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Albert Einstein's explanation of his theory of relativity, "*When you sit with a nice girl for an hour, you think it is only a minute; but when you sit on a hot stove for a minute, you think it is an hour.*"

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wisconsin engineer

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Editorial

Welcome Dean Marshall

With the retirement of the distinguished Dean Kurt Wendt, William Robert Marshall has aspired to the position of Dean of the University of Wisconsin School of Engineering. We, the staff of the *Wisconsin Engineer*, welcome Dean Marshall to the office, and proudly dedicate the first issue of the 1971-72 school year to him.

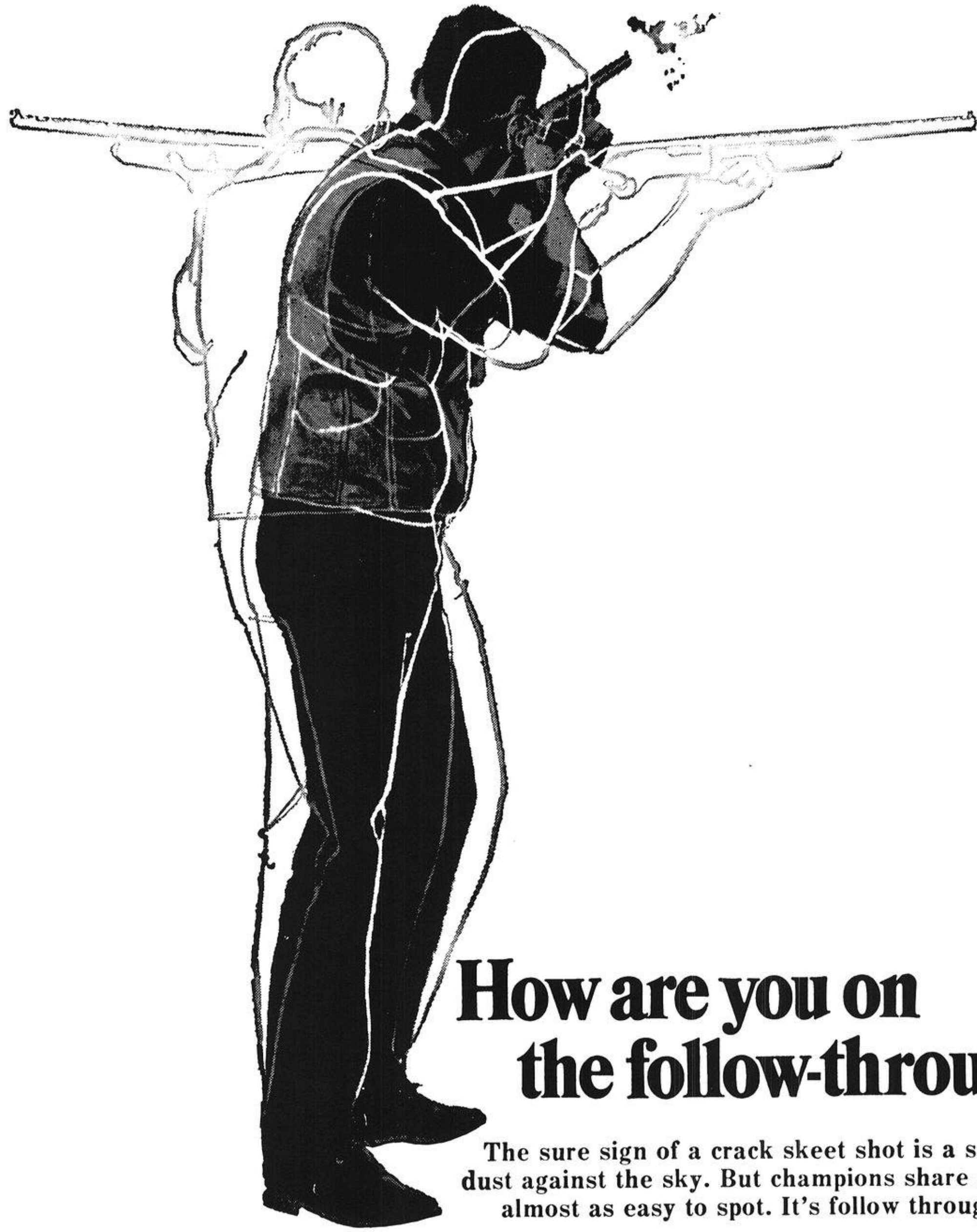
Dean Marshall is no stranger to students, faculty and alumni of the School of Engineering. A member of the University staff since 1948, Dean Marshall has many friends. He knows what makes the school run, and he has ideas on how to improve it. He's accustomed to spending a limited budget in the best way possible. Dean Marshall understands people and people-type problems, and his activities and attitudes reflect this strong interest. Equally important, he appreciates the vital role of the technological world in improving people's position in life.

A member of many engineering organizations, Dean Marshall stays abreast of the world of engineering. Many societies have conferred various honors upon him, including his election to the National Academy of Engineering (See "Meet the Dean" article).

Dean Marshall worked closely with the former Dean Kurt Wendt to improve old programs and innovate new ones for the school. Dean Wendt claimed that "Wisconsin is singularly fortunate in having Bob Marshall as the new Dean in the College of Engineering. Nationally renowned as a distinguished scientist and engineer, he is inquisitive, imaginative, analytical and logical." The former dean also called his successor "a skillful administrator and a stimulating teacher." Wendt also emphasized that "Above all, he is a true gentleman, always kind, sympathetic and courteous. Our college is in good hands."

Members of the faculty, student body and alumni of the College of Engineering share Dean Wendt's sentiments for the new dean.

In welcoming Dean Marshall to his new office, we extend our best wishes to him for a successful career as dean of the School of Engineering. His humanitarian approach to problem solving, tempered with good technological knowledge make him the kind of individual any college would be proud to have. The College of Engineering at the University of Wisconsin will continue to be a better place for its students, faculty and the people of Wisconsin and the world because of Dean Marshall's service.



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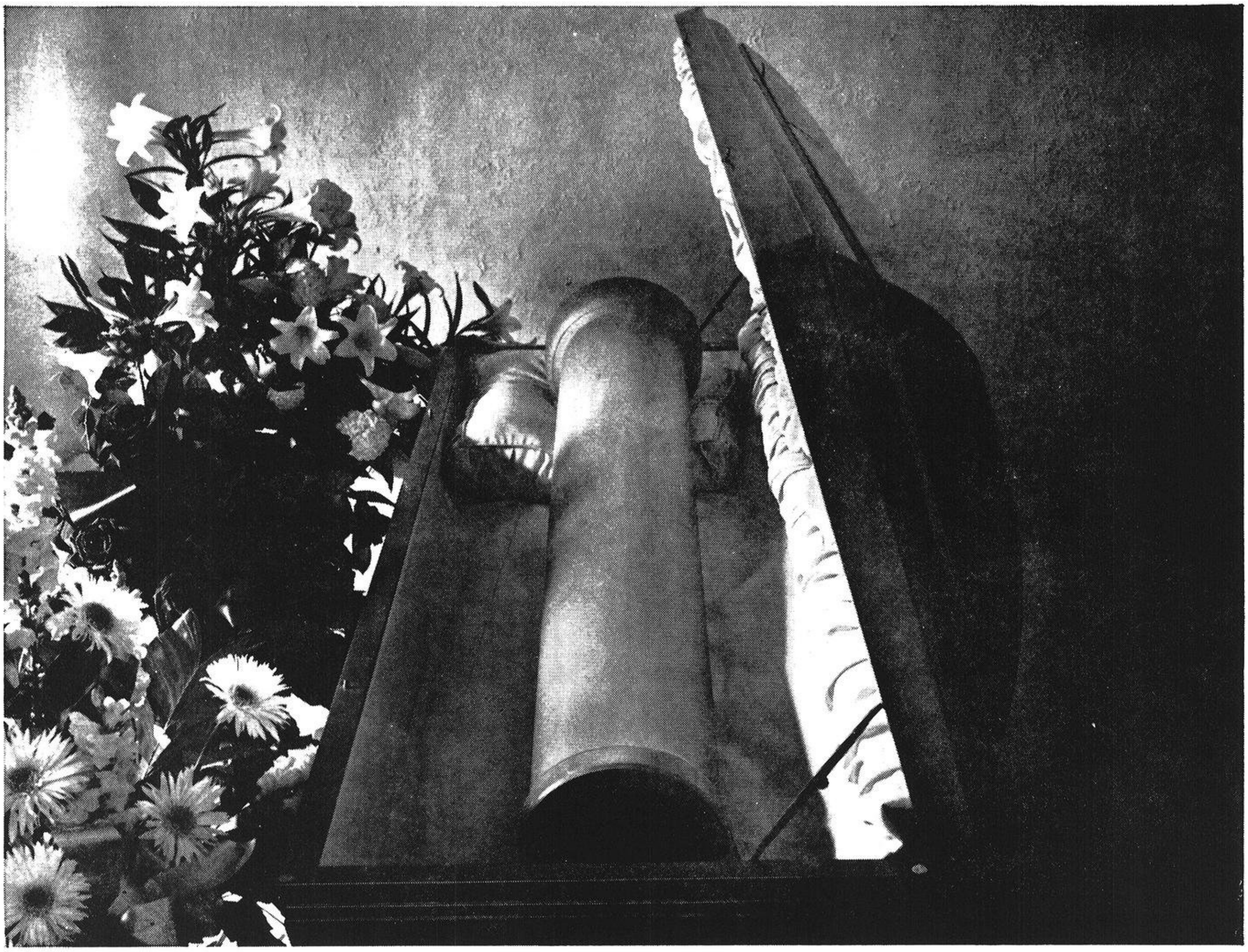


MEET THE DEAN

by James Guenther

Chem E-4

Fifty-five years ago in Calgary, Alberta, Canada the distinguished William Robert Marshall was born. He emigrated to the United States in 1925. Later, as an undergraduate he attended the Armor Institute of Technology, now the Illinois Institute of Technology, and received his BS in Chemical Engineering in 1938. The University of Wisconsin was the site of his graduate work and where he received his PhD in Chemical Engineering in 1941. His first position was with the prestigious DePont Experiment Station. There he did basic engineering research in the areas of heat and mass transfer while at the same time acting as a consultant to various plants of the DuPont Company.

In 1948 he left DuPont and came to the University of Wisconsin as an associate professor of Chemical Engineering. After five years of teaching he was named an Associate Dean of the College of Engineering and Associate Director of the Engineering Experiment Station. Then in 1966 he became Executive Director of the Engineering Experiment Station.

He is continually keeping up with new trends in engineering education as can be seen by his membership in the American Society of Engineering Education. In 1967 he was elected to the National Academy of Engineering, the highest professional distinction that can be conferred upon an American engineer. Later he was named chairman of the Commission on Education. He is also a past president of the Association of Midwest Universities and has served as the chairman of the Nuclear Engineering Education Committee since 1967.

An ardent supporter of professional societies, Dean Marshall has been a member of the ALChE since his University days. He became National President in 1963 and currently holds the membership grade of fellow. He received the William H. Walker award in 1953, the Professional progress Award in 1959, and he served as the chairman of the Continuing Education Committee from 1964 to 1968.

1953 was an important year for the University of Wisconsin. At that time Kurt F. Wendt became Dean of the College of Engineering and William R. Marshall became an Associate Dean. Since then they have worked together to build the engineering campus to its present stature as one of the best in the country. In 1954 they planned and inaugurated the Superior Student Program in the College of Engineering, which was later taken up by the University as a whole. Dean Marshall was actively involved with Dean Wendt in the inception of the UW Monterrey Program.

Editor's note: The comments that follow came from an interview with Dean Marshall by the author.

There are always problems though: and the foremost of these today is the economic situation. The budget from state funds for the College has remained essentially stationary the last few years. The Engineering Research Building has been the hardest hit because the additional funds necessary for its operation were not appropriated after its completion and occupancy. Many research projects have been slowed or terminated because of a drop in federal grants, and even National Science Foundation Traineeships have been cut. All of this has led to two major changes according to the Dean.

"We live in a world of people. Once one becomes employed, the human relation aspect of his work can become equal to or greater than the technical."

"The engineer of the past has not always been called on to place a value on his solutions, as far as aesthetic value, social acceptance, or social welfare is concerned — as he is called on today."

In instruction, capital equipment expenditures have been cut. This is not as bad as cutting faculty or their salaries, but it is hurting the college nonetheless. With research the effect has been to cause faculty to seek substantial additional outside funding by shifting their emphasis to research areas where funds are more plentiful.

For those serious in continuing current programs, turning to newly established outside sources for funds is not always satisfactory, because the agencies which have these funds do not always have policies compatible with the education and research goals of the universities. Also, an ever-present danger is the fact the funds received in this fashion can usually be retracted at any time and for this reason it is termed "soft money." The graduate students who are caught in this soft money bind have been forced to depend on the limited resources of the College and University for their research support. Many of the research groups on the campus have shifted their work to more contemporary projects. Two excellent examples are: the growing trend toward environmental engineering and biomedical engineering research.

When asked what directions research would be taking in the future, Dean Marshall replied that "research will reflect the changes which we see taking place in instruction." He felt that it would be a mistake to give up doing fairly basic research or "engineering" engineering research. On the other hand he sees a challenge for engineers to turn from purely technical kinds of research to technical-social research – problems such as urban development, transportation and the environment where the main problems are intimately related to people.

When discussing instruction on the engineering campus, Dean Marshall said that today's graduate should have the confidence and capability to solve problems. He must be taught, though, that there can be more than one answer to our problems. The word "value" is the key here. "The engineer of the past has not always been called on to place a value on his solutions, as far as aesthetic value, social acceptance, or social welfare is concerned, as he is called on today." The modern engineer will have to use value as a major criteria in judging the feasibility of solutions to his problems.

To follow these new trends in engineering practice, the Dean feels that curriculum changes are important. "They show a healthy desire to keep the courses current and the curriculum flexible and up to date." He added a note of caution, though, that the more flexibility you incorporate in the curriculum the more responsibility the faculty has to make sure the student uses good judgement in choosing his program.

The next question asked of the Dean was what the main criterion should be for faculty promotions. He said teaching, research and service are all significant and that none should carry all of the burden. Teaching is of course important, but a teacher cannot remain competent without keeping abreast of his field. Service is also important; such as membership on university committees; working with industry, state or federal agencies; or serving on national committees. With respect to publication, Dean Marshall feels it is the obligation of faculty members to publish new discoveries and worthwhile results of research but he disagrees with the motto "publish or perish." Too much of the literature today is written just for the sake of a professor's resume, so that quality and not the quantity of publications should be judged when considering faculty promotions.

"Many new challenges are beckoning the engineer of the next decade and it is up to us to tackle them with new outlooks, vision, and imagination."

Membership in a professional society has made Dean Marshall more conscious of his profession. He feels to that professional societies are also important in developing an engineer's ability of deal with people. "We live in a world of people. Once one becomes employed, the human relation aspect of his work can become equal to or greater than the technical." He continued saying that "very often it's not a technical matter which stops something from getting done – it's a human matter." Thus underlining the importance of involvement in campus activities such as professional societies and professional fraternities.

In the past 20 years many major changes have occurred in the field of engineering. The next question asked of the Dean was which changes have been the most important. He answered that the innovation which has had the biggest impact on engineering is the computer. It has affected both the way engineering is taught and how it is practiced.

Social pressures as of late have also influenced engineering practice, engineering research and engineering instruction. Changes are necessarily produced by forces, and now the changes in our environment are forcing us to change our attitudes. Man is creating quite an environmental sink for himself and yet he knows very little about the technology of our global environment. For example, with the SST we had a great deal of knowledge about the plane, but almost nothing was known about the atmosphere through which it would fly and what effect it would have on this atmosphere. "Many new challenges are beckoning the engineer of the next decade and it is up to us to tackle them with new outlooks, vision, and imagination."

The final question discussed was related to Dean Marshall's personal interest. Golf is his favorite participation sport. Football, and three grandchildren are his favorite spectator sports. Being a Canadian by birth, though, I'm sure you could find him watching the hockey team play on weekends during the season.

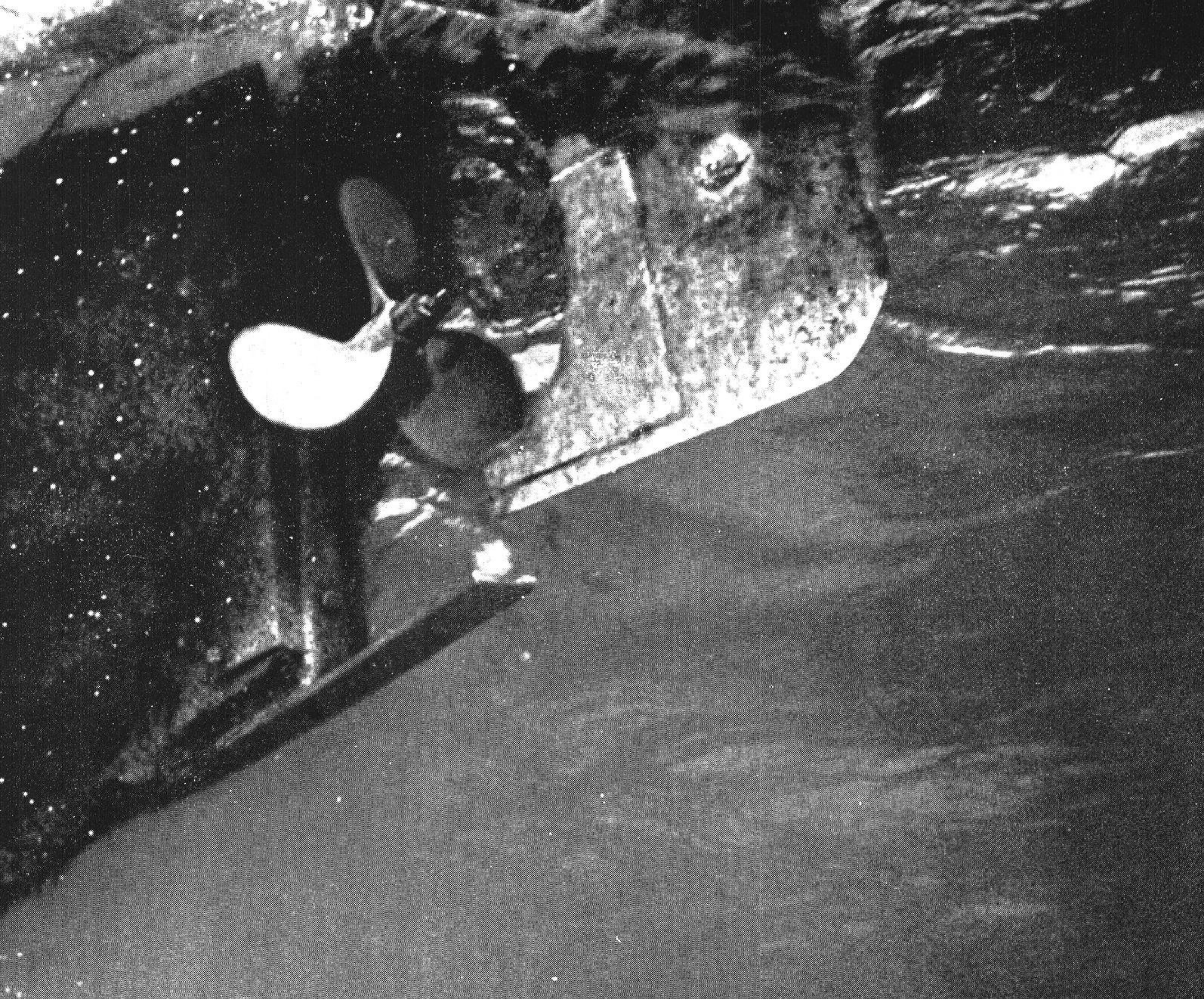
Barnacles. They're uninvited—and expensive. So a new hull is being tested that could keep them at bay. And nickel's helping make it happen.

Shrimp boats are a-comin'—out of a harbor at San Juan del Sur, Nicaragua. And one of them is unlike any other work vessel in the world.

It has a new kind of experimental hull designed to fend off barnacles and other drag-producing marine growth *permanently*.

The Copper Development Association, sponsor of the project, estimates that the new hull material could reduce fuel consumption by as much as 15 to 20 percent. And, by totally eliminating hull scraping and painting, could slash maintenance costs up to 80 percent.

Most impressive of all, though, may be the savings that come through improved efficiency. At present, for example, a slowdown of even one knot because of bottom-fouling can cost a big tanker as much as $4,000 a month. And the loss of five profitable working days for a layover in drydock can mount up to $100,000 or more.



"GUESTS" ON THIS BOAT.

The new hull is a time-proven marine alloy of copper and nickel. It's the copper, really, that's anathema to the barnacles. The 10 percent of nickel is there to make the metal easier to weld and form, to give it the necessary strength, and to help protect it from pitting and corrosion.

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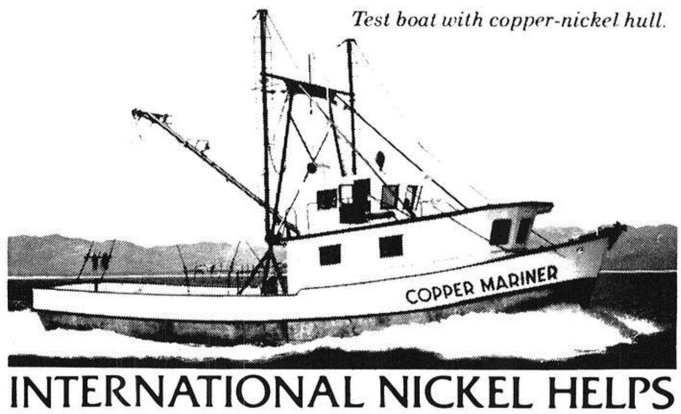
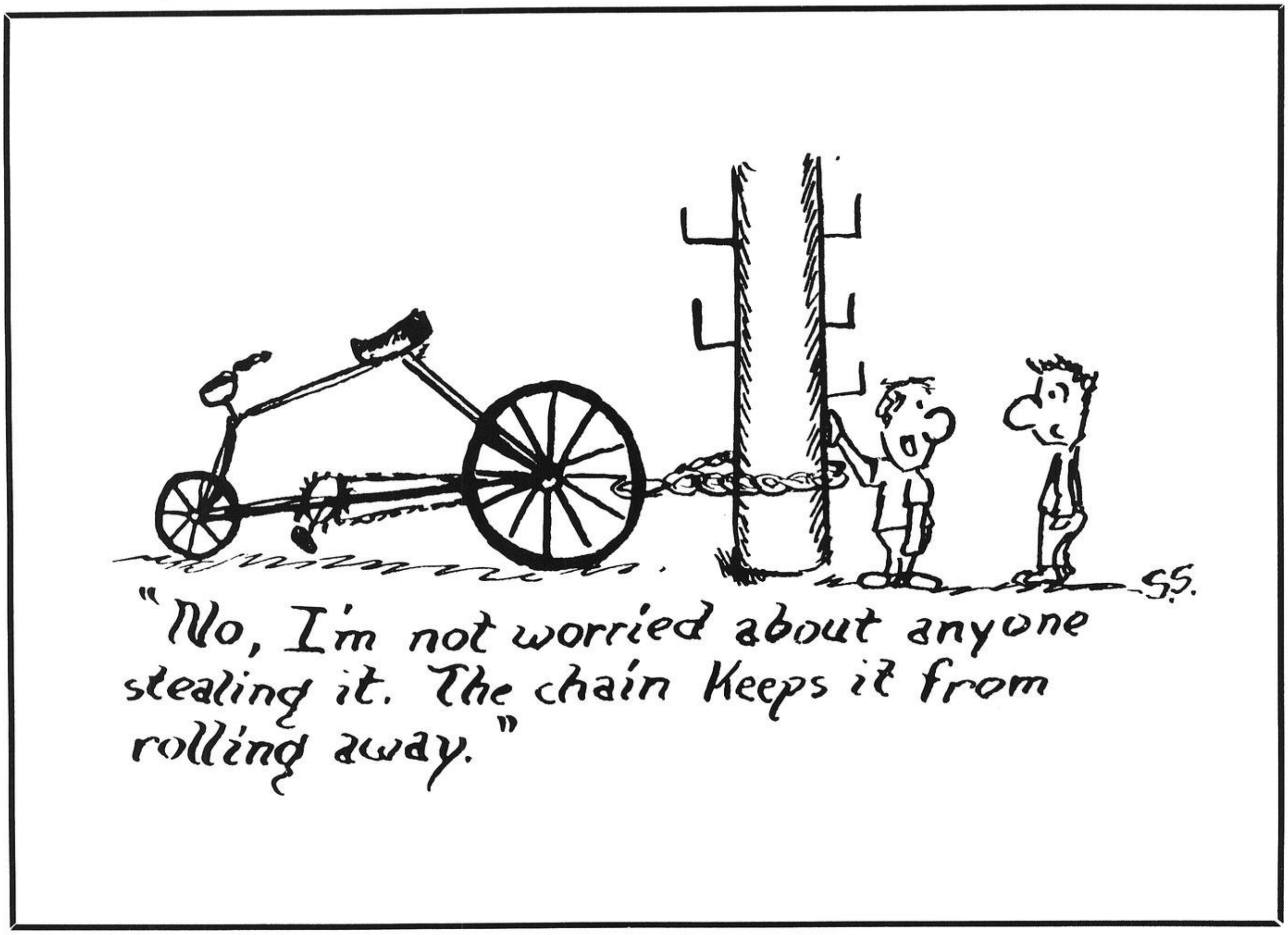


INTERNATIONAL NICKEL HELPS

Would You Like to Work for the Wisconsin Engineer?

Staff Members (L to R): Prof. H. J. Schwebke (Advisor), Jim Guenther, Don Robinson, Carolyn Graff, Stan Crick, Dave Blumke, Steve Sanborn, Jeff Crick (taking picture).

"We need staff members who can do interviews, write technical articles, think up jokes, or whatever could be helpful. If you're interested, stop in at 308 M.E. and talk to us. We need some help."



Coast Uphill!

by Steve Sanborn

This bike was featured at the Wisconsin Engineering Expo in March 1971. It is equipped with a device that enables it to coast uphill.

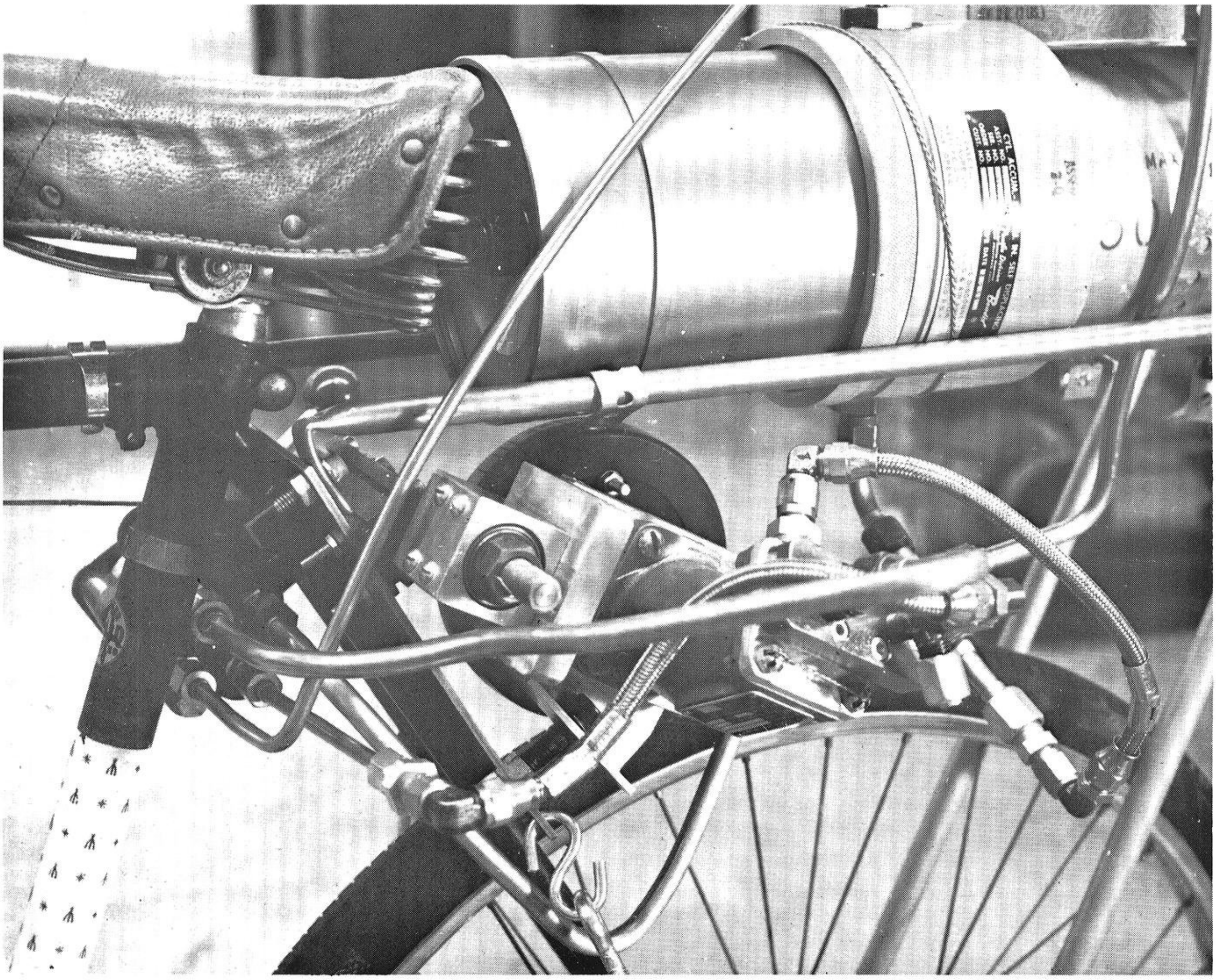
Impossible? Some may think so, but a few such as Professor David Otis disagree. No, madness has not touched the U.W. Mechanical Engineering Department. Instead the right combination of cleverness, intelligence and social consciousness has been brought together to develop just such a machine, one that will coast uphill.

Professor Otis has recently developed a bicycle equipped with a device that stores energy often lost in the form of heat when the brakes are used. This energy storage device collects energy when the bike is moving downhill or coming to a stop. Then later, when going uphill the stored energy is re-used to help propel the cycle forward. Enough energy can be stored in the device to drive the cycle 2/3 of a mile. "This bike will never beat a good ten speed," Otis explained, "The storage system added 60 pounds to the bike, a weight that no one wishes to peddle around."

Professor Otis was aided with the development of this device by a recent U.W. Engineering graduate, Robert Schasse. Schasse helped Otis construct the device so that it could be demonstrated during the last Engineering Exposition on campus.

"Though this device was developed for a bicycle," Professor Otis noted that "Bikes are the least likely future applications. The potential for this system is really in a stop and go vehicle such as a delivery van, bus or small car driven about town."

Ultimately Professor Otis hopes that his device



A close-up view of the energy storage device attached to the rear of a bicycle.

will recover 60% of the energy lost to heat. Presently it only retrieves 30%. This is still sufficient to enable the bike to climb a 50 ft. hill. "But the idea of the system is not to store large amounts of energy but to store small amounts to be used when you need peak power." Otis goes on to say, "An automobile driving around town may have 200 hp under the hood and yet it takes about 15 hp to go 40 mph on the level. The rest of the horsepower is used only when passing and accelerating."

The diagram illustrates how the device functions. The pictures and explanation of the energy storing process were provided by Professor Otis. This is a prototype so there are no such devices for sale yet. However, the components may be purchased at about $1500. Otis hopes to install a similar device in an auto at an estimated cost of between $1000 and $2000.

"We are hopeful that this device can be built cheap enough so people will buy them. It may be that if the cost of gasoline and pollution control equipment goes up much more, then operating with a smaller engine might pay." Otis also speculated that other future applications for this energy storage device could include large industrial machinery that must be stopped and restarted or large centrifuges which require a large initial amount of energy.

Description of the Bicycle System

As shown in Fig. 1, a drive wheel running directly on the rear bicycle tire is connected to a hydraulic motor. When the 4-way "spool valve" is positioned as shown, high pressure oil flows from the accumulator through the motor to the reservoir (as indicated by arrows), and power is being delivered from the system to drive the bicycle.

If the spool valve handle is pushed full forward (the spool moves to the left), the motor now operates as a pump drawing oil from the reservoir and pumping it into the accumulator. This of course, takes work which is transported to the pump from the bicycle tire via the drive wheel, and the system is now storing energy. As long as the bicycle is moving forward, the motor always turns in the same direction whether operating as a pump or as a motor. This means that oil always moves through the motor in the same direction, but the connection of the motor outlets to the accumulator and the reservoir can be reversed by action of the valve.

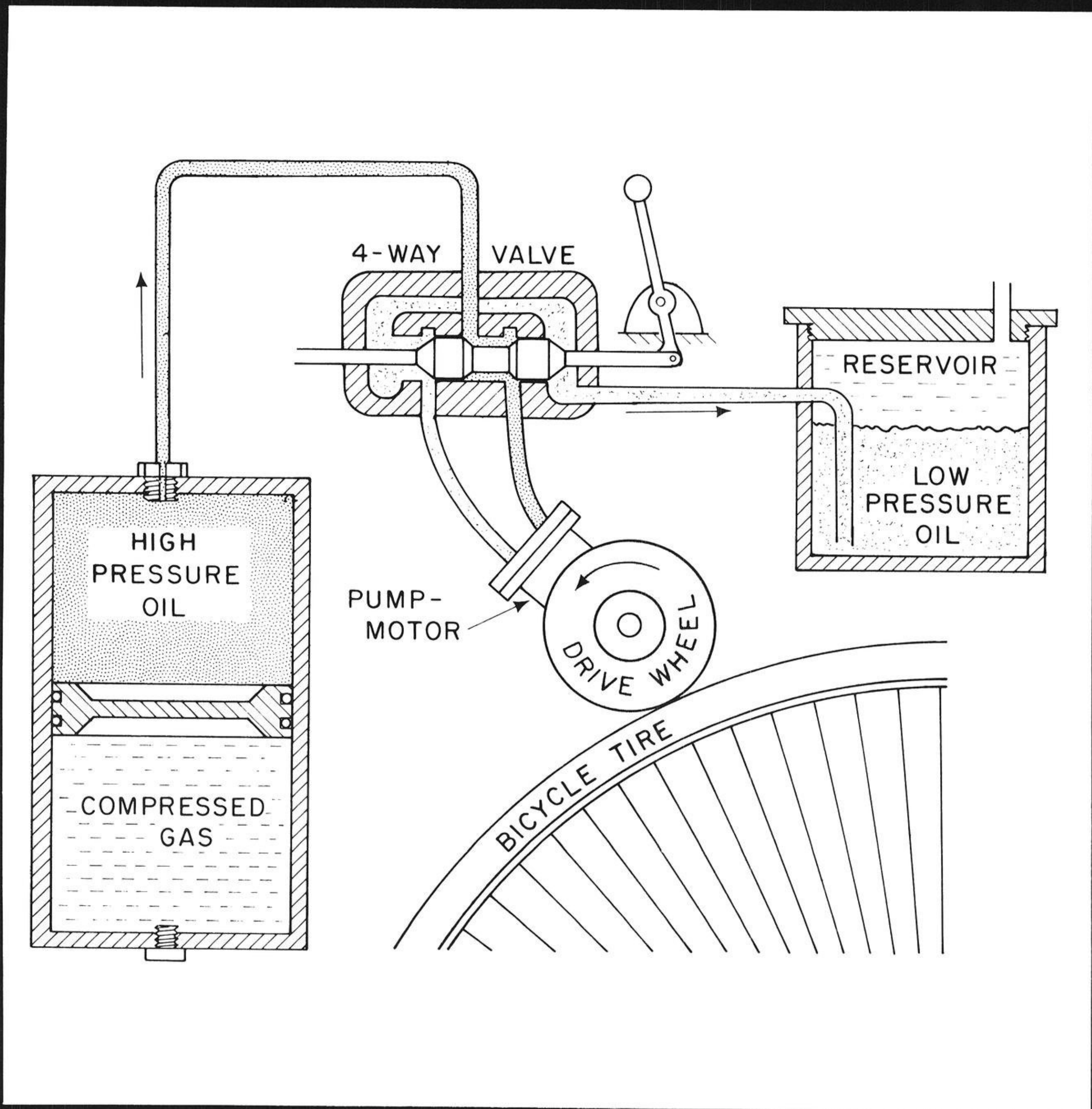


FIG. 1

With the valve in the neutral position, the accumulator oil line is sealed off by the valve so that the energy can be stored indefinitely. The motor parts and the reservoir are connected to each other so that the motor can freewheel with little drag. (Note: A spool valve is shown here only for illustration. A different type was actually used, but it accomplishes the same function).

This system allows no real control over the motor torque except by throttling across the valve which amounts to throwing energy away. So, this is never done, and the system is operated with the valve in one of three positions: accelerating, neutral, or decelerating. Any future system that we would build would utilize a variable volume pump-motor so that with a single lever the torque can be carried continuously to plus and minus values without throttling losses. Such units are used in hydrostatic transmissions which are coming into common use now-a-days even in small home garden tractors.

Professor Otis believes that this system of compressing a gas is far more efficient than similar devices for storing energy i.e. a compressed spring or battery. Yet the cost of energy is not high enough to cause the public to accept this device even though the savings in gas for a small car using this device may well pay for the cost of the system. "Sometimes energy is just so cheap you can throw it away but the whole price picture is changing," stated Otis. Perhaps the price of fuel may rise fast enough to encourage automakers to install this device that will let a car coast UPHILL.

PLASMA

Energy Source of the Future?

by Tom Abbott
EE-4

Last June 17-23, while many of us were working summer jobs (well, at least looking for them), or attending summer school, a group of talented engineers, physicists, and mathematicians converged on Madison for a conference sponsored by the International Atomic Energy Agency: Controlled Fusion. Scientists representing many nations, including European countries, Japan, and most notably – Russia, came to share their ideas and theories on work they're doing in plasma physics. Now, your first question might be – so what? How can plasma physics possibly affect my future, and the future well-being of man? Research in this area suggests that plasmas may be a source of limitless energy for man's future energy demands.

In order to discuss how a Plasma provides energy, we first must go back to early work in nuclear physics, and see what kind of matter plasma is. A plasma is a high-temperature gas with equal densities of positively and negatively charged particles. This hot gas is first created by a fusion reaction, or, when two "light" nuclei, such as heavy isotopes of hydrogen join together to form heavier nuclei, giving off a large amount of energy. This energy in turn can be used to run a steam generator plant. Examples of fusion reactions are the sun and the hydrogen bomb. But the sun and the hydrogen bomb are examples of uncontrolled fusion, and the bulk of current work in this area is aimed at achieving controlled fusion.

The problem on earth is that it is impractical to use any material to contain the plasma, since its temperature is about 100 million degrees Delsius. But because the particles are charged, magnetic and electric force fields can essentially "bottle" the plasma in a near vacuum, allowing the gas to touch nothing, and keeping the density of particles high

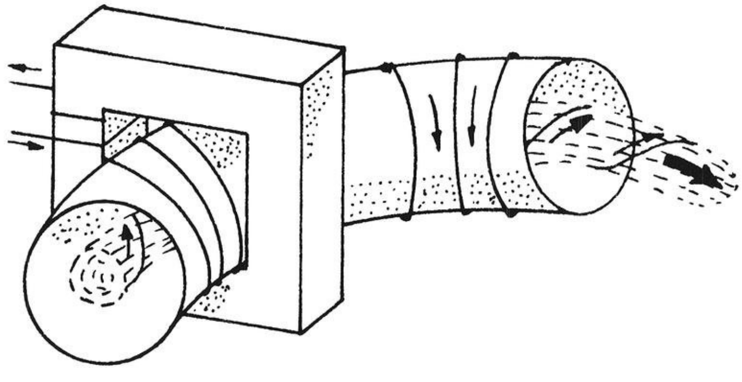


Diagram of Russian Fusion Reactor TOKAMAK

enough to maintain the reaction. Another important feature of this electro-magnetic containment method is safety. Fusion in the hydrogen bomb is uncontrolled, but scientists think that fusion in the plasma state can be controlled. Thus, it is hoped that some of the expensive safety equipment and procedures needed in current nuclear fission power plants can be eliminated.

As important as safety precautions, are the effects energy sources such as plasmas might have upon the environment. (If pollution costs are greater than energy profits, mankind in general does not benefit.) Plasmas look very promising in this area. The fuel consumed in the reaction is deuterium, a heavy isotope of hydrogen easily separated from sea water, and its supply is nearly infinite. The fusion reaction gives off no harmful combustion products. Radioactive by-products of fusion are less dangerous, and create fewer storage problems than do current fission reaction by-products. Also, because of its extreme operating temperatures and the possibilities of direct conversion (see SCIENTIFIC AMERICAN, Feb., 1971; "The Prospects of Fusion Power"), fusion plants might operate at higher efficiences, reducing power costs and waste heat disposal (neighboring lakes and streams won't be contaminated by hot water, as is now happening with fission plants). Finally, the by-products produced by this type of reaction can not currently be directed towards use in atomic weapons, making this method of energy conversion advantageous to the control of the proliferation of nuclear weapons.

With all these good points in mind, you would expect plasma fusion plants to spring up around the country tomorrow. But like most potentially "golden" energy sources, many technological problems must be surmounted. Examples of these problems in the plasma state are numerous, but decreasing as research efforts continue. A major problem is the instabilities that occur when large densities of currents in the plasma add their own electro-magnetic fields to the containing magnetic field. Also, to minimize the radiation and energy losses that take place when the particles leak through the magentic "bottle", the device housing the vacuum and the magnetic fields must be large. This combined with the requirement of large magnetic fields in a large vacuum necessitates the consumption of large amounts of energy, which means increased costs. Impurities in the plasma and surrounding environment also have a very negative effect. Thus, the technical problems can be summarized as:

(1) The problem of stable magnetic containment

(2) Rapid initial heating — getting the plasma hot enough to go into the fusion state.

Russian scientists, who are very active in plasma research, have had much success with these limiting technological problems. Their fusion reactor, named TOKAMAK, (see fig.), located at the I.V. KURCHATOV INSTITUTE OF ATOMIC ENERGY near Moscow, achieved promising results. The density achieved was -10^{14} particles per cubic centimeter, the operating temperature reached was - 5×10^{7} ^{0}C, and the impressive figure of 10^{-1} seconds for confinement time. Although one-tenth of a second seems a short time, a lot of energy can be liberated during this time. All three criteria, density, temperature, and confinement time, must all meet nominal values for the fusion reaction to be useful.

Current work in plasmas appears to be approaching this level of usefulness. Like many research programs, money and time are the limiting resources. If programs are expanded as much as researchers suggest they should be, profitable results might be attained in ten years. If funds are limited, it might take fifty years. For the reader who would like to know more about the nature of the plasma state, and the work being done on this campus in plasmas, see Professors J.L. Shohet or J.E. Scharer in the Electrical Engineering department.

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308 Mechanical Engineering

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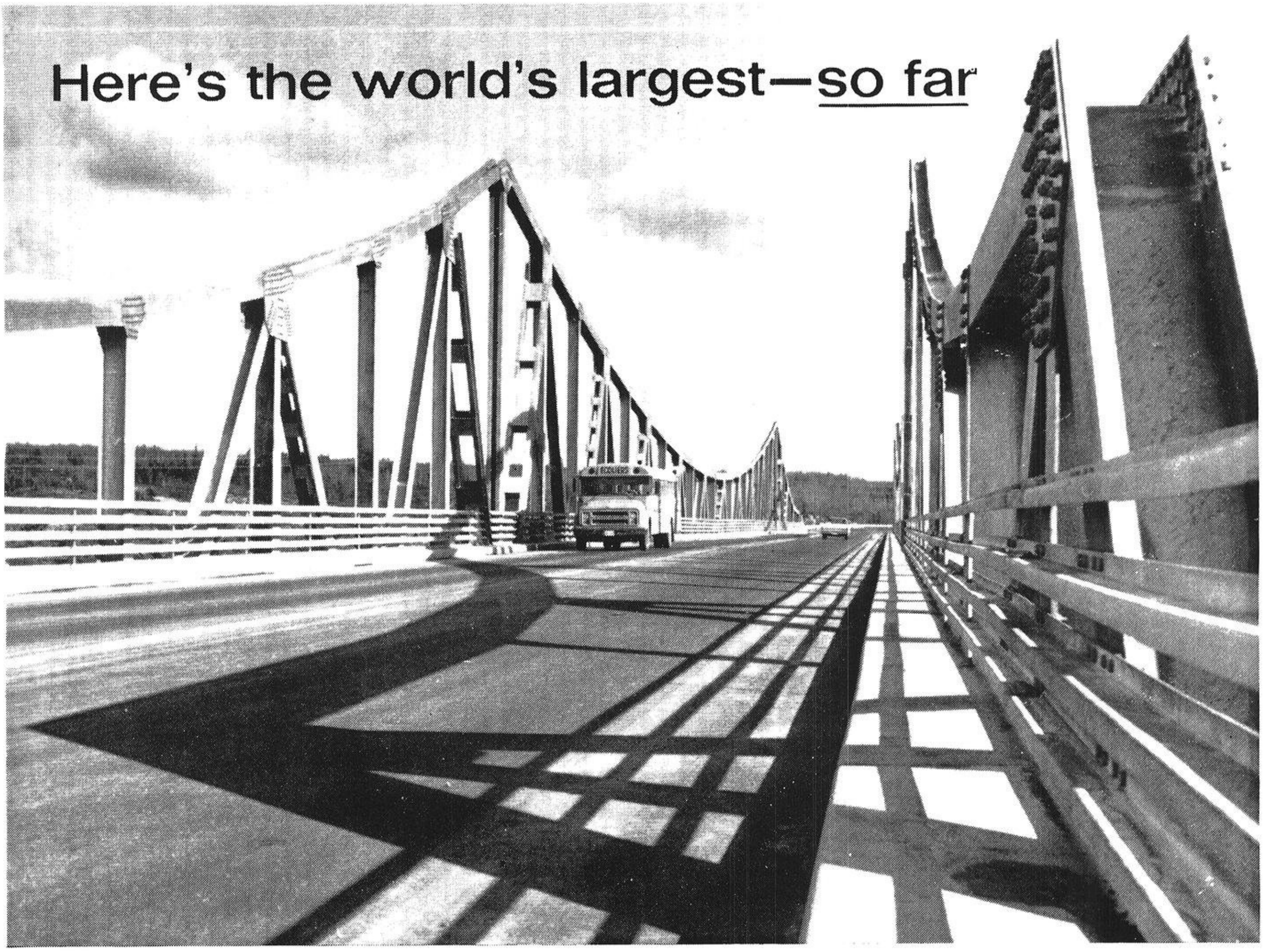

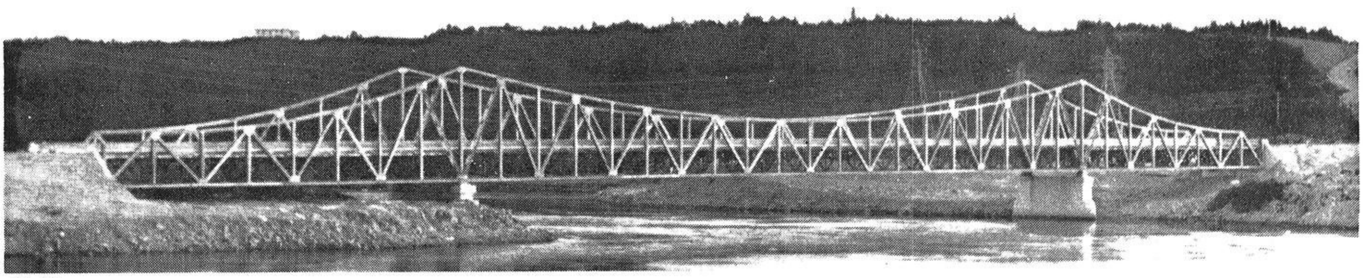

ZN 461

This new 900 foot long bridge is the latest example of the trend to maintenance-free galvanized steel bridges. It is the Hauterive Bridge over the Manicougan River, 250 miles north of Quebec City, Canada. □ Because of its relatively remote location, designer Emile Laurence gave special consideration to the taxpayers maintenance dollar. He specified a zinc overcoat to protect the bridge against corrosion and also avoided possible damage from tall loads by eliminating any upper wind bracing. The designer placed the deck higher than usual—approximately 14 ft from the lower chord. This made it possible to use very deep bridging to insure stability. The composite deck also acts as wind bracing, supplementing the stiffness provided by the horizontal bracing at the lower chord, so that the whole acts as a tubular truss. □ Most of the steel was hot dip galvanized while other members were metallized with zinc. □ In bridges and guard rails, steel's strength guards human life and zinc guards steel's strength against corrosion.

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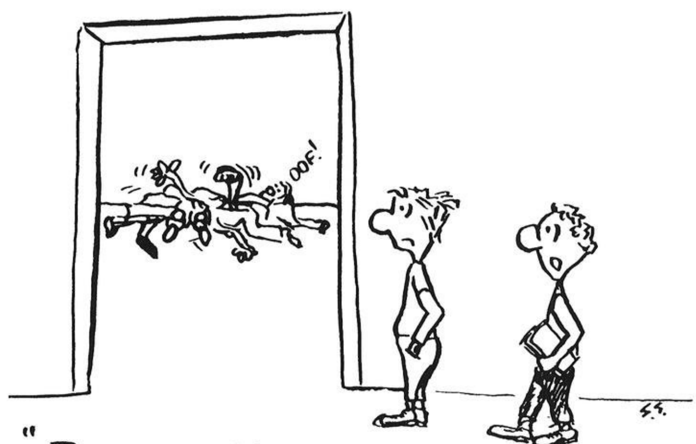
CAMPUS COMMENTS

AIChE

During the month of October, AIChE is sponsoring a two day field trip to the Chicago area. The companies tentatively scheduled include: Corn Products Company, a large producer of starches and other corn derivatives; Republic Steel, a steel mill; and Atlantic Richfield, a petroleum company.

The trip will start from Madison on Thursday morning, October 28, and return on Friday evening, October 29. A business meeting, with a panel of engineers from the local AIChE chapter, will be held on Wednesday, October 13. All chemical engineering students are invited to attend any of the meetings.



"I guess they're still working on the budget!"

ASCE

The University of Wisconsin student chapter of ASCE has set two goals for itself this semester. These goals will provide more contact between students, faculty, and professional engineers; also there will be more involvement by the younger members.

Static

by I.R.Drops

Engineering is like a hippopotamus, you get a lot of behind.

* * * * *

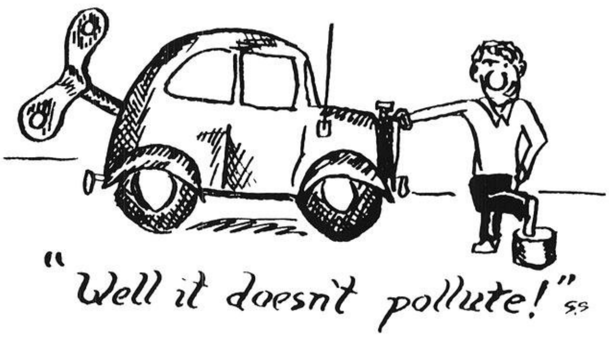
The Engineer is a great publication

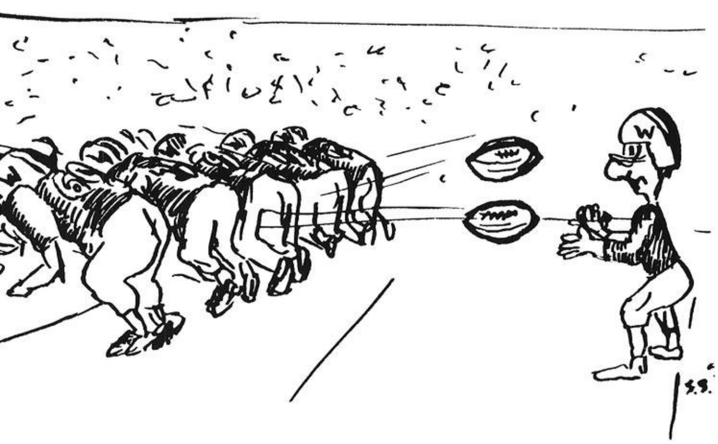
I once had a classmate named Jessar
whose knowledge grew lesser and lesser
It at last grew so small

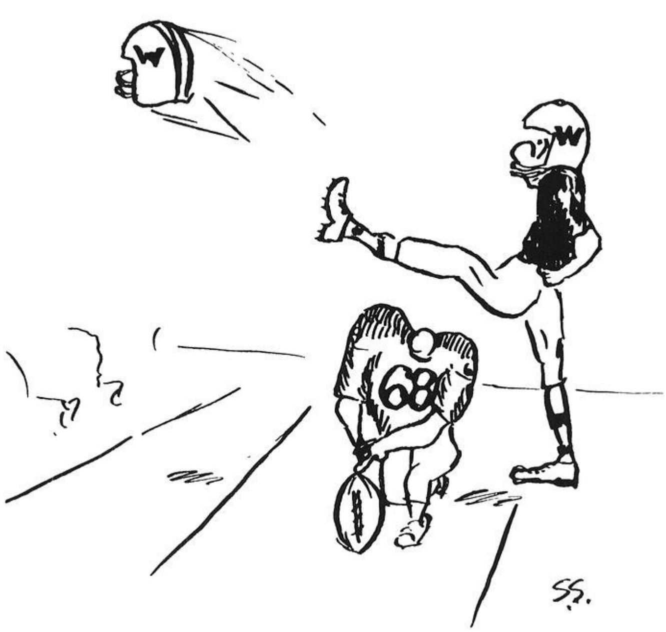
IEEE

The 1971-72 school year presents quite a challenge to IEEE. After winning the first place award in the 1971 Engineering Exposition, plans are now being made for the 1973 project. All members, including freshmen and sophomores will work on this project.

The first meeting of the year will be on Wednesday, October 13 at 7:00 p.m. in room 1227 Engineering. The guest speaker will be Dr. Thomas R. Benedict, of the Cornell Aeronautical Laboratory, Inc. He is a graduate of the University of Wisconsin Electrical Engineering Department and will speak on "Analysis of a Large Computer/Radar System." An overview of this year's planned activities will also be given at that meeting.







THETA TAU

Theta Tau, a professional engineering fraternity, will be looking forward to an active month of October. Initiation of John Pederson and Jerry Gollnick will take place on October 16, the day of our Founder's Day celebration. Also on this day there will be an informal get together for all alumni and friends of Theta Tau.

The house is open for all interested engineering students. Please come to visit at any time.

TRIANGLE

This year as in the past few years, Triangle again sponsored the New Student Engineering Picnic. We had another good turn out again this year. The freshmen engineers learned more about their chosen majors by talking to the older students and the members of the faculty. We would like to thank those members of the faculty, including Dean Marshall and Dean Leidel, for taking time out to come meet these young men. They had many of their questions cleared up and met some of the faculty at the same time.

We will also be sponsoring the Parents' Day Tours again this year. The tours will be held on Saturday, October 16, before the football game. These tours are to acquaint the parents of the engineering students with the Engineering Campus and what the different branches of engineering deal with. Tell your parents early so they can keep this day open. We will be sending them a letter later this month to give them some more information.

This semester Triangle initiated four new members. They are: Kent Cori, Terry Krause, Jim Owen and Fred Spelshaus. We cordially invite any student engineer to stop by the house after the football games for a little talk and refreshment.

Static

by I.R.Drops

Engineering is like a hippopotamus, you get a lot of behind.

* * * * *

The Engineer is a great publication,
The school gets all the fame,
The printer gets all the money,
And the staff gets all the blame.

* * * * *

He: "I suppose you dance?"
She: "Oh yes, I love to."
He: "Great, that's better than dancing."

* * * * *

"Did that course in English help your boyfriend at all?"

"No, he still ends every sentence with a proposition."

* * * * *

A hug is energy gone to waist.

* * * * *

Girls without principal draw interest.

* * * * *

Sliderules don't make mistakes, just slips.

* * * * *

Co-ed: "I'm going to quit dating engineers. They always leave blueprints on my neck."

Roommate: "Yes, but those lawyers are always contesting your will."

* * * * *

He who laughs last has found a double meaning that the censors missed.

* * * * *

Once on a dark and stormy night, a knight was riding through the snow and bitter cold when he saw an inn ahead. He struggled up to the door, followed by his St. Bernard, and asked the inn-keeper for a room. The landlord said there were no rooms left, but the knight insisted on a room. He still was unable to get accommodations. So the knight said he guessed he'd have to climb back on his St. Bernard and ride on to the next inn. The landlord said, "Did you ride up here on that dog?"

"Of course," said the knight.

"Then I'll find you a room. I wouldn't send a knight out on a dog like this.

* * * * *

She: "Where's your chivalry?"
Sr. M.E.: "I traded it in on this Ford."

I once had a classmate named Jessar
whose knowledge grew lesser and lesser
It at last grew so small
He knew nothing at all
and now he's an engineering professor

* * * * *

At time T equals zero there lived in a small cavity in a dielectric a poor struggling dipole by the name of Eddy Current. He was deeply in love with a beautiful double layer by the name of Anne Ion, the daughter of an influential force in the town, Cation. Anne was the center of attraction of the young dipoles of the town. Her golden curls, her symmetric line integrals, and her simple harmonic motion affected the susceptibilities of all the gay sparks. However her father, rich magnet and power factor, had laid down a strict set of boundry conditions for her future husband. Eddy's first contact with her came at the time T equals A. As he passed by a beauty parlor on his periodic orbit, he saw her having a standing wave induced in her filaments. He made a fine sight in his beautiful doublet, it was a case of mutual polarization.

By a coincidence they met at a dissipation function the following night. After a few oscillations to the strains of a number N by Mo Mentum and His Incandescent Tuning Forks, the couple diffused into the field outside. There on the Wheatstone bridge the young dipole felt that his big moment had come. "Gauss, Anne, you are acute angle! I am determined that U shall marry me for I sphere I will never be happy without you."

"Oh Eddy, don't be obtuse," said Anne. "Integrate out of here!"

"Anne, are you trying to damp my oscillations? Can't you see I am in a state of hysteresis over you?"

Eddy did not allow her reluctance to phase him, for he knew it was only a surface charge. "I admit I only get paid a low calorie in my present position, but I have potentialities, and I am sure that money cannot B T U of any importance compared to my love."

(Had enough? Wait till next month for the exciting conclusion.)

You've got to hear $99.95* to believe $99.95

Everybody's ads try and tell you their hundred dollar stereo sounds like a million bucks.

Don't you believe a word you read.

There's only one way to tell how any stereo sounds. Go listen to it. If it sounds like a million, your ear will tell you.

Take our hundred dollar stereo, for example.

Looks nice in the picture, right? Nice walnut grain feeling. Plenty of controls. Separate ones for bass, treble, stereo balance, and loudness. Headphone jack if you ever get into the headphone thing.

What you can't see is nice, too. 40 watts of peak music power. BSR automatic turntable. Diamond needle. But best of all, two 4″ full-range air suspension speakers that really pour out the sound.

That's the Sylvania MM12WX.

But how do you know all this isn't just a lot of words? You don't. Until you go and hear it.

Once you hear it, you'll believe it.

GTE SYLVANIA

*Manufacturer's suggested retail price, Model MM12WX, $99.95.

HOW CAN A FOUR-INCH CERAMIC CYLINDER HELP PREVENT A MUGGING?

By itself, there's no way the cylinder we're talking about could prevent a mugging. Or any other crime.

But if you build a light bulb around it, it can. And has.

A few years back, General Electric engineers built a light bulb with a ceramic filament called the Lucalox® lamp. Then they built a streetlighting system to use it.

Purely as a feat of engineering, that was pretty good. Because it's the most efficient source of white light ever invented. It gives off twice the light of the best mercury system... without any extra electricity.

But, engineering aside, it's even better. When Lucalox went up in four of the highest crime areas of Washington, D.C., the crime rate went down for the first time in years. Down 32%. And we expect to hear similar figures from the more than 90 other cities now using Lucalox.

It's a clear example of how a technological innovation can help solve a social problem. A lot of times, the effect of technology on society is rather direct.

That's why, at General Electric, we judge innovations more by the impact they'll have on people's lives than by their sheer technical wizardry.

Maybe that's a standard you should apply to the work you'll be doing. Whether or not you ever work at General Electric.

Because, as our engineers will tell you, it's not so much what you do that counts. It's what it means.

GENERAL ELECTRIC