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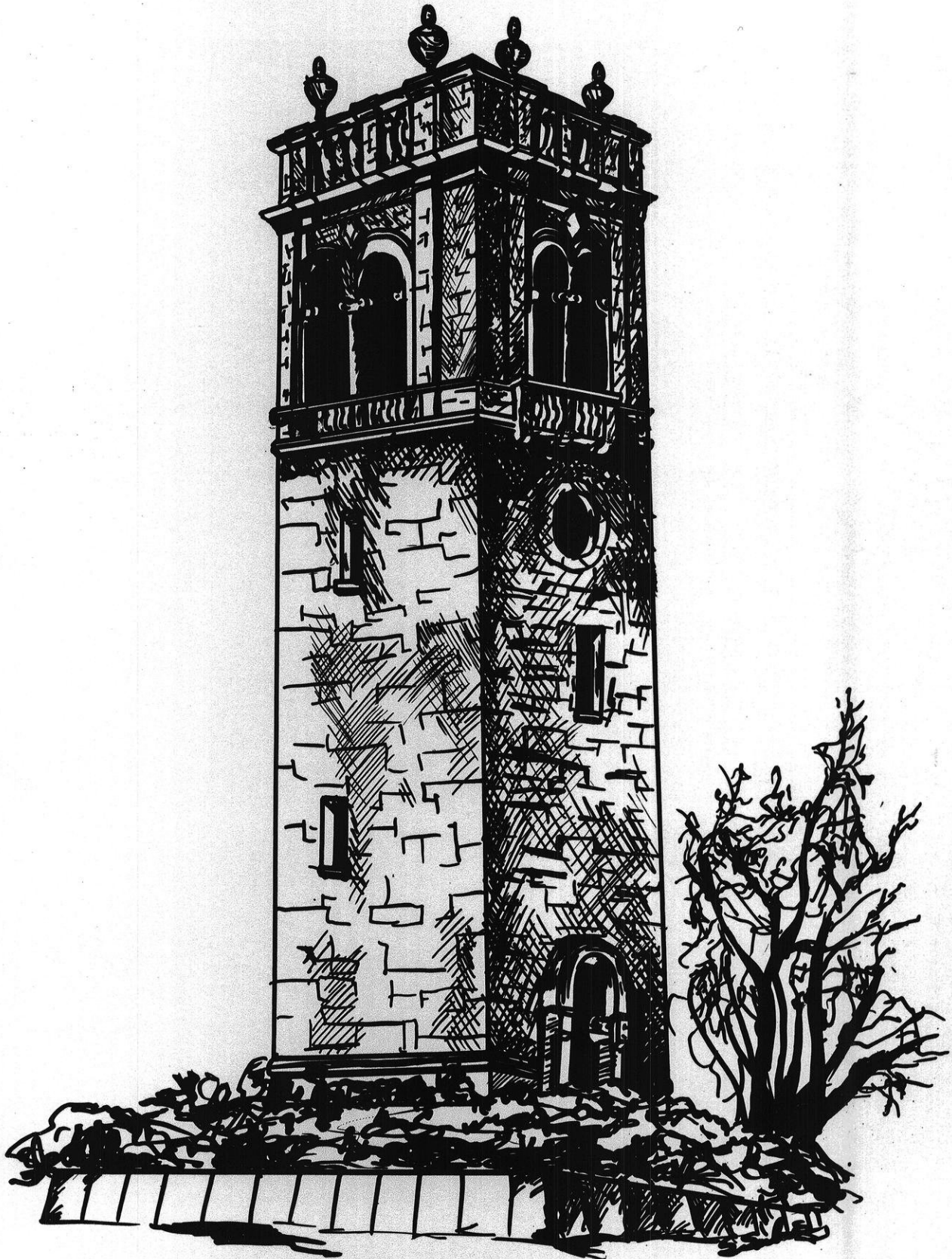
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# wisconsin engineer



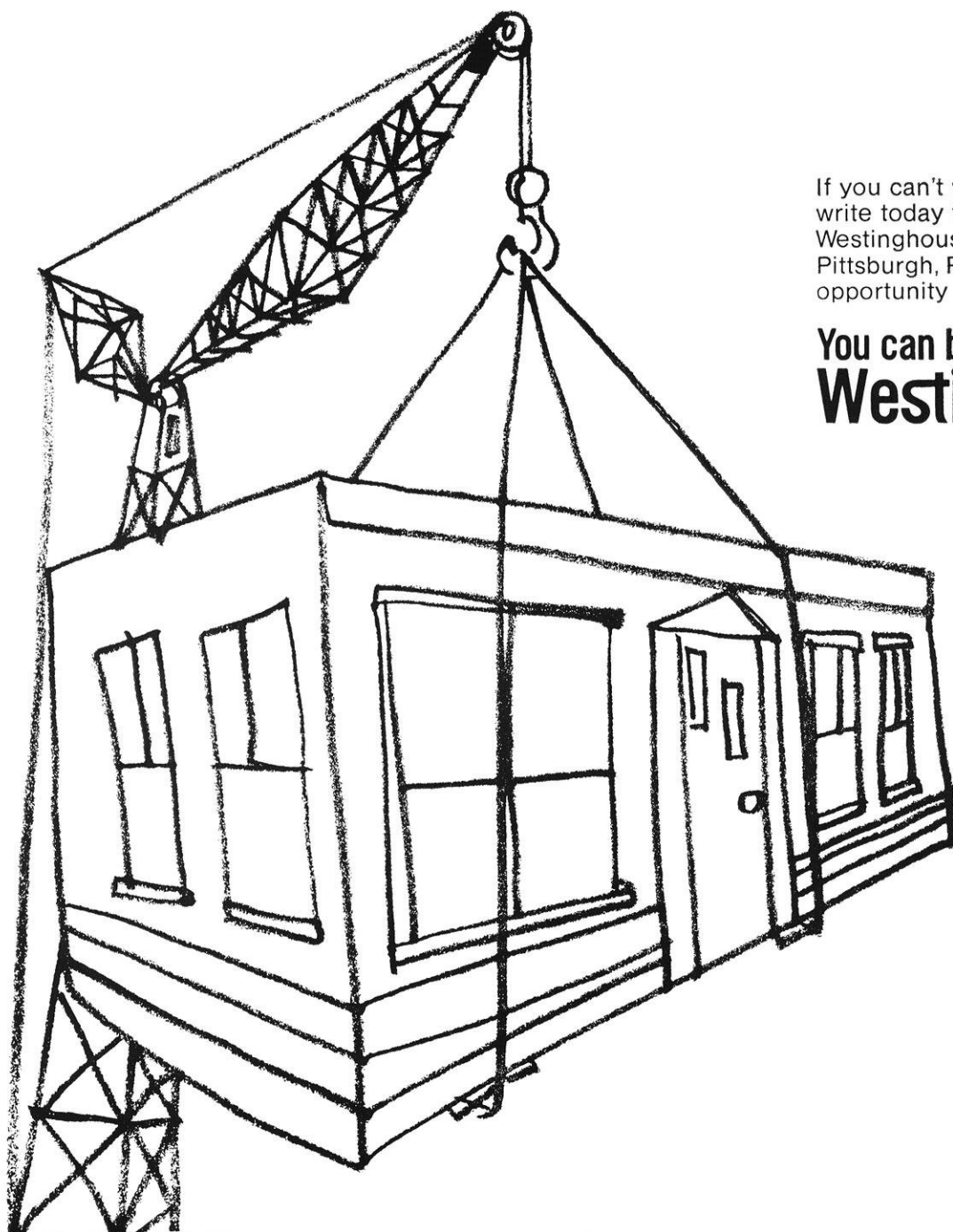
# Whose factory made this house?

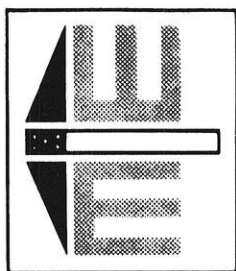
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**Albert Einstein:**

*"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

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**Marginal land:  
the same area  
raises 30 chickens  
or 1 ton of catfish**





WISCONSIN ENGINEER

The farmers at a "Kombinat" (collective farm) in Nasice Breznica, Yugoslavia are really making their acreage pay off.

They flooded it, and are raising good old American channel catfish.

About three years ago, FMC visited the Kombinat as part of a state department-approved agricultural development program. At the time, the Yugoslavians were raising carp in huge man-made ponds covering marginal land—land not best suited for crops. "Why not switch to farming catfish?" we asked. "They yield twice the harvest. And they bring a premium price in the marketplace."

The Yugoslavians said, "Good idea—where do we get the fish?"

That's when our work began. We contracted to ship them 21,000 fingerlings, 110 brood stock, and 120,000 newly hatched "fry," knowing live fish shipment mortality rates often reached 50%.

To do this job, special FMC containers were developed to fit into the baggage compartment of a Pan Am 707. They maintained precise life support levels of oxygen, carbon dioxide, ammonium, and controlled thermal levels, too. During four 50 hour trips from St. Louis to Yugoslavia we lost just six fish. A record.

More importantly, Yugoslavia has more productive "farmland."

Fish farming, or aquaculture, is an extension of FMC agricultural programs. The company is capable of building ponds, supplying pond cleaning and pond operating equipment, building fish processing and canning plants, as well as containers for shipping fish by air.

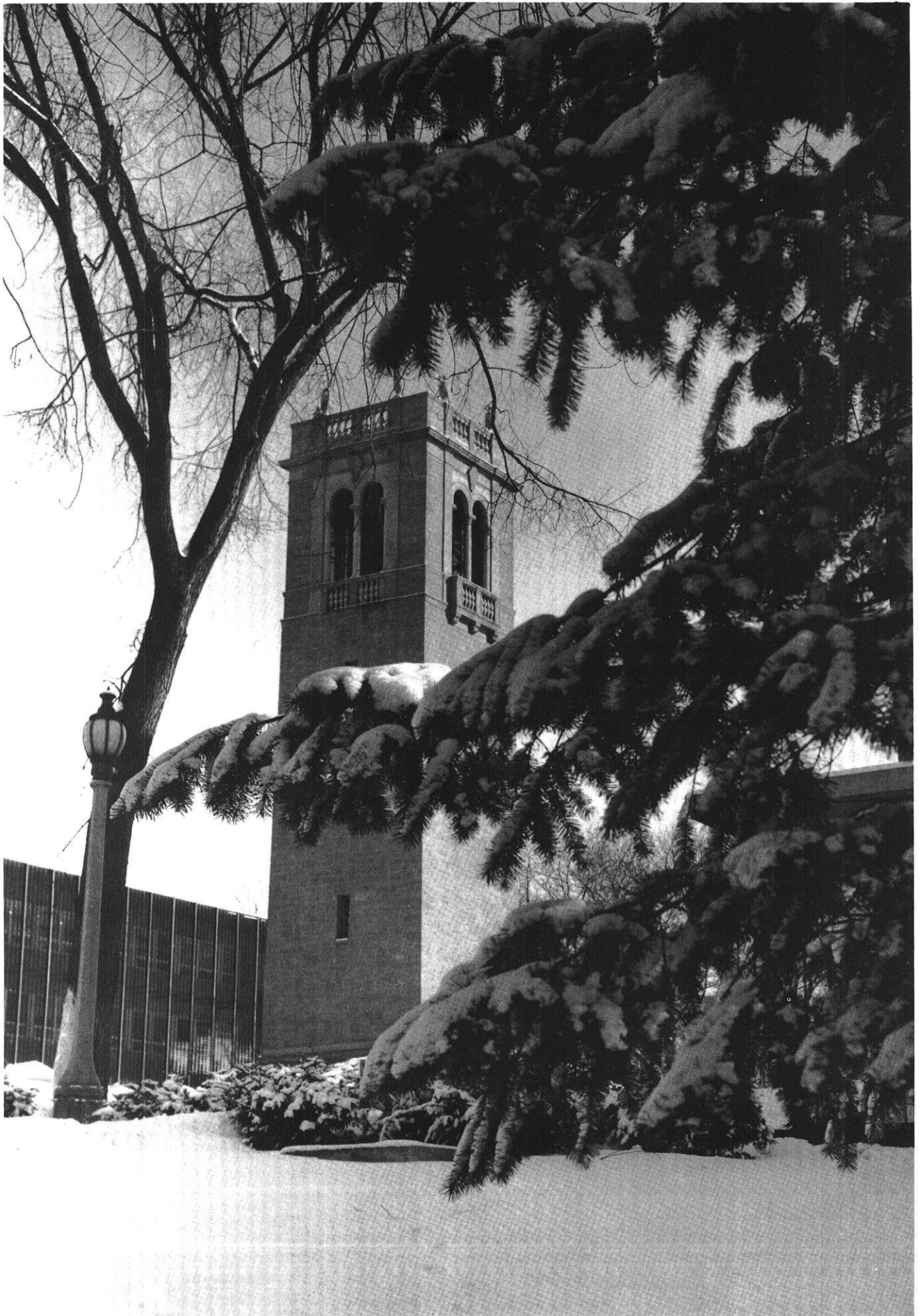
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**You'd be surprised  
at all the things we do.**





# U-W Engineering Student

## "Discovers"

## Carillon

## Tower

**text and photographs**

**by**

**Richard Burg**

The Carillon tower, situated on Observatory Drive across the street from Bascom Hall, has been gracefully standing since 1935. It contains 51 chromatically tuned bells. The person in charge of this building and all it contains is Professor John Harvey. After arrival at the University in 1960 he was pronounced Associate Professor of Music (Organ) and University Carillonneur. He is the only professor at Madison who has claim to his own building. In an interview with this carillonneur I learned the interesting history concerning carillons in general, and ours in particular.

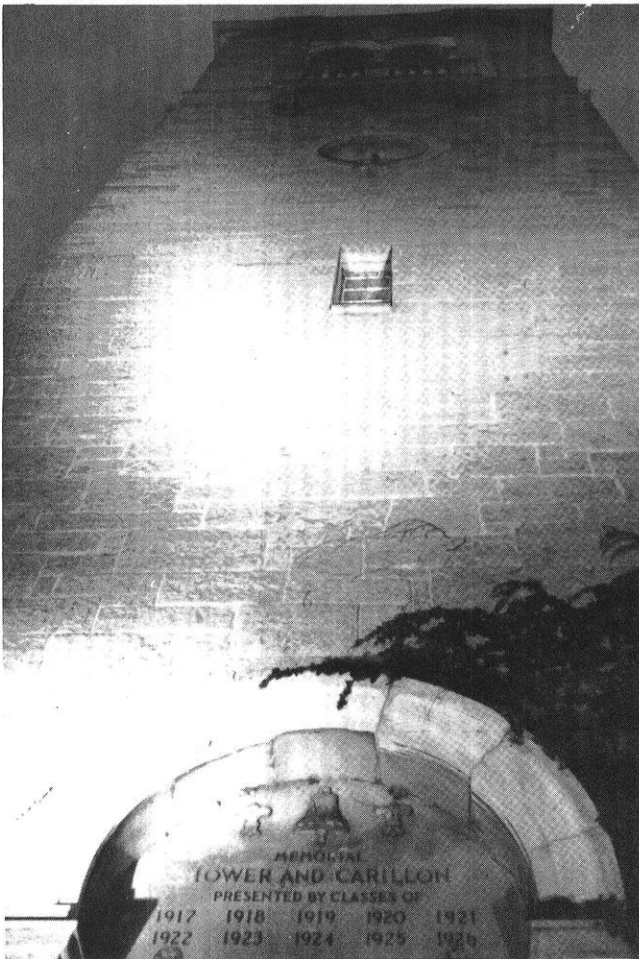
They originated in the lowlands of Europe, and this is where the maximum concentration of carillons is today. The Netherlands alone has nearly the number of carillons as the entire United States. These flatlands are perfect for carillons since it is a line of sight instrument. All the carillons in the Netherlands are city owned, their carillonneurs being city employees. Some enterprising carillonneurs perform their service to three or four cities, but none die rich.

Though carillons originated in Europe, the largest two reside in the United States. One located at the University of Chicago's Rockefeller Chapel boasts 72 bells with the largest weighing 38,000 pounds. Riverside Church in New York City has the largest in the world with 74 bells. Its lowest pitched bell weighs in at a mere 20 tons.

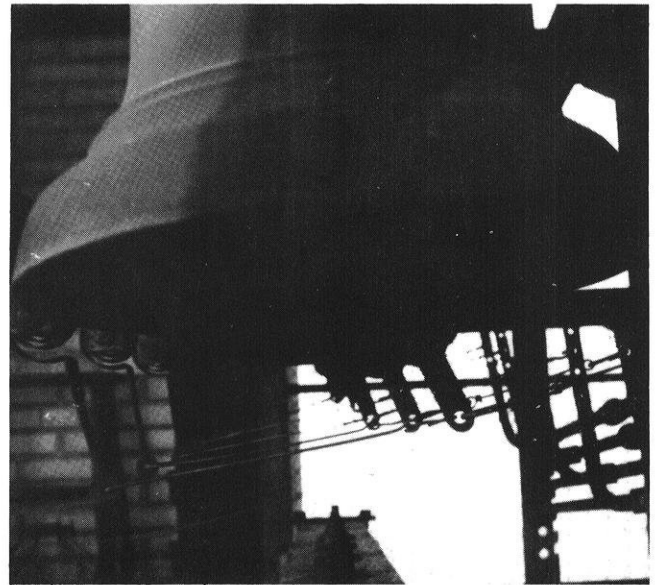
Our carillon contains 51 bells, ranging from a low E flat to high G sharp. Our present low bell, the E flat, weighs 3100 pounds compared to high G sharp at 15 pounds. When donations permit, five large bells will be added to the total. The new bells will add a low BB flat, plus low C, D, E, and F to the carillon's range. Their weights range from about  $\frac{3}{4}$  of a ton for the F bell to  $3\frac{1}{2}$  ton for the BB flat bell. \$30,000 of the installed price of approximately \$40,000 has already been donated. Quite a price jump from the \$11,000 paid for the original 25 bells in 1935. Inflation accounts for most of the change but the need to match the tonal characteristics of the new bells to the existing bells also increases the price.

Matching tonal characteristics is an involved science. People from the bell foundry use adjustable tuning forks and chromatic tuners to measure the relative strength of 6 bell partials relative to the strike tone. Partial is analogous to harmonics, which brings up an interesting point. All musical instruments have overtones (harmonics) made up of multiples of the played tone — all except bells. Bells may have overtones (partials) anywhere they wish. This fact makes bell tuning all the more demanding. Bell tuners study the 6 important partials of a bell and of necessity ignore the infinite number of lesser partials. The tuners perform this process on all the existing bells in order to guarantee harmonious sound between old and new bells.

Harmonic content of bells is determined by the shape of the curves making up the bells. The bell shaped curve so to speak. Three other factors also enter into bell design: diameter, height and thickness. Halving the diameter roughly doubles (1 octave) the pitch while increasing the height lowers the pitch. Increasing thickness intensifies volume of the bell tone. All these factors are complexly interrelated, which may partially explain why there was only 5 carillon foundries in existence. Three are in the Netherlands and one each in Britain and France. France's carillon manufacturer, the oldest, was founded in 1796.

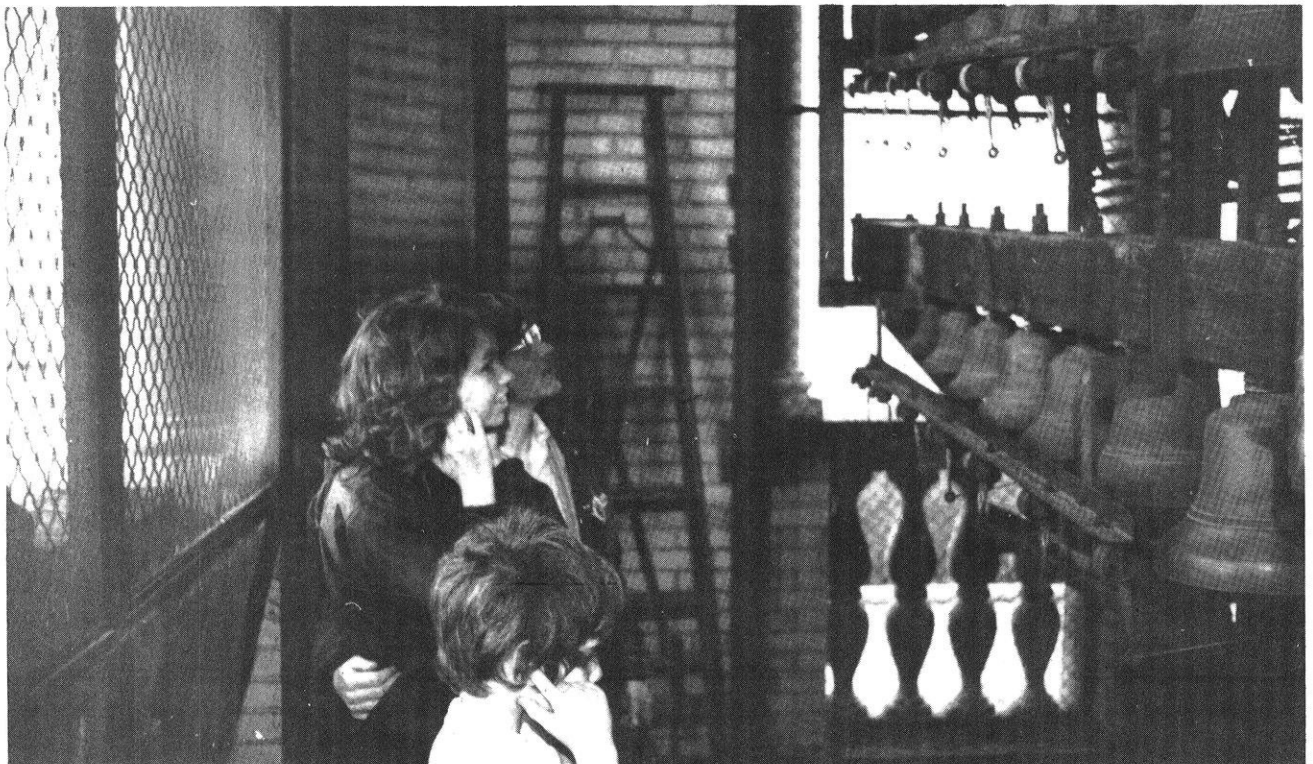


This worm's eye view shows the memorial stone located under the doorway arch.



All carillon bells are rigidly fixed. The bell clappers on the U-W tower are connected to the keyboard with steel wires. The spiral springs on the left keep the wires under tension and return the clappers to their ready position. These springs alleviate possible sound deadening by the clappers.

While Professor Harvey is playing, visitors are free to investigate the bell chamber.







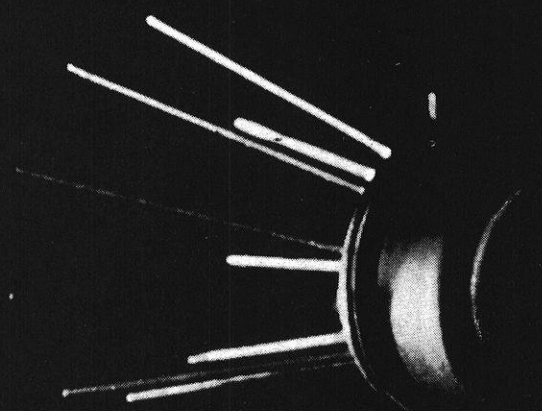
**The steel connecting wires behind Professor Harvey's keyboard thread their way from the over head bells.**

Like the carillon foundries, a few old carillon compositions are still left. Some date back to the 1600's. The carillon is a versatile instrument, sounding well playing anything from piano pieces to adaptations of full orchestra compositions. Mozart piano and harpsichord pieces are especially suited to our carillon. Since there are no standards at all connected with carillon manufacture, each carillon has its own unique tonal personality. The carillonneur must sound out this personality to decide what types of music should and should not be played on a particular carillon.

Our carillon has been standing for 47 years and will no doubt last many more. If you are nearby around 5 o'clock on a summer Sunday afternoon, pause and listen to its beautiful music. If you wish, walk up the stairs to where Professor Harvey plays – the door is always open.



**Professor Harvey demonstrates proper carillon technique to a young friend.**



## IF IT WORKS ON THE MOON, IT

**That cylinder, the size of a pea, is a building block of all space-age electronics gear. Soon millions will put more zip in your mail. And nickel's helping make it happen.**

The U.S. Postal Service is busily streamlining itself with some of the most sophisticated electronic hardware in—or out of—this world.

Optical scanners to decipher addresses in over 90 different type fonts. Computers. Coders. High-speed printers. Giant, 15-ton electro-mechanical sorters.

By 1975, this equipment should begin to slash postal operating expenses as much as \$500 million a year. And make a whopping improvement in service.

At the core of the new machines—and of business, medical, aerospace, and other advanced electronic hardware—are millions of spidery gadgets like the one in our photo. Anywhere from 29 to 100 percent nickel, they're hermetically sealed *packages* for miniaturized components. Most house tiny chips of silicon covered with transistors, resistors, diodes, and complex circuitry—complete *systems* for storing, amplifying, or otherwise harnessing faint electronic impulses.

The nickel in the packages helps because it has



# SHOULD WORK IN THE POST OFFICE.

good thermal and chemical compatibility with silicon. Because it enhances formability, bonding, and electrical conductivity. And because corrosive humidity won't faze it. (Nor snow, nor rain, nor heat, nor gloom of night, for that matter.)

Insignificant as the little cylinder looks, it took over 4,000,000 pounds of nickel to make enough of them for the electronics industry last year.

Just as our metal is a helper, so International Nickel is a helper. We assist dozens of different industries all over the world in the use of metals. We offer technical information. And the benefit of our experience. Often, Inco metallurgists are actually able to *anticipate* alloys that will be needed in the future, and to set about creating them.

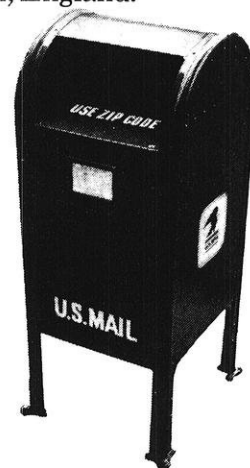
This kind of helpfulness, we figure, will encourage our customers to keep coming back to us.

And that helps all around.

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WISCONSIN ENGINEER

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## INTERNATIONAL NICKEL HELPS



## U.W. to Host

# AIIE Regional Conference

by Jeanne Veers Hildebrandt

The American Institute of Industrial Engineers (AIIE) regional conference for student chapters is being held in Madison at Allen Hall on March 9-11. The region involved in the conference includes schools in North Dakota, South Dakota, Minnesota, Iowa, Illinois, Wisconsin, and Indiana, and an estimated 125 students are expected to attend. Each spring the conference is held at a different school in the region; last year it was at Purdue, and next year it is scheduled for Univ. of Iowa.

The theme of the conference is to promote learning through open exchange of ideas. The entire conference has been built around this open exchange.

A month prior to the conference, each school will receive a problem statement concerning an actual situation. Each school will be asked to suggest a logical approach to solve the issue. The various approaches to the solution will be discussed in a workshop.

For those students inclined to write, a technical paper contest will be run with cash prizes to the top contestants. In addition, the winner is eligible for national competition and recognition.

The main focus of the conference will be on small workshops rather than speakers. Workshops covering such topics as engineering economy,

quality control, decision-making, human factors in engineering, labor relations, and management information processing systems will be held. Selected undergraduate and graduate students from the UW and from other universities and several professors are donating their time to lead these workshops.

While at the conference, three students from each school will form a team to solve a problem requiring expertise in decision-making. The goal will be to either minimize costs or maximize profits. After attending two workshops on engineering economy and quality control, the students will be given some information which is essential to solving the problem and some which is superfluous. Each team will determine which information is significant for solving the problem and substitute some parameters, determined from the information, into a simulation program on a computer. After four runs of the simulation program, the team with the best solution will be awarded a plaque.

The conference will be closed with an awards banquet Saturday noon. Awards will be given for the paper contest, management game, and a man-mileage for the school with the most people coming the greatest distance will be given.



Four of the seven conference committee chairmen from the Madison campus pose for the *Engineer* photographer: Roger Murphy, program Co-chairman; Jeanne Veers Hildebrandt, Conference Chairman; Dan Pfeiffer and Kim Bennet, Housing Co-chairmen; not pictured are Steve Dvorak, Communication Chairman; Al Musser, Program Co-chairman and John Pederson, Finance Chairman.

## **Environmentalist Urges Preservation of Marshlands**

Marshlands should be diligently preserved because of their beneficial effects on water quality, according to University of Wisconsin-Madison water chemist G. Fred Lee.

"While marshes can have some detrimental effects on water quality, from an overall view their good effects far outweigh the bad," Lee, who recently completed an extensive study of marshes and water quality, contends.

Draining eliminates all of a marsh's beneficial effects on water quality and generally aggravates many detrimental effects, he adds.

On the beneficial side, marshes remove substantial amounts of aquatic plant nutrients like nitrogen and phosphorus from water passing through them, he explains. This reduces the amount of fertilizers moving into lakes and streams.

Marshes also change the outflow pattern of nutrients not removed, storing them in summer and fall and releasing them with heavy spring rains.

"This change cuts down the amount of nutrients flowing into lakes during the heavy-growth summer months, minimizing excessive algae blooms," Lee said. "Since the nutrients are released all at once, it may also be possible to trap water from marshes and treat it to remove nutrients."

In addition to storing nutrients, marshes trap sediments, removing large amounts of solid materials which normally would adversely affect water quality, Lee continued. Marshes also stabilize stream flow, reducing fluctuations caused by heavy

rains and thereby cutting down on erosion of stream banks.

Lee, director of the UW's Water Chemistry Program-Department of Civil and Environmental Engineering, conducted the studies primarily on Horicon, Waunakee, and Shakey marshes – all in south-central Wisconsin. He was aided in the project by former water chemistry graduate students Eugene Bentley and Rohel Amundson.

Their study, funded principally by the Wisconsin Department of Natural Resources, also pointed out some ways in which marshes are harmful to water quality.

Marshes tend to release large amounts of highly colored water which can contaminate water supplies, making them unfit for industrial or domestic use without extensive treatment. Also, Lee notes, some areas experience severe taste and odor problems whenever marshy lands drain into well-water supplies.

Marshes are generally unsuitable habitats for most fish due to low dissolved oxygen content. But it may be possible, Lee adds, that fish could use marshes for spring spawning so long as small fish leave for open water before oxygen levels decline.

Thus marshes possess both benefits and some disadvantages, but Lee feels that the strongest argument in their favor is the damage resulting when they are drained.

"When this happens, large amounts of nitrogen and phosphorus are released which can cause heavy growth of algae and water weeds in surrounding lakes and streams," Lee explained. "The draining of thousands of acres of marshlands adjacent to Madison's Lake Mendota over the past 50 years has contributed significantly to the current excessive fertilization of the lake."





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## CORPS OF ENGINEERS



*U.W. News Service*

## **Engineering Craftsman Retires from EE Shop** **by Mark Briggs and Larry Teske**

The electrical engineering department of the University of Wisconsin at Madison has lost an old friend, Harry Robertson.

Robertson, at Wisconsin for 46 years, retired this week. He started working for the old Engineering College in 1925 when it was located on "The Hill" in the building now occupied by the School of Education. He is leaving a large well-equipped shop in the main engineering building — a \$200,000 shop he designed.

Hired as a laborer, he took vocational courses in welding, auto mechanics, motor winding, and woodworking to increase his ability. He received six promotions, the last to the position of instrument shop supervisor in 1968.

As supervisor, Robertson was responsible for building the equipment necessary for nearly all research being done in the department. He also enforced safety precautions and supervised and instructed faculty, students, and stall employees using the shop.

Robertson's civil service record classifies him as an instrument maker, but this doesn't explain the job. Since in research it is not possible to predict what kinds of equipment will be needed, his job required creativity and adaptability. Often a student or faculty member would come to him with an idea but without drawings or specifications.

His civil service record says Robertson was an instrument maker, but this doesn't explain the job. Since in research it is not possible to predict what kinds of equipment will be needed, his job required

creativity and adaptability. Often a student or faculty member would come to him with an idea but without drawings or specifications.

One professor said Robertson ran a model shop because a researcher could deal directly with the man building the equipment. Prof. James J. Skiles, chairman of the department, said: "Harry has always been willing to undertake any task. He has done everything that has been asked of him."

Another of his characteristic which helped him in his job was his warm personality. "I think it's significant," Prof. Skiles said, "that any faculty member or student who has had contact with him considers Harry a friend."

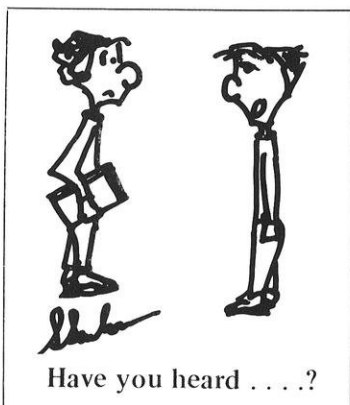
Prof. William Birkemeier said: "Harry is willing to build me a piece of machinery without a complete set of drawings." Similarly, every faculty member who has ever had anything he built has been very impressed by his skill and understanding.

When asked what would make a man work for 46 years at the same job, Robertson said it was the challenge of building original equipment and never building the same things twice. He commented: "You get interested in the project, and it's a challenge to get it to work. Of course, when you turn out something that works, you get some satisfaction knowing you have accomplished something. No two projects are alike, and that's what gets you interested. Then there's an incentive to prove it will work."

He has three sons: David, 31, Tomas, 25, and James, 20, a student at the University of Wisconsin in Madison.

# CAMPUS

# COMMENTS



## AIChE

Jack Weikart, from ESSO, will speak at the February meeting on the topic of Arctic Petroleum Exploration. The meeting will begin at 7:00 p.m. on February 16 in the Union South (see bulletin boards for room). Beer and snacks will be served after the meeting. All chemical engineering students are invited to attend.

## ASCE

Prof. James R. Villemonte of the University of Wisconsin College of Engineering's Civil and Environmental Engineering Department at Madison has been elected chairman of the hydraulics division of the American Society of Civil Engineers.

A native of Fennimore, Prof. Villemonte holds three UW degrees: B.A. 1935, M.S. 1941 and Ph.D. 1949. Before joining the Wisconsin faculty in 1947, he served five years as an engineer with the Wisconsin Highway Commission and six years on the Pennsylvania State College faculty.

He has twice traveled to India to design a laboratory at the Bengal Engineering College at Howrah, where he developed the graduate program in hydraulic engineering. His major research interests are flow measurement, hydraulic model studies, and measurement of liquid turbulence.

Former chairman of an influential University Committee, the University Faculty Council, and the civil engineering curriculum committee, he has also served as director of the University Hydraulic and Sanitary Laboratory.

## THETA TAU

Theta Tau is again planning an active month of social and professional activities. Brother Wayne Ziebell, a graduate student in Civil Engineering, will give a presentation on Sanitary Engineering at the February fourteenth meeting. Rush meetings will be held on February 9, 10, 14 and 16. All interested engineers are invited to attend any or all of the rush functions.

During the month of January our traditional initiation ceremony and banquet were held. Dinner at the Hoffman House West was preceded by a reception at the home of alumni Dick Jenks. The after party was held at the home of Brother Jim Guenther. Another alumni, Al Mense—from the University of Arizona, was the master of ceremonies for the honors program.

## “INVENTING TECHNOLOGY”

Inventing is often viewed as some wierd magic skin to alchemy, but University of Wisconsin-Madison engineers are now systematizing the process into several general principles.

“We are developing a general outline describing how new technology can best be invented,” stated UW chemical engineers Dale F. Rudd and Richard R. Hughes. The principles behind this outline are applicable to a variety of fields, from ehcmical and food processing to treatment of environmental pollutants.

Perhaps the most important application, however, will be in the classroom — teaching beginning engineering students how to invent. Professor Rudd is presently teaching a course entitled “Process Discovery,” for publication in 1973.

For his work in this field, Rudd received the 1971 Allan P. Colburn award from the American Institute of Chemical Engineers.

# Americans Want to Live Near Big Cities

What has often been billed as the American Dream — getting away from it all and moving to the country — may turn out to be a misleading picture.

Many national public opinion surveys have indicated a sizeable majority of people would like to live in rural areas or small towns, according to University of Wisconsin-Madison rural sociologists James J. Zuiches and Glenn V. Fuguitt.

However, few people are actually moving to isolated rural areas, he added. In fact, the trend is in the opposite direction.

Based on a statewide survey in Wisconsin, the sociologists have found that most state residents actually want to live in small towns or rural areas but within commuting distance of a large central city.

“Basically, people seem to want the best of both environments,” Zuiches, a UW graduate student, said. “If there were to be a shift in population at all, expressed preferences indicate many more people would move closer to big cities

than away from them.”

Population trends from the 1970 U.S. census accurately reflect this desire, he said. Both rural areas and small towns near large cities have gained significantly in population.

The survey — a representative sample of over 900 adult state residents — was made by the UW Survey Research Laboratory in Madison.

Analysis of the survey also indicated some clear-cut differences in the types of people preferring different residential areas.

Those preferring to move into metropolitan areas were generally younger, better educated, and held higher status jobs than those wanting to move away.

“These results do not mean that rural development should be discouraged,” Zuiches stressed. “But if rural development programs are to succeed, they must take into account the features of life that make small towns and rural areas near metropolitan centers the most preferred residential locations.

## U-W Scientists Develop Metal Bones

A metal bone that promises to be better than any other in use today is being developed by University of Wisconsin-Madison scientists.

Metallurgist Joel Hirschhorn and orthopedic surgeon Dr. Andrew McBeath are using a technique known as powder metallurgy to make porous metal bone replacements that behave almost like real bones.

Presently, prosthetic devices to replace broken or worn-out bones are cast from molten metal or machined from solid ingots. They are made from metals that the body will not reject but they are sufficiently foreign so as not to become a part of the body.

Moreover, these prostheses can loosen and they wear out or fatigue faster than bone. They also have poor shock-absorbing and flexing qualities.

Prof. Hirschhorn says that porous metal prostheses made by powder metallurgy will alleviate the problems. He makes the devices by putting metal powder in a rubber mold and compressing it. Then the compacted powder is sintered-heated without melting, so that the powder grains bind together.

The resulting prosthesis is filled with tiny holes

like natural bone. Hole size and shape can be controlled by altering powder grain size and the amount of compression in molding.

The porosity gives the prosthesis elasticity so that it can bend a little, absorb shock and possibly wear slower than a solid prosthesis. Although not as strong as a solid metal prosthesis, the porous prosthesis is lighter and still stronger than the bone it replaces.

Perhaps more importantly, the porosity provides for natural binding between prosthesis and bone. Bone cells or soft tissues grow into the pores in the prosthesis and lock it into place.

Hirschhorn is presently testing a hip prosthesis in a dog. He notes that the hip joint is one of the most common prosthetic devices used and that it must stand up to heavy load with frequent use. If the porous prosthesis works in hip joints, Hirschhorn says that it will likely work anywhere in the body.

Funds provided by the Orthopedic Research and Education Foundations have run out and Hirschhorn and McBeath are now looking for additional money to continue this research and develop experimental prostheses for humans.



# Static

## The E.E's Lament

Through the smoke and ozone fumes  
The student slowly rises,  
His hair is singed, his face is black  
His partner he despises  
He shakes his head and says to him  
with words so softly spoken,  
"The last thing that you said to me  
'I'm sure the switch is open'."

\* \* \* \* \*

The best angle to attempt a problem is the  
try-angle.

\* \* \* \* \*

Young sweet thing: "Isn't it funny that the  
length of a man's arm is just equal to the  
circumference of a girl's waist?"

\* \* \* \* \*

C.E.: "Let's get a piece of string and check it  
out."

\* \* \* \* \*

"Yeah, wow, I was at a party over vacation  
where everyone was so drunk I could hardly see  
'em."

\* \* \* \* \*

When women go wrong, men go right after  
them.

\* \* \* \* \*

Little Wille  
Feeling Fine!  
Stole his father's wine  
Mother seeing he was plastered  
Cried: "Go to bed you little  
booze-hound."

\* \* \* \* \*

Speaking of girls —  
When one is mentioned, here are  
some of the things the boys want to know:

Fine Arts Student: "What plays has she seen?"  
Business Student: "Is she the business type?"  
Journalism Student: "What did she ever write?"  
The Engineer: "Where is she?"

Walking with a friend one day, a professor  
passed  
a large fish shop where a fine catch of codfish  
with  
mouths open and eyes staring were arranged in a  
row.

The prof. suddenly stopped, looked at them,  
and clutching

his friend by the arm exclaimed: "Heavens!  
That

reminds me, I have a class in EE this hour.

\* \* \* \* \*

The professor who comes in fifteen minutes late  
is rather rare; in fact, he's in a class by himself.

\* \* \* \* \*

A new person on campus stands out in the  
crowd.

\* \* \* \* \*

Seven-year-old- Michael, who had a reputation  
as a little trouble-maker, had just finished his  
summer vacation at his grandfather's farm. Back in  
the city, one of the neighbors asked him about his  
holiday and especially about his grandfather.

"Oh, he's great," responded Michael. "We  
played a swell game every day, Late each afternoon  
he'd row me out in the middle of Claytor Lake,  
throw me over the side of the boat and let me  
swim ashore."

"Claytor Lake?" gasped the neighbor, "That's a  
big lake. Wasn't that a hard game for such a little  
fellow as you?"

"I'll say it was," said Michael, "But the hardest  
part was getting out of the sack."

\* \* \* \* \*

Did you hear about the Oriental basketball  
team, they wear highheel sneakers.

\* \* \* \* \*

A big buck Indian had just ordered a ham  
sandwich at a drug counter and was peering  
between the slices of bread when he turned to the  
waiter, "Ugh, you slice um ham?"

The waiter replied, "Yes, I sliced the ham."

"Ugh," grunted the Indian, "You damn near  
miss um."

\* \* \* \* \*

And then there was the drunk who  
stumbled into the telephone booth and  
dialed his wife.

"Shoo, cum and pick me up," the drunk  
asked.

"Where are you," asked his wife.

At the corner of WALK and DON'T WALK,"  
the drunk replied after a long look out the booth.

"No," the wife said, "What street are you at?"

"Just a minute," the drunk answered, and hung  
up, dialed the operator and said, "Trace this call,  
and tell me where I am."

\* \* \* \* \*

Since we call our professors profs.,  
It's easy to see what we should call assistants.





## Stereotype

Many who use the word wouldn't know one when they see one. Those who recognize it as a metal casting of a newspaper page, curved for the press, may be deriving a livelihood from this and everything else they know about printing. The more people who depend on the printing industry for a living and the more they know, the better for Kodak. The intricate complex of businesses and crafts centered on the art of printing and packaging is more than a principal market for specialized Kodak products. One way or another, it provides a life role for a not inconsiderable segment of mankind. **Finding a role in life does seem to be a common problem.**

So you picture an executive conference. Sweeping generalities uttered, fine details worried over, a strong voice takes command: "Products alone can't sustain the growth we look for. The key is people—people to man our customer industries, to want growth in them as much as we do. Wouldn't we really be accomplishing more with a campaign to attract more kids to printing?"

Not quite.

We can't and shouldn't mount a campaign powerful enough to lure large numbers of kids into printing and the graphic arts, but we have collaborated with new-style academics, the printing and allied industries, and their unions in a measurement just completed of 1) manpower needs in these fields (not just ambitions), 2) how changes in technology promise to affect the needs. Interest in the findings should be made known to W. F. Flack, Dept. 942, Kodak, Rochester, N. Y. 14650.



*Recruiting should run on  
more than enthusiasm*

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