 1. The first of these phases is the entry of the water at the cribs and its journey to the filtration plants.

The cribs are located two to three miles offshore and in from 32 to 37 feet of water. The cribs consist of two concentric cylinders, filled with stone and concrete, which rest on the bed of the lake. Water enters ports near the bottom, rises and passes through screens (to exclude fish), and flows by gravity down the center shaft to the tunnel approximately 150 feet below the bed of the lake. Early tunnels were constructed in clay, lined with bricks and varied from five to ten feet in diameter. Since 1910 all tunnels have been constructed in rock, lined with concrete, and vary in height from 10 to 20 feet in the inverted "U" design. These tunnels lead to the filter plant intake basin to begin the second phase of the water's journey.

There are two filtration plants in the Chicago Water System: the South District Filtration Plant, completed in 1945, and the Central District Filtration Plant, currently pr-
paring for full time operation. The South District Plant provides a good example of the operation of either plant. Figure 2 shows the flow of the water through this plant. The addition shown in Figure 2, which increases plant capacity by 50 per cent, is currently being completed.

Water enters the filtration plant principally from the tunnel to the crib, but, in case of damage to the tunnel or crib, water can enter the intake basin directly from the lake through shore intake ports. The water is screened prior to entering the suction well at the low lift pumps. These low lift pumps raise the water 20 to 24 feet into an upper and a lower raw water conduit. Next the water passes through a chemical application conduit where the chemicals are added and mixed rapidly.

The more important chemicals added are chlorine, activated carbon, aluminum sulfate, ferrous sulfate, anhydrous ammonia, lime, and fluoride. The chlorine and ammonia are used to kill bacteria. The activated carbon is used to remove tastes and odors. The aluminum sulfate and ferrous sulfate are used in the coagulation of suspended matter, plankton organisms, and bacteria. The lime lessens the corrosiveness of the water to the distribution water mains. Fluoride is added to reduce dental caries in children's teeth.

The water is metered from the chemical application conduits into the three mixing and settling basins. In the mixing basins, the water is gently agitated by slowly revolving paddles. The floors of the settling basins are equipped with scrapers for sludge removal to one side from where it is eventually pumped back into the lake far from the plant. The water leaves the settling basins via a settled water header from where it is conveyed to the filter galleries. After the water goes through the filters it enters the clear water reservoir located under the filter beds. The filters consist of six layers of sand and gravel. They are cleaned on the average of once a day by reversing the direction of the flow through them. The filters consist of six layers of sand and gravel. They are cleaned on the average of once a day by reversing the direction of the flow through them. The filters were originally made by graduating from fine sand on the top of the filter bed to three and one-half inch diameter gravel on the bottom. However, after about 12 years of continuous operation, the layers of sand began to mound because of this daily backwashing operation. After many experiments it was found that by graduating the bottom four layers from largest to smallest and then placing two medium sized layers on top this difficulty could be avoided. A clear water header carries the water from the reservoir located under the filters to the main clear water reservoir from where the water enters the underground tunnels which carry it to the pumping stations.

The pumping station is the last phase in handling the water before it enters the main for distribution. When the water reaches any of the 11 pumping stations, it is pumped under 30 to 50 pounds pressure through the water mains. There are a total of 55 pumps in the 11 stations with a combined daily capacity of 3,030 mgd. Six of the stations use steam power to drive their pumps while the remaining five use electric power. These two sources of power provide reliability of service in case of a failure of one or the other sources. The new Southwest Pumping Station uses pumping equipment of the submerged, vertical-turbine, high-lift type. This is the first station in Chicago to use this type of equipment. There are a total of four pumps in this station. Three of them provide 50 million gallons per day and the other one provides 25 million gallons per day. The 50 mgd pumps are each driven by a 2,250 hp. electric motor. After the water leaves the pumping stations it is delivered to homes and industries through the more than 4000 miles of water mains in the city.

In addition to pumping the water, the Chicago Water System also maintains extensive chemical and bacteriological laboratories to test the water that flows through the Chicago water mains. The Chicago Water System was the first public water system to continuously monitor their water to protect against radioactivity hazards. The labs are also equipped with an electron microscope to speed bacteriological tests.

The Chicago Water System is currently looking to the future with its Capital Improvements Program. Money for this program as well as for all other Water System operations comes entirely from revenue collected from the sale of water. This improvement program runs into the millions of dollars and is based on water demands up to the year 1980.
Just 10 years ago, Max Stanton received his BA in Physics from Indiana University.

Today, Max is a senior project engineer at Delco Radio Division of General Motors Corporation in Kokomo, Indiana.

Max is shown above analyzing gas ambients found in sealed transistor enclosures. The system—a residual gas analyzer—is pumped down to a low vacuum with an absorption tank and vacuum pump. Then a transistor is punctured and the gas introduced into the analyzer. Using mass spectrographic techniques, an analysis of the constituents through mass number 80 can be made. Such analyses are helpful in the study of surface effects in solid state devices.

Max Stanton has established a challenging and satisfying career with Delco—the electronics division of General Motors. As a young graduate engineer, you, too, could soon be on your way to a long-time, rewarding career at Delco.

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Dawn of the Atomic Age came in July, 1945, with a burst of blinding white light from a steel tower in Alamogordo, New Mexico.

The tower vaporized and the sand beneath it fused into glass. Over mountains and mesas thunder rolled and rumbled. A cloud, unlike any ever seen before—mushroom shaped and many colored—boiled upward for over seven miles.

The energy that lights the sun and the stars had been released on Earth. This was the first atomic explosion, the dawn of the Atomic Age.

THE ATOMIC AGE

The Atomic Age had its beginning in the cold winter of 1896. In his Paris laboratory, one of the early pioneers, Henri Becquerel, made a startling discovery. By chance he left a sealed, unexposed photographic film near a piece of uranium ore. Later, he was astonished to find the film had darkened, as if by exposure to light. Studying the film, he concluded that it could have been darkened by an unknown kind of energy, which he later called "radioactivity." Soon afterward, Pierre and Marie Curie discovered that radium was also highly radioactive, but could not explain why.

Then, in 1905, Albert Einstein suggested a radical answer. Radioactivity is matter gradually changing into energy. Despite Einstein's revolutionary suggestion, that matter can be changed into energy, scientists continued to believe that atoms, of which all matter is composed, are indestructible. But in 1909, Rutherford of England, working with rays emitted by radium, disintegrated an atom of nitrogen. His experiment did not show, however, that energy had been released. Einstein's belief was still a theory.

Finally, in 1932, an Englishman, John Cockcroft, proved that the destruction of atoms did in fact release energy. Two years later, Irene and Frederick Joliet Curie found that exposure to radiation also made other substances radioactive. And in America, only eleven years before Alamogordo, E. O. Lawrence invented the first large atom-smashing machine, the Cyclotron.

Then, early in 1939, news came from Berlin that two Germans had split the uranium atom. Shortly before, a woman scientist, Lise Meitner, had fled from Berlin to Denmark to escape Nazi tyranny. It was she, working with another refugee scientist, Otto Frisch, who first proved that the splitting of uranium atoms could release enormous amounts of energy. This new process was labeled "fission." Within days, Neils Bohr of Denmark (Continued on Page 20)
Graduation was only the beginning of Jim Brown's education

Because he joined Western Electric

Jim Brown, Northwestern University, '62, came with Western Electric because he had heard about the Company's concern for the continued development of its engineers after college graduation.

Jim has his degree in industrial engineering and is continuing to learn and grow in professional stature through Western Electric's Graduate Engineering Training Program. The objectives and educational philosophy of this Program are in the best of academic traditions, designed for both experienced and new engineers.

Like other Western Electric engineers, Jim started out in this Program with a six-week course to help in the transition from the classroom to industry. Since then, Jim Brown has continued to take courses that will help him keep up with the newest engineering techniques in communications.

This training, together with formal college engineering studies, has given Jim the ability to develop his talents to the fullest extent. His present responsibilities include the solution of engineering problems in the manufacture of moly-permalloy core rings, a component used to improve the quality of voice transmission.

If you set the highest standards for yourself, enjoy a challenge, and have the qualifications we're looking for — we want to talk to you! Opportunities exist now for electrical, mechanical and industrial engineers, and for physical science, liberal arts and business majors. For more information, get your copy of the Western Electric Career Opportunities booklet from your Placement Officer. And be sure to arrange for an interview when the Bell System recruiting team visits your campus.

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ATOMIC AGE
(Continued from Page 18)

brought news of uranium fission to scientists in America.

Then on September 1, 1939, Hitler moved into Poland amid reports that the Germans were expanding their studies of uranium. Shortly afterward, the United States government began a program to determine the possibilities of atomic energy.

War:
At 7:30 A.M., Sunday, December 7, 1941, Japanese planes blasted Pearl Harbor. The United States went to war on the battlefronts and in the laboratories. As atomic research was stepped up, the Army established a secret organization titled "The Manhattan Engineer District." Its mission was to develop and produce an atomic bomb as fast as possible.

From mines deep in the Belgian Congo came much of the uranium needed by the great new atomic plants at Oak Ridge and Hanford. Every ounce was hauled out through more than 1200 miles of rocky canyons and steaming jungles, then shipped across 5,000 miles of submarine infested seas to America.

Finally, on July 16, 1945, the work of the Manhattan District was put to the test. Observers waited tensely in the desert as the seconds ticked by. Then, just before daylight, they saw the darkness ripped by an incredible light. The first atomic device had worked.

Just twenty days later, the Japanese city of Hiroshima was almost completely wiped out by the first atomic bomb. Three days later, the second atomic bomb burst over the city of Nagasaki. Finally, the Japanese succumbed. With the end of war, and the beginning of peace, American doctors and nurses joined with the Japanese personnel in treating the injured and studying the effects of atomic radiation.

Interval:
Following the war, a new law was passed in the U.S., which transferred control of atomic energy from the Army to a newly created, all civilian Atomic Energy Commission.

Improving the public welfare and promoting world peace were two of its objectives.

In 1946, the United States delegation to the United Nations told the world body that America would give up the A-Bomb if all nations would agree to a system of foolproof safeguards underwhich atomic energy could be only used for peaceful purposes. The Russian answer was no! Instead of cooperating, the Soviet Union erected an "iron curtain" of barbed wire. Armed guards and censorship between the communist nations and the free world prevailed.

Faced with Russia's belligerent attitude, the United States began to strengthen her defenses. If there was to be an atomic arms race, she knew she must win it. Spurred on by the first Soviet atomic explosion in 1949, and by the outbreak of the Korean War in 1950, Congress earmarked more than seven billion dollars for the task. New and better atomic plants rose all over the nation.

The search for uranium to feed these plants became a 20th Century "Gold Rush." School teachers, taxi drivers, and clerks joined in the hunt. Some struck it rich, and others failed. But vast new deposits of uranium were found in America and Canada.

U.S. troops began to learn the battlefield techniques demanded by such weapons. At tests in Nevada, the troops dug in near ground zero, getting used to the shock and sound as atomic artillery and baby A-Bombs were used on them.

Then in 1952, using the newly discovered process of atomic fusion, U.S. scientists produced the most unbelievable force of all, the first Hydrogen Bomb. More than 300 times as powerful as the Hiroshima A-Bomb, the first H-Bomb test literally wiped a small Pacific island off the map.

Progress:
Meanwhile, the search for a means to harness the tremendous force of the atom went on. Most of the effort centered around the design and development of nuclear reactors. Progress came quickly, for in December, 1951, a bulb was lighted by electricity produced by a small experimental reactor at a testing station at Arco, Idaho. Although then only the lights of a laboratory were lit, by 1980 more electric energy may be produced in the United States by atomic power than is now produced by conventional fuels.

At 11:33 A.M., January 17, 1955, in the Thames River, Groton, Connecticut, the blinker signal on the conning tower of the submarine "Nautilus" flashed: "Underway on nuclear power." Only minutes before, her massive streamlined hull had backed cautiously away from her pier for the first time. As she cruised swiftly into Long Island Sound, her brief message told the world that atomic power had at last been controlled and put to constructive use. To everyone, everywhere, the short message meant that the bright dream for the atomic age was moving toward reality and that atomic power might revolutionize all forms of travel, not only on the sea, but on land and in the air.

Atomic energy is world-wide. Canada, one of the leaders in the field, built its first reactor in 1945. Great Britain, which is second only to the U.S. in the free world, has undertaken a huge construction plan for reactors. And France, which has one of the leading atomic energy laboratories near Paris, is not far behind the U. S.

Applications:
Atomic energy has many uses in everyday life. In medicine, radioactivity can be used to kill diseased human tissue. Many ingenious ways have been developed to bring it into contact with diseased cells. Atomic pistols, for example, shoot tiny pellets of radioactive gold into cancerous growths. And in many hospitals, radioactive lamps direct the strong rays from radioactive cobalt on the cancerous tissue.

Radioactive iodine has been used since 1947 to treat diseases of the thyroid gland. The radio-iodine is

(Continued on Page 24)
The accelerated pace at which technology is advancing has produced a wrong decision for your first job may cause you to slip into the abyss of obsolescence. Engineers and engineering management at Hamilton Standard have already confronted and successfully overcome this bleak problem. In the early 1950's, while continuing an undisputed position in the propeller business, management initiated a swift, sound product diversification program. By judiciously applying the valued skills and capabilities that HSD engineers acquired as the world's foremost developers and manufacturers of propellers, the switch to new product opportunities in the then-new jet market was orderly and highly successful. Hamilton Standard rode the wave of aviation progress to leadership in the jet aircraft and aerospace equipment field as they already held in the field of propellers. Engineers with heavy experience in hydro-mechanical control devices for propellers turned their skills to metering fuel flows in engine controls; the aerodynamics of air conditioning and manufacturing. The dynamics of air conditioning the field was broadened to include jet engine controls and pneumatic valves, beginning with analytical feasibility studies through preliminary design and prototype development. Since early 1960 this same determination and mobility has been applied to adapting engineers' skills to obtaining a share of the new missile, rocket and space vehicle opportunities. Company state-of-the-art advances have led to receipt of contracts to provide the environmental control for the lunar excursion module, and space suits. Studies have been completed on one-man propulsion units to be used by astronauts during orbital rendezvous and on the moon's surface. The company's continued expanding probe into the fields of electronics, ground support, electron beam technology and industrial valves, among others, is sustained by an organization of almost one thousand graduate engineers and technicians with a wide variety of complementary engineering and manufacturing skills. Supporting these technical/production teams, in turn, are some of the most extensive privately-owned experimental and manufacturing facilities in the United States. Without such support, theory holds sway, new products rarely mature, and obsolescence of both company and personnel set in. Hamilton recognizes that its ability to produce a workable article is measured by two basic criteria: its people, and the tools at their immediate disposal.

Such diversification has brought Hamilton into the areas of engineering and scientific disciplines including aerodynamics, compressible flow, control dynamics, digital computation, analog computation, electronics, electron optics, fluid dynamics, heat transfer, hydraulics, instrumentation, internal aerodynamics, kinematics, magnetic circuitry, mechanical metallurgy mechanics, metallurgy, physical chemistry, physics, quality control, reliability, servo-mechanisms, statistical analysis, structures, systems analysis, thermodynamics, thermonuclear, tool engineering, transistor circuitry, vehicular dynamics and vibrations. Hamilton Standard's successful diversification also hinged on another hedge against engineering obsolescence...
Miss Technic For December
Our Miss Technic for December is Miss Linda James. She is a freshman French major at DePauw University.

When not away at school, Linda lives with her family just down the road from Rose in Seelyville. Included in her family is a senior Rose man, Steve James. Maybe these are indications that Rose men have a good chance for a date with our December Miss Technic.

Other than being very active as a Delta Gamma pledge, Linda spends her free time swimming, horseback riding, and playing tennis. But during the cold days—and nights—of winter, she has time for other activities. Hopefully, one of these will include dates with Rose men.

Linda is 5'3" tall and weighs 116 lbs. The figures on her figure are 35 - 23 - 35. This attractive figure, coupled with her enchanting personality make her an ideal date for some lucky Rose man.
ATOMIC AGE  
(Continued from Page 20)

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In agriculture, radioisotopes are helping biologists to solve the mystery of what makes plants live and grow. Radioactive carbon and hydrogen can be used to trace the intricate process, called photosynthesis, by which plant tissue is created. Scientists hope to duplicate this process and thus produce food artificially. At agricultural experiment stations, radioisotopes are blended into fertilizer and used to measure how efficiently the fertilizer is taken up by growing plants.

By using radioisotope tracers, agricultural technicians are learning what minerals and chemicals should be added to the diet of livestock in order to keep them healthy and productive. Also, mosquitoes can be tagged with radioisotopes in the larvae in breeding grounds, thereby setting up more effective pest controls. Through the many uses of atomic energy, farmers will be able to produce more nutritious food at lower costs.

In industry, because radioactivity will penetrate solids in the same way that light shines through glass, it can be used to measure precisely the thickness of sheet materials during manufacture. Rolling mills use the rays from radioisotopes to determine the thickness of sheet metal to within one ten-thousandth of an inch. Deviations are adjusted automatically with electronic instruments.

At rubber plants radioactive phosphorus is mixed into tire fabrics to show the rate at which tires are worn down during laboratory tests. Even the most intricate chemical processes, such as petroleum cracking, can be followed with radioisotopes and thereby made more efficient. Radioactivity can also induce new chemical reactions leading, for example, to the development of stronger, more heat resistant plastics.

With the aid of radioactivity, technicians can see through and record on film pictures of otherwise invisible flaws in welds and castings. With the newly invented transistors, radioactivity can be transformed directly into electricity in small quantities. Such atomic batteries are used to transmit data from high-flying weather balloons and missiles.

A signal from a radioisotope in the wristwatch of a worker can stop a machine in time to prevent an impending accident. Thus the atom, in industry as in medicine and in agriculture, has begun to help mankind in many ways.

Tomorrow:
The new atomic age requires infinitely complicated refinements of theory that tax the brains and the time of even the world's foremost mathematicians. To aid in the task, giant electronic computing machines are being pressed into service at atomic research centers. Future atomic progress must be based on our understanding of the nucleus of the atom. In order to increase this understanding, powerful atom-smashers (bevatrons and cosmotrons) are being constructed. They bombard atoms with tiny particles of matter moving at nearly the speed of light.

Since one pound of uranium can do the job of 1300 tons of coal or 360,000 gallons of gasoline, atomic fuel will revolutionize the transportation industry. Already in use are atomic ships that will be able to travel for months without refueling. Atomic aircraft may soon be with us and some preliminary studies have been made on atomic locomotives.

(Continued on Page 30)
Reuben C. Gooderum, BSME Wisconsin, 1962, is shown examining combustion liners after a thermal paint engine test at Allison Division, General Motors, Indianapolis, Indiana. Thermal paint, developed by Allison, is used to determine temperature gradients existing on engine parts.

Gooderum is one of the young engineers at Allison assigned to design and development of air-cooled turbine engine hardware. This work involves rig testing of turbine engine parts to determine optimum configurations. Parts later are endurance-tested on engines to prove the design.

New, air-cooled turbine blades developed by Allison engineering have permitted more than 250°F higher turbine inlet temperatures on turbo-prop engines, providing as much as 63% increased horsepower for the same engine envelope.

We think you, too, will like the creative climate at Allison, as well as the advantages of being associated with a long-established leader in the design, development and production of high performance aircraft engines. Talk to our representative when he visits your campus. Let him tell you what it’s like at Allison where Energy Conversion Is Our Business.

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LUMINESCENCE  
(Continued from Page 9)
emit visible fluorescence when excited by an ultraviolet radiation which it can absorb. In general, any photoluminescent substance has an absorption band in the spectral region immediately adjoining and even somewhat overlapping it. Hence, red fluorescence is excited by orange light, yellow by green, green by blue, and violet by ultraviolet. Infrared fluorescence, observed in a few cases such as chlorophyll and some crystal phosphors, can be excited by red light. The fluorescence intensity radiated by a substance varies with the wavelength of the exciting light only in so far as the absorption power is a function of the wavelength. The absorption of x-rays is a function of the atomic number or atomic weight of the absorbing atoms. It is exceedingly small in the light atoms of which most organic substances consist (carbon, hydrogen, oxygen). Only luminescent materials containing heavy atoms will emit bright fluorescence under x-ray excitation. When fluorescence is induced by x-rays, the luminescence is actually a tertiary effect produced by secondary cathode rays (electrons) set free by the x-rays.

In cathodoluminescence, the most important type of electroluminescence, the primary energy is supplied by electrons which have acquired a high velocity under the action of an electric field. The energy of an electron after a free fall through an accelerating potential of one volt is called an electron volt (e.v.). In order to excite an electron from the ground state \( E_0 \) to an energy level \( E_i \) so that it may be able to emit radiation of frequency \( f \), the energy of the electron must be at least equal to

\[
hf = \frac{hc}{\lambda}
\]

The corresponding wavelength to the energy of one e.v. is 12395 Å.

Not only is the type of luminescence important, but also how intense the emitted and absorbed light

(Continued on Page 28)
"He that loves reading, has everything within his reach." — William Godwin

library notes

by harry gilbert, librarian

Biography is one area of the college library that should be strong, and it should be kept that way, because biographies generally are written about people who make a mark in their area of interest. It doesn't matter if one's interest is science, engineering, humanities, or even the narrower or less well known areas, because there are biographies written about all kinds of people. This article will be devoted to biographies of two widely different types of people, and consequently, to two entirely different kinds of books.


The author is Charles Chaplin, but to the millions around the world who treasure him for his mixture of laughter and pathos, the trademark of his genius, he is Charlie Chaplin. The little tramp with the bamboo cane, the derby, and a moustache was one of those happy happenstances of history.

A vaudevillian from London touring the U.S. in 1914, Chaplin was under contract to Mack Sennett to appear in three films a week for $150 a week. The early attempts were disappointing and Sennett suggested that Chaplin put on a comedy make-up. Chaplin was at a loss as to what make-up to put on. On an impulse he decided to dress in baggy pants, big shoes, a cane and a derby hat. He wanted everything to contrast — the baggy pants, the coat tight, the hat small, the shoes large. To add age to his twenty-five years he put on a small moustache. "I had no idea of the character," Chaplin recalls. "But the moment I was dressed, the clothes and the make-up made me feel the person he was. I began to know him and by the time I walked onto that big stage he was fully born."

The real Charlie had been born in a poor section of London. His parents were separated. His father was a vaudevillian until he drank himself out of the business. His mother was a soubrette until she lost her voice. Such circumstances resulted in a very Oliver Twist like childhood with the attendant poverty, hunger, hardship and humiliation. These experiences gave pointed authenticity to his tramp character. But before the birth of Charlie his livelihood came from touring vaudeville and production groups.

After capturing the world with his pantomime his financial worries were over. Trouble continued to plague him through the complications of his many marriages, his championing of a Second Front which branded him a Communist, and his tax difficulties in the U.S. and Britain.

In his long and eventful life Chaplin has met everyone from Nehru to Churchill, Gertrude Stein to Albert Einstein, Mary Pickford to Valentino. Of these people and the fascinating details relating them to his life, Charlie Chaplin writes in My Autobiography.


This is a work which fills a vital gap in the history of our age. All the great figures of World War II and its aftermath have been portrayed. General George C. Marshall has until now remained voiceless. The collection of source material for this work is unprecedented. It includes all the General's personal papers, taped interviews with the General, taped interviews with his relatives, classmates, friends, fellow officers and associates, newspaper files of the period, and microfilm copies of over half a million items from official government files. Many of the latter were classified until now. Much of the material about the conduct of both World Wars and about the crucial problems of diplomacy will be new even to students of the period.

This is the first in the three-volume biography. It follows Marshall's progress from childhood in Uniontown, Pa., to 1939 when Hitler overran Poland. Marshall became Chief of Staff of the U. S. Army at that time. The time between the beginning of his military career and 1939 is filled with activity in the Philippine Islands during the Spanish-American War, duty in France in World War I, China in the time of the War Lords, and many places in the U. S.

Marshall triumphed over formidable odds to become, first, an Army officer with responsibilities beyond his rank, a member of Pershing's staff, and finally Chief of Staff amidst the complex tensions of service rivalries. But Education of a General goes beyond the life of a military officer. He is seen in the light of his family devotion, his humanity, and his increasing insight into men and nations. Even beyond this the present work is a picture of America's end of innocence, the time of her altered course toward world power, away from isolation, and the part played by a great American in shaping his country for her new role in world affairs.
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LUMINESCENCE

(Continued from page 26)

total energy input without questioning which part of this energy is absorbed by the luminescent material is since luminescence is used as a source of light. There are three different ways of defining the efficiency of a luminescent source of light: the luminous efficiency, the energy efficiency, and the quantum efficiency. Of these, the first has greatest importance from the technical point of view while the last is most important from the theoretical point of view.

The luminous efficiency is the ratio of the total light output to the energy input, lost by reflection, transmission, or by any other process. The primary energy per second is usually given in watts or ergs per second. The light output is not defined in real energy units, but in lumens. The number of lumens present in the radiation is the resultants of three components: the total energy of the emitted light, its spectral distribution, and the sensitivity curve of the eye (see Figure 2).

An amount of energy emitted in the green or yellow part of the spectrum corresponds to a much greater number of lumens than the same amount of energy if the light is red or violet. Infrared or ultraviolet light does not contribute anything to the luminous efficiency. If all primary energy were transformed into light of wavelength 5550 A (maximum of the eye sensitivity curve) the highest luminous efficiency obtainable would be 621 lumens per watt.

The energy yield Φ is the ratio of the energy of the luminescent light in ergs or watt seconds, to the energy absorbed by the luminescent material not accounting for the part of the primary energy reflected or transmitted.

The quantum yield Q is the ratio of the number of photons contained in the emitted light to the number of photons absorbed by the luminescent material. The energy yield and
quantum yield are related by the following equation:

\[ \frac{\lambda_0}{\lambda} = \Phi = \frac{Q}{Q} \]

where \( \lambda_0 \) and \( \lambda \) are the wavelengths of the absorbed and emitted light respectively. For a given material, \( Q \) is, in general, independent of the wavelength of the primary light over a large spectral range. The quantum yield is strongly influenced by external conditions such as temperature and the nature of the solvent the luminescent material is in. The color of the luminescent light of different materials is in no way connected with the absolute values of \( Q \). The yield can be high or low for a blue fluorescence as well as a red fluorescence. \( Q \) varies between extremely wide limits, from 100% to less than 1%.

Many luminescent materials deteriorate more or less rapidly under the action of radiation which excites fluorescence. In general, this deterioration is characterized by a decrease of luminescence and some change of body color, as the fading of a dyestuff or darkening of a colorless or light-colored substance. It is due to a chemical change in the luminescent material.

For a time, the hypothesis prevailed that in every case luminescence is only a secondary phenomenon accompanying some sort of chemical reaction. The hypothesis seemed especially useful for the explanation of the so-called scintillations which are observed when \( \delta \)-particles impinge on zinc sulfide screens and provide a method for counting \( \delta \)-particles. Every individual \( \delta \)-particle impinging on the fluorescent screen produces a sharply localized burst of light emission which was ascribed to the "breaking up" of some kind of "centers" in the material of the screen. The efficiency of \( \delta \)-particles when used in luminescence, however, and the relatively slow rate of deterioration of the screens proves that it is not possible that energy emission processes are linked to the destruction of an emitting center.

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Atomic research requires many new materials capable of withstanding high temperatures and heavy stresses. Mills are now producing the new metal zirconium. It can resist corrosion caused by exposure either to air or chemicals. Radioactivity can sterilize and thereby preserve meats and vegetables. Studies under way envision mobile atomic sterilization units, which can be moved to remote areas where normal preservation techniques like refrigeration are difficult or impossible.

On December 8, 1963, former President Eisenhower proposed to the United Nations that the world join together to strip the atom of its military casing and adapt it to the arts of peace. From this the United States has built portable atomic power stations that can and have been shipped by air to any part of the world. These capsules of civilization can be used to produce heat and power. In order to apply the new source of energy, many nations of Asia, Africa and South America have been sending scientists and engineers to research centers in America for training.

From radioactivity will come the knowledge and the techniques to raise the health standards of people everywhere. Already radioisotopes are being used for medical purposes in nearly every nation of the world.

Within the atom is the promise of a new age in which we will have complete control over our environment. With new structural materials from which spotless, airy buildings may be spun, and with the availability of tremendous supplies of heat, power and radioactivity, we may one day build germ free, air-conditioned cities. Even in the forbidding continent of Antarctica, comfortable mining communities, protected by transparent plastic domes, would permit access to new mineral wealth.

Future distillation plants, powered by atomic heat, will produce from the oceans pure clear water without limit, from which to supply the world's cities and to irrigate arid lands.

Mastery of Nature's process of photosynthesis will permit the mass-production of food by artificial means; enough to feed many times the world's present total population.

With the harnessing of the fusion reaction, known to occur in the sun and the hydrogen bomb, we will be provided with limitless energy, enough to last a million years. The frontiers of space no longer lie in the realm of dreams. Someday, not far distant, ships, guided and propelled by atomic power, will leave the Earth to venture across interplanetary distances.

From the hearts of atoms, the energy of the universe has been released on Earth. But whether nuclear energy will ultimately destroy our present world or help to create a new and better one lies not in the hearts of atoms, but in the hearts of men. Human hate and ignorance or human love and knowledge are the masters. The atom will serve either—Only Time Will Tell—.

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Little boy in woodshed: "Father, did grandpa spank you when you were a little boy?"
Father: "Yes."
Little Boy: "And did great-grandpa spank grandpa when he was a little boy?"
Father: "Yes."
Boy: "Well, don't you think with my help you could overcome this inherited sadism?"

Why is it that men praise women for their virtue and dislike them so when they try to keep it?

Did you hear about the new medical discovery? Frozen band-aids for cold cuts.

After delivering Mrs. Jones of her ninth child, the doctor called the husband aside.
"Next time you feel like propagating," he said, "ask yourself if you can support another child."
"Doc," replied Jones, "when I feel like propagatin' I feel like I could support the whole state of Georgia."

Rumba: A dance where the front of you goes along nice and smooth like a Cadillac and back of you makes like a Jeep.

Two men were working on the White House lawn, each supplied with a small push cart upon which was a garbage can. They walked about picking up papers with a long spear. One spied a piece of toilet paper and started to spear it, when suddenly a gust of wind came up and blew the paper into the White House through an open window. The man became frantic and rushed into the building. He returned shortly and said: "I was too late. He had already signed it."

A five year old boy had a terrible habit of sucking his thumb; a habit his mother had been trying desperately to break. She told him that if he kept on sucking his thumb, he would blow up and burst. A few days later, his mother's bridge club came over. One of the women was very much in the family way. The little boy wandered into the room, looked at the pregnant woman and said in a loud voice, "Say, I know what you've been doing!"

"Two-" shouted the pint-sized umpire.
"Two what?" snarled the big catcher.
"Yeah, two what?" echoed the brawny batter.
"Too close to tell," said the umpire.

M.E.: "Do you know who was the first engineer?"
E.E.: "No, Who?"
M.E.: "Adam, he furnished spare parts for the first loud speaker."

E.E.: "I nearly ran over a pedestrian a few minutes ago and I think he was from Miami."
M.E.: "How do you know he was from Miami?"
E.E.: "Well, when he reached the sidewalk I heard him say something about the sun and the beach."
Men on the move
at Bethlehem Steel

BRUCE SHAFEBOOK, MET.E., LEHIGH '60—Bruce supervises the metallurgical lab that watchdogs the quality of alloy, tool, and bearing steels made at our Bethlehem, Pa., Plant.

BERNIE BAST, CH.E., PENN STATE '61—An engineer in our research laboratories in Bethlehem, Pa., Bernie is shown making distillation studies for a research project on coal chemicals.

JACK LAMBERT, E.E., KENTUCKY '60—Jack works on design, installation, and maintenance of power stations, distribution networks, motors, and drive systems at our Steelton, Pa., Plant.

DON McCANN, M.E., PRATT '60—After experience as a maintenance, design, and construction engineer, Don became a cost-control specialist at our Lackawanna Plant, near Buffalo, N.Y.

ALVIN TYLER, MET.E., CASE INSTITUTE '60—“Tim” is a salesman assigned to our Buffalo District. His technical training is a valuable asset in selling steel products.

DON DIXON, C.E., MASSACHUSETTS '60—A field engineer in our Fabricated Steel Construction Division, Don supervises steel erection for major buildings and bridges.

These alert young men are a few of the many recent graduates who joined the Bethlehem Loop Course, one of industry’s best-known management development programs. Want more information? We suggest you read our booklet, “Careers with Bethlehem Steel and the Loop Course.” Pick up a copy at your Placement Office, or write to our Manager of Personnel, Bethlehem, Pa.

An equal opportunity employer
Could a U.S. firm that helped save a cotton crop abroad also have a hand in keeping Jayne Tippman’s skin soft?

You’d expect that a U.S. company engaged in mining, production and marketing in over a hundred countries might have an impact on many national economies. And you’d be right. For instance, with an insecticide sold under the trade mark “Sevin,” this company was largely responsible for saving a middle east cotton crop.

And when a leading chemical manufacturer’s products include silicones, which have a soothing and protective effect on skin, they’re bound to turn up in skin lotions, creams, and emollients. Jayne Tippman uses them to keep a glowing complexion that weather can’t beat.

Cotton fields and skin lotions are unlikely markets for one company’s products. Unless that company is Union Carbide.

But then, Union Carbide also makes half a dozen major plastics, along with plastic bottles and packaging films. And it’s one of the world’s most diversified private enterprises in the field of atomic energy. Among its consumer products are “Eveready” batteries and “Prestone” anti-freeze. Its carbon products include the largest graphite cylinders ever formed, for possible use in solid-fuel rockets. Its gases, liquefied through cryogenics—the science of supercold—include liquid oxygen and hydrogen that will be used to propel the space ships designed to reach the moon.

In fact, few other corporations are so deeply involved in so many different skills and activities that will affect the technical and production capabilities of our next century.

It’s a future that glows like Jayne Tippman.
Advancement in a Big Company: How it Works

An Interview with General Electric’s C. K. Rieger, Vice President and Group Executive, Electric Utility Group

C. K. Rieger

Charles K. Rieger joined General Electric’s Technical Marketing Program after earning a BSEE at the University of Missouri in 1936. Following sales engineering assignments in motor, defense and home laundry operations, he became manager of the Heating Device and Fan Division in 1947. Other Consumer-industry management positions followed. In 1953 he was elected a vice president, one of the youngest men ever named a Company officer. Mr. Rieger became Vice President, Marketing Services in 1959 and was appointed to his present position in 1961. He is responsible for all the operations of some six divisions composed of 23 product operations oriented primarily toward the Electric Utility market.

Q. How can I be sure of getting the recognition I feel I’m capable of earning in a big company like G.E.?

A. We learned long ago we couldn’t afford to let capable people get lost. That was one of the reasons why G.E. was decentralized into more than a hundred autonomous operating departments. These operations develop, engineer, manufacture and market products much as if they were independent companies. Since each department is responsible for its own success, each man’s share of authority and responsibility is pinpointed. Believe me, outstanding performance is recognized, and rewarded.

Q. Can you tell me what the “promotional ladder” is at General Electric?

A. We regard each man individually. Whether you join us on a training program or are placed in a specific position opening, you’ll first have to prove your ability to handle a job. Once you’ve done that, you’ll be given more responsibility, more difficult projects—work that’s important to the success of your organization and your personal development. Your ability will create a “promotional ladder” of your own.

Q. Will my development be confined to whatever department I start in?

A. Not at all! Here’s where “big company” scope works to broaden your career outlook. Industry, and General Electric particularly, is constantly changing—adapting to market the fruits of research, reorganizing to maintain proper alignment with our customers, creating new operations to handle large projects. All this represents opportunity beyond the limits of any single department.

Q. Yes, but just how often do these opportunities arise?

A. To give you some idea, 25 percent of G-E’s gross sales last year came from products that were unknown only five or ten years ago. These new products range from electric toothbrushes and silicone rubber compounds to atomic reactors and interplanetary space probes. This changing Company needs men with ambition and energy and talent who aren’t afraid of a big job—who welcome the challenge of helping to start new businesses like these. Demonstrate your ability—whether to handle complex technical problems or to manage people, and you won’t have long to wait for opportunities to fit your needs.

Q. How does General Electric help me prepare myself for advancement opportunity?

A. Programs in Engineering, Manufacturing or Technical Marketing give you valuable on-the-job training. We have Company-conducted courses to improve your professional ability no matter where you begin. Under Tuition Refund or Advanced Degree Programs you can continue your formal education. Throughout your career with General Electric you’ll receive frequent appraisals to help your self-development. Your advancement will be largely up to you.

FOR MORE INFORMATION on careers for engineers and scientists at General Electric, write Personalized Career Planning, General Electric, Section 699-11, Schenectady, N. Y. 12305

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