The Bridge

Eta Kappa Nu

Spring 1965

Bridge

of ETA KAPPA NU

Electrical Engineering Honor Society

SPRING, 1965, Vol. 61, No. 3

Editor and Business Manager
Paul K. Hudson

OUR COVER

We will sail up to the moon
In a little toy balloon
And live on love and kisses
On our Pi Phi honeymoon.

Now that space ships are being sent to the moon on a regular basis we can well imagine that the time is not far distant when tourist flights will be scheduled to that romantic place. We who still marvel at the safety pin are utterly overwhelmed by the complexities of outer-space transportation. But lest we go off the deep end, let us ever be reminded that when the first tourists reach the moon they will be greeted by a souvenir shop that sells fluorescent neckties imprinted with hula girls (very appropriate for morticians and diamond cutters), mother-of-pearl coated 39¢ binoculars (excellent for watching a flea circus), and lavender satin cushion covers with tombstones in relief (no Halloween party should be without them).

Features

The BRIDGE is published by the Eta Kappa Nu Association, an electrical engineering honor society. Eta Kappa Nu was founded at the University of Illinois, Urbana, October 28, 1904, that those in the profession of electrical engineering, who, by their attainments in college or in practice, have manifested a deep interest and marked ability in their chosen life work, may be brought into closer union so as to foster a spirit of liberal culture in the engineering colleges and to mark in an outstanding manner those who, as students in electrical engineering, have conferred honor on their Alma Maters by distinguished scholarship activities, leadership and exemplary character and to help these students progress by association with alumni who have attained prominence.

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Real and Imaginary

The Story of the REGAL LILY

In June and July, when the regal lilies blossom in rich fragrance and lovely form, it is interesting to think of how they came to be in American gardens. They are a reminder of the plant hunter, Ernest Wilson, reminiscent of botanical adventurings, of a desperate summer day in 1910, and of the size of a mule's hoof.

Near the Tibetan border, the gorge of the Min River that day lay grim and sheer, its purple-gray rocks almost lifeless in the heat, the river galloping far below through its stony canyon. A trail for pack mules and men moving with supplies between Sungpang Ting and the cities of Szechuan Province had somehow been cut along the wall of the gorge. It was a narrow, dangerous trail with only occasional places which were wide enough for an advancing pack train to pull over to let another one pass.

It was a narrow spot, however, that Ernest Wilson lay helpless on his back, one leg disastrously shattered by a rock slide which had torn loose from the mountainside only moments before. A mule train plodded toward him. There was no place for the animals to turn out, and he was unable to be moved from their path. He awaited the mules.

There were forty of them. As they approached the fallen man, each one paused a moment, then stepped gently over him. Not one touched his body, but never afterward would he forget the size of a mule's hoof nor the endlessness of that pain-wracked experience.

Ernest Wilson had been a plant hunter since 1899. As director of the Arnold Arboretum in Boston, he went out on years-long expeditions into the unknown, flower-filled wilderness of China and Tibet to bring back new species for American and English gardens.

Great numbers of plants which are accepted parts of American gardens came originally from Asia. Robert Fortune in the early nineteenth century brought out the first chrysanthemum, the bleeding heart, the peony, and many more. Ernest Wilson had gone to China several times. On one journey he had discovered a wild region far from known roads, eighteen hundred miles up the Yangtze, then

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Our Satellite, The Moon

A closeup look at the lunar surface is necessary in order to prepare for future instrumented soft landings and finally the manned missions.

Jet Propulsion Laboratory, Pasadena, California

The Moon, our closest celestial neighbor and the object of legends and superstitions since history began, is as familiar to us as is the face of a close friend. We know the solemn beauty of the full Moon and the half comic, half frightening face of the "Man in the Moon." Poets ponder the influence of the ever-constant Moon on romance. Children speculate whether or not it is really made of green cheese. And more sober adults smile condescendingly at both of these theories. Yet very little is actually known about the Moon.

A prehistoric remnant, relatively unchanged for billions of years, the Moon may prove to be the Rosetta Stone that will unlock many of the secrets of the origin and evolution of our solar system.

In 1609 Galileo described his observations of the Moon as follows:

"The prominences there are mainly very similar to our most rugged and steepest mountains, and some of them are seen to be drawn out in long tracts of hundreds of miles. Others are in more compact groups, and there are also many detached and solitary rocks, precipitous and craggy. But what occur most frequently there are certain ridges, somewhat raised, which surround and enclose plains of different sizes and various shapes but for the most part, circular. In the middle of many of these there is a mountain in sharp relief and some few are filled with a dark substance similar to that of the large spots that are seen with the naked eye; these are the largest ones, and there are a very great number of smaller ones, almost all of them circular." [a]

Galileo first gazed at the Moon through a telescope more than 350 years ago. Since that time, however, we have seen little more of the detail of the Moon's surface than did Galileo. Our modern telescopes are better, but we still stand the same distance from the Moon and on

[a] "Galilei, Galileo"; p. 63; dialogue concerning the two chief world systems, Ptolemaic and Copernican; Translation by Stillman Drake; Foreword by Albert Einstein; University of California Press, Berkeley, California.

Photo courtesy Mt. Palomar Observatory

Figure 1. Crater Clavius and surrounding regions

Photo courtesy Lick Observatory

Figure 2. Lunar region of craters Copernicus and Eratosthanes

the same platform—the Earth. We still must peer through the same mantle of atmosphere that hindered Galileo's viewing. That blanket of life-giving air that protects Earth life and causes the stars to twinkle so delightfully unfortunately makes the details of the Moon twinkle also.

Although the lunar surface conditions still elude us, we have learned a few facts about the Moon. We conclude that the Moon has no surface water and no appreciable atmosphere. For all practical purposes, its distance from the Sun is the same as the Earth's, and so it receives the same amount of heat from the Sun. But, due to the lack of atmosphere, the temperature on the Moon's surface ranges from 261°F at noon, hotter than boiling water on Earth, to −243°F at midnight—more than twice as cold as any place on Earth. Such extremes of temperature, coupled with the lack of atmosphere on the Moon, would presumably preclude the existence of any form of life as we know it. Still the possibility of the existence of so-called sub-life forms must be considered. The action of atoms and molecules at the surface, or just under the surface of the Moon, under eon-long bombardment by undiluted solar radiation and by cosmic rays, cannot be predicted. The formation of complex macro-molecules may be possible.

Additionally, the Moon has a diameter of about 2163 miles—about one-quarter that of Earth. Because it is smaller than Earth, its gravity is much less. Standing on the surface of the Moon, one would weigh only one-sixth as much as he weighs on Earth. The density of the Moon is 3.3 times that of water, while that of Earth is 5.5. Scientists agree that the Moon's mass is about 1¼ percent of the Earth's mass. The lunar world is in a slightly elliptical orbit at an average distance of approximately 238,000 miles from Earth. The Moon requires 27⅓ days to make a complete orbit of Earth and, because its rotational period is the same, it always presents the same face toward Earth.

The Moon generates no light of its own and shines solely by reflected Sunlight or Earthlight; only 59% of its surface is visible from Earth. The Moon has no obvious effect on the climate of the Earth, but is the dominant factor in the production of tides. There is also some slight but distinct relationship between the changes of distance of the Moon from the Earth and variations in terrestrial magnetism.

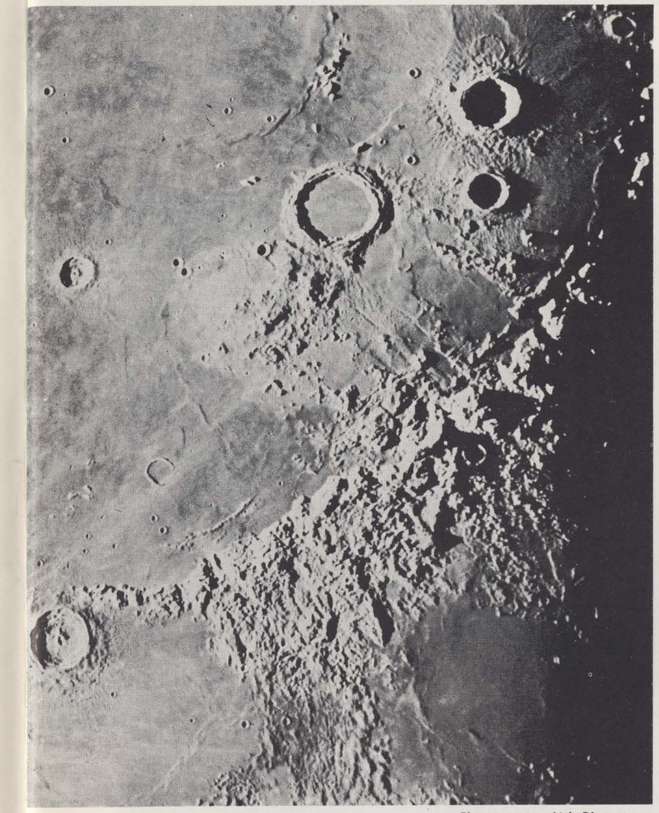


Photo courtesy Lick Observatory

Figure 3. Lunar area, southwestern margin of Mare Imbrium

Recent studies have made it appear probable that the great craters on the Moon are impact craters rather than volcanic craters (Figs. 1 and 2). It also seems that at least some of the maria (the great plains) are the direct result of impact (Fig. 3). It is not clear if the impacts acted primarily as a trigger mechanism releasing molten material (if any) from the Moon's interior, or if the melting material resulted primarily from the kinetic energy of the impacts.

Although the great craters appear to be meteoric in origin, this does not imply that no volcanic activity can exist on the Moon. On the contrary, there are rows of craterlets, near Copernicus, which may be due to volcanic activity. One of the most interesting observations in the past few years was made in a portion of the crater Alphonsus. A temporary haziness was found which lasted long enough to obtain a spectrogram confirming the existence of carbonaceous molecules and some yet unidentified species. So gases do exist, at least for a short time, on the surface of the Moon. This "atmosphere" is very tenuous at best and must consist primarily of a few stray molecules of heavy inert gases. Perhaps a few light gases are in existence for a short time and immediately after a volcanic emission. Additionally, in recent months, unidentified temporary reddish areas have been sighted in other parts of the lunar surface.

One school of thought suggests that the maria, or plains, as well as the centers of many of the old craters, are filled with dust. The thickness of the layer of dust is estimated by the total amount of rock which could have been worn from all of the old crater walls in the highlands. On this basis, a number of 1 kilometer is reached for the maximum dust depth—that is, a little over ½ mile.

Experiments have indicated that dust, in a vacuum such as on the surface of the Moon, would tend to become hard packed. So we can imagine that any deep dust layer on the Moon would resemble pumice more than the dust with which we are familiar. Accordingly, there would seem to be little danger of our spacecraft being buried in a half-mile of loose dust. However, there are also the theories of suspended dust, sintered dust, and no dust at all. Thus, the most important task we must accomplish in the early stages of lunar exploration will be to determine the exact nature of the Moon's surface. This will be the starting place, and eventually all the questions will be answered. The exact nature of the Moon's surface is extremely important to the basic design of both unmanned and manned lunar spacecraft; unfortunately, it is not possible to resolve these questions by looking through our telescopes.

In the photograph (Fig. 4) the Mare Imbrium—the right eye of the man in the Moon—is seen (top left). This is one of the level plains or maria. Standing out on the plain just below the outer rim of mountains is Mt. Piton. In the photograph (taken by Lick Observatory, University of California, Mt. Hamitton, California), Mt. Piton appears as a small, jagged hound's tooth. It is possible to measure heights on the Moon with surprising accuracy by measuring shadow lengths. A better understanding of the actual configuration of Mt. Piton may be obtained by considering ourselves as Moon explorers, standing on the surface of the Moon, a few miles from its base. From here it would appear as a high but gentle sloping mountain rising to about 7000 feet and stretching out more than 70,000 feet (about 13 miles). The top is so nearly level that it would be difficult to determine the highest point. Certainly, from this point of view, it looks very different from the rugged mountain it appears to be in the photograph.

In pictures of the Moon taken with the 200-inch telescope at Palomar at high magnification (Fig. 1), the smallest detail that can be seen is almost a mile across. Details smaller than that are simply unresolved and must await the actual landing of our scientific instruments on the Moon or close distance photographing of the Moon by cameras operating outside the distortion of the Earth's atmosphere.

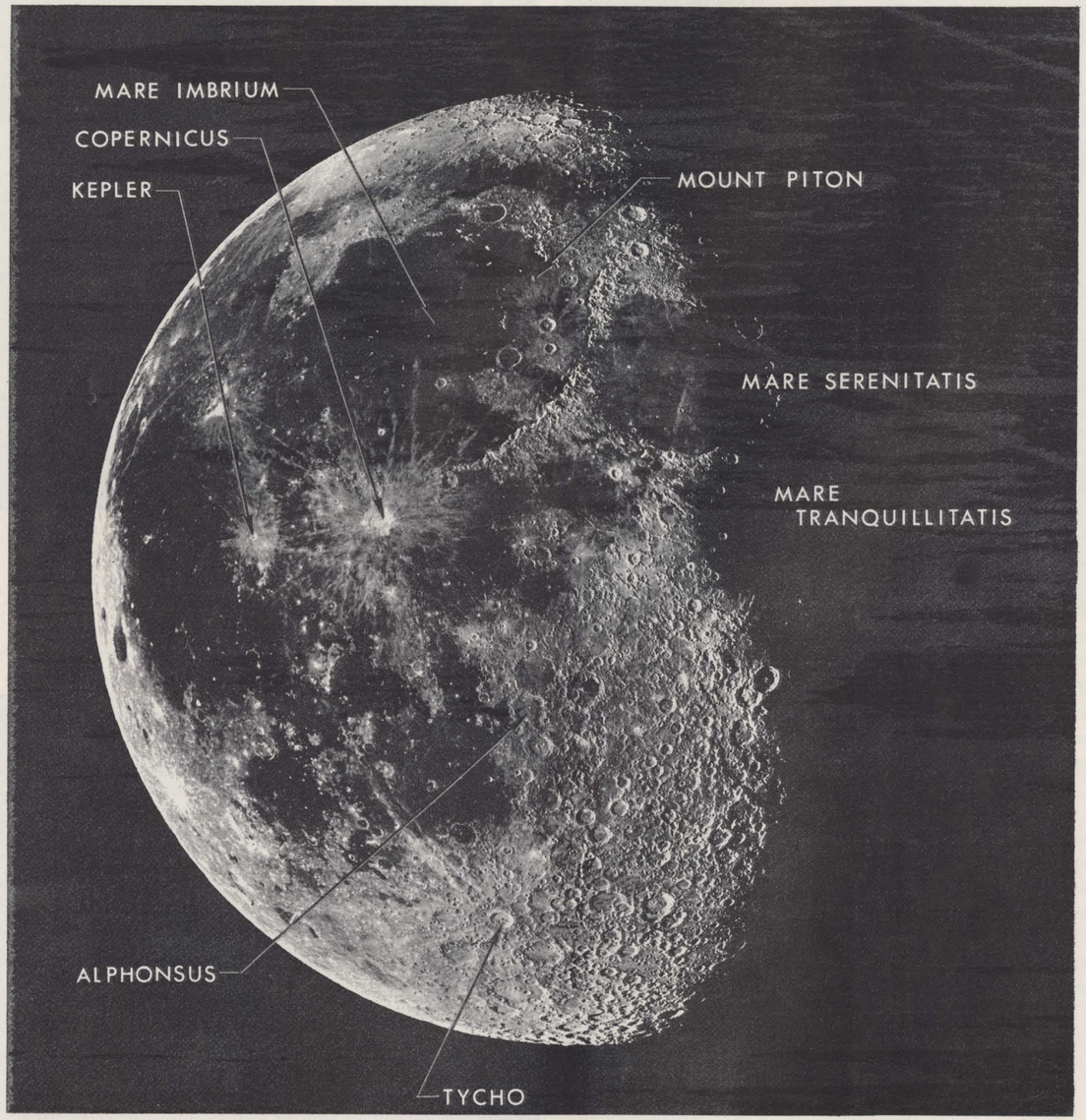


Photo courtesy Lick Observatory

Figure 4. Eastern part of the Moon

Electrical Industries of America VI

Western Electric began operations in a Cleveland loft in 1869 as the firm of Gray and Barton. Its purpose: to build quality telegraph instruments and other electrical products.

Its founders were Elisha Gray, a physics professor and inventor; Enos Barton, a former telegrapher; and General Anson Stager, who had been chief of military telegraph for the Union Forces in the Civil War.

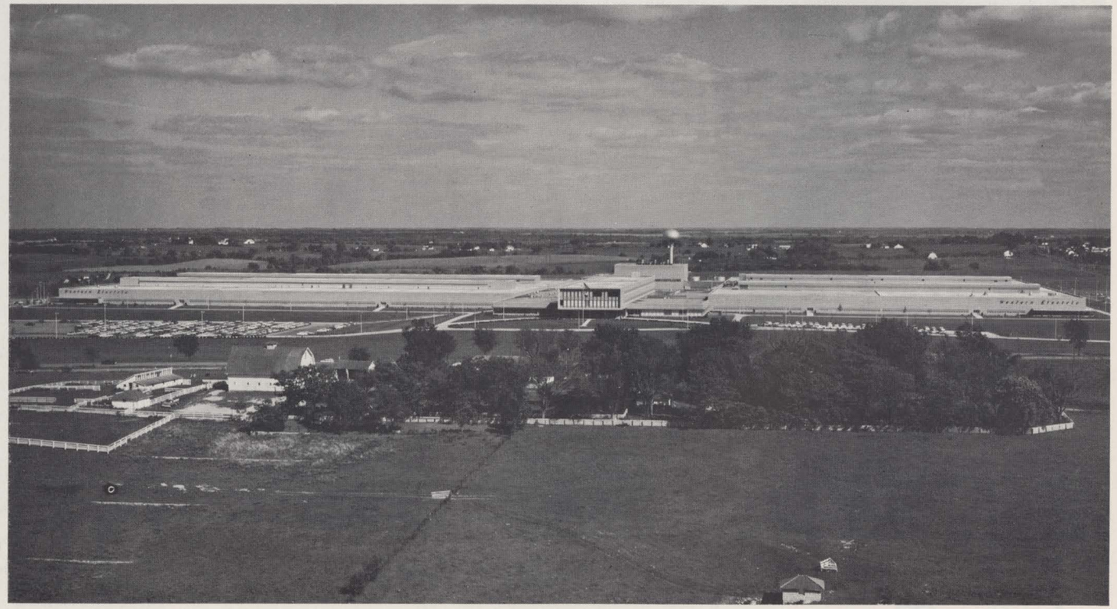
The firm moved from Cleveland to Chicago, and in 1872 changed its name to the Western Electric Manufacturing Company.

After the telephone was invented in 1876, Western Electric became one of a half-dozen firms competing in the production of telephone equipment. But in 1882, the fast-growing Bell Company acquired a controlling interest in the Western Electric Manufacturing Company and shortened the name to its present form.

As the telephone industry began to expand, Western Electric grew with it until its name appeared around the world—on telephone products, on heavy power equipment and, to a smaller extent, on household appliances. By 1906, Western Electric had become the largest electrical manufacturer and distributor in the United States and eventually there were W.E. plants in several European countries. Belgium, France, Italy, England and Germany.

In the meantime, the Company had taken on other tasks for the Bell System: it had become the chief installer of central office equipment and the central buyer of supplies.

As the number of telephones in the nation increased—there were more than a million by the early



KANSAS CITY WORKS OF THE WESTERN ELECTRIC COMPANY

WESTERN ELECTRIC CORPORATION

1900's—Western Electric expanded its manufacturing and purchasing programs and opened its first Distributing House. This was in 1901, in Philadelphia.

After World War I the growing needs of the telephone industry required Western Electric to concentrate more and more of its resources on its job as the Bell System's basic source of supply. By 1925, Western Electric had sold its power equipment and home appliance business and its foreign telephone and electrical jobbing interests, gaining a singleness of purpose in its Bell System tasks.

The period since World War II has been one of further growth and dynamic change for Western Electric, which now ranks among the top companies in the nation in terms of number of employees and dollar volume of sales.

Now, as we enter the Space Age, there are many new challenges in the science of communications. Western Electric will respond to them.

Technology

Rapid and startling changes in the science of communication have taken place in recent years. In telephony, for example, some two-thirds of the products Western Electric makes for the telephone companies were introduced or substantially modified after 1950.

To produce them, Western Electric has constantly improved its processes, methods and equipment to take full advantage of the developments which have flowed from Bell Laboratories. New processes and techniques originating with W.E. engineers and technicians have been adopted by patent licensees around the world.

Advances in communications science in recent years, for example, have included such diverse achievements by Bell Labs and Western Electric as the artificial growing of quartz crystals; development of a "tropospheric scatter" system of radio relay; and development of a Data-Phone system in which "machines talk to machines," transmitting and receiving business data over regular telephone circuits, an electronic telephone switching system and a completely automatic production line for manufacturing deposited carbon resistors.

The coming years will undoubtedly see even greater technological advances by Western Electric. To spur such work in the future, an engineering research center has been established near Princeton, New Jersey. Here, engineers and scientists are doing basic research in the application of machines, materials and computers to manufacturing processes.

But, as in the past, the successful penetration into the future will come from the motive force, the unified momentum of all Western Electric and Bell System people.

The Western Electric Job

W.E.'s basic job is much the same as it was in 1882—to provide the Bell System with a reliable source of high quality telephone equipment. There are four principal ways in which Western Electric goes about this job:

MANUFACTURING: Western Electric produces to uniform standards of design and quality a great variety of equipment, wire and cable for the Bell System network. The task calls forth the cumulative effort of major plants in 13 cities.

DISTRIBUTING: Western Electric maintains 35 distributing houses for warehousing materials and supplies needed by the telephone companies and for the repair of Bell System equipment.

INSTALLING: W.E. installers handle the job of installing central office equipment for the telephone companies, completing in the field the assembly of complex switching and transmission units produced in W.E. factories.

PURCHASING: Western Electric buys from thousands of large and small companies the raw materials needed for its own manufacturing processes, and those finished products which are manufactured by others.

Manufacturing

Each year, Western Electric produces more than 50,000 different kinds of telephone products,

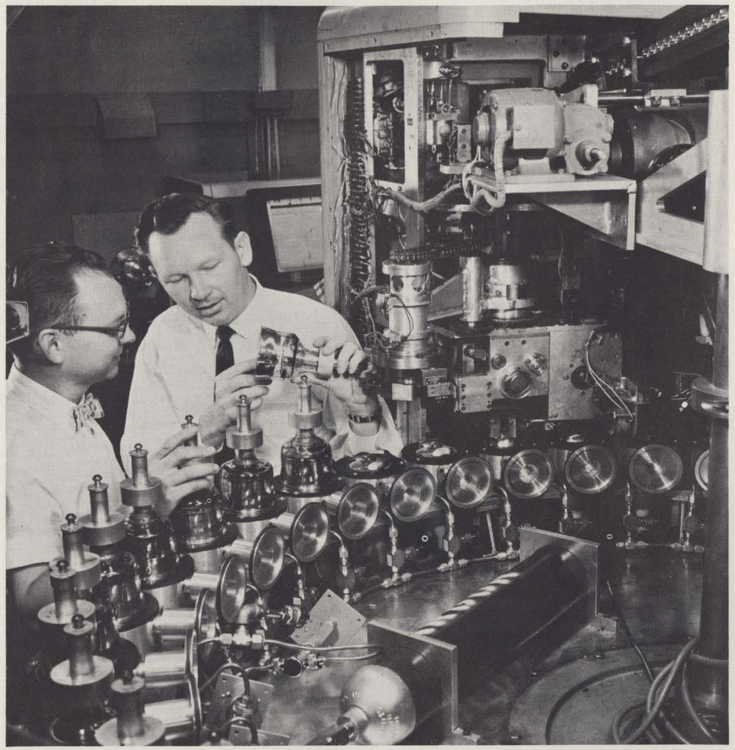
(Continued on next page)

covering a tremendous range including telephone sets, switchboards, cable, relays, coils and filters. Major manufacturing "Works" in 13 cities and numerous tributary Plants and "Shops" are constantly active satisfying the demand for these products.

Some of the 50,000 are made in quantity — the telephones, cable, switches, repeaters — to meet the needs of a growing America and to make possible the economies of volume manufacturing. Many, though, are made only in tens or hundreds, to perform specialized communications tasks or to keep serviceable the Bell System equipment that has been long in use.

The products of Western Electric vary greatly. In size: from giant reels of cable and tall central office switching equipment to tiny thermistors which are almost invisible. In shape: items round as a finger-wheel dial or square as a telephone booth. In complexity: from relatively simple mechanical switches to equipment as intricate as that employed in the recent developed "TASI" (Time Assigned Speech Interpolation) system which has doubled the capacity of undersea cables by actually permitting utilization of the normal pauses that occur during telephone conversations.

But each of W.E.'s products bears a common mark. Each has been subjected to rigid inspection and tests in conformance with unyielding Bell System standards. And, as a result, each is readily distinguishable by its built-in quality, a quality compounded from fine materials, engineering skill and the efforts of able personnel.



"This one needs a new cathode." That could be what G. L. McClamrock is telling A. J. Matthews, a fellow engineering associate at Western Electric Company's North Carolina Works. They are inspecting the computer-controlled terminating machine in the automated production line for manufacturing deposited carbon resistors. The gold cathode in the bottom of the bell jar he is holding is used to sputter a layer of gold on the ends of the carbon-coated resistor core. This gold termination forms a contact on each end of the resistor, to which the succeeding machine in the line attaches caps and wire leads.

Distributing

America's great chains of retail stores are successful largely because they compete vigorously in offering quality merchandise at the lowest prices possible while pursuing a "customer-is-always-right" policy of service.

Western Electric also operates a nation-wide chain of "stores" called distributing houses. Each of these stores has only one cusomer—the local Bell telephone company—and its job is to see that this one customer is furnished top-notch service and quality products at attractive prices.

The 35 distributing houses serve the Bell telephone companies in two chief ways: they furnish supplies and equipment and they repair service-worn telephone items. In addition, the distributing houses work closely with W.E.'s marketing organization which makes certain that (1) Western Electric is offering the products, services and supplies that the Bell companies want and need, and (2) that the telephone companies are thoroughly informed about the new products and services offered by Western Electric. Through the distributing houses pass the orders which the Bell telephone companies place on Western Electric. Some orders are filled from local distributing house stocks. Others are forwarded to the company's factory merchandise organization for scheduling and manufacturing, and still others are routed to the supplies service organization for shipment from suppliers on contracts arranged by the purchasing division.

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MEET THE NEW HKN OFFICERS AND DIRECTORS

R. J. W. KOOPMAN
President

Professor Koopman was born in St. Louis, Missouri, in 1905. While at an early age his parents moved to a farm in the vicinity of Wright City, Missouri, where he attended a rural school, Wright City High School, and Central Wesleyan Academy at Warrenton, Missouri. His freshman college year was spent at the Missouri School of Mines and Metallurgy at Rolla, after which he transferred to the University of Missouri at Columbia, receiving the B.S. degree in Engineering with major in Electrical Engineering in 1928.

From 1928 to 1931 he was associated with the General Electric Company in Schnectady, New York, doing work on vacuum switches, mercury rectifiers, testing rotating machinery and indus-

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HOWARD H. SHEPPARD
Vice President

Upon my graduaton from the University of Pennsylvania in 1932, with a B.S. in EE, the great depression was well underway, and the only electrical engineering jobs open to most of us were at Philco Radio at $15.00 a week.

Most of the EE's graduating from Penn during the depression took any jobs they could scrape up, and in many cases these were quite remote from electrical engineering. One started as a teller in a large industrial bank and is now the bank president. Another sold life insurance and today is the owner of one of the most successful agencies in the East. A third wound up as a nationally-known radio announcer and personality during the heydays of radio.

(Continued on Page 21)

THOMAS L. ROTHWELL
National Director

A 1928 vintage son of a Michigan school superintendent, Thomas L. Rothwell, Jr., enjoyed an old-fashioned straight-laced upbringing. Believing in the early development of independence and self-reliance, young Tom's parents encouraged his efforts in this vein.

Tom worked his way through High School as a stock clerk in a local supermarket. During this period he somehow found time to pursue a hobby he had loved since boyhood—flying. Model airplanes sufficed until age 16, the minimum for solo flight. At age 16 he "soloed" in the real thing. While enjoying this model airplane and flying hobby, Tom had discovered a new interest and was studying and developing a hobby that would ultimately affect his professional fu-

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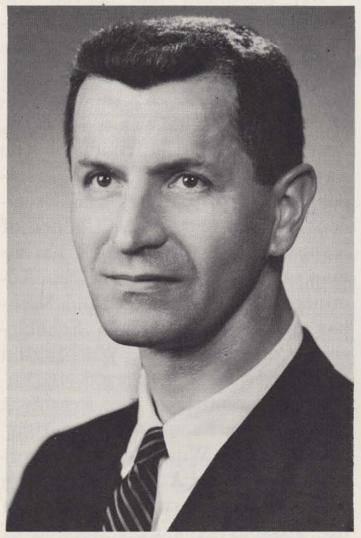

OCTAVIO M. SALATI
National Director

Octavio M. Salati was born on December 12, 1914, in Philadelphia, Pennsylvania. His family soon settled in the suburban Philadelphia area of New Jersey where he completed his elementary education.

He attended Haddonfield Memorial High School prior to entering The Moore School of Electrical Engineering of the University of Pennsylvania. He joined the Institute of Radio Engineers, the American Institute of Electrical Engineers and the Franklin Institute in 1934. He was elected to Lambda Chapter of Eta Kappa Nu in 1935. He received the B.S. degree in electrical engineering in 1936. Following brief employments with Philco and the Radio Corporation of

(Continued on Page 22)

WILLIAM P. SMITH
National Director

William P. Smith was born in Superior, Wisconsin, on January 5, 1915. He received the B.E.E. degree with distinction in 1936 and the M.S. in E.E. degree in 1937 from the University of Minnesota. From 1936 to 1937 he was a teaching fellow in the Electrical Engineering Department at the University of Minnesota. He was initiated into Omicron Chapter of Eta Kappa Nu in 1934.

After leaving Minnesota he was associated with the Commonwealth Edison Company of Chicago. In 1941 he was called to active duty in the Naval Reserve and served throughout World War II at the Inspector of Naval Materiel Office in Schnectady, New York. He presently holds the rank of Captain USNR.

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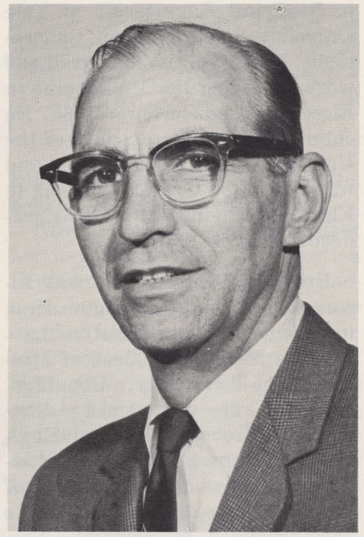

LAWRENCE F. STAUDER
National Director

Lawrence F. Stauder has been a member of the faculty of the University of Notre Dame since 1937. The Delta Sigma Chapter of Eta Kappa Nu was established at Notre Dame in April, 1962, during Professor Stauder's tenure as Acting Head of the Department. He is vitally concerned with the welfare of his students who have, in turn, selected him as Branch Counselor of AIEE (now IEEE) continuously since 1946. He has served AIEE as Section Chairman, District Chairman of Student Acitvities, as well as a member of several national technical committees.

A native of Illinois, Professor Stauder received his B.S.E.E., magna cum laude, from the University of Notre Dame in 1929. He accepted employment with General

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KOOPMAN (from page 12)

trial control, revising test manuals and standards, and preparing test codes for synchronous machinery. During this period he also attended Union College in Schnectady.

In 1931 he became an Instructor in Electrical Engineering at Yale University in New Haven, Connecticut, where he also did graduate work, receiving the M.S. degree in Electrical Engineering in 1933. He entered the Graduate School of the University of Missouri in 1934 and was appointed Gregory Scholar in Electrical Engineering for the academic year of 1934-35.

From 1935 to 1937 he was Instructor in Electrical Engineering, in charge of Communication Laboratory, Michigan College of Mining and Technology, Houghton, Michigan. He was named Assistant Professor of Electrical Engineering in charge of A.C. machinery courses at the University of Kansas, Lawrence, in 1937. He was promoted to Associate Professor in charge of A.C. machinery, power transmission courses and the power laboratory in 1940. While at the University of Kansas he continued graduate work at the University of Missouri during several summers and received the Ph.D. with major in Electrical Engineering in 1942.

In 1943 to 1946 he was Head, Electro Mechanical Section, Curtis Wright Research Laboratory (later Cornell Aeronautical Laboratory), Buffalo, New York. He was responsible for certain phases of a project to develop a system of telemetering from air to ground, various aerodynamic quantities and was also responsible for directing the development of a complete system of radio telemetering aerodynamic quantities from rockets.

In 1946 Dr. Koopman became Associate Professor of Electrical Engineering at Washington University, St. Louis, in charge of a graduate course in servomechanisms. In 1949 he was named Professor and Head of the Department of Electrical Engineering, which position he held until the reorganization of the Engineering School in 1961 when he became Chairman of the Electronics and Electrical Science Area—the position he now holds. During this period a significant graduate program at the doctoral level was developed.

In addition to his university duties, he has maintained a close connection with the developments in industry through summer appointments and development projects at the University. Among such assignments are, one summer with the General Electric Company on the solution of power system problems by network analyzer; seven summers with Lockheed Aircraft Company as Research Specialist, Research and Development Scientist, and University Faculty Associate on aircraft controls, autopilots, and electronic weapons' systems; two summers with the Midwestern Universities Research Association on power supply and distribution problems for a proposed proton accelerator. At Washington University he was Project Engineer on a guided missile project, Project Director on a servomechanism improvement and on a Naval Ordnance Fire Control project; General Supervisor of a Signal Corps Diversity Reception Project and a Bureau of Standards Ionospheric Propagation Project. He has been a consultant to a large number of companies on electrical system protection and on causes of electrical failures. He has written a number of papers and discussions on electric power, instrumentation, control and related subjects. His paper "Induction Motors on Unbalanced Voltages" with H. R. Reed won the 1937 AIEE National Prize for Initial Paper. His paper "Operating Characteristics of Two-Phase Servo Motors" has been widely quoted in papers and texts on Servomechanisms.

Dr. Koopman has served the Academic Community, Professional and Scientific Societies, Civic and Religious organizations in many capacities. At the University of Kansas he was a Member, Secretary, and Chairman of the Tau Beta Pi Advisory Board, Member of Advisory Board and President National Executive Council of Kappa Eta Kappa, Chief Freshman Advisor, Member of the Administrative Committee, and Member of the Summerfield Scholarship Committee. At Washington University he has served on numerous Committees, was President of the Men's Faculty Club in 1953, President of Washington University Association Advisory Board in 1959. In 1951 he was Chairman of the Missouri-Arkansas Section of the American Association for Engineering Education. He was AIEE Branch Counselor at the University of Kansas for several years, a Member of man Section Committees in Kansas City, Buffalo, and St. Louis; he has chaired AIEE National or District Technical Sessions or National Committee Meetings in St. Louis, Seattle, Santa Monica, Buffalo and Tulsa. He is a Member of the AIEE National Committees on Telemetering, Aero Space Instrumentation and the Instrumentation Division. He was a Member of the Education and Feedback Control Committees for several years and Past-Chairman of the Aero Space Committee. He was Vice-Chairman of the Kansas City Section, Treasurer, Secretary, Vice-Chairman and Chairman of the St. Louis Section. In 1954 he was elected Fellow of the AIEE with the following citation:

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THE SCIENTIST AND THE ENGINEER*

by
DR. LEE A. Du BRIDGE

President, California Institute of Technology

It is indeed a high honor to have been elected by your organization to the status of Eminent Member of Eta Kappa Nu. One has only to look through the list of individuals who have been given this honor in former years to realize what a privilege it is to join such a highly select company of great leaders in the fields of science, engineering and education.

I am more than a little humble about accepting this honor, but at the same time, I suppose, all the more pleased because, as you know, I am not exactly an electrical engineer. At the same time I must confess that during the last twenty-five years I have not been completely out of contact with the electrical engineering field. In the fall of 1940, through what might be called an accident of war, I was thrown inadvertently and somewhat unwillingly into the management of a large project of research and development in what today would clearly be considered an area of electrical engineering; namely, in microwave radar. In 1940, however, the word radar had not even been invented and microwaves were still pretty much of a laboratory curiosity. Because there was, therefore, no real engineering know-how in the microwave field and since the problems of generation and transmission of microwaves posed some pretty basic problems in physics, and since also at that time physicists weren't doing much that was very useful anyway, our Radiation Laboratory at M.I.T. was recruited largely from the ranks of physicists. They were mostly nuclear physicists at that, chosen because they had had experience in operating cyclotrons and had, therefore, been forced to learn something about high-frequency oscillators. Under the spur of military necessity this group of physicists did solve the physical problems which immediately faced them and then promptly turned themselves into a group of engineers to bring their ideas into workable and reliable military realities. Thus, without quite knowing it, or even intending it that way, the war-time radar groups really established a new field of electrical engineering—the field of microwave technology.

Now I mention this indcident not to rationalize my own election to eminent membership in your society but only to cite an example of what has been a major trend in all fields of engineering and in many fields of science during the past twenty-five years; namely, the closer tie between engineering and science. It is not my intention to use this occasion to present a thesis on this subject. It has been discussed at great length and almost ad nauseum in professional societies, in organizations of engineering educators and in the engineering literature ever since World War II.

The basic fact remains, however, that engineering and science have come closer together in these recent years and the result has been

(Continued on Page 20)

Dr. Du Bridge addressing HKN—WESCON Luncheon

*Text of remarks given by Dr. Lee A. Du Bridge on the occasion of his induction as an Eminent Member of Eta Kappa Nu at a luncheon held at the Statler Hilton Hotel in Los Angeles on Tuesday, August 25, 1964.

WESTERN ELECTRIC (from page 10)

Installing

When you pick up a telephone and call someone just down the street or in another country, your voice first passes through a central office or exchange located in a telephone company building. The central office is essentially a large switching system — a remarkable array of vacuum tubes, wires, relays, switches, and other components — which channels your call and thousands like it to the proper destinations.

Back in the 1880's it was not unusual for the men who built the switching equipment in the shop to go out and install the same equipment for the telephone company. In that way, the customer was assured of a top-notch installing job by the same company that made the equipment.

The principle is much the same today. But the job is largely handled by W.E.'s installation organization — an efficient, mobile force of thousands of skilled personnel who install almost 3,000,000 telephone lines a year on about 60,000 different jobs in more than 7,000 communities.

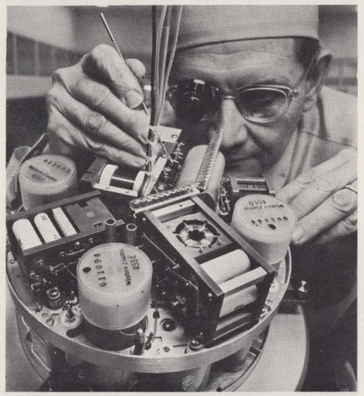
Included in this work are not only central office jobs for the telephone companies, but many special assignments such as large switchboard installation for business and government, installation of radio relay stations and terminal equipment for oceanic telephone cables.

Today's central office switching equipment is large and complex. About 87 major operations are required, for example, to install and test a 10,000 dial line central office. That office would include about 12,000,000 feet of wire, 500,000 wire connections and 225 tons of switching and power equipment. Obviously, no one is more familiar than the manufacturer with the requirements for the proper positioning, wiring and testing of that equipment. That is why the task is entrusted to the W.E. installer—an important link in the company's function of providing switching equipment for the Bell System.

Purchasing and Traffic

The alert American housewife knows the value of comparison shopping. She buys in quantity when it will save in the long run, but she's also smart enough to pass up questionable "bargains." She knows that quality must be considered along with price.

As purchasing agent, Western Electric uses the same techniques when it goes shopping for the Bell System and its objectives are the same: to get good quality products and the greatest value for every dollar spent. At the same time, W.E.'s purchasing people are guided by certain well-established principles. They give fair and impartial consideration to any reputable concern, large or small. They award business to dependable sources on the basis of the best price for material of desired quality and assured availability. They continually seek new materials and processes to improve quality and lower costs.



A technician at the Clark, N. J., plant of Western Electric, uses a dental mirror and a five-power jeweler's magnifying glass to inspect a soldered connection in the amplifier unit used in the rigid submarine repeater.

In recent years W.E.'s purchasing specialists have been spending more than $1,000,000,000 annually with outside suppliers for materials for the company's manufacturing operations and for ready-to-use supplies for the Bell operating companies, roughly one-third of the total amount being spent on the latter. More than 35,000 companies share in this volume and nine out of ten are small business, employing fewer than 500 people.

When W.E.'s buying specialists go to market, they take along a huge shopping list of more than 100,000 different items, including copper, steel, aluminum, plastics, telephone directories, poles, office machines and linemen's tools.

Coordinating their efforts with purchasing are W.E.'s traffic specialists—a corps of transportation experts who make certain that the millions of tons of material necessary in W.E.'s operations move quickly and economically and arrive as needed.

Our Nation's Defense

It takes an outfit with the right facilities, trained personnel, and plenty of skill to tackle large national defense projects for the Armed Forces. Western Electric has these resources. Even more important, Western Electric is part of an integrated Bell System effort in which research, supply and operation are blended to produce high quality, reliable communications networks. That is why the Government has frequently called on Western Electric and other Bell System team members to handle some of its biggest and "hottest" assignments. As a result, throughout the world, Air Force, Army, Navy, Marine Corps and Coast Guard units employ W.E. products or services.

Western Electric, as a matter of fact, has been contributing to our country's defenses for more than three generations — U.S. cavalry men at our Western frontier outposts in the 1870's used W.E. telegraph equipment. Since then, W.E.'s dependable products have been used in every period of national emergency.

The standards of quality and precision that Western Electric adheres to in the manufacture of critical military products are higher in some cases than any that have ever been set by an American manufacturer for commercial use. So uncompromising are its own standards of acceptability that in many areas of production, the military services have discontinued the stationing of inspectors at W.E. plants and rely entirely upon Western Electric for quality assurance.

As an examle of W.E.'s significant role in our nation's defense, the Nike family of guided missiles is typical. Western Electric, as prime contractor to the Army, has headed an industry team that has been engaged in the production of two generations of this weapon, and is now in the research and development stage of the third generation. First the Nike Ajax, an anti-aircraft missile with a conventional warhead. Next, the Nike Hercules, a bigger, faster version capable of carrying an atomic warhead. And now the Nike Zeus in advanced development, designed to travel at speeds of 15,000 m.p.h. and to destroy, with amazing accuracy, enemy intercontinental ballistics missiles long before they approach their targets.

W.E.'s role in the missile field includes other key projects. Command guidance equipment providing extreme accuracy is used for Air Force intercontinental ballistic missiles, National Aeronautics and Space Administration space-probe vehicles. Other missiles using W.E. guidance equipment are Marine Corps Terrier and Tartar missiles.

Western Electric is also called upon to furnish management services to the Armed Forces. On the basis of its proven organizational abilities, Western Electric was assigned the DEW Line projects, a string of radar stations stretching 6,000 miles across the frozen Arctic; the "White Alice" communications network in Alaska; the SAGE System of continental air defense; and management of the Sandia Corporation in New Mexico for the Atomic Energy Commission, handling the non-atomic aspects of nuclear weapons. W.E. and A.T.& T. also own Bellcom which is working on the Apollo.

Western Electric also designed and installed the rearward communications facilities for transmitting detection data from Arctic outposts of the Ballistic Missile Early Warning System (BMEWS), back to the control centers in the United States.

Western Electric also captained the industrial team which engineered and installed the worldwide tracking and ground instrumentation network for Project Mercury, the National Aeronautics and Space Administration's manned space flight program.

In addition, W.E. plants turn out special transistors for space satellites, fire-control equipment for naval guns, navigation and bombing equipment for planes, and underwater detection systems for locating the impact point of missiles. Soldiers in the field have telephone equipment made by the same people who make Bell telephones. In addition, more than 800 W.E. engineers, belonging to the Company's Field Engineering Force, travel the world over to show servicemen how their electronic tools of defense should be maintained in battle-ready condition.

Toward the Future

No one can predict the future with accuracy, but there are Bell System people who are already reckoning with the years to come. They are planning and working on the telephony of tomorrow.

From almost any perspective the future of telephony appears bright. In a rapidly growing America, the demand for telephone service is expected to reach phenomenal proportions. Today, about three-quarters of all American families have the convenience and protection of a telephone in their homes. By 1975 it is estimated that the number of subscribers will have increased to a point where as many as 95 or more out of every 100 households in the United States will have telephone service. This will amount to almost 65,000,000 households with telephones in use.

Engineering advances and the influence of contemporary design are already altering the appearance of the telephone and will alter it still further. At special shops in key W.E. plants, working models of future telephone equipment are being made in small quantities for testing purposes.

Already under test are "telephones of tomorrow"—novel, attractive, functional. Included are sets with push-buttons, replacing the long-familiar dials. Others are equipped with pre-set automatic dialing mechanisms, and on some the dials are in the handset.

Development work is under way on even more exciting telephones, apparatus and systems—picturephones, by which a user can see as well as hear the person he talks with; improved wave guides (hollow copper tubes) which carry as many as 400,000 telephone conversations at the same time; space satellites used as "mirrors" for reflecting radio signals between points on earth; "active" satellites with repeaters which will be able to receive, amplify and transmit telephone and TV signals; and extremely compact and efficient electronic switching systems for central offices. And, while voice com-

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WESTERN ELECTRIC (from page 17)

munication undoubtedly will increase greatly in the coming 25 years, it is anticipated that machine communication — the transmission of data between processing centers—will someday challenge it in volume.

The future appears to hold much in store for Western Electric: although electro-mechanical switching devices and equipment will be developed to greater levels of sophistication, we may expect that electronic devices will be used in ever-increasing numbers. Units will be smaller in size and will incorporate more printed wiring circuits. Certain types of units will be produced to operate at extremes of temperature, as in the case of mesa transistors, which will function at 450 degrees below zero. Plastics will be used increasingly in a variety of ways. Automatic machines, many pre-programmed on coded tape, will be used more and more, while giant computers will help direct production machines.

Advances in communication technology will be matched by advances in production methods. In other words, Western Electric is finding faster, more efficient ways to apply to its manufacturing, installation, supply and repair operations.

But while there may be new ways, new equipment and new materials, the goal will be the same: to help the Bell System give better telephone service to more people.

This, then, is the story of Western Electric — it calls for many things and many activities, blended together, to create the miracle of telephonic communications. It takes people and equipment, inventiveness and technical skill. It takes experience, and, above all, the fundamental desire to be of service to the public and the nation.

The outward characteristics of Western Electric's job are apparent, if you stop to think about them, every time you make a telephone call. The instrument itself, the vast switching apparatus behind it, the almost endless miles of wire and cable, have come from Western Electric. Three generations of Western Electric people have devoted themselves to the task of helping to expand and improve this great network. Their craftsmanship, their many years of experience, their pride in quality and durability, are built solidly into every piece of equipment and apparatus that bears the Company name.

One reason why Bell System service is good today, reasonable in cost, and will grow better and more useful, is that Western Electric people and the things they make are blended into the time-tested Bell System formula that combines research, supply, and operation.

SMITH (from page 13)

From 1946 until 1948 he was Dean of Pre-Engineering at Sampson College, Associated Colleges of Upper New York. He was at the University of Texas from 1948 until 1950 and received the Ph.D. from the University of Texas in 1950. He has been at the University of Kansas since 1950 and Chairman of the Electrical Engineering Department since 1955.

He has been active on research projects for the Office of Naval Research, the Signal Corps, and the Army Engineers. He also has served as consultant for a number of industrial organizations. He has presented papers to the AIEE and ASEE. In 1962 he served as consultant on Engineering Education in Bogota and Cali, Colombia.

Dr. Smith is a member of IEEE, ASEE, AAUP, Tau Beta Pi, Sigma Tau, and Sigma Xi.

He was instrumental in founding Gamma Iota Chapter of Eta Kappa Nu at the University of Kansas in 1962 and has served as chapter adviser since that time.

STAUDER (from page 13)

Electric Co., Lynn, Massachusetts, where he qualified for a cooperative program with a graduate degree from the Massachusetts Institute of Technology. He was employed by Allis-Chalmers Manufacturing Co., Milwaukee, 1934-1937, and has had summer employment and/or consultantships with Detroit Edison Co., Bendix Products Co. (South Bend) and General Dynamics (San Diego). His patents and publications have been principally in the area of electro-magnetic devices and systems. He is currently Resident Research Associate with the Controls Group of the Particle Accelerator Division of Argonne National Laboratory.

Professor Stauder is a licensed Professional Engineer (Indiana), a member of Tau Beta Pi, the American Society for Engineering Education and a Senior Member of the Institute of Electrical and Electronics Engineers. He is married and has one son, a sophomore in Electrical Engineering at the University of Notre Dame.

REAL & IMAGINARY (from page 2)

north up its tributaries to the Min River, two hundred and fifty miles into the little-known wilds of Tibet.

He had reached the upper valleys of the rocky Min in June, when the heat was terrific by day, the chill at night cutting to the bone, the wind an endless punishment. He had struggled up the shaly trail, his chair-bearer going ahead while he himself walked—and that was when the wave of fragrance met him and he first saw the lilies.

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PHILADELPHIA

Chapters HOLD JOINT Initiation

The Triple Initiation Ceremony and Dinner-Dance held jointly by the Lambda Chapter of the University of Pennsylvania, the Beta Alpha Chapter of Drexel Institute of Technology, and the Delta Mu Chapter of Villanova University provided an opportunity to hold a large and enjoyable affair at a minimum cost to all members. It also provided the chance to meet with members from other chapters on an informal basis.

This year's event was held at Kugler's Restaurant in Philadelphia. In past years it was held at one of the different schools, but there were certain advantages to having the affair at a private banquet hall.

Entertainment for the wives and dates of the members and pledges during the initiation ceremony is an important aspect. The decision to show them an Alfred Hitchcock movie, "North by Northwest," was well received and many members who had planned to be there for just the dinner and dance came early to see the movie.

The banquet was held in the English room and live dinner music was provided by three members of the Penn. Dance Band. Many distinguished members of HKN were present, such as Dr. S. Reid Warren of the Univ. of Penna., a former National President of HKN, and Mr. Holmes MacDonald of Drexel Inst. of Technology, a former National Vice President of HKN.

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Du BRIDGE (from page 15)

that new scientific discoveries are much more rapidly transformed into practical and useable things for men to use than was ever considered possible fifty years ago.

I would, however, like to make a few remarks on one aspect of this subject, which I trust may be of some interest to the student members of your organization. My remarks are based on this simple thesis that while engineering and science have come closer together in recent years it should not be assumed that science and engineering are identical subjects. It is true that the electrical engineering student must learn much more physics than used to be thought necessary. He must not know only about the laws of electricity but must know about quantum mechanics, the theory of solids, statistical mechanics, the nature of atoms, electrons, nuclei and radiation. He must also study many more advanced subjects in mathematics than used to be required. This is in addition to all of the usual material in what is called classical physics—the basis of the more traditional engineering disciplines.

Understandably, therefore, an electrical engineering student today may get the impression that there is very little difference between his undergraduate curriculum and that of his fellow students who are majoring in physics. "Why don't I just call myself a physicist and be done with it," he may say. His temptation may be increased when he gets acquainted with some engineers who are working in industry and finds, indeed, that they did take their undergraduate and possibly their graduate degrees in physics rather than in engineering. He will see many examples of graduate physicists who have become engineers and, if he looks further, he may even see examples of graduate engineeers who became physicists. He may well ask himself "what's the difference these days between the scientist and the engineer?"

I think the difference can be summed up in a brief but almost significant statement. The difference is not as much in the subject matter to be mastered but in the point of view of the practicing physicist as compared to the practicing engineer. A professional physicist studies and pursues his subject with the primary objective of extending the bounds of our knowledge about the physical universe. A professional engineer studies and pursues his subject for the purpose of putting our knowledge of the universe to practical use. A physicist pursues the study of solid-state physics in order to learn more about the nature of solids and their atomic, molecular and electronic structure. An engineer pursues the physics of solids in order that he may better understand solid-state electronic devices and develop better and more useful ones. A physicist pursues his study of nuclear physics in order to understand more about how the nucleus is built and what holds it together. An engineer pursues similar studies because radioactivity, nuclear fission and nuclear fusion have important practical applications and important future potentialities.

Now this difference in point of view between the scientist and the engineer is not a trivial matter, for in any professional field it is the point of view which one has which governs one's entire career. The process of conversion from a scientist to an engineer, or vice versa, while often achieved, may not be an easy one; and if it is done too late in life it may be difficult indeed.

My advice to the student, therefore, is very simple—as soon as it becomes clear to you in your own mind as to whether you are interested in the pursuit of knowledge for its own sake, or in the pursuit of knowledge for its usefulness, then you have decided whether to be a scientist or an engineer and you should begin at once to plan your education career accordingly. The sooner you can engross yourself in the goals toward which your career is to be directed, the more successful is your career likely to be.

REAL & IMAGINARY (from page 18)

It was an utterly impossible place for lilies, or for flowers of any kind; yet there were thousands of them, tens of thousands growing in narrow meadows and on the slopes. They stood on steel-sturdy stalks two to four feet high. Each bore clusters of large, fragrant, trumpet flowers which were white inside, the throat washed with gold, the outer parts flushed with wine-pink. Their perfume filled that whole harsh, hot area and half intoxicated him.

Before his men could figure a way to make a litter on which to carry him on an excruciating three-day journey to the nearest mission hospital, the downbound mules came, and stepped over him with their one hundred and sixty hoofs.

Eventually, after much anguish and difficulty in Chinese hospitals, Ernest Wilson reached Boston for another long siege of treatment. Soon afterward, the crates of lily bulbs arrived. They were in what seemed to be perfect condition, nearly seven thousand of them. They were planted; and next spring when Wilson could hobble about, the lilies came up and nearly all of them blossomed. Those in American gardens today are believed to be descended from those

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original seven thousand regal lily bulbs collected in 1910. They are easily grown, are inexpensive, and blossom profusely in early summer. Of all the flowery legacies left by Ernest Wilson, this lily of the wilderness is surely his finest.

by VIRGINIA EIFERT
EDITOR: THE LIVING MUSEUM

KOOPMAN (from page 14)

> "for contributions to the theory and practice of Servomechanisms and telemetering as well as his diversity of interest in the several fields of electrical engineering, through which he has become a well-rounded and inspiring teacher and educational administrator."

He has been Director, Treasurer, Vice-President and President of the Engineers' Club of St. Louis. Dr. Koopman was a Member of the Brentwood PTA Council for several years, President of Frazier School PTA and is a delegate to the November White House Conference. He is serving his second term as director of the Brentwood Public School System. He is a Past Master of the Masonic Lodge in Wright City, Missouri, is a Board Member of the United Christian Campus Fellowship at Washington University and was a Delegate from the Brentwood Congregational Church to an International Layman's Seminar in Chicago in 1956.

He has been a Member of Tau Beta Pi since 1927, Sigma Xi since 1935, Eta Kappa Nu since 1936 and was listed in *America's Young Men* 1938, *Who's Who in Engineering* since 1941, *American Men of Science* since 1944 and *Who's Who in America* since 1956.

SHEPPARD (from page 12)

Also of note is the one who became a prominent advertising executive, and another a sales promotion manager for a leading farm journal. One turned to the law and is now an outstanding patent attorney whereas one even became a highly popular minister. Apparently Electrical Engineering is a good background, no matter what you may be called to do.

One of my more brilliant classmates was a candidate for a well-paying position at the Stetson Hat factory until he unfortunately neglected to wear a hat to the interview, which led the employment manager to believe that he lacked basic intelligence.

In my case I spent the summer after graduation selling Real Silk Hosiery on the Eastern Shore of Maryland, and that fall through the goodness of heart of the University of Pennsylvania, I was able to return to Penn for graduate study.

Even after obtaining an M.S. in EE from Penn the best I could do was to accept the job at Philco Radio for the same $15.00 a week offered the previous year with a B.S. in EE. Dollars bought much more than today, so I managed to eat reasonably well, and was even able to help support my widowed mother wth a little bit left over for dates, providing we wound up for refreshments at the girl's home.

After a couple of interesting jobs, including a few years with McGraw-Hill Publishing Co., I joined the Rumsey Electric Company in 1937. Rumsey Electric specializes in selling power equipment to electric utilities and industrial plants, and has offices and representatives in key cities throughout eight Middle Atlantic States, combined with a complete electrical supply business serving the Delaware Valley, with headquarters in Philadelphia. My present position is Vice-President of Sales, as well as being a Director of the Company.

In 1938, in spite of six years of the so-called "new deal," we were still in a depression and it almost appeared to be a way of life. Hence without waiting for more of my life to slip by, I married and imported to Philadelphia a young graduate nurse from Windsor, Ontario, Canada, by the name of Margaret Sinclair. I met her as her patient during a brief stay in the Kingston General Hospital, which occurred during a visit to the 1000 Islands, and in my weakened condition, I was in a susceptible mood for marriage.

Our daughter Jane was graduated from the University of Pennsylvania last year and Susan is a senior at Penn this year, whereas our son Norman is in his second year at the George Washington University in our nation's capitol.

My activities in Eta Kappa Nu, since being initiated by the Lambda Chapter in my junior year at Penn, include serving as the Chairman of the Outstanding Young Electrical Engineering Award Dinner Arrangements Committee held in Philadelphia in 1941, President of the Philadelphia Alumni Chapter 1941-42, National Director 1962-64 and presently National Vice-President.

For the American Institute of Electrical Engineers (now IEEE) I served as Chairman of the Philadelphia Section 1951-52, Chairman of the Sections Committee 1953-55, and Vice-President Middle Eastern District 1962-64.

Becoming a Registered Professional Engineer enabled me to join the National Society of Professional Engineers wherein my assignments included serving as President of the Philadelphia Chapter and currently Director of the Pennsylvania Society of Professional Engineers. I was Chairman of the Engineering and Technical Societies Council of the Delaware Valley 10 years ago.

My alumni activities at the University of Pennsylvania include being President of the Engineering

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Alumni Society in 1954 and currently Chairman of the General Alumni Society Editorial Board.

Other organizations to which I belong are the Association of Iron and Steel Engineers, The Franklin Institute and the Newcomen Society in North America. Also, the Engineers' Club of Philadelphia; the Union League of Philadelphia; Philadelphia Cricket Club; the Wissahickon Skating Club; and Phi Kappa Psi fraternity.

These various activities and associations have been a source of gratification, but more especially they have given me the opportunity of knowing and working with a host of wonderful people throughout the United States and Canada.

However, there is no group with whom I have had any greater privilege and enjoyment of being associated with than those active in Eta Kappa Nu.

ROTHWELL (from page 12)

ture—electronics and amateur radio.

After completing High School in 1946 he joined the U.S. Army Air Corps for a three-year hitch. Two and one-half of the three years were spent in Japan, where he progressed rapidly to become Maintenance Chief for a communications outfit. Earning his amateur radio license just prior to leaving for the Orient in early 1947 proved to be a real advantage. It gave an opportunity for technical development, and occupied quantities of spare time. By the time he departed in 1949 he had become internationally renowned for his excellent communicating.

Returning home in the Fall of 1949 he met and married his vivacious wife Vivian. February 1950 found him underway at the University of Southern California in pursuit of his E.E. degree. In order to supplement their income he joined the Air Force Reserve in late February 1950. On 10 August 1950 President Truman sent him his greetings, and invited him to report in ten days for a 21-month recall tour of duty to assist in the Korean War.

This behind him, Tom returned to civilian life, and resumed college in Summer 1952. In Fall 1953 he was elected to Eta Kappa Nu. He was elected Treasurer, then President of Upsilon Chapter. As President, he attended the Eta Kappa Nu Golden Anniversary Convention at Urbana in the Fall of 1954. During college he also served as Vice President of the Tau Beta Pi Chapter, and Vice Chairman of the Student Joint AIEE/IRE Branch.

Joining Hughes Aircraft Company upon graduation in January 1955 Rothwell taught, and later supervised the training of graduate engineers on classified advanced electronics systems. During this five-year time period he attended USC evenings and earned himself an MSEE, in January 1959.

From early 1960 until mid-1961 he managed the company's retrofit engineering operation, with the responsibility for systems modernization through modification.

Recognizing the future of the field of digital computers as one of the most promising, Rothwell involved himself in the area related to their application for automatic checkout, test and monitoring. Currently Manager of Autotest Applications, he has the responsibility for charting the company's future course in this exciting new field. During this time he has made numerous technical contributions in the development of techniques and equipment in this area.

Active in Eta Kappa Nu since his election as an undergraduate, he was elected as Treasurer of the Los Angeles Alumni Chapter in 1959, and subsequently served as Secretary, Vice President, and President.

Recognizing this service to our Association, the Board of Directors, in establishing the new Western Region in 1962, appointed Tom Rothwell as one of its Directors. This appointment was later confirmed by the Assembled Convention of 1962. He served his appointed term with vigor, ability and enthusiasm, and has recently been elected to continue in his efforts for Eta Kappa Nu.

On the personal side—Tom and Vivian, married now for nearly 15 years, have a daughter 8½ and a son 4½ years old. The family favorites include flying trips, and campouts in the desert or mountains.

SALATI (from page 13)

America, he received the M.S. degree in electrical engineering from the University of Pennsylvania in 1939.

An early interest in music and experience with the repair of pianos and reed organs was responsible for his Masters' Thesis: "An Experimental Study of the Variation in Harmonic Content of Violin Tones." This study led to his subsequent employment at C. G. Conn Ltd., Elkhart, Indiana. Here he was engaged in the development of disc and wire recording equipment and studies of piano tuning using the Conn Chromatic Stroboscope.

In 1941, he transferred to the Hazeltine Electronics Corporation where he became senior engineer in charge of Antennas and Magnetrostrictive Delay Line Development. It was here that he conveived his first invention, the BNC connector.

In 1948, he returned to the Moore School to retread his engineering training with part-time research and academic work. Research on a U.S. Army Fire Control System was responsible for four additional patents. This work

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RESEARCH IN INVESTMENTS

By MISS SHIRLEY M. MARCO

BRIDGE Financial Editor

The skills of today's engineer will become the basic factors of tomorrow's research. The Electrical Engineering Field is still regarded in its primary stages as compared to what it will become in succeeding generations. Consequently, the investment climate is closely attuned to what is going on in the research laboratories of our major universities and in the research and development centers of our electrical manufacturing companies.

Today, the flow of development funds is going to various companies who are illustrating the foresight of tomorrow's leaders. Therefore, it is not what the actual cash earnings are today but what is the present worth of the research staff that the investment market seems to place a value on with regard to a particular industry. This is comparable to the situation which occured during the early 19th Century with the development of the "Great American Railroad System." Many years ago a young man developed the electric light bulb and in the process of this development came up with what we call the radio tube and said "a remarkable phenomena but no value." This might have been forgotten except for the foresight of what is now called Radio Corporation of America.

It is research and development like the above that interested *Fortune Magazine* to publish an article recently on "The Egghead Millionaires." My point is that

Miss Shirley M. Marco is an account executive with Goodbody & Co., member firm of the New York Stock Exchange. Her business consists of stocks, bonds and commodities. Miss Marco attended H. Sophie Newcomb College in New Orleans and later was graduated from the University of Illinois with a degree in economics.

electrical engineers are on the ground floor and are able to use basic knowledge when contemplating the investment of your disposable funds in the securities market.

The securities market reflects the attitudes and opinions of traders, financial institutions and the man on the street. How does one go about deciding what road to take? Several questions need to be answered first:

What is the outlook for the general economy?

Does it call for bold or cautious action?

Given the economic climate, which industries should do best; which companies within these industries?

In regard to the particular companies within the chosen industry the questions which occur are the following:

How up-to-date and competitive is plant and equipment?

What percent of earnings does the company "plow back" into research?

What percent of sales comes from new plants and how does this compare with competition?

How much is brought down from sales to earnings and from earnings to dividends?

After securities are selected on a diversified basis, they should be supervised continuously. We live in a static world, and the gilt edge security of today may become a "cat and dog" of tomorrow. New industrial trends and new products or technical processes can change the prospect for an individual corporation overnight. A management that has been successful may be on the verge of retiring. Patents may be close to expiration. Many things can happen. With business in a constant state of flux, changing conditions may require the sale of a security that looked good only a short time back. Buy-

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ing a security and forgetting about it can lead to disaster. Investments always should be watched carefully.

There are various avenues available for channeling investment funds.

Mutual Funds — These are investment companies whose sole business is to invest shareholders' money in securities and manage these investments for a fee. Its funds for investment are obtained through the sale of shares to investors. The money received from the investors is combined and invested as though it were a single account. Each shareholder participates in net income and capital appreciation in proportion to the number of shares owned.

The mutual fund receives its income from 1) dividends and interest payments made on the securities in which its money is invested; and 2) from net gains made whenever it sells its portfolio securities at an overall profit. (On occasion the fund will sell to offset gains against losses.) After deducting expenses, including management costs and custodian fees, the Fund generally pays out and balance in dividends (approximately every three months) and capital gains distributions (probably at the end of the year if any) to the shareholders. We will discuss mutual funds at greater detail in future articles.

Individuals with funds available for investment should undergo a self-examination with regard to the following points:

How dependent am I upon investment income?

How much risk am I able and willing to take?

Am I patient enough to give investments time to mature?

With reference to the above, there are three basic ingredients that can be blended toward completing a most delacitable and fruitful investment program.

Common Stocks — Some companies have only one issue listed—usually common stock, or, as it is sometimes called, capital stock. The common stockholder is an owner of the business in a broad sense of the word and he almost always has the right to vote for the directors of the company. Common dividends, which are determined by the Board of Directors, may be increased when business is good; if business is bad, or the Board wishes to conserve cash, dividends may be cut or omitted.

Preferred Stock — This is so named because it is given certain preferential treatment over the common. This usually includes, most importantly:

1—The right to receive a fixed dividend before the common receives any dividends, and

2—A prior claim against the assets of the company in the event of liquidation.

Because of these advantages, preferred stockholders are usually limited in their participation in company affairs. They generally have no voting privileges, except when a specified number of preferred dividends are defaulted, nor can they usually expect more than their stipulated dividend no matter how prosperous the company may be. If the company runs into hard times the dividend may be reduced or omitted. If it is cumulative, an omitted dividend must be paid before the company may pay any dividend on the common stock. But if the preferred stock is noncumulative, an unpaid dividend may be lost.

Bond — This is basically an IOU or promisory note, usually issued in multiples of $1,000, although $100 and $500 denominations are not uncommon. A bond is evidence of a debt on which the issuer usually promises to pay the bondholders a specific amount of interest for a specific length of time, and to repay the loan on the expiration date. The bondholder is a creditor of the corporation and not a part-owner as is the share owner. So long as the company continues to meet its obligations, such as paying the bondholder interest when due at the rate called for and paying off the bonds at maturity, he has no voice in the business.

A debenture is a form of bond which is backed solely by the general credit of a company and not secured by a mortgage or lien on any specific property. The debenture, which may or may not be convertible into common stock, has a somewhat unique place in financial history and is becoming the most popular form of debt financing.

Bonds, like stock, are an investment. Share owners and creditors alike are interested in the welfare of a particular business in very much the same way that a man's family and the bank which lends him money are both interested in his financial well-being.

I must caution you to note upon purchase whether or not the bond is subject to call before maturity. If it is, the issuer has the right of redeeming the bond at a stated price before the maturity date. One must avoid paying too high a premium for a bond (that refers to the present market price well over the current call price), in order to avoid the possibility of unnecessary loss. The current value of a bond will fluctuate with the rise or decline of the money market so that the current yield will equate itself with the going interest rate.

There are a wide variety of bonds: railroads, industrials, utilities, U.S. Treasury and tax exempts (usually of state and local government obligations). The latter have become extremely popular of late among the modest sized portfolios.

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After all this research, your question might still be what exactly influences the securities market other than its inherent characteristics:

A. International Political and Economic Situation.
B. Domestic Political Scene.
C. Labor Union Activities—settlements or strikes.
D. Automotive Production and Steel Production.
E. Railroad Carloading Reports.
F. National Association of Purchasing Agents Reports.
G. Retail Sales Figures.

And many more I could mention.

This is just to illustrate my point that the matter of investing one's hard-earned dollar employs the same principle of research and analysis that the Electrical Engineer uses daily in his laboratory.

Miss Marco will be pleased to answer specific questions of BRIDGE readers. Address questions to:

Miss Shirley M. Marco,
Financial Editor
The BRIDGE of Eta Kappa Nu
Dept. of Electrical Engineering
University of Illinois
Urbana, Illinois

SALATI (from page 22)

later led to a reliability study of the Navy Typhoon Analog Computer at Johnsville, Penna.

Since 1953, Tav (as his family and friends know him) has been active in research on electromagnetic interference and electromagnetic radiation hazards to mankind. This research led to his receiving the Doctor of Philosophy degree in 1963.

An early interest in mountain climbing and bicycling led him to join the American Youth Hastels (life member), the Fresh Air Club of New York, the Appalachian Mountain Club and the Philadelphia Trail Club. He has been active in these clubs as a trip leader and as a counselor. While living in New York City, he was in charge of the New York Office of AYH and was responsible for the Cabin weekends of Intercollegiate Alumni at Bear Mountain Park (Vice-President of I.A.). He presently is Faculty Advisor of the University of Pennsylvania Outing Club.

In Philadelphia, Brother Salati has been active in local section activities of I.R.E. and A.I.E.E. He is a past secretary and treasurer of the A.I.E.E., Philadelphia section, and was a member of the Atlantic City Convention Committees. He has served on ISA Committees and was chairman of the Utility Committee of the 1963 ASEE National Meeting. He is currently a senior member of IEEE, a member of the papers committee of the professional technical group on electromagnetic compatibility and chairman of subcommittee 2 and 3 of ASA C-95 on Radiation Hazards.

In Eta Kappa Nu, Brother Salati has served the Philadelphia Alumni Chapter as BRIDGE Correspondent (1958-59), Secretary-Treasurer (1959-60), Vice President (1960-61) and President (1961-62). He assisted in the induction of Delta-Mu Chapter at Villanova University (1961) and has been responsible for the annual joint initiation of the three local chapters (Lambda, Beta-Alpha and Delta-Mu). He is presently Faculty Advisor of Lambda Chapter.

Brother Salati is married, has three children, and now spends some of his spare time assisting in Cub-Scout and Little League activities.

PHILADELPHIA (from page 19)

Seated at the head table were the faculty advisor of Beta-Alpha Chapter at Drexel, Mr. Alan Glazer and his wife; the faculty advisor of Lambda Chapter at Penn., Dr. O. M. Salati, who is presently Eastern Regional Director of HKN and his wife; the M.C., Mr. Thomas J. Bauld, President of Lambda Chapter at Penn., and his wife; the Dean of the E.E. Dept. at Villanova, Father Mullen; the faculty advisor of Delta-Mu Chapter of Villanova Mr. Joseph Hicks; and the Guest Speaker Mr. Howard Sheppard and his wife.

Mr. Sheppard is a graduate of the Univ. of Penna., the Vice President of the Utilities and Power Dept. of Rumsey Electric Co., and presently the Natl. Vice President of HKN.

Mr. Sheppard spoke about the current activities of the national organization and suggested to the engineering students that they become Registered Professional Engineers. Mr. Sheppard feels strongly that this registration will have significant long-term effects by improving the image of engineers held by the general public.

Dance music was provided by the full 15 pieces of the Penn. Dance Band, under the direction of John Dunphy. Members and faculty present enjoyed the band immensely and were very enthusiastic in their compliments.

The entire affair was a fine success and each year it becomes better and better.

We are sure that many other schools which have chapters close to each other can benefit by combining together and enjoying the savings possible with a large group.

This type of affair can also serve as a starting point for more inter-chapter activities.

CHAPTER AWARDS FOR 1964

The New York Alumni Chapter of HKN had again the pleasure to select the outstanding college chapters, and honor them accordingly. Traditionally four regional awards and one national award are made for the best chapter report submitted by a student chapter located in the various parts of the country.

Eastern Region—Beta Pi Chapter, City College of New York.

East Central Region—Beta Upsilon Chapter, University of Kentucky.

West Central Region—Gamma Theta Chapter, Missouri School of Mines.

Western Region — tie between Gamma Chi Chapter, New Mexxico State and Rho Chapter, University of Colorado.

The Western region presented an unusual problem since two chapters were rated so closely in all respects that it was very difficult to select a winner. In all fairness it was desided to declare a tie and honor the two chapters equally.

While the selection of the regional winners was a difficult job, the selection of a national winner was an impossible one. Several of the regional reports were so excellent as to be considered for the National Award. Each of these reports was preeminent in one respect, and it was impossible for the Committee to select a winner. Hence, the committee decided that no National Award be made this year.

It may be of interest to the various chapters to learn something about the methods used in selecting the winners, and some of the outstanding features of the most excellent reports.

The committee members usually do not know the various schools and the activities of the chapters. It is most important, therefore, that the report in its contents and appearance, reflects the true nature of the chapter. The composition of the report is judged among other things on:

1. APPEARANCE OF REPORT
   a) the cover should be clean and professional in appearance.
   b) the report should be neatly typed.
   c) samples of work through pictures are most helpful.
2. ORGANIZATION OF REPORT
   a) numbered pages and a table of contents is desirable.
   b) each report should have an appropriate introduction.
   c) the report should preferably be divided in parts or sections.
   d) the number of student chapter members should be given, and each activity should be listed with the number of hours devoted to its accomplishment.
3. CHARACTER AND STYLE OF WRITING
   a) the writing should be informative in the engineering sense of the word. The report should be to the point, and should avoid long passages which contribute to the general information. Weight is not a substitute for good reporting.
   b) the report should be written in a factual, yet interesting style.

Most reports submitted conformed to the various points mentioned above. Some reports contained a very brief "summary of activities" which was very helpful to the committee.

In judging the activities, various categories were considered.

1. Activities designed by the chapter to help others.
2. Activities carried out cooperatively with other groups solely to help others.
3. Activities which were mutually helpful to HKN Chapter and others.

In considering the various activities the size of the chapter was taken into consideration. The average time per member to carry out the activities provided a weighing factor. New activities requiring initiative and organization carried more weight than continuing activities. In considering the regional winners for the National Award, regional characteristics had to be considered. Guest lecturers have been viewed as highly desirable, but had to be regionally weighted in accordance with the local availability of such people. The committee also had to consider the relative size of the chapter. A spectacular group effort of one large chapter was balanced by an interesting trip to a neighboring country by an individual who was chosen by a small chapter to promote good will among engineers of the other nation.

One chapter made laboratory insurance protection available to all students. For the low fee of fifty cents, a student could insure himself with a coverage of up to and including seventy-five dollars. This particular chapter made a hand-

(Continued on next page)

some profit of $345.00. Who said engineers are poor economists? Most generous was the time devoted by one chapter in slide rule and other tutoring sessions. This type of technical and unselfish activity was regarded as very highly desirable.

It is the hope of the N. Y. Alumni Chapter that the above brief description of some of the activities and reports will help the chapters in improving their programs and reporting.

Most reports submitted served as proof of the countless hours of service provided by the chapter members in the true HKN tradition.

Credit should also be given to the Awards Committee who have given many hours in reading and screening the reports: Dr. Frederick A. Russell, Awards Committee Chairman, Newark College of Engineering, N.J.; Philip F. Carl, Jr., American Electric Power Service Corp., N.Y.C.; William T. McMahon, Bell Telephone Laboratories, Wippany, N.J.; Bruce Renz, American Electric Power Service Corp., N.Y.C.

Assisting the committee in the final act of selecting the winners were the followng officers of the New York Alumn Chapter: Daniel Douglas, President, RCA, New York City; Berthold Sheffield, ex-President, RCA, New York City; Irving Engelson, Bridge Correspondent, Trenton Junior College, Trenton, N.J.

The New York Alumni Chapter wishes to congratulate the winners on their fine reports. Only through such reports can the National Headquarters know of the successful efforts of HKN chapters throughout the country to carry out the deals of service for which HKN stands. It is hoped that the awards will encourage even greater activities in all chapters for the current year.

Chapter Activities

ALPHA, University of Illinois — A pledge class of 33 members, plus actives, faculty, and guests attended the fall semester invitation banquet. Featured at the banquet were the Faculty Players of the University of Illinois who presented a whimsical one-act play, "Creative Confusion," and Captain George Oetting, Assistant Professor of Air Science at Illinois, who presented his "History of Magic."

The highlight of last semester was a trip by 16 members of IBM's Poughkeepsie, New York plant facilities. Included in the itinerarywasaninformative lecture on the latest work being effected at IBM and a tour of their computer research and production facilities at Poughkeepsie. IBM extended their hospitality by providing us with all meals, transportation, and lodging for the night.

Among activities sponsored by Alpha Chapter last fall was a movie, produced by Jet Propulsion Laboratory, on the successful Ranger VII moon shot. The complete series of photographs taken by Camera A was included. Over 650 students from different colleges of the University saw the movie.

The "E.E. Handbook," a review of pertinent information used in E.E. classes: conversion tables, physical constants, theorems, etcetera, is about to be published after three years of preparation.

Also on the list of activities was the Alpha Chapter sponsored Professional Engineering Exam Refresher Course and the Master Thesis projects file, compiled in part by the pledges who obtain them from staff members as part of their pledge duties. The outstanding senior award, formerly presented only once a year, is now presented in January and June to the senior who best represents the graduating Electrical Engineering class. Work is presently taking place on dressing up the lounge in the Electrical Engineering Building. When complete, the lounge is expected to have color television!

Finally, the guest speaker program, designed to bring to the bi-weekly meetings speakers from compus and industry, was most fortunate to have Dr. James Bardeen, Nobel Prize winner, who spoke on the development of the transistor.

BETA, Purdue University — Began its 1964-65 program by sponsoring a series of undergraduate seminars for all Electrical Engineering students. The topic areas ranged from space communication to micro-circuitry. Very high attendance indicated the general interest and importance of this program.

During the December 3 meeting, a very interesting speech was presented by Mr. R. F. Haglund. Mr. Haglund is a representative of Collins Radio Company, Rapids City, Iowa, and his subject was: "Engineering, Marketing, and Management." This topic was well received by all members since practically all engineers will need to associate directly or indirectly with the principles of management.

Beta Chapter initiated 47 qualified E.E. students at its fall initiation ceremonies on November 22. Our vice-president, Robert A. Sullivan, was master of ceremonies at the banquet. A very interestinng speech was given by vice-president, Dr. Paul F. Chenea, who discussed the humorous aspects of Purdue's Board of Directors' minutes from 1865-1880. Dr. W. H. Hayt presented an award to the outstanding freshman E.E. for the previous year. This went to Paul Heller who has a 5.91/6.00 grade average.

The "Double Eagle," Beta Chapter's newspaper for Electrical Engineering, is being published this year. It serves the E.E. School as a necessary voice and sounding board for the thoughts of both students and faculty.

THETA, University of Wisconsin — The most important innovation in Theta Chapter's activities for this past semester was the establishment of an "Eta Kappa Nu Distinguished Instructor to a selected graduate student instructor to "express appreciation for his outstanding classroom performance, and to encourage him to continue in the teaching profession."

Our annual "Distinguished Sophomore Award" was presented at an assembly of all freshmen engineering students in order to encourage scholarship and publicize our chapter. Other publicity activities included the preparation and distribution of a short flyer explaining HKN, and setting up a display case in the Engineering Building lobby.

After careful study, our High School Visitation Program was broadened to permit non-HKN members to participate this year for the first time. This program encourages and prepares students to return to their high schools to give a presentation and meet with students. The purpose of this is to answer questions concerning engineering as a field of study and how to prepare for it.

The Fall Banquet for initiation of 16 new chapter members featured industrial relations professor Earl Wyman speaking on "Engineers, Arabs, and Other Minority Groups." Another outstanding speaker during the semester was none other than HKN's Dr. Clyde Hyde, who spoke at the October meeting on the relationship between the HKN national and the individual chapter.

In the planning stage are tutoring sessions for basic electrical engineering courses to be taught by chapter members, and exhibits for the forthcoming University of Wisconsin Engineering Exposition, held every three years in the Spring.

LAMBDA, University of Pennsylvania —The Lambda Chapter's tutoring program, which is available to all E.E. undergraduates and which includes all technical and mathematics courses offered to E.E.'s, has been continued and streamlined to make it more effective and efficient.

We have also joined with the local branch of the IEEE in sponsoring a program of field trips to nearby industrial and research facilities to acquaint the engineering students with the opportunities and types of positions available to them upon graduation.

In the planning stage is a suitable symbol of HKN to be displayed in the Moore School of Electrical Engineering to inform new students and visitors of the presence of an HKN chapter at our school.

The coming Spring semester is the time for the annual Engineer's Day at Penn., and some members of HKN will provide projects for display and others will act as guides for this important event. Another event at which HKN members serve as guides is the annual session of the Engineering and Technical Societies Council of Philadelphia which invites superior juniors from local high schools to learn about engineering.

MU, University of California — The fall semester began with an officers' meeting to plan and schedule the Mu Chapter activities and to select a new faculty adviser. After the grade point list of eligible juniors and seniors was available, invitations were sent to them to attend the traditional smoker at the University's Strawberry Canyon Clubhouse. The smoker provides an informal get-together for meeting prospective pledges and answering their questions about the organization. Dr. Theodore Van Duzer gave an interesting talk on the values of attending graduate school. Interviews and the election of the prospective pledges were held during the following weeks.

The pledges were assigned two projects. One was an essay on a non-technical topic concerning the College of Engineering. The other was a wooden cutout of the traditional Wheatstone Bridge to standard specifications. The pledge's name is placed on the top two branches. Signatures of forty active members, graduate and faculty members, including all officers and the faculty adviser, are placed on the lower two branches. The initials HKN are inked in on the center portion. This project affords the pledges an opportunity to meet the members and also provides an impressive keepsake.

Following the Initiation Ceremony for 19 new members, the Initiation Banquet was held. Master of Ceremonies was the new faculty adviser, Professor Charles F. Dalziel. Guest speaker was Mr. Graham A. Rigby, visiting lecturer in Electrical Engineering from Australia. President Robert E. Lee made the Outstanding Pledge Award to iWlliam McCalla. Honorable Mention was given to Adelbert Owyoung for his outstanding essay, "The Education of an Engineer."

Our chapter project this semester was assisting the Electrical Engineering Department give tours of the graduate research facilities to sophomore and junior electrical engineering students. The purpose of this tour was to acquaint prospective E.E. students with some of the current research work being done in the E.E. Department. This may become a regular semester project. Also the men of Eta Kappa Nu assist the College of Engineering with orientation of new students. The Mu Chapter has a representatve in the University of California campus undergraduate engineering coordinating committee, the Engineering Joint Council.

President Robert E. Lee and Vice President Joe Moaveni attended a meeting at San Jose State College to assist the establsihment of a branch of Eta Chapter. Mu Chapter will have the privilege of inducting the men from San Jose State College into Eta Kappa Nu this year.

NU, Iowa State College — Last spring Nu Chapter decided to try to raise some money. We opened a concession stand at one of Iowa State's major activities. The active members put in about 200 man-hours on the project and I am happy to report a profit on the event. We made $1.83 or less than $.01 per man-hour. We have decided to try and find a project that will yield a little better return.

On December 7, 1964, 21 men began the first pledge week of the year. On December 11 the pledge week was climaxed by the traditional pie session. The 21 men were then inducted on Sunday, December 13.

One of our projects for the year is making a bulletin board for the pictures of our scholarship winners. The other project s to look into the possibility of sponsoring a schlarship for some of the JETS students. JETS is an organization for high school students interested in engineering. Every summer Iowa State has a short course for these students. We are interested in paying the cost of this short course for one or more students.

The cative members are looking forward to the annual banquet January 23 and the spring picnic in May.

XI, Auburn University — In concluding a highly-successful initiation week in November, Xi Chapter joined with other engineering honoraries under the guidance of the Engineers' Council for a joint banquet. This was the first time a joint banquet had been attempted, and the results were most encouraging. The banquet, which was attended by over a hundred honorary members and guests, helped all honoraries keep their expenses to a minimum, while simultaneously recognizing all new initiates. Members of other school non-honorary organizations [e.g. IEEE, ASME, SAM, etc.] were also invited and attended. We hope other chapters will try this innovation and find its results as gratifying as we did.

PI, Oregon State University — The major news from Pi Chapter this term is the success of its new pledge program. A pledge class consisting of 25 eligible students was organized. The names of the 25 individuals had previously been approved by the members. The pledge class was instructed to perform certain tasks to prove their desire and ability to work together. The main task was to compile, type, mimeograph, assemble, and distribute an Electrical Engineering Student-Faculty Directory, using departmental records.

Other pledge duties included an oral report on the engineering activities of two graduate students by each pledge and collecting the signatures of all staff members of Eta Kappa Nu. Of the 25 members of the original pledge class, 17 performed the tasks satisfactorily and were invited into membership.

Pi Chapter is now ready to tackle the various service projects it has planned for the rest of the school year. Among these is the selection of the outstanding Electrical Engineering sophomore for the year. The winner of this annual award receives a certificate and has his name engraved on a plaque, prominently displayed in the Electrical Engineering building. This award has become a highly coveted honor here at Oregon State University.

Other projects planned are tours of the Electrical Engineering facilities for the students and parents during Dad's eWekend, an annual all-school activity; a program of safety inspection of the Electrical Engineering labs, and the submission of recommendations for safety improvements to the department; a book auction, where used books donated by the students and faculty are sold to the highest bidder; and the arrangement for the Senior Class picture. This large framed collection of individual senior pictures, appropriately arranged and labeled, is to be added to a display of similar pictures of past classes, with smaller copies being sold to the senior students.

SIGMA, Carnegie Institute of Technology — Sigma Chapter is in its second year of sponsoring a departmental student evaluation committee. All students taking slectrical engineering courses are represented. The purpose of this committee is to provide the department administration with a picture of student feelings, suggestions, and attitudes regarding electrical engineering courses, instructors, facilities, etc. By retaining members from one year to the next, a more intimate relationship with the administration is expected, as well as a noticeable increase in organizational continuity. As this project evolves from the status of an experimental to that of an established institution, it is hoped that similar committees will be formed in other departments and that we may be of assistance to them.

Another project undertaken by Sigma Chapter during the fall semester was the procurement of technical displays for the lobby of the student activities center. Prior to this time, the displays were of a non-technical nature, such as art dsplays. Therefore, contact was made with several companies concerning their donating technical displays, and their response was most encouraging. The companies scheduled for displays in the coming year include Alcoa, Esso, General Electric, Kodak, General Motors, and Bell Telephone of Pennsylvania. The only cost is for the shipping charges, and the displays provide an excellent opportunity for the campus community to become acquainted with our honorary.

This fall, Sigma Chapter held a smoker for all prospective pledges. The purpose was to acquaint these men with the active members and with the honorary itself. Likewise, the actives had a chance to meet these men before membership elections were conducted. The success of this first smoker has assured it of being a regularly scheduled event each semester.

Twelve pledges were inducted into Sigma Chapter at the fall initiation and banquet held jointly with Beta-Delta Chapter.

UPSILON, University of Southern California — Prospective candidates were invited to a smoker at which they were introduced to the members. Following this smoker, those candidates elected to pledge status underwent the rigors of a pledge week. This week included the performance of various pledge duties. This week was culminated by an informal initiation, during which tests and interviews were given the pledges.

Those pledges elected to membership were formally initiated at a ceremony on November 28. This initiation and the following banquet brought to a fitting climax a very exciting day which saw USC's stunning football defeat of the University of Notre Dame. The game was the topic of conversation at the banquet following the initiation which was held at Sir Michael's Restaurant in Los Angeles. Mr. Robert Knox, Chief Scientist of the Minuteman Division of Autonetics and also one of the newly-initiated professional members, was the guest speaker. He spoke about the development of the Minuteman rocket and supplemented his speech with an interesting film about the Minuteman rocket.

Members of Upsilon Chapter were pleased to initiate members for Eta Chapter of California State College at Long Beach on December 19. Upsilon Chapter did this since Eta Chapter was not yet a full chapter.

In addition to activities previously mentioned, Upsilon Chapter took part in the annual High School Institute at USC as well as in other school activities. Plans for projects of benefit to the school are currently being studied and will be confirmed at a later date.

PSI, University of Texas — The Psi Chapter of Eta Kappa Nu had quite an enthusiastic semester during the Fall, 1964. The major events held were the organization, pre-election, election, and first pledge meetings; however, the awe inspiring "thrillers" were the pledge work day and the pledge picnic, both having been held at Professor B. N. Gafford's home on Lake Austin. The formal initiation saw 22 undergraduates, 13 graduates, and two faculty, Dr. Lyndon Taylor and Prof. E. J. Wagner, become members of HKN.

A new asset to the University of Texas campus came last Fall with the dedication of the $6.8 million Engineering Science Building, which has been called the electrical engineers' "paradise." All in all, the Fall semester has been very worthwhile and meaningful to President Bob Hank's HKN Chapter at Texas.

BETA GAMMA, Michigan Tech. — The Beta Gamma Chapter of Eta Kappa Nu this last fall commenced its first full school-year of activities on the campus of the newly named Michigan Technological University.

The first project of the year was to sponsor the annual slide-rule class for the nearly 900 incoming freshmen. Attendance was completely voluntary and the class was designed and taught to familiarize the new students with the value and time-saving convenience of the instrument in making calculations. In six class periods the various operations were explained, varying from simple multiplication and division to the use of the more complex log-log and trig scales.

Recently the Beta Gamma Chapter has gained 12 new worthy members, as new initiates were just inducted into the chapter.

The next big project to be considered by Beta Gamma is our contribution to the bi-annual Engineering Show to be held in May on the Michigan Tech campus. Tentative plans are to combine our efforts with those of the IEEE Chapter on campus and construct a joint project to represent the electrical engineering department. The project certainly will prove to be a challenging task for us all.

BETA EPSILON, University of Michigan — The first meeting, held early in the fall, was a general business meeting for the newly-elected officers. It was devoted to starting the new activities and to considering new projects. Committees were apponted to admnister the actvities of the Chapter and to take action on proposed worthwhile projects. At this meeting the approximate schedule of meetings was set up for the semester.

THE OLD PROFESSOR SAYS: My nephew Elmo has just bought a lovely house high on a hill overlooking the payments

The second and third meetings of the Chapter were business and pledge election meetings. The business included both Chapter and National matters. The election of pledges follows recommendations by the elections committee of those eligible for membership and examination of each candidate's qualifications by the entire membership. hTe latter is done chiefly by means of questionaires filled out by the candidates, and by personal contact with them by the members.

The pledge meeting was held midway through the semester. The pledges were instructed on the Society and the National and Chapter activities and were assigned the various pledge duties which are described in a later section. The formal meeting was followed by an informal session in which the pledges mixed with the officers and themselves.

The following two meetings were attended by both pledges and actives. They served as business and informal smoker-type meetings, and gave the pledges and members present an excellent opportunity to become acquainted with each other. The second of the two meetings included a written pledge test.

The final meeting of the semester was held on December 2, 1964. This was the Formal Initiation and Banquet and was the high point of the semester's activities. The formal initiation was held early in the evening and the banquet followed at a well-known local restaurant. The turnout at the banquet was excellent and the fine food and speaker made a very enjoyable and memorable evening. And having A. D. Moore [eminent member] as toastmaster, provided the wit and commentary to enhance the occasion.

Following the practice established recently, the address was presented by Prof. Howard M. Wolowitz, dealing with a non-engineering subject. The subject was "The Theory of Dreams" and was exceptionally interesting and thought-provoking. The evening's program also included an address to the newly-elected members by the president, followed by a response by a representative of the old pledge class. Also, the presentation of the outstanding pledge award was an important part of the evening's program.

BETA THETA, Massachusetts Institute of Technology — This term's pledge social served as an escape for the seniors taking the November Granduate Record exams. It was held in the Senior House basement November 21, the evening after many of the seniors—pledges and members—had spent the day fighting the exams at scattered places in the Boston area.

Instead of confining the foodstuffs to beer and pizza, the committee provided greater quantities of liquid refreshments supplemented with chips and dips. Those who attended reported that the social was a great success. Virtually nothing was left at the end, although the beer keg was still providing large quantities of foam for those remaining at the close of the evening.

With Open House quickly approaching, one of the committees was working on preliminary plans for the EE student exhibits. The final plan to attract projects for the department exhibit is the prize contest which has been announced in some of your classes.

Three $25 prizes are being offered for the best EE type lab projects submitted for display in April. One prize will be for 6.70, 6.71, and 6.342 projects entered. Another prize is offered for the best 6.72 and 6.73 project entered ni the contest. The remaining prize category is open to any project from any student which does not fit in the previous divisions.

Since HKN pledges have great quantities of time and there is little money available to finance pledge activities, the pledge committee convinced Stu-Fac to provide the prize money. The HKN committee has provided publicity in the Course VI classes.

Dr. Harold Edgerton was featured Tuesday, November 24, in the Bush Room. Dr. Edgerton spoke on one of his many interests. Unfortunately, Bush Room scheduling problems prevented this noted personality from reaching more Coure VI students.

The summer job committee started as a project to obtain and distribute information of specific interest to Course VI students. The Placement Office does not maintin files of the type of information desired.

However, the Placement Office does not miss a good opportunity for student help. The job committee was busy sending out letters to find possible leads for summer opportunities.

Many of the replies will be of interest to EE students and should be arriving shortly. If you are hunting for a summer job, keep a close watch on the Placement Office literature and stop in occasionally in 24-211.

BETA OMICRON, Marquette University — Among the activities generally participated in by the Eta Kappa Nu members at Marquette University are tours and problem solving sessions for undergraduates. While tours dwindled during the fall semester, the help sessions didn't. In these, students with problems in Engineering or Science studies may come to a prearranged room where members of the honor societies are on hand to help.

In the planning are trips to high schools to get students interested in Engineering. This will be done in conjunction with a recruitment committee.

Also visits to the evening division Electrical Engineering classes will be made to inform these students about Eta Kappa Nu. Now that we have several members from the evening school, efforts can be made to bring the day school activities just a little closer to the evening school students.

BETA-PHI, University of Tennessee — This past quarter saw eighteen members inducted into the Beta-Phi Chapter of HKN. This pledge class has been very active in promoting and bringing recognition to Beta-Phi. All sophomore electrical engineering classes were visited and a brief explanation of the purposes and objects of Eta Kappa Nu were given. A large poster was also made, dsiplaying the names of the pledges and actives of Beta-Phi and was hung in the main entrance of Ferris Hall, the electrical engineering building. We feel that such a program will help to inspire the underclassmen to strive to achieve the goals set forth by Eta Kappa Nu.

The highlight of the quarter was the induction banquet in which the initiates were given their keys and certificates. We were especially fortunate this year to have Mr. Charles E. Hickman, a faculty member of the EE department, as our speaker. Mr. Hickman, who had recently returned from a three-month tour of the Soviet Union, presented a very informative speech, accompanied by several slides.

Beta-Phi has had several notable projects this quarter. We were very proud to have an employment survey, recently taken by the chapter, printed in the Eennessee Engineer, the official publication of the College of Engineering. This survey, based on data collected at U.T. for 1962-63, shows starting salaries for each college as well as for each engineering department. A second project, which is still underway, is the compiling of an elaborate folder to be placed in the Engineering Library thoroughly describing the EE technical electives. This pamphlet will contain information on courses offered by other colleges as well as those engineering courses which may be taken for credit. In January HKN and the IEEE co-sponsored an informal program to promote and inform other students about electrical engineering. This program was planned especially for the Freshmen students who had not decided which phase of engineering they would like to enter.

GAMMA THETA, University of Missouri — The most important activities are as follows: providing guides for visitors on Engineer's Day and Parent's Day, printing pamphlets to be distributed among the students showing pictures of the E.E. instructors and listing some of their qualifications and backgrounds, printing various "characteristic curves" to aid the instructors in teaching certain subjects, and providing a fund from which two scholarships of $200.00 each are given to deserving students each semester. eW are also proud to announce that we have taken in 27 new members and a professional member, Dr. Ralph St. Clair Carson, who is a new instructor in the E.E. Department on this campus.

GAMMA NU, Texas Technological College — Gamma Nu Chapter at Texas Tech initiated eleven new members this fall, one of the smallest groups in several seasons. The Chapter joined with the Texas Beta Chapter of Tau Beta Pi in sponsoring the Fall Banquet at the Lubbock Country Club to honor the new members. Mr. Roy James, a Tech EE Graduate, now with the Sales Engineering Division of Southwest Public Service Co., spoke to the assembled members and their guests on the topic of Public Speaking for Engineers.

A program of major importance to our school was initiated by the chapter this fall. At Texas Tech, as at other schools, there is a high attrition among Freshmen who have declared themselves as Electrical Engineering majors. Many one reason or another, change their ma- of these are promising students who, for joh field before ever having taken an E.E. course, or having had a chance to become acquainted with the department. Our chapter organized and sponsored a symposium for Freshman E.E.'s, featuring addresses by Dr. H. A. Spuhler, Department Head, other members of the staff, and officers of Gamma Nu Chapter. The more than sixty freshmen who attended evinced a lively interest in the proceedings, and joined enthusiastically in a penetrating and informative question and answer session after the formal activities. It is too early to estimate how many potential E.E.'s we "saved," but the signs have encouraged us to make this an annual program.

The chapter has purchased a Building Directory Board which is being installed in the West Engineering Building at Texas Tech. Besides housing the E.E. Department, this building contains the College Placement Service and the Offices of the Dean of Engineering.

GAMMA XI, University of Maryland — The 1964-1965 academic year promises to be another successful one for the Gamma Xi Chapter. With the fall initiation the chapter gained ten new members: two seniors and eight juniors, five of whom were honor juniors. The tutoring committee offered its help, with little response, to floundering EE sophomores. Members of HKN participated in the TBPi sponsored slide-rule course for freshmen and sophomore engineers. For the first time this year, members of the EE Faculty, HKN, IEEE and TBPi formed a student co-ordinating committee to promote better student-faculty relations. This group has been meeting once every month.

An HKN bookmark is being designed and will be printed before the spring semester. A bookmark and a copy of "A Worthwhile Goal" will be made available to undergraduate EE students at each registration by an HKN Committee.

GAMMA OMICRON, Southern Methodst University — Our efforts of the past several months in starting a new student radio station were richly rewarded when KSMU began normal line carrier broadacst activities in October.

Students of all schools of the unversity have cooperated enthusiastically to make this project a success. Eta Kappa Nu members concentrated activities on the technical aspects of the project. eW checked out and installed the line carrier transmitting units. We built new cabinetry for and renovated much existing equipment such as turntables and cueing equipment from the TV-Radio Workshop and installed it in KSMU's new quarters in the newly enlarged and remodeled student center. Dr. Charles Baker and Dr. Kenneth W. Heizer of the Department of Electrical Engineering gave generously of their time and effort in giving technical aid and advice.

This Fall the members of Gamma Omicron Chapter were again rewarded by success in a freshman tutoring project. The project began as slide-rule proficiency sessions. These sessions were deemed valuable to freshmen because the new freshman curriculum contains a computer programming course in place of a former course which included slide-rule training. Aware of the value of thorough familiarity with the slide-rule to an engineering student, this chapter planned the proficiency sessions including instruction using a Keuffel and Esser projector slide-rule as a visual aid. Several non-engineering students also attended the sessions. The program branched out spontaneously to offer aid in the freshman courses, particularly in chemistry and math.

A smoker was held the evening of November 3, 1964, to acquaint prospective pledges with HKN and with the members of Gamma Omicron Chapter. Ten new members were initiated on December 12. Keys and shingles were presented on aJnuary 9, 1965, at a joint banquet with Sigma Tau engineering fraternity and Pi Tau Sigma mechanical engineering fraternity honoring new initiates of the three groups. The banquet was attended by 91 persons, including student and faculty members and their wives and dates. This was the largest attendance of any engineering school banquet to date. After a steak dinner, Mr. T. Carr Forrest of Forrest and Cotton consulting engineers, spoke on the topic "Where Do You Go frome Here," regarding the responsibility of engineering students to continue their education beyond the bachelors degree.

GAMMA RHO, South Dakota State University — Ten new members were initiated into Eta Kappa Nu November 19, 1964, by Gamma Rho. All of the initiates are students at South Dakota State University.

After the initiation ceremony and banquet, all initiates were asked to present a prepared humorous speech.

GAMMA CHI, New Mexico State University — Consulting psychologist, Dr. Frank M. duMas, of this university, delivered his talk on "Psycho-Physics," 21 men were inducted, and the full semester's activities were underway in the award-winning chapter of this region. Following are some of the current projects:

The new initiates are in charge of maintaining the "electrical engineers, this is your home" atmosphere of the E.E. study hall by brewing and selling soffee, providing reference books, and aiding underclassmen in their studies. They also keep the bulletin board posted with HKN, E.E. Department, and employment news.

A "magaznes" committee is presently preparing a list of readable technical magazines for the study hall. Subscriptions for these will be bought by Gamma Chi Chapter.

The new officers met with the officers still in their staggered terms and outlined objectives of their term. Among these are: promotion of active instructors for the introductory E.E. course and special slide-rule class, manning the open house displays during Engineering Week, and the award of a $50 textbook scholarship to the outstanding sophomore E.E.

Two tube curves have been added to each of the sets sold by the chapter as a funds source.

Members of Gamma Chi Chapter are striving to win the Western Regional Silver Plaque Award for outstanding activities again this year—that would be three times in a row.

DELTA ALPHA, Wayne State University — In June, Delta Alpha Chapter took part in the annual HKN-IEEE picnic. The informal atmosphere provided an opportunity for broadening the contack between student and instructor and among students.

During the summer, members continued to give periodic talks and demonstrations on electrical topics to a group of Boy Scouts. Included were a demonstration of electrical machinery and a talk on digital computers.

One chapter is preparing to take part in a joint effort with other engineering student organizations to increase the nterest and participation of freshmen and sophomores in campus activities. As part of this program, a display describing Eta Kappa Nu will be constructed.

DELTA EPSILON, Ohio University — New ideas were discussed, the mejority of which aimed at the better acquaintance among faculty and students and in general among the chapter and the university student.

Among the many activities of the chapter the most important ones were the initiation of new members, the pledge project and the sophomore award.

There were five new qualified students initiated to the chapter this semester. Their pledge project was the following: Since many of the freshmen—and sometimes sophomores—that plan to study engineering do not usually have much information about the courses they have to take ,the chapter tried to help them. Each of the pledges did some research about various E.E. courses, interviewed the professors that teach them, and finally wrote a short paragraph with information about these courses. All the information was gathered and put together in a form of a booklet to be distributed among the freshmen and sophomores in Electrical Engineering.

But the new step that this chapter took this semester in encouraging and promoting high academic accomplishment within the undergraduate classes was the establishment of the "Sophomore Award."

The chapter is sponsoring a Sophomore Award to be given to the outstanding sophomore in E.E., student of Ohio University, at the end of the second semester of each academic year. A

plaque will be established and maintained by Eta Kappa Nu in the Electrical Engineering Department for the purpose of publicizing the Sophomore Award and recognizing its recipients.

Each year the recipient will receive a commemorative gift donated by the active members of the chapter and have his name engraved on a brass plate and attached to the plaque.

DELTA ZETA, Washington University — On December 5, 1964, nine new members were initiated into the Delta Zeta Chapter. After the initiation, a banquet was held, and the chapter was fortunate to have in attendance both Professor R. J. W. Koopman, National President HKN and Chairman of the EE department at Washington University, and Professor P. K. Hudson of the University of Illinois, National Executive Secretary of HKN. To his great surprise, Professor Hudson was the after-dinner speaker.

The Chapter has made plans to procure some permanent initiation equipment. Plans are also being made to give an award on the basis of the annual Engineers' Day projects to a student or students of the EE department. The nature of this award and other details will be decided early next semester.

DELTA ETA, University of Massachusetts — On November 21, 1964, Delta Eta Chapter initiated 14 new members into Eta Kappa Nu: 5 seniors and 9 juniors. Following the initiation our annual Fall banquet was held at the Red Barn in Chicopee for all members and their guests.

Presently Delta Eta Chapter is engaged in designing lighting equipment to be used for the Spring water ballet show at Mt. Holyoke College. The lights will be attached to the swimmers and used underwater during the performance.

Weekly movies have been shown by the Chapter on various phases of electrical engineering. These movies are open to the public without charge. The Outstanding Senior Award Committee has started their work to select one senior electrical engineer who has shown excellence in scholarship, leadership, and interest in his profession and his school.

DELTA IOTA, Louisiana State University — The Delta Iota Chapter of HKN has been active in various activities this semester, one of which included a publicity program to familiarize new freshmen with the Department of Electrical Engineering, and in particular, to interest them with majoring in E.E. Although we feel that there was much room for improvement in this vicinity, we hope that it will become an annual event and encourage many students into the field of electrical engineering.

DELTA KAPPA, University of Maine —This past semester the major projects of Delta Kappa Chapter have been the holding of tutoring sessions for sophomore members of the Electrical Engineering class and maintaining the department reading room.

On November 11, 1964, the student members of HKN served as guides in a program sponsored by the Main Section of IEEE, to show high school students some of the opportunities available in Electrical Engineering.

Presently plans are being made for extending the tutoring sessions to include juniors during the spring semester. Plans are also being made to engrave slide rules during the spring semester. In the past this has been found to be a very profitable venture.

DELTA TAU, University of Southwestern Louisiana — Delta Tau Chapter of Eta Kappa Nu is now starting its third active year on the campus of the University of Southwestern Louisiana. Eight new members were initiated into the chapter December 14, 1964, increasing the membership to 13 active members.

This year Eta Kappa Nu will spearhead the Department of Electrical Engineering during the Engineering Days activities Mary 5 and 6. All members will take part by either presenting their own project or assisting the Electrical Engineering Department.

A large wooden copy of the shield, made by Frank Corts, will be used to improve the initiation ceremony and make it more meaningful to those being initiated. Plans for the future projects are now underway.

DELTA PHI, University of South Carolina — On November 24, 1964, six new members were inducted into Delta Phi Chapter of Eta Kappa Nu. Following the initiation, a banquet in honor of the initiates was held. The speaker was Dean C. H. Witten of the University of South Carolina, whose topic was on the history of the University of South Carolina.

The fall semester also saw the publication of the "Delta Phi Engineering Review," which included various articles on the activities of the engineering societies on campus.

In February, the chapter will cooperate with the other engineering societies to make the Second Annual Engineering Exposition a success. Last year's exposition was a tremendous success, and we hope that it will be an even bigger success this year.

DELTA SIGMA, University of Notre Dame — Delta Eigma Chapter began the fall semester with a seminar in October on graduate schools. Members of the faculty of the Electrical Engineering Department and of the School of Business Administration discussed the factors which might influence those planning on graduate study. In this same area, plans are now being made to assemble a collection of graduate school catalogs for the use of next year's seniors.

In conjunction with the local IEEE Chapter, we also sponsored a lecture and panel discussion on opportunities for electrical engineers in industry. The panel was composed of five employment interviewers fro mmajor firms as well as the Notre Dame Placement Director.

This semester we accelerated an effort to contact former Notre Dame students who were graduated before the founding of Delta Sigma Chapter, with the intention of niitiating them as Professional Members. At the fall initiation ceremonies two such members were inducted, along with one graduate student and 13 undergraduates.

A banquet for all members, the faculty, and their wives followed the initiation ceremonies. Our guest speaker was Professor Edward A. Fischer of the Communication Arts Department, who is currently writing, producing, directing, and acting in a television series on how to watch motion pictures. Professor Fischer provided us with a very interesting talk on the correspondence between artistic design and science.

SONNET

Shall I compare thee to a Summer's day?
Thou art more lovely and more temperate:
Rough winds do shake the darling buds of May,
And Summer's lease hath all too short a date:
Sometimes too hot the eye of heaven shines,
And often is his gold complexion dimm'd;
And every fair from fair sometime declines,
By chance or nature's changing course untrimm'd:
But thy eternal Summer shall not fade
Nor lose possession of that fair thou owest;
Nor shall Death brag thou wanderest in his shade,
When in eternal lines to time thou growest:
So long as men can breathe, or eyes can see,
So long lives this, and this gives life to thee.

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