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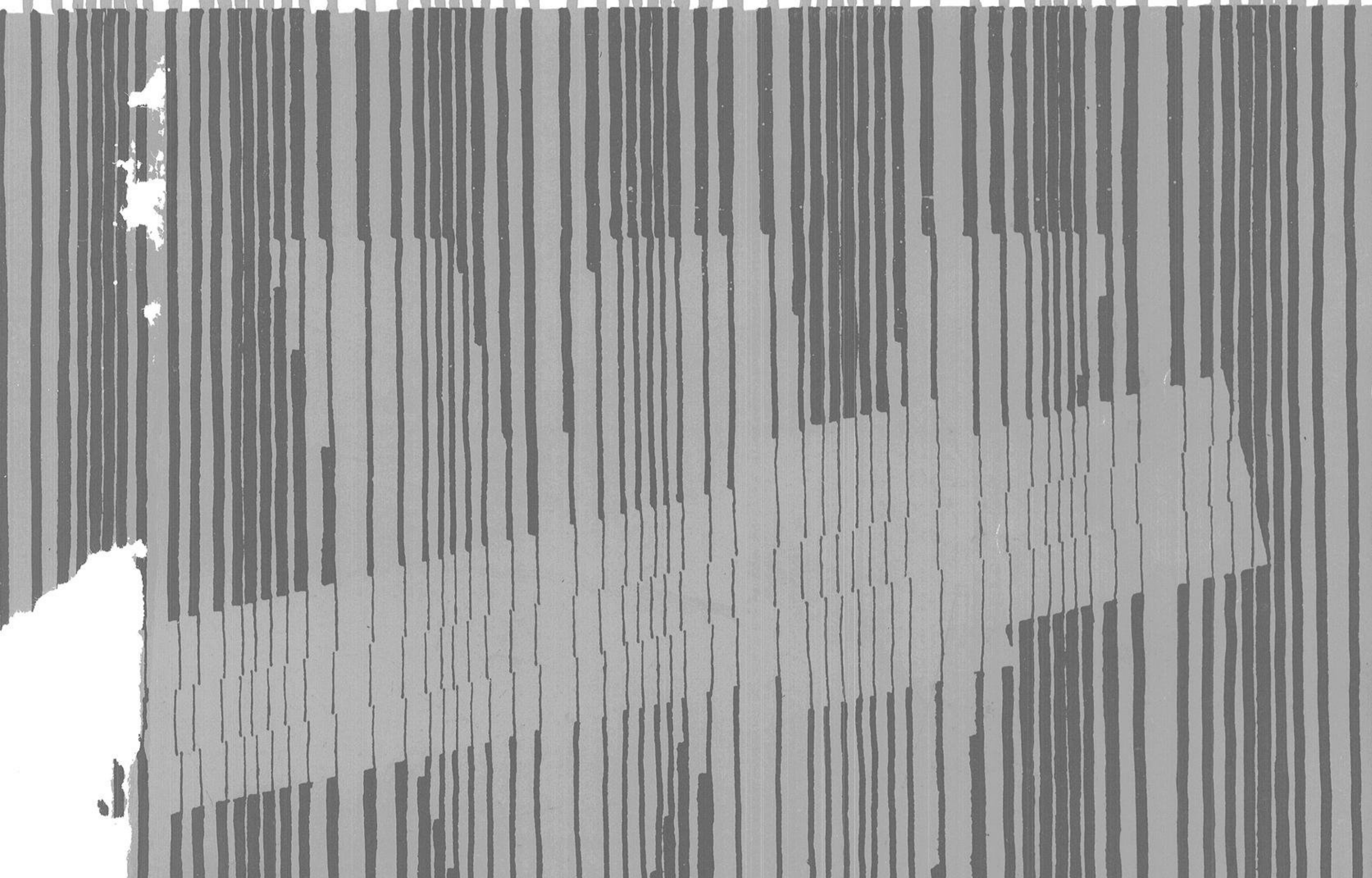
THE WISCONSIN ENGINEER



MAY 1936

Member, Engineering College Magazines, Associated

With the Contributors . . .

△ This is the last issue of a sweet and successful school year. And on his page, you'll find the editor saying so and giving credit where credit is due.

△ In Steam & Gas 109, Paul Streckewald, m'4, presented a paper that would interest any car owner. See page 143.

△ About Prof. Dawson—had you heard? Well, peek into the Campus Notes, page 146.

△ Remember that picture you posed for sometime ago? Start hunting in the twelve pages following page 150.

△ If you want to know what Polygon did, and what it is-and-will-be-doing, see page 156.

△ The seniors show their first signs of senility on page 158. Let the editor deliver a few of their homely homilies—there really is a great deal in them.

△ "It's page 164 that the frosh have been waiting for."

△ Our pal, Maurie Swanson, c'36, wrote an article—"High Speed Streamline Trains"—for our December number. You cried, "More!" So Maurie goes historical on page 167.

△ This issue put the cap on Carl Walter, our humor (?) editor. He will soon be summering (and simmering) on the sunnier side of Mendota—one look at page 171 will convince you.

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Member of Engineering College Magazines, Associated

Leonard H. Church, *National Chairman*, 1510 Hanna Building, Cleveland, Ohio

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EDITORIALS

"All education is self education"
—President Lowell

LOOKING AHEAD In a few weeks, the engineering class of '36 will have completed its work and will be facing a new field of adventure. Happily enough, this field appears a little brighter and considerably less formidable than has been the case for the past few years. Business is on the up-grade. Manufacturers of all types are discovering a need for well-trained technical men—a need made more acute by the retrenchment and pessimism of the past few years. Openings would be even more plentiful than at present if all the men needed were hired; too many concerns are still a bit punch-drunk and lacking in confidence because of the beating that most of them took from Kid Depression.

A period of recovery and expansion offers fine opportunities for young engineers. Now is the time to enter the field and grow up with the reorganized concern. To a man who is alert, willing to work, and aware of all the possibilities, the rapid growth in business activity is offering more and better opportunities than the graduates of the last few years ever dared to expect.

Good luck to you, Class of '36!

A PRAGMATIC IDEALISM The editorial entitled, "On The Threshold," which appeared in the April issue of this magazine, has aroused among our readers reactions that in some cases were characterized by considerable heat. Alumni, both on the faculty and in active practice, resent energetically any implication that engineering is "vile, bitter, cruel, and selfish." They also protest against the statement that "during the first tremendous year following graduation" the young engineer must learn "to crawl, to lie, and to bribe." After reading the editorial, a Wisconsin man is likely to retort, "Well, where does Danny Mead fit into this picture?"

The writer of the editorial evidently wished to warn the men who are about to graduate that the world in which they will practice their profession is not so idealistic as the homes from which they have come and the school in which they have been trained. There is shock and disillusionment coming to any young man whose naivete exceeds moderate limits. Under that shock, some men go to pieces, convinced that their home training and school training have not been pragmatic. They feel that their faith has been betrayed, and so they lose all faith. A warning might have saved them by lessening the shock.

The young engineer must be prepared to meet attacks not only upon his ethics, but also upon his technical training. His confidence in his own judgment has not yet been developed, and he does not feel sure that his teachers were practical men; therefore, he is unable to meet assaults with calm assurance in the correctness of his ideals. It is a critical period for the young man. What is perhaps the best formula to use under the circumstances has been expressed succinctly by some worldly-wise philosopher in these words: "So live that you can look any man in the face without fear and without shame."—**L. F. V.**

INVENTORY Inventories help one to measure his position with respect to the past and to plan and prepare for the future. A personal inventory should help the senior engineer; he is a student about to become a unit in economic society. Here are a few questions he might ask himself:

Have I made the most of my four years in college?

How have I changed since I first entered as a freshman?

Is four years' college training worth more than four years' actual experience on a job?

Have I developed socially to the point where I can fit into a niche in society with the least possible friction?

Have I developed a philosophy or way of life?

The answers to these and many more questions of a similar nature should reveal a man's character and personality rather well. Some cannot be answered except as each individual's opinion indicates, but the thoughts provoked in attempting to find answers will be enlightening. Each man must know himself: the optimist must temper his optimism with a dash of cynicism; the pessimist must develop a philosophy that will relieve his misery; the cynic should exercise his sense of humor—it has probably long lain dormant. The cause must be known before the disease can be cured; let each man know himself and be able to report each day an advancement in his way of living.

THANK YOU

This issue of the Magazine brings to a close one of the most valuable episodes of my life. As a member of the staff, I found what it meant to work for a fellow student. As editor, it was my pleasure to have others do things for me. In either capacity, I found happiness, knowledge, and friends—what finer things are there in life?

To my staff I give my heartfelt thanks. To two of them who are graduating, Howard Holm and Robert Whiteside—to them I say that it is the dream of every editor to have men of their caliber on his staff.

For Polygon, I have nothing but praise and respect.

Professor Van Hagan, I found, was one of those men who cannot be thanked in word or deed—no material thing is good enough. His wisdom, kindness, and modesty are qualities beyond worldly reward.

Professor Frederick E. Volk and Mr. Kurt F. Wendt are the silent, hidden forces that move at the core of every fine institution—their value is beyond measure.

May my successors be fortunate as I.

—Leo S. Nikora

Vapor Lock . . .

Its Causes and Remedies

by **PAUL B. STRECKEWALD, m'36**

With summer days upon us, many car owners will be doing a great deal of riding. It sometimes happens, especially if you are driving hard on a hot day, that the car will stall. Or, if you've stopped for a moment, you cannot get the motor running again. After a number of attempts, you notice that the car seems to become less temperamental, and eventually you can get it going. Almost every automobile driver has experienced such an event some time or another—especially in this day of small, streamlined radiators, and gasolines of high vapor pressure.

The immediate cure for the nettling situation depicted is a rest for the car. What has happened is that gasoline has vaporized in the fuel line somewhere, and a bubble has formed, so that no gas is going into the engine. Under such circumstances, you are defined as being a victim of vapor lock. To regain your independence, you merely let the car stand. The gasoline soon cools down, the vapor condenses, and, when you try to start the car, (lo and behold!) it starts! There is, once more, a solid stream of gasoline in the fuel system. So you can resume your trip.

But let Mr. Streckewald give you a more enlightening version of it all.

THE fuel-feed system in any automobile is designed to feed fuel constantly from the gasoline tank to the intake manifold of the motor in proper quantities. One of the common causes of the system's failure to perform the above function is vapor lock. This vapor lock, or boiling of the gasoline in the fuel-feed system, has three primary causes. It may be due to faulty design, which permits the gasoline to become excessively heated while in the feed line; or the gasoline may have an unnecessarily high vapor pressure; or atmospheric conditions may be adverse. However, as the engineer has no control over the weather, and since the gasoline producers are manufacturing gas with as low a vapor pressure as possible without sacrificing good starting characteristics, the only field for attacking the problem lies in the re-design and modification of fuel-feed systems.

In order to discuss the relations between vapor lock and fuel-feed systems, the different types of systems will be treated separately. The three types in general use today are the vacuum tank system, the gravity feed system, and the fuel pump system.

The gravity system is the simplest. The force causing the gasoline to flow from the tank to the carburetor is simply the static pressure exerted by the head of gasoline in the fuel line above the carburetor. As this pressure is not very great, the formation of bubbles in the line seriously interferes with the flow of gasoline, and vapor lock would result much more frequently than it actually does if it were not for two other characteristics of the gravity system that counteract this tendency. One is due to the location of the tank which is generally adjacent to or partially enclosed in the motor compartment. This position of the tank and the consequent heating of the gasoline causes the more volatile pressure to weather off, thereby lowering the vapor pressure of the remaining fuel and removing much of the vapor-locking tendency. The other feature is that, due to the extreme simplicity of the system, and because of the shortness of the fuel line, the temperature usually stays within safe limits.

The vacuum tank system is nothing more than a gravity feed system with a vacuum-operated device to raise the gasoline from the main tank to the vacuum tank. Conditions between the vacuum tank and carburetor are the same as those in the gravity system. However, there is an additional factor — that of supplying gas to the vacuum tank. It is in this part of the system that most of the vapor-locking difficulties are centered. Gasoline is drawn from the main tank to the vacuum tank by suction from the intake manifold. This involves a lift of from two to two and a half feet, or a pressure difference of about .75 lbs./sq. in. However, on very hot days, or when the throttle is wide open and the motor is operating under a heavy load, the suction produced may be insufficient to draw fresh gas into the vacuum tank, so the motor stalls. This difficulty may appear to be due to basic imperfections in the vacuum feed system and not to vapor lock at all, but the conditions causing both types of fuel-feed failure are the same. As it is necessary for the vacuum tank to be emptied not only of the gas and vapors present at the beginning of refilling, but also those formed by the inflowing gasoline, high temperature or high vapor pressure of the incoming gasoline may cause it to give off more vapor than the intake suction can handle and still maintain the necessary vacuum, resulting in gasoline stoppage. The reduced pressure on this side of the system also aids in the excessive formation of vapor.

The essential feature of a fuel pump system is the use of a mechanical pump to transfer the gasoline from the gas tank to the carburetor. The gas is usually lifted a foot or so to the pump by suction and forced out of the pump at a pressure of about 3 lbs./sq. in. into the carburetor. This pressure helps to prevent vapor lock between the pump and carburetor, so most vapor locking trouble occurs in the fuel line on the vacuum side of the pump. Whether or not vapor lock actually occurs

Honor Roll

TAU BETA PI

Initiates

Alumnus

Edward J. Maurer

Seniors

Phillip S. Davy
Leroy W. Griffith
Willis F. Kraemer
Harrison C. Mayland

Juniors

Charles W. L. Burroughs
Donald B. DeNoyer
John F. Eppler
Francis E. Fontaine
Arthur R. Luecker
Neal D. Olson
Marvin C. Riggert
Gerald J. Risser

depends upon the temperature of the gas and the vapor handling capacity of the pump. In general, the pump system is less susceptible to vapor lock than are the gravity or vacuum systems, due to the appreciably larger vapor handling capacity of the pump—also, some of the gaseous fuel which passes through the pump is reliquidified by the pressure in the line from the pump to the carburetor.

There are three general ways in which to modify the design of fuel systems to assist in the prevention of vapor lock, assuming that atmospheric conditions and the type of fuel used remain the same. They are:

1. By increasing the capacity of the system for handling vapor.
2. By decreasing the amount of heat which gets into the fuel system.
3. By putting pressure on the fuel.

These changes in fuel system design will be discussed in the order named. Special reference will be made to the fuel pump type of feed. This is the type in general use in today's automobiles, which are more subject to vapor lock than the cars of five or ten years ago.

Although the capacity of the system for handling vapor can be increased to some extent, this alone is not likely to give freedom from vapor lock. Increasing the vapor capacity of the system is done in two separate parts. First, it is necessary to improve the fuel line from the gasoline tank to the suction side of the pump. This can be done by using tubing of absolutely uniform cross-section over its entire length, and of such a size that the flow does not exceed 0.5 ft./sec. Eliminating all traps where bubbles might collect, removing all unnecessary bends, and having the entire line sloping forward from the tank to the pump would give maximum vapor capacity in the fuel line. Second, the vapor handling capacity of the system can be increased by installing a larger pump or redesigning the pump for the purpose of handling large amounts of vapor. However, this would not be overly effective, because a slight increase in temperature over that at which vapor lock occurs causes a large increase in the amount of vapor produced; redesigning or enlarging the pump, then, would be able to increase the operating temperature only a few degrees. The effectiveness of this type of remedy is further limited by the fact that the gasoline flow becomes intermittent even before the vapor locking temperature is reached. Therefore, although the average amount of fuel supplied would be sufficient to keep the motor running, operation would be erratic, and stoppage might result because of the temporary leanness of the fuel mixture.

The simplest and most effective way of minimizing vapor lock in the usual type of fuel pump systems is that of limiting the amount of heat getting into the fuel. It is impractical to keep the fuel temperature below that of the atmosphere, since this would involve artificial refrigeration which would be costly and troublesome. Most present day gasolines are modified seasonally, so that maintaining the fuel temperature as near atmospheric as possible is satisfactory. To accomplish this, two things are necessary. One is that the fuel tank be protected from the heat of the exhaust pipe and heat reflected from the road—nor should the fuel be heated en route from the tank to the pump. The other requirement is that any heat supplied to the fuel in the rear tank must be removed while the fuel passes from the tank to the pump. This involves the placing of the fuel line in some cool air stream or possibly installing some type of fuel radiator.

The temperature in the rear tank of the average auto travelling at 40 m.p.h. is 18° Fahrenheit above atmospheric, with individual cases ranging from 8 to 31°. In order to design a more efficient fuel feed system, the fuel tank temperature should be reduced. This problem is fairly simple, since it merely involves shielding the tank from heat radiated from the road and from the exhaust pipe. With cool gasoline in the rear tank, the object, then, is to keep it cool on its way to the pump.

The increase in fuel temperature between the rear tank and pump at normal operating speeds is generally about 12° Fahrenheit, although it may go up to 20° in some cases. On idling after fast driving, the temperature may go up as much as 30 or 40°, and it is at this time that vapor lock frequently occurs. This excessive rise in fuel temperature is generally due to the fuel lines located near the exhaust pipe. Shifting the line to the other side of the car will help considerably, the ideal position being on the outside of the car frame away from the exhaust pipe. Here the line will receive no heat from either the motor or the exhaust pipe, and if properly insulated from the frame and located in an air stream, the fuel will gain no heat, and possibly lose some on its way from the tank to the fuel pump. In tests conducted on four cars of different makes, there was an average decrease in temperature of 16°, obtained by relocation of the fuel line. This is equivalent to increasing the permissible vapor pressure 2.5 lbs./sq. in. It is best to have as little of the fuel line as possible in the engine construction, and to have it thermally insulated, unless it is directly in the air stream through the radiator. These precautions will cut down the undue temperature rise that occurs when the motor is idling.

Because there is often considerable heating in the fuel pump itself, it too will have to be investigated and perhaps changed. The pump is usually mounted on the crankcase and well sheltered from any stream of air. Then, too, in lubricating the pump, large quantities of hot crankcase oil are circulated through the pump shell, with the oil giving up much of its heat to the gasoline being pumped. These conditions cause a temperature rise in the pump of 10 or 15°, which could be eliminated if the pump were relocated so as to be in the air stream and further away from the motor proper, and lubrication were accomplished with a

Honor Roll

CHI EPSILON

Initiates

Boyd G. Anderson
Howard R. Jensen
Wayne W. Johnson
Reinhardt E. Peters
Robert E. Stiemke

smaller quantity of cooler oil. Tests made on models with such redesigned fuel pumps indicated that the pump could be constructed and located so as not to increase the fuel temperature at all.

The third major way of avoiding vapor lock is by applying pressure to the fuel. In present systems, the gasoline is forced from the pump to the carburetor under a pressure of about 3 lbs./sq. in., but this pressure does not help much in combating vapor lock. It is necessary to have the pressure where the locking occurs—generally between the rear tank and the pump, which is under a slight vacuum. Pressure can be applied in two different ways: a pump located just outside of the rear tank with remote or electric drive, or the use of gas pressure on the tank. Both of these systems have their own peculiar difficulties. The design of the remote drive for a pump would be rather difficult, and the use of an electric motor would be much simpler were it not for the fire hazard involved, for which proper insulation would be expensive if it would give complete protection. However, location of the pump in such a position would raise the vapor locking temperature 20 or 30°. This would be sufficient to remove any vapor trouble in the line.

The use of gas pressure on the system, with the elimination of the fuel pump, could be accomplished in two ways. The motor could operate an air compressor which would automatically maintain the proper pressure on the gasoline, although a compressor would require frequent attention and would be just another piece of equipment to keep in repair. A simpler method of obtaining a pressure would be by using part of the exhaust gases. But they would require purification, the removal of acidic and sulphuric compounds being especially necessary because of their corrosive action on the metal—also, the catalytic action on the gasoline causes the formation of gum. While vapor lock is not likely to occur in the line of one of these pressure systems, serious trouble might take place in the float bowl of the carburetor. The gasoline, entering under pressure, might be at a temperature much above the vapor locking temperature at atmospheric pressure, so that violent boiling would result, thus causing an excessively rich mixture and possible stalling of the engine. The gasoline, therefore, must be fairly cool if such a system is to operate properly. This possibility of vapor lock in the carburetor makes it apparent that, in general, it is better to reduce the temperature of the fuel, rather than increase the pressure. And this is the way that vapor lock is usually remedied.

Another very simple and positive way of eliminating vapor lock is by venting the fuel line between the pump and carburetor. In this way, all excess vapor is discharged to the atmosphere and causes no trouble in the carburetor. There are several patented devices on the market that will do this, but they have not proved very popular because of the very poor economy resulting from discharging part of the fuel without utilizing any of its heating power. Some current makes of automobiles incorporate a similar attachment but have it discharge directly into the intake manifold, thereby using all of the fuel with a resulting improvement in economy. However, it is sometimes difficult to maintain the proper combustible mixture, due to the varying amounts of vapor being discharged to the manifold.

Honor Roll

PI TAU SIGMA

Initiates

Russell H. Baum
Ronald L. Daggett
Edward P. Faust
Robert O. Losse
John R. Myers
Thomas E. S. Spence

A New High Speed Indicator

After several years of experimentation, the Mechanical Engineering department will announce, next month, a new method of studying what goes on inside an internal combustion engine when the mixture explodes.

At the national meeting of the Society of Automotive Engineers, to be held June 2 in White Sulphur Springs, West Virginia, Mr. R. A. Rose, instructor in steam and gas, will present a paper entitled "Photoelectric Analysis of Combustion" — one of three papers being delivered in a symposium on combustion study. The paper Mr. Rose will present is the result of the joint efforts of Mr. R. R. Benedict, instructor in electrical engineering, Mr. G. C. Wilson, associate professor of steam and gas, and Mr. Rose.

The paper describes a new piece of apparatus which these men have developed to study the relations between the injection of the fuel, the burning, and the building up of pressure in an internal combustion engine. A three beam cathode ray oscillograph is used to provide a rapid means of recording these three variables simultaneously on a film; 1/100 of an inch on the film represents a time interval of 1/60,000 of a second. The complete picture of what happens in 1/200 of a second, the period during which fuel is shot into a cylinder and burns, takes about five inches of film. With such terrific speeds necessary for recording, it is obvious that in an internal combustion engine it is necessary to have some means of eliminating the inertia effects of moving parts — and for this, the electrical circuit with the photoelectric cell and the cathode ray oscillograph is used

This development is extremely important in the study of high speed internal combustion engines.

"Centrifuge Developments for Biological Research," by Reginald T. Saue, M.E.4, our Student A.S.M.E. president, won third prize in Chicago, April 20, at the 1936 Conference of the Midwestern Section of the American Society of Mechanical Engineers. Congratulations, Mr. Saue.

ON THE CAMPUS

ENGINEERS SUE SHYSTERS

Four engineers recently filed charges of unlawful imprisonment against William Buenzli, law senior, and George Parish, liberal arts junior, in the mock court conducted by the Law school.

The trial is part of the Law school program of providing actual experience for law students. It is one of the first real cases to be tried in some years and, according to Steven Lewandowski, counsel for the plaintiffs, it is a case that would be good for a legal court to try except for the fact that the defendants have no money for which they could be sued.

The plaintiffs, Frank E. Parish, freshman civil, Spaulding A. Norris, junior civil, William H. Polk, junior civil, and Lawrence W. Carlson, junior civil, swear that they were held against their will in a truck driven by the defendants on the day of the St. Pat's parade.

They charged that they were peacefully standing in the box of a dump truck watching the ceremonies when the two defendants drove away with the truck. Each time they tried to get out of the truck, the defendants threatened to release the dump.

The plaintiffs are seeking punitive damages of $50 each, but, of course, the judgment of the court is not binding.

The trial comes up May 22, with Prof. A. L. Gausewitz acting as judge. The only catch is that the jury is to be composed of first year law students and they will probably let their feelings get the better of them and return a verdict of not guilty for the sinning shysters, that is, if there is any truth in that old saw about honor among thieves. They might even try to fine the engineers for daring to bring suit against their comrades.

CONGRATULATIONS

Perhaps you have noticed the unusual exuberance and high spirits which have characterized Prof. Royce Johnson, director of the standards lab, since spring vacation. The reason is a fine baby girl, born the latter part of April.

AUF WIEDERSEHEN, MR. DAWSON

The College of Engineering regrets the departure of Prof. F. M. Dawson, chairman of the hydraulics department, who will leave sometime during the summer to take the position of dean of the College of Engineering at the University of Iowa. He takes the place of Dean C. C. Williams of Iowa, who is leaving to become president of Lehigh university.

Prof. Dawson received his master's degree at Cornell and was an instructor there for a year. Following that, he taught for six years at the University of Kansas, coming to Wisconsin in 1928. Under his direction, the hydraulics department here has become one of the leading departments of its kind in the country. His book, "Hydraulics," has had a large sale and is used as a standard text in several universities.

While not directly connected with the hydraulics department at Iowa, Prof. Dawson expects to continue his work in that line.

The ENGINEER staff offers its congratulations to Prof. Dawson and extends its best wishes for his continued success.

S. P. E. E. CONVENTION

The 44th annual convention of the Society for the Promotion of Engineering Education, holding its annual meeting here June 23, 24, 25, and 26, is expected to attract more than 1,200 persons to the university campus.

General sessions will be held in the mornings and conferences in the different departments or branches in the afternoons. Special entertainments of various kinds are being planned for the visitors and trips to scenic points arranged.

The drawing section will meet a day or so before the general session starts and will hold a sort of summer school for drawing instructors. New methods will be taken up and the drawing teachers will have a chance to "go to school."

The civil engineering section will probably visit the T. E. department's Summer Camp at Devil's Lake some evening. The camp will be in progress and should interest the civils attending the convention.

Accommodations are being provided for the visitors at nominal charge at one of the men's dormitories, Chadbourne Hall, Barnard Hall, Ann Emery Hall, the University Club, and the University Y. M. C. A. Arrangements for campers are also being made.

PI TAU SIGMA

Wednesday evening, April 1, Pi Tau Sigma, honorary mechanical engineering fraternity, initiated six new members. Prof. P. H. Hyland was toastmaster, John P. Thomas welcomed the initiates, Russell H. Baum responded for the new members. The speaker of the evening was Dr. Charles H. Mills, director of the school of music.

Elsewhere in this issue will be found the names of the initiates.

ENGINEERS PLAN EXHIBITS FOR WISCONSIN CENTENNIAL

As a part of the activities in connection with the centennial celebration of the founding of the territory of Wisconsin, the various departments of the College of Engineering are planning to construct exhibits of general interest to the public. The exhibits will be set up in the Mechanical Engineering building between June 27 and July 5 and will serve to show the people of the state some of the things engineering students do here and how the subjects taught are linked with practical applications.

All of the branches of the college are at work forming plans, but the electricals are the only ones who could be found who have a tentative outline of their exhibit.

The electrical engineering department is planning to show laboratory pictures and some of the interesting experiments performed in lab courses. There will probably be: some display of the various effects produced by electricity — heating, lighting, and the like; a wave form demonstration—showing wave forms produced by different pieces of apparatus on a cathode ray oscillograph; an exhibit of electrical conduction in gases as shown by a thyratron or photoelectrically controlled device; something from the communications lab indicating the progress in that field; insulation and high tension exhibits; an illumination layout showing the effects of various operating conditions on electric lights; also perhaps an exhibit from the standards lab with the set-up used in some of their tests. Publications by the faculty will be posted, together with information as to their availability.

The exhibits are, of course, just in the formative stage and will undoubtedly be changed or varied before the exhibit takes final form, but they serve to indicate to some extent what will be done.

Anybody in the city between June 27 and July 5 will find much to interest him in the Mechanical Engineering building.

RESEARCH CONFERENCE

About 40 persons attended the final research conference of the year, held in the Mechanical Engineering building, May 5.

The program contained these papers:

"The Drying of Granular Solids" by Norman H. Ceagelske.

"The Relation Between the Helix Angle and the Efficiency of Worm Gearing" by Thomas P. Colbert.

"Recent Developments in the Activated Sludge Sewage Treatment Process" by Lewis H. Kessler.

Prof. J. B. Kommers is chairman of the research committee which arranges these programs during the year.

POLYGON

Wayne T. Hunzicker, Min.3, was elected to the presidency of Polygon Thursday evening, May 7. He will, assisted by Secretary Paul F. Andree, M.E.3, and Treasurer Edwin J. Voss, C.E.3, guide next year's engineers in their social activities. We wish Polygon the most successful year in its history.

To the Polygon men graduating this June, we give a vote of thanks. Especially ought all of us to be aware of the admirable diligence and loyalty of Gilbert Nieman, Carl Matthias, and Joel Hougen. We owe, also, a debt of gratitude to Mr. Kurt F. Wendt —no one could have been more helpful.

Thank you, and good luck to all of you.

CHI EPSILON

Thursday evening, April 2, Chi Epsilon, honorary civil engineering fraternity, initiated five new members. Prof. L. H. Kessler was toastmaster, Eldon C. Wagner welcomed the new members, and the response for the initiates was given by Robert E. Stiemke. The address of the evening was given by Dean G. C. Sellery of the college of letters and science.

The names of the initiates are given elsewhere in this issue.

TAU BETA PI

Thursday evening, April 16, Tau Beta Pi, honorary engineering fraternity, initiated 13 new members. The toastmaster was Prof. Gordon F. Tracy, Earl F. Senkbeil welcomed the new members, the response for the initiates was given by Neal D. Olson. Prof. Charles F. Gillen of the French department was the speaker of the evening, speaking on the appreciation of literature. He expressed the idea that men of all professions can enjoy poetry and showed the engineers how close poetry was to their own work.

Elsewhere in this issue are the names of the initiates.

SURVEYORS GET THEODOLITES

During the winter, Prof. Ray S. Owen came into possession (how is another story) of two theodolites of foreign manufacture, one of which saw service in the German trenches during the war. It was used for following the courses of small observation balloons. The horizontal and vertical verniers are arranged so that they are side by side and a picture can be taken of them, showing their readings, by merely pushing a button which operates a built-in camera.

CONFERENCES

One of the largest and most successful conferences ever put on by the Mechanical Engineering department was the Solid Fuels and Domestic Stokers conference held April 21, 22, and 23. Five hundred and thirty-one men from all over the country, leaders in their field, registered for the conference.

Prof. L. A. Wilson was in charge of all arrangements.

Another conference held recently was the Diesel Power conference, May 6 and 7. One hundred and thirty-one men registered for the programs.

The conference was in charge of Prof. G. C. Wilson.

ALUMNI NOTES

Electricals

BOHMAN, ROBERT B., '23, is engaged in the real estate and mortgage business with McKey and Poague, 5300 Blackstone Avenue, Chicago.

CADBY, JOHN N., '03, E.E. '07, besides carrying on a consulting engineering office, acts as director of research for the Klau-Van Pietersom-Dunlap Advertising agency in Milwaukee.

GUTH, SYLVESTER K., '30, serves as research engineer for the General Electric Company. He and his wife, Beryl Van Deraa Guth, '32, are residing at 15998 Nelacrest, E. Cleveland, Ohio.

LEMMER, VERNON E., '26, has a position with the Wisconsin Telephone Company and is located in Milwaukee.

TEARE, WILLIAM H., '31, was numbered among those 43 General Electric employees who received the Charles A. Coffin Foundation award for 1935. This award is the highest award a GE employee may receive. It is given in recognition of service to the company and to the electrical industry. At present, Teare acts as an engineer in the vacuum tube engineering department, located at Schenectady, New York.

BAUMGARDT, WALTER C., '35, has employment in the engineering department of the D. J. Murray Mfg. Company, located in Wausau.

BRUEGGEMAN, LESLIE T., '32, writes that he is employed in the engineering department of the Lexrope division of the Allis-Chalmers Manufacturing Company of Milwaukee.

CLARK, JACK M., '34, acts as service manager for the Westinghouse Distributor at 114 East Main St., Madison.

CREGO, JOHN, '34, works for the Gisholt Machine Company of Madison as a draftsman.

ENGHOLDT, RICHARD K., '33, began working for the Milwaukee Gas Specialty Company of Milwaukee on March 30 last. He writes that, although the work is not electrical, he believes that it will be very interesting.

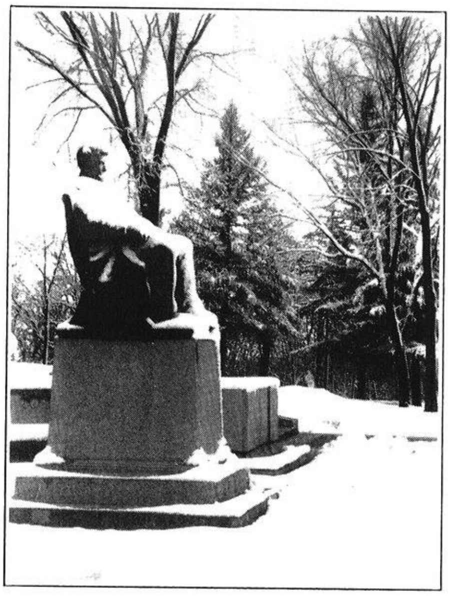
NAYSMITH, STANDLY R., '36, has employment with the Miller Company of Meriden, Connecticut. He acts in the capacity of assistant engineer.

THOMAS, ROY E., writes that he is returning from Poland this month to spend his vacation in the United States and expects to drop in at Madison some time after the first of June.

Miners and Metallurgists

BEECHEL, GRAYDON, '36, has established himself with the Mountain City Copper Company of Mountain City, Utah, where he acts in the capacity of assistant engineer.

COLE, IVAN L., '30, who is an engineer with the Luedtke Engineering Company of Frankfort, Michigan, recently paid the department a visit. This summer he expects to be employed by the government in the building of a breakwater at Kewaunee.



GALLISTEL, ALBERT F., JR., '35, begins work for the Leeds and Northrop Company of Philadelphia on June 1. He will spend nine months in the factory itself, acquainting himself with the products manufactured by the above company, with the view of going into the sales end as a sales engineer.

GILLETTE, JOHN B., '34, was married to Lulubelle Chapman, '34, of Berlin, Wisconsin, on April 14. At present he is employed as plant engineer for the Libby, McNeill and Libby Company of Houston, Delaware.

GOFF, IRA N., Ph.D. '28, visited the department during the recent "Miners" reunion in April.

HORTON, WILLIAM H., '35, a junior engineer with the Aramayo de Mines of La Paz, Bolivia, acts in the capacity of shift foreman for his company's Telemayu mill. Horton has worked as a sampler and underground foreman at the Animas mine, while at present he is operating the Telemayu mill as a tin and silver mill.

HUGHES, ROBERT W., '15, has been appointed mine superintendent of the Miami Copper Company. After graduation he joined the engineering staff of the Inspiration Consolidated Copper Company, located at Miami, Arizona. In 1924 he accepted the position of chief mine engineer for the Miami Copper Company and in 1926 advanced to assistant mine superintendent. The latter position Hughes held until his recent promotion.

MATTEK, LAWRENCE J., '35, visited Madison during the recent "Miners" reunion. At present he is in the employ of the Wisconsin Steel Company, South Chicago, Illinois, where he acts as an inspector of open hearth practice. His address is 7456 S. Shore Drive, Chicago.

PATERICK, HENRY R., '32, became a benedict on February 22 at Madison. He married Helen G. Morse, '36, of Madison. Mr. and Mrs. are making Detroit their home.

TURNEAURE, F. STEWART, '21, chief geologist for Patinio Mines and Enterprises, Ltd., Llallagua, Bolivia, visited the department during the recent "Miners" reunion. He expects to spend a few months' vacation in Madison, having recently just completed his second contract with the above company, before beginning his third contract in Bolivia.

Chemicals

DARBO, HOWARD, '32, is practicing law with the Rochester Legal Aid Society of Rochester, New York, and hopes to get into patent law in the near future.

FLUCK, WILLIAM Z., '35, works for the Illinois Steel Company at South Chicago. His work has mainly to do with the taking of pyrometric observations on steel ingots.

HAIGHT, WAYLAND Z., '34, acts as vice-president of the Sprayit Sales Company of Milwaukee. He writes that business seems to be decidedly picking up.

HARR, RUSSELL, '32, has a position with the General Motors in their plating department.

JUSTL, OTTO, '34, is employed by the Wisconsin Power and Light Company at Fond du Lac in their gas plant. He is doing a variety of different types of jobs among them being tests on fuels and products.

KERNJACK, ANTHONY, '34, acts in the capacity of an engineer for the Trane Company of La Crosse. He has been estimating and designing air conditioning systems and is to be transferred to a branch office this spring where he will act as a sales engineer.

MARTIN, HERBERT, '32, was married December last to Miss Helen Marr Love of De Ridder, Louisiana. Martin at present is the chief chemist for the Southern Kraft Corporation's Bastrop Mill, located at Bastrop, Louisiana.

MENNERICH, FRED, '32, serves as microscopist for the United States Testing Company. His address is 3-5 Potter Place, Weehawken, New Jersey.

MOCZEK, STEVE, '34, works for the Libby, McNeill and Libby Company of Morrison, Illinois. He is engaged in their general laboratory doing new products research work.

MOHR, JOHN, '32, represents the Chromium Corporation of America (Chicago) in Green Bay.

PELTON, GLENN, '34, is on duty with the United States Army at Fort Sheridan, Illinois.

RUMMELE, ROBERT, '32, holds down the position of superintendent for the Schreier Malting Company of Sheboygan. He says that he is enjoying life exceedingly, except for some pitot tube air-flow measurements.

SOBOTA, JOHN, '32, is running Fort Howard Paper Company's laboratory up in Green Bay.

TOCK, WILFRED H., '35, was a recent weekend visitor to Madison. The Engineer's former business manager said that he is still in his home town, Appleton.

TRELEVEN, HARRY, '33, was married in February to Miss Louise Langemo of Stoughton. At present Lieut. Treleven is stationed at Phillips, Wisconsin, as executive officer of the 6664th Company, CCC.

WILLIAMS, G. C., '32, has the job of developing chemical engineering courses down at Mississippi State College, where he acts as an instructor in chemistry.

WUSTRACK, OTTO, '34, is employed by the Centralab of Milwaukee where he is doing research on volume control for radio and television, besides specific development of lacquer bodies and ink pastes.

YOUNGCHILD, KENNETH, '34, serves as a chemical engineer for the International Paper Company, located at Glens Falls, New York. His work has to do with the research division of the above company.

Civils

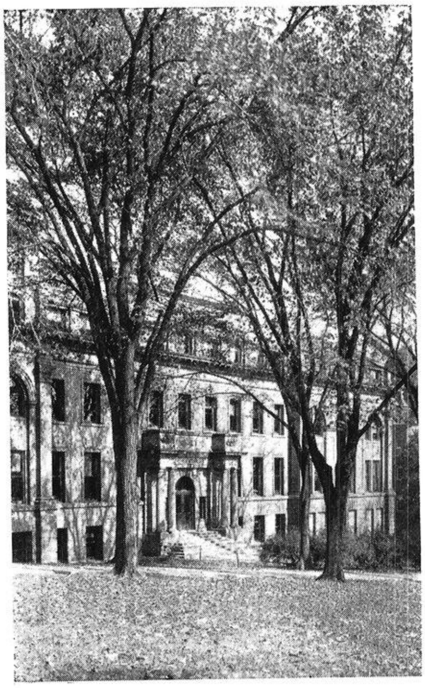
BLIFFERT, WESLEY P., '29, is with the Tews Lime & Cement Company of Milwaukee. He is in charge of the ready-mixed concrete plant.

BROWN, EDWIN S., '08, died late this winter at his home in Bloomington, Illinois, as a result of injuries he sustained in an automobile accident in February, 1934. After his graduation from the university he pursued his profession in engineering, and in 1918 he took a position with Campbell Holton Company of Bloomington. For the last three years he had been associated with the publishers McKnight and McKnight.

BUSH, WILLIAM L., '35, was married on February 1 to Winifred M. Shirk of Madison, Phy. Ed. '35. Bush has been working with the Wisconsin Highway Commission at Green Bay.

CONNELLY, ROBERT, '16, of Appleton, was elected president of the Engineering Society of Wisconsin at their last annual convention.

ENGELHARDT, ROBERT L., '34, has been with Allis-Chalmers Company since July, 1935, taking the student course.



FIELD, GEORGE H., '25, was appointed chief regional engineer for 10 mid-west states for WPA on May 1. His headquarters will be in Chicago. He has been deputy administrator for WPA in Wisconsin.

HERMANSEN, EVALD, '34, on April 1 received appointment under civil service as assistant topographic engineer with the Army Engineers at Fort Humphries, D. C.

HINTZ, ALFRED H., is employed by the United States Geological Survey as a junior topographical engineer. Prior to this he had done topographic mapping, been plane table operator for torsion-balance and seismograph parties in Venezuela, S. A.

LA CHAPPELLE, HARRIS A., '35, has been engineer with the Green Bay and Western Railroad since February 1.

McDONALD, ROY S., '33, works for the Wisconsin Highway Commission, Division No. 6, out of Eau Claire, as a junior assistant highway engineer.

MATTHIAS, FRANK, '30, former editor of the **Wisconsin Engineer** and instructor in topographical engineering at the university is now commanding officer of the 957th Heavy Pontoon Battalion, being stationed at Fountain City, Tennessee. In this capacity he is working and cooperating with the TVA.

WHEELER, EARL W., '32, acts as camp superintendent with the United States Department of Agriculture Soil Conservation Service at Ellsworth, Wisconsin.

Mechanicals

ANDERSON, CHESTER B., '34, who has been an assistant in the purchasing department, has been promoted to the newly established production planning department of Packard Motor Car Company of Detroit, Michigan.

BARNEY, EDWARD, '35, has secured a position at the Chain Belt Company of Milwaukee.

BROWNLEE, FRANK R., '08, died at his home in Minneapolis recently of pneumonia. For the past 20 years he had been associated with the Minneapolis-Moline Power Implement Company. Surviving him are his wife and two children.

COLLADAY, EDGAR B., '08, is lieutenant-colonel in the Coast Artillery and senior instructor in Coast Artillery at the United States Military Academy, West Point, New York.

EHLERS, G. F., '35, of Neenah, Wisconsin, died of pneumonia on April 8. He was connected with the Four Wheel Drive Company, of Clintonville, Wisconsin.

HOGAN, BRAYTON W., '33, is working as a draftsman at the Gardner Machine Company of Madison.

JORGENSON, GERALD, '31, is now engaged as an assistant engineer at the Phoenix Hosiery Company of Milwaukee.

PORTH, WALTER, '23, has a position with the Bucyrus-Erie Company, acting as their export representative. He spends his time commuting on the east and west coasts of South America.

THORKELSON, HALSTEN J., '98, M.E. '01, long associated with the Kohler Company of Kohler, Wisconsin, was recently elected to the firm's board of directors.

VAN RYZIN, WILLIAM J., '35, has transferred from service with the marines and is now a member of the United States embassy guard in Peking, China.

VAN VLEET, JAMES, '33, has accepted a position with the Linde Air Products Company, subsidiary of the Union Carbide and Carbon Corporation.

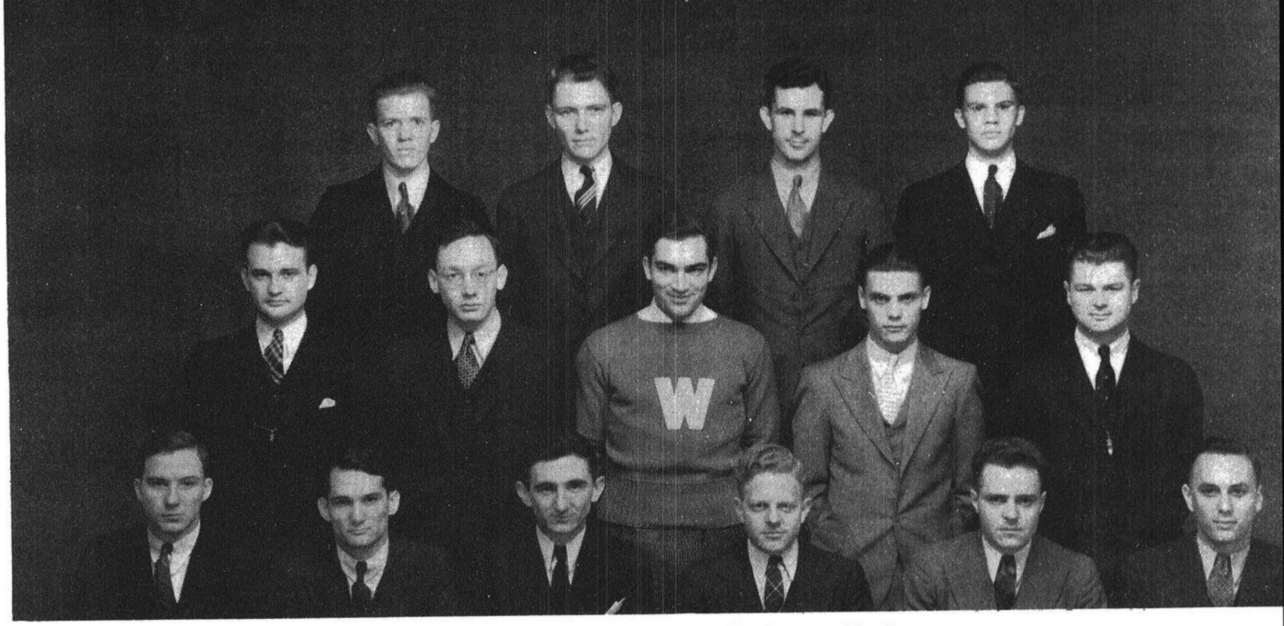
WOJTA, A. J., '32, has been promoted to the position of supervisor of machines in the Soil Conservation Service. He is designing a machine to chart the rainfall in various districts for a comprehensive erosion project now being undertaken.

OUR CAMPUS— Lovely in the WINTER

Bascom Hall

A Typical Campus Winter Scene

What The Frosh Look Forward To - - - - -



Top Row: Anderson, Stiemke, Liebmann, Eppler.
Middle Row: Johnson, Luecker, Leopold Jensen, Ter Maath.
Bottom Row: Matthias, Shipman, Rohlich, Wagner, Peters, Voss.

chi epsilon

Honorary Civil Engineering Fraternity

CLASS OF 1936

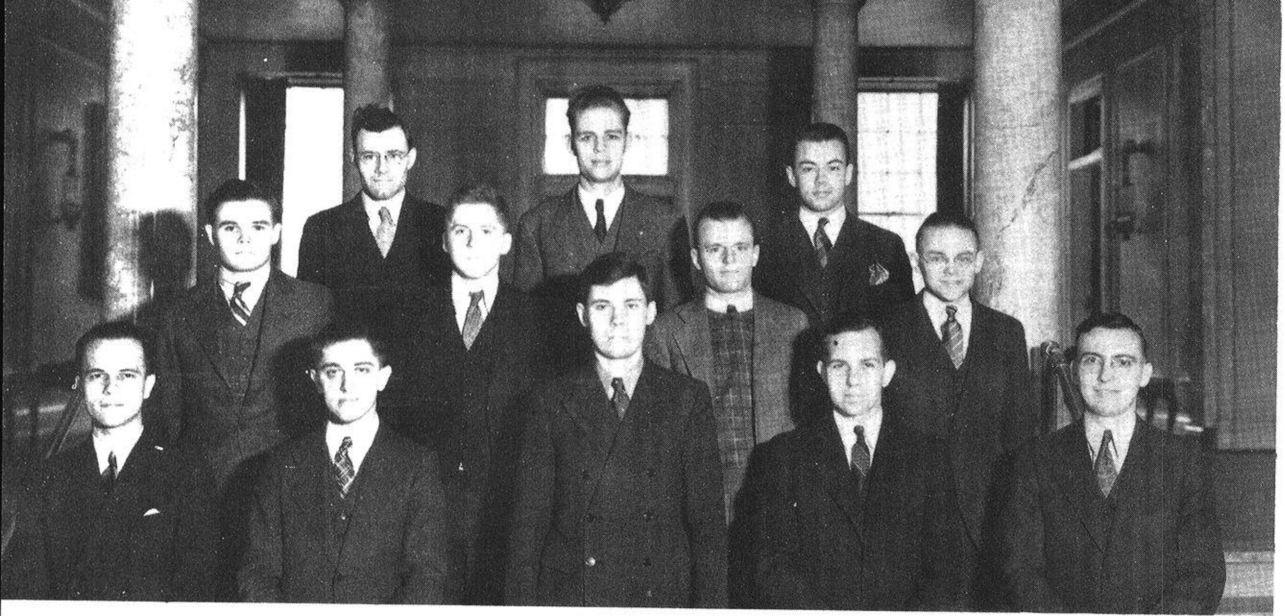
Boyd Anderson
Lee Crandall
Luna Leopold
Hoachim Liebmann
Carl Matthias
Reinhardt Peters
Gerard Rohlich
John Shipman
Robert Stiemke
Bernard Ter Maath
Eldon Wagner

CLASS OF 1937

John Eppler
Howard Jensen
Wayne Johnson
Edwin Voss
Arthur Luecker

Founded 1922
University of Illinois
13 Chapters

Local Chapter
Wisconsin
Established 1925



Top Row: Wallace, Riggert, Kraemer.
Middle Row: Schultheiss, Hafstrom, Heinrichsmeyer, Davis.
Bottom Row: Kopenitsi, Perschbacher, Peterson, Davis, Hertel.

eta kappa nu

Honorary Electrical Engineering Fraternity

CLASS OF 1936

J. B. Davis
Richard Davis
Roland Hertel

Willis Kraemer
Chris Kopensitsi

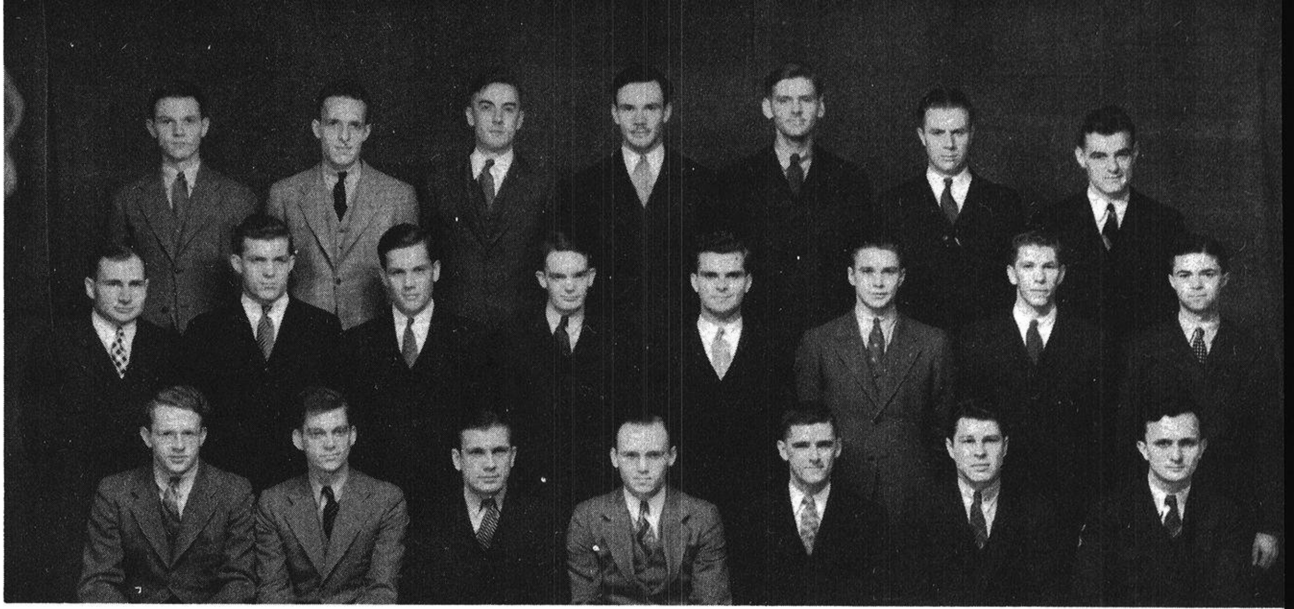
Howard Perschbacher
Donald Peterson

CLASS OF 1937

William Hafstrom
Edwin Heinrichsmeyer

Herbert Luoma
Marvin Riggert

Earl Schultheiss
Everett Wallace



Bottom Row: **Gother, Daggett, Losse, Wefel, Thomas, Behrens, Beyer.**
Middle Row: **Myers, Cole, Sohns, Lawrie, Nikora, Baum, Faust, Gross.**
Top Row: **Caldwell, Spence, Noyer, Burroughs, Stuewe, Griffith, Rosecky.**

pi tau sigma

Honorary Mechanical Engineering Fraternity

CLASS OF 1936

Arnold Beyer
James Cadwell
Allan Cole
Edward Gross
Leo Nikora
Herbert Stuewe
John Thomas

CLASS OF 1937

Russ Baum
Charles Behrens
Charles Burroughs
Ronald Daggett
Donald DeNoyer
Edward Faust
William Gother
Leroy Griffith
James Lawrie
Robert Losse
John Myers
Edward Rosecky
Carl Sohns
Ellison Wefel

Founded 1915
Universities of Wisconsin
and Illinois
15 Chapters

Local Chapter
Wisconsin Alpha
Established 1915

Top Row: Liebmann, DeNoyer, Riggert, Burroughs, Griffith, Scheer, Parrott.
Second Row: Olson, Williams, Stubbings, Davy, Nieman, Kraemer.
Third Row: Johnson, Kaufman, Luecker, Mayland, Nikora, Gother, Hertel.
Bottom Row: Fontaine, Davis, Halamka, Senkbeil, Rohlick, Liska, Kopenitsi.

tau beta pi

Honorary All-Engineering Fraternity

CLASS OF 1936

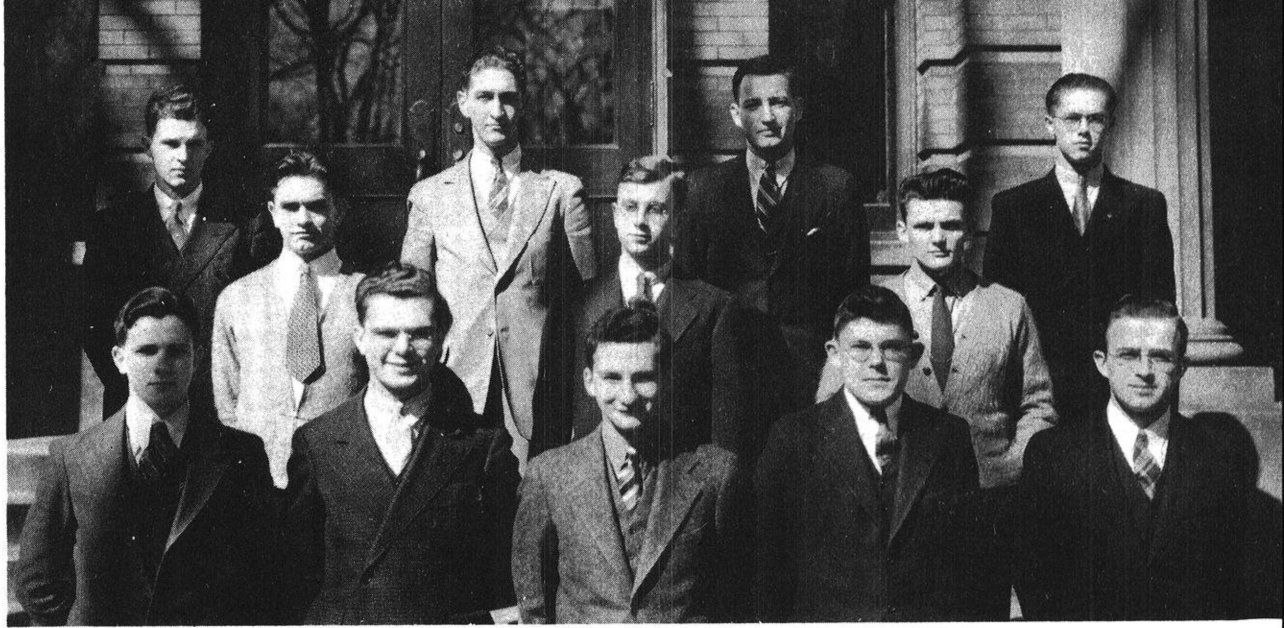
James J. Cadwell
Allan W. Cole
Richard E. Davis
James A. Gillies, Jr.
Donald H. Gordon
William F. Gother
Charles J. Halamka
Roland F. Hertel
Howard G. Holm
Kermit Johnson
Hershel E. Kaufman
Chris T. Kopenitsi
Willis F. Kraemer
Luna B. Leopold
Joachim E. Liebmann
Joseph A. Liska
Gilbert O. Nieman
Leo S. Nikora
Howard Perschbacher
Gerard A. Rohlick
Wilmer P. Scheer
Earl F. Senkbeil
Russell H. Stubbings
Eldon C. Wagner
Robert E. Whiteside
Tom J. Williams

CLASS OF 1937

Charles W. L. Burroughs
Philip S. Davy
Donald B. DeNoyer
John F. Eppler
Francis E. Fontaine
Leroy W. Griffith
Arthur R. Luecker
Harrison C. Mayland
Frank W. Parrott
Neal D. Olson
Marvin C. Riggert
Gerald J. Risser

Founded 1885
Lehigh University
67 Chapters

Local Chapter
Alpha
Established 1899



Top Row: **Wilson, Jorgensen, Holm, Stanley.**
Second Row: **Sheerar, Ketchum, Antisdel.**
Bottom Row: **Leviton, Nikora, Alexander, Herning, Whiteside.**

wisconsin engineer

L. S. NIKORA
Editor

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The WISCONSIN ENGINEER

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Member Madison Association of Commerce

△

Founded 1896

NIKORA

ALEXANDER

our report

....polygon

Well, fellows, the two year test of the Polygon Plan is over. And you have to admit that the plan proved itself an excellent one. We've spent a great deal of time and energy in its administration these past two years, and now, as your representatives, we report the following:

The Polygon Plan is a fine thing. It lifts a tremendous load from the minds and backs of the students who run your WISCONSIN ENGINEER, your dances, smokers, societies, and parade. It lessens the expense per individual. It gives group solidarity to the engineering students. It provides opportunity for student participation in extra-curricular activities and promotes the interchange of ideas between faculty and students on an informal basis.

Our experience with the plan, during the past two years indicates you should continue to use it after you made these two amendments:

1. The Activity Fee should be collected only once during the school year —$2.00 at the start of school in September, with adequate provision for refunds to students who withdraw from the university.

2. Since the Ag Engineers, a small, isolated group of students, take a course very nearly like the Mechanical Engineering Course, you should admit them to Polygon — they have several times asked us to consider this.

FINANCIAL STATEMENT OF POLYGON
2ND SEMESTER, 1935-36.
As of May 8, 1936.

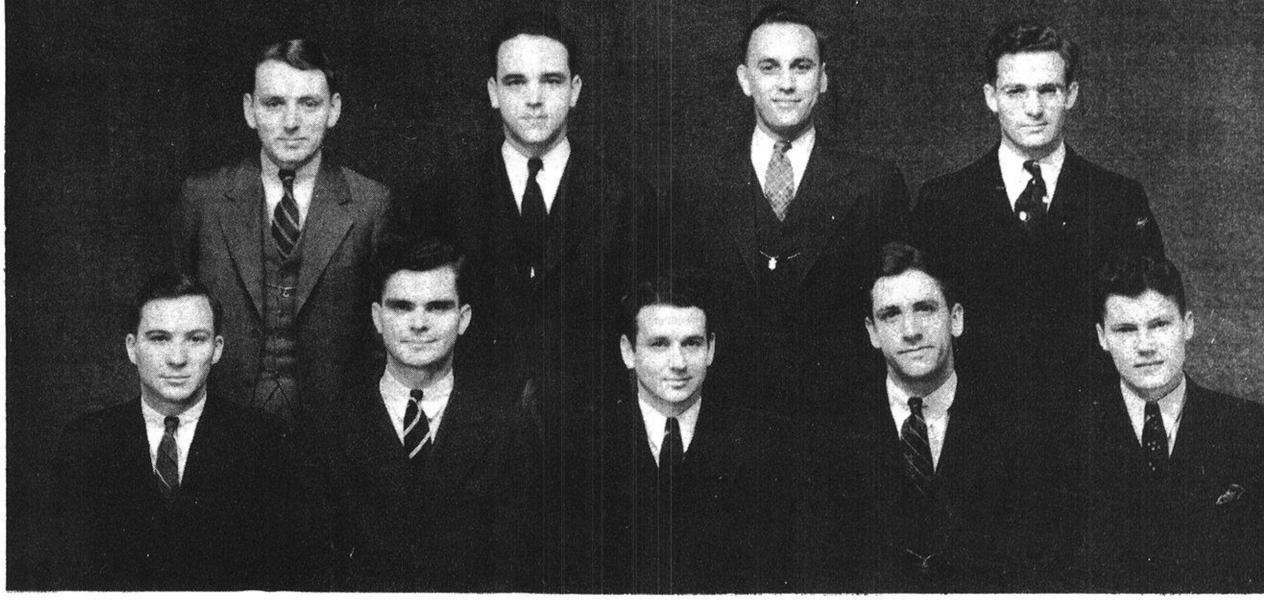
Balance from 1st Semester		$139.96
Income 2nd Semester:		
Fees:		
354 students @ $1.00	$354.00	
10 faculty @ 2.00	20.00	
Total from fees	$374.00	
Dance	38.70	
St. Pat elections	47.29	
Total Income		$459.99
Total		$599.95
Disbursements:		
Societies:		
A. I. Ch. E.	$ 22.20	
I. I. E. E.	23.70	
A. S. C. E.	24.60	
A. S. M. E.	26.40	
Mining Club	9.60	
Research Fund	6.00	
Wisconsin Engineer	187.00	
Expenses	219.82	
Total		$519.32
Balance		$ 80.63

Respectfully submitted,
JOEL HOUGEN,
Polygon Treasurer.

May 8, 1936.

The reasons for collecting the Activity Fee but once a year should be readily evident to you. The main reason is that the number of students paying their activity Fees the second semester is smaller than that paying the first semester. That slump should be done away with. Moreover, by a single solicitation of the fees, cumbersome bookkeeping is eliminated, a definite budget can be set up at the beginning of the school year, the difficulty of contacting the whole student body need be gone through but once during a year, and the social events can be planned and run better.

Sometime during the latter part of this May, Polygon will distribute ballots amongst you. We urge you to vote in favor of the two above mentioned amendments. You owe it to yourself and to the students of the future.



Top Row: Andree, Friess, Voss, Sargent.
Bottom Row: Matthias, Nikora, Hunzicker, Nieman, Hougen.

polygon

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Treasurer . . . . Joel O. Hougen
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Earle A. Sargent

Civil Engineering
Carl D. Matthias
Edwin J. Voss

Electrical Engineering
Oscar L. Welker
Robert W. Friess

Mechanical Engineering
Leo S. Nikora
Paul F. Andree

Mining Engineering
Gilbert O. Nieman
Wayne T. Hunzicker

Polygon is a central committee governing the activities of the engineers. It is composed of ten men, a junior and a senior from each of the five branches of the Engineering College. Every year, the engineering societies elect one sophomore, who, on becoming a junior, is admitted to Polygon. Thus, each branch of engineering is perpetually represented by a junior and a senior.

The engineers are fast becoming a larger and more closely knit group. The main purpose of Polygon is to coordinate the activities of the engineers. Thus, by assessing each man a dollar every semester, Polygon gives him membership in his respective society, pays part of his dues to the national chapter, and runs two dances and two smokers during the year.

Polygon also appropriates money to partly finance the Wisconsin Engineer Magazine, a subscription to which Polygon gives each paid member. Polygon also takes charge of the St. Pat's Parade, which was highly successful this year.

a senior sermon
by the editor

So we've been through the mill—four years of it. And now that we're here, we feel a bit preachy. We'd like to stir up a few thoughts in the minds of the undergraduates we leave behind us. Think you can stand it? (The following little dissertations are the results of a good deal of serious thought by the seniors who are about to step out "into the great big world.")

First of all, let us say that we are glad we studied engineering. It was a long, hard, road—especially that Junior year—but we're pretty glad we lasted it out. We have an excellent training academically, as well as a fine coaching in mental discipline. If a problem is given us, we not only have the proper mental attitude toward it, but we also know how to go about determining a solution. Those two assets alone are enough to convince us that, if we had our lives to start over again, we'd go into engineering.

Yes, we know how locomotives run, why the electric clock works, how to repair the kitchen faucet—in fact, we have a beautiful knowledge and understanding of almost everything around us. But some of us can see that we did not go at this education of ours in the best possible way. We'd like you to know what we think ailed us—maybe it would help you. For one thing, some of us did nothing but study all the time. We didn't spend enough time learning how to talk and dance with the boss's wife. When the interviewers from the various corporations in the country came to speak with us, we hardly knew how to act when we stood before them. We didn't have the slightest idea of how to sell ourselves. A lot of us thought that a couple courses in speech would have been a tremendous help to us. But then, we ruefully recall, we took our electives in the engineering departments. So now we realize that we should have made a special point of getting this "social engineering" education while we were here. Especially when we are fortunate enough to be attending a co-educational institution such as this university. We can see, now, that we should have gone on more dates while we were in school. If we had gone to more movies and had read more non-engineering books, perhaps we could now talk more easily and interestingly to people. Why didn't we learn to speak of artists and musicians when we had the Memorial Union Art Exhibits and Sunday Concerts right next door?

The subject of health is another thing that used to get us going every now and then. As interested as we are in efficiency, we still don't seem to have brains enough to take care of our bodies. We can tell what ails the family car just by the noise it makes; and we can fix it up, too. But woe are we when we have an ache or a pain. We used to get up every morning around seven and then not get to bed until midnight. And most of us were more foolish than that. Now, when we look back at the whole thing, we see that all the education in the world wouldn't have been worth a hang if we'd have ended up in a hospital. 'S funny how a fellow finally wakes up all of a sudden.

Most of us wish we had had enough sense to get into outside activities of some sort or another. This campus certainly is full of them. But about all we did, far as activities were concerned, was watch the other fellow do the work. It's nettling to recall how much he seemed to be getting out of it, too. Most likely, also, we hate to have nothing to write in the activities spaces of the application blanks we have been fortunate to have handed to us.

Another thing that rankles quite a bit is the sight of "what some of our worst dressed engineers are wearing." We remember that we couldn't very well wear a white shirt to shop, but we ought certainly have tried to look decent the days we had no shop classes. A lot of us have no idea what some of our classmates would look like in a suit. And where are all those neckties that we are all cursed with every Christmas and birthday? The way we feel about clothing now is that college is the proper place to learn how to match ties and suits. After all, the way you'll make your first impression on people out in the business world is by your appearance.

Guess all of this must sound like a call for you to stop going to school so you can get an education. We don't want to convey that idea to you. School work is the first thing. That is the reason for your being here. That is why we came. But we found out that we have been a bunch of time wasters. We could have done a lot more than we did. Of course, we would have had to do school work under some pressure, but that often is a good thing. Indeed, most of us have discovered that we can do a mountain of work in a comparatively short time if we are close pressed. The idea we would have you see is that you, like many of us, may be spending your money and time in school and not be getting out what you put in. You ought to live your whole school life to the full. Take all that comes your way. You're here—now get down to enjoying it. All of us should be blessed with a bit more of the Epicurean philosophy.

In the final analysis, what are you here for? That can most beautifully be answered by our own President Glenn Frank in these words:

"The University of Wisconsin is dedicated to the development and discipline of the free mind of the first class man, the major marks of which are:

"The free mind of the first class man knows no loyalty that should take precedence over loyalty to the truth which it seeks to see clearly and without bias in the dry light of facts.

"The free mind of the first class man resists enslavement to passion, to prejudice, and to partisanship, brings to the bar of disinterested judgment the pleas of all parties and all powers, and ceaselessly searches out the motives that coin the catch-words of all classes and all cliques.

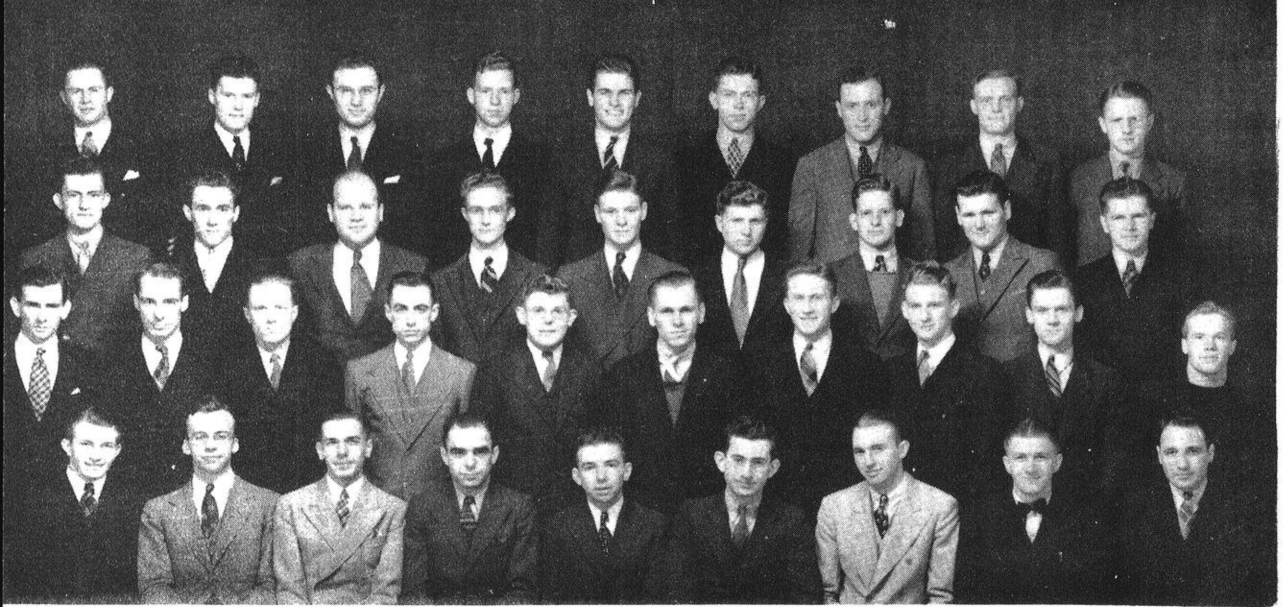
"The free mind of the first class man turns a deaf ear alike to democracy when it grows sentimental and to plutocracy when it grows selfish.

"The free mind of the first class man is independent alike of tirading minorities and of tyrannical majorities if it happens that the truth abides in neither.

"The free mind of the first class man inspires its motives with sincerity and informs its methods with science.

"The free mind of the first class man, when entrusted with power, is never guilty of saying the thing that will take rather than the things that are true.

"The free mind of the first class man serves the crowd without flattering it and believes in it without bowing to its idolatries."



american institute of chemical engineers

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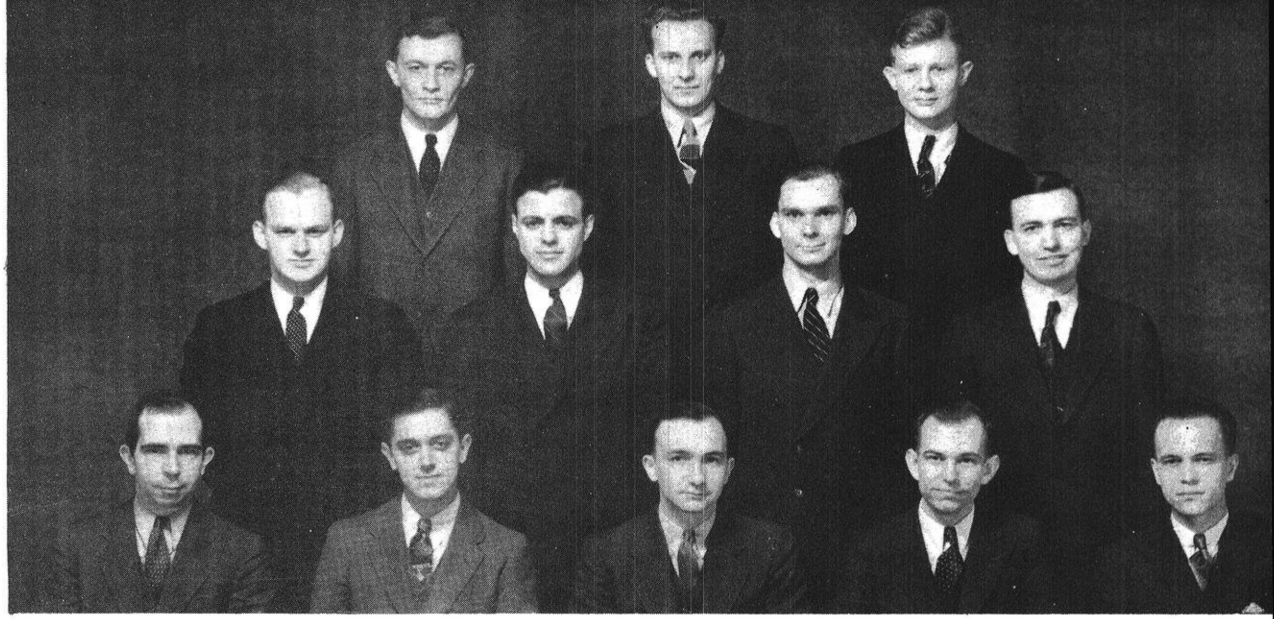
Donald Scheak
Peter Sarocha
Frank Watters

CLASS OF 1939

James Christenson
Andy Johnson
Donald Watters



american institute of electrical engineers

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THEODORE GERLAT

ROLLAND HERTEL

CHRIST KAPENITZI

ALAN LUND

ROBERT OETTING

RALPH PARKER

HOWARD PERSCHBACHER

J. BRYON POWERS

VERNON SCHMIDT

JEROME SCHACKTON

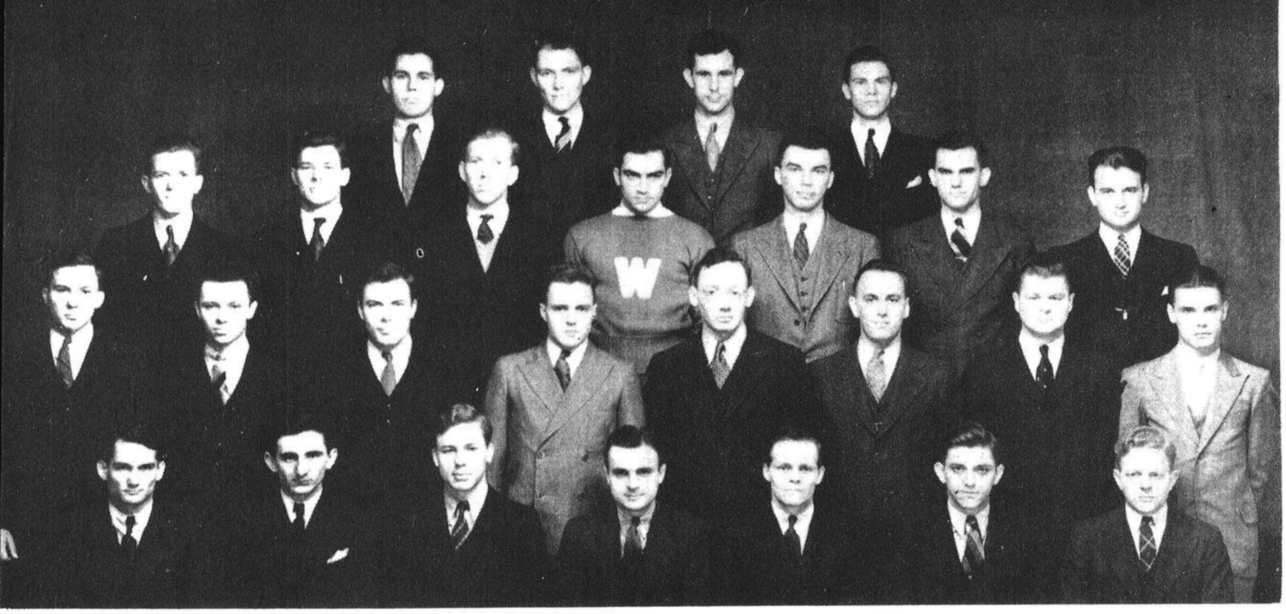
JOHN SOULE

ROBERT SUTHER

MAURICE SWANSON

ALBERT VOLLENWEIDER

OSCAR WILKER



american society of civil engineers

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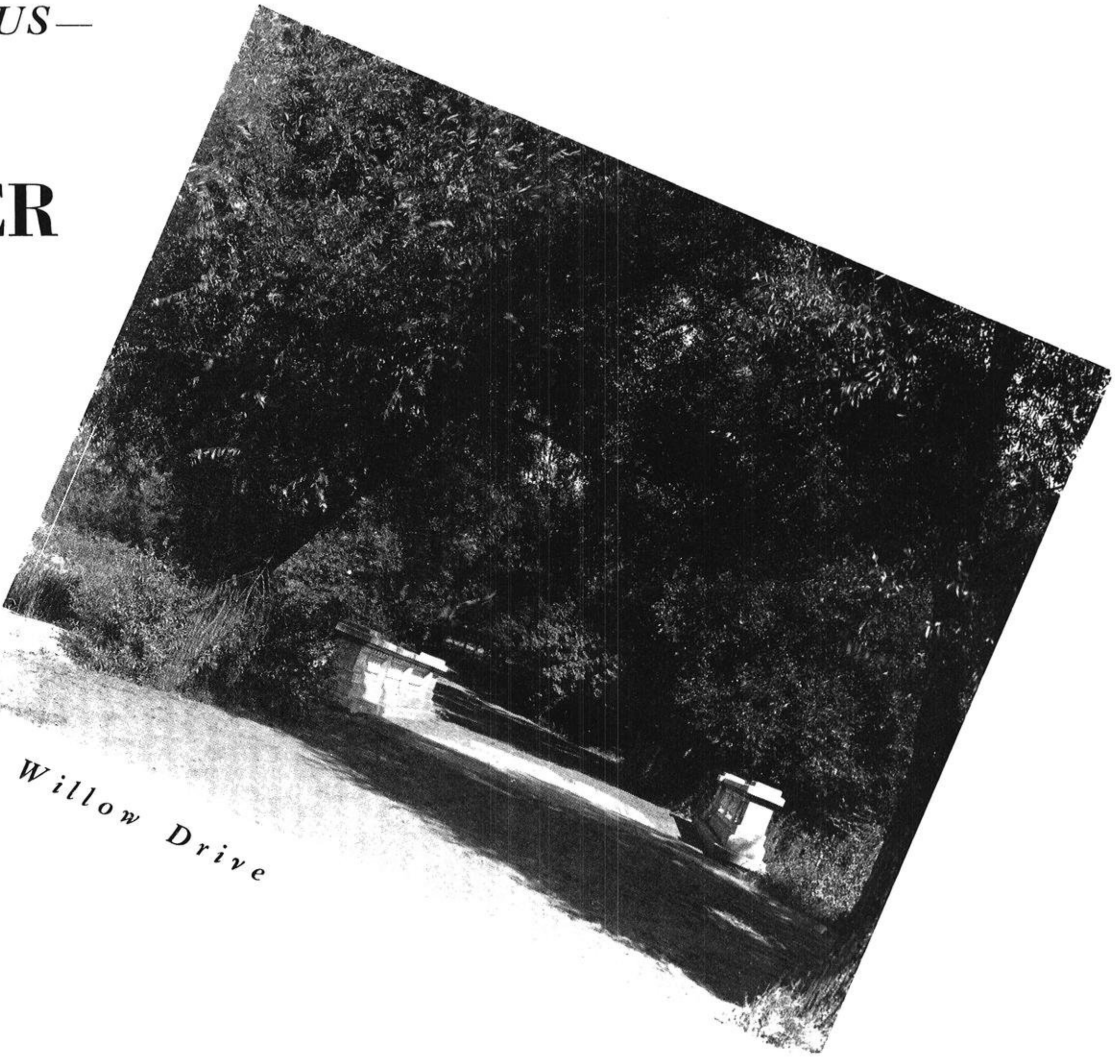
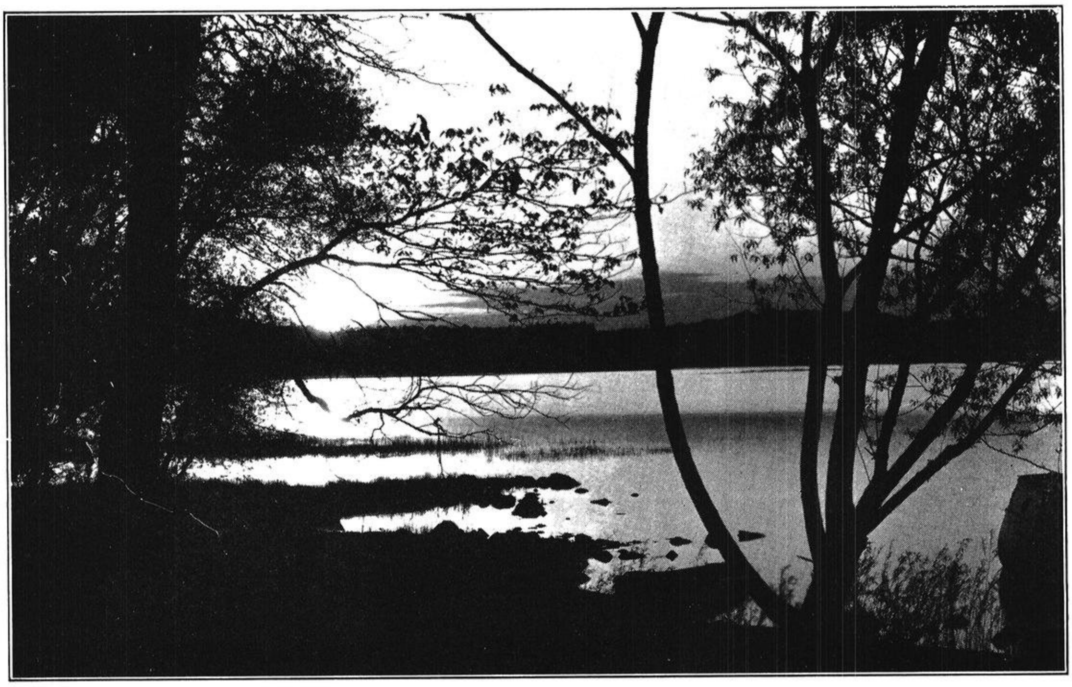
Cedrec B. Wernicke
Frank C. Wiedeman
William D. Zahrte

OUR CAMPUS—
Lovely in
the
SUMMER



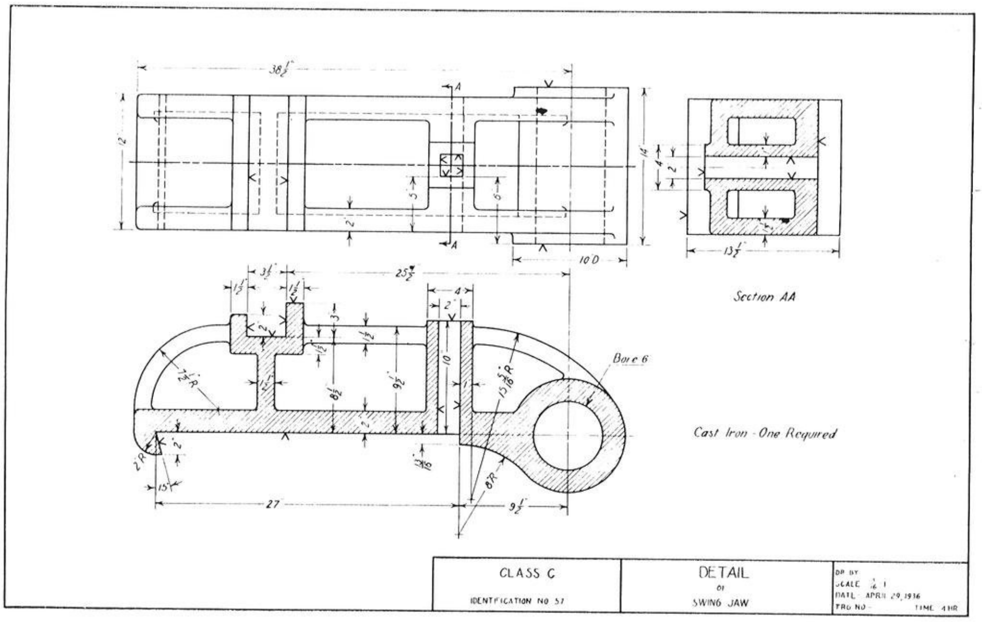
On Willow Drive

Sunset on Mendota



- - - - - - *What The Grads Look Back Upon*

Drawing Contest



THE third annual Wisconsin Engineer Drawing contest, sponsored by Alpha Tau Sigma, honorary engineering journalism fraternity, closed with a 100% increase in entries over last year. The winners were:

First Place—HUGH W. WRIGHT, M.E. 1
Second Place—JOHN J. HUPPLER, E.E. 1
Third Place—CLIFFORD C. VANDER WALL, M.E. 1

Each entrant made a complete working drawing (a pencil mechanical drawing) from a pictorial sketch of a **Swing Jaw.** The sketch merely indicated the nature of the project together with a few key dimensions, the selection of views and complete dimensioning being left to the student making the drawing. An ink tracing made from the winning drawing is reproduced above. Entries were graded under four general headings: technique and theory, accuracy, lettering, and neatness, the first named receiving the greatest weight.

The judges were P. H. Hyland, professor of machine design, W. S. Cottingham, assistant professor of structural engineering, and R. W. Fowler, assistant professor of drawing, Extension Division. The **Engineer** wishes to take this opportunity to express its sincere thanks to the judges for the time and effort they contributed in selecting the winning drawing.

The three prize winners will receive their awards at the Wisconsin Engineer's staff banquet to be held near the end of May.

The prizes are:

First—A Kodak Bantam Camera, donated by the Photocraft, 305 State Street.

Second—An Automatic Pencil, donated by Rider's Pen Shop, 605 State Street.

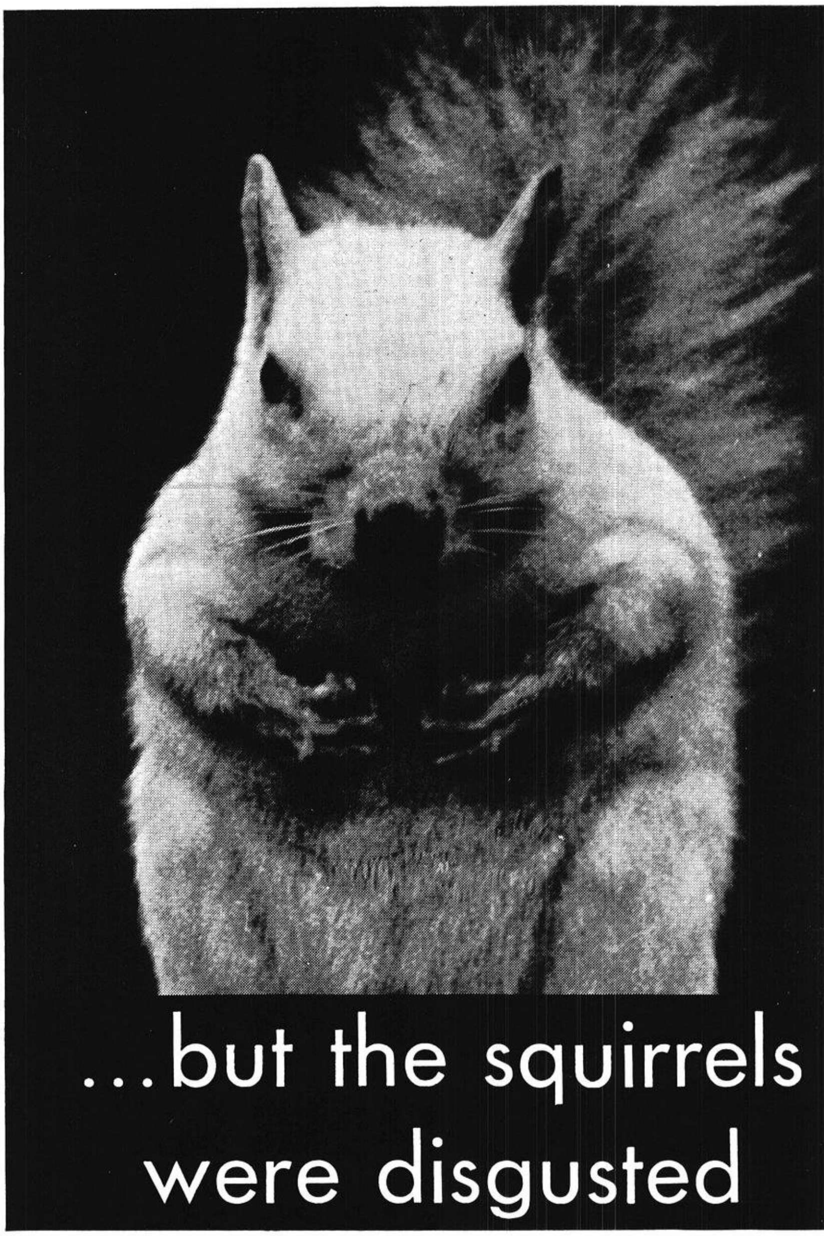
Third—$1.50 in Trade, at the Netherwood Printing Company, 519 State Street.

The manner in which these merchants support engineering activities is greatly appreciated.

The problem used in the **Engineer** drawing contest was furnished by the Society for the Promotion of Engineering Education which sponsors a national drawing contest with several different classifications each year. Only one entry from a school is permitted in each classification and the entries submitted compete with drawings from other schools all over the country. The national winner in each classification gets a certificate indicating his proficiency in mechanical drawing.

Since the drawings entered in the **Engineer** contest meet the specifications for the national contest, one drawing will be selected from them and used as Wisconsin's entry in the national contest. Wisconsin's drawings have done well when entered in national competition, winning a number of first places.

The men who submitted drawings in the Wisconsin Engineering Drawing contest are: Phillip B. Dent, Roger E. Schuette, Jack N. Melcher, Leo J. Fuchs, Dale K. Greenwald, Daniel Jakovich, Hugh W. Wright, George R. Amery, Edward C. Bauer, Jess H. Nourse, Robert H. Bennewitz, George A. Rumstrom, Leo E. Brodzeller, John J. Huppler, Seymour M. Anoff, Clifford C. Vander Wall, Jay L. Burch, Kenneth P. Johannes, Ray Brittan, and Joseph F. Dogby.



TELEPHONE engineers had to find a way to stop gray squirrels gnawing holes in the lead sheath of telephone cables. Even a tiny hole may let in moisture—short circuit the wires—and put a number of telephones out of service temporarily. ℂ Many ideas were tried, but the squirrels gnawed on. Finally the cables were painted with black asphaltum and sprinkled with sand. The gnawing stopped. ℂ Not a major engineering problem, to be sure. But thousands of strange *little* problems, too, have been solved in order to assure you the world's fastest and most reliable telephone service.

Why not call your folks more often? For lowest rates to most points, call station-to-station after 7 P. M. daily or any time Sunday.

BELL TELEPHONE SYSTEM

Early History of Diesel-Electric Motive Power

by **MAURICE C. SWANSON, e'36**

PREVIOUS to the opening of the twentieth century, the steam locomotive was the only successful form of motive power, which, for transportation purposes, reigned supreme for some 80 years — until the arrival of the electric locomotive in 1906. For a time, it was believed that this new rival would replace a great part of the steam motive power; a great program of railway electrification and expansion of electric traction was visualized. Since, however, electric traction has found a very definite field of operation of maximum economic feasibility — namely, on lines of extremely dense traffic and on heavy grade mountain service.

With the development of the internal combustion engine in 1878, there came a second means of producing power. The chief advantage of this type of engine lay in its portability and flexibility, which, at that stage of development, made it a very desirable type of prime mover. From a commercial standpoint, the importance of the internal combustion engine was not realized until it was adopted for the propulsion of automobiles. In 1902, gasoline engines were applied to rail cars by the French Westinghouse Company; in 1905, the McKeen rail car was placed in service in the United States on the Union Pacific Railroad; in 1906, the General Electric gas-electric rail car appeared on the railroads.

The second rival, which appeared about 15 years ago, now a rival to both the steam and the electric locomotive, was the Diesel-electric locomotive. The reason for the advent of the Diesel locomotive was due to the high efficiency of the Diesel engine. This type of engine has shown itself to be the most efficient type of prime mover yet developed. It was, therefore, quite natural that the Diesel locomotive should follow the stationary Diesel engine, just as the Stephenson steam locomotive followed Watt's stationary steam engine, and the electric trolleys and locomotives followed the stationary electric motors.

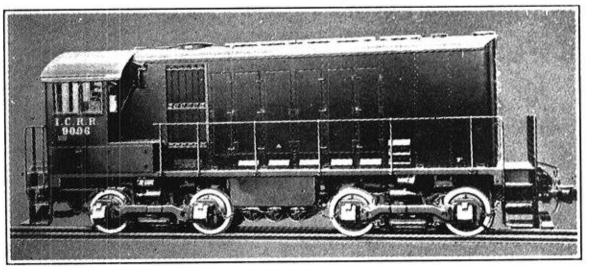
The first Diesel locomotive, in the development of which Dr. Diesel himself took a very prominent part, was built jointly by the Borsig Locomotive Works of Berlin, Germany, and Sulzer Brothers of Winterthur, Switzerland, in 1912. The locomotive had a strength of 1,000 h.p., a 4-4-4 wheel arrangement, and a four-cylinder, two-cycle, single-acting Diesel engine. The cylinders had a diameter of 15″ and a stroke of 21⅝″, and were arranged in a V at an angle of 90°, acting on a jack shaft mounted in the locomotive frame. This shaft was coupled to the driving axles by means of connecting rods, thus producing a direct drive. The engine developed its full power (1,000 h.p.) at a speed of 62 m.p.h., or an engine speed of 304 r.p.m.

About the time the Borsig-Sulzer Diesel direct drive locomotive was undergoing tests in Germany (1913), the first combination Diesel engine with an electric transmission for rail service, a 120 h.p. rail car was built in Sweden by the Swedish General Electric Company (Almanna Svenska Electriska Aktiebolaget) in conjunction with the Atlas Diesel Engine Company (Aktiebolaget Atlas Diesel) for service in the Swedish State Railways. Other Diesel electric rail cars and locomotives from 60 to 300 h.p. capacity were built in Sweden and other foreign countries immediately after.

Recent Development of the Diesel Locomotive

The first Diesel locomotive to appear in this country was built jointly by three companies — Ingersoll-Rand, American Locomotive Company, and General Electric Company — in 1924, and placed in switching service in 1925. The Ingersoll-Rand Company supplied the engine — the first solid injecting engine in this country, which developed 300 b.h.p. at 600 r.p.m. and weighed 63 lbs. per horsepower. The General Electric Company built the direct current generator, four electric traction motors, and the control. The American Locomotive Company built the mechanical parts, including the frame, cab, two swivel trucks, radiators, brake equipment, and safety appliances, and assembled the whole locomotive. The locomotive weighed, completed, about 60 tons and could developed a starting tractive effort of 36,000 lbs. and a continuous effort of 16,800 lbs. at a speed of 4.5 m.p.h. This locomotive was the first of a series of locomotives built by the aforementioned three companies for a number of years.

Since then, the American Locomotive Company has built 34 locomotives of the single and two power types, using Ingersoll-Rand, 300 b.h.p. engines. At present, the American Locomotive Company is building 300 and 600 b.h.p. single power locomotives with engines built by its new subsidiary, the McIntosh and Seymour Corporation. The weights of the new engines vary from 45 to 55 pounds per horsepower, depending upon the service requirements.



A powerful Diesel-electric switching locomotive

—COURTESY AMERICAN LOCOMOTIVE COMPANY

If the lighter type is needed, the engine has a welded frame, some parts being made of aluminum; if higher weights are permissible, the engine is made of cast iron. The fuel consumption of these units is about .4 lbs. of oil of 18,000 B.T.U. per b.h.p. hour.

One important, interesting, and very popular type of locomotive, which was the forerunner of 44 more, was placed in service in 1928 in the dense traffic, switching, and warehouse area on the New York Central Lines in New York City. This type of locomotive, known as the "three power locomotive," was especially designed to operate inside of warehouses, where there is considerable fire hazard, on storage batteries; to operate in the switching district with the Diesel engines; and operate on the 600 volt d. c. electrified lines, taking power through an overhead pantograph trolley and third rail shoes. Thus, this type represents one of the most flexible types yet built, and is economically feasible only in cities where electric traction is very necessary, but complete electrification is inadvisable.

The first Diesel electric freight locomotive to be placed in regular road service on this contingent began operation on the Putnam division of the New York Central Railroad in 1928.

Early in 1929, a passenger locomotive with an identical wheel arrangement was placed in service on the same division; the engine was of the air injection type built by the McIntosh and Seymour Corporation. Both locomotives have operated satisfactorily in regular service, but as yet no plans have been made for the construction of any more of that type.

The General Motors subsidiary, the Electro-Motive Corporation, has recently been experimenting with a two-unit, 3,600 h.p., locomotive, each unit of which is a complete locomotive in itself. A few months ago, the same company completed another two-unit locomotive of streamline design for service in drawing the "Chief," the coast train of the Atchinson, Topeka, and Santa Fe Railroad Company. It is equipped with four, 12-cylinder, V type, two-cycle, 900 b.h.p. Winton engines.

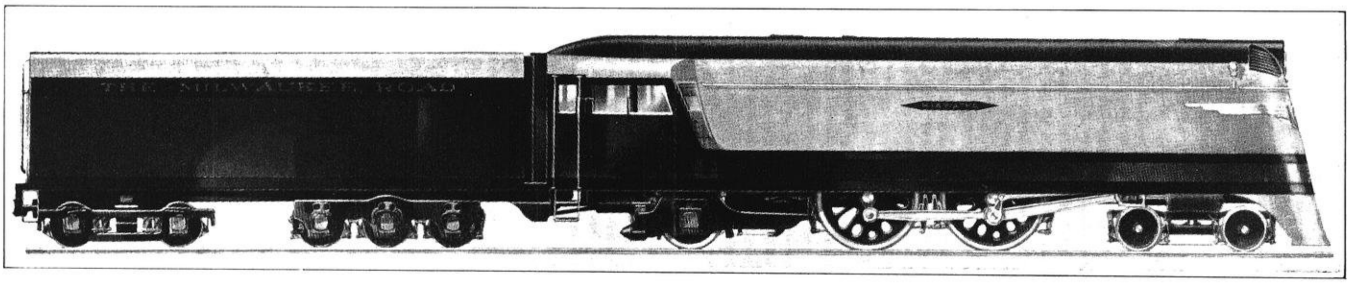
Technical Description of Equipment

In most types, the oil engine is started electrically from the storage batteries, which furnish energy to the main generator. The main generator acts as a motor and turns the oil engine. The generator is connected directly to the crank shaft of the engine and is usually of a direct current, 600 volt, compound-wound, commutating pole, self and separately excited type. The combined characteristics of the generator and exciter are such as to produce a machine of practically constant kilowatt output, the voltage of the generator being regulated by the current demand of the traction motors. The energy or kilowatt output of the generator varies with the output of the engine, and is constant at any position of the throttle throughout the whole work range of the combined power plant.

Mounted on the same shaft with the main generator is a 125 volt, constant voltage, auxiliary generator, which supplies excitation for the main generator and power to the air brake compressor motor, traction and radiator blower motors. This generator also charges the storage batteries.

The electrical control system of the Diesel-electric locomotive is peculiar and considerably different from any of the other various types of control as applied to the other types of heavy and light electric traction under the alternating or direct current, constant power systems. The object of any type of control is to regulate the current and voltage input to the traction motors in conformity with the operating demands and motor limitations.

There are several types used by the different builders, but which are quite similar in operation. One type, known as the "lemp control," has been developed for this service and includes a generator having a drooping characteristic, furnishing direct current to four series wound traction motors, with the result that constant power is furnished over a rather wide range. This characteristic of the generator limits the power output such that at heavy loads caused by short circuits or heavy starting duty, it is impossible to stall or overload the engine. The characteristic, in addition, is such that it will not unload the engine or cause it to race. The drooping characteristic is obtained by a differential series winding mounted in the generator and so designed that the power output is maintained quite constant throughout the full operating range. The separately excited field is provided by an exciter generator mounted on the same shaft as the main generator. The exciter obtains its initial excitation the moment the throttle is closed, which completes the circuit between a storage battery and the exciter field. Thus, the electrical power remains practically constant while the two factors — volts and amperes — vary automatically. Or, to express the same thing in terms of mechanical equivalents, the horse-



"The Hiawatha"—a steam locomotive now vying with the Diesel-electric for high speed honors

—COURTESY THE MILWAUKEE ROAD

power remains constant while the tractive effort and locomotive speed vary automatically.

Thus, this type of control makes possible widely varying tractive efforts on the drivers from an internal combustion engine which has a definite maximum possible torque, beyond which it would stall. The following is a practical illustration of capability of this type of control. The locomotive may have its air brakes set, the throttle wide open, and the oil engine running at full speed without stalling. Then, upon gradually releasing the air brakes, the locomotive will start, and gradually attain its maximum balancing speed consistent with the resistance of the trailing load.

Comparative Performance of Diesel and Steam Locomotive Operation

In looking in the direction of the modernization of railway motive power and rolling stock, the economic value of the Diesel locomotive was recognized. It has recently been established that the Diesel-electric locomotive is an economical and reliable motive power unit in certain types of railroad service in certain areas. Because of its limited engine capacity, the prevailing notion has been that locomotives of this type could not compete with the steam locomotive having high horsepower ratings, especially in switching and transfer work. Upon comparing the characteristics of these two types of locomotives, a Diesel locomotive with a horsepower rating considerably less than half the maximum horsepower of the steam locomotive will often outperform the latter.

The better performance of the Diesel-electric locomotive compared to the steam locomotive is primarily due to the better tractive effort characteristics of the former in the lower speed ranges. The high tractive efforts have been obtained by the greater weight on the drivers, and by the continuous torque application.

Because of the greater factor of adhesion characteristic of the all-electric locomotive, and because of the correspondingly greater horsepower available at low speeds, the Diesel-electric locomotive has a considerably higher tractive power available at speeds up to 5 or 6 m.p.h. than a comparable steam locomotive. Electric drive at the axles provides a smooth and continuous application of torque, reducing the tendency of the wheels to slip. In the case of the steam locomotive drive, four distinct impulses are produced at the wheels for revolution. In a 90° rotation of the wheels, the minimum torque is 29% less than the maximum torque, there being a pulsating torque varying from 71% to 100% of the maximum available. Thus, the useful tractive effort of the electric drive may be appreciably higher (without exceeding the adhesive limit) than that of wheels driven by the reciprocating engines through side rods. For an equivalent weight on the drivers, this has been demonstrated in service to be from 20% to 30% greater than the useful steam tractive force for equivalent weight on the drivers.

The cost of the initial Diesel-electric locomotive unit is almost double the cost of an equivalent steam locomotive, but, when making the comparison, the great availability or capacity for continuous service of the Diesel-electric locomotives must be considered — the availability of the steam locomotive varies between 50% and 60%, and the availability of the Diesel-electric locomotive varies between 85% and 90%. Upon making full allowance for the greater availability, the initial cost of the Diesel-electric locomotive is only from 40% to 50% greater than the cost of the equivalent steam locomotive.

Ordinarily, if a locomotive has certain operating advantages, its first cost is higher; otherwise, the new locomotive would replace the old one in no time. Therefore, the whole problem would be considered as simmering down to a question of balancing the fixed charges (interest and depreciation) resulting from the great investment against the economics of operation to find the point of marginal economic feasibility.

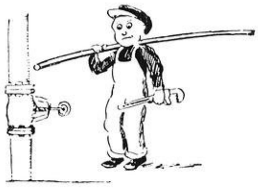
It should be emphasized that, from the very beginning of the railroads until a time years advanced into the twentieth century, there was only one commercial source of railroad motive power — steam. Now there are two — steam and the internal combustion engine. The rapid development which has taken place in the Diesel-electric locomotive since the introduction of the Diesel engine as a traction prime mover promises great possibilities for this new method of propulsion. The immediate field for the Diesel-electric locomotive is in switching and transfer service. As the Diesel locomotive becomes more firmly established and greater production takes place, it will gradually find its way into the field of road locomotive service.

"STATIC"

by ENGIN EARS

IN MEMORIAM

● May again! Putting leaves on the trees, crib notes in our pockets, and new coats of tan on the bald pates of our profs. Even the frosh, optimists that they are, go about with a sophomoric swagger. Canoes, moonlight, mosquitoes, and "B-H Characteristics and Hysteresis Loops of Sheet Steel" are upon us. Nor can we forget graduation, which is one of those things which ends many a brilliant campus career. Let us shed a sentimental tear for the color which the campus loses. For instance, the demon Van Vleets (they wuz reckless mountain boys), reading from left to right, Casanova and Harpo, collectively the bane of instructors, class, and barbers, but a perpetual joy to editors hard pressed for campus scandal and owners of the finest set of old reports in existence (notice to competition: we had our bid in first). And there's Koller, the big sputter and egg man, whose political creed has been "A chicken in every pot." Or Jack Meyer, the reason for the special bracing on the 4th floor Ochsner, who, after four years of presenting no mean front to his profs, this year put on his act for Haresfoot patrons who really appreciate acting. Or Shackton, E.E., "the human fly,"



whose innocent pan covers a multitude of things we'd better not mention. How Master Lloyd of the Double E lab will miss "Committee-Meeting" Rutter and the other short-circuit experts. And dear old "Do-we-have-to-know-that-for-exam?" Knopow will take his inevitable questions and depart, as will "Drug-store" Nepil, "General" Goggin, "I-like-Schlitz" Welch, Miedaner, and the rest of the "illumination" engineers (did you ever see 'em "illuminated" of a Sat. nite?). Then there is Joe Rice, who claims never to have been more than three seats away from the right answer in any quiz. Or any of the gang who haunt the better pubs (like the Palm Gardens or Malt House), and who undoubtedly know more about the flow of liquids through an orifice than the whole Hydro. Department.

So they pass (they hope) into the reference files of the Alumni Association and are heard of no more until, at the ripe old age of 70, they began writing letters of advice and inspiration to the Class of '89. Others step up to fill their seats in class and their booths in Lohmaier's. Sic transit gloria mundi (no reference to T. E.). But we'll miss 'em; don't think we won't.

»» ««

● The civils report that, strangely enough, more people make use of the ski slide in summer than in the winter. It is thought that Eric Miller, who gets an eyeful every time he goes topside to adjust his gadgets on North Hall, could suggest some amendments to the Dean's code of behavior. And why did Henry Fuller blush when Eric remarked on same the other day? . . .

RANDOM THOUGHTS

On an Engineer's Specifications for Rating Dates

Relative Humidity—zero

Integral $\frac{dv}{dt}$—very high

Integral $\frac{ds}{dt}$—even higher

Moment of Inertia—negligible

Center of Percussion—ht. of lips

Center of Gravity—a matter of taste

Radius of Curvature—ditto

Personality—slight corona discharge

Permittivity—normal

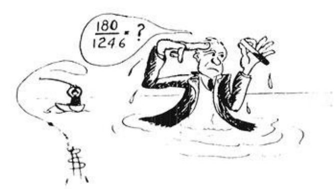
Capacitance—at least 5 beers

Temperature Coefficient of Resistance—low

Extra Important

1. Must not worship men who look like a page from Esquire.
2. **Must** be able to type reports.

»» ««



● Prof: Give me the formula for water.

Heuser: H_2O.

Prof: For sea water?

Heuser: CH_2O.

● We hadda fill space, so someone batted this out while the editor raved:

WAY UP THAR
(with apologies to Snuffy Smith)

Scene: A mountain clearing in the hills behind Devil's Lake. As the curtain rises, a hill-billy with smoking gun comes loping up the trail to the shack before which his pa is sprawled a la 'Baccy Road.

Young 'Un: "Say, paw, thar's one o' thim thar revenuers agalavantin' araound in the bresh. 'Pears he's a'aimin' t' borry some o' yer corn likker refrashments en he wuz a'totin' a rifle gun—it wuz arful stompy, en it hed three laigs. He hed pants on, tew, en tall city shews. He set thet gun plum up agin the wall o' yer corn liquifier, en when I dusted off his britches wif a rifle ball, he hallered moughty fierce—somefin abaout a "turnin' pernt."

Paw: Shecks, son, thet thar aint no revenuer; thet's one o' thim thar furriners—calls theirselfs "Civils" er some sech tarnal thin'. Mus' be nigh onto summer agin . . . ."

» «

● And then there are people who still think the Electricals put insulation on wires to keep the birds from picking the currents off.

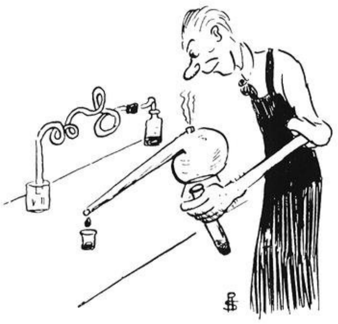
● A Freshman stooge reports that Walter Otto, Ch.E., met some doll the other P.M., got her address but not her name, and spent some two hours with his nose in the directory, later, going over addresses. The ending? He found the name — but hasn't called her. "Faint heart n'er . . ." etc., and etc. . . .

» «

● With finals here, don't feel down in the mouth; remember Jonah — he came out all right.

And then there is the little ear of Iowa corn who still thinks the stalk brought him . . . **—Technic.**

» «



● Which reminds us of something we overheard passing the door of the frosh chem. lab the other evening, just as two studes groped their way out. Gasped the first: "Phew, what's that funny smell?" Replied the second: "Oh, you'll get used to it—that's fresh air!"

» «

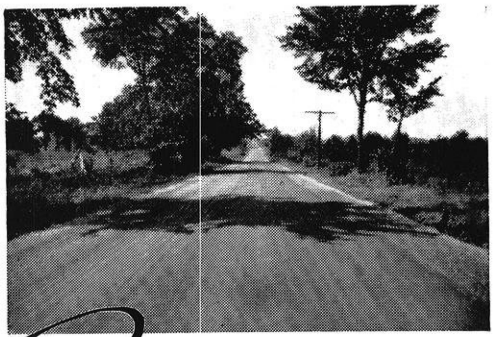
● The Mechanicals insisted on honorable mention for Marg. Lindergren, Larson's secy., who actually takes the sting out of that long hike to the M.E. building.

» «

● The Engineers, unable to agree on a favorite prof-of-the-year, have compromised on Prof. Herbie Page of the Law Shop, who really makes them shysters sweat.

» «

If you don't like the stuff we use,
You oughta read what we refuse.



Chemistry's CONTRIBUTION *to* DUSTLESS, LOW-COST ROADS

STATISTICALLY, it may be interesting to record that The Dow Chemical Company is one of the foremost producers of calcium chloride which it markets under the trade name, Dowflake.

But, far more gratifying to Dow than large tonnage is the ever-growing acceptance of Dow methods and Dowflake in the building and maintenance of better roads.

Fifteen years ago Dow chemists saw in the basic water-attracting and holding characteristics of calcium chloride an answer to a pressing public problem—dusty roads.

Rapidly growing traffic—faster vehicles—both combined to focus attention on road dust. For not only did dust constitute an annoyance and hazard—it represented the loss of actual *road surface*—material that must be replaced. In short, it represented the taxpayers' money—the cost of road crews, of equipment and materials.

Thus, Dow pioneered and advocated the application of calcium chloride as a method of road dust control. Spread upon the surface it gathers and retains sufficient moisture to greatly retard the development of dust.

Following this primary use, further research and study brought forth a totally new technique in road construction. Within a special laboratory, Dow built sample roads to determine the best combination of dirt road materials.

Out of this effort Dow gave to road engineers a method of stabilized road construction wherein low cost aggregates, soil binders and Dowflake are scientifically combined to give a surface of boulevard-like smoothness, dust-free, with exceptional wearability.

In addition to its great service in road building and maintenance, Dowflake (calcium chloride) does many other things. Notably, it has speeded concrete construction (both road and structural) by accelerating the set.

It is used in fighting icy pavements. Combined with sand or cinders, it prevents these abrasives from freezing; keeps them ready for fast spreading and embeds them into ice through its melting action.

Coal treatment is still another instance. Here, under the Dow tradename of Koltreat, calcium chloride prevents dust which is obnoxious in the home and, developed at the dealer's yards, represents a cash loss to him.

Obviously, the value of calcium chloride for dust control on public roads is carried to private estates, to tennis courts, playgrounds, race tracks, fairs and other places where dust is objectionable.

Calcium chloride is only one of more than 250 chemical products bearing the Dow name. Each in its field is respected and each, like Dowflake, brings definite benefits or advantages to millions of people.

DOW

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

Branch Sales Offices:

30 Rockefeller Plaza, New York City; Second and Madison Streets, St. Louis

G-E *Campus News*

"DON'T TALK BACK"

YOU can't argue with an officer. One G-E engineer learned the truth of this modern proverb when he was detained by Panama Canal authorities and the radio tubes he carried were impounded. The officers were convinced that the unfamiliar objects were bombs. And when an officer has made up his mind, that settles it. The tubes were carted away.

Some years ago, I. R. Weir, of the General Electric Radio Engineering Department, was en route to Tegucigalpa, capital of Honduras, Central America, to install a radio transmitter. He carried with him two of the first large, part-metal radio transmitting tubes which had been developed by General Electric.

"Upon arriving at the Panama Canal," he relates, "I was surprised to find that I was detained for investigation on suspicion of carrying bombs. After much argument it was decided that I should have to leave my radio vacuum tubes in the ammunition dump during my stay in the Canal Zone."

CLEAN DIRT

SOAP and water will still be needed to clean Junior's face and hands, but if Junior's father is a florist he will welcome this clean dirt.

Florists and specialty growers wage a never-ending battle against weeds, insects, and plant parasites which flourish in greenhouse soil. But reinforcements have arrived. Clean dirt may now be economically obtained by means of electric equipment developed by General Electric scientists.

Electric heating units, arranged in a wooden bin, heat a quantity of soil to a temperature of 160-180 F. Heating sterilizes the soil by a process which resembles the pasteurization of milk, and weed seeds, insects, and fungi which are dormant in the soil are killed during the sterilization process. In the resulting germless dirt, plants can attain a vigorous, uniform growth, free from the competition of weeds and the inroads of other plant enemies.

"AH, WATSON, AN INDUSTRIAL CRIME"

THE "corpus delicti"—a broken resistance wire; the suspect—a defect in the wire; the detective—a microchemist. With microscope and analytical apparatus of incredibly small dimensions this industrial superdetective finds tiny crystals of sulphate near the break. The trail leads to a nearby furnace giving off sulphurous fumes. Thus the wire is cleared of suspicion of having been defective, and the criminal fumes are eliminated.

This analysis is typical of many industrial "micro-mysteries" that have been solved in the Research Laboratory of General Electric. A development from methods devised in the fields of biology and medicine, microchemistry has become an indispensable servant to industry, with accomplishments as great as the quantities with which it deals are small.

With thimble-sized beakers, and test tubes as small as 1/50 of an inch in diameter, the microchemist analyzes quantities of material 17,000 times lighter than a drop of water. He has defined a new unit of mass, the gamma, one millionth of a gram. A streak of dirt, a smudge, a minute pit mark—all these can be taken into the laboratory with a reasonable assurance that the microchemist will be able to provide the answer to the problem.

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GENERAL ELECTRIC