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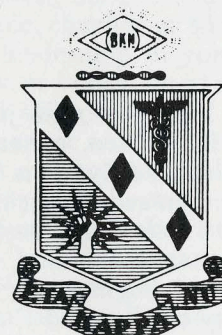
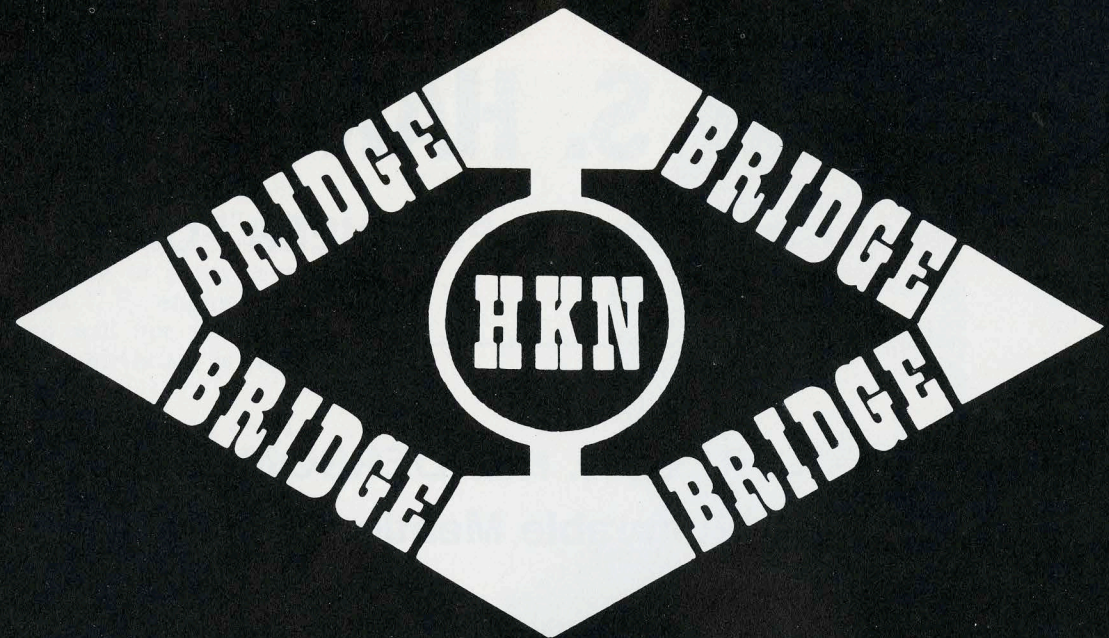
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The Bridge of Eta Kappa Nu



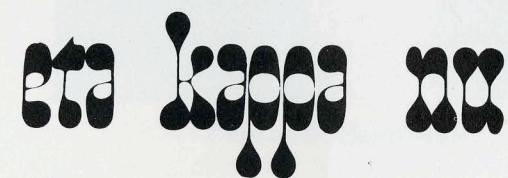


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OUR COVER
Introduces our special series on Country
Schools. See page eleven.



Electrical Engineering Honor Society
November, 1977, Vol. 74, No. 1

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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.

The BRIDGE is published four times annually—November, February, May, August—and is published by Eta Kappa Nu, Haywood Publishing Company, 5th & Ferry Sts., Lafayette, Indiana. Second Class postage paid at Champaign, Illinois and additional mailing office. Copyright, 1977, Eta Kappa Nu Association. Subscription price: three years, \$7.50; Life Subscription, \$30.

Address editorial and subscription correspondence and changes of address to: BRIDGE of Eta Kappa Nu, P.O. Box 2203, Station A, Champaign, Illinois 61802.

CLINTON S. HARTMANN

OUTSTANDING YOUNG ENGINEER FOR 1976

JOHN G. N. HENDERSON Honorable Mention

Clinton S. Hartmann is the outstanding Young Electrical Engineer of 1976. The Award was presented to him at the 41st Annual HKN Award Dinner in New York City on April 18. The recognition is given annually to young electrical engineering graduates for meritorious service in the interests of their fellow men as well as for outstanding achievements in their chosen profession. At the same ceremony, John G. N. Henderson was awarded Honorable Mention for 1976.

Mr. Hartman is an engineer with Texas Instruments, and was named Outstanding Engineer for his "original contributions to research and technology of acoustic surface wave devices, and for his participation in civic activities." Mr. Henderson is an engineer with RCA Laboratories, Princeton, N.J., receiving his honorable mention for "contributions to the advancement of television technology, and for his interest in civic and cultural affairs."

The Award winners were honored both for their contributions to electrical engineering and for their contributions to society at large. Mr. Hartman was nominated by Norman G. Einspruch, Assistant

Introduction by DONALD CHRISTIANSEN Chairman, Award Organization Committee

Vice President, Texas Instruments Incorporated. Mr. Henderson was nominated by S. Reid Warren, Jr., Professor, Moore School of Electrical Engineering, University of Pennsylvania.

The Eta Kappa Nu Recognition is awarded to emphasize among electrical engineers that their service to mankind is manifested not only by achievements in purely technical pursuits but in a variety of other ways. Eta Kappa Nu holds that an education based upon the acquisition of technical knowledge and the development of logical methods of thinking fits the engineer to achieve substantial success in many lines of endeavor.

The Jury of Award, appointed by the National President of Eta Kappa Nu, with the approval of the National Executive Council, consists of two present or past national officers of Eta Kappa Nu, and three or more prominent American educators or industrial-

ists. This year, the jury was Joseph K. Dillard, general manager of Advanced Systems Technology, Westinghouse Electric Corp. and IEEE Junior Past President (chairman); Earl D. Eyman, professor of electrical engineering at the University of Iowa and Eta Kappa Nu president; Howard H. Sheppard, president of Relay Associates, Inc.; Larry Dwon, manager of Engineering Manpower, American Electric Power Service Corp.; Eugene L. Mleczko, general manager, Alvey/Control Flow, Inc.; and Roger I. Wilkinson, the founder of the Award and a Bell Telephone Laboratories retiree.

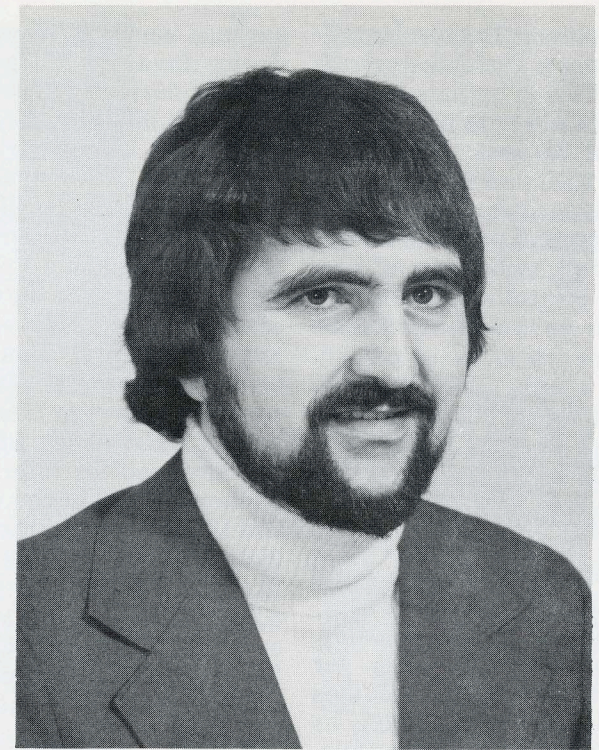
Nominations for the Award are solicited each year through the Eta Kappa Nu Award Organization Committee. Nominations may be made by any member or group of members, of HKN, by any Section or Group/Society of the Institute of Electrical and Electronics Engineers, by the head of the EE department of any U.S. college or university or by other individuals or groups, who in the opinion of the Award Organization Committee are properly qualified to make nominations.

The nominations for the 1977 Awards should be submitted to the

Chairman of the Award Organization Committee, or to the Executive Secretary of HKN, by June 30, 1977. Any candidate who, by May 1, will have been graduated not more than ten years from the regular electrical engineering course (B. S. in EE or equivalent) of a recognized U.S. engineering school or who will not yet have reached his 35th birthday, is eligible.

Awards are made based on (1) the candidate's achievements of note in his or her chosen work, including inventions of devices or circuits, improvements in analysis, discovery of important facts or relationships, development of new methods, exceptional results in teaching, outstanding industrial management, or direction of research and development; (2) the candidate's service for community, state or nation, such as activity in philanthropic, charity, or social enterprises, leadership in youth organizations, or engagement in civic or political affairs; (3) the candidate's cultural or esthetic development, such as good work done in the fine arts, architecture or the drama, and courses taken or studies made in historical, economic or political fields; and (4) any other noteworthy accomplishments including participation in professional societies and other organizations.

The Award Organization Committee members are Donald Christiansen, Staff Director, Institute of Electrical and Electronics Engineers (chairman); Clarence J. Baldwin, Westinghouse Electric Corp.; Herbert S. Bennett, U. S. Army Electronics Command; James D'Arcy, RCA; Larry Dwon, American Electric Power Service Corp.; Irving Engelson, University of Nebraska; Anthony F. Gabrielle, American Electric Power Service Corp.; Willard B. Groth, IBM; Marvin J. Kolhoff, General Electric Co.; Everett S. Lee, General Electric Co. (ret.); Robert W. Lucky, Bell Labs; Steven A. Mallard, Public Service Electric & Gas Co.; James H. Mulligan, Jr., University of California at Irvine; Harlan J. Perlis, New Jersey Institute of Technology; Berthold Sheffield, RCA (ret.); and Roger I. Wilkinson, Bell Labs (ret.).



Clinton S. Hartmann

*Biography of Clinton S. Hartmann
By Norman G. Einspruch
Assistant Vice President
Texas Instruments Incorporated
Dallas, Texas*

It is very gratifying to see Clinton Hartmann recognized by the Eta Kappa Nu award. He has demonstrated unusual abilities as an inventor and innovator, along with outstanding talent as a scientist, engineer, and manager of a large research group.

Clinton has a well-developed curiosity in a wide range of subjects. He is equally interested in the fundamental physical principles governing the behavior of a device and the details of application of that device to a new system architecture. In addition, he keeps constantly well informed on a wide range of new technologies, including optical, acoustic, magnetic, and other solid state phenomena. He is also continually improving himself in the nontechnical aspects of his work, including interpersonal relationships, management by objectives, financial forecasting and accounting techniques, and device and system marketing trends. His wide-ranging knowledge on many

subjects is an important component of his outstanding performance at Texas Instruments.

The natural enthusiasm that Clinton brings to his work tends to motivate not only himself but also the people who work with him. Clinton is well liked and respected by his peers, and the excitement of pursuing new ideas is very evident in his group.

Clinton received his bachelor's degree in EE from the University of Texas at Austin in 1967. He received his S.M. degree in EE in 1968 and his Professional EE degree in 1969, both from the Massachusetts Institute of Technology in Cambridge, Massachusetts. In all his academic work he was consistently at the top of his class. Solid state theory and devices were Clinton's primary area of specialization, but his thesis work dealt with acoustic amplification in piezoelectric semiconductors and with the theory of direct piezoelectric coupling between electromagnetic waves and acoustic waves.

Clinton joined Texas Instruments Advanced Technology Laboratory in 1969 and became a member of a group studying surface acoustic wave devices. In the late 1960's, the potential for acoustic surface wave devices was evident, but several critical problems were preventing full utilization of the technology. Clinton became a key element in overcoming these problems.

His most important theoretical work came with the development of the impulse model for surface wave devices, which was the subject of the lead invited paper in the 1973 Special Issue of *IEEE Transactions on Microwave Theory and Techniques* and, jointly, the *Transactions on Sonics and Ultrasonics*. This elegant, simple theory for surface wave transducers provides the same degree of accuracy as previous equivalent circuit models. However, because of its simplicity, it is readily amendable to design synthesis and, more important, to distortion compensation, which previous models failed to provide. Other theoretical work of Clinton's included calculation of end effects of surface wave transducers and the inclusion of reflection effects in equivalent circuit models.

Invention of new device structures and new device applications has been the most outstanding aspect of Clinton's work at TI. He currently holds some 12 patents, including numerous fundamental ones such as U.S. Patent 3,686,518 on Unidirectional Surface Wave Transducers; U.S. Patents 3,755,761 and 3,855,556 relating to Selectable Surface Wave Bandpass Filters; and U.S. Patent 3,886,504 on Surface Acoustic Wave Resonator Devices. The unidirectional transducer invention eliminated both the insertion loss and the reverberation problems inherent in the previous bidirectional surface wave transducer structure. The selectable surface wave bandpass filter utilizes a novel technique for combining a small number of surface wave filters to realize tunable bandpass filter characteristics with a large number of different center frequencies and a moderate number of different bandwidths. The

surface acoustic wave resonator device invention is a major new class of surface acoustic wave devices that differs radically from the traditional surface acoustic wave transversal filter structure. This device class includes high Q crystal resonators, multipole resonator filters, and frequency discriminators. The importance of these devices is that they can easily be fabricated for fundamental mode operation using conventional planar processing techniques to frequencies beyond 1 GHz. They fill a very important need for filtering and frequency control in the crucial VHF and UHF ranges. Other inventions include Surface Wave Delay Line Stabilized Oscillator, U.S. Patent 3,868,595; Surface Wave Frequency Discriminator, U.S. Patent 3,750,027; and Cascaded FM Correlators for Long Pulses, U.S. Patent 3,675,163.

Clinton also has been very prolific in devising new methods, including impulse optimization techniques for surface acoustic wave device design, compensation techniques for electrical loading and matching distortion effects, and a new weighting technique for surface acoustic wave transducers known as withdrawal weighting. This weighting technique allows shaping of transducer responses without the distortion effects inherent in previous overlap weighting techniques.

System design and application of surface acoustic wave devices have also been major strengths. Clinton has been a key contributor to advanced systems designs for both navigation and radar programs at TI. He also developed several new techniques based on transform processing utilizing the chirp-z algorithm implemented with surface acoustic wave devices. These processors are expected to be key to future spread-spectrum communications systems.

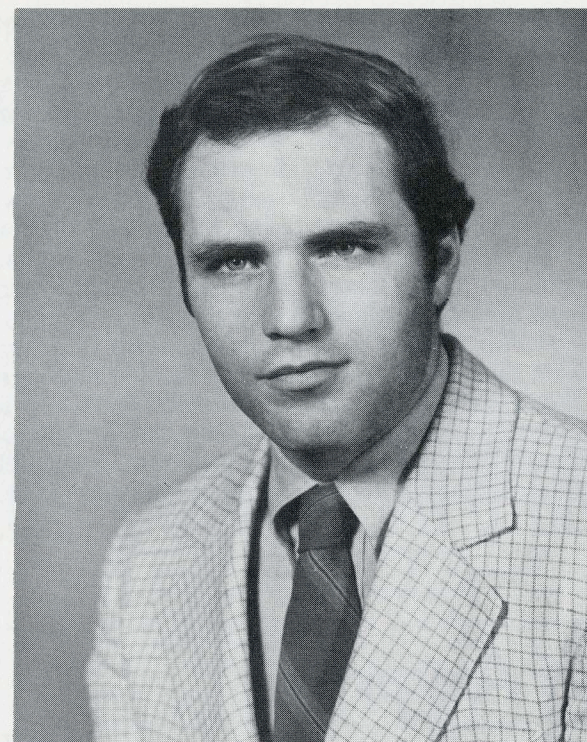
Combined innovation in devices and system application is currently a major thrust of Clinton's research group. Approximately half of his group's effort is devoted to innovating new systems concepts and demonstrating their feasibility, while the remainder of the effort is focused on advancement in the art

of surface acoustic wave devices. Typical of the synergism achieved in his group is a program to develop a high performance TV receiver under contract to the FCC. This program is totally within Clinton's branch and includes advanced surface acoustic wave devices as well as new active device developments.

Clinton is a major contributor to the electrical engineering profession. He currently has more than 20 publications, including two major invited journal articles. He has presented more than 30 papers, many of them invited, at major symposia. He is a member of the program committees for the IEEE Ultrasonics Symposium and the IEEE Microwave Symposium. He was co-author of the paper that won the best paper award in the 1971 *IEEE Transactions on Sonics and Ultrasonics*. In the instructional field, Clinton was one of two faculty members selected nationwide to teach the three-day National Electronics Conference Seminar on Surface Wave Devices. He was one of four faculty members selected to teach a one-week seminar on the same subject at Purdue University in 1975. He is a frequent speaker at IEEE chapter meetings, both in the Dallas area and in other cities across the United States.

Clinton's family attends the Ascension Lutheran Church in Richardson. During the past four years, he has taught Sunday School groups ranging from preschool through high school. Clinton and his wife were part of a group within his church that participated in a block-partnership program with a group in a low-income black community in Dallas. Their work was primarily concerned with providing information and moral support to enable the community to obtain its fair share of city, state, and federal services. As a result of this block-partnership program, not only were major flooding and other problems solved, but the people gained confidence in their ability to deal with their own problems now and in the future.

In addition to the above activities, Clinton is active in various community affairs.



John G. N. Henderson

*Biography of John G. N. Henderson
By Walter G. Gibson*

John G. N. Henderson was born and raised in Philadelphia. He attended the public schools there, graduating first in his high school class in 1963 with a strong interest in science in general and electronics in particular. His summer vacations, then as now, were spent in Cape May, New Jersey, and, despite an initial distaste for the grittiness of sand and the salt water that made it stick to fingers and toes, he gradually came to love the ocean, to tolerate the sand, and to learn something of boats and sailing. That learning process has the making of a lifetime avocation.

During these years he also acquired an enduring interest in music. As with most youngsters, beginning music lessons were somewhat less than completely voluntary efforts, but by mid-teenage years the interest became genuine, and he learned to play the piano, organ, violin, trumpet, baritone horn, and tuba. The first two instruments were played primarily in church; with the last four he was

active in high school and college bands and orchestras. Today he concentrates mainly on playing the piano for pleasure (mostly classical, but under pressure he will admit to a more recent interest in ragtime) and on serving as summer church organist in Cape May Point, New Jersey.

After graduation from high school, he entered the University of Pennsylvania, enrolling in the Moore School of Electrical Engineering. The choice of major resulted from a combination of interest in science, a high school computer and math club, some successful electronics kits, and the opportunity to work with some much more knowledgeable electronics hobbyists and students on a church public address system. With this early electronics exposure, parental blessing and strong encouragement, and the smiling handshake of a high school guidance counselor, freshman courses in the University's General Honors Program began. This program was primarily in the humanities, and so it was not until sophomore year that Mr.

Henderson began to haunt the Moore School with regularity. However, the Program's humanities electives were always a welcome addition to the Moore School courses. Electrical engineering and related science and mathematics courses, always challenging and most frequently interesting, consumed the largest share of college time. However, the opportunity arose to continue some high school athletic efforts (varsity letters in swimming and track), this time in the sport of rowing. Rowing is a year-round sport at Penn (unless the river freezes), and four years and several thousand miles with an oar allow one to claim familiarity with a certain four-mile stretch of the Schuylkill River. Mr. Henderson ultimately earned his letter with the heavyweight varsity crew.

Mr. Henderson graduated cum laude from Penn in 1967, joined the RCA Laboratories, where he is presently employed as a Member of its Technical Staff, and moved to Princeton, New Jersey. He obtained an MSE degree from Princeton University under the Laboratories' Graduate Study Program. His work at RCA has been primarily in the area of consumer electronics. Project areas to which he has contributed include IF filter design procedures, electronic tuner control systems, and surface acoustic wave filters. He has received two RCA Laboratories Achievement Awards. The first was for work on an all-electronic, all-channel television tuning system; the second was for research leading to improved television IF filters. Three pending patent applications have been filed in his name in the area of frequency synthesis. He is also presently working with high school students from minority groups as part of RCA Laboratories' "Minorities in Engineering Program". The students receive supplemental, technically oriented, education and exposure to engineering career opportunities.

In May of 1971, John and Nancy Henderson were married. Mrs. Henderson is a teacher of foreign language and is presently also

studying for an MA in French. Among her hobbies is a relatively new one, acquired, as it were, by marriage. She and her husband race together in their 17' Thistle Class sloop, and she is one of the best spinnaker handlers, jib trimmers, and good-humored small-boat-bruise absorbers in Cape May. When her studies allow time, she is a Sunfish sailor in her own right.

This shared interest in sailing is a dominant feature of the Henderson's non-professional activities. Mr. Henderson has taken a leadership role in the clubs with which he sails. He has moved through the

Flag Officer's ranks of the Carnegie Sailing Club in Princeton and is now the immediate Past Commodore. He has been a Director of the Corinthian Yacht Club of Cape May, has served on its Finance Committee, and is presently Rear Commodore. As such, he is responsible for the Club's sailing instruction program for junior members, for its small boat racing program, and for coordinating the ocean racing. He has been fleet champion in the Thistle Class at Corinthian of Cape May for the past four years and has twice in the past been fleet champion in the

Laser Class (a 14' singlehander) at the Carnegie Sailing Club. Between these two Clubs, the sailing season is nine or ten months long. In addition, he follows a lifelong interest in boats and their contentions with water and wind by studying with the Westlawn School of Yacht Design — he has about half-completed an approximately four-year program. He has found a way to combine his amateur interests in aerodynamics and hydrodynamics with electronics as a hobby by building radio controlled gliders and sailboats, for which he designs most of his radio gear.

Jury of Award



The 1976 Jury of Award Meeting (left to right): Howard H. Sheppard, P.E., President, Relay Associates Inc.; Earl D. Eyman, President, Eta Kappa Nu & Professor of Electrical Engineering, University of Iowa; Larry Dwon, P.E., Manager engineering Manpower, American Electric Power Service

Corp.; Standing, Donald Christian-sen, P.E., Chairman Award Organization Committee & Editor IEEE SPECTRUM; Joseph K. Dillard, P.E., Jury Chairman, General Manager Advanced Systems Technology, Westinghouse Electric Corp. & Immediate Past President IEEE; Eugene L. Mleczo, P.E.,

General Manager Alvey/Control Flow, Inc. & Past President Los Angeles Alumni Chapter Eta Kappa Nu; Roger I. Wilkinson, P.E., Founder of the Award & Retired from Bell Telephone Laboratories.

Mssrs. Dwon, Sheppard & Wilkinson are Past Presidents of Eta Kappa Nu.

Interesting Places

PART TWO

THE COUNTRY SCHOOL

by Ellery Paine

From my seat on the girls' side I liked to watch the classes as they recited. I think I enjoyed most the class that afterwards I learned was grammar. I was puzzled by the big words which I did not understand. Later I learned them and could say "Grammar comprises orthography, etymology, syntax and prosody." Then there were words the big girls rattled off which I did understand. "this, that, these, those, former, latter, which, what, etc." When I got to that point in grammar I had already learned that list. I liked to hear the girls as they said "Noun, common noun, third person, single number and ending with Rule number etc." This at last I learned was "Parsing."

But when I actually studied the subject I found I did not like grammar. So I went through the book as rapidly as I could and when I reached the end of the book I never took it to school again.

The first new book I had for school was a beginning arithmetic. I was greatly pleased when Father brought it home from the store. I liked its look and I liked its smell. I at once set out to find the answers to the problems. I think I worked them all before I took the book to school. But then I learned

that even though I had the correct answers I had not got them right way so I had to start at the beginning and go slowly through it. I liked arithmetic very much. I was in a class all by myself and I went rapidly through the whole series then in use in the Woodstock schools. Then I took to school a copy of National Arithmetic I found at home in the book closet. This book kept me busy until I left Woodstock. The book was dated 1835. It had plenty of good meat for me to work on. During the last years I was in the school I was studying such things as Allegation Medial, Allegation alternate, Evolution or how to extract any root of any number, Permutations and Combinations, Analysis by Position or how to solve problems of several variables Duodecimals, Scales of numbers or how numbers may be expressed in systems having other than the ten characters of our decimal system, etc.

I have never forgotten two of the problems I worked at the last term in Woodstock. One was to find how many inches of a 40 inch grindstone each of four men should wear away in order each might have his proper share of the stone, each having paid the same in their joint purchase of it. The other was

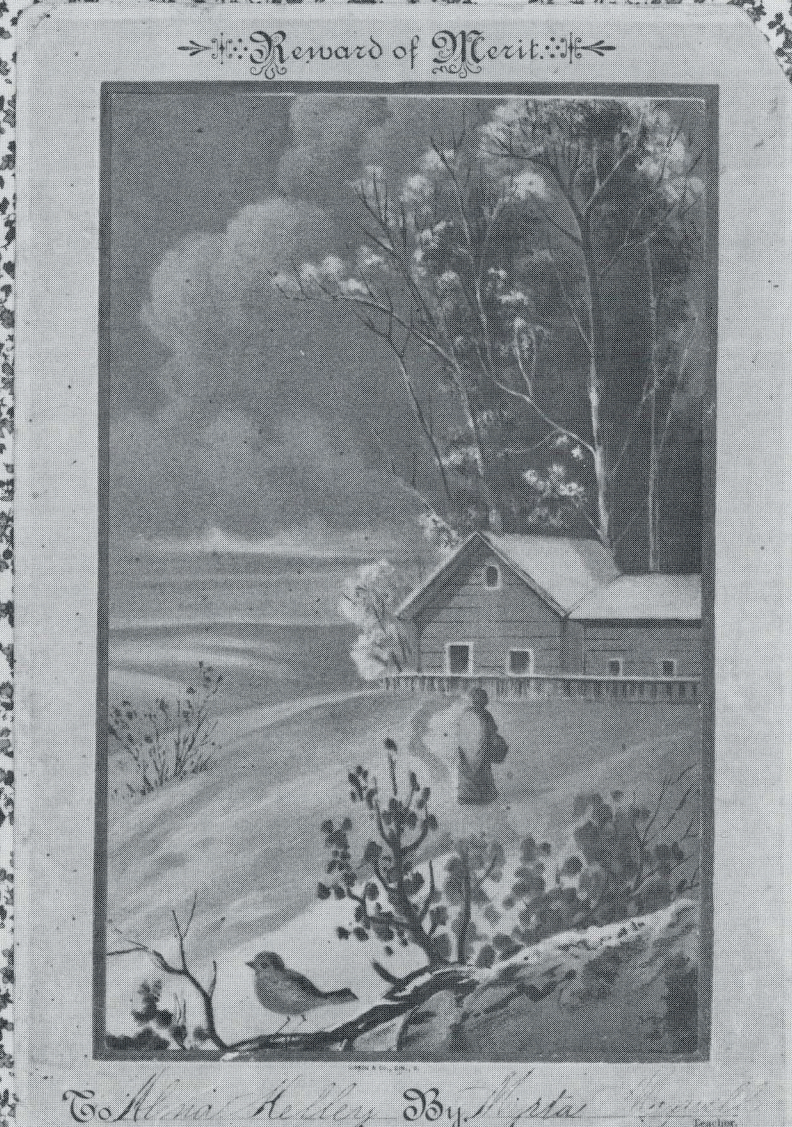
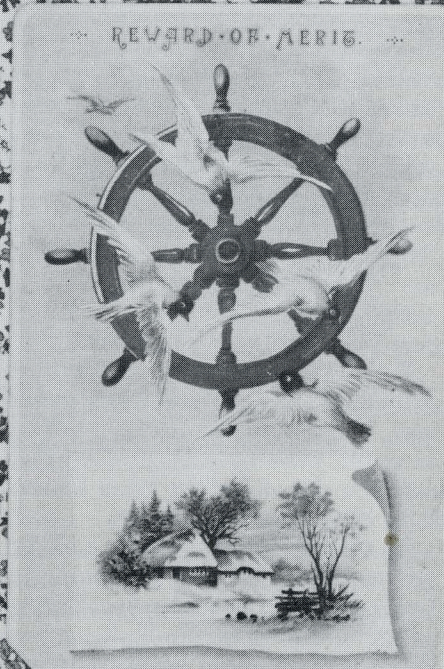
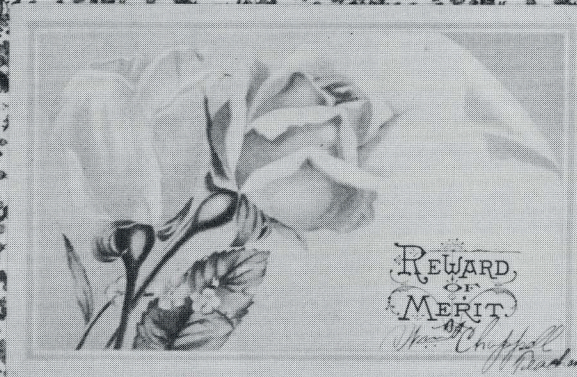
to find how many feet of a conical stack of hay of given size each of four men in turn should take in order each get the same value if the top part of the stack was so much poorer than the third, etc., the hay having been damaged by water.

After finishing grammar I took to school an old Algebra I found in the closet. This I studied several years. In the Willimantic High School where I had algebra I did not go as far as I had gone in the Neighborhood school.

I did not find the History books of interest. Neither did I find the recitations in history I listened to from my seat sounded of interest. So I never took such a book to school. Never in my life have I had History in class. A long time after I found one of my favorite subjects is History. But the books I then read were very different from the ones I saw as a boy.

I studied Geography but it did not seem good to me. Hence as in the case of Grammar I buckled to it and got to the end of the book as soon as I could. Then I took to school an old copy of Physical Geography. This dealt with the for-

In the country schools the equivalent of the Honor Society was the REWARD OF MERIT cards. The ones shown here were presented to Alma Kelley 80 to 90 years ago.



◆ Country School

mation of the solar system and a description of the whole surface of the earth. This book I found most interesting. I especially liked the parts telling of cloud formations and the currents of air and ocean and their effects on navigation and climate.

Spelling came early and I never finished that subject. From my seat on the girls' side I liked to watch the spelling recitations. It was the last of the classes before the day ended. In calling the class as the teacher said "Number One" that one would go quickly to the front and hand the book to the teacher. If that one were a boy I would see him leaning forward in his seat with hands clasping the top of the desk so he could get a rapid start when the word "One" came. He would then shout the other numbers. When all were there the teacher would say "On the line." Then all would toe the same crack in the floor as did the one at the head. Then came the words of the lesson. Some teachers would tell if the word was not spelled correctly. Some would not but would give out the next word. In that case the pupil was expected to spell not that but the one which was in error. This meant that sometimes one near the foot might spell a missed word and go up above the one who made the mistake. The lesson ended when the one at the head would go to the bottom of the line and a head mark would be entered in the teacher's book. Then seats would be resumed each shouting his number for the next day.

I found spelling very hard. I studied the words each evening at home and before going to school would spell them to my Mother. How many times did it happen that when someone would go above me I would say "But I spelled it the way it is in my book". I would be asked to bring my book but never in such a case did the book bear me out.

Two other subjects which I never finished were Writing and Reading. I really enjoyed the writing periods when all slates and books were put on the shelf under each desk and

the book to write in was brought out. Except when the lesson was in progress the writing books were kept in the teacher's drawer. Whenever a visitor came these books together with the "Register" were handed out for examination. One teacher made a great point that no tardy marks should show. In bad weather he might not call the roll until school was in session a little while. Then in calling if one did not answer a pupil near the window would be asked to look and see if the missing one was in sight. If so and if that one were actually running he would be marked as present.

I did not enjoy the reading exercises but the worst of that sort of thing was to be set to "Speak a Piece" at the last day exercises when parents attended. I worried greatly that I should forget my piece. The first one I had to do was "Little by little, The acorn said. As it sank to earth, In its mossy bed, . . ." But in spite of the worry I seem not to have forgotten it even yet.

Of course the first thing after roll call was to read in the New Testament, each pupil one verse in turn. Once in a while the teacher would call for each to give a verse from memory. When it went that way the first boy to recite would say "Jesus wept".

The top half of the desk I occupied was broken away. It was at a later time that I learned it had been broken during a struggle between the teacher, John Hibbard, and one of his pupils. This man was called "White Birch John" to distinguish him from the man of the same name who lived near the school. I never knew whether he was called this because of his free use of rods of that kind of wood or whether it was on account of the great number of white birches that grew on his farm on the west side of the hill.

Do you ask what I think of that old fashioned school now that so many years have passed since I was a pupil in it? Most people would say it was a very poor school. However, as I think over all that has happened to me since I left home at the age of 14, I am sure I got much from it that helped me

afterwards. I was allowed to follow my own interests and they were strongly developed even then. I learned how to learn even though I knew the teacher did not understand the subject matter any better than I did. In fact the last year or two I realized I could handle arithmetic and algebra better than could the teacher.

Of course there were games at recess time. I have an impression that several of the group games in which all pupils and the teacher took part were developed at that school for I have never heard of them being played elsewhere. These included "Hot Pot of Blue Beans" for which a discarded piece of harness leather was needed; "Healy Over"; "Duck on Rock"; "Hill Dill"; and "Baller Up". There were various forms of "Tag" and "Hide and Seek". With a pig's bladder blown up for a football we had "Foot Ball" in which all from little to big took part. With a ball made of wool yarn wound from a discarded stocking the boys played "One Ole Cat" "Two Ole Cat" and "Round Ball". We had contests of running and jumping and also "Mumbly Peg", a game played with an open knife. In winter when there was ice, it was the custom for pupils to eat from their dinner pails during the morning recess and forego the afternoon recess so there would be a longer time for all to spend skating. On such occasions it was arranged for a shawl to be hung out of a school window as signal it was time to go back to the books.

Marbles and tops were never seen in the country school. I had such toys at home but no games were ever played with them.

The school where I went as a boy was in operation but 30 weeks each year and so I had more time to devote to the study of such books and to the other of my boyhood interests than would have been possible had I attended a school of the type called more highly developed. The school was operated in a most democratic manner by the men of the neighborhood. The cost of operation of the school was \$220 per year for Teaching and for

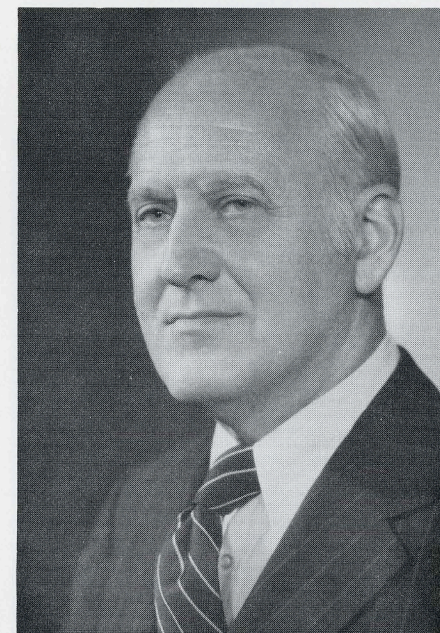
Written and oral communication traditionally has been approached in terms of training the engineer in technical report-writing and speech-making. I would like to depart from this approach and address my comments to the growing need for the engineer to be able to express and interpret his technical and scientific knowledge and convictions in terms that the man in government or the thinking layman can understand. On the basis of my own experience, I find few young—and indeed few older engineers—fully alert to this problem.

We are living in a rapidly changing world. Our society today is one of challenge and confrontation. Science and technology are being blamed by many in the non-technical community as the cause of our social ills rather than as the only practical means for solving many of our problems. In brief, we, as representatives of technology, are rapidly losing—and in some cases have lost—our credibility with the man in the street. Much of today's battle of ideas is being fought in legal forums or in the news media, with the engineer oftentimes a handicapped participant in the struggle.

What, then, is our problem? One aspect of our problem is that for years we have been writing and talking to each other and to ourselves. We have insisted on using our own technical jargon. We have failed to enunciate technical problems and programs in terms understandable to the layman. We refuse to put ourselves in the position of the recipient of our communications. We have concentrated on the transmitter and lost sight of the receiver. A case in point is what has happened in the field of nuclear power and what now is occurring in the entire energy area.

A second problem is that we have not disciplined ourselves to write in a well-reasoned manner and in a logical sequence when developing an issue. Is this perhaps a reflection of our thinking patterns? After all, to write well and convincingly is hard work—in that it compels us to organize our thinking. In oral communication

Written and Oral Communication



THEODORE NAGEL
Executive Vice President
American Electric Power

we can oftentimes gloss over the logic and sequence of our ideas. In written communication, however, the gaps in our thinking show through. In my judgment, well-disciplined writing stems from well-disciplined thinking.

What then should the role of the university be in this regard? I suggest courses in both oral and written communication where the student must present his case—first, in non-technical terms and, second, before a critical student

audience which will challenge his presentation. Where possible, it would be helpful if the student audience could include other than engineering candidates. This early exposure to questioning and criticism on the part of the engineering student is, in my judgment, the best stimulus to meeting the objectives I have referred to. It is the best way to prepare him for later life. I can testify personally to the importance of reaching this critical non-technical audience through written reports and to the difficulties encountered in appearing before governmental and regulatory bodies on technical matters.

Some of you may say that such a program is not part of our teaching role or that we must devote our efforts solely to the teaching of science and engineering. My response to that is, if you don't get your students involved in such a program, their future role in our society will be one of technician—followers rather than thought-leaders. This lack of early training, in turn, may well limit the engineer's potential to grow toward his career goals.

You may also argue that you don't have enough time to add subjects to an already crowded curriculum—crowded because of your attempts to cover an ever-expanding field of technical knowledge. However, this problem reduces to a question of priorities. My recommendation is that you examine your curricula for technical subjects which can be deleted or moved to a master's program. Also, many of you allow for electives. Such electives often are in so-called "relevant" subjects—all technical in nature. While we all would like to add to our technical knowledge, it is a fact that with the rapid development of such knowledge, an engineer has no alternative in keeping up to date in his field other than through continuing education after graduation and through the learning that occurs in his daily work.

In conclusion, I believe it to be more important to learn early the art and science of effective communication than to fill one's mind with facts which may or may not be relevant to real life later on.

Who's Who in Eta Kappa Nu

WILLIAM T. BURNETT



Mr. and Mrs. William T. Burnett on the occasion of their 70th Wedding anniversary in 1976. Mr. Burnett was one of the ten founders of Eta Kappa Nu.

Dear Friends:

"It was so nice of you to ask me for a few comments on the founding of HKN. . . . (HKN was founded on October 28, 1904.)

At the original meeting one Sunday evening at what was then the Champaign County Fairground, there were only Carr, Armstrong, and Bowsee present. At the next Sunday evening meeting held under the cottonwood tree by invitation, Wheeler, Smith, Winders, Akers, and myself were present.

At first it seemed unnecessary to form an organization for Electrical Engineers since there were so few at that time. . . . but we determined that there were many questions that should be asked and settled and that an organization was needed to answer these questions. For example, the city of Champaign had 133 cycle power, and Urbana had just put in a new generator, which was 60-cycle. There were four types of lamp sockets in the Twin Cities. Carbon lamps were in use and lamps were rated in candle power instead of watts. Electricity was just coming into real use and we saw that some sort of standards were going to be necessary. Therefore, the founding of HKN took place. . . .

Thank you again for asking my help. . . .

WILLIAM T. BURNETT ('05)

ETHICS AND PROFESSIONALISM

The good I would, I do not, but the evil which I would not, that I do.
(Romans 7:19)

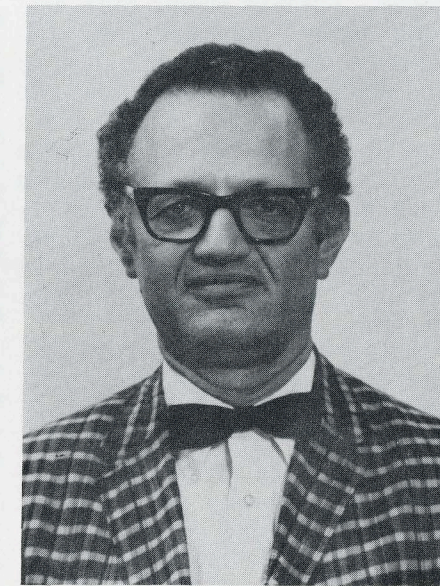
Introduction

The study of ethics concerns what is good and the behavioral patterns desired from a good person. The lay public, when considering ethics, usually refers to the confused set of behavior patterns considered to be moral. This conventional morality comes from both his social group and a distorted view of the Christian ethic. Many lament the fact that men inherently want to be good, but that individual man is unable to be moral within the nation-state. Others maintain that basically people are amoral; nevertheless, the majority even of these individuals contradict their own belief by activities hopefully destined to raise the general moral climate within the public arena.

A clear distinction between science and ethics should be made. Science is concerned with facts and with the patterns the facts form. These patterns are called physical laws. Science gives us knowledge about the facts, but no method of science tells us how, or if, to use our knowledge. Science and technology tells us how to do things, not whether or not we ought to do them. The what one ought to do is what ethics is all about. This analysis concerns itself first with general ethics and more specifically professional ethics.

General Ethics

Ethics is the grouping of value-concepts and general principles into a code of life. The value-concepts center about what is consid-



Martin Levine

ered intrinsically good. In the Judeo-Christian faiths, ethical imperatives relating to conduct are implicit in the New and Old Testaments. Though the theories of man and what denotes right conduct differ somewhat in the Old and New Testaments, these documents form the cornerstone of western ethics and what is therefore individually moral in western civilization.

Many consider ethics as a series of things one should not do. Actually, ethics supplies guide-lines so that the non-performance of certain acts prevents us from doing bad things while proper performance will enhance the common good.

Those that consider ethics a system of specific rules can be considered misguided. Nevertheless, history reminds us that factions

developed within religion calling for personal introspection and the categorizing of certain actions isolated from all antecedents or the present situation as ethical or not. Aristotle wisely indicated that ethics is not an exact science and such categorization is not applicable in ethics. The constant referral to a code-book made obsolete by the findings of science has caused many to consider ethics as worthless. From this view, there has arisen a concept or relativistic ethics. To these individuals, codification of any kind is meaningless. Such a view is fundamentally untenable in a complex society where individual man is related to other men. With oneself as the only ethical guide, anarchy exists, and such a situation would prevent a modern society from functioning.

Western civilization indicates its adherence to Christian ethics from the various religious pulpits. Many individuals contend that this adherence is given only lip service and rarely carried out in deed. The criticism in the use of words and the non-performance of deeds may arise from the two alternate interpretations to the Old Testament (Hebrew) and another to the New Testament (Christian). Both interpretations of ethics exist in American Society, but with different emphasis. At times, the two interpretations are not harmonious and may actually be in direct conflict, creating the appearance of unethical conduct which may not be the case. These different interpretations have, in the past and present, caused a considerable amount of controversy in ethics. It is useful, therefore, to examine and understand the relevance of both interpretations of ethics to

individual morality. In many individuals, both interpretations exist and they vary from one to another view. For the purpose of this discussion, they are assumed to be completely distinct.

These interpretations have been given many names, but here they are subtitled under total surrender and self-fulfillment.

I — Total Surrender

One interpretation requires the *total surrender* of self-interest. This view places emphasis on general virtues rather than the development of a code of normative behavior. One notes the emphasis given to general virtues by many of the religious faiths from the many pulpits of the western world. These include: love thy neighbor, be kind and generous, etc. This view developed many subsidiary doctrines relating to behavior, one of the most important being non-resistance to social evil. Thus, non-resistance to evil is considered by some as representing the highest ethical good. Non-resistance to evil has never been widely practical with the exception of certain small minorities over short periods of time. Non-resistance in the long run, unless the evil terminates, only leads to group annihilation.

The concept of total surrender accepts political tyranny and submission to social inequality. Opposition, when given must be non-violent. The position is primarily an individualistic interpretation of ethics and ignores the social group as an effective modifier of individual behavior. Adherents are admonished by the leaders upholding this view to make a total sacrifice of themselves for the sake of others. The individual may go as far as self-destruction to emphasize their opposition, but actively they may not oppose a change.

An ethical system based on total surrender, although applicable to a transitory situation apparently cannot operate practically in an enduring society. Individuals who have died in self-emulation for a cause, e.g., Christ, do cause change. Nevertheless, one cannot apply the total surrender of self-interest as a quantitative measure for action

whether on social, political, or professional level. All martyrs do not cause social change, and self-destruction is not practical for most of us. The self-sacrifice of oneself as a basis of an ethical system does not work as a basis of action on the problems confronting the individual or social group. For this reason, groups advocating non-violence are always on the verge of, and often practice violence. In a static society, one undergoing little change, the view can be maintained. Through such a faith despotic leaders convince their followers to accept all deprivation as God-made and unchangeable, and in certain instances, as in Ghandi's case change does occur. One notes here that the creed non-violence worked against the British, many miles away, but with India's independence a "blood bath" occurred between the Hindus and the Moslems.

Today, some individuals advocate unilateral disarmament (the other fellow will see how sincere we are), and naturally those who believe we are in this world to suffer and thereby better enjoy our after-life take solace in total surrender. Believers in the status-quo, and individuals who believe in their personal ineffectiveness and the few martyrs of the world hold to this view. For most of us mortals this ethical standard can not be reached. It is not sensible to perform certain acts which would be tantamount to self-destruction.

II — Self-Fulfillment

The second interpretation centers its ethical base about responsibility. This interpretation begins by considering self-fulfillment with an over-all interest in one's entire life which includes linkages to other individuals and groups. Under this interpretation, every individual first strives to maintain his life and seek its maximum expression as long as this does not infringe on the similar right of other individuals. The qualifications regarding others is important and forms an important foundation to the principle of self-fulfillment. Without the prohibition on infringing the rights of others, self-fulfillment leads to anarchy. When dis-

regarding completely the rights of others, one can enjoy a hedonistic way of life. This assumes that others are not so inclined. When large numbers live hedonistically all suffer since anarchy prevails. One must then consider the general applicability of a specific action's effect on others, in addition to its individual self-fulfillment. This ethical standard regards the maintenance of life as the highest good, as long as it is not achieved by the destruction of other life which has an equal right to survival.

Consider obedience to traffic signals. In not obeying the rules, one can drive to his destination more rapidly. Assuming most of the others follow the rules, this method, sad-to-say, works. When everyone practices this procedure, anarchy occurs, and you are better off not driving. The advantage gained by an individual in breaking social rules without much penalty causes individuals to crash lines for tickets, etc. Should everyone do this, the consequences are obvious. Self-fulfillment, based on personal aggrandizement, supplies a necessary basis for preparing codes of behavior in terms of specific principles. Rather than the generalized moralistic attitudes supplied under the non-resistance to social evil, one is restrained from performing an activity which is self-fulfilling but infringes on the rights of others. This ethical standard appears to make more sense and though not preached by all is practiced more frequently than total surrender.

Through codes, laws, etc., self-fulfillment necessitates and lays the foundation needed to protect weaker individuals and groups from those who are either stronger or in the majority. Furthermore, self-fulfillment requires knowledge of the act and mere motive is unimportant. Merely thinking about an immoral act does not do harm to others and the fantasy may even amuse you.

Ethics hinged to self-fulfillment necessitates the setting up of a code of fair play, which is achievable, rather than a maximum unselfishness which, in practice, apparently is not achieved.

III - Conclusion

Ethics, when given unachievable goals, appears naive and unrealistic; but considered in a practical light as personal fulfillment with its normative restrictions, one notes the overall immense good derivable by living under such a code.

The acceptance of a normative code requires two prerequisites—one an emphasis on reality and, secondly, intelligence in order to comprehend the reality. Various ethical codes have been supplied with a considerable number of documents and legal penalties, and these codes fail because of a deficiency in intelligence. Moralisms also fail due to a lack of realism or intelligence in the preparation of its principles. High-sounding phrases do not make a workable code of ethics; they only put in codified form general virtues which are not achievable.

Intelligence lets us know that in reality a number of opposing goals exist which must be traded-off between one another. The existence of conflict between two ideals does not deny the inherent validity of both, but rather the need to set up a scaled listing of what is "more" good among our goals, in order that in the trade-off of values, one retains the maximum good under the conditions available. One cannot achieve all ideal ends simultaneously since they may be, and in many cases, are, in fact, contradictory. An understanding of the existence of goal conflict and the need of intelligence to trade-off alternatives becomes central to an ethical and workable code. One moralizes about various things such as: thou shalt not kill, love thy neighbor, etc., but intelligence and reality necessitate that these be adjusted under various conditions. The attempt here is to make the need explicit. During World War II, a popular song, expressing the dilemma of conflict, went as follows:

*Praise The Lord,
and pass the ammunition!
Praise The Lord,
and pass the ammunition!
Praise The Lord,
and pass the ammunition
And we'll stay free!*

Words by Frank Loesser, ©1942

In many cases, as is evident in the popular song just mentioned, necessity requires a temporary suspension of an ethical principle, but such a condition should be modified as soon as possible. This is also illustrated by a hungry man coming upon a campsite in which food is present. Taking the food may harm the original campers, but necessity may require suspension of any injunction against taking what is not yours. Similarly, as students taking an examination where the proctor has permitted or even condoned dishonesty, the need to pass may require suspension of the honesty principle. At other times, one intelligently reconciles two valid, but conflicting goals. This adjustment between goals may remain valid for long periods of time and should cause an individual no anguish. This can simply be illustrated by the desire to have an interesting position and a high income. We may forgo one choice in order to obtain the other since both together may be unobtainable.

All ethics is based on the concept of free choice and the responsibility of the individual. Therefore, our response to an ethical code requires honesty and intelligence. Without moralistic pretensions, one can better understand the basic issues and, facing them, solve them using intelligence in order to scale one's goals. This scaling technique for our goals will make clear to each of us that heaven can never exist on earth for the goals to be arrived in heaven are to some extent contradictory here on earth.

One cannot separate professionalism from ethics nor consider professional ethics different from general ethics. Understanding that true ethics is not moralisms, impossible of successful achievement, but rather an intelligent appraisal of self-fulfillment with equal concern for our neighbor should give you a clearer insight into the need and desirability of an ethical code.

Divorcing morality on an individual's part from the professional ethics can only cause ultimate destruction of the profession in the eyes of others. This effect has necessitated the formation of tri-

bunals to administer the codes and deal out the penalties for their infringement.

14 Country School

the wood to keep the school warm in winter. In that school district there were about 30 persons of age up to 18. This means that the cost of schooling was a little over \$6.00 per pupil, an amount that seems extremely small by our present day standards. Any repairs to the school building was determined in the annual district meeting and the amount needed for such expense was a tax laid on "The polls and the property list of the district." The money for operation came chiefly if not entirely from the state fund that was realized when Connecticut sold her claim to land in the west to Ohio.

If the proof of the pudding is in the eating in my case it would seem that that old fashioned school rendered good service to me. After one year in Willimantic High School where I was placed in the group from the city school I found at the end of my first year that my scholastic rank was at top of the boy students. At Worcester Polytechnic Institute entrance was based on the completion of four years of high school work. I passed the entrance examinations after three years of high school and went on to earn the scholarship prize on graduation.

So, if you ask my opinion, after all the years that have passed since I went to school I will say it was not too bad; perhaps I should rate it as Excellent.

*"I want a round-trip ticket, please."
"Where to?"
"Back here."*

After six months of using a new bourbon flavored toothpaste, a test group reported they had 40% more cavities and couldn't care less!

UNIVERSITY OF PORTLAND

by Patrick P. Fasang

The Installation Ceremony of the Theta Beta Chapter of Eta Kappa Nu at the University of Portland was held at Osbecks' Restaurant in Portland, Oregon, on March 30, 1977. Mr. Marcus D. Dodson of the Department of Water and Power, City of Los Angeles, who is the National Vice President of Eta Kappa Nu, performed the Installation Ceremony and presented the Charter of the new chapter to Dr. Robert J. Albright who is the Chairman of the Electrical Engineering Department. Fourteen student members and one professional member were initiated at the Ceremony. After the ceremony, a banquet was held for the members and guests among whom was University President Rev. Paul E. Waldschmidt. Patrick P. Fasang is the Faculty Advisor of the new chapter.



MERRY MOMENTS WITH MARCIA

Have you heard about the new medical discovery? It's alcoholic acupuncture — you get stuck for the drinks.

A very elderly prim lady, tasting her first martini: "How odd — it tastes just like the medicine my husband has been taking for the last 30 years."

I've recently heard about the fellow who decided to procrastinate, but never got around to it!

They tell me he who hesitates is not only lost, but several miles from the next exit.

Have you heard about the father who fainted when his son asked for the keys to the garage, and came out with a lawnmower?

Current status symbol: coffee nerves

I've heard the cheapest way to have your family tree traced is to run for public office.

Overheard: A taxi driver talking to another — "It's not the work I enjoy. It's the people I run into."

The amount of sleep most average people require is about 10 minutes more.



I've heard of a doctor who tried to steal another doctor's patients and he was sued for alienation of infections.

The reason why some people are up to their ears in work is because they have lain down on the job.

Experience is a hard teacher. She gives the test first, the lesson afterwards.

"You better give me a raise, Mr. Brown," his assistant told him. "Three other companies are after me."

"A likely story," said Mr. Brown. "What companies?"

"Light, Water, and Gas," came the reply.

They tell me "push" is a form of energy that will get you anywhere except through a door marked "pull".

Anyone observant enough to guess your age correctly will annoy you in other ways, too.

I've heard one goes on vacation to forget things. You open your luggage and find out that you have.

A great many people are already working a four-day week; it just takes them five or six days to do it.

When you want to forget all your other troubles, wear a pair of tight shoes.

People who think it's nobody's business what happens to the other guy don't realize that to everybody else in the world they are the "other guy".

by Marcia Peterman

CHAPTER NEWS

BETA THETA CHAPTER, M.I.T.—

The Beta Theta Chapter continued the 1976 year with the induction of 47 new members on December 5, 1976. The initiation banquet that followed was not the standard salad, steak, and potato, but rather a ten course Chinese feast featuring Peking Duck. To the delight of all those attending the guest speaker for the occasion was Professor Harold Edgerton (more commonly known around the Institute as Doc Edgerton). Pledge projects carried out by the new members this year included tutoring high school students in mathematics, assisting in organizing the Electronic Research Association (which allows members to use lab equipment and to buy electronic parts at a discount), and organizing the new Electrical Engineering Sophomore Award. In addition some pledges helped in planning a new Eta Kappa Nu intramural basketball team, while others aided the organization of a Chapter ski trip to take place during the January interim.

Other on going Chapter activities include participation with other campus groups in negotiating for an Electrical Engineering lounge.

All in all with 133 active members the Beta Theta Chapter is happy to report steady progress in most areas of current endeavor.

The officers for 1976-77 are as follows: President, Mark A. Clements; Vice-President, Stephen P. Tobin; Treasurer, Peter D. Beaman; Recording Secretary, Russell T. Nevins; Corresponding Secretary, Arthur V. Radun; Bridge Correspondent, Peter Zieve; First Member At-Large, Len Picard; Second Member At-Large, Arthur Wilding-White; Third Member At-Large, Craig W. Christensen.

by Greg Cooper

BETA ETA CHAPTER, North Carolina State University — HKN lives and flourishes at North Carolina State University. Attendance was good at most HKN meetings during the fall semester, 1976. For Open House HKN members helped set up exhibits for the Electrical Engineering Department and provided

much direct interaction with prospective students. Donations are still being received for the bronze HKN Bridge to be erected in front of the Electrical Engineering Department.

Our pledge class was large this semester (28 new members). They carried out a wide variety of pledge projects including high school visitations, sophomore help sessions, work for the United Cerebral Palsy Campaigns, the survey of humanities courses, development of a Christmas card - newsletter for retired faculty, and some general maintenance around the Electrical Engineering Department.

The most ambitious undertaking, however, was the expansion of help sessions to cover all required undergraduate electrical engineering courses. This project has helped to foster better academic standards and discipline among the undergraduates, as well as provide an opportunity for HKN members to review the fundamentals of electrical engineering.

As always, our banquet was a big success. Our speaker was the eminent Don Easterling, Swimming Coach at North Carolina State University. He related incidents of his childhood in the small though revered community of Resolute Speed, Arkansas. Coach Easterling closed his address by pointing out that high academic achievement among students of electrical engineering requires hard work and needs the kind of recognition provided by HKN.

by Charles Morrison

UPSILON CHAPTER, University of Southern California — In the first week of March, we'll have an introductory meeting for the HKN candidates. This is succeeded by the informal initiation which requires a personal interview, an autobiography and a letter of acceptance from the candidate. We also plan to initiate a professional as an eminent member to our chapter. Next comes our annual Outstanding Sophomore Award. The judging is based on the candidate's grade point average, an examination and a personal interview. Sometime in April we'll conduct a "work day" for initiates and members of HKN. This consists of working a full day at the home of one of USC's Electrical Engineering Professors. This gives the student a chance to have a different kind of relationship with a professor outside of the classroom. The chapter is paid by this professor in which the proceeds are used toward our semiannual banquet. Our formal initiation will be held at the end of the semester. Following the initiation will be our banquet where the Outstanding Sophomore Award will be presented. A dis-

tinguished guest speaker will be present to say a few words.

by Scott K. Takiguchi

GAMMA DELTA CHAPTER, Worcester Poly. Inst. — The Gamma Delta Chapter has been active this year with our chapter of IEEE. In the fall, they conducted a casual "get-together" for all Electrical Engineering Dept. faculty and students. The occasion served to better acquaint some of our newer EE students with the EE faculty, to promote a more relaxed and personal feeling between EE faculty and students in general, to allow exchange of ideas for new projects (projects are an important part of the WPI Plan), and just to allow everyone to have a good time. Refreshments were served and the turnout was excellent.

Also, HKN and IEEE have put together one, of many to come, EE Project Newsletters. These are distributed to all EE students via their mail boxes. It informs them of projects currently in progress in the EE dept. and also advertises new ideas from students or faculty that wish to initiate new projects in these areas. The newsletter idea has been successful and was enjoyed by all who read it.

The Fall Initiation of the Gamma Delta Chapter of HKN brought 11 seniors and 5 juniors into the society. The reception, following the ceremony, was held at the William Paul House, in Holden, Mass. A good time was had by all.

by Judy Bagdis

EPSILON BETA CHAPTER, Arizona State University — On Friday, November 19, Epsilon Beta Chapter inducted twelve new members into Eta Kappa Nu. Following the initiation ceremony, a dinner was held at the ASU Memorial Union to honor the new initiates. This also provided an excellent chance for old and new members to become better acquainted.

The officers for spring semester are Jim Boyd, president; Ken Berry, vice-president; Jim Baillie, treasurer; Mike Bodinet, recording secretary; Roger Peckham, correspondence secretary; and Phil Wong, Bridge correspondent. Dr. Aaron Donnelly and Dr. Richard Kelly ably serve as our chapter advisors.

Plans for the spring semester include screening EE students to find eligible members for this semester's initiation. Pictures of the May graduating seniors are also proposed for the EE bulletin board. Other plans for the semester include setting up the pizza smoker and electing next year's officers.

All of us here have enjoyed reading The Bridge. Keep up the good work!

by Phil Wong

CHAPTER DIRECTORY

Alpha University of Illinois
Beta Purdue University
Gamma Ohio State University
Delta Illinois Institute of Technology
Epsilon Pennsylvania State University
Zeta Case West. Reserve U.
Theta University of Wisconsin
Iota University of Missouri
Kappa Cornell University
Lambda University of Pennsylvania
Mu University of California-Berkeley
Nu Iowa State University
Xi Auburn University
Omicron University of Minnesota
Pi Oregon State University
Rho University of Colorado
Sigma Carnegie Mellon University
Tau University of Cincinnati
Upsilon University of Southern California
Phi Union College
Chi Lehigh University
Psi University of Texas-Austin
Omega Oklahoma State University
Beta Alpha Drexel University
Beta Gamma Michigan Tech. University
Beta Delta University of Pittsburgh
Beta Epsilon University of Michigan
Beta Eta North Carolina State University
Beta Theta Massachusetts Institute of Technology
Beta Iota State University of Iowa
Beta Kappa Kansas State University
Beta Lambda Virginia Polytechnic Institute
Beta Mu Georgia Institute of Technology
Beta Nu Rensselaer Polytechnic Institute
Beta Xi University of Oklahoma
Beta Omicron Marquette University
Beta Pi City College of New York
Beta Rho West Virginia University
Beta Sigma University of Detroit
Beta Tau Northwestern Technological Institute
Beta Upsilon University of Kentucky
Beta Phi University of Tennessee
Beta Chi South Dakota School of Mines
Beta Psi University of Nebraska
Beta Omega University of Connecticut
Gamma Alpha Manhattan College
Gamma Beta Northeastern University
Gamma Gamma Clarkson College
Gamma Delta Worcester Polytechnic Institute
Gamma Epsilon Rutgers University
Gamma Zeta Michigan State University
Gamma Eta Syracuse University
Gamma Theta University of Missouri-Rolla
Gamma Iota University of Kansas
Gamma Kappa Newark College of Engineering
Gamma Lambda Columbia University
Gamma Mu Texas A & M
Gamma Nu Texas Technological College
Gamma Xi University of Maryland
Gamma Omicron Southern Methodist University
Gamma Pi University of Virginia
Gamma Rho South Dakota State University
Gamma Sigma University of Utah
Gamma Tau North Dakota State University
Gamma Upsilon John Hopkins University
Gamma Phi University of Arkansas
Gamma Chi New Mexico State University
Gamma Psi Lafayette College
Gamma Omega Mississippi State University
Delta Alpha Wayne State University
Delta Beta Lamar State College of Technology

Delta Gamma Louisiana Tech. University
Delta Epsilon Ohio University
Delta Zeta Washington University
Delta Eta University of Massachusetts
Delta Theta Pratt Institute
Delta Iota Louisiana State University
Delta Kappa University of Maine
Delta Lambda Duke University
Delta Mu Villanova University
Delta Nu University of Alabama
Delta Xi Air Force Institute of Technology
Delta Omicron University of New Mexico
Delta Pi Colorado State University
Delta Rho University of North Dakota
Delta Sigma University of Notre Dame
Delta Tau University of Southwestern Louisiana
Delta Upsilon Bradley University
Delta Phi University of South Carolina
Delta Chi Cooper Union
Delta Omega University of Hawaii
Epsilon Alpha Cleveland State University
Epsilon Beta Arizona State University
Epsilon Gamma University of Toledo
Epsilon Delta Tufts University
Epsilon Epsilon University of Houston
Epsilon Zeta Lowell Technological Institute
Epsilon Eta Rose Hulman Institute
Epsilon Theta California State-Long Beach
Epsilon Iota San Jose State University
Epsilon Kappa University of Miami
Epsilon Lambda Vanderbilt University
Epsilon Mu University of Texas-Arlington
Epsilon Nu California State-Los Angeles
Epsilon Xi Wichita State University
Epsilon Omicron University of Delaware
Epsilon Pi Princeton University
Epsilon Rho Tennessee Tech. University
Epsilon Sigma University of Florida
Epsilon Tau University of Cal.-Santa Barbara
Epsilon Upsilon Tuskegee Institute
Epsilon Phi Calif. Poly. State University
Epsilon Chi University of Louisville
Epsilon Psi University of Santa Clara
Epsilon Omega University of Mississippi
Zeta Alpha Monmouth College
Zeta Beta Texas A. & I. University
Zeta Gamma University of Rhode Island
Zeta Delta University of Texas-El Paso
Zeta Epsilon Florida Institute of Technology
Zeta Zeta University of Akron
Zeta Eta Brigham Young University
Zeta Theta California State Poly College
Zeta Iota Clemson University
Zeta Kappa Tennessee State University
Zeta Lambda Prairie View A & M College
Zeta Mu Northrup Inst. of Tech.
Zeta Nu University of Tulsa
Zeta Xi S. E. Massachusetts
Zeta Omicron W. VA. Inst. of Tech.
Zeta Pi S. U. of N. Y. Buffalo
Zeta Rho University of New Haven
Zeta Sigma Polytech. Inst. of N. Y.
Zeta Tau San Diego State Univ.
Zeta Upsilon Old Dominion U.
Zeta Phi Tri-State U.
Zeta Chi Florida Tech. U.
Zeta Psi Southern U.
Zeta Omega U. of California-Irvine
Theta Alpha Tulane U.
Theta Beta U. of Portland