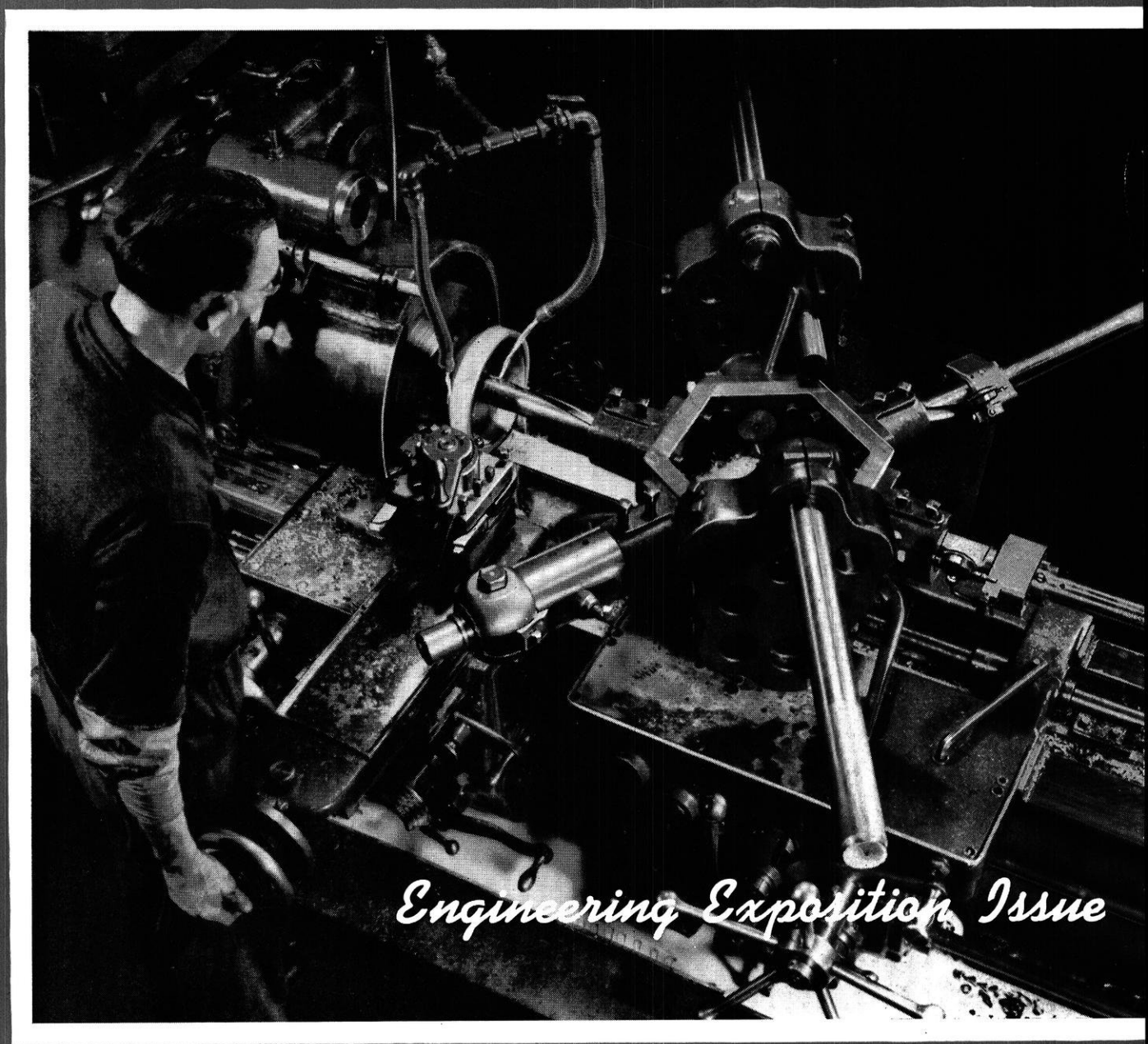
# The Wisconsin engineer. Volume 45, Number 7 April 1941

Madison, Wisconsin: Wisconsin Engineering Journal Association, [s.d.]

https://digital.library.wisc.edu/1711.dl/7P3DBZ6M5SIJV8I

The ★ WISCONSIN ENGINEER



*Engineering Exposition Issue*

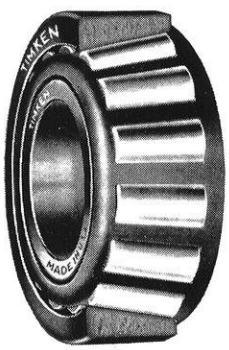
*April, 1941* ★ Exposition Program on Page 16

# Don't make this mistake

Bearings sometimes are regarded merely as incidental factors in machine design. This is a great mistake. Many an otherwise well-designed piece of equipment has failed to live up to expectations because of inefficient bearings.

With operating speeds constantly going higher, radial loads getting heavier, thrust loads more severe, and precision tolerances closer, bearings are more important than ever before. Don't make the mistake of underestimating their value.

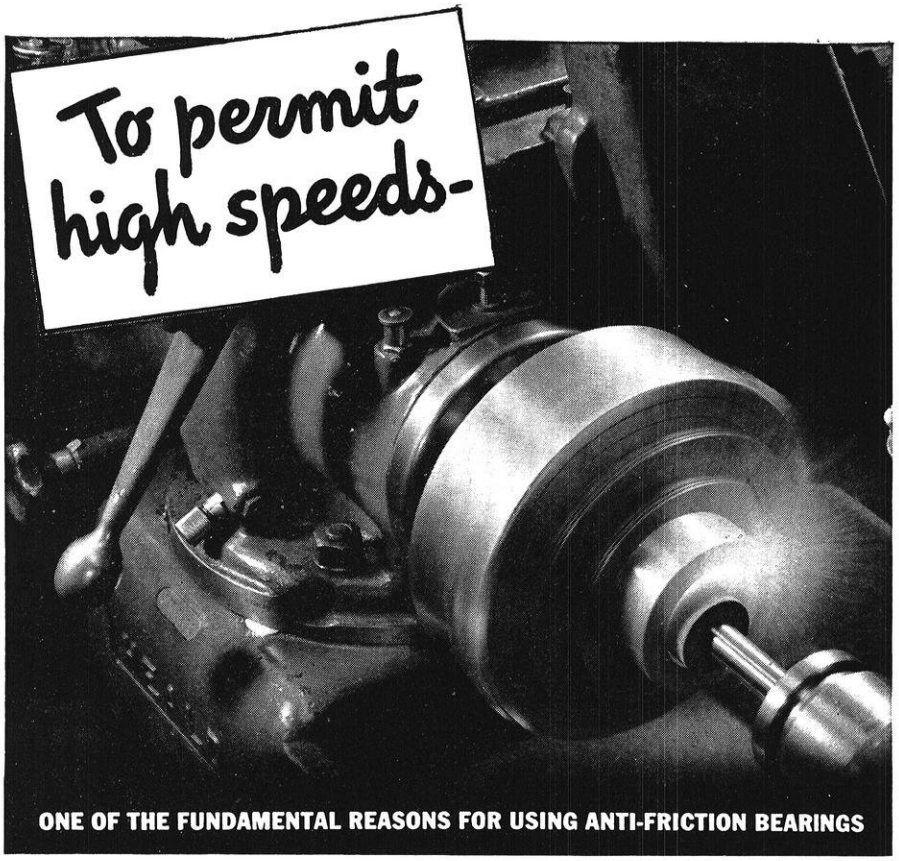
By getting a thorough knowledge of the principle, construction and application of the TIMKEN Tapered Roller Bearing you will be able to meet every bearing need, avoid trouble and assure correct performance. This knowledge will be one of your most valuable assets when you graduate. It will make you a better engineer. Take the first step now—write for a *free* copy of the Timken Reference Manual.




THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; and TIMKEN Rock Bits.

**TIMKEN**
**TAPERED ROLLER BEARINGS**




WHEN fault exists in any type of bearing, high speed will inevitably bring it to light . . . in excess heat and wear. Thus, high speed machine operation is at once a test of the accuracy with which a bearing is made and of the efficiency of the basic bearing design.

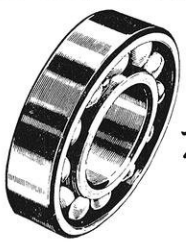
Significant then is the fact that each year more manufacturers of machine tools and other high speed machinery standardize on ball bearings . . . on New Departure ball bearings, used throughout industry wherever wheels or shafts turn.

Spectacular Proof
that New Departures
Permit High Speeds

Many high speed machines operate at between 5,000 and 10,000 r.p.m. A notable exception is the Madison-Kipp air grinder which runs at 50,000 r.p.m.—and which runs successfully on New Departure ball bearings.

*ENGINEERING STUDENTS: For interesting brochure, "Ball Bearings for Higher Speeds," write New Departure, Division of General Motors, Bristol, Connecticut.*

# NEW DEPARTURE



## BALL BEARINGS

*Nothing Rolls Like a Ball*

# The WISCONSIN ENGINEER

Founded 1896

Volume 45 | APRIL, 1941 | Number 7

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

PROF. H. C. RICHARDSON, *National Chairman*
UNIVERSITY OF MINNESOTA
Minneapolis, Minnesota

Arkansas Engineer
Colorado Engineer
Cornell Engineer
Drexel Technical Journal
Illinois Technograph
Iowa Engineer
Iowa Transit
Kansas Engineer
Kansas State Engineer
Marquette Engineer
Michigan Technic
Minnesota Techno-Log
Missouri Shamrock
Nebraska Blue Print
North Dakota Engineer
North Dakota State Engineer
N. Y. U. Quadrangle
Ohio State Engineer
Oregon State Technical Record
Oklahoma State Engineer
Pennsylvania Triangle
Purdue Engineer
Rose Technic
Tech Engineering News
Villanova Engineer
Washington State Engineer
Wayne Engineer
Wisconsin Engineer

*National Advertising Representative*
LITTELL-MURRAY-BARNHILL, INC.
101 Park Ave., New York





Entered as second class matter September 26, 1910, at the Post Office at Madison, Wisconsin, under the Act of March 3, 1879. Acceptance for mailing at a special rate of postage provided for in Section 1103, Act of Oct. 3, 1917, authorized Oct. 21, 1918.

*Published monthly from October to May inclusive by the Wisconsin Engineering Journal Assn., 356 Mechanical Engineering Bldg., Madison*

**Subscription Prices**
$1.25 PER YEAR . SINGLE COPY 20c

HOMER J. SCHNEIDER, *Editor*
HARVEY A. SCHLINTZ, *Business Manager*
JOHN R. ERWIN, *Associate Editor*

**Editorial Staff**

PHILIP F. DESCH, e'41, *Advisory Editor*
BOB DIEHL, e'43, *Campus News Editor*
ROY McINTOSH, min'42, *Alumni Notes Editor*
BLAKE WHEELER, e'42, *Engineers in the News*
ROBERT ZENK, m'42, *Humor Editor*
JEROME BAIRD, min'43, *Illustrations Editor*
DOUG BAINBRIDGE, min'43
GALE FROEMMING, e'43, *Exposition Editors*
BOB SHORT, min'42
HERB BLOCKI, m'43
BILL ZUMACH, ch'44
BEN BENNETT, e'41
BOB WALTHERS, m'44
BUD LOEFFLER, m'44
GEORGE YOUNT, e'42

**Business Staff**

FRED TEUSCHER, m'43, *Advertising Manager*
CARL WULFF, m'42, *Circulation Manager*
RAYMON EVENSON, m'43, *Campus Circulation Mgr.*
MILTON SUCKOW, m'41, *Alumni Circulation Mgr.*
HENRY GEBLER, m'43, *Sales*
RUSK HEAGLE, m'43
WALTER SPIEGEL, ch'43
ORVAL SCHROEDER, m'43

**Board of Directors**

J. B. KOMMERS, *Chr.* L. C. LARSON
W. K. NEILL, J. F. OESTERLE
R. A. RAGATZ, K. F. WENDT
L. F. VAN HAGAN, P. H. HYLAND
H. J. SCHNEIDER, H. A. SCHLINTZ


## On The Cover

THE MAN and his machine symbolize much in our existence. The products of his hours at work are our walls of defense, our transportation, our light and heat. They have made the present ghastliness of war possible. Fortunately, as they permit, so may they prevent.

Deep in the great heart of the defense movement these precision tools whir and slice, producing parts which fit closely to their mating parts which may have been manufactured a thousand miles away. This interchangeability, Eli Whitney's greatest contribution to the world, combined with adaptable mechanisms such as the turret lathe of the cover, has made mass production possible.

Though these modern tools seem utterly incomprehensible to the layman watching their rotating cams, clicking knock-off pins, and meshing gears, basically they are little different than the familiar wood-turning lathe every boy has toyed with. The difference lies in standardization—the universal use of standard sizes of each article. Thus the task of the modern machine tool is to duplicate one article many times over, for in duplication lies cost reduction: few motions, the unbending of slow, tiring human backs with fast, efficient, tireless automatic motion. It is this complex and automatic motion which is so difficult to achieve, for we are substituting our gears and cams for that amazing machine, the human mind.

## In This Special Issue


*Greetings from Dean Johnson* . . . . . 5

*Articles*

**Professional Conduct, by Daniel W. Mead** . . . . . 6
*Professor Mead's fifteen points of professional relations for the student engineer.*

**Mr. Saint Pat, by Nathan Itzkowitz** . . . . . 8
*New light on the saga of that great engineer.*

**The College of Engineering** . . . . . 9
*And how it grew.*

**The Electron Microscope, by Howard R. Hegbar** . . . . . 10
*New horizons—infinitesimal in dimension, limitless in possibility.*

**Madison Industries in Defense, by Robert Short** . . . . . 12
*Local help for the national cause.*

*Exposition Section*

**Guiding the Expo** . . . . . 14

**Program of Events** . . . . . 16

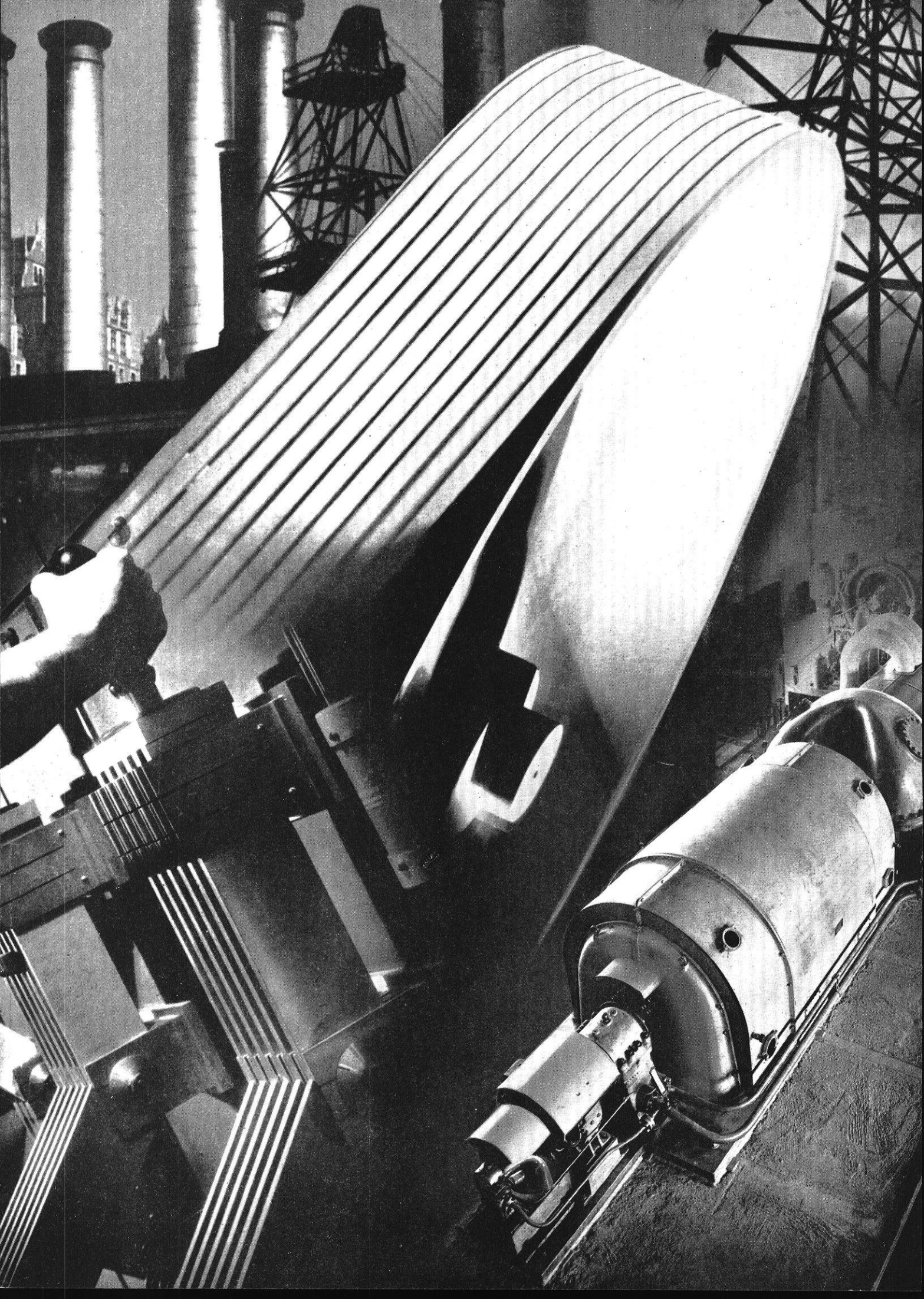
**Location of Exhibits** . . . . . 16

**Student Exhibits** . . . . . 18

**Industrial Exhibits** . . . . . 24

*Cover*
*Turret lathe in operation. Photo courtesy Gisholt Machine Co.*

*Frontispiece*
*A photomontage symbolizing Power. Courtesy Allis-Chalmers Co.*



# *Significance of the* ENGINEERING EXPOSITION

AS SKIES *darken and the clouds of the world's turmoil overshadow us, it is wise that in every field of endeavor we take sights, locate ourselves, and try to retain our perspective.*

*Thus our Engineering Exposition acquires particular significance this year.*

*Thus it is that our faculty, our alumni and our friends in industry can wisely give encouragement and cooperation.*

*Thus it is that our students have an unusual responsibility in tackling their task with enthusiasm and vigor.*

*And, thus it is that we gather with the thousands of our friends from the University community and Madison, the Governor and the legislature of Wisconsin, with our young friends from high schools far and near and with parents and citizens from farm and city —we should find more than mere interest and pleasure in our Exposition.*

*For, first of all, from such applications of science as our exhibits we must count immediately upon the implementing of our national defense and the physical protection of our American way of life. The astonishing importance of the contribution of the engineering profession to the defense program of the United States is evident from the estimates of authoritative sources that government services and industry will need from forty to fifty thousand additional engineers this year. Contrasted with this need is the available supply of only twelve thousand newly trained men. There is therefore sound reason for all engineering students to go about their work with patriotic fervor.*

*Further effects of the engineer's future application of science may be expected to affect materially and alter the social problems of our country. In any event, it may be anticipated that future work of the engineers will have as profound effect upon our social problems as did the development of the steam engine in producing "the Industrial Age" or as has the development of the internal combustion engine and the radio in our present generation. Visitors to the Engineering Exposition may well ponder the part to be played in the future by some of the things they may see.*

*It is with pride in the important significance of our Engineering Exposition that we welcome all who come.*

F. Ellis Johnson

# Professional Conduct

*by Prof. Daniel W. Mead*

**Past President of A.S.C.E.**

IT MAY well be asked, "Why is a Code of Conduct desirable?" In answer it should be said that a knowledge of the science of successful and useful living is the most important knowledge that any man can acquire. In the schools, colleges and universities, the students learn the principles that underlie a successful understanding of physics, chemistry, biology, physiology and the various other subjects studied in their selected courses. In very few cases is any instruction given in the schools on the most important subject of all—the Science of Living, the science of proper conduct in the affairs of life. In this the writer believes that the schools have been very derelict and that this subject should be taught to all students.

It seems to be commonly assumed that the students, at least in our colleges and universities, have already received instruction in proper conduct at home, in the churches, and perhaps in the schools which they have attended. Perhaps that assumption was warranted in the more simple life of the past. At present, however, our civilization has become so complicated and so involved with the the manifold professions, businesses and trades that the principles which should be practiced by the student when he leaves his alma mater and enters into business or professional life have also become complicated and cannot well be acquired except by the hard knocks of personal experience or through the experience of others who have already trod the seamy path of similar experience. It is quite evident, the writer believes, that the fundamental principles upon which all proper conduct is based are quite similar in all cases regardless of business, profession or occupation. The Golden Rule of all conduct is "to do unto others as you would that others shall do unto you," and it may seem to many to be sufficient for all practical purposes. So it would be if the individual were always capable of applying that principle under the manifold conditions under which it must be applied. The principles of physics, however, do not greatly aid the student in understanding the principles of chemistry, although both are based on fundamental natural laws. Likewise the principles of conduct as practiced in schools and colleges do not fit the student for the rules of conduct which are necessary to be applied in business or professional life. In conduct, as in professional practice, the younger man will do well to seek the precedent of older men who long have been in the special business or profession which he is to follow in his life work. Precedent in either case is not to be blindly followed, but neither should it be ignored. The importance of principles of action are well set forth by Raymond Moley[1] as follows:

PROF. D. W. MEAD

"What are principles that men live by? What, for that matter, is the meaning of principles itself? Reduce the question of principle to the case of an individual and one of the problems he faces. A man does not govern his life by chance. He learns, as the years pass, and profits by what he learns. He learns that there are some things that he cannot eat without distress. He learns that there are some games he cannot play. He learns that there are ways of doing his work better. He learns how to conduct his relations with other people. Out of the accumulation of individual experience he creates rules for himself. As time goes on, those rules become principles of living. He finds that by observing and respecting them he saves himself untold trouble and discomfort. He doesn't have to argue out thousands of individual decisions with himself. He depends upon his principles. Ultimately he lives not only with but by them."

General rules of conduct, like the Golden Rule, often are hard to apply under new conditions of experience not hitherto encountered. Therefore, if correctly stated, the more detailed and explicit a code is, the more useful it is to the inexperienced. The writer of this article never heard these matters discussed in his own university course and undoubtedly made mistakes in conduct as he did in practice in his early professional life. He early recognized his need of information along both lines, and when he began teaching the subject of Contracts in the Engineering Department of the University of Wisconsin, he introduced the subject of Engineering Relations as a regular part of the course in order to give the students in his classes the advantage of his own personal experiences.

In 1936, the writer was honored by election to the Presidency of the American Society of Civil Engineers, which now has some 17,000 members. As president of this society he felt it his duty to bring to its membership this subject of Professional Conduct, and by the request of the Board of Direction of that society, he prepared a somewhat extended article entitled: "Standards of Professional Relations and Conduct." This paper has ten subdivisions containing principles which applied particularly to certain relations of the engineer, although most of the principles must be regarded as applying to all engineering positions.


Space will not permit the reproduction of this paper in full but Section I, which was written especially for the student and young engineers, is reproduced below.

**The Engineering Student and the Young Engineer**

The engineering student should understand that he is preparing to enter a profession in which success, in general, is the reward of honest and strenuous effort. Professional success, while always involving opportunity, usually depends largely on the individual himself and on his intelligence, his personality, his ambitions, his courage, his industry, and his determination.

1. The mental discipline necessary to do well the work of a required but distasteful course is of great value, as throughout life one must frequently solve new problems and do things one would prefer not to do. Hence, if the student finds his required course includes subjects which he does not like, nevertheless he should give such subjects sufficient attention, for the ability to do work well whether he likes it or not is an essential factor to success.

2. It should be remembered that the college commencement is not the end of professional study but rather that it is the beginning of special investigation and the acquisition of knowledge of the practical application of the fundamental principles acquired in college. If a man is to succeed in any branch of the profession he must keep abreast of all new developments in that special field. He must be a constant reader of all books and periodicals that deal with the subject. He must (through active participation in the work of technical societies) keep in touch with the men who are doing important work in engineering. In brief, he must continue to be a student for the remainder of his life.

3. The engineer's employers will seldom ask him what he likes to do for it is his business to like the duties assigned to him. Interest in the job at hand will induce study and investigation as to how it can be best and most economically designed and completed. Only when the engineer feels an interest in his work can he accomplish the best results.

4. Even if the young engineer's immediate work is foreign to that which he intends to follow in later life, a thorough study and understanding of any engineering subject will be found of great advantage in later years.

5. The last half century has witnessed a great development in engineering literature. This is contained in engineering society publications, in engineering magazines, and in engineering books with which few young engineers are familiar. A knowledge of this literature, especially along the line of the young engineer's specialty, is of great imimportance. By extensive study the young engineer should utilize this great storehouse of information. "The difference between an educated and an uneducated man is not so much in the greater amount that the educated man knows as in his ability to find out"—Huxley.

Every one must build largely on the experience and precedents of the past. The young engineer should not be rigorously ruled by precedent, however, but he should not ignore it. On the other hand, he should not strive too much for originality. That which is entirely new is likely to be bad in principle or design. When, after thorough study and investigation, a new principle, method, or design is found to be more desirable, the engineer should not hesitate to adopt it; otherwise no improvements in principle, practice, or methods would be possible.

6. Frequently new ideas and new plans are outlined in more or less detail in the engineering press. Such plans seldom should be adopted without careful inquiry as to their success after some years of practical use. Often, apparently good and economical methods or design prove unsatisfactory in practice because their success or failure frequently can be determined only by use. Where new or untried methods are contemplated, the site of such works, preferably, should be visited and inquiry made as to the degree of success which has been encountered in actual usage before such plans are adopted.

7. The young engineer owes it to himself to join such local or national technical societies as are pertinent to the work in which he is engaged; he should attend their meetings whenever practicable, should read the papers at least in so far as they refer to his line of work, present or prospective, and should join in the discussions verbally or in writing whenever he has information which is new or important. Such association results in new friends and acquaintances, and such participation shows his interest in and knowledge of the work and, when new work is proposed, his availability for such future work. Many successful engineers owe their prominence in no small degree to their association with, and participation in, these engineering societies.

8. The young engineer should not take himself or others too seriously; even if he has been near the head of his class, he will find that the application of principles in practice is often a difficult matter, and requires study, inquiry, and sound common sense. The older members of the profession, men of long experience and extensive practice, should be recognized as human and fallible. Their opinions should be taken subject always to careful con-

(continued on page 30)

*Hibernian, Humanitarian, Engineer . . .*

# Mr. Saint Pat

*by Nathan Itzkowitz, c'41*

ON APRIL 4, 5, and 6 of last year, 7,500 people visited and were amazed at the 40 industrial and 100 student exhibits of the Engineering Exposition. In addition to the 7,500 admissions, another individual was present . . . an omnipotent spirit whose presence was manifested in many different ways. For while the 7,500 gaped, marveled, and reveled in the scientific media, our guardian spirit, from his coveted perch in the celestial firmament, looked down at the proceedings with a benevolent smile creasing his bearded features; for at last the glory and tradition of Saint Patrick had reached the zenith of its meteoric ascent.

For verily, Saint Pat is the patron saint of the Engineers, and the Exposition was a shining beam illuminating the history and the destiny of the great Engineer of all time.

'Way back in days of yore (or gore, as the case may be), an able man, Saint Pat, rose from among the common people of Ireland and rid that beautiful isle of the ghastly curse of snakes and lawyers. The latter achievement alone marked Saint Pat as a great humanitarian, but he gave further evidence of his prowess by devising the calculus (what kind it makes no differential), inventing the monkey wrench, and surveying the Pearly Gates ('tis rumored that he's the only Engineer who got that close to heaven). For these oustanding and humanistic achievements, the Engineers of former day decreed that fitting celebrations should be held on Saint Patrick's day of each year to pay homage to our adopted saint.

The Engineers at the University of Wisconsin inaugurated the celebration of Saint Pat in 1912 with a fitting celebration . . . it was a beautiful day and Saint Pat in all his glory paraded through the street preceded by a 40 piece band and the ever-present snake . . . the blarney stone and famous monkey wrench completed the procession.

However, through the years, the Engineers' parade became the target of the left wingers and fifth columnists of that day (and we do mean the barristers) and the gentle and refined custom of daintily hurling eggs at the parade had its inception. Quoting from a scribe of that day, "Leading were the street cleaners, busy with cart and broom, solicitous and conscientious in the discharge of their duties."

The 1923 parade was marked by a kidnapping, a libel suit, and whole raft of editorials in the Cardinal, but undaunted the Engineers gave Saint Pat the homage he deserved.

The eggiferous shysters hibernated until 1925, when they emerged from their hovels and once again the peasantry of Madison witnessed a battle the yolks of which no chicken has ever seen.

In 1926, the rival factions kissed and made up, and the parades of '27, '28, and '29 were unnotable affairs . . . the parade was dropped in 1930 and the wearing of green feathers was instituted instead.

The year 1933 marked the beginning of a new era in hostilities and once again the Engineers and lawyers came forth fighting . . . the trees in front of the Law building budded prematurely with green bathroom stationery . . . the respective strongholds were raided in midnight sorties, and then to climax the chain of events, the parade of '38 was tops for rampant rowdyism. Immediately the merchants of littered State Street set up a howl and finally the powers that be prohibited the use of odoriferous missiles.

The parade of '39 was a peaceful affair and as a result it seemed that the tradition had come to a tragic end . . . but the spirit of Saint Pat could not be confined. It struggled and groaned and groped and finally burst forth in a shower of splendor at the highly successful Engineering Exposition of 1940.

And this year, ladies and gentlemen, as you witness the various exhibits, do you notice that spirit hovering o'er you . . . guiding your footsteps and ours? You probably can't see him, but he's there and he will always be there . . . that, ladies and gentlemen, is Mr. Saint Pat.

# The College of Engineering
## *and*
# How It Grew

THE College of Engineering needs more room in which to carry on its work. It is severely cramped in its present quarters, especially for laboratory space. When one looks into the history and growth of the Engineering College, he will see why the college is hard pressed to maintain its educational standards with the present facilities.

The Engineering College was created in conjunction with the Agricultural College in 1868 when the State of Wisconsin accepted an endowment of 250,000 acres of land from the federal government. The Morrill Act of 1866 had provided for the establishment of a College of Agricultural and Mechanic Arts by means of land grants.

In 1876 old Science Hall was built. When it burned eight years later it was replaced by the present Science Hall with laboratories and machine shops at a cost of $400,000. In 1887 the engineering shops (now electrical engineering lab), a chemistry building (now chemical engineering lab), and the old heating station (now radio hall) were constructed, and these together with rooms in Science Hall composed the Engineering College.

The College of Engineering was reorganized in 1889 and separated from the College of Agriculture. By 1892 173 students were enrolled, and in 1900 the old engineering building was built. The chemical engineers took over the old chemistry building and shared it with the Medical School. When the present heating station was erected in 1908, the miners appropriated the old building for a laboratory.

After the World War it was planned to have an engineering campus on Camp Randall from Dayton Street to University Avenue and from Randall Avenue to Breese Terrace. A nine-building campus consisting of Main Engineering Building, Mechanical, Mining, Chemical, Electrical, Civil, Hydraulics, and Transportation Buildings, and a materials testing lab, was planned. However, this plan has been abandoned in favor of a few large buildings covering a smaller ground area.

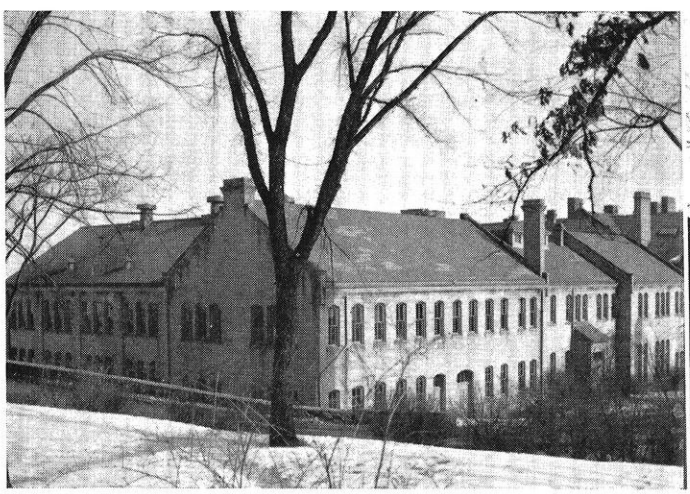
The Mechanical Engineering Building was built in 1930 at a cost of $527,000. The miners moved into the old Forest Products Lab in 1932, leaving the older heating station to Radio Station WHA. The School of Education has taken up much of the space in the old engineering building, so it has been renamed Education and Engineering.

Although the Mechanical Engineering Building was constructed for the mechanical engineers, it has become the main engineering building, and every engineer has at least one class in it. It has served to relieve some of the congestion due to lack of classroom facilities, but it also houses the steam and gas lab, the foundry, the library, the machine shops, and several minor labs.

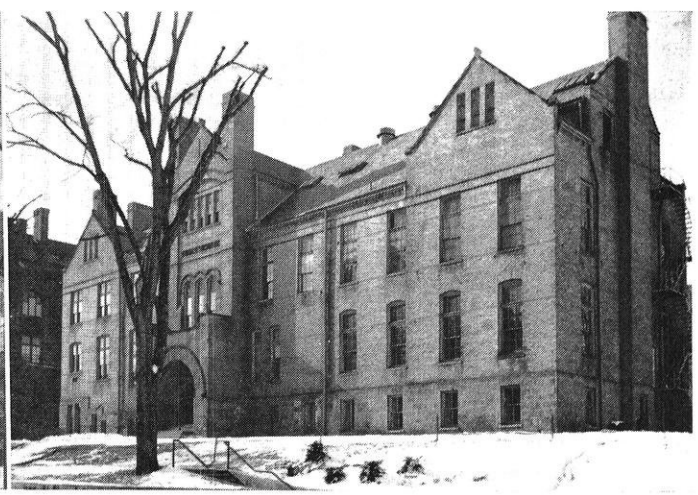
Three of the largest and most important departments of the College of Engineering, the electrical, the chemical, and the mechanical, whose work is essentially concerned with large laboratory requirements, are anchored to present inadequate quarters at a great distance from our geneneral engineering facilities. New building space for ALL THREE is necessary if we are to care for not only our intrinsic needs, but also our present grievous handicaps in scheduling classes and laboratories because of the long distances traveled at intermissions.

The present Chemical Engineering Building with its 27,000 square feet is inadequate and not well suited for this type of work. The enormous importance of chemical engineering not only in existing industries, but in finding

(concluded on page 28)



The Ancient Electrical Engineering Laboratory



The Aged Chemical Engineering Building

# The Electron Microscope

## *A recent development of interest to everyone*

*by Howard R. Hegbar*

*Research Assistant in Electrical Engineering . . . Past Editor, North Dakota State Engineer*

THE HUMAN eye, aided by the microscope, is enabled to investigate, compare, and measure physical detail of small dimensions. The biologist, the metallurgist, and the bacteriologist have depended on the measurements and information made possible by the use of the optical lens. One of the greatest single contributions to the field of microscopy is the physicist's brain child, the electron microscope. Electrons, accelerated by potentials of from 30 to 100 kilovolts, speed down a highly evacuated chamber and are focused, deflected, and projected on a photographic plate in a manner very similar to that in which light waves are used in an ordinary microscope.

The first light microscope is credited to Galileo and had a magnification of three diameters, which was no mean achievement at the beginning of the 17th century. Leeuwenhoek followed this discovery by his development of the compound microscope in the latter part of the same century. Before considering the features of the electron microscope we will examine the performance and limitations of the light microscope. By the "limit of resolution" of a microscope we mean the smallest distance between two lines that will allow the two lines to be shown as separate and distinct when magnified by the microscope. The theoretical limit of resolution has been shown to be roughly one-half the wave length of the light wave employed. The range of visible light wave lengths being approximately 3900 to 4600 Angstroms, the light microscope cannot then satisfactorily magnify objects smaller than 2000 Angstroms in length, about 1/120,000 inches. In an attempt to extend the range of the light microscope, ultra violet light has been used, giving a limit of resolution not less than about 1000 Angstroms. Going farther into the ultra violet range to obtain shorter wave lengths and consequently a higher resolution, we are limited by the higher absorption of the shorter waves in the glass lens. X rays had been considered for use in microscope because of their short wave length but no means were available whereby they could be focused and projected as are light waves in the light microscope.

The physicists and engineers of England, France, Germany, Canada, and the United States have contributed to the development of the electron microscope. In 1924 the French physicist Louis de Broglie stated that the behavior of a stream of high speed electrons was such that the electrons possessed wave-like characteristics similar to hard X rays. The wave length was mathematically predicted as being inversely proportional to the velocity of the electron, the higher speed electron having the shorter wave length. In 1926 Heinrich Busch showed that electrostatic and electromagnetic fields could be formed which would focus the electrons as the glass lens does the light beam. This was indeed an important discovery, for here was a means of constructing a "lens" that could be used in a vacuum and present no absorption difficulty such as a glass lens does for ultra violet light. Eager to try this new arrangement as a microscope, Knoll and Ruska undertook the construction of the first electron microscope in Germany in 1931. Study by Dr. Ing. von Borries, Bruche and Johannson proceeded in Germany until 1937, when another electron microscope was built by Prof. L. C. Martin of the Imperial College in London. At about this time Dr. V. K. Zworykin, director of electronic research at the R.C.A. laboratories, started work on the problem, applying the theories of electron optics developed in connection with television studies. Designed by Dr. L. Marton and built under the direction of Dr. V. K. Zworykin, a practical electron microscope, which does not require an electronics expert as an operator, has been built by R.C.A.

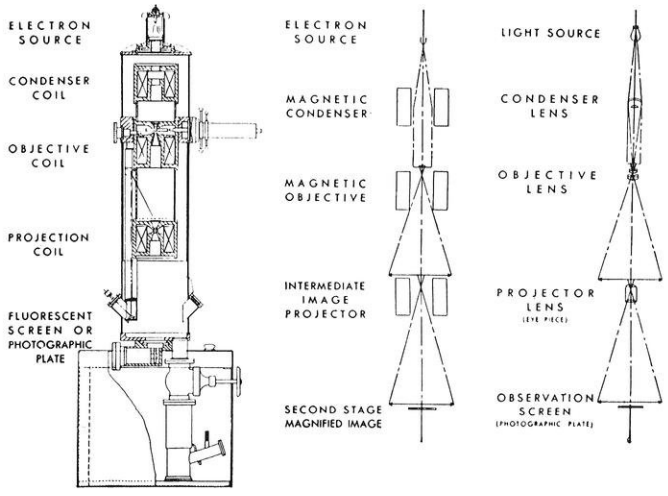


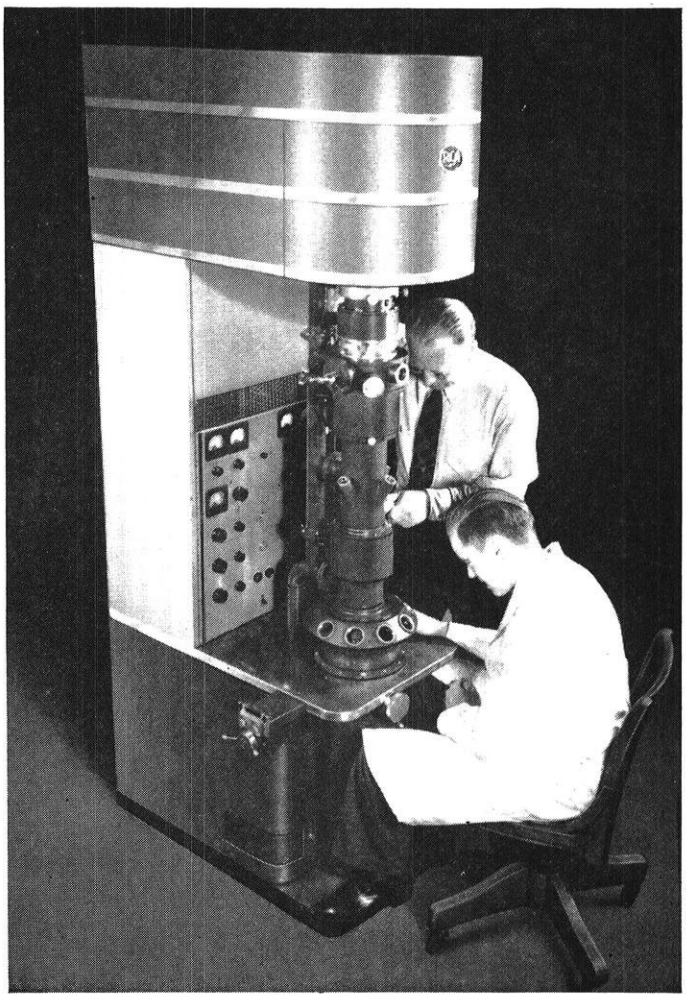

**Diagram of Electron Microscope**

In operation the electron microscope is much like the ordinary light microscope. If we examine the schematic diagrams of the electron microscope and the light microscope we find that each part of the light microscope has its counterpart in the electronic instrument. In the light microscope the light is emitted by the source, then passed through the condenser lens, the objective lens, the projective lens, and to the screen. The electrons in the electron microscope are emitted from the electron gun, passed through the condenser coil, the objective coil, the projec-

tion coil and on to the screen or photographic plate. The electron source is a hot tungsten filament maintained at a high negative potential with respect to the anode which is directly below it and is grounded. The electron beam receives its total initial acceleration in its travel from the hot cathode to the anode and proceeds through a small hole in the anode to the condensing coil below. This electron beam is concentrated on the object by the magnetic condenser lens. Some of the electrons of the beam are scattered as they pass through the object, the amount of scattering being dependent on the thickness of the various parts of the specimen. It is by this scattering effect that the image is produced, the method differing from that of the light microscope in which the variation in absorption of light is used in producing the image. The electrons passing through the object and an aperture in the magnetic objective lens are focused by the latter into an image of the object magnified approximately 100 times and located just above the magnetic projector lens. Selecting a portion of this intermediate image, the projector lens enlarges it about 250 times, yielding a final image projected on a fluorescent screen or photographic plate with a total magnification of about 25,000. This image may be photographically enlarged up to more than 100,000 diameters total magnification. The three lenses are axially symmetric magnetic fields set up in the evacuated chamber by coils of wire enclosed in a soft iron shield so shaped as to concentrate the magnetic field on a short section of the microscope axis.

Several difficult problems are encountered in the design and construction of an electron microscope. Because variations in the speeds of the individual electrons cause the equivalent of chromatic aberration in ordinary optical systems, the accelerating voltage must be kept nearly constant. The voltage is usually kept within 0.01 per cent of a constant value, the newest R.C.A. microscope having regulating equipment that is credited with maintaining a voltage constant within 0.002 per cent. A lack of symmetry in the electrostatic or magnetic field about the axis of the tube will cause a distortion comparable to spherical aberration. Variation in the magnetizing current must be kept to very small values, about the same order as the variations in accelerating potential. Since electrons are scattered by any particles in the beam path the gas pressure must be low. A pressure of $10^{-5}$ millimeters of mercury or less is maintained in the microscope by vacuum pumps mounted in the base. Complete electrostatic and electromagnetic shielding is necessary to eliminate unwanted electron beam deflections due to external disturbances.

The object chamber is provided with an air lock so that air is admitted to only a small chamber when a new specimen is inserted. The specimen mounting is connected to a set of screws and gears by which the operator may move it relative to the electron beam. In being withdrawn from the evacuated chamber the specimen is moved to the air lock by means of the gears and then a gate between the air lock and the main chamber is closed. After air is admitted to the lock it is opened and the specimen is removed. In this manner the only chamber that must be evacuated each time the specimen is changed is the small air lock.



*—Photo courtesy R.C.A.*

**Seated at the microscope is James Hillier, who designed this instrument under the supervision of Dr. V. K. Zworykin (standing), director of the R.C.A. Electronic Research Laboratories.**

Because glass is opaque to an electron beam the conventional glass slide mounting of specimens cannot be used. The development of a suitable method of mounting was first undertaken by Dr. L. Marton at the University of Brussels. In the present method the specimens are deposited on nitro-cellulose foils less than $10^{-6}$ centimeters thick, which are in turn supported on a wire mesh.

In the base of the microscope is contained the photographic plate and the fluorescent viewing screen, either one being available to the operator. The photographic plate is arranged in an air lock similar to the specimen chamber and several photographs may be made before the film is removed. If desired, the final image can be observed on the fluorescent screen through vacuum tight windows in the side of the microscope.

The satisfactory magnification obtained with the present electron microscopes is large but the designers believe further improvements are possible. Dr. Zworykin states that a resolution capability of at least 20 times better than the

(continued on page 26)

# Madison Industries in Defense

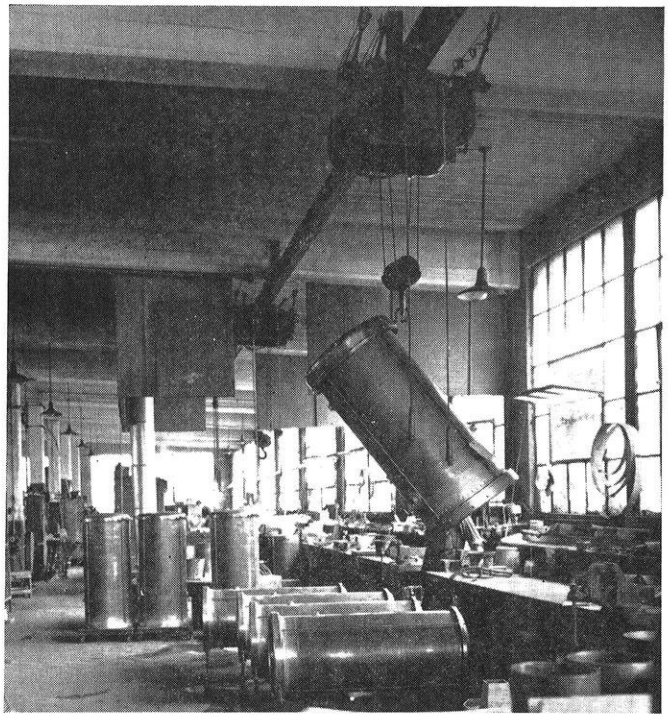
## *Local Concerns Take Part in the Program*

*by Bob Short, min'42*

ALL OVER the United States, large plants covering several acres of ground and small plants employing but a few men are straining under the demands of national defense. Madison industries, too, are doing their part in the preparedness drive. The activity is much more widespread than during the World War I days.

In the years 1917 and 1918 there were only a few large plants equipped to participate in the wartime work. The effect of the 40-hour week has led to an increase in employment. Some of the skilled workmen, due to the shortage of skilled labor, are permitted to work overtime but the long working days of the last war period are not prevalent.

The largest of the Madison industries working on defense orders is the Gisholt Company. Mechanization of the army has created a large demand for machine tools, such as balancing machines and lathes manufactured at the Gisholt plant. The lathes manufactured by the company are of many varieties ranging from small machine shop lathes to the very large machines in which large artillery guns are turned. Although army orders for Gisholt turret lathes have been large, they make up only a small portion of these machines which will be used in defense work. The largest percentage comes from companies holding defense orders. Also, large orders have been sent to Europe.



*—Photo courtesy Scanlan-Morris*

**These sterilizers, shown under construction at the Scanlan-Morris Company, are part of an order for the Red Cross.**

At least for the present, Gisholt is not making guns as it did during World War I. The plant is, however, on a 24-hour basis and employment has been practically doubled. Workers at the plant are identified by means of badges and identification of all visitors is necessary. No photographers are permitted in the building.

The Madison-Kipp Corporation has taken over the old Four Lakes Ordinance plant, where 5 inch naval guns were manufactured during the last war. This company has been on defense work for two years in ever increasing amounts. Here again no guns are being manufactured at present. The defense work being done by the company consists in the manufacture of fuse parts, shell parts, and howitzer parts. Much of this work is done with special equipment and by special processes developed by the Kipp Corporation. Details of these processes are carefully guarded secrets. The lubrication department is busy working on details for use in the machine tool industry.

Hospital equipment also plays an important part in the picture of national defense. The Scanlan-Morris Company has provided dressing sterilizers, water sterilizers, instrument and utensil sterilizers, and operating and fracture tables for the army, navy, the Canadian government, and the Canadian and American Red Cross. The company makes about twenty different kinds of general operating and fracture tables. With the fracture table it is possible to x-ray the patient, set the bone, and apply the cast without moving the patient. Fifty of these tables have been ordered by the American Red Cross for foreign shipment. Sterilizing equipment for use in army camps and on board naval vessels is being manufactured. Overtime work is necessary to complete such orders. Similar equipment has been sold to the Canadian and American Red Cross for use in a hospital near London.

Another Madison industry doing defense work is the Wisconsin Foundry and Machine Company. Most of the work done here is in the nature of sub-contracts for parts to be used by larger industries. One of the orders is for parts to be used by the Highway Trailer Company in Edgerton. Parts being finished for this company will go to make up digging equipment for the removal of bombs. These machines, which will go to England, are the same as those used in this country to dig post holes for telephone and electric lines. The army signal corps also uses such equipment.

Machine work is being done on steel castings for the Beardsley-Piper Company in Chicago to go into sand conditioners. These sand conditioners will go to foundries

all over the country to help speed up the defense program.

At the Wisconsin Foundry and Machine Company large crushing plants are also turned out. These are of the Blake jaw crusher and the roll types. Such crushers are to be used to crush stone for company streets in army camps, and in road improvement wherever troop movements may be necessary. All roller bearings are used in these crushers, and all moving metal on metal parts are machined to get an even distribution of stresses during the crushing action.

Bench legs for the lathes produced at the Gisholt plant are also made here along with table bases for the Scanlan-Morris operating tables. Other companies for which work is being done are the Jacobson Manufacturing Company, Racine, Madison-Kipp, Productive Equipment Corporation, Chicago, and many others. This plant also furnishes all the mechanical supplies for the canning industry in this territory. The greatly increased activity has caused a 20-25 per cent increase in employment.

Gray iron is the only material used in the castings produced at the plant but machine work is done on all types of castings. Machine molding is used where it is possible. An air vibrator keeps the sand from sticking to these molds.

Perhaps the busiest industry for its size is the Madison Brass Works. Practically all of the work here is on subcontracts. Copper and brass parts that make up the Scanlan-Morris sterilizers, and operating tables are cast here, also the nickel-silver castings required to resist the corrosive action of salt water used in sterilizers on naval vessels. Gears, mainplates, and gear housings for lathes produced at the Gisholt Company are made here. Besides these, there are bronze bearings for the gun carriages being manufactured by the Highway Trailer Company, and oil burner parts which will be used in burners to heat army barracks.

The working capacity of the plant has been increased about 50 per cent. The big problem is to get the equipment necessary and still keep up production until it is installed. An additional problem is the scarcity of aluminum.

Another busy little industry is the Howard Welding and Machine Company. They have no direct defense work but are doing sub-contract work on hospital tables, mounting assemblies, and sterilizer leg frames. This equipment is to be delivered to the navy. Much machine work is being done on lathe parts, motor shafts, and dual trailer parts for army transport. Tool, die, and jig work is also being done for an Oshkosh firm making depth charges for the navy. This company is doing all the welding engineering work for the government power station being erected at Genoa, Wis.

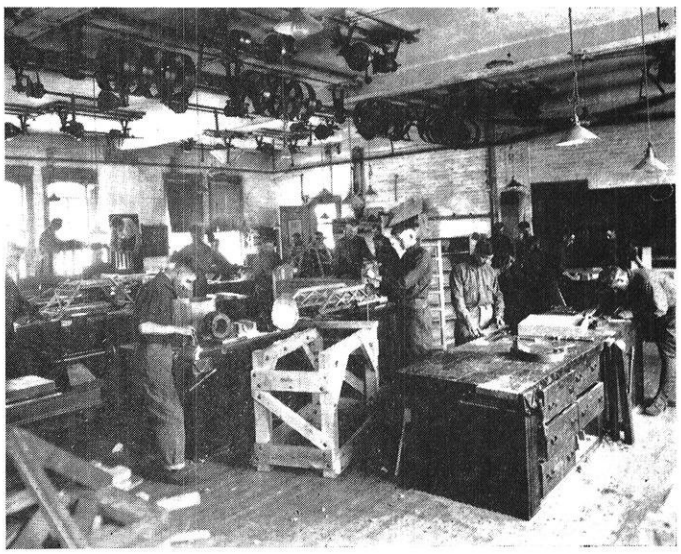
Additional planers, grinders, and lathes are now being installed. They have submitted bids for direct defense work. The acceptance of these bids would necessitate moving to a large building.

The orders of the Wisconsin Oil Burner Company have been increased considerably because of the national defense program. Oil burners produced by this company are being used to heat theater tents and barracks in many of the army corps. Also, they are being used to heat water on many of the new naval vessels being built, and some burners are to be used in the kitchens.

In some army camps entire heating units are placed on skids so that they may be moved from place to place depending on the needs of the camps. In this way one heating unit can be used to heat more than one tent or building.

The Wisconsin Oil Burner company does not make the whole heating unit but only the burner part. The remainder of the unit is manufactured by the L. J. Miller Company of Milwaukee. Due to the shortage of scrap caused by the large amount of material being sent overseas, it is becoming more difficult to obtain aluminum used to cast the housings. Therefore, in the near future cast iron will replace the aluminum castings now being used. Cast iron is cheaper for one thing and is always easily obtainable.

Before the national defense program started, the company never had more than 200 electric motors in stock and more could be easily obtained within 15 to 30 days after placing the order. Now, Mr. Westmont, the president of the company, finds it necessary to keep 1,000 motors in stock. Reorders on these motors must be made four months in advance of the time of delivery. This company is the originator of the spinning flame. This spinning flame is brought about by causing air for the combustion chamber to rotate as it leaves the blast tube, thus giving the flame its appearance of spinning. Complete combustion is accomplished by the spinning flame and more of the heated air is allowed to escape. As high as 15 per cent carbon dioxide has been obtained in the flue gases of a unit employing the spinning flame principle.



**During World War I the University's machine shops were used by the United States Army in giving practical training to recruits, here working in the pattern shop.**

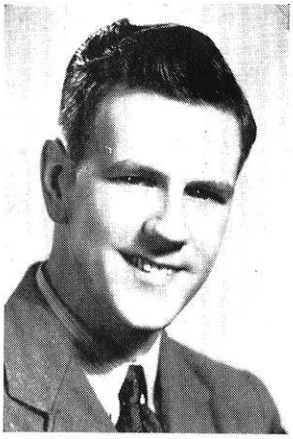
C. A. Hooper and Company, heating engineers, are installing a central heating station at the army headquarters at Jeffersonville, Indiana. This camp is to be used as a Quartermaster's Department materials depot.

# Guiding the Expo . . .

OVER fourteen hundred students in the College of Engineering are represented by the societies of their respective departments. These societies are national organizations of practicing engineers which maintain student branches on the campuses of the engineering colleges. For the chemical engineers there is the American Institute of Chemical Engineers; for the electricals, the American Institute of Electrical Engineers; for the civils, the American Society of Civil Engineers; for the miners, the American Society of Miners and Metallurgists; and for the mechanicals, the American Society of Mechanical Engineers and the Society of Automotive Engineers. Representatives from these organizations are elected to the Polygon Board which is then the governing body for certain student activities of the college.

The Polygon Board plans the three-day exposition presented by the Wisconsin engineering students, together with the St. Pat's dance for engineers on Friday night. This year's Polygon Board delegated the duties of organization to a general chairman and secretary, six assistant general chairmen, and nine special chairmen.

General chairman is Ray Erickson, president of the Polygon Board. Ray is a senior chemical engineer from Whitehall, Wisconsin. Last year Ray worked as secretary for the first engineering exposition. For his outstanding scholastic work he has been elected to Tau Beta Pi, Phi Lambda Upsilon, and Phi Kappa Phi, honorary fraternities. This year he has been working on an apprenticeship awarded by the Wisconsin Alumni Research Foundation. His proficiency also extends into the physical field, for he has been a member of the Hoofers ski jumping team for three years.



Ray Erickson

Art Burns and Bill Zunke, both seniors in mechanical engineering, are co-chairmen in charge of exhibits. Assisting them are Henry Schmalz, in charge of student exhibits, and Harold Peterson, in charge of industrial exhibits. This work consisted of contacting students and industrial concerns to secure exhibits, and locating these in the most satisfactory manner for both exhibitors and the public.

Art Burns, from Kansas City, Missouri, graduated from the University of Missouri in 1937 with a B.S. degree in education. After entering the University of Wisconsin as an engineering student he proved his ability again by attaining election to both Pi Tau Sigma and Tau Beta Pi honorary fraternities. Just recently he has taken up the duties of instructor in mechanical engineering.

Bill Zunke was the mechanicals' candidate for St. Pat. After graduating from Washington Park High School in Racine, he worked four years for the Modine Manufacturing Company. For the past year he has been assistant engineer at the university pumping station. Bill is secretary of the student branch of the American Society of Mechanical Engineers.

Harold Peterson, a senior from Madison, and Henry Schmalz, a junior from Wauwatosa, are both chemical engineers. Harold is vice president of the student branch of the American Institute of Chemical Engineers, and a member of the all-engineering honorary fraternity, Tau Beta Pi. Last year he was on the committee for industrial exhibits. Henry is a member of the American Institute of Chemical Engineers and this semester has been elected to the Polygon Board. Careful records of this year's work are being made to assist those who build engineering expositions in future years.

George Schaack, a senior from Rib Lake, Wisconsin, is assistant chairman in charge of organization. This department takes care of housing and construction. George is vice president of the American Society of Mechanical Engineers. Last year he worked with the committee in charge of concessions.

To assist George are Joe Kelar to handle construction, and Dan Klaus to take care of

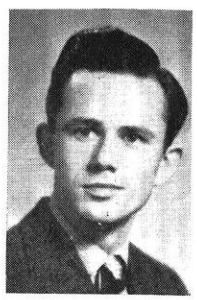
Schaack

Klaus

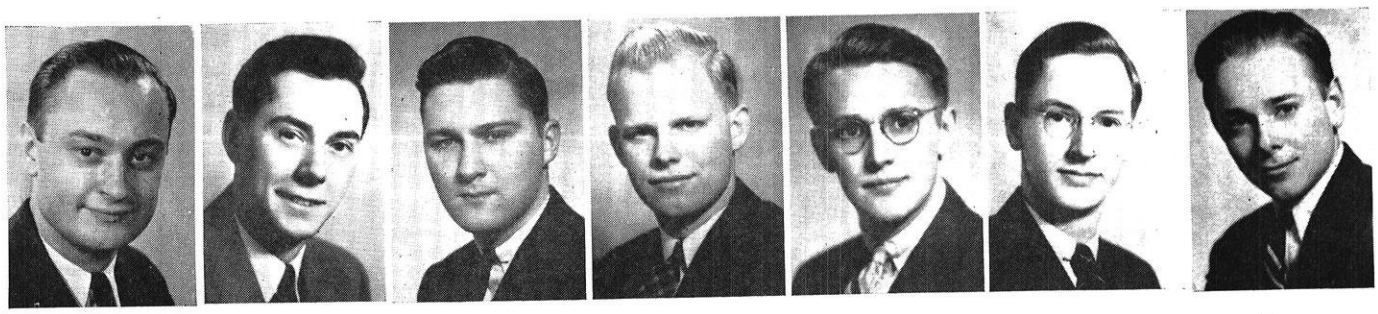
Kelar

Burns

Peterson



Schmalz



Zunke Fluck Bennett Hauver Lamb Hussa Giese

housing. Joe is a sophomore from West Allis. Before coming to school he was employed by the Cutler-Hammer Company. Besides attending school he now works for the electrical department of the university as a sub-station operator. Dan Klaus, a senior from Milwaukee, has earned part of his way in school as an instructor in mechanical engineering, coming here with experience obtained in industrial machine shops. He is a member of the Society of Automotive Engineers and Pi Mu Epsilon, honorary mathematics fraternity. Residing in the men's dorms, he was president of Tarrant House last semester and is now social chairman.

The treasurer of Polygon and the assistant chairman in charge of finance for the exposition is a senior mechanical engineer from Wauwatosa, Dan Lamb. Dan is chairman of the Society of Automotive Engineers, a member of the American Society of Mechanical Engineers, and Pi Mu Epsilon. Last year he was in charge of the exhibits shown by S.A.E. at the exposition.

Owen Hussa is in charge of ticket sales. The pre-door sale was conducted by the engineering societies in competition for the election of St. Pat. Owen is a senior chemical engineer from Bangor, Wisconsin. He is secretary and treasurer of the student branch of the American Institute of Chemical Engineers, a member of the Society of American Military Engineers, Tau Beta Pi, and Phi Lambda Upsilon, honorary chemistry fraternity.

To acquaint the public with the exposition, the department of public relations was created with Walt Giese, a senior metallurgist from Milwaukee, at its head. Walt belongs to the Mining Club, the American Society of Metallurgists, Pi Mu Epsilon, and Sigma Nu. He plays in the university band and has been on the Polygon Board for a year.

Nelson Hauver, program chairman, is a senior electrical engineer from Madison. He is a member of the American Institute of Electrical Engineers and Kappa Eta Kappa, professional electrical engineering fraternity. He has been active in the program of the Presbyterian student center. Duties of the program committee include arranging for tours, guides, demonstrations and all other special events. Lee Day assisted with this work until he graduated in February.

The publicity has been handled by Ben Bennett, a senior in electrical engineering. This included coverage of publications, and posters for both exposition and dance. Ben represents the American Institute of Electrical Engineers on the Polygon Board. He is a member of Eta Kappa Nu, Alpha Tau Sigma, Pi Mu Epsilon, Kappa Eta Kappa, and Chi Phi. During the past year he was editor of the Wisconsin Engineer. His home is in Gary, Indiana.

Acting as secretary for the exposition organization is Paul Fluck, senior civil from Algoma, Wisconsin. Scholastically, Paul is one of the top-ranking men in the engineering school. He has not only attained membership in Tau Beta Pi, but is president of the local chapter as well. This year he has been awarded a scholarship by the Wisconsin Alumni Research Foundation. He is a member of Chi Epsilon, civil engineering honorary fraternity, American Society of Civil Engineers, and Polygon Board.

Tony Choren and Bob Bennewitz, February graduates in mechanical engineering, comprised a planning committee. This committee functioned earlier in the year in determining somewhat the policies of this year's exposition.

The success of the exposition is due not only to the work of these chairmen, but also to the work of about two hundred committee members and exhibitors.

## *1941 Expo Committees*

### INDUSTRIAL EXHIBITS

Harold Peterson (Chairman)

| | |
|---|---|
| James Coffin | Lawrence Millonig |
| George Runstrom | Joseph Ranftl |
| Gordon Wibbert | George Antlfinger |
| Tom Olson | Charles Gould |
| Warren Beyer | Robert Tubesing |
| James Rogers | John Pritchard |
| Bernard Singer | Edward Vetter |

### STUDENT EXHIBITS

| | |
|---|---|
| Henry Schmalz (Chairman) | Chemical |
| Leroy Kelling | Electrical |
| Bob Kuenning | Electrical |
| Newell Dunn | Chemical |
| Fred Thoke | Mining |
| Everett Barlow | Mechanical |
| John Riley | Civil |

### CONSTRUCTION COMMITTEE

Joe Kelar (Chairman)

| | |
|---|---|
| Edwin Meier | Harold Grittner |
| Carl Rowe | Peter Valentyne |
| Richard Burton | Frank Durzo |

### HOUSING COMMITTEE

Dan Klaus (Chairman)

| | |
|---|---|
| John Wilson | James Allman |
| Frank Roberts | Newell Smith |

### TICKET SALES COMMITTEE

Owen Hussa (Chairman)

| | |
|---|---|
| Foster Larson | Fred Bartman |
| Glenn Finner | Donald Jelinek |

Richard Juergens

### PROGRAM COMMITTEE

Nelson Hauver (Chairman)

| | |
|---|---|
| Clarence Fralick | Jim Wilson |
| Edwin Katz | Carl Hessler |
| Clyde Kaiser | Bill Bloch |
| Carl Bloom | George Williams |
| Ed Brown | Robert Wicen |

Hjalmer Rindall

### PUBLICITY COMMITTEE

Ben Bennett (Chairman)

| | |
|---|---|
| Nathan Itzkowitz | Dean Bennett |
| Arnold Barganz | Don Ely |
| Phil Desch | Gale Froemming |
| Hugh Faville | Doug Bainbridge |

# Program of Events

## EXHIBITION HOURS

THURSDAY, MARCH 27.....7:00-10:00 P. M.
FRIDAY, MARCH 28.....2:00-10:00 P. M.
SATURDAY, MARCH 29.....9:00 A. M.-10:00 P. M.

## OPENING PROGRAM

THURSDAY .....7:00 P. M.
*Selection by Radio Hall Firemen Band*
*Remarks by General Chairman Ray Erickson*
*Crowning of St. Pat by Dean F. Ellis Johnson*
*Opening Address by Governor Julius P. Heil*

## RADIO BROADCASTS

WIBA.....THURSDAY, 4:30-5:00 P. M.
*Comments of beard contest judges*
*Introduction of Expo chairmen and remarks by general chairman*
*Description of work in progress on exhibits*
WIBA.....FRIDAY, 3:00-5:15 P. M.
*Roving interviews*
WHA.....FRIDAY, 1:00-1:30 P. M. and SATURDAY, 11:15-11:45 A. M.
*Interviews and descriptions of exhibits*

## TOURS AND DEMONSTRATIONS

*The foundry will pour Thursday evening, Friday afternoon and Saturday evening. Core and mold making will also be demonstrated.*

*In the machine shop laboratory machines such as the turret lathe and automatic screw cutter will be in operation.*

*Heat-power laboratory students will conduct tests on the engines and explain their operation.*

*Arrangements have been made with the physics and chemistry departments to inspect the high-voltage atom-smashing laboratory in Sterling Hall, and the ultra-centrifuge in the Chemistry Building on Saturday.*

---

### LOBBY

1. Revolving Magnetic Field, Surge Generator, Original Edison Light Plant
2. Frying Eggs on Ice, Jacob's Ladder, Electro-Magnetic Levitation, X-Rays, Diathermy
3. Twin Disc Clutch Co.
4. General Electric Co.
5. Chain Belt Co.
6. Kissometer
7. Polaroid Corp.
8. SKF Bearing Co.
9. Keuffel and Esser Co.
10. The Bent of Tau Beta Pi
11. The Slide Rule
12. Ford Motor Co.

### WELDING LABORATORY

13. Carborundum Corp.
14. Westinghouse
16. Waukesha Motors
17. Northwest Airlines
18. Cutler-Hammer
19. Midwest Iron Fireman Co.
20. Monsanto Chemical Co.
21. Eastman Kodak Co.
22. Texas Gulf Sulphur Co.
23. Cleveland Steel Products Corp.
24. Aluminum Company of America
25. Norris Industries
26. Heil Co.
27. Corning Glass Co.
28. Falk Corp.
29. Bucking Broncho Motor
30. Research Products Corp.
31. Chrysler Corp.
94. Voice Mirror
32. Barber-Colman Co.
33. Refreshment Stand
34. Wheelco Instrument Co.
35. Four-Wheel Drive Auto Co.
36. E. I. Du Pont de Nemours Corp.
37. Minneapolis-Honeywell Corp.

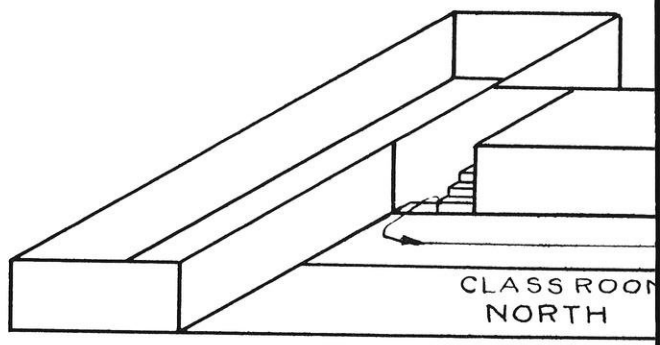
### HEATING LABORATORY

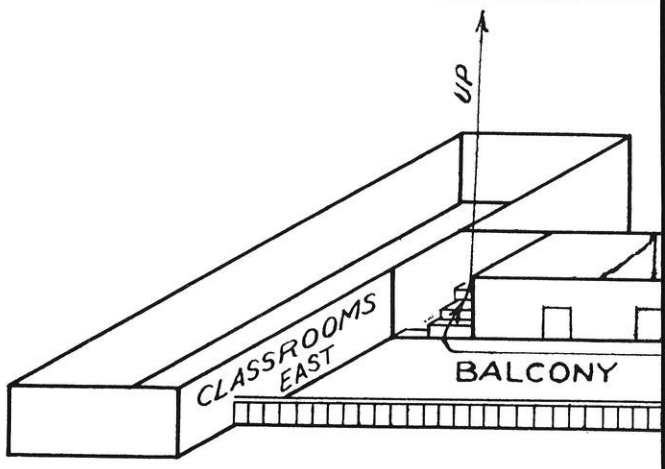
38. Chemical Engineer in the Home
39. Electro-Plating
40. Chemical Magic
41. Temperature Control
42. Products and Equipment
43. Metallography
44. Cottrell Precipitator
45. West Virginia Pulp & Paper Co.

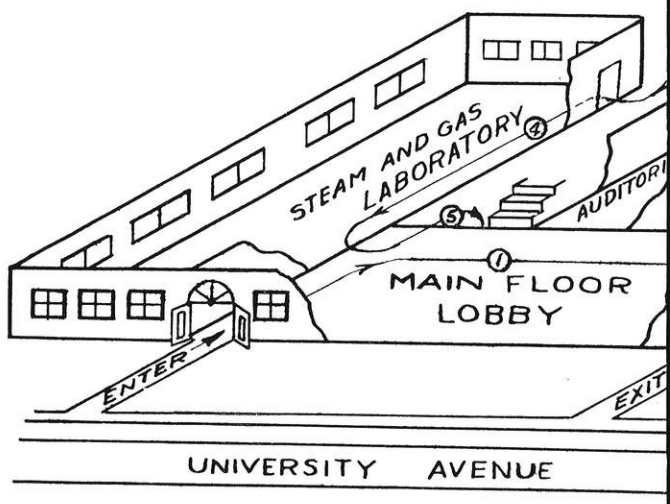
### STEAM AND GAS LAB

46. Model Dams and Drainage Structures
47. Highway Exhibit
48. Activated Sludge Suspensions
49. Hydraulic Specimens
50. Water Supply
51. Pulsometer
52. Ericsson Hot Air Engine
53. Light Wave Yardstick
54. Smoke Meter
55. Activities of S.A.E.
56. Surveying
57. Nelson and Foster Insulation
58. International Nickel Co.
59. Wisconsin Electric Power
60. Allis-Chalmers
61. Corliss Engine
62. Kimberly Clark Paper Mills

# Location

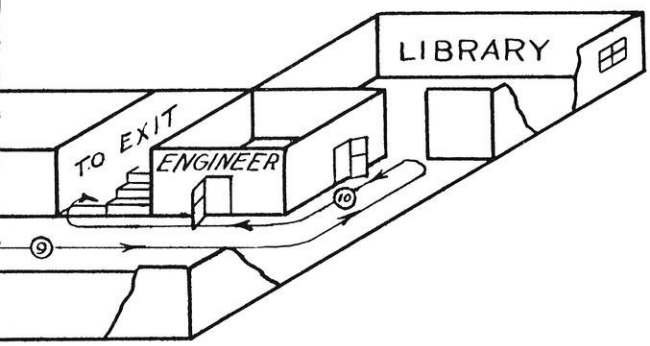


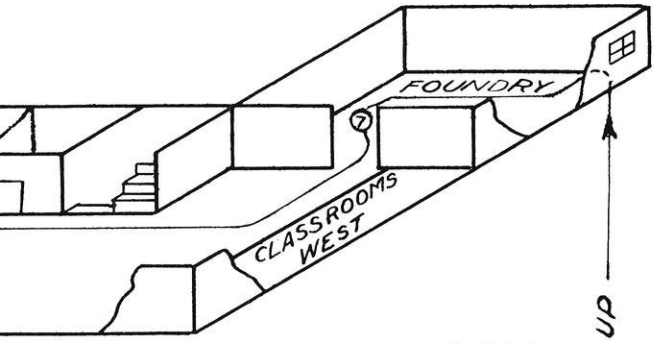




**For greatest convenience in viewing the Exposition exhibits, a tour route has been devised. The pictorial views of the Mechanical Engineering Building above show the route as arrowheads, indicating the three floor plans, the connecting stairways, and the departments into which the building has been divided. There are also several exhibits in the Mining Building, located next to the Mechanical Engineering Building.**

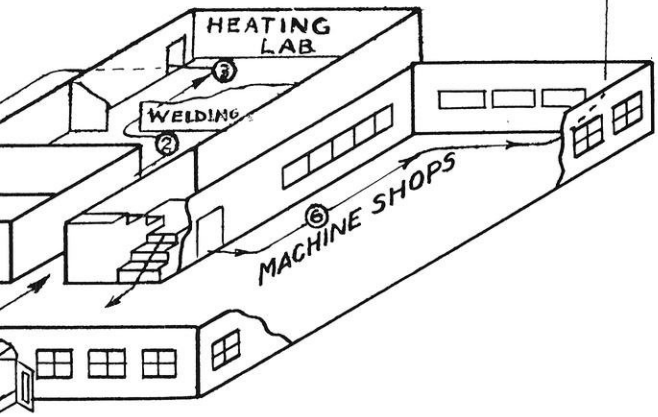
# Exhibits




THIRD FLOOR




SECOND FLOOR




**When the tour of all the exhibits has been completed, visitors may return to the lobby to re-inspect some of the exhibits, attend special movies or lectures in the auditorium, or join one of the special laboratory tours (listed in the PROGRAM OF EVENTS on these pages). For information as to the location of exhibits and other matters pertaining to the Exposition, an information booth will be maintained in the lobby of the building.**

# ★ Program of Events ★

## MOVIES

Several hours of free movies, both in color and black and white, will be shown in the auditorium of the Mechanical Engineering Building. Some of the movies to be shown are listed below. For times see posted schedule.

1. JUST AROUND THE CORNER—General Electric. *The advantages and convenience of an all-electric kitchen, stressing simplicity and economy of operation.*
2. HIGHLIGHTS AND SHADOWS—Eastman Kodak Company.
3. A NEW WORLD THROUGH CHEMISTRY — DuPont. *Recent marvels in chemistry, such as the development of nylon, neoprene, lucite, and synthetic dye-stuffs.*
4. STEEL . . . MAN'S SERVANT—United States Steel Corporation. *A technicolor film, taken in U. S. S. plants, showing the manufacture and use of steel.*
5. FREE MEN BUILD A NATION—National Association of Commerce. *The growth of a nation, showing the increase of taxes and their effect upon living.*
6. THE MAGIC OF MODERN PLASTICS—Modern Plastics Magazine. *A technicolor film on the manufacture and use of plastics.*
7. SYMPHONY IN F—Ford Motor Company.

## SPECIAL DAYS

FRIDAY—National Defense Day—Special R.O.T.C. Activities.

SATURDAY—High School Day—High school students from all over the state have been invited to attend the exposition.

## IN HONOR OF. ST. PAT

ST. PAT'S BALL—Friday evening, 9 o'clock in Great Hall of the Union. Music by Steve Swedish.

JUDGING OF BEARD CONTEST—Expert judges are Jane Eriksen, Barbara Morey, and Jean Grinde. Judging will take place Saturday evening at the exposition.

---

63. Panama Canal Model
64. Evinrude Motors
65. Model Corliss Engine
66. Walking Beam Engine
67. Atmospheric Turbine Engine
68. Refrigerating Engine

### BASEMENT

69. Liquid Light Beam
70. Structural Testing Lab
71. Society of Military Engineers
72. Signal Corps Unit
73. Stroboscopic Light
74. Refreshment Stand
75. Appliance Testing

### MACHINE SHOP

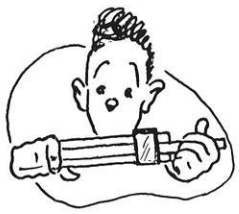
76. Liquid Air
77. Safety in the Home
78. Exposition Office
79. Winkley's Planetarium
80. Mechanical Milker
81. Machine Shop Demonstration
82. Snake Killer
83. Tacoma Bridge Failure
84. Water Forge
85. Floating on Air
86. Model Trains

### SECOND FLOOR

87. Foundry Demonstration
88. Stream-Line Flow
89. Water Tunnel, Wind Tunnel
90. Mechanism Model
91. Aircraft Models
92. Industrial Microscopy
93. Polarized Light
94. Voice Mirror
95. Musical Light Beam; Talking Arc Light
96. Poulsen Arc Generator
97. Unidirectional Counter
98. Cathode Rays
99. Robot Machine Gunner
100. Strong Woman-Weak Man
101. Magic Wire Burglar Alarm
102. Water Drop Generator
103. Power and Lighting by Radio
104. Gyro-Wrestler
105. Flow Light
106. Hearing Range
107. Radio Explained
108. Teletype
109. Black Light
110. Speech Reflector
111. Activated Sludge Determinations
112. Amateur Radio Station
113. The Wisconsin Engineer
114. University Co-op
115. Calibration Lab
116. Balcony

### MINING AND METALLURGY BUILDING

117. Limp Solids
118. Fractional Distillation, Crystallization
119. Mineral Distribution
120. Flotation
121. Fire Assaying Lab
122. Metallography
123. Electric Furnace Demonstration
124. Rock Drilling



# STUDENT EXHIBITS

## Polygon Exhibits

### AMERICAN SOCIETY OF MECHANICAL ENGINEERS

#### *Stroboscopic Light*

Rampaging machines are brought to a standstill with this exhibition of the stroboscope. In this manner the reactions of high speed are peacefully determined. (Just one hint—please don't try to touch those things that appear to be standing still—you may end up with only 9½ fingers.) *Exhibitor:* GEORGE H. VOLK.

#### *Floating on Air*

If you don't believe that four ping pong balls will hang in mid-air by themselves, rotate about in a circle, and pass through a series of hoops without anything touching them, see this. *Exhibitor:* MAURICE ZUCKERSTEIN.

#### *Light Wave Yardstick*

With this beam unit, it is possible to measure sodium light wave deflection by means of lens refraction. Newton can stick with his corpuscular theory of light, but we'll vouch for ours. *Exhibitor:* CLIFFORD REUSCHLEIN.

#### *Liquid Air*

Things are pretty cold at —340° Fahrenheit. Yes, a rubber ball gets as delicate as a clay pipe, solder makes excellent coil springs, and the liquid air itself does a bang-up job in boiling on ice. The explosive properties and the commercial applications of the substance will also be demonstrated. *Exhibitor:* HJALMAR RINDALL.

#### *Mechanism Model*

Here's your chance for an honest to goodness headache. Simply drop around and try to keep track of all these many ways of translating motion. *Exhibitor:* WALTER MEYER.

#### *Water Forge*

It is indeed a unique process that will permit a metal to be brought to forging temperatures in a tank of water. Following this comes the working of the metal, and when this is complete, the metal is quenched in the same water it originally came from. You figure it out. *Exhibitor:* MAURICE ZUCKERSTEIN.

#### *Ericsson Hot Air Engine*

In this exhibit, the operation and practicability of the Ericsson Engine are carefully brought forth. *Exhibitor:* EVERETT P. BARLOW.

#### *Liquid Light Beam*

Forever changing color, this fountain bears forth with a radiance all its own.

#### *Heat Engines*

This exhibit is an historical action display of the Walking Beam, Corliss Steam, Atmospheric Turbine, Richard's, and Refrigerating Engines. A model Corliss will be operated in conjunction with the full-sized engine.

#### *Polarized Light*

This apparatus will clearly show the use of polarized light in the latest practice of stress analysis. Some interesting patterns are in store for you.

### AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

#### *Talking Arc Light*

And now they tell us that even an arc can talk back when it gets excited. By modulating an electric arc with an audio amplifier, sound is made to develop through variations of the arc's and surrounding air temperatures. Heating characteristics result in the alternate sound waves. *Exhibitors:* BERT ZARKY, VICTOR W. RICHARDS.

#### *Teletype Machine*

By means of a standard A. T. & T. teletypewriter, you will be able to send messages from one part of the building to another by merely typing them out on the control board. Your message is transmitted to the receiving typewriter by wires where a duplicate copy is automatically formed. The copying tape, consisting of punched out letters, is yours for the asking. *Exhibitor:* JOHN PUTZ.

#### *Magic Wire Burglar Alarm*

Beware! Everytime you get near this watchdog he will begin to yelp. Of course, there is a slight difference in that this instrument makes use of a body capacitance effect and rings a bell instead of barking. Nevertheless, it is still a practical device and can be applied to guarding safes, windows, cash registers, and most anything you might desire. *Exhibitor:* E. CHRIS LITSCHER.

#### *Robot Machine Gunner*

You won't get killed, but this little man will do his darndest. The robot will automatically follow you around with a machine gun and fire everytime it gets you in its line of sight. Control is accomplished with vacuum tubes, photoelectric cells, and magnetic contactors. *Exhibitor:* CHESTER F. LUKAS.

#### *Kissometer*

To you, dear friends, a permeability analyser; more specifically, an osculatory meter. Here's your chance to prove what you always thought about that cute little girl of yours. The intensity of your kiss is measured on a metered scale so that you may discover your true potency. We wish to ask exceptional couples to "take it easy" in order that the circuit breaker's life may be extended. *Exhibitor:* GEORGE PLOETZ.

#### *Strong Women, Weak Man*

This isn't the first time the weaker sex has been miscalculated. If you "he men" think you are veritable power houses, then bring your girl friend around and she will prove that you have been only kidding yourself all these years. Who knows, maybe the women should be drafted instead of the men. At any rate, you can't cheat the "Powermeter." *Exhibitor:* FRED BARTMAN.

#### *Original Edison Light Plant*

Shades of electricity's infancy are resurrected in this equipment of yesteryear. Among meters, switches, and other antiquated control equipment shown is the only known remaining Edison Dynamo of the fifteen which were used in the original demonstration of electric incandescent lighting at Menlo Park. The old generator has an historic past, having been built early in 1880, used at Menlo Park, the Edison Lamp Works in Harrison, N. J., and later placed on display in the 1893 Chicago World's Fair. *Exhibitor:* LEROY KELLING.

#### *Poulsen Arc Generator*

This generator is of a design similar to those formerly used in old fashioned spark radio transmitters. Now it is applied to the induction heating of metals for welding. *Exhibitor:* WILLIAM TICE.

#### *Electrostatic Water Drop Generator*

Finely divided droplets of water will pass through screens and mysteriously build up alternate charges on the series. After a short period of time, the charge becomes so great that the droplets are repulsed and thrown out to the side. *Exhibitor:* ROBERT KUENNING.

#### *Unidirectional Counter*

This rather complicated mechanism is no more or less than an artificial brain. If you walk past it in one direction, it will take notice of you. However, when you go by in the other direction, it pays no heed. The whole secret lies in the use of twin light beams and photoelectric cells. *Exhibitor:* JACK PETTERMAN.

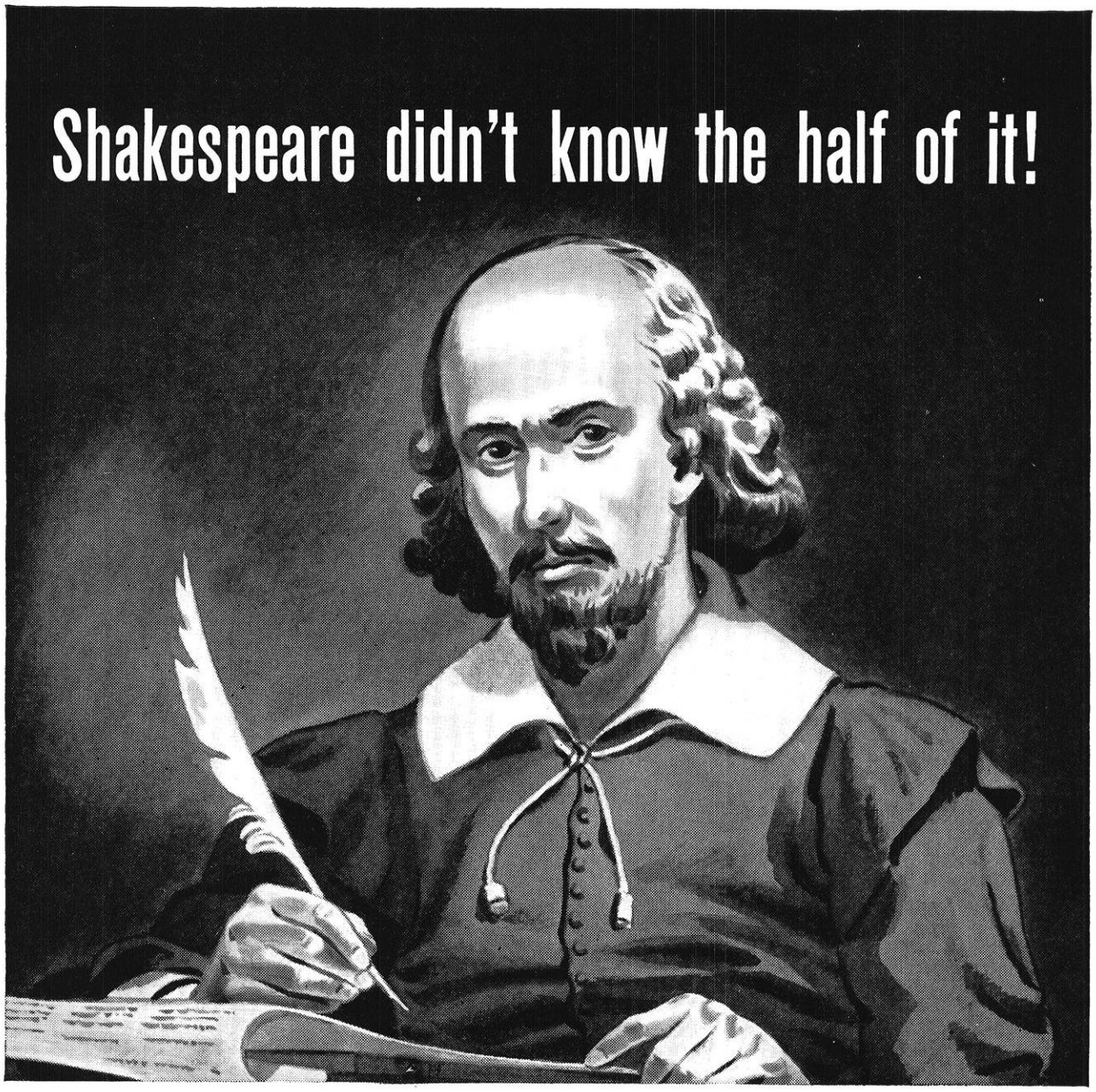
#### *Cathode Rays*

You have heard a great deal about the oscilloscope, but perhaps you still do not understand the principles that underlie it. This specially constructed cathode ray tube clearly illustrates the bending of the rays when subjected to either a magnetic or electrostatic field. *Exhibitor:* WILLIAM TICE.

#### *Flowlight*

A weird glow of light to four feet in length controlled to the n'th degree by simply turning a knob? Incredible, but there is even more. Control is established by a radio oscillator that operates on a frequency of 7,175,000 cycles. *Exhibitor:* NEIL RITZOW.

# Shakespeare didn't know the half of it!



## ...when he wrote "What's in a Name?"

The Bard of Avon was right about the rose—its name is unimportant. But if he'd had anything to do with naming telephone exchanges, he'd have learned a lot!

Names must be easy to pronounce and transmit—must not look or sound like other exchange names—must not use the same dial finger spaces.

Take MUIR and OTIS, for example. Fine!—except they *dial* alike! For the first two letters of each appear in the same finger spaces on the dial.

Often hundreds of names are listed, studied, discarded before *one* is found that meets all requirements. Such care in every phase of Bell System work helps to make your telephone service the world's finest.

**Why not telephone home often? Long Distance rates to most points are lowest any night after 7 P. M. and all day Sunday.**

AMERICAN TELEPHONE & TELEGRAPH CO. BELL SYSTEM AND ASSOCIATED COMPANIES

### *High Voltage Surge Generator*

Power sufficient to disintegrate a wire with the booming report of a cannon is produced in this apparatus. Condensers are first charged in parallel and then connected in series to produce a voltage approximately ten times that of the original. In industry, this method of developing exceptionally high voltages is frequently used in the testing of insulating materials. *Exhibitor:* ROBERT KUENNING.

### *Radio Explained*

Have you ever considered what goes on as the radio wave from the station goes through your receiver? Signals from WIBA will be picked up with a standard broadcast receiver and, on the screen of a cathode ray oscillograph, you will see the signal as it goes from one tube to the other through the receiver. *Exhibitor:* ROBERT KUENNING.

### *Gyro Wrestler*

The gyro wrestler with a new twist takes on all comers. Pit your strength against the mechanical marvel and see if you can twist him at will. *Exhibitor:* LEROY KELLING.

### *Power and Lighting by Radio*

By means of a radio transmitter and a small receiving antenna, power is sent through the air without the use of regular transmission lines. Will this be the method of lighting homes in the future? *Exhibitor:* CORWIN HANSON.

### *Hearing Range*

The frequency of the output signal of an audio oscillator is varied over the complete range of sounds. By operating this instrument, it is possible for you to determine how high and how low you can hear. *Exhibitor:* NORBERT SCHMITZ.

### *Revolving Magnetic Field*

A wire squirrel cage, a tin can, steel balls, and coins spin around apparently of their own accord in this piece of apparatus. In reality, the remarkable properties of induction motor action are brought forth in an awe-inspiring manner. *Exhibitor:* HAROLD E. MAY.

## AMERICAN SOCIETY OF CIVIL ENGINEERS

### *Water Supply*

Soap and linen savings are here related to scientific water softening methods. Various means of water treatment will be described. *Exhibitor:* CHARLES N. BELIK, JR.

### *Activated Sludge Suspensions*

This exhibit will show a method for the rapid determination of suspended solids in activated sludge by means of the centrifuge. The Gooch and ordinary filter paper methods will also be explained in detail by having exhibitors carry out the processes. A microscope will be available to show the action of the micro-organisms of the sludge particles. *Exhibitor:* ROBERT C. HOGENSEN.

### *Surveying*

For those sophisticated people, they call this subject more generally Topographical Engineering. All types of surveying instruments will be on hand, and will be presented in an atmosphere similar to that of the civils' summer camp at Devil's Lake. Students will be present to offer information concerning the use of their equipment. *Exhibitor:* ROBERT JOINER.

### *Model Dams and Drainage Structures*

These models consist of both working and pictorial exhibits. The miniature dams are working models that have been tested for their hydraulic characteristics and proven satisfactory. *Exhibitor:* JOHN RILEY.

### *Hydraulic Specimen*

Various types of pipe and pipe failures will be on display along with plaster of Paris model structures that are used in correcting soil erosion. This field of erosion is rapidly becoming a serious problem warranting more and more attention with the coming of each year. *Exhibitor:* CHARLES N. BELIK, JR.

### *Pulsometer*

'Something different in the line of pumps.' This instrument utilizes steam flowing through a jet to pump water. *Exhibitor:* CHARLES N. BELIK, JR.

### *Structural Testing Lab*

How strong is concrete? How tough is steel? At what point will a brick crush? What is light weight concrete? The civils, operating a typical testing laboratory, will be glad to explain and demonstrate the answers to these seemingly perplexing questions. *Exhibitor:* GERALD FINTAK.

### *Highway Exhibit*

If you get a kick out of watching that steam shovel you pass on the way to work, then you will appreciate these models and pictures of machines used in highway construction. *Exhibitor:* JOHN RILEY.

## AMERICAN INSTITUTE OF MINING ENGINEERS

### *Assaying*

The assayer must decide whether a rock is economical to mine or not. To do this by fire method requires the fusion of the rock. This will be demonstrated along with cupelling operations at high temperatures. Wet chemical analysis is used for a more detailed study. *Exhibitor:* ROBERT BEMM.

### *Flotation*

This installation is typical of those used in a plant for the first step in mineral recovery. The plant contains all the units to be used in future developments and is limited only in capacity. When such processes have been perfected in the pilot plant, the actual mill is erected. *Exhibitor:* WILLIAM GOODIER.

### *Rock Drilling*

A large boulder has been imported from the shores of Lake Mendota for this exhibit. Regulation drill rigs will be used to make typical shoot holes in the rock, and the blasting procedure which follows will be described by the exhibitors. It just goes to show that nothing is too tough for the engineer. *Exhibitors:* ROBERT A. SCHROEDER, ROBERT G. HENDY.

### *Metallography*

The process of bringing out the grain structure in a metal is rather complicated. Students will go through the entire processes of grinding, polishing, etching, micro-examination, and photo copying. It is amazing to see that metals perfectly polished to the naked eye are anything but smooth when "blown up" to 200 or so diameters of magnification. *Exhibitor:* MILTON A. SIEVERT.

### *Mineral Distribution*

What is your country worth? In this exhibit, the production values and location of coal, gas, metallic, and non-metallic substances in the United States will be cleverly illustrated on four maps. Charts concerning mineral production in both the United States and abroad along with our imports and exports of these materials will also accompany the above display. *Exhibitor:* JEROME E. BAIRD.

## AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

### *Chemical Magic*

The ostentatiously effervescent phrases of Professor Phineas T. Vacuum will be directed toward a scientific (?) treatise on water. Welcome, friends! *Exhibitor:* PHILIP I. JOHNSON.

### *Cotrell Precipitator*

Fortunately, we don't live in famous Pittsburgh, but there is the answer to its smoking problem. By means of a proper system of electrification, smoke can be precipitated before it leaves the chimney. In this manner, the smoke hazards of present day large cities may be practically nullified. *Exhibitor:* NEWELL C. DUNN.

### *Water Softener*

Water may be soft when it comes to walking on it, but chemical engineers can make it softer. Capable Chems will elucidate, with visual aids, on the operation of the household Zeolite water softener. *Exhibitor:* KENNETH E. SCHULTZ.

### *Industrial Microscopy*

It becomes readily apparent with this exhibit that the microscope is daily becoming more vital to industry. Textiles, furs, wood sections, and the like assume a vastly different form when projected on the screen with immense magnification. Samples of the latest developments in scientifically produced fabrics will also be on demonstration. *Exhibitor:* ARNOLD E. BARGANZ.

### *Limp Solids*

Would you believe that a starch solution in a mortar could be solid under certain conditions? It can, and this exhibit will prove it. *Exhibitor:* MICHAEL DUNFORD.

### *Temperature Control*

In the heat treatment of the steels that make up the world in which we of today live, it is necessary to have temperature control reduced to a science of its own. This automatic controller demonstrates how a piece of steel can be maintained at any desired degree of temperature in an electric furnace. *Exhibitor* KENNETH E. SCHULTZ.

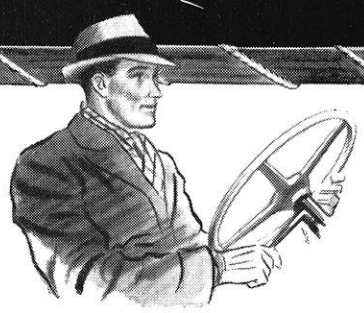
### *Electroplating*

This exhibit consists of a stationary bath and tumbling barrel in which plating operations are carried out. Small objects such as keys and coins will be plated for the public. *Exhibitor:* GRANVILLE ZIMMER.

### *The Chem Engineer in the Home*

Watch out, housewife! The chem engineer challenges you to your position in the home. Such problems as difficult spot removal, the cleaning of silverware, the cleansing of aluminum, and other similar everyday problems will be attacked by the chem student as a challenge to the old methods. It just goes to prove that engineers get a broader training than you think. *Exhibitor:* J. CHARLES GOULD.

# How Chrysler's Fluid Drive is Different!

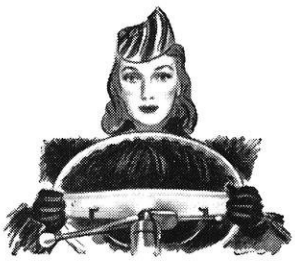


**Some drivers have to shift gears constantly!**

Nobody ever really liked to shift gears! For years motorists have preferred cars that would operate in "high" as much as possible. Yet in ordinary cars, there are dozens of occasions in starting and stopping where it is necessary to shift gears because the car cannot negotiate the situation in high. Only *Fluid Drive* as Chrysler has it, solves that problem. It lets you stay in high!

**Some drivers have their gears shifted mechanically!**

It isn't only the work of shifting gears that bothers people! It's the racing engine, the thumps, the grinding, the whole atmosphere of fuss and effort. And that holds true with gears that are shifted for you as well as the gears you shift yourself! But Chrysler says "Why shift gears? . . . just stay in high for all normal driving!" You can do that in a Chrysler . . . thanks to *Fluid Drive* and Chrysler's high proportion of power to weight!



**But only Chrysler drivers can do all their normal driving in high gear!**

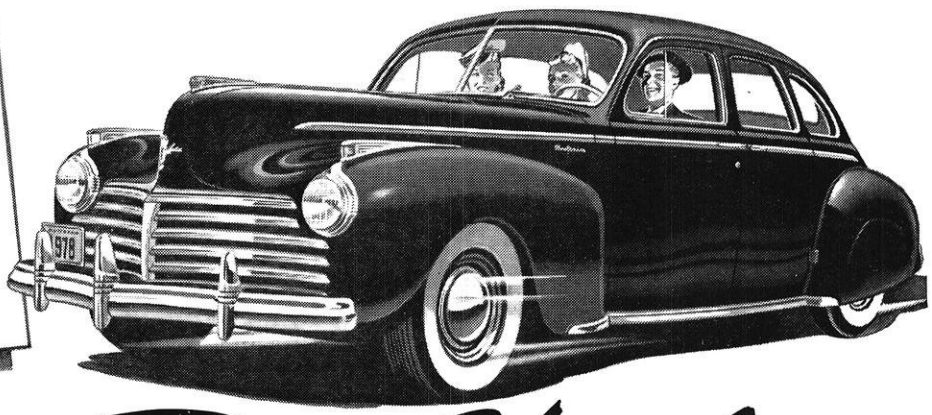
With the high reserve horsepower of the Spitfire engine, Chrysler's *Fluid Drive* enables the car to negotiate situations in high that ordinarily necessitate shifting gears. Chrysler's Vacamatic transmission will shift gears for you if you wish it to, but it doesn't shift unless you desire it, and with Chrysler's *Fluid Drive,* it is possible to drive most of the time in high. The difference is important . . . thrilling . . . delightful. Try it!

★Tune in on Major Bowes, Columbia Network, Every Thursday, 9 to 10 P. M., Eastern Standard Time.

**WHY SHIFT GEARS?**

***. . . Try Fluid Driving in a Chrysler!***

Chrysler's *Fluid Driving* is the most talked about advancement in motoring. But your own sensations will tell you more than any description you may hear. Take a ride in a *Fluid Drive* Chrysler.



**BE MODERN** *WITH FLUID DRIVE* — ***Buy Chrysler!***

## AMERICAN SOCIETY OF AUTOMOTIVE ENGINEERS

### *S.A.E. Activities*

For air minded individuals, there will be numerous model planes and motors on display along with both wind and water tunnels. A smoke meter, used in the analysis of combustion engine gases, will also be a part of the S.A.E. group. Another general exhibit will cover the activities of this organization and will serve as a meeting place for all member visitors.

# *Other Exhibits*

## KAPPA ETA KAPPA

### *X-Rays*

With up to the minute practice, it is possible to make use of X-Rays in the examination of foods for foreign substances, spoilage, and damage by frost. Defects in the structural members of small aluminum models will also be demonstrated. *Exhibitor:* JOHN MOSES.

### *Eggs Fried Over Ice*

The engineer comes through with another surprise for the housewife. Throw that gas or electric range out and try using a cake of ice for your summer cooking. One catch stands in the way to your success. You see, you have to have an alternating current electromagnet which will set up eddy currents in an aluminum frying pan, thus forming the necessary heat. *Exhibitor:* JOHN MOSES.

### *Black Light*

This isn't the type of light London uses in its "blackouts," but at least many weird effects can be procured from it. Odd applications for ultra-violet light in window and theater displays will be shown along with various luminous effects obtained through its excitation of fluorescent paint. *Exhibitor:* ROBERT D. MILLER.

### *Diathermy*

Fevers are now developed in the human body for combating colds by subjection to high frequency radiations. This diathermic effect will be demonstrated by really making "hot dogs" hot. *Exhibitor:* ROBERT D. MILLER.

### *Jacob's Ladder*

This ladder consists of two nearly vertical diverging electrodes. An applied voltage causes an arc which rises to the top of the ladder due to the heat developed. At the top, the arc breaks and starts its trip over again from the bottom. *Exhibitor:* JOHN EISING.

### *Electro-Magnetic Levitation*

Have you ever seen a large aluminum pan park in mid-air by itself? The levitator consists of a laminated core so wound as to produce a powerful magnetic field upon which the pan will float at a height of about six inches. *Exhibitor:* JOHN MOSES.

## TAU BETA PI

### *The Branches of Engineering*

The national engineering honorary fraternity presents miniature scenes depicting the various branches of engineering. How many of these branches can you recognize as the scenes rotate into view behind the fraternity's largest key? *Exhibitor*: FRED WEBBERE.

## TRIANGLE FRATERNITY

### *The Panama Canal*

Present day defense interest in the United States centers on that vital zone of the Americas famed as being the Panama Canal. In recognition of this fact, a scale model of this entire section of country has been developed. The exhibit, which is six by eighteen feet in dimensions, includes everything from operating locks and boats to the finest details of the surrounding terrain. By examining this thin isthmus spanning streak of water, the advisability of a "Two Ocean Navy" becomes readily apparent. *Exhibitors:* JAMES G. SMITH, HAROLD G. HOLLER.

## ALPHA CHI SIGMA

### *Fractional Distillation*

This exhibit will include many of the various types of fractional distillation equipment used in an organic chemistry research laboratory. These fractionaling columns are utilized to separate substances that are too intimate for simple separation. *Exhibitor*: ENOCH JOHNSON.

### *Growing Crystals*

Crystals, the freaks of nature, will grow before your very eyes. They will be projected on a screen microscopically so that their formation can be easily noticed. *Exhibitor:* ENOCH JOHNSON.

## CHI EPSILON

### *Tacoma Bridge Failure*

"Galloping Gertie," the "gal" who was responsible for the Tacoma bridge disaster, will be simulated as best possible by means of an electric fan. Small models will thus be set in motion to illustrate the vibration effects, and pictures will clarify additional points. *Exhibitor:* JOHN MANTHEY.

## MILITARY SCIENCE

### *Signal Corps Unit*

Have you ever wondered how infantry divisions keep in contact with each other in times of war when telephone lines cease to operate? Equipment furnished by the Division Signal Company will serve to demonstrate actual practice as it exists today. *Exhibitor*: JOSEPH PEOT.

### *Military Display*

Up to the minute defense developments will be included in this exhibit. Aerial photograph maps will be on demonstration along with model military bridges, bomb shelters, gas masks, anti-motorized defense, and the complete field equipment of today's soldier. *Exhibitor:* CLARENCE ZARN.

## SANITARY LABORATORY

### *Activated Sludge Determinations*

At the present time, the best sewage plant operation test would take a good five days. However, with the aid of this oxidation-reduction potential recorder, it is possible to determine the effectiveness of the plant in a matter of minutes.

## AG ENGINEERS

### *Mechanical Milker*

Wisconsin, the Dairyland of the Nation, presents the latest methods employed in the milking industry. The Agricultural Engineers won't be able to keep a real cow going steady throughout the expo, so they have decided to use a reasonable facsimile thereof. The important thing is that it gives off milk steadily without getting the least bit discouraged. *Exhibitor*: AMOS EINERSON.

## ETA KAPPA NU

### *Appliance Testing*

Electrical appliances of varieties from "soup to nuts" get a real working over in these demonstration tests. The performance characteristics are determined with the procedure used by the University of Wisconsin Electrical Standards Laboratory. *Exhibitor:* DANIEL R. MILLER.

## DORM RADIO CLUB

### *Amateur Radio Station*

Ever standing ready to sacrifice himself in emergencies, the "Ham" has become the unsung hero of American flood and hurricane disasters. A 150 watt amateur station utilizing both voice and telegraphic transmission will be on working display with an additional attraction of the semi-automatic high speed sending key. This same station has contacted points over the entire country from its regular location in Ochsner House, Adams Hall. *Exhibitor*: ARTHUR C. LYTLE, W9WEO.

## INDIVIDUAL

### *Bucking Broncho Motor*

Here is one thing you definitely won't believe unless you're an electrical. In normal operation, this motor first runs in one direction for awhile, and then, just to be indifferent about the whole thing, decides to run the other way. On the other hand, you will be able to tame it to run in one direction by loading the motor with your own weight. *Exhibitor:* DONALD C. PEROUTKY.

### *Snake Killer*

With apologies to Rube Goldberg, we present this most horrible assortment of gingles and gadgets. There are wee rumors circulating to the effect that the contraption was imported from across the lake.

### *Pictorial Representation of Sound*

You've heard your own voice for most of your life, but you haven't had much opportunity to see it. The oscillograph in this exhibit affords you just such a chance along with the viewing of sounds issuing from all sorts of musical contrivances. The distinctive overtones of each instrument serve as a means of easy identification when they are transformed into pictures. *Exhibitor:* JAMES E. ANCELL.

### *Voice Mirror*

Speak and ye shall hear. This clever little gadget records speech for fifty seconds and then automatically plays it back. The secret to its success lies in a thin steel tape that is affected magnetically. *Exhibitor*: JAMES CALHOUN.

### *The Slide Rule*

Material: several slipsticks
Presentation: eight minute discourse plus
Object: amazement and amusement
Result: amazement and amusement
*Exhibitor:* FLORIAN YANIKOSKI.

### *Musical Light Beam*

Do you believe that sound can be carried in light without making any noise? Seeing is believing, but here is a rough idea of the principles involved. By means of a neon light excited by an audio amplifier, musical notes will be transmitted by light waves to a photocell. Here, the emanations are converted back to audible frequencies where they are amplified to the strength of the original notes. *Exhibitors*: BERT ZARKY, VICTOR W. RICHARD.

# 2 CHAMPIONS IN 1 YEAR

## THE 1941

## *Championship*

# BADGER

IS YOUR ONLY

PERMANENT RECORD

OF THE

## 1941

# *Championship Basketball Team*

- *The Best Team in 23 Years*
- *The Best BADGER Ever*

## $3.50 NOW!

*at the*

BADGER OFFICE MEMORIAL UNION UNION DESK

# INDUSTRIAL EXHIBITS

## *Allis-Chalmers Company*

Allis-Chalmers Manufacturing Company is displaying turbine blades of various types and other industrial machinery.

## *Aluminum Company of America*

The entire story of aluminum, from mine to finished product, is told in detail by this exhibit. The methods of mining and the extraction of the metal, all the processes through which it passes, right up to the point where it takes shape as tubes, sheets, and other products, are strikingly illustrated.

## *Barber-Colman Company*

The Barcol Radio Control is a new and reliable remote control device for opening doors and gates, and for controlling lights. A unit designed for the car has a control button mounted on the dash, and with it you can unlock and open the door, and turn on the lights without even stopping the car. Because of frequency tuning, each car can operate only the door to which it is tuned.

## *Brown Instrument Division of Minneapolis-Honeywell Company*

Highly technical in nature, and of considerable interest to the graduating engineer who will soon employ these instruments in his daily work, is the exhibit of this company. Included are recording potentiometer, pyrometers for temperature control up to 2,000° F, recording meters, and other temperature control instruments.

## *Carborundum Company*

A large steel and glass display case form the nucleus of this exhibit. In this case will be displayed the many different forms in which this abrasive can be used. After the exposition, the exhibit will be donated to the University.

## *Chain Belt Company*

This company serves a wide range of industries and some of the applications of its products will be illustrated by colored pictures, and chain belt samples. This exhibit also includes a small pump and a machine conveying cans and bottles on the new Rex Table Top Chain Belt. Both of these machines will be operating.

## *Chrysler Corporation*

Smooth operation requires s m o o t h, well polished surfaces on moving parts. This exhibit is devoted entirely to the display, demonstration, and explanation of the Chrysler super-finish, a finish so fine that the usual break-in period for new car motors is no longer necessary.

## *Corning Glass Works*

Corning Glass Works, the world's largest manufacturer of technical glass, is displaying a portion of the various types of chemical and industrial glassware which it produces. Pyrex Glass, a trade-mark applied to various low expansion, borosilicate glasses, is displayed in the form of flameware and tea pots as well as insulators and industrial products.

## *Cutler-Hammer Corporation*

The operating and protective features of the Cutler-Hammer Multi-breaker are demonstrated with an actual unit in cross-section. Other equipment on display include the latest designs of motor control, service control, multi-breakers, and safety switches.

## *Eastman Kodak Company*

A short and extremely interesting movie, entitled "Highlights and Shadows," will picture the manufacture of the cameras, lenses, and other photographic supplies furnished by this company. In addition, there will be a series of forty photographs to illustrate high speed photography, night photography, and the use of infra-red light for illumination.

## *E. I. Du Pont de Nemours & Co., Inc.*

Everything from dynamite to the cloth for dresses is manufactured by this large chemical products company, and much of it will be on display at their exhibit. Especially emphasized will be the recently developed Nylon products, made from cloth woven with plastic thread, and possessing remarkable strength and sheerness.

## *Evinrude Motors Company*

This exhibit portrays the latest development in two-stroke engine development as applied to outboard motor units. The exhibit includes section drawings, mounted parts, and complete motors from the assembly line.

## *Falk Corporation*

The Falk controlled torque display consists of a solenoid brake, a controlled torque coupling, and a Falk triple reduction motoreducer combined with a 1 h.p. motor. As the motor is running, the brake is applied to the driving shaft. The coupling absorbs the resultant shock. The peak shock load is limited which on an industrial application would break some part of the machine.

## *Ford Motor Company*

A study in contrast is to be found in the Ford Motors exhibit, which consists of a 1941 and a 1906 model car. Here you can see at a glance the tremendous progress which has been made in this important branch of engineering.

## *Four-Wheel Drive Corporation*

Here it is at last, a toboggan that will turn around when it gets to the bottom of the hill and take you right back up to the top again without slowing down. This motorized toboggan is propelled by means of an endless belt which runs down the center, and it is said to be capable of 40 m.p.h. It is now in use as an amusement device at winter resorts and is being considered as a possible military weapon.

## *Heil Company*

The Heil products company of Milwaukee is displaying its newest model oil burners.

## *General Electric Company*

The Madison representative of the GE Company will have on display new products recently developed for industry such as the new TRI-CLAD motor, cut-away gear motor, clapper operated magnetic control, the new hook-on Volt-Ammeter, laboratory model Tesla coil equipment, and a photoelectric relay demonstrating kit.

The lamp division in Chicago will show the numerous colors and the details of starting and operating control of the new and glamorous fluorescent tubes known as MAZDA F lamps. Also shown will be the uncanny way in which a photo-electric eye can turn on the artificial lighting in a school room as daylight fails.

## *International Nickel Co., Inc.*

By means of samples the exhibit shows three typical steps in the production of nickel. These are: nickel ore, nickel-copper matte, and the final product, electrolytic cathode nickel having a purity of 99.95 per cent, which is the commercial form usually used for alloying purposes.

## *Keuffel and Esser Company*

The Royal Blue Print Company will send a representative to display, demonstrate, and explain the uses of the engineering instruments in this exhibit. Slide rules, surveying instruments, drawing instruments, etc., will be exhibited.

## *Kimberly Clark Corporation*

A display of various colored papers, house and industrial insulation, and illustrated steps in the process of manufacturing pulp and paper.

## *The Milwaukee Road*

The Milwaukee Road will have a locomotive on display. It is located outside of the Mining Building.

### *Midwest Iron Fireman Company*

This exhibit shows modern automatic coal burning equipment, incorporating the latest developments in stoker design. Cutaway displays show latest forms of feed worms transmission burner retorts, automatic air control, and stoker controls, including the "Hold Fire" control. There will also be a model demonstrating controlled furnace drafts.

### *Monsanto Chemical Company*

The Monsanto Chemical Company exhibit outlines the production of phosphorus. The mining of the raw phosphates is explained, and the reducing of these phosphates to the free phosphorus in huge electric furnaces is outlined. This company's daily production of almost two tank-car loads makes it the first in the field.

### *Nelson and Foster, Inc.*

A display of new glass products, many of which are already being used extensively in industry. Glass yarn, cloth, tape and insulation, because of its chemical and physical stability, are rapidly finding new fields and uses in industry.

### *Norris Industries*

A model house with a cutaway section of wall to show the methods of installing mineral insulation.

### *Northwest Airlines*

Information and pictures on aviation in the midwest will be displayed by Northwest Airlines.

### *Polaroid Corporation*

Two discs of Polaroid Film, each over two feet in diameter, are used to demonstrate the principles underlying light polarization. These principles are applied to sun-glasses, anti-glare illumination, interference color displays, and three dimensional pictures. Especially emphasized is the use of Polaroid in detecting stress and strain in plastic models of engineering parts.

### *Research Products Corporation*

An actual nine-cell air filter bank will be shown with a description of method for computing size requirements for given air flows and capacities. There will be samples of various types of Research air filters as used in home heating installations, commercial ventilating installations, and air conditioning installations and units.

### *SKF Bearing Company*

An exhibit composed of samples of various types of ball bearings will be displayed.

### *Texas Gulf Sulphur Company*

This exhibit contains samples and photographs illustrating the manufacture and use of sulphur.

### *Toridheet Division of Cleveland Steel Products Corporation*

The A-B Company, local distributor of Toridheet equipment, will exhibit a Wall Flame oil burner, pressure burner, water heater, and air conditioner. These machines are all based on the design of the famous Ropeller construction.

### *Twin Disc Clutch Company*

A better understanding of workings of large industrial engines will be yours after viewing the cutaway working models exhibited here.

The models include a power take-off for use in connection with large engines, and clutches and gear units for many types of work and engines. Also included is a model of a marine reverse and reduction unit.

### *Waukesha Motor Company*

A continuous Kodachrome movie film is the substance of this exhibit, and bears the impressive title "Combustion in Hesselman Spark Ignition Injection Oil Engine." The colors are true reproductions of the combustion phenomenon as observed through quartz windows. The time for one complete showing is about seven minutes.

### *Wheelco Instrument Company*

Here is an exhibit of some interesting special applications of electricity for control. Outstanding feature of the display is the application of the electric eye for flame control in large industrial heating units.

### *Westinghouse Electric and Manufacturing Company*

Magic is made easy by the use of the "Stroboglow," a new and strange light source which will make water appear to run back up into the faucet, or stand in midair in glistening jewels; a light which seems to stop the blades of a whirling fan and make them rotate backwards. It shows moving objects doing all sorts of funny things. Another display will be the "Million Dollar Watchman," a little bi-metallic device used in many industrial applications for automatic control.

### *West Virginia Pump and Paper Company*

We all have our own tastes, but this exhibit will help you test your taste sensitivity by chemical taste-papers representing sweetness, sourness, bitterness, and saltiness. An experiment demonstrating absorption and desorption is also featured.

### *William K. Walthers, Inc.*

An operating model railroad to show the latest ideas in hobbies. Every piece of equipment is built topscale from actual railway drawings. Latest display of miniature locomotives and interurban cars, suburban cars, and a demonstration of operating signals, block control, and automatic switching.

### *Wisconsin Electric Power Company*

The power of 200,000 horsepowers is represented by this model of the Port Washington turbine and its auxiliary equipment. It is a to-scale replica of part of this noted power station that has established and retained a world's record of efficiency during the past five years.

### *U. of W. Co-op*

Forty engineering handbooks will be displayed.

**MICROSCOPE . . .** (continued from page 11)

theoretical limit of the ordinary microscope has been attained. The University of Toronto microscope produced a magnification at the screen of 12,700 times and the photograph was satisfactorily enlarged to 180,000 diameters. The finest detail obtained was about 60 Angstrom units. Dr. Zworykin has predicted that objects 10 Angstroms in length may ultimately be photographed. There are yet certain defects of the electron lenses that the scientists have been unable to overcome. At the present time these defects are the subjects of active research.

No discussion of this microscope is complete without a brief mention of the variety of materials and substances that have been magnified and photographed. Cultures of bacteria, virus filtrates, colloidal suspensions, dusts or smokes, crystal structure of thin foils, and electron emitting oxide coated surfaces, are some of the items that have been successfully photographed.

**BUILDINGS . . .** (continued from page 9)

new uses for raw materials and in the development of new industries, is recognized throughout the country. Our enrollment is growing rapidly and we need at least double the present floor space.

The Electrical Engineering Building was never intended for such use. It constitutes a dangerous fire hazard not only to the valuable equipment it houses, but to the lives of all who use the building. For lab purposes in this building, electrical engineering uses 25,000 square feet, and practically all of the class work in this department is given in other buildings because of lack of space.

The department of mechanics is now confined to 21,000 square feet in the old engineering building. Since modern construction and design requires the testing of materials and of new forms, more than double existing floor space is needed. Some of the best known researches of our Engineering College have been carried out in the department of mechanics. For example, that on the "Fatigue of Metals" has been published in foreign languages and circulated throughout the world. This research was carried out under such facilities that we were able to devote but 160 square feet to it; the University of Illinois has for similar purposes a whole floor of 9,350 square feet.

The Engineering College must expand to take care of its overcrowded facilities and to uphold its high educational standards. It is an absolute necessity that this space be provided if the State of Wisconsin is to continue to be served in the future by high grade engineers.

**CONDUCT . . .** (continued from page 7)

sideration, and should not be accepted without careful thought as to their application to the problems at hand. The young engineer should not be a "yes" man; he should agree only when, after careful study, he can conscientiously adopt, as his own, the opinions expressed by others.

9. Some older engineers depend too much upon past experience and attempt to solve, too quickly, new problems on the basis of such experience, and without careful consideration and study. Every problem is a new problem involving some new conditions, and hence requiring careful investigation and thorough study. Any engineer who will not give a new problem due consideration and study should be retired and thus give the man who will do so an opportunity.

10. If possible, every engineer should visit the plants on which he has assisted in the design and construction after it has been in operation for a few years. Preferably, he should visit them without the announcement of his connection with their origin; and he should inquire of the operators as to any faults or troubles in stability, safety, and operation. If the engineer appears as a stranger, he is likely to obtain information which may improve his future designs, although it may not always add to his self-esteem. Many engineers, for lack of contact with the work they have already done, continue for years making the same mistakes in design.

11. The young engineer should do his work as if he were personally responsible for the success of the entire project on which he is engaged. He should do his work as if it were his own and as if his own funds were involved. The personal point of view should always be the basis on which the engineer's work is done. "Will it be safe and economically sound?" "Would I do this work at all, and if so would I do it this way if it were mine?" These questions should always be in the mind of the engineer in charge of any project. It is not always practicable for the engineer, if in a subordinate position, to influence a design so that it will accord with his ideas of economic and sound practice but his study of the fundamental principles and their applicability is essential to his future success.

12. A pleasing personality is of the highest importance. Cultivate, so far as possible, optimistic tendencies; look at the pleasant and attractive side of life; cultivate a friendly attitude toward those whom you meet, and meet them with a smile. They will respond, generally, in a similar manner. This will smooth the way for the adjustment of differences in opinion and the reconciliation of misunderstandings.

13. Consideration for, and a real interest in, others is the foundation of a fine personality, and when accompanied by ability is the surest way to success. In some cases the rough character, heedless of the feelings or the rights of others, may succeed by sheer ability and in spite of—not on account of—his unfortunate personality.

14. The young engineer searching for a job should seek employment under men of recognized standing and ability and of high ideals. Association with men of low ethical standards is sure to affect, seriously, the mental attitude of the young man who is likely to assume such standards are common to the profession. It is much better to serve with a man of fine reputation and fine character even at a financial sacrifice.

15. Truthfulness and dependability are the fundamental basis of all proper conduct. The engineering student should agree to accept a position only after he has fully made up his mind to carry out his agreement. His failure to do so on account of a later offer of a higher salary is unethical and therefore a very unsatisfactory way to begin work in the profession.

[1]See "Indispensable Principles," an address by Raymond Moley, delivered September 17, 1940, at the Union League Club of Chicago.

# "STATIC"

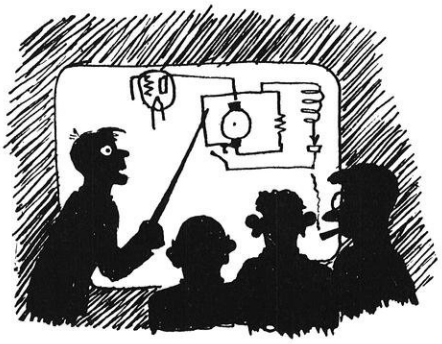
The concensus of opinion seems to be that foot powder is no good for shaking in the boots. Some of the boys in Speech 7 tried it and report that the shaking continued as before.

•

If we planted light bulbs, would the fruit be currents?

What would the speed of lightning be if it didn't have to zig-zag?

Is there any correlation between the electricity in m'lady's hair and these lampshade hats?



•

Pardon me, Mrs. Astor, but that never would have happened if you hadn't stepped between me and the cuspidor.

•

The Chinese cook was walking through the woods one day when he heard a branch snap behind him. Turning he saw a huge grizzly bear smelling of his tracks. "You likee my tracks?" he exclaimed, "Velly good, I make some more!"


## Recording an epoch-making achievement in chemical engineering

January 21st, 1941, will remain an historic date on the calendar of chemical engineering progress.

For on that day, at Freeport, Texas, a truly epoch-making achievement was accomplished—the first production of magnesium metal extracted in commercial quantities from the waters of the sea.

Metal from sea water—magnesium—lightest of all structural metals in common use.

This achievement is the fruition of Dow's 25 years of experience in the continuous development of magnesium metal production. For at Midland, back in 1915, Dow began extracting magnesium from Michigan brine by its own processes.

A quarter century of effort in developing uses and applications for DOWMETAL* (Dow's name for its Magnesium Alloys)—creating demand that has permitted a progesssive lowering of price—has made magnesium metal indispensable to American industry. Now demand is suddenly increased enormously. For magnesium is essential to airplane construction; vital to national defense.

The successful production of this all-important metal from sea water marks an epoch—the beginning of a new era in the production of metals.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN
*Branch Sales Offices:* New York City—St. Louis—Chicago—San Francisco—Los Angeles—Seattle

*Trade Mark Reg. U. S. Pat. Off.

TRADE MARK
DOWMETAL
MAGNESIUM ALLOYS
LIGHTEST OF ALL STRUCTURAL METALS

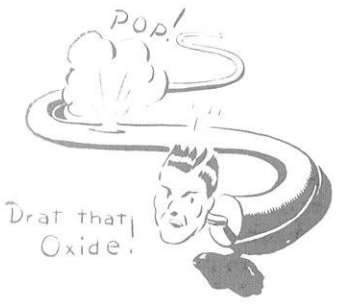
# G-E Campus News

## INTRODUCING . . .

A NEW champion! The world's largest and most powerful industrial X-ray unit, packing a wallop equivalent to $90,000,000 worth of radium, is now at work in the General Electric plant at Schenectady.

Stronger by 600,000 volts than others in its class, the 1,000,000-volt monster clips down to two minutes the old record of an hour to take a picture through four inches of steel.

The machine is housed in a special building, with 14-inch concrete walls plus 12 inches of exterior brick to absorb stray radiations. Another safeguard for X-ray technicians is the X-ray safety "wrist watch"—a leather case, worn on the wrist, carrying a small piece of unexposed X-ray film. This, when developed at the end of the day, will show up any scattered X-radiation to which the wearer may have been harmfully exposed.

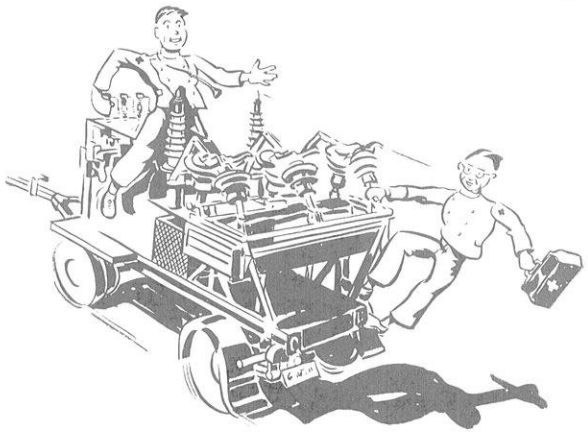



## SCRAM, OXIDES!

WHEN a high-voltage cable fails, there's the devil to pay. Lights go out, breakers blow, production lines clatter to a halt, confusion reigns! Most cable troubles are caused by moisture, which seeps in through a break in the waterproof (lead sheath) covering.

Oxides are lead sheath's Enemy No. 1. They are born when the cable is being made; i.e., when the lead press is being charged. The lead is then molten and has its greatest affinity for oxygen.

General Electric engineers have solved this problem with the new "nozzle-swirl" process. In charging the lead press, any oxides present are collected, swirled to the center of the molten lead, pulled to the surface, and scooped off with a ladle. The nozzle—the secret of the whole process—was developed and patented by a graduate of the G-E Test Course, C.A. Piercy, Ohio State, '16.



## TO THE RESCUE

WHEN Mother Nature goes berserk, and whole towns are cut off from electric power, that's when repair crews go into sudden action to find the break and fix it.

In the past power companies have had transformers mounted on small trailers to be rushed to location to restore power. Now General Electric has announced a completely factory-built 1000-kva mobile substation, first of its type.

This unit, mounted on a huge trailer, can be towed along at 40 miles an hour. It can take power from high-voltage lines of almost any voltage and transform it to service values. When an outage occurs, the substation is whizzed to the spot, parked, grounded, and tied in. It can also be used to by-pass regular substations during repairs or maintenance work. General Electric Company, Schenectady, N. Y.

GENERAL ELECTRIC

968-17