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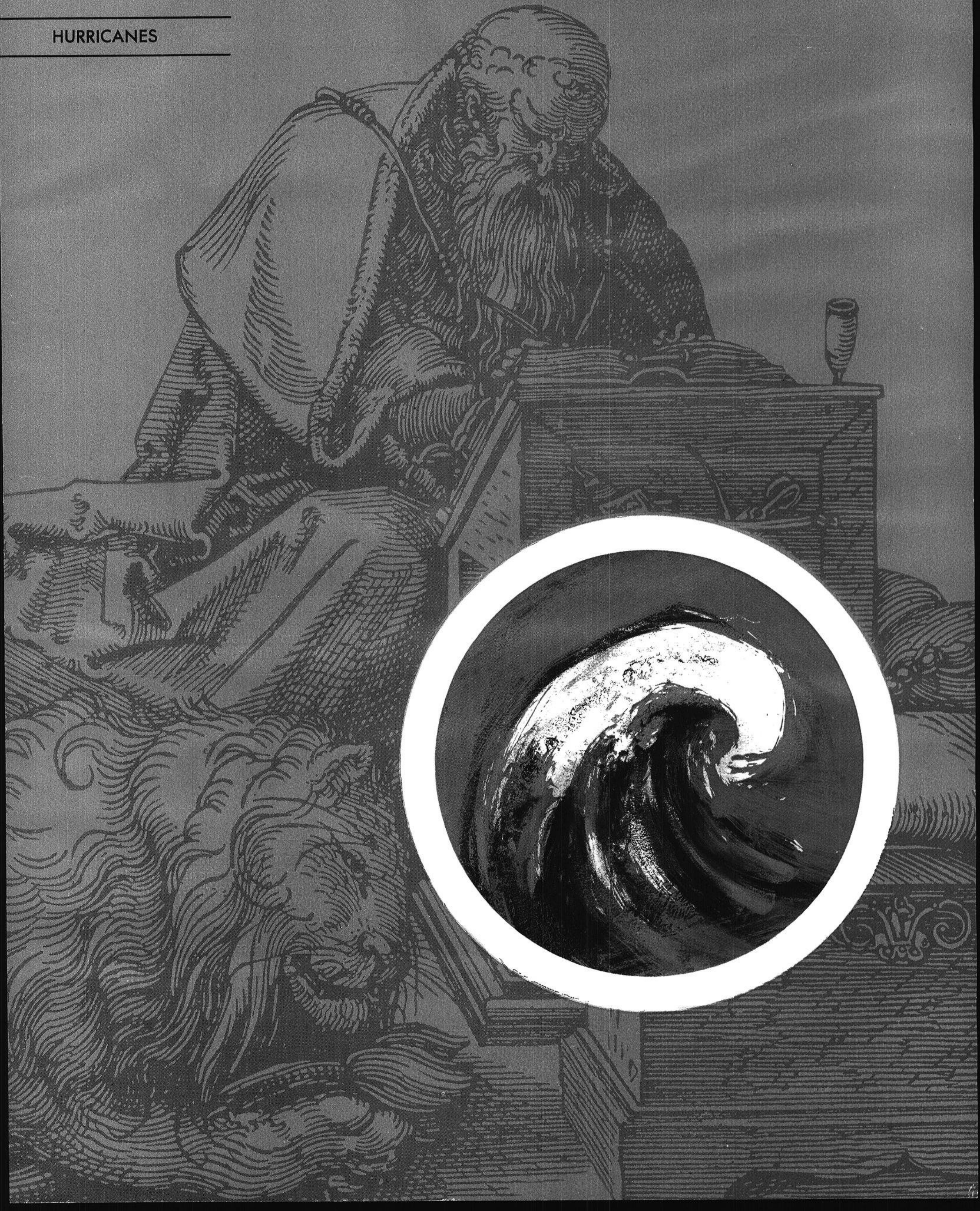
VOL. 72, NO. 8 MEMBER ECMA 35 CENTS MAY, 1968

wisconsin engineer

HURRICANES



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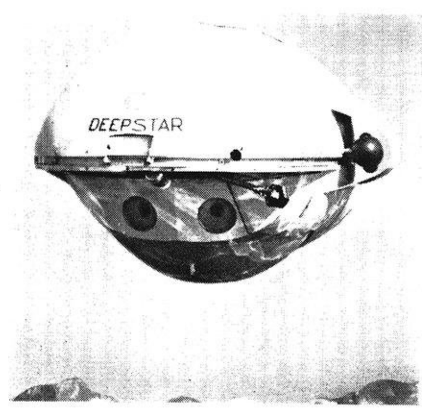

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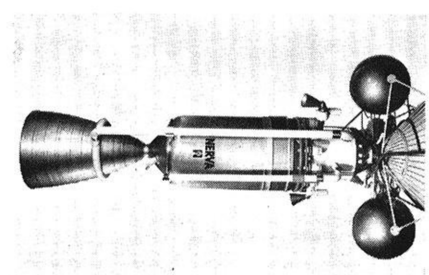

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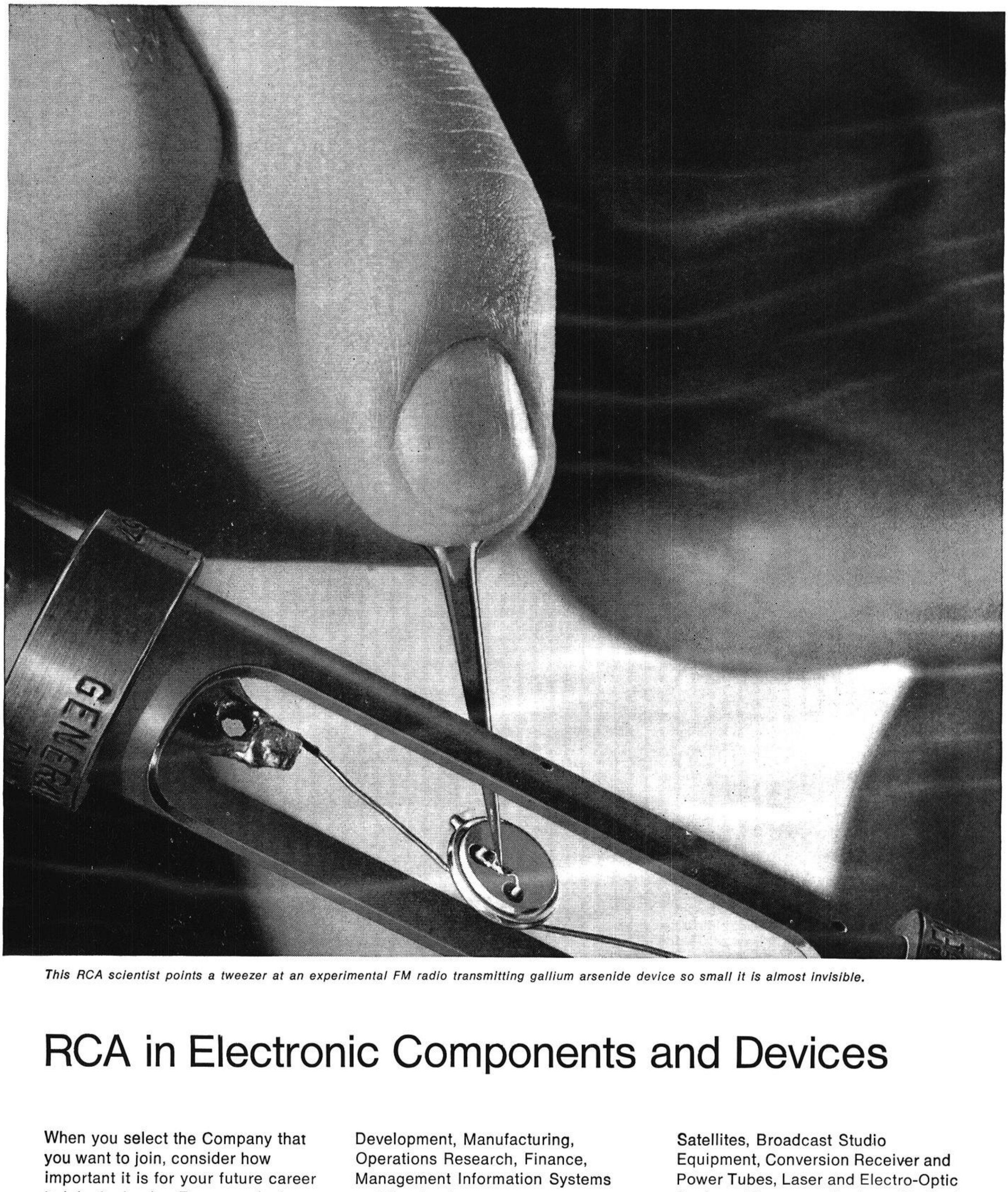

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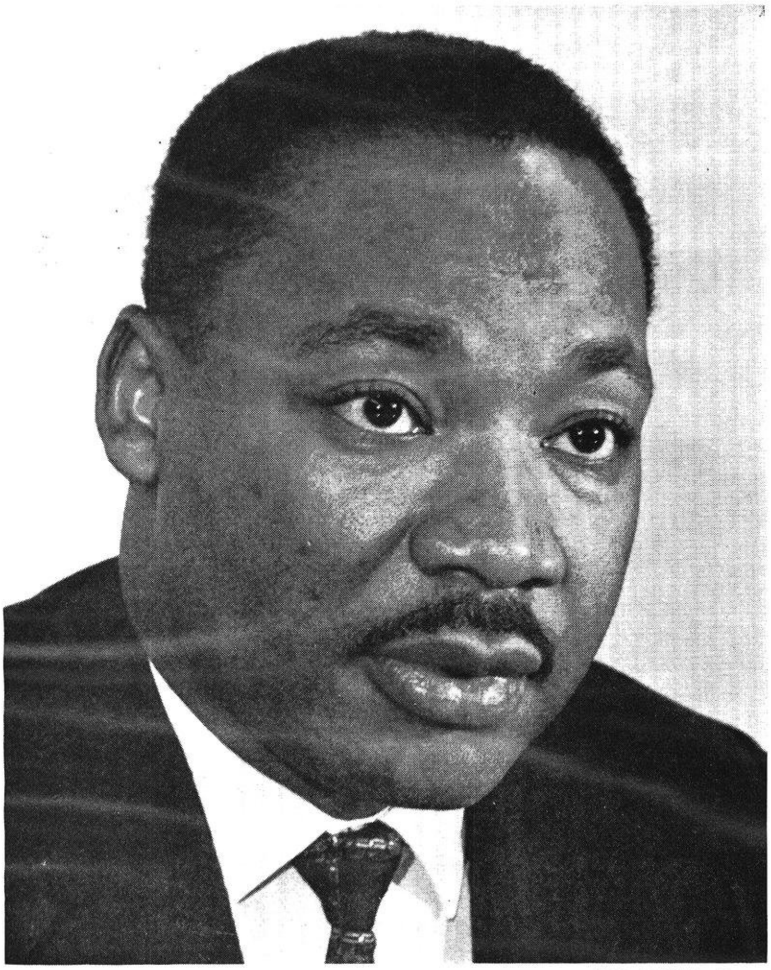

courtesy of World Wide Photos

Martin Luther King, Jr.
1929-1968

"Racial injustice is still the black man's burden and the white man's shame . . ."

FEATURES:

REAPPEARING NONENTITIES:

wisconsin engineer

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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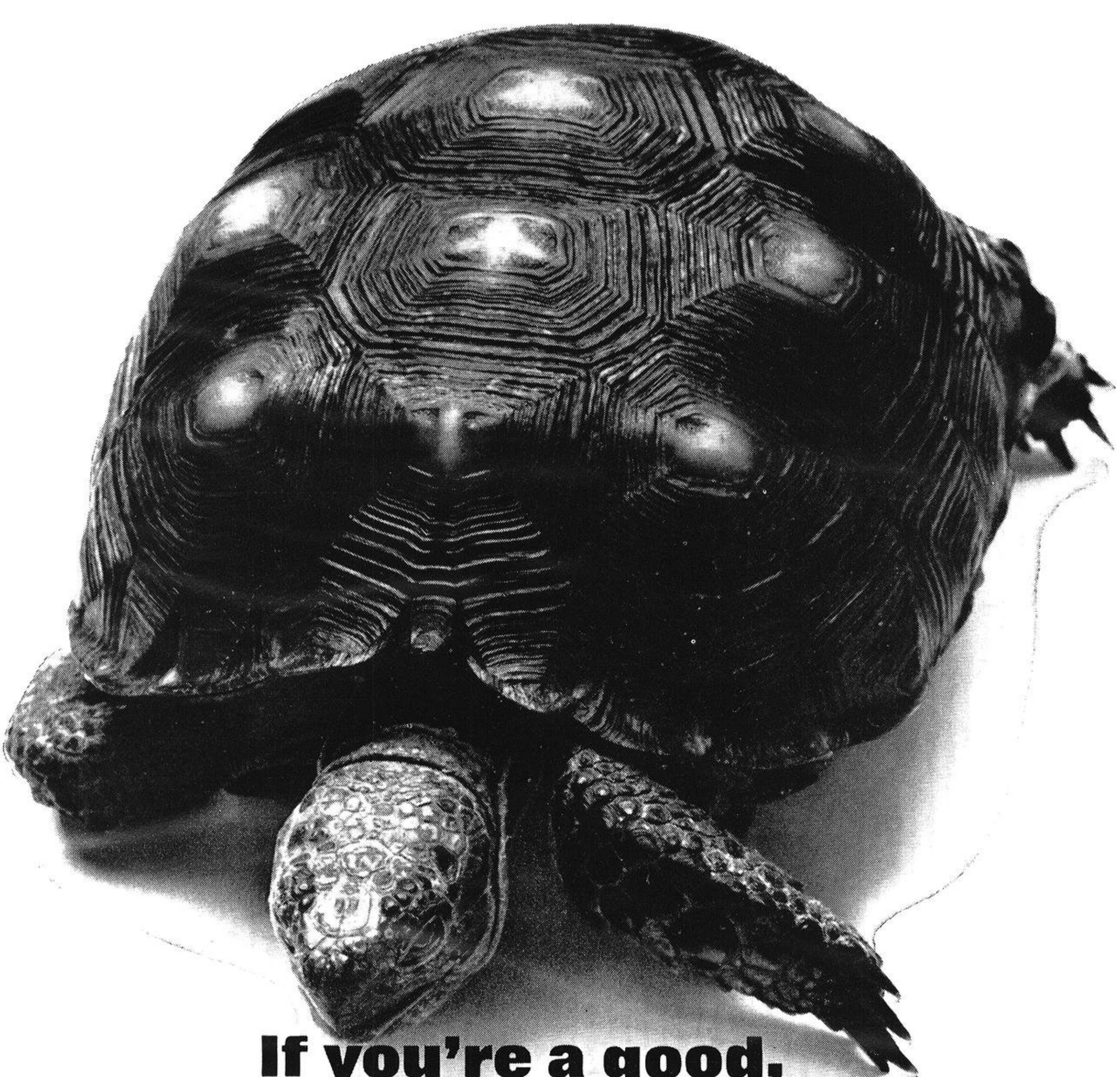

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CELANESE

EDITORIAL

THE MEASURE OF THE MAN...

"The measure of a man's real character is what he would do if he knew he would never be found out."—Thomas Macaulay

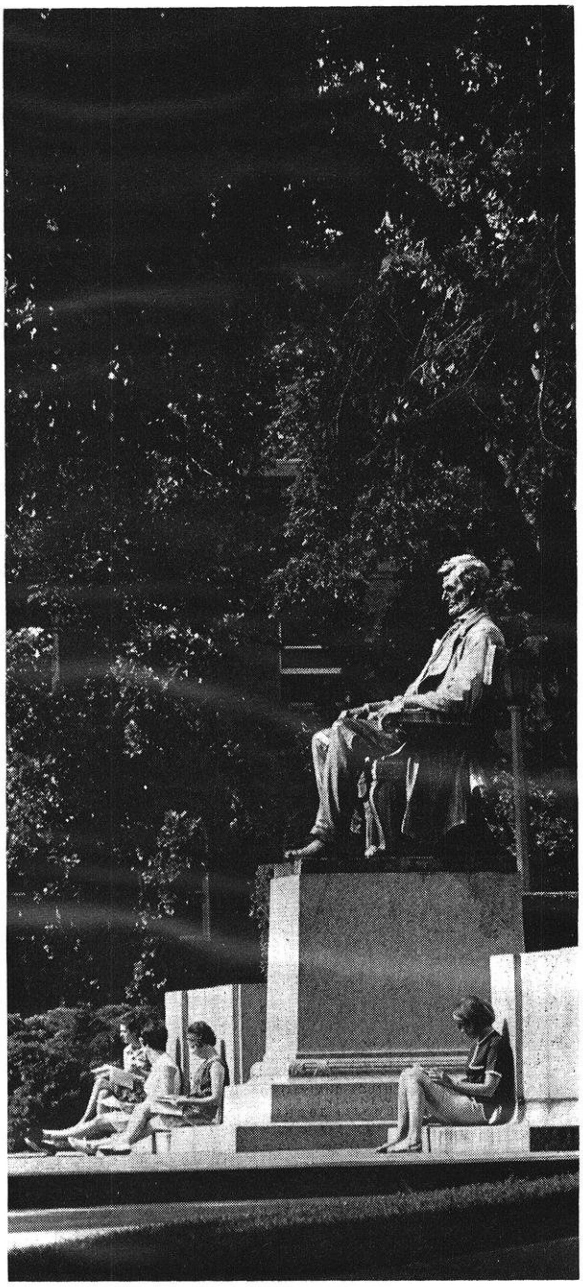
Perhaps you are wondering why Martin Luther King's picture appears at the beginning of this issue. There are many of you, I'm sure, who feel that it was Dr. King's death, and not his life, that made him as revered as he is today. I am not, as it would appear, dedicating this issue to him, but rather to all men whose lives have so exemplified their beliefs; and particularly to Professor Edward F. Obert, winner of this year's Pi Tau Sigma Outstanding Teacher Award. More specifically, I would like to endorse Professor Obert as the nominee for Vice-Chancellor of Student Affairs.

Why? It's not just his background; the list of his achievements is nearly 11 pages long. He has received the George Westinghouse National Outstanding Teacher Award, given annually to *one teacher in the nation*. He originated the AIM program of study, currently teaching some 30 students, and recently saw the first graduate of the program, in the M.S. degree. I could mention that he served on many committees on ethics and professionalism in American Society for Engineering Education, or that he is working on "liberalizing the engineer's curriculum." He has written several textbooks, and was chairman of the ME department for several years. Significantly, out of the 12 people he has graduated in the Ph.D. program, 10 of them have gone into teaching. But these things are not enough to qualify him as Vice-Chancellor for *all* students.

What does qualify him is his honesty, his objectiveness, his real concern for students and their problems. These are the traits that initiated the honors and achievements above. As a teacher, he always has time for questions, or for just talking. He is concerned about political affairs and better read on local and national situations than most officials. He periodically, with several others, goes to Ogg Hall for discussions with students completely unconcerned with engineering, and goes out of his way to seek constructive, opposing viewpoints to discuss.

I could go on, but there is too much to say. I hope that if you agree with me, you will take the time to communicate your support to Professor Moy, of the Industrial Engineering Department, who is concerned with this appointment.

Mary E. Ingeman
editor



IN MEMORIAM, CLASS OF 1968

ONE GREY DAY last March, a black clothed-group gathered among grey crosses in front of Lincoln's statue to mourn the Class of 1968.

Your future might be as bleak and hopeless as that March day, as barren as the crosses planted on Bascom Hill. Your elders have polluted the air and water, have stripped the mountains, engaged in dirty wars and have let population growth outstrip our capacity to feed new mouths. They have nearly killed the city and have alienated its inhabitants. Too often, technology rather than morals has determined what is good or bad. Perhaps the mourners' grief will be justified.

The future is your responsibility. What are you going to do about the problems, the crosses? Ignore them?

You, the graduating engineer, are in an excellent position to help. You, the man with the diploma, can use your problem-solving abilities for something more significant than designing a better drive train or a better relay. You can help build a humanistic technology, pollution-free communities and the opportunity for every man to be a MAN.

How? By being aware and by participating.

Be aware of what goes on about you in a world that stretches from the Kremlin Wall to Saigon. Read. Expand your mind, not with drugs, but with serious thoughts. Build yourself socially, intellectually, and morally.

Participate. Run for alderman. Write your congressman. Confront your senator if you disagree with him. Vote. Contribute your time to human rights committees, conservation committees, city planning committees, and Big Brothers.

Make your decisions logically and then fight for your beliefs. Or will you decay into a social and intellectual slum?

"Why build these cities glorious
If man unbuilded goes?
In vain we build the world, unless
The builder also grows."*

DICK SHELL
ASSOCIATE EDITOR

* Edwin Markham, American Poet

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COVER STORY

Hurricanes

by Peter Landwehr CE '68

WHETHER you're in India where it's called a cyclone, or in Australia where it's a willy-willy, or in Japan where it's a typhoon, or in Southeastern United States where it's a hurricane, you still must guard against one of the most destructive forces known to man. Each year, beginning in late August, the southeastern portion of the United States, as well as the Islands of the Caribbean and Mexico, begin their fearful watch for the progression of Audreys, Barbaras, Cleos, and their sisters, which will work their way north from the warm ocean of this area. No year in recorded history has been without at least two of these swirling storms, and the number has reached as high as 21 in 1933.

These gigantic storms, over 800 miles in diameter, with winds from 74 to 200 mph, rain, lightning, and occasionally tornadoes, daily release the energy of a 20 megaton hydrogen bomb.

BIRTH

Hurricanes form over oceans between the latitudes of 5° and 15° when the water has been heated to at least 82° Fahrenheit. Yet this warm water cannot be the only cause for formation. If it were, they would form continuously in this area. A source of energy is needed to start the circular rotation about the vortext (center). This energy is provided in part by the latent heat of condensation from the condensation of the warm water vapor rising to the cooler air above. This rising air is formed into a weak vortex because of the Coreolis effect. The Coreolis effect, caused by the earth's rotation, bends the surface winds into a circular flow. Once the air has risen, energy is added by the mixing of warm and cood air.

All of this is still not enough to form a vortex powerful enough to endure. It is also necessary that a low pressure center be in the area. If the center of the low moves over the existing vortex the two circulations superimpose upon each other, producing one storm of higher magnitude. If there is a disturbance in the winds at upper level, so that they diverge from the area while other winds are converging at the surface, an intense upward draft of high velocity will occur at the storm's center. Under all these simultaneous conditions, a hurricane will be born.

GROWTH OF A STORM

While the birth of a hurricane takes from 12 hours to several days, the full life of the storm may last up to 30 days. But what is it that happens to change the fledgling storm, with winds of 40 mph, into a giant storm threatening man's environment? The storm now has enough energy to overcome the small resistive forces of the water, which are applied in the form of frictional resistance to the storm's progress across the water and to the winds circulating about the vortex. The pressure at the center continues to fall slowly, and the winds continue their upward motion, yielding more energy. During this time, the developing storm sits over the warm ocean with very little lateral movement. Then, for some unknown reason, the pressure suddenly falls rapidly, winds increase to better than 100 mph within a 20 to 30 mile diameter, and clouds and rain form in spiral bands about the vortex. The hurricane is now full grown and restless.

MOVEMENT

The only consistent feature of a hurricane's movement is that it generally moves toward the North Pole. In less than 12 hours, hurricanes have been known to stop, move in a circle, or reverse upon themselves, making forecasting extremely difficult. No specific reason can be found for this erratic action except that it indicates there is some basic instability within the storm. Moving slowly, the young storm will travel 12 to 15 mph, while in its old age it will travel at a speed of 60 mph. This high speed also complicates forecasting, since predictions must be made 36 hours in advance. Thus a 5° error in the projected route could yield an error of 188 miles in the forecasted location.

FEATURES OF DESTRUCTION

The strong winds connected with a hurricane is not the only destructive force which man must contend with. Rainfall aligned in spiral bands precedes the storm by 300 to 400 miles. Maximum rainfalls occur in the right-forward quadrant of the storm yielding intensities of over five inches in a one-hour period.

High waves, caused by the storm, erode the harbors and breakwaters in the hurricane's path. Most severe directly ahead of the storm, the waves travel at rates of 1,000 miles per day, preceding the storm by 600 to 700 miles. Before modern forecasting, these waves were the first and only warning available to coastal cities. These waves raise the water level as much as 10 feet above high tide before the wind and rain actually begin. High water level, plus the action of the waves, causes destructive flooding of cities as the hurricane hits.

Squall lines preceding the storm can spawn devastating tornadoes. These tornadoes burst buildings which have been tightly sealed to prevent rain damage. The intense low pressure associated with a tornado causes the higher pressure inside the buildings to burst outward. Sealing the building, the standard protection for a hurricane, makes the structure the most vulnerable for a tornado. Tornadoes also threaten the lives of those who take refuge in their homes to be safe from the flooding water. Many times they kill more people than the wind and water of the hurricane.

HURRICANE EYE

One of the most unusual and unique elements of a hurricane is the eye. Formed inside the swirling air of the vortex, this is a calm area of winds less than 15 mph, clear skies, high humidity, and warm temperature. On all sides of the eye one can see the towering masses of clouds which contain the most intense winds of the storm. Encompassing an area of 15 to 40 miles in diameter, these areas are often the refuge for birds trapped by the storm. Many reports of birds in unnatural lands have been made after the passage of a hurricane. It may be supposed that, once trapped, they flew with the storm until the storm's death.

Although the winds of the eye are relatively calm, this is not a safe refuge for ships on the ocean. Surface winds bounding the eye make the sea so turbulent that many times the waves are more destructive here in the eye than in the area of rain and winds which surround it.

DEATH OF THE STORM

Hurricanes die for one reason, the loss of a source of energy to feed the storm. When mature, a hurricane releases the energy of a 20-megaton hydrogen bomb, and it needs a source for this energy.

A hurricane may pass over small bodies of land without appreciable loss of energy since the air will still be moist and any lost energy may be regained over open water. When a hurricane moves over a large land mass, such as Texas, it is doomed to die. Once over a land mass, its warm, moist air supply is cut off, thus eliminating the energy gained by condensation. Along with the small amount of additional surface friction, this energy loss will stop the storm.

Over open water the storm in its poleward trek will eventually reach the colder waters of the North Atlantic. Here, as over land, the loss of vapor to condense spells death to the storm.

FORECASTING AND PREVENTION

In our world today, man does not let nature overrun his domain without trying to control it or at least know when it is coming. This is typified by his fight against the hurricane. He knows where they occur, and each season modified B-29's patrol this area watching the development of disturbances which may form hurricanes. These "hurricane hunters" relay the velocity, direction, wind speed, and associated activity of any hurricanes back to the United States Weather Bureau in Miami. Weather satellites have been particularly helpful in detecting the new-born storms. From the collected data, in addition to any radar contacts obtainable, the storm's path is projected and storm warnings are posted.

In the 1960's man has tried to control the hurricane. By seeding the eye and surrounding clouds with silver iodide, the latent heat contained in the clouds is released. Just as initially energy is gained by vaporization, now energy is artificially withdrawn by condensing the vapor in the clouds into rain. Seeding also tends to enlarge the eye of the storm. By enlarging the eyes, any winds still rising have a larger radius to traverse, thus reducing their angular momentum and slowing the wind speed.

These new control devices are still in the testing stages, but they are signs of progress. With continued advances in forecasting and repeated trials at control, man will, in the foreseeable future, become the master rather than the victim of these seasonal monsters.

To All Faculty:

To all Faculty: From Office of the Dean
Subject: Death of University Professors

It has been brought to our attention that many professors have been dying on the job and refusing to fall after they are dead. This practice must stop.

On and after May 20, any professor found sitting up after he had died will be dropped from the Payroll at once, or within ninety days where the body is supported by a lecturn or other property marked U. of W. 00,000. The following procedure will be strictly adhered to:

If after several class periods it is noticed that a professor has not moved or changed position, Mrs. Baxter will investigate. Because of the highly sensitive nature of the U. of Wis. Faculty and the close resemblance between death and their natural working attitude, the investigation must be made quietly so as not to disturb the professor if he is only sleeping. If some doubt exists as to the true condition of the professor, extending of a pay check is a final test. If the professor does not reach for it immediately, it may be reasonable to assume that he is dead. In some cases, however, the instinct is so strongly developed that a spasmodic clutch or a reflex action may be encountered. Do not let this fool you.

In all cases, a sworn statement must be filled out by the deceased. Fifteen copies will be made. A formal application for permanent leave of absence must be filled out by the deceased. Be sure to include correct information, especially forwarding address. If he cannot write, the signature must be witnessed by two other professors, preferably alive.

ENVIROMENTAL EROSION

A Critical Challenge to Man

Courtesy of McGraw-Hill

● Man has faced several critical problems in his evolution: exhaustion of readily available sources of food, fuel and other materials, inefficient and slow transportation and communication systems, and so on. When these problems were acute, the probability of a human being surviving to old age was low; consequently, population death rates were in balance with population birth rates, and the world population of human beings grew very slowly. Sometimes, as in Europe in the 14th century, over large areas and for extended periods, life was so rigorous that populations actually declined. Until the last two centuries, man faced such serious problems on this planet that he was a relatively unimportant factor in the overall scheme of life. However, now that the important problems of the past have been solved, a new group of problems has arisen, potentially more deadly to our continued life on this planet.

THE CENTRAL CHALLENGE

The central problem is that with a relaxation in man's struggle for simple survival, there has been a drop in death rates all over the world, unaccompanied by corresponding drops in birth rates. The result is the well-known population explosion. What is not nearly so well known is the precise dimension of the problem. Even experts on population problems are guilty of statements to the effect that the human population is "growing exponentially," or "doubling every 30 years." Both these statements imply the same thing: that the human population is growing at any instant at a rate proportional to the world population size at that instant. In fact, this is not the case: we are growing at a much faster rate. In 1960 three engineers predicted that humanity would squeeze itself to death in 2026; nobody paid much attention. Even fewer seem to have noticed that subsequent data from the United Nations have shown their predicted growth rates to be badly underestimating current growth rates. What can scientists and concerned laymen do? First, support birth control programs, particularly in newly developing countries. Second, speak out firmly against the notion that a man is not a real man unless he has several children. Experts on the population problem insist that physical birth control devices are not the basic problem. The basic problem exists in the minds of the people who are not disposed to use contraceptive measures even if they are available free until they have had three or four children.

Other problems are a consequence of human population explosion and the massive resultant effect our species is having on everything which occurs on this planet.

CAN THE SEA SOLVE THE FOOD PROBLEM?

A particularly dangerous notion is that the sea is an inexhaustible source of food. The facts speak differently. First, much of the world's oceans are aquatic deserts, relatively poor in minerals and therefore supporting little plant or animal life. Second, much of what we remove from the ocean is high up on the food chain: we eat fish predators that eat small fish that eat crustaceans that eat plankton that derive their energy from the sun. At each step in this chain, there is tremendous loss of energy. The efficiency of the whole process is extremely low, comparable to that of growing grass to feed to rabbits which are eaten by lynx which are then eaten by mountain lions, which are then eaten by man. Man in fact does nothing comparable to this on land, either eating plants directly, or herbivores which eat the plants. In Asia, particularly, even the herbivore step is too costly, and most people live on an almost entirely plant diet.

Some people will counter this argument by insisting that man will some day live on the algae in the ocean. The central difficulty is that many algae exist in the water at such low densities that much pumping and sieving would be required to extract useful quantities. The only parts of the oceans rich enough in minerals to support dense plant and animal concentrations of economic consequence are close to the continents; it is precisely these parts of the oceans we are polluting and degrading most rapidly.

CAN WE SURVIVE POLLUTION?

Many forms of pollution are by now sufficiently well known to require no further mention. Pesticides are in this category. Anyone who has lived on the shores of

Lake Erie for at least 30 years will require no further discussion of what this is doing to his environment. However, man is polluting this planet in more important and more subtle ways which are in dire need of open discussion. Two important recent incidents have alerted the population to hazards of petroleum products being released at sea. The incidents aroused wide interest, because the fractions released were in enormous quantities and were swept to, or close to shore. However, ocean-going vessels routinely clean themselves at sea by flushing out a viscous fraction of crude petroleum left behind after the lighter fractions have been refined off. This heavy fraction is called bunker fuel, and in the cold north Atlantic it kills millions of birds every year. The significance is that the sea birds' feces (guano) rich in essential minerals aid in circulation of chemical elements in the ocean which are the basic input to the cycle which terminates in commercial fish stocks.

Pollution of the air is probably the most serious pollution problem and will probably have the widest array of types of (often surprising) effects. There is considerable evidence that air pollution has implications for the weather, for human health, for growth of agriculture plants and animals, and for almost any imaginable chemical process on this planet. It is not widely recognized that the total quantity of air which determines the entire course of events on this planet is not very great: most of it occurs in a sphere seven miles out from the earth's surface. Man is now in a position to have a very major effect on this volume of gas. A regular jet traveller will have noticed, for example, that jet contrails are a major contributor to the origination of clouds at certain altitudes and in parts of North America.

Those of us fortunate enough to live in thinly populated parts of this country find it a trying ordeal to visit the manufacturing cities of the northeast and the midwest, because of the oppressively poisonous-smelling air. Unfortunately, an increasing proportion of the U.S. population is becoming adapted to living in this air, and tolerating sinus operations, rapidly rising emphysema death rates, lung cancer, and all the concomitant hazards. Unfortunately, Homo sapiens is a remarkably adaptable species, so much so that we may have adapted to our ultimate doom before we are aware that it is upon us. The time has come to cease adapting, and speak out vigorously about the contamination of the environment before it becomes uninhabitable.

Ironically, much of the material with which we are destroying the planet could be very useful as input for various factory processes. This is true of smoke, wood chips, beer cans, abandoned cars, newspapers, and most solid liquid waste. Massive, aggressive research programs on techniques for reclaiming solid and liquid waste should be initiated before exhaustion of our mineral wealth, forests, and fossil fuels forces us to such massive efforts on a crash basis. Corporations devoted to such reclamation have been remarkably profitable.

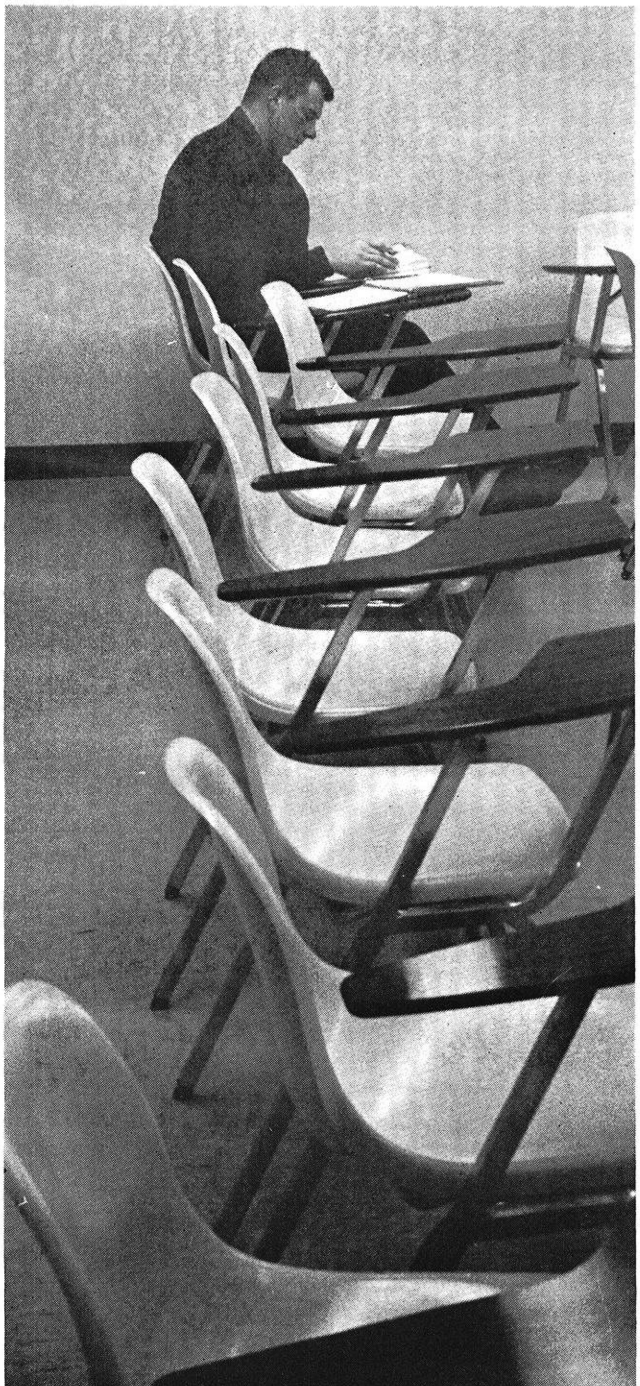
As human populations become ever larger, it becomes more important that agriculture be as efficient as possible for this reason. Pest control needs very critical reexamination. The public should look carefully at any pest control campaign and ask the following question: in the season following the season when we made an intensive effort to control a particular pest, were there as many pests as the previous season, or more, or less? If the number of pests in the season following treatment was equal to or greater than the number preceding treatment, then something is wrong. One does not have to be very observant to realize that this is often the case. Further, criteria for successful pest control campaigns are repeatedly being established by those campaigns which are successful; e.g., the Florida screwworm program, which eradicated the screwworm. A program which purports to be successful must gradually reduce densities of the pest, or the public is being deceived.

CAN NOVEL FORMS OF AGRICULTURE BE USED?

Every time European settlers moved elsewhere, they had available alternative courses of action, although it is only in the last six years that it has been widely recognized that the alternative existed. One possibility was to transplant European style agriculture, built around conventional grains, and standard breeds of cattle, pigs, sheep and goats. This was the option invariably chosen. The other alternative was to set up intensive and scientific harvesting of native plants and animals, such as bison, kangaroos, antelopes, etc. Native organisms have often been totally or almost wiped out, then replaced by imported species. If it is true that natural selection selects a given place for those species and strains which, because they are best adapted, make most efficient use of incident solar radiation, then man has been guilty of a very foolish mistake. Organisms which make best use of resources in a particular habitat have been replaced by other types which are not so efficient, as when buffalo were replaced by Shorthorns and Herefords in the American West. Data bearing on this point have become more plentiful recently. It turns out that in Africa, for example, higher quantities of meat can be produced per annum off a given acreage by harvesting 13 species of native game than by harvesting conventional livestock. Perhaps even more important, much of the native game produces higher quality meat. Critics of this argument will assert that buffalo meat, for example, is inedible. This would have come as interesting news to many of the early American settlers who somehow consumed about 1,300 pounds of the stuff per person per annum, every year of their lives.

The moral of this story is: don't change anything until it has been conclusively demonstrated that the change is for the better. Mother Nature has produced her results after a rather long sequence of experiments, and it may take considerably more sophistication than we sometime realize to improve on her work.

THE NEED FOR BREADTH IN ENGINEERING EDUCATION



The following is an excerpt from the report of the Goals Committee of American Society for Engineering Education. The stimulating report, discussing the engineer in future society and basic and advanced education, is printed in the January 1968 issue of the Journal of Engineering Education.

In the past, general subjects were included in undergraduate and graduate engineering curricula for a twofold purpose: (1) to provide a foundation notably in mathematics, physics and chemistry, for the professional engineering courses, and (2) to provide content in the humanities, social sciences and communications so that graduates could assume their role as college-educated citizens in our society.

Mathematics and the physical sciences have continued as ingredients of engineering education, but the needs for general education now include knowledge of the life sciences, the social sciences and the humanities as necessary qualifications for engineers' performance as *working members* of society, as well as broadly educated citizens. The rapid development of interdisciplinary activities makes it paramount that future engineering graduates have a broad enough education to enable them to cope not only with physical forces but biological and social forces as well so that they may make contributions with other colleagues to the solution of the still dimly seen problems of tomorrow.

Responding to inquiries about the future role of engineering graduates, educators from 156 institutions were more likely to anticipate an increase in the social than in the technical role of engineers in the decade ahead. It seems clear, then, that educational programs must be designed to help engineers meet the challenge of this new responsibility.

(Continued on next page)

ENGINEERING EDUCATION continued

Non-technical activities in the day to day life of engineering graduates share importance with technical activities. Engineering graduates report the use of English composition, speech and economics as frequently as the use of algebra, engineering design and properties of materials. Similarly letter and memo writing, supervision, and oral and written reporting were among the most frequently reported activities of engineering graduates. These findings stress the dual importance of liberal and technical content of engineering education.

Additional support for the viewpoint that there is an important need for breadth in the education of future engineers is found in the opinions of practicing engineers surveyed. When questioned, about one-half of the engineering graduates indicated that their undergraduate experience did not provide enough liberal or general education. A similar view was noted in the comments of engineering managers and personnel representatives who were queried regarding the strengths and weaknesses of recent and earlier graduates. For example, 60% of the managers felt earlier graduates were "too weak" and 35% felt that recent graduates were "too weak" in liberal or general education.

The following *observations* are presented: (a) Engineering education and the engineering profession must recognize the integral role of general and professional education at both undergraduate and graduate levels. (b) New interdisciplinary activities will continue to emerge not only within engineering and the natural sciences, but also within the life sciences, the social sciences and the humanities during the coming decade. These developments will create new challenges for the future. (c) Strides made in recent years in broadening and liberalizing the education of engineering students should be continued and extended during the next decade.

Therefore, it is recommended that (a) the engineering student should be sufficiently exposed to the new facts and theories offered by the social sciences to help him understand the large social problems of his time; (b) he should be persuaded in college to set a course of lifelong study in this area; (c) he should be impressed with the importance of his role in the ultimate solution of these problems; (d) he should understand and appreciate the vital mutual influences which have been operating since the industrial revolution between technology on the one side and the more slowly changing institutions of society on the other; (e) the youthful idealist should be persuaded that engineering offers him a field of opportunity for the exercise of his enthusiasms and fulfillment of his highest goals for humanity.

It is also recommended that the appropriate organizations launch a nation-wide investigation of the education of the engineer in communications, the humanities and social sciences — a comprehensive study in depth of all the forces and activities that help or hinder this educational enterprise in the life of the student — from high school diploma to college degree. Such a study might reveal that the problem of providing adequate work in humanities and social science is not peculiar to engineering; that it arises wherever a student is preparing to become an expert in a specialized field.

AN INTRODUCTION TO METEOROLOGY

by Abby Trueblood
Wis. Engineer Staff

Most people think that they understand a weather forecast because they have learned to connect what the forecaster says with their own weather observations. The weather seems to be all-powerful and mysterious when it forces us to take it into account in making our daily plans. It becomes all the more terrible and strange when it destroys human life and property — when a ferry off New Zealand overturns in heavy winds drowning countless passengers, when a hurricane leaves hundreds homeless in the Caribbean, or when a tornado sweeps through Illinois or Wisconsin destroying and killing.

Most of us never think about the weather or attempt to understand "how" it works except at its more dramatic moments. However, if one can comprehend how to interpret a weather forecast, then one can have a better understanding of why the weather can do such damage. The following is only meant to be an elementary guide to knowing what makes the weather tick — it is not intended to be a comprehensive study of meteorology. If, after reading this article, one would like to learn more about the subject, there are courses open to you in the Meteorology Department here at Wisconsin.

TEMPERATURE OBSERVATIONS

Temperature has to do with molecular motion. As the velocity of inter-molecular motion increases, there is a rise in the temperature. Matter in motion possesses a certain amount of energy and, therefore, it is capable of exerting a force and of doing work. The energy due to molecular motion is called heat and it is measured in terms of temperature.

The most important temperature to a weather man is that of the atmosphere. A thermometer assumes its own temperature, and one must be sure that it is the same temperature as the surrounding air. To obtain the correct reading, thermometers are exposed to the freely moving air and also sheltered from other influences which might affect the temperature reading. A precise measure of the temperature is essential for correct forecasting.

WIND OBSERVATIONS

Wind refers to air in horizontal motion, while air moving vertically creates currents. Winds are always named for the direction from which they originate. When winds change in a clockwise direction they are said to *veer*. Winds *back* when they shift in a counter-clockwise direction. Wind vanes are commonly used to measure wind direction.

Air turbulence refers to the gustiness of the wind. Air turbulence increases with wind velocity and is greater over land than sea and over land that is not flat and bare.

HUMIDITY OBSERVATIONS

Water is the most variable of the gases in the atmosphere, ranging from almost zero to a maximum of four percent by volume. Relative humidity is the percentage of water vapor present in the air in comparison with saturation conditions for that temperature. Relative humidity is measured by hygrometers, which obtain this measure from observing changes in the length of a human hair.

Precipitation means either the falling of moisture to earth in any form or the quantity so deposited. The measurement is expressed in depth of water. Snowfall needs two measures: 1. depth of the snow itself and 2. the water equivalent. Although the amount of water in any snowfall varies, the ratio of one inch of water to ten inches of snow is the usual standard.

> *Fair with no important temperature change today. High 65-70. Continued fair with little temperature change tonight and Wednesday. Rain probability less than 5 per cent today and 10 per cent tonight.*

CLOUD OBSERVATIONS

There are three principal cloud forms: Cirrus clouds are delicate and fibrous. They are generally white and have varied forms from tufts to feathered plumes. Stratus clouds are recognized by their stratified development. They are usually found in fairly uniform layers at various heights. Cumulous clouds are characterized by their vertical development. The upper surfaces of these clouds are usually dome shaped.

THE TOTAL PICTURE

One can already see at this point how all these factors work together to produce the weather. Pressure, temperature, and wind can be shown to be related. Pressure differences result from vertical and horizontal movements of air brought about by differences in density. These, in turn, are due chiefly to differences in the temperature.

The difference between the pressures at points "A" and "B" is the force that is pushing the air at "A" toward "B" (where "A" has a greater pressure than at point "B"). The magnitude of the force depends on the difference of pressure or the *pressure gradient*. As the force increases with the gradient, the rate of movement of the air also increases. Consequently, the direction and the speed of the wind are the result of the pressure gradient.

The movement of air is also influenced by the earth's deflection and the centrifugal force. Turbulence and friction near the surface reduce the speed of a wind produced by a given pressure gradient. In an area of low pressure the air has a tendency to move inward toward the center of the system in a counter-clockwise direction in the Northern Hemisphere and a clockwise direction in the Southern Hemisphere. The high pressure system wind moves spirally outward from the center in a clockwise direction in the Northern Hemisphere and counter-clockwise in the Southern Hemisphere.

Clouds are chiefly the result of the dynamic cooling produced by expansion under reduced pressures. The most important cause of the formation of clouds is the cooling process that results from the upward movement of air, although some clouds are the result of the mixing of warm and cool air in the atmosphere.

There are four major theories about the process which ends in precipitation on earth. One theory, the Berberon ice-crystal theory, is based on the idea that there are ice crystals formed at the top of all clouds. When the crystals reach sufficient size, they fall through the cloud, condense with the higher temperatures, and continue falling to earth. The problem with this theory is that rain can fall in areas where it is known that there are no clouds that have areas of freezing temperatures.

Other theories have been suggested to explain this process by which minute drops of water grow to the size of rain drops. One suggestion is that these drops have an unusual hygroscopic (water absorbing) nuclei. Another says that the process results from a vapor-pressure gradient due to the presence of drops of differing temperatures. A final theory supposes that drops of differing sizes collide as they fall to earth and then coalescence occurs.

Rain falls directly beneath the air in which it is formed. It can, however, be carried short distances by the wind. A large amount of rainfall (or snowfall) cannot occur unless there is a continual renewal of the moisture supply. If rain is held aloft for a time and then suddenly released by a down draft of air, the result is commonly called a "cloudburst."

One final aspect of weather forecasting that needs to be looked at is that of *fronts*. A front is a transition zone separating air masses of quite different temperatures. It has a sloping boundary and is narrow — usually only from 50 to 500 miles in width. The major types of fronts are warm and cold fronts.

MADISON FORECAST

Mostly sunny today and Wednesday. High today 65-70. Fair tonight, with low near 40. Cooler Wednesday. Precipitation probabilities less than 5 per cent today, 5 per cent tonight. North to northeasterly winds 5 to 12 miles an hour today.

A warm front is a boundary line between warm air and a retreating wedge of colder air, over which the warm air is forced as it advances. Usually warm fronts advance northward and eastward. The amount and type of cloudiness associated with this type of front and the amount of precipitation which it produces depends upon the existing humidity and lapse rate in the warm air. In most cases in this country the warm air is a tropical maritime air mass, so that the air is often humid and unstable.

In advance of the approach of such an air mass there is first a drop in the barometer and a formation of high clouds. Cloudiness increases while the temperature is slowly rising, unless a rainfall lowers the temperature. As the front draws near there is an increase in the pressure and often rain (where there is high instability there are apt to be thunderstorms). Often fog is produced and, in the winter, there is icing. With the passing of the front, there is a gradual rise in temperature, a change in wind direction, and generally clearing weather.

As might be expected, a cold front is about the opposite of a warm front. A cold front is a boundary line between cold air and a mass of warmer air, under which the colder air pushes like a wedge, usually advancing from the northwest. Here, too, the vertical structure of the warm air determines the amount and type of cloudiness and precipitation. A cold front is steeper than a warm front, it slopes backward instead of forward, and here the warm air is being removed.

U.S. FORECAST

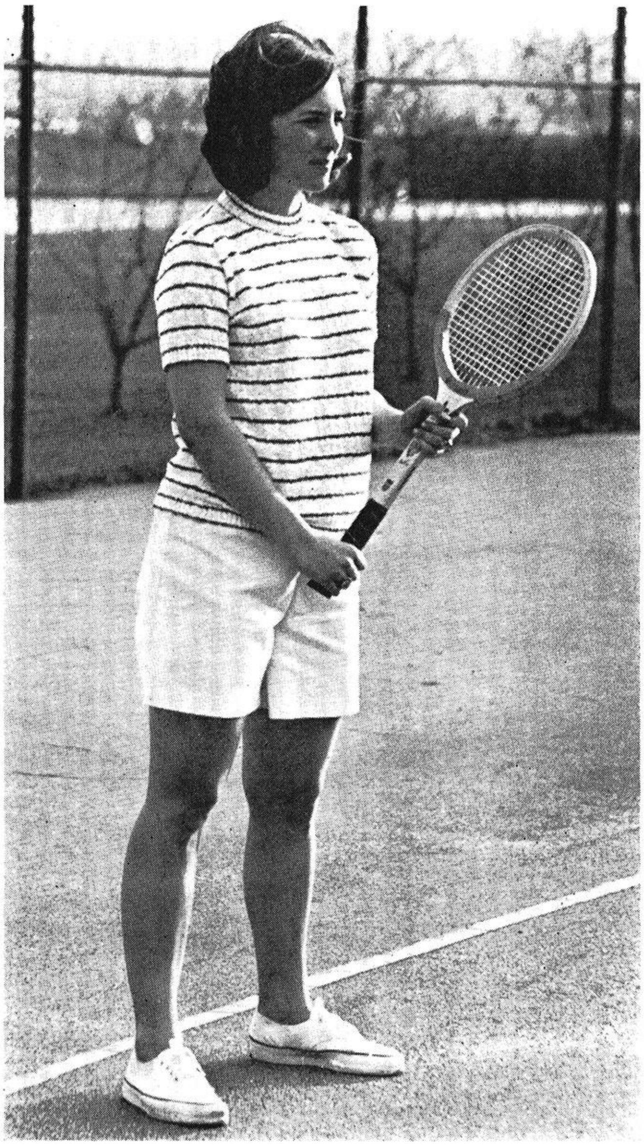
Scattered showers are expected today in southern Florida and on the northwest Pacific Coast. Fair weather will dominate the rest of the nation except for the Northeast where cloudy skies will prevail.

Ordinarily there is no warning far in advance of an approaching cold front, unless there is a string of thunderstorms (squall line) preceding the front. There is generally a narrow band of clouds and precipitation with sharper and more violent reactions. There is usually an increase in the wind in the warm sector of a cold front and some clouds appear. Then the clouds become thicker and rain falls with the front actually passing through. As the front passes there is an increase in pressure, an abrupt and often large drop in temperature, an increase in wind force, and a change in wind direction from southwesterly to northwesterly. Usually clearing follows.

All fronts are either warm or cold. Some of these fronts cease to move in either direction and are called *stationary fronts*. A front may remain stationary for several hours or days before it begins to dissipate or move again.

When one front overtakes another and three air masses are brought into close proximity, we have an *occluded front*. This occurs when the middle mass is warmer and therefore lighter. This mass is pushed upward so that it is completely occluded from the ground, hence the name given to this type of front.

It should now be possible to see how storms develop from everyday weather occurrences. For instance, hurricanes and tornados grow out of low pressure systems, which follows from the way winds in these systems revolve. Thunderstorms are due to more local disturbances in the atmosphere. All of the more dramatic expressions of weather which receive so much attention are equally explainable in terms of special cases of everyday weather phenomena.



wisconsin's finest

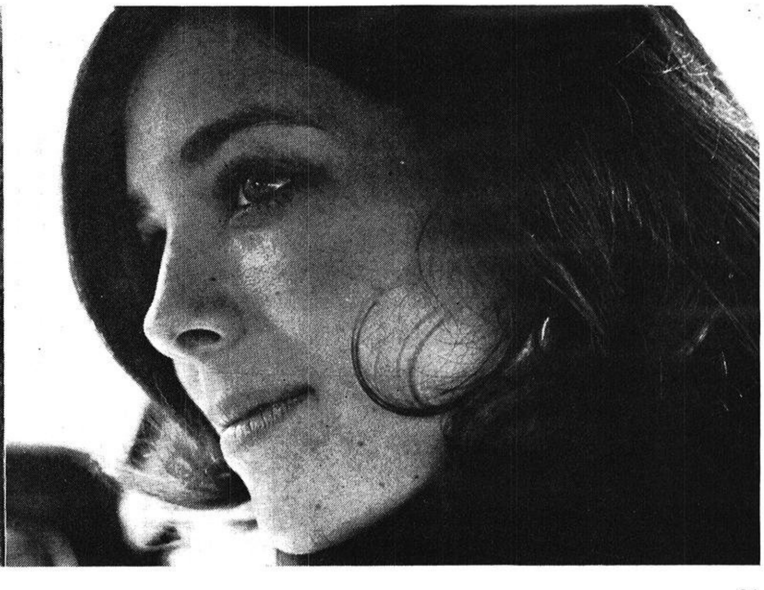
Priscilla Reichardt

Wisconsin's finest for May is pretty Priscilla Reichardt. In case the name sounds familiar, Priscilla's oldest brother is the former Wisconsin athlete, Rick Reichardt, who is now playing for the Anaheim Angels. Priscilla may see her brother play often this summer because she is hoping to work at Disneyland.

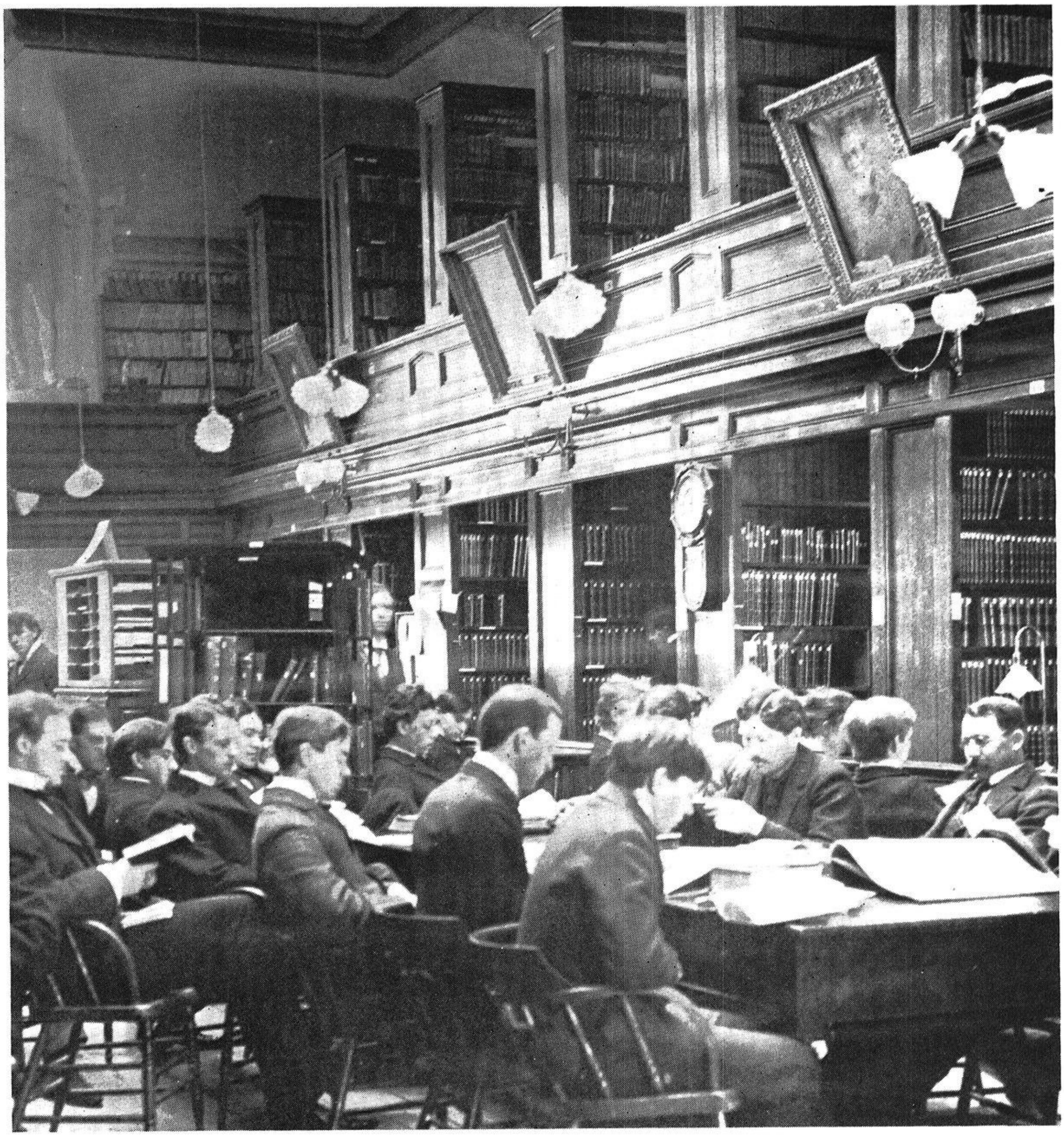
Priscilla is the third oldest in her large family of four brothers and four sisters and thus enjoys that distinction of being the "third Reich" (get it?). Although she has just started playing tennis in earnest, Priscilla enjoys all sports and says she will try anything. (?)

Priscilla is majoring in elementary education and is a member of Delta Delta Delta. When she graduates, she wants to teach culturally disadvantaged children. (Would you believe culturally disadvantaged engineers?)

photos by Norm Frater and Bruce Pease



wisconsin's album



The first days of June are the final days of the year. Good luck!

HUMOR

FLIRT: A coed who believes that it's every man for herself.

* * *

Thermometers aren't the only things that are graduated and have degrees without having any brains.

* * *

On the tombstone of an atheist: "All dressed up and no place to go."

* * *

Confucius, who has been saddled with more garbage than the city of New York, say: "Bosom companion often turn out to be false friend."

* * *

When the Creator was making the world, he called Man aside and bestowed upon him 20 years of normal sex life. Man was horrified. "Only 20 years?" But the Creator wouldn't budge.

He called the Monkey and gave him 20 years. "But I don't need 20 years," the Monkey protested. "Ten is plenty."

Man spoke up, "Can I have the other 10 years?" The Monkey graciously agreed to this.

Then the Creator gave the Lion 20 years. The Lion, too, only needed 10 years. Again Man asked, "Can I have the other 10 years?" The Lion agreed.

Then came the Donkey. He was given 20 years, but 10 years was enough for him too. Man asked for the spare 10 years and got them.

This explains why Man has 20 years of normal sex life, 10 years of monkeying around, 10 years of lion about it, and 10 years of making an ass out of himself.

A marriage counselor in Detroit has been getting pretty fair results with a sign over his desk which reads: LIVE ALONE AND LACK IT.

* * *

A profound philosophy of life is reflected in the reply of a no-longer wealthy engineer who, when asked what he had done with all his money, said, "Part of it went for liquor and fast automobiles, and part of it went for women. The rest I spent foolishly."

* * *

Three degrees you can get in college: B.S. and everyone knows what that means; M.E., which, naturally, means more of the same; and Ph.D., which means "piled higher and deeper."

* * *

Sign seen recently in a Madison merchant's window: "You can fool some of the people some of the time, and generally speaking, that's enough to allow for a profit."

* * *

Engineering Conversion Factor: It takes two pints to make one cavort.

* * *

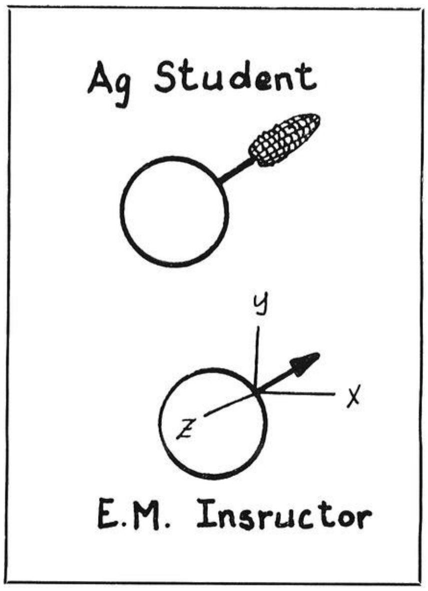
A bachelor is a man who didn't have a car when he was in college.

* * *

Sign in front of a crematorium: We're Hot For Your Bod.

* * *

The Indian mother was trying to explain the facts of life to her daughter, "Not true baby brought by stork," she confided. "Indian girl get papoose with beau and error."



A worker in a violin shop claims to be able to restring 14 violins in one day. "And that," gentlemen," he adds, "takes guts."

* * *

The prairie tourist marveling at New England's scenery, finally asked a New Hampshire man where all the rocks came from.

The native farmer replied, "The great glacier brought them here."

"Well," demanded the tourist, "where's the glacier now?"

"Went back for more rocks," drawled the farmer.

* * *

Badger definition of a maternity dress: A slip cover.

* * *

We believe that what the world needs is a good loudspeaker for the still, small voice.


"I used to think IBM would be one of the last places for an M.E."
"I was skeptical about IBM as a place for a mechanical engineer to work. E.E.'s, sure. But M.E.'s?" (This is Dick Driscoll, B.S.M.E. '67, a Manufacturing Engineer at IBM.)
"I was wrong. There are plenty of opportunities for M.E.'s in just about all areas, especially in development and manufacturing.
"When I joined IBM, I chose manufacturing engineering. In my case, this got me involved in producing core planes for memory components. After the component has been designed, I coordinate the tooling and all the other manufacturing processes. I initiate basic ideas on the design of tooling and work closely with the machine tool and die designers and builders, and with the installers of the production machinery.
"It's sort of like solving a very difficult three-dimensional jigsaw puzzle. And it's a 'pure' engineering job. The kind I was trained for. Because, in the final analysis, product responsibility for manufacturing the memory component rests with one person. Me.
Interdisciplinary environment. "You get exposed to a lot of different disciplines in manufacturing engineering. Electronic. Metallurgical. Chemical. This kind of interfacing broadens you as an engineer.
"It may sound square, but I think IBM is a great place for an M.E. to work."
If you'd like to know more about a career in mechanical engineering with IBM, visit your campus placement office. Or send a brief outline of your educational background to Irv Pfeiffer, IBM Corporation, Dept. E, 100 South Wacker Dr., Chicago, Ill. 60606. We're an equal opportunity employer.
IBM®

Dan Johnson has a flair for making things.

Just ask a certain family in Marrakeck, Morocco.

A solar cooker he helped develop is now making life a little easier for them—in an area where electricity is practically unheard of.

The project was part of Dan's work with VITA (Volunteers for International Technical Assistance) which he helped found.

Dan's ideas have not always been so practical. Like the candlepowered boat he built at age 10.

But when Dan graduated as an electrical engineer from Cornell in 1955, it wasn't the future of candle-powered boats that brought him to General Electric. It was the variety of opportunity. He saw opportunities in more than 130 "small businesses" that make up General Electric. Together they make more than 200,000 different products.

At GE, Dan is working on the design for a remote control system for gas turbine powerplants. Some day it may enable his Moroccan friends to scrap their solar cooker.

Like Dan Johnson, you'll find opportunities at General Electric in R&D, design, production and technical marketing that match your qualifications and interests. Talk to our man when he visits your campus. Or write for career information to: General Electric Company, Room 801Z, 570 Lexington Avenue, New York, N. Y. 10022

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