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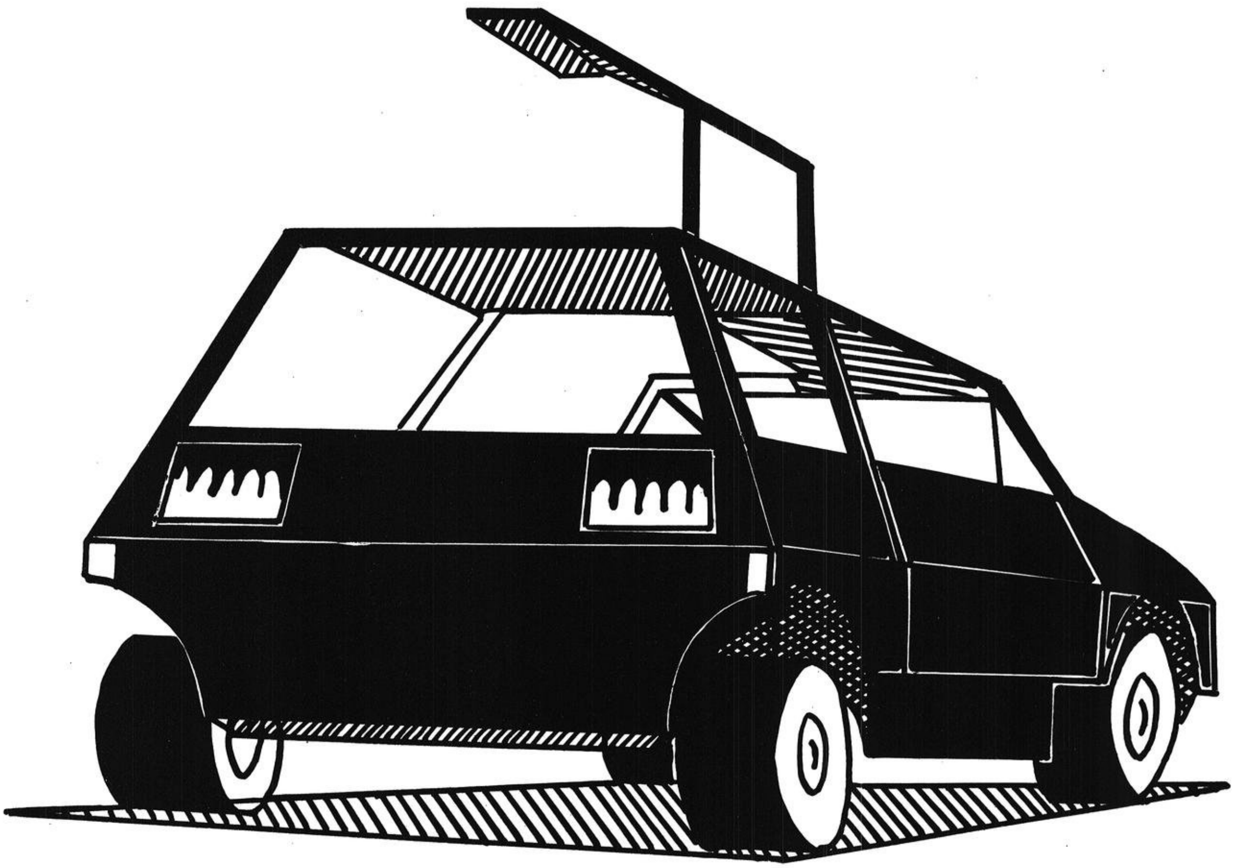
wisconsin engineer



Albert Einstein:
"The concern for man and his destiny must always be the chief interest of all technical effort. Never forget it among your diagrams and equations."

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wisconsin engineer

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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PRODUCT LIABILITY — "WHERE DOES IT END?"

By MARY STEIN

Professor Obert listens while Professor Moll gives his view of product liability.

Product liability is subject to live debate in the University of Wisconsin College of Engineering.

The number of consumers suing manufacturers for defective products stands out with increasing frequency. In 1960, approximately 2000 product liability cases were heard in Wisconsin. Currently, the Wisconsin court calendars list over 200,000.

According to Mining and Metallurgy Professor, Richard Moll, this is only the beginning. "I can see a time when product liability cases will outnumber the traffic accident cases 5 to 4 in Wisconsin courts."

Moll argued the merits of consumer's rights with Mechanical Engineering professor, Edward Obert during Engineer's Week, sponsored by Theta Tau, a UW professional engineering fraternity on the Madison campus.

Historically, Moll considers "Winterbottom-vs-Wright" as a landmark case in product liability. In 1842, Winterbottom, an English mailman, was riding in a stagecoach when one of its wheels fell off.

The stagecoach, owned by the postmaster general, was contracted to Wright for proper maintenance. Since the coach prematurely failed because the wheels weren't greased, Winterbottom was hurt. He sued Wright for damages.

The courts said that Winterbottom did not have the right to sue because there was not a contract between him and Wright. The contract was between the postmaster and Wright. This first decision on product liability became known as the Doctrine of Privity of Contract.

Even at that time, Wright's defense attorney Ward Addington, summed up the fears of many today when he said, "Courts were correct in deciding this way . . . If they hadn't, next week there'd be 10, next year there'd be 10,000. Lord knows where the end would be."

Moll says that after the Industrial Revolution had been established in the United States, more and more defective products came out. Through many court cases, Moll said that the Privity of Contract Doctrine slowly eroded.

In the early twentieth century, the case of McPherson-vs-Buick constituted a change away from this "unfair doctrine," according to Moll. McPherson bought a car from Buick that had a defective wheel. The car crashed because of it. He was hurt and took Buick to court.

The court decided that Buick was guilty of negligence. Buick went to court maintaining that the contract was between him and the tire dealer, not concerning McPherson. It was ruled that there was a contract between McPherson and Buick, therefore Buick owed the consumer to the extent that they should have examined the wheels.

Obert says that bad products are part of living

From left to right are Professors Moll, Obert, and Bollinger.

in a society. "Man can predict statistically every bad product that will fail. Manufacturing every product to be perfect would cost too much in terms of productivity. If General Motors were to build a flawless car, it would triple the cost to the consumer. All modern society is based on productivity and how much we can afford to pay," said Obert.

Moll concedes two things: mass production does turn out defective products and there are extreme cases of product liability. However, Moll points out that product defectiveness has gotten so bad that companies have had to set up their own inspection teams.

"I still don't think that enough thought has been given to product safety. It is every easy to cheat the consumer," Moll commented.

Obert feels that the problem lies not in a generation gap, but a gap between engineering, technical thinking and liberal arts thinking. "An engineer," says Obert, "realizes that every product will have defective parts. For example, every road built is responsible for people's deaths for one reason or another. Overpasses would be much 'safer' but it just is not economical to rebuild our entire system of roads."

He went on, disagreeing with the Ralph Nader concept that all products should be perfect. "There isn't enough money in the country to pay for it," he said. "There is a lack of student understanding that last year in the U.S., there was $50 billion in total profits for business. Compare this with a GNP of over one trillion dollars and figure out where the money will come from."

"If you grant one million dollars to every product liability suit filed by unethical lawyers, he continues, there isn't enough money in the country to handle it. Simply, it is either rebuilding and redesigning all our products or ending up paying one million dollars in settlement for every product liability suit that comes along. It is a terrible thing to say that the individual has to be sacrificed for the common good, but it happens all the time," said Obert.

Moll agrees that lawyers are capitalizing on product liability. He recommends, not that the idea should be abandoned entirely, but that the cases be settled out of court.

"If there was a system of no-fault product liability insurance like no-fault auto insurance, a lot of time and money could be saved by letting the insurance companies fight it out," said Moll.

Any way that this controversial topic is approached, the question still boils down to dollars and cents, according to Obert.

He sums up by saying, "If you allow people to sue for liability someone has to carry insurance – to the tune of $10-15,000. Small premiums are too dangerous. Why do you think doctors associate with clinics? They cannot handle alone the tremendously high insurance rates, caused by all these suits."

Moll is coordinating a course on Product Liability for undergraduate students. "It's a multi-disciplinary problem. Starting next fall, the course will involve lawyers, engineers, economists, sociologists, and others. If this trend is to be continued, its implications must be studied," concluded Moll.

CAVEAT EMPTOR TO CAVEAT VENDITOR

"Let the promoter, designer, the engineer, the production specialist, the advertiser, the shipper, the distributor, the wholesaler, as well as the retailer Beware, for liability is yours."

By KEN JAFFE

This quote from the Insurance Law Journal typifies a field labeled by legal experts as the "most subtly complicated field in law. In a brief span of fifteen years, products liability has evolved from CAVEAT EMPTOR (buyer beware) to CAVEAT VENDITOR (seller beware).

Modern product liability laws proclaim the death of caveat emptor and the economic background it once represented. The key idea is consumer vulnerability to an unknown risk that is controllable by a "sophisticated and well-heeled professional." Thus, product liability laws have evolved on the basis of two assumptions. These are 1) an enterprise engaged in the production of consumer goods must be responsible for injuries resulting from defective products produced by the enterprise and 2) that this liability for defective products should not rest upon the classic law of negligence.

Let us first discuss the question of cost allocation. Professor McKean of the University of Chicago points out that if customers and bystanders could not inflict meaningful penalties, manufacturers of defective products might "be sorry" about these accidents, but there would be little incentive to correct the situation.

This leads us to one of the main objectives of a product liability suit: the problem of causing manufacturers to improve their products. If judicially imposed liability forced manufacturers to bear part of the damages, it could be expected that accidents would become comparatively expensive to the manufacturer. This alternative of increased safety standards would become financially more attractive and rewarding.

The engineer is charged with the knowledge of an expert and must keep abreast of scientific knowledge relating to his product. Is it wrong to institute law to "afford justice to the vast majority of consumers whose well-being, health and lives are dependent upon manufactured articles and facilities, the fitness or safe use of which the ordinary consumer can know little other than the fact that the manufacturer holds them out to the public as reasonably fit . . ..?"

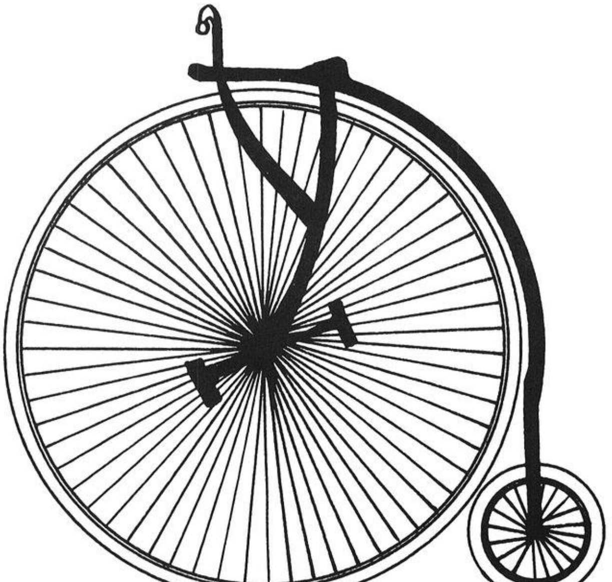
It is frequently suggested that the question of corporate responsibility in this area be left to the marketplace. A manufacturer who develops a reputation for marketing defective products could supposedly be eliminated from the industry due to consumer awareness. This presupposes that the man in the marketplace is a perfectly rational being, that this massive amount of information could be effectively distributed to the consuming public, and that we have a perfectly competitive market. The weaknesses are self-evident and when one considers the role that "creative marketing" plays in our society, he realizes the necessity for consumer protection even if the consumer himself is not aware of his need.

"One who sells any product in a defective condition unreasonably dangerous to the users or consumers or to his personal property is subject to liability for physical harm caused to the ultimate user or consumer."

This far-reaching policy statement by the American Law Institute has imposed liability upon the manufacturer regardless of the amount of care exercised by him. The entire body of liability assigned on a "strict-liability" basis is often held up to ridicule by emphasizing the cases where soft-drink manufacturers are sued because a consumer found a partially decomposed mouse in the bottle. Strict liability's benefit to the consuming public cannot be negated because debate arises on the question of pain and suffering. To deny recovery for blindness due to exploding soda bottles solely because one rejects the social utility of recovery based on pain and suffering is to support irresponsibility and denial of the basis upon which our entire common law system is founded.

RE-DESIGNING A BICYCLE

By MANMOHAN JERATH



The first bicycles to have pedals looked different from the ones we use today. They had one very large wheel in front (as much as five feet in diameter) followed by a small wheel (about a foot in diameter). The pedal was connected directly to the axle of the large wheel. These bicycles were enjoyable to ride, except when you wanted to go up-hill.

For each revolution of the pedal, the large wheel had to make one also. This made any kind of motion on an incline a formidable obstacle to overcome. To eliminate this problem, both wheels were made the same size with the rear wheel driven by a chain linkage connected to the pedals. This gave the cyclist a better ratio of cycles of pedaling to wheel revolutions. Now the linkage could be geared to any desired ratio.

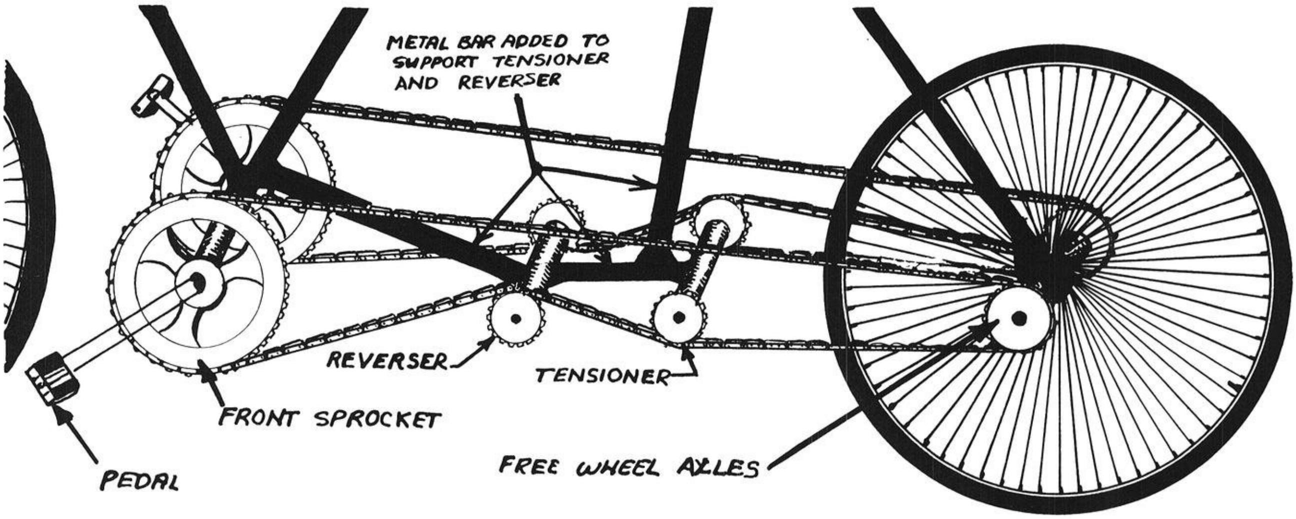
Since then, bicycle manufacturers have only made small changes to the conventional bicycle to improve its efficiency. They have added gears, reduced the weight of the bicycle, and improved the bearings.

Efficiency of a bicycle could be again improved by altering the most critical mechanism: the pedalchain drive system.

If you are perceptive you would have noticed that this new mechanism is incorporating two chains. Also, the pedals are facing the front, rather than 180 degrees out of phase. This is because the pedals move up and down instead of in full revolutions. When one pedal moves down it transmits motion to the rear wheel through the drive sprocket. At the same time it turns the gear. This is called the "reverser." The "reverser gear" raises the other pedal to the "up" position so it can be depressed by the other foot. When the second pedal is depressed the mechanism goes through the same process of driving the rear wheel and raising the opposite pedal. When neither pedal is depressed the bike "coasts."

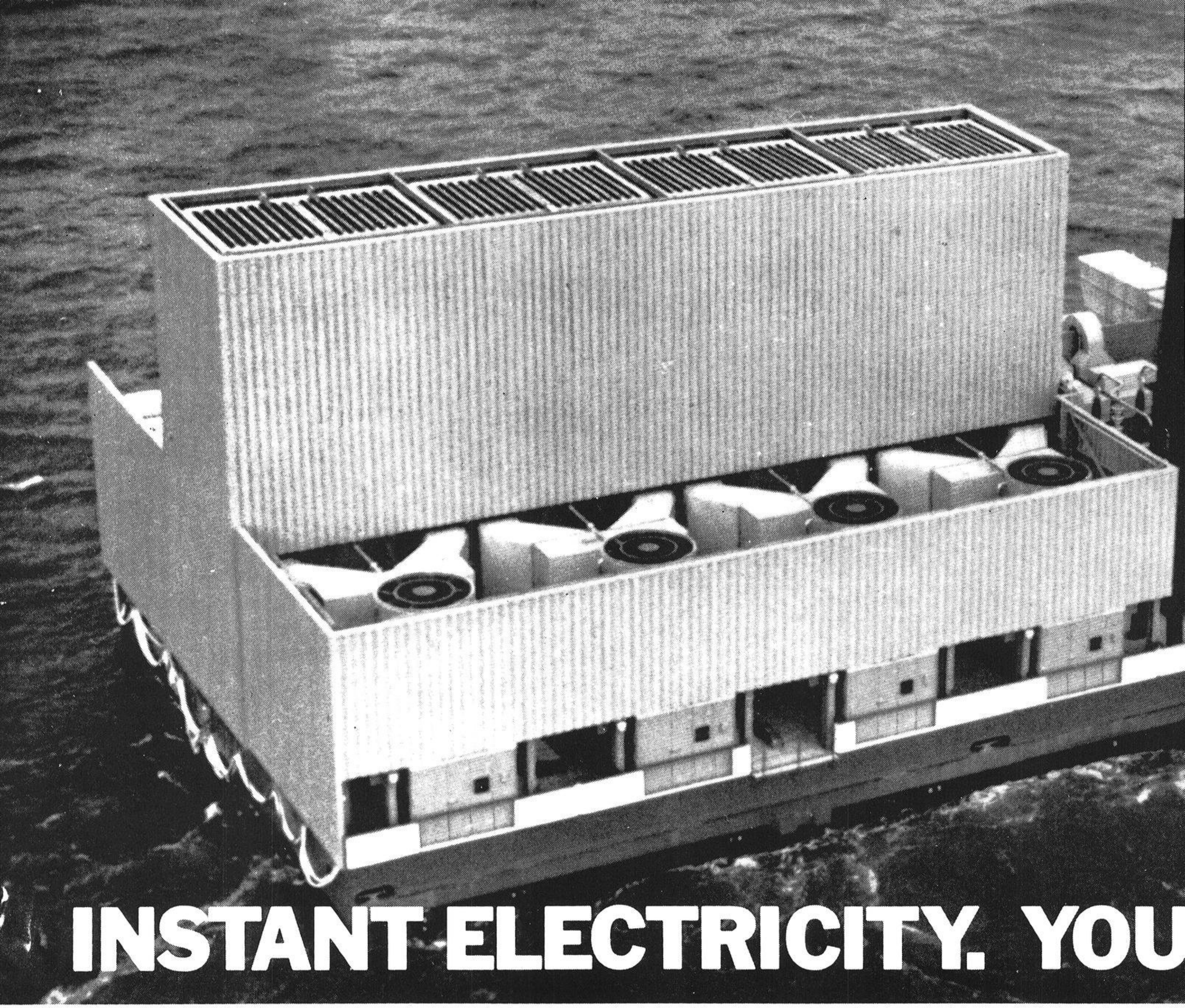
The second gear, called the "tensioner", merely prevents the chain from slipping off the reverser.

The theory behind this mechanism is that it will decrease the time that the leg muscles are not providing maximum torque to the pedals (i.e. at the top and bottom of the down stroke.)



The Figure above illustrates the two-chain mechanism for propelling a bicycle.

The sprockets that are connected to the pedals are mounted on separate axles, one axle inside the other. There are two free-wheel axles on the rear wheel, which are mounted on the same axle. The remaining components of the mechanism are old bicycle parts. Machining the parts for the bicycle is quite simple. Care should be taken not to make the outside axle, on the rear wheel, too thin, since it must support the weight of the bicycle and rider. Constructing such a mechanism for a bicycle should be a simple challenge to any amateur bicycle mechanic or tinkerer.



INSTANT ELECTRICITY. YOU

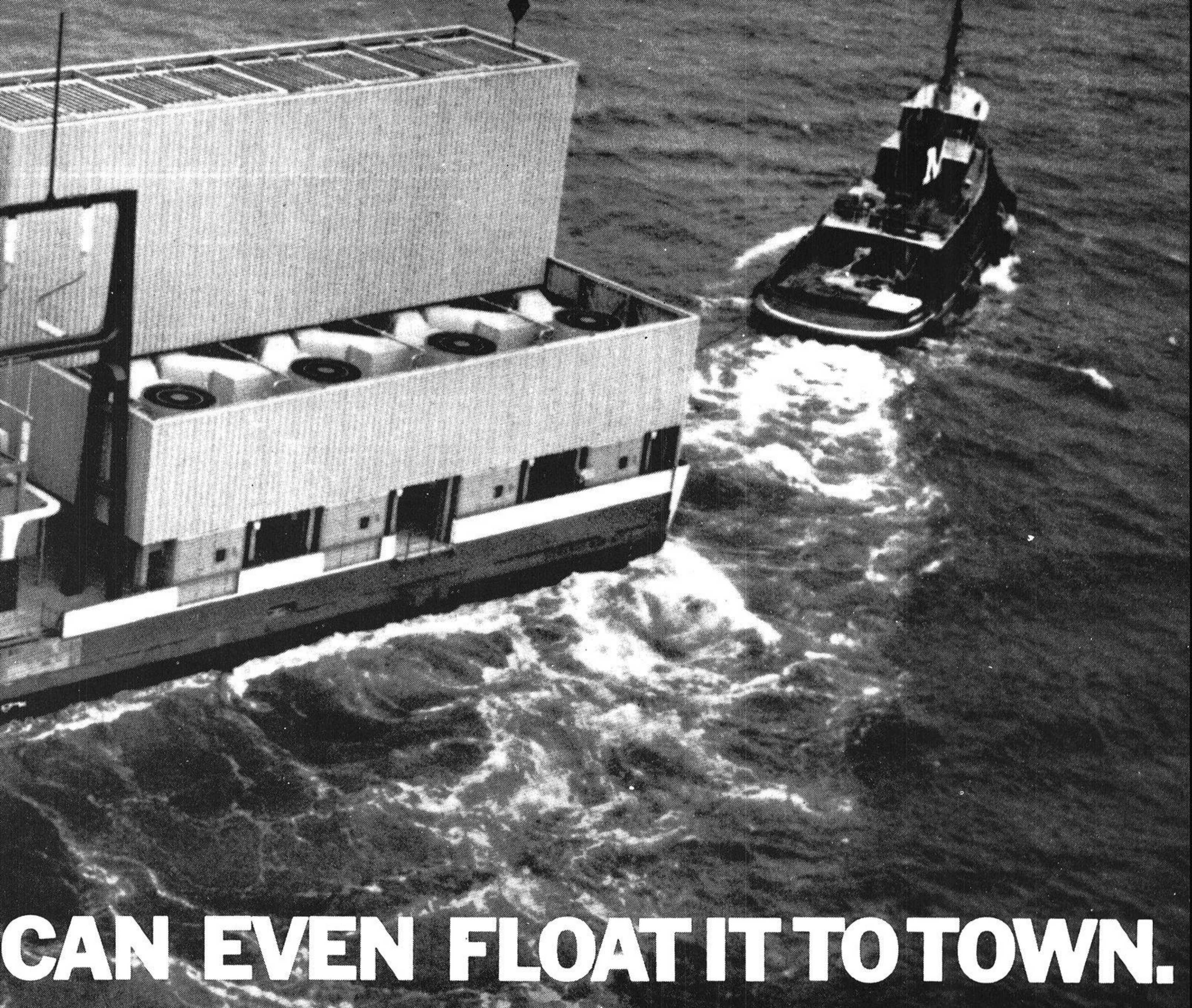
Portable gas turbine generators, mounted on barges and trucks, are being plugged into existing power networks to boost capacity. And nickel's helping make it happen.

One tool that more power companies are using in both their short- and long-range efforts to close the generating gap is a down-to-earth cousin of the jet aircraft engine, the gas turbine.

A typical turbine, hitched to a generator, can produce enough power to light a city of 25,000 people. (Above, *eight* turbines are ganged on one barge. Combined output: 156,000 kilowatts!)

The beauty of the turbine is that it can be bought and set up almost anywhere in a matter of weeks. And it can be turned on and off in mere *seconds*. Which makes it ideal for those muggy summer evenings when everybody gets home and hits the air-conditioner button at once.

Gas turbines have proved such a boon to utilities that sales of them are soaring. Last year, they actually accounted for more than *one fifth* of power companies' total new generating capacity.



At the volcanic heart of the turbines, where temperatures reach 1,800 degrees, only specially designed superalloys can be used. Almost all of these alloys contain a high proportion of *nickel*—up to 78 percent. Nickel is vital for the properties required for dependable turbine service. It helps to provide alloy stability and corrosion resistance.

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And that helps all around.

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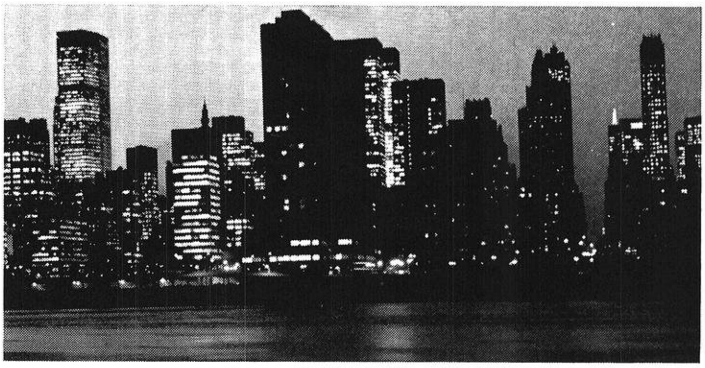
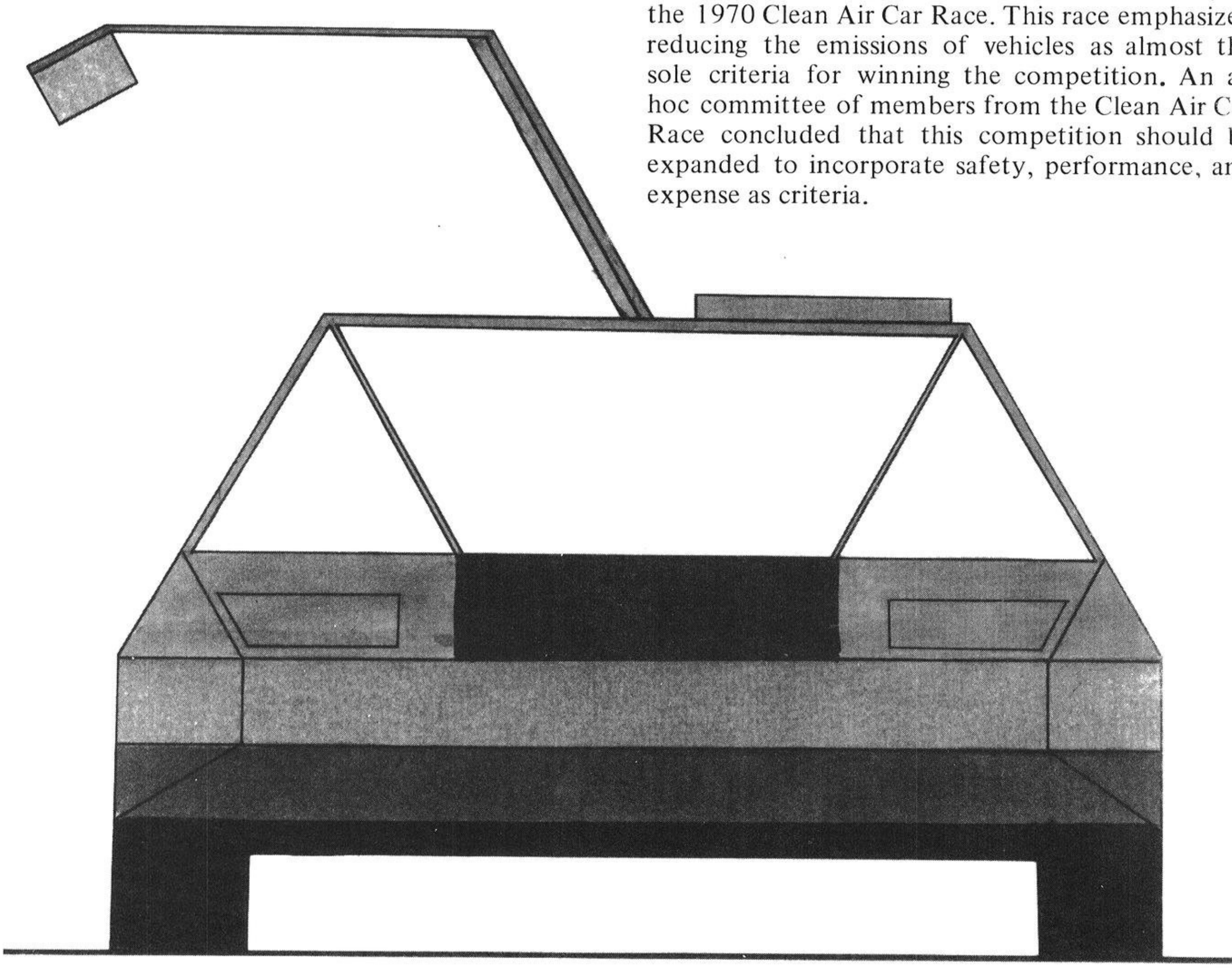


INTERNATIONAL NICKEL HELPS.

UW Enters Competition for Urban Vehicle Design

By STEVE SANBORN

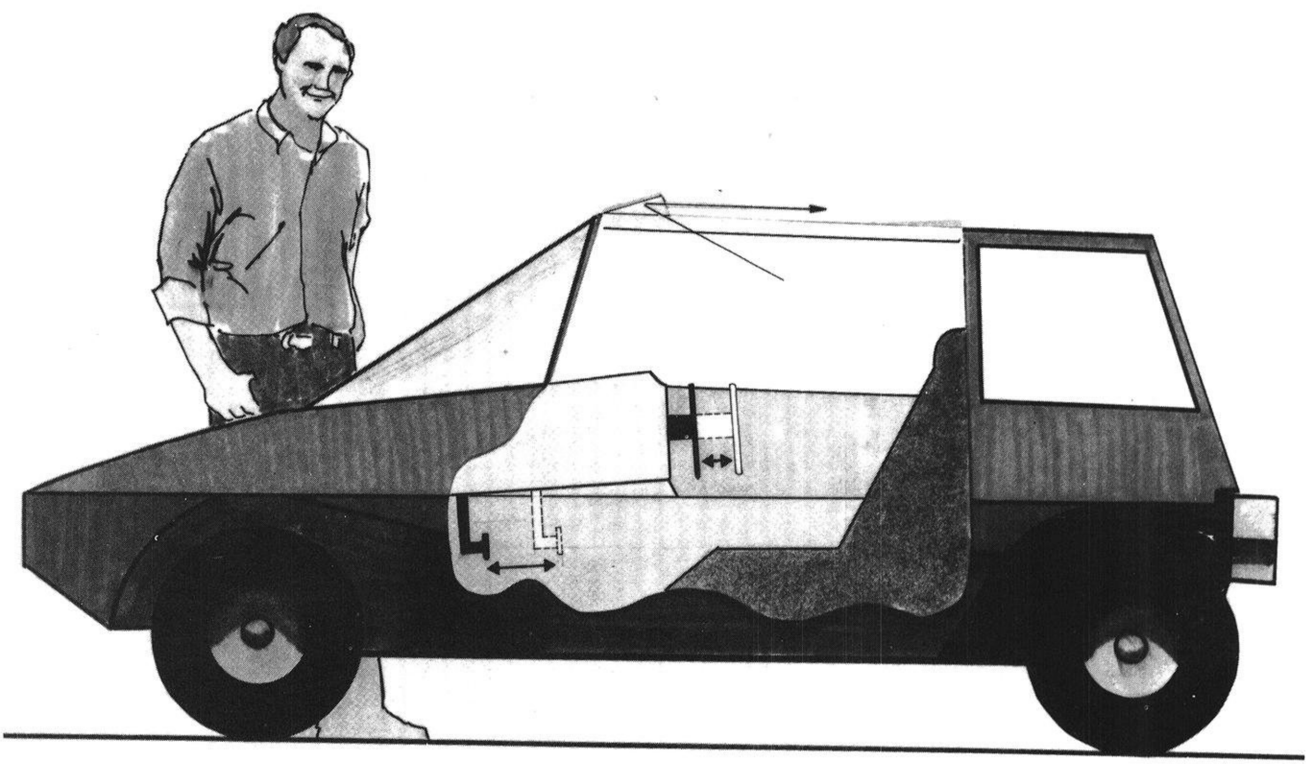
An Urban Vehicle Design Competition sponsored by the Student Competition on Relevant Engineering will be held this August. This is a nationwide contest involving the design and construction of urban vehicles. Last year an issue of the "Wisconsin Engineer" featured the UW entry in the 1970 Clean Air Car Race. This race emphasized reducing the emissions of vehicles as almost the sole criteria for winning the competition. An ad hoc committee of members from the Clean Air Car Race concluded that this competition should be expanded to incorporate safety, performance, and expense as criteria.



The cover of this magazine and the included illustrations are an artists conception of the car the University of Wisconsin College of Engineering will be entering in the competition. The car will be competing with about 100 cars from over 80 other universities and colleges. "Unlike many other entires in the competition," remarked Prof. Frank, faculty advisor to the project, "we are building our car from the ground up. Adapting cars to meet the criteria just is not really solving the problem."

One of the most important criteria in the design will be safety. "The vehicle will be designed to sustain at least 5 MPH front and 5 MPH rear barrier crashes without damage. It will further be designed to provide 'safe' crashes at highway speeds." To provide this much safety for the occupants, the design of the car has incorporated many features focused about the concept of a "passenger capsule." This capsule is constructed so that it will remain intact upon collision, absorbing energy throughout other parts of the car. Thus the vehicle will absorb the energy and not the passengers in the event of an accident. As Prof. Frank noted, "In effect we are extending the length of time that a collision occurs so as to reduce the sudden impact."

The "passenger capsule" will be framed by a roll cage so that the passenger is still protected in the event the car is up-ended in a collision. The interior of the capsule is padded and fireproofed. "The dash is made of an energy absorbing foam shaped in such a way so as to 'catch' the passenger, in the event of impact." There are also bucket seats, a collapsable steering wheel, shoulder harnesses, lap belts, and a heat sensing fire extinguisher. The front windshield was designed to be sufficiently forward of the occupants so that they will not strike the glass when a head-on collision occurs.



The artist's drawing above shows the "passenger capsule" with the collapsable steering column.

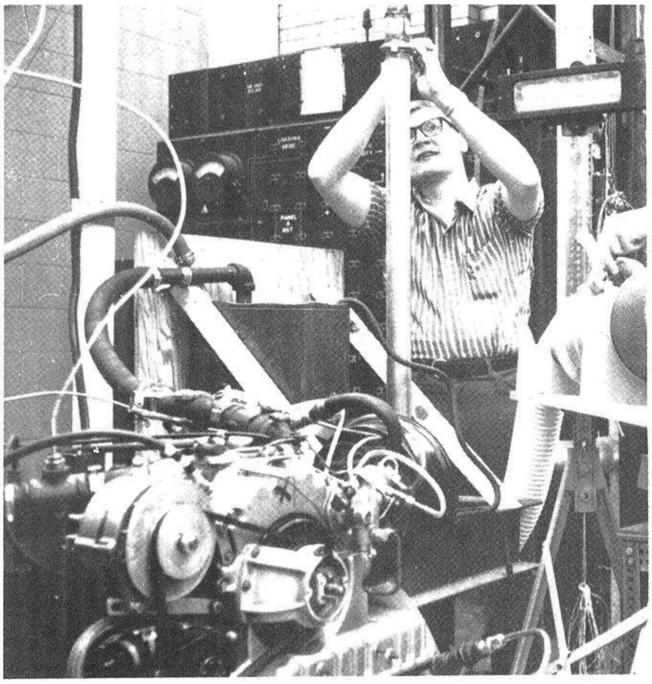
The chassis of the vehicle is constructed of a unique combination of sheet metal and an expandable epoxy foam. The foam is injected into the hollow chassis sections and allowed to expand yielding an extremely strong lightweight sandwich construction. Testing under compressive load revealed that the foam filled sections failed in a progressive manner rather than buckling. The bumpers are then fastened rigidly to the chassis structure and are constructed of an energy absorbing foam. The foam absorbs approximately 80% of the energy of an impact. This significantly reduces the amount of spring-back in low speed collisions.

To increase side impact protection, large foam filled box sections are incorporated into the sides of the chassis. To compliment this type of construction plus to ease entry and exiting from the vehicle, gull wing doors have been used. An additional feature of a gull wing door is that it does not extend into the street when the door is left open; a common cause of auto accidents.

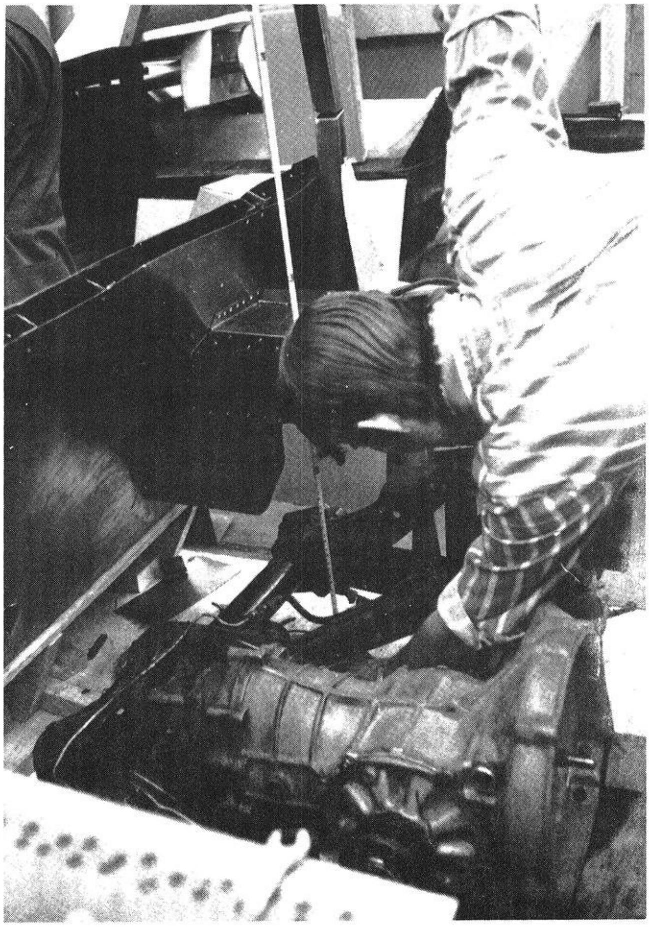
In addition to safety, performance is an important criteria. So far, indications are that this is only one of three entrants in the competition utilizing liquified Petroleum Gas as a fuel in a Wankel Rotary Combustion engine as a prime mover. The Wankel Engine is a small engine producing a surprisingly large amount of power for its size. As a consequence the Wankel can provide the power needed for a small urban car and still weigh less than similar performing conventional piston engines. The Wankel Engine is designed to operate between 2500 and 5000 RPM. Since it will never operate at low speeds, there is no need for a low speed carburator system.

Linked to this Wankel is an electric transmission. The transmission serves as a pump storage device to store energy in a battery package for low speed operation. Thus the Wankel is able to operate over a restricted speed range making emission control easier. Conventional hybrid cars have always used two electric machines in one configuration or another. The Wisconsin hybrid eliminates one of these machines through the use of their electric transmission. This enables one to drive a car as well as charge the storage batteries with one electrical machine. This arrangement reduces the weight of the electrical system (excluding the batteries) by almost 50%. "Warm-up time should also be significantly reduced when operating the IC engine in this manner because of the high loading conditions and high operating speeds."

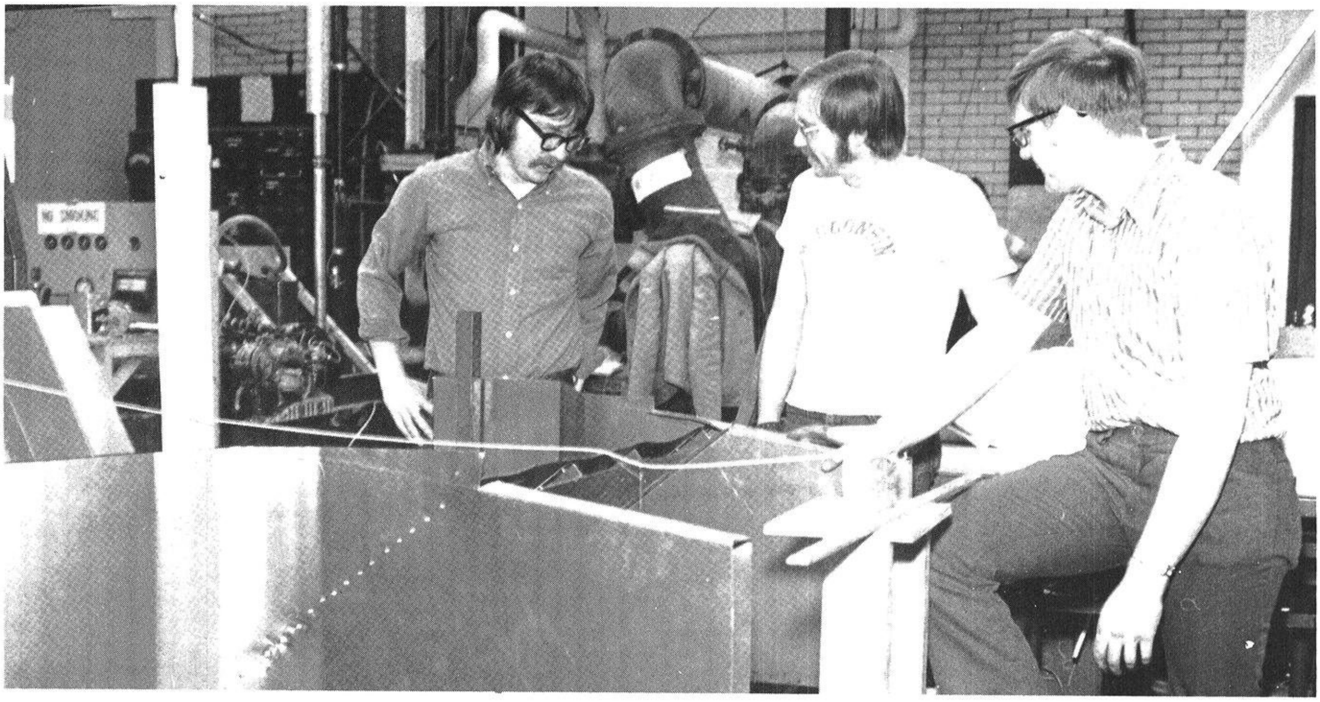
In addition to operating on LPG the Wisconsin entry will operate the Wankel with a lean air to fuel ratio. This is possible because of the good mixing properties of the gaseous LPG. To further reduce emissions a thermal reactor and/or catalytic muffler will be used. Both have been found to significantly reduce unburned hydrocarbons and



Many tests are being performed on the Wankel to determine ways to best reduce emissions.



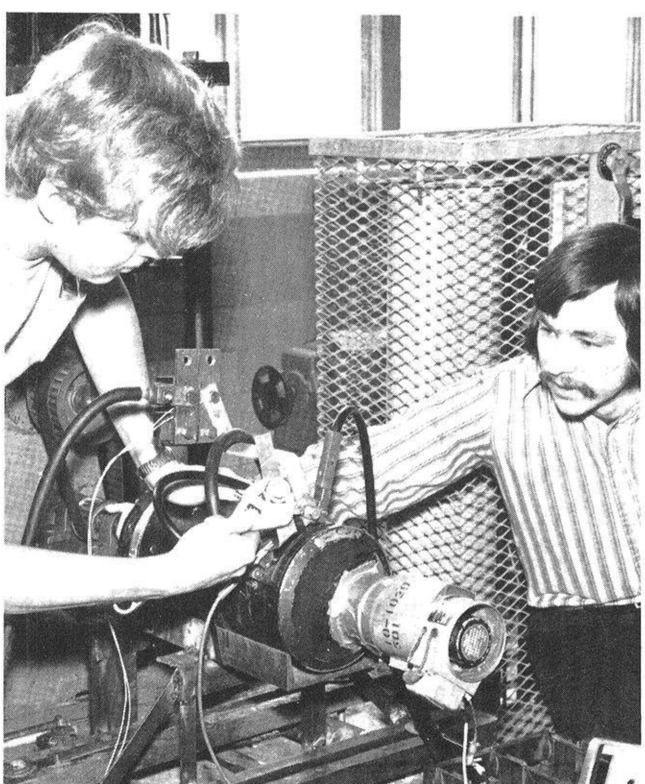
Shown above is the rear of the Urban Car in its first stages of construction. Note the hollow sections of the chassis. Foam will be injected into these sections and allowed to harden. This will provide increased safety for the passenger.



Shown above is the metal mock-up of the Urban Vehicle that Wisconsin will enter in the competition.

carbon monoxide.

As mentioned earlier, the cost for production will be another major criteria. It makes little sense to construct a vehicle out of expensive components of limited supply. Thus, the team has tried to utilize mass produced components of today's technology wherever possible. Also, for the sake of reliability of their design, "off the shelf" components are used where ever possible.



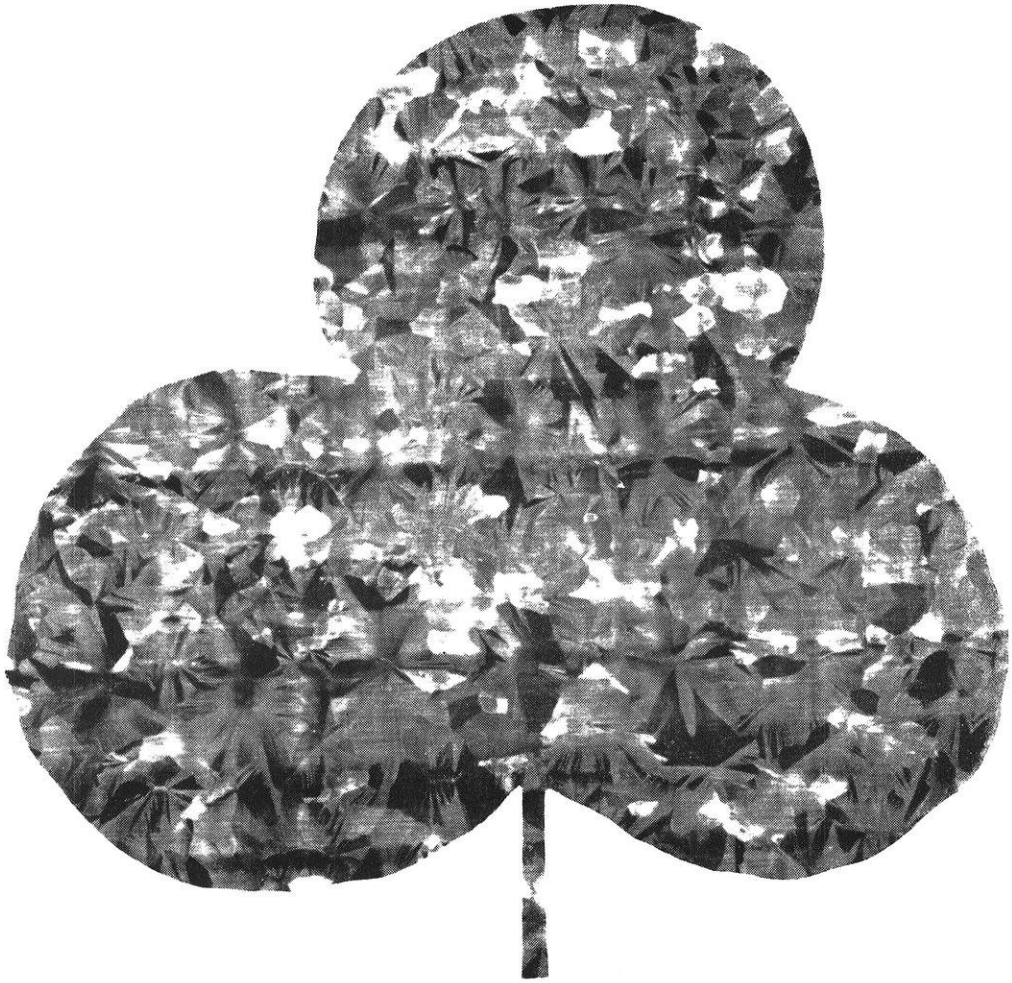
Electric motor being tested.

The following list gives the point breakdown for scoring as established by the UVDC rules committee.

Area	Points
Emissions	8
Safety	7
Consumer Cost	4
Handling	1
Acceleration	1
Braking	1
Noise	3
Turning Circle	1
Parkability	2
Drivability	1
Space Utilization	1
5 MPH Crash	4
Energy Efficiency	4
Size	2
Total	40

The team is aiming at an estimated total production cost of about $2,000. This seemed to be the minimum figure that could purchase the safety and performance of a car of this type.

The construction of the car is expected to be completed by this June. Testing will be performed on the car throughout the summer before the competition on August 9. Efforts are now being made to solicit funds for the project so that work can continue through the summer, improving and altering the design, and to pay travel expenses to the competition. Private individuals, businesses, or corporations wishing to contribute to this project should contact Prof. Norman Beachley or Prof. Andrew Frank at the College of Engineering of the University of Wisconsin.



How FLOWERS OF ZINC guard steel against rust for 20 years and more

The myriad of shining zinc "petals," which galvanizing deposits on steel, form both a shield and an "electric fence" against rust. ☐ The layer of zinc protects first as a mechanical barrier which completely covers the steel to seal out corrosion's attack. Zinc's secondary defense is called upon when the protective coating is scratched gouged or worn through to the steel itself. Then, an electrochemical current of galvanic action fences these gaps and the zinc slowly sacrifices itself as it continues to protect the steel. This action takes place because, in the galvanic series, zinc is less noble than steel and will corrode sacrificially . . . fighting a stubborn delaying action against corrosion's attack. ☐ No other material provides the combination of strength, corrosion-resistance and economy found in galvanized steel. That's why it's so widely used in guard rail, bridges, transmission towers, reinforcing rods, automobiles and many other industrial applications.

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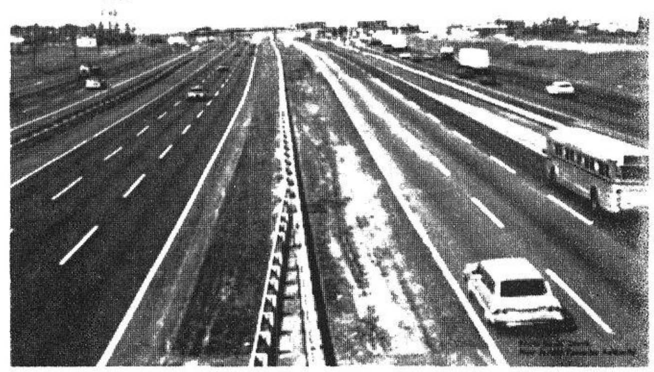

Galvanized steel guard rail on the New Jersey Turnpike has a record of no passenger vehicle breakthrough and no maintenance after ten years.

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THE NUCLEAR ACCELERATOR FACTORY

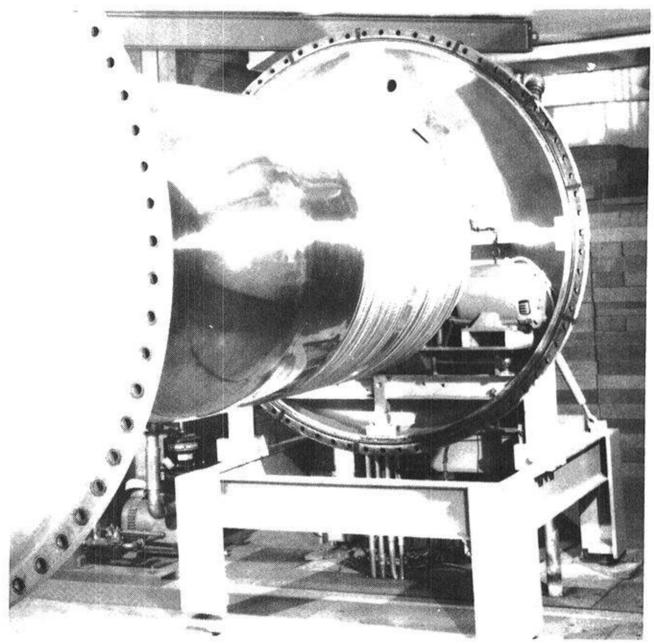
By TOM MARTENS

It is only in an area like Madison, that you might find a nuclear accelerator factory sharing the same road with a drapery plant. Yet nestled into the side of a ridge on Graber Rd., Middleton, is National Electrostatics Corp., (NEC) the developer of the electron accelerator in the Nuclear Engineering Department at the University of Wisconsin.

This accelerator is the result of work that began in 1932, and led to the Pelletron accelerator and the birth of NEC. Following publication of the first results of Van de Graff, Dr. G.G. Havens started work on a belt charging utilizing vacuum insulation for isolation of the terminal from the enclosing tank. Further design led to the use of high pressure gas in 1933, and work was completed in 1934. Research continued until the first column accelerator was developed in 1937. Later research led to the "pelletron" charging, which uses a string of metal pellets to form a charging chain. The need for production facilities to build the newly dubbed "pelletron Accelerator" led to the birth of NEC.

National Electrostatics Corp. was organized in 1965 for the development and production of high energy electrostatic particle accelerators. Their multi-level building consists of 10,000 sq. feet of production space, and a six story tower for testing accelerator storage tanks.

The President of the company, Dr. R.G. Herb, is a pioneer in the field of nuclear engineering. He built the first electrostatic accelerator, insulated by high pressure gas in 1933-34. During the period from 1935-40, with D.B. Parkinson, and Prof. D.W. Kerst, of the University Physics Dept., he built three electrostatic accelerators, culminating in a 4.5 MeV machine in 1940. Two of these accelerators were used on the Manhattan Project for work at Los Alamos from 1943-46, for the existing war effort. Resuming development work in 1946, his efforts were concentrated on accelerator beam characteristics. The work involved precise energy measurement and control of the beam, including development of negative hydrogen and helium ion

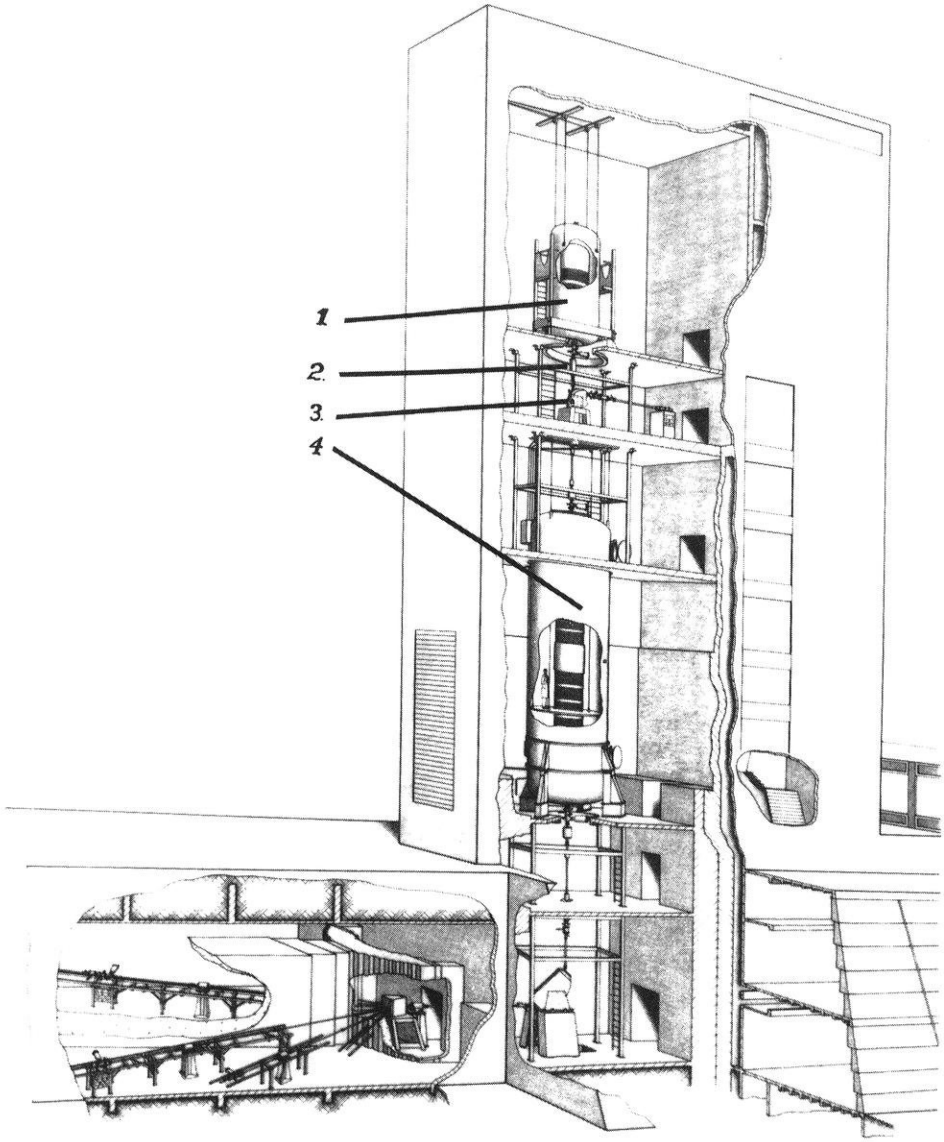


Pelletron negative ion injector tank in the Nuclear Engineering Department of the University of Wisconsin.

sources. From this research and development group came the first practical ion getter pump. Ceramic to metal bonding was studied extensively, and in the period 1951-55, an accelerator was constructed utilizing all metallic bonding and getter-ion pumping.

A University of Wisconsin graduate, Dr. James Ferry, is Vice President in charge of production at NEC. He started work on charging systems and support column improvements as an undergraduate, then continued accelerator development as a graduate student, and headed efforts that led to the first successful use of pellet charging. His Ph.D. thesis was on precise measurement, which led to improvements in the resolution of an electrostatic analyzer used for beam energy control and measurement.

Dr. Walid G. Mourad, who made the first



Twenty-two MeV Pelletron Accelerator now under construction at the University of Sao Paulo, Brazil.
1. Pelletron negative ion injector. Tank is 6 feet in diameter, and 16 feet high. Gas is SF_6 up to 150 PSIG.
2. Crossed field velocity selector.
3. Rotatable 90 degree magnet for injection from other ion sources.
4. Pelletron charge exchange accelerator. Tank is 10 feet in diameter and 38 feet high. Gas is SF_6 up to 150 PSIG.

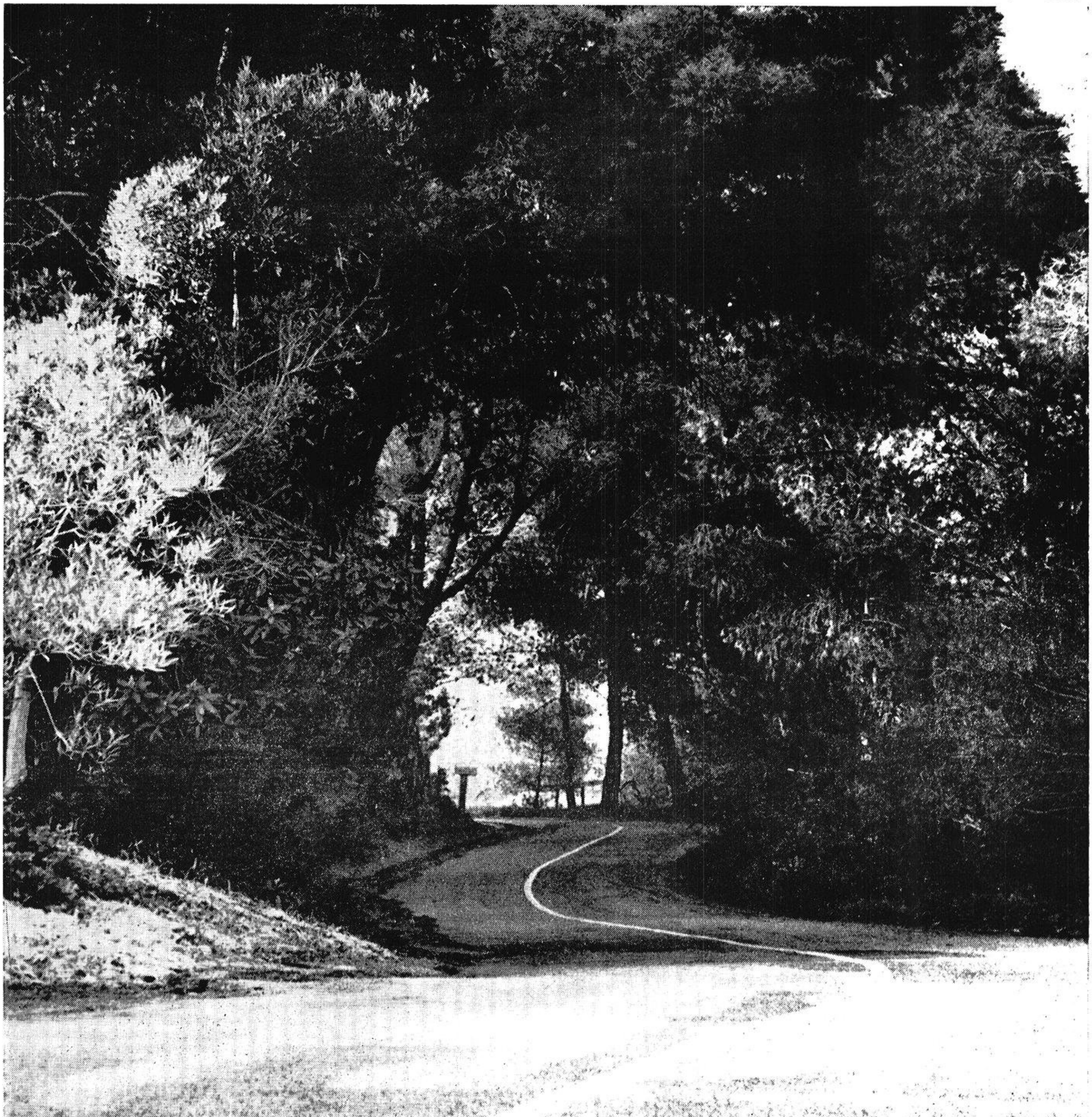
thorough study of the characteristics of the orbitron ion gauge, and Robert Daniel, who worked on development on an accelerator utilizing pellet charging at North Texas State University, complete the technical staff.

Dr. Herb's company is one of the few in the world that has been able to manufacture a practical, working accelerator system. Although assembly line production of nuclear accelerators was hardly imaginable a few years ago, NEC has been able to make use of a high speed punch press in the construction. The cost of one of their 22 MeV accelerators is approximately $2 million.

National Electrostatics is currently constructing two accelerators. One is a 22 MeV Pelletron accelerator for the University of Sao Paulo, Brazil. A second accelerator, which will operate at 14 MeV, is being built for the Australian National University. Still in the developmental stages is a 40 MeV tandem accelerator. "A number of laboratories are requesting funds for the 40 MeV model," said Dr. Herb, "but we haven't had any orders yet."

Size and cost were formerly the only limiting factors in accelerator development. The first accelerator Dr. Herb, and Dr. Kerst built could not be too large, because it had to be moved into Sterling Hall through a window. The money available at post war University of Wisconsin was limited for nuclear research projects. Today, money is available from outside Wisconsin, and the size of accelerators is only limited by the size of building you can build.

730 Third Ave., N.Y., N.Y. 10017



As you can see, you can't see our new telephone lines.

They're underground.

We think America has enough eyesores, so wherever possible we're burying our new cable. And converting old aerial lines.

We already have over 50% of our lines underground. And before we're through we'll have about 92% buried.

We'll never reach 100% because in a few places it's practically impossible to get the cable underground. And in a few other places it's ridiculously expensive.

In the 15 years that we've been burying cable we've gone through hills and high water and turnpikes and mountains.

We've struck oil in Texas (a pipe in someone's backyard). And we've had to get a special repellent to keep gophers from eating the cable.

So if you still see a fair number of telephone poles around, bear with us. Our engineers are working as fast as they can to bury our lines.

And resurrect our scenery.

GTE

GENERAL TELEPHONE & ELECTRONICS

HOW CAN A MICROBE HELP TURN GARBAGE INTO FOOD?

The petri dish at the bottom of the page holds a special strain of thermophilic microbes. What does it have to do with garbage?

The microbes digest cellulose. And cellulose is what nearly two-thirds of all municipal garbage and farm refuse are made of.

So the microbes can digest your garbage. But that's not all they can do. They can convert it into a high-protein substance that livestock will accept as food.

This strain of microbes was first isolated in a General Electric research lab a few years back.

Today, our engineers are working to design a pilot plant to make the waste-conversion process work on a large scale.

It's a technological innovation with a good chance of solving one of the biggest problems facing the country today. But, then, that's hardly surprising. Technology is one of the surest ways of solving social problems.

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