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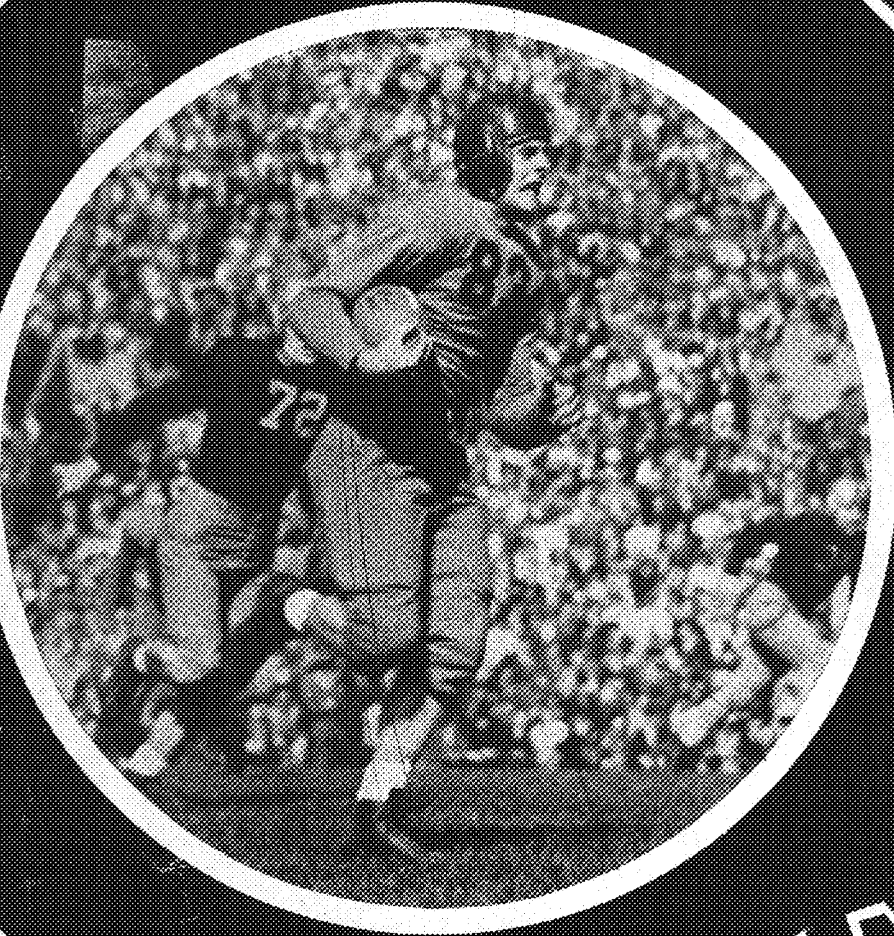

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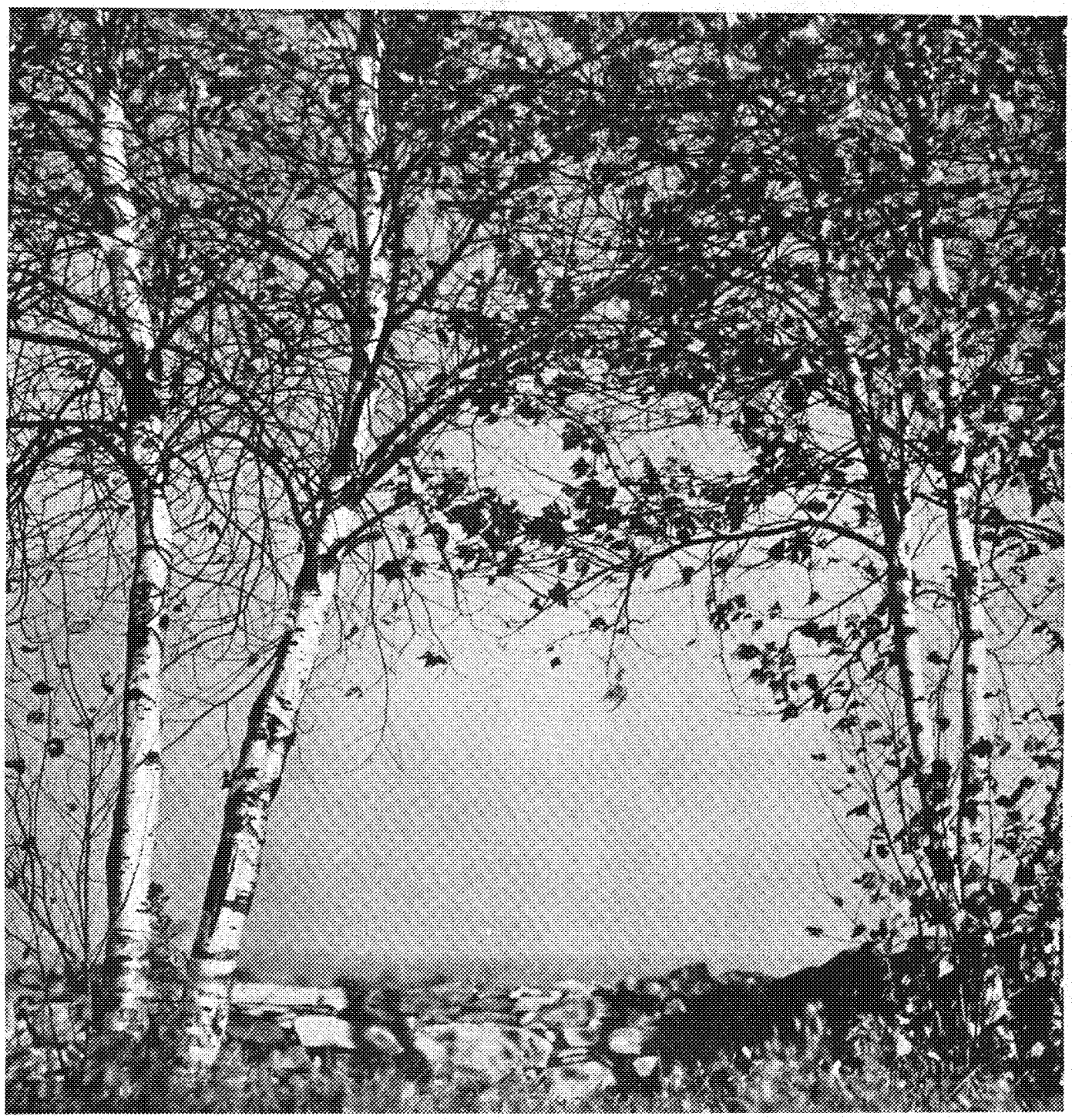

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For Ambitious Engineers Only

What qualities does an employer look for in a senior engineer? What single defect keeps the most engineers from being successful? If you are interested to the answers to these questions, and what engineering student isn't, you should read this article. It contains information that will be valuable to you now and in the future.

By C. Vernon Olson, E.E.B. '40

Illustrations by Albert Arneson, Arch. '39

FOREWORD

Looking above at the title, the introductory paragraph, and the author's name, you may wonder by what right a fellow student writes an article purporting to answer the question "What qualities does industry want in its graduate engineers?" The answer lies in the fact that what the author is presenting here is essentially a summary of current opinion on the subject.

Vern read a large number of articles by men in different positions in industry and in different industries. He then selected quotations from the articles to give authenticity, and combined them into the article you see here. You cannot fail to be impressed, when you read the article, by the unanimity of opinion in regard to which qualities are most important in an engineer. Read this article—you will profit by taking the advice it offers.—The Editor.

"Is it a mistake for an 18-dollar-a-week clerk and a millionaire's daughter, who feel sure that they are in love, to marry when doing so will cause the enraged father to disown his daughter?" That question is typical of ten questions asked by a prominent, anonymous industrialist of applicants for three jobs. These questions were given, along with the usual extensive application questionnaire, to help pick men for a job in the personnel department, one in the credit department and one in a new South American branch. Sounds silly? Why, no!

The employer wants to be sure that the men selected had, in addition to the requisite technical knowledge and abilities, inherent natures well fitted to the particular jobs. The man selected for the credit department had answered, "No," to the questions. The job required a critical, cautious, analytical personality. The man who obtained the job in the new South American branch had answered, "Yes." His job needed a daring, romantic, adventurous, take-a-chance character. The third successful applicant had answered, "I don't think I want to work for a man who asks such damn fool questions." This man happened to have the qualifications of a character analyst, which fitted him for the job in the personnel department. Undoubtedly he changed his mind on the value of "such damn fool questions."

This illustration brings home the fact that we must preface all remarks following: Employers want engineers who . . . by saying that it all depends on what job the engineer is wanted for, including what he will be wanted for five, ten, or fifteen years hence. Traits indispensable to an African highway engineer might be of negative value to an engineer on a job of making highly involved mathematical calculations for electronic equipment. A man's character, personality, inherent nature—or whatever you want to call it—is vitally important to an employer and no less important to the applicant. What's more, it is becoming, and will continue to become, more and more important.

While technical production efficiency has been the goal in the past, personnel efficiency is becoming increasingly important in our keenly competitive industrial world. This means that employers will try hard to find men who fit well into the particular jobs of the organization. This character analysis is most difficult in the short time allotted, so that anything the young engineer can do to find out what job he will be most interested and successful in will aid him greatly in getting a job. We can be sure that a prospective employer will *not* be greatly impressed if we say, in effect, "Here I am, Mr. Employer. You probably know more about me than I know about myself. Take me and put me where you think I belong. I will work hard and I am sure I will be a success."

To quote Mr. C. A. Phillips, Bell Telephone man, "It is your responsibility to inform your prospective employer of your honest conclusions with respect to your ideas of the kind of work in which you believe you will be happiest, produce the best results, and receive the most satisfaction. It is the prospective employer's responsibility to decide whether or not, in his opinion, your conclusions are right so far as his requirements are concerned." Employers want men who know for what kind of work they are best fitted.

Since we are not here concerned with the qualifications most needed for success in a particular job, we will limit ourselves to a discussion of other general traits for which all employers of engineers are keenly on the lookout.

Let us take a panoramic view of the suggestions offered to young engineers by eminent employers, engineers, and engineering educators in completing the statement: Employers want men who . . .

What Employers Say

Professor Frank L. Eidmann of Columbia University, who sent out questionnaires to about 60 firms employing young engineers in design, research, production and sales, found that dissatisfactions, with few exceptions, were due to personal characteristics rather than lack of technical knowledge. This is probably partly the case because technical knowledge can be easily measured before employment, whereas personal characteristics must be judged.

Leading the list was "the inability to get along with other people." Engineering work, even research, is accomplished through close coöperation of the members of

Steel Mill

← *Courtesy Architectural Forum*

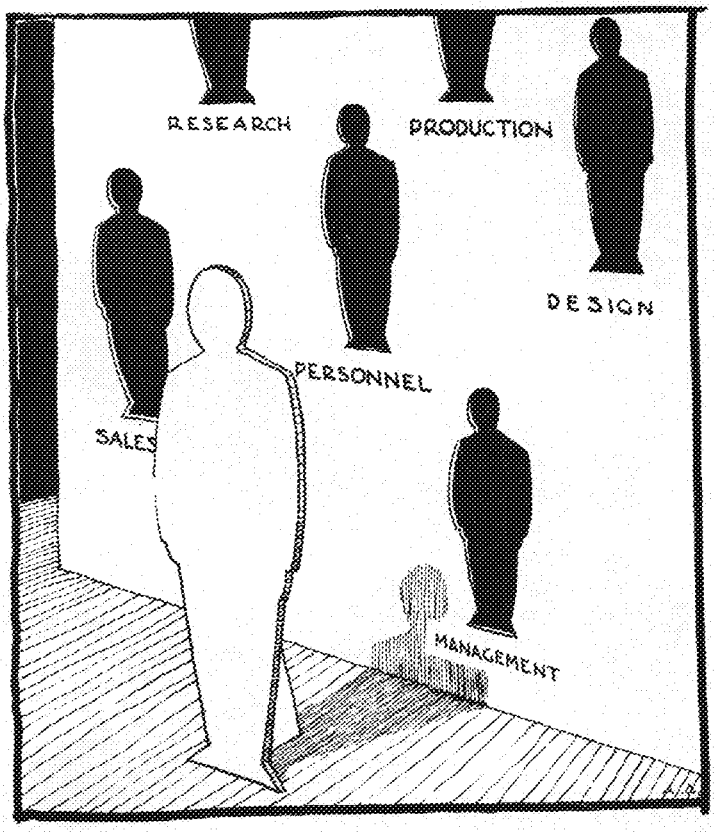
the organization. Obviously, the inability to get along with other people is a gross inadequacy, and yet it can be overcome by intelligent effort.

Other criticisms prominent in Professor Eidmann's report are "over-eagerness for advancement and unwillingness to prepare for advancement over a long enough period," "lack of aptitude for engineering work," "inability to adapt themselves to the routine of operating work and, at the same time, avoid getting in a rut," "lack of initiative," "lack of self-confidence," "inability to grasp the practical aspects of problems and situations," "lack of willingness to work," etc. We can do well to pause over each of these criticisms to ask ourselves, "Will my employer probably criticize me for these same failings?"

Philip Swain, editor of *Power*, is convinced that "men are as important and interesting as machines, and that the engineer must gain equal facility with both." He also says: "Lack of front is the peculiar vice of engineers. After years of observing them, I am convinced that engineers as a class are altogether too damn modest. The time to start acting modest is after other people begin to think you are somebody. Then it pays, because people like to think their heroes are unassuming men. Before that it may be an expensive luxury."

General Motors' research chief, C. F. Kettering, argues the importance of that old bugbear, English: "A man's English is an index to his mind. A paper or a report that is clearly and precisely written indicates sound reasoning and reliable results. An obscure, poorly written manuscript may disclose illogical and muddled thinking. Success in engineering depends as much upon the ability to present an idea convincingly as it does upon the ability to perform calculations or experiments. . . . It is only by speech and writing that discoveries made in the laboratories are made useful. Scientific men too often look upon writing reports or making talks as an irksome part of their job and do as little of it as possible. Engineering work is not finished until the results are clearly recorded and presented to others."

The man must fit the position if success is to be achieved.



As E. B. Roberts of the Westinghouse Electric and Manufacturing Company sees it, ". . . industry finds the best of the engineering graduates, who are coming to us from our engineering colleges, thoroughly well prepared as to fundamentals for the technical work of engineering, research, design, and development, but . . . we feel there is much to be desired in the way of developing more men who have not only the technical ability, but who can meet the requirements from a business and management standpoint as well." Mr. Roberts also stressed temperamental and personal weaknesses, lack of coöperative ability, lack of tact, antagonistic attitude, unattractiveness of appearance, retiring disposition, unambitiousness, and emotional instability.

A. M. MacCutcheon, past president of the American Institute of Electrical Engineers, lists important qualities in order: integrity, dependability, determination, resourcefulness, forcefulness, adaptability, coöperativeness, diplomacy, friendliness, broadmindedness and knowledge. Again we see the qualities of character listed first and knowledge last.

Humanities vs. Technology

G. E. Doan, in an article entitled, "Our Sons Specialize," says: "Get the humanities and the foundations of science, but don't get technology. Industry will teach the man its technologic methods quickly enough. But industry cannot undertake to give him a liberal education or a sound scientific background if he comes without these."

An employer has stated that 25 per cent of a prospect's worth is judged by scholastic record as an indication of his technical ability, and the remaining 75 per cent depends upon his personality, ability to work with his fellows, character, judgment, efficiency, and understanding of men.

M. A. Smith emphasizes in *Civil Engineering* the need for improvement of general appearance and in the social graces at introduction and departure. Engineers should "awaken to the fact that slide rules, triangles and drawing pens are not the only tools of the trade."

A. A. Potter says, in *Electrical Engineering*, "The engineer of today must have a thorough preparation in science and technology, as well as an appreciation of æsthetic values, economic forces, and social trends."

C. J. Freund feels, in *Mechanical Engineering*, that since about 70 per cent of engineers gain executive responsibility sooner or later, the following executive characteristics are important: physical energy, innate interest in and affection for people, strength or power of personality, scientific trend of mind, sound judgment, application, responsibility, willingness to take the penalties of responsibility; but exceptional intelligence is not so important.

H. P. Eddy, writing in *Civil Engineering*, expresses the belief that if wanted for eventual executive job or as a partner in a firm, a young engineer should have a very broad educational foundation and possess the virtues of initiative, originality, ingenuity, judgment, dependability, self-assurance (fight if right; admit if wrong), personal-

ity, good health, appearance, experience, leadership, cultural development, and versatility. He feels the last two mentioned to be as important as any!

The editors of *Power*, in an article for young engineers, stress the importance of starting early to learn to talk and write English, work with people, sell, handle tools and machines, write business letters, keep simple accounts, shake hands smoothly, write smart letters, and talk glibly.

John M. Drabelle has this to say in *National Engineer* about success: "The greatest essential in my mind after you have a thorough knowledge of your life's chosen work is your ability to convey that knowledge to others, and to get them to work for and with you and, further, to maintain discipline in your organization, not by the fear of dismissal or lay-off, but by commanding the respect of those who work for you."

You're saying, "Boy, oh boy! These birds don't want much, do they?" Well, the idea is that there are plenty of men to handle the small jobs and a dearth of big men with these many desirable qualities. That is why employers are so keenly on the watch for the valuable, rare specimens.

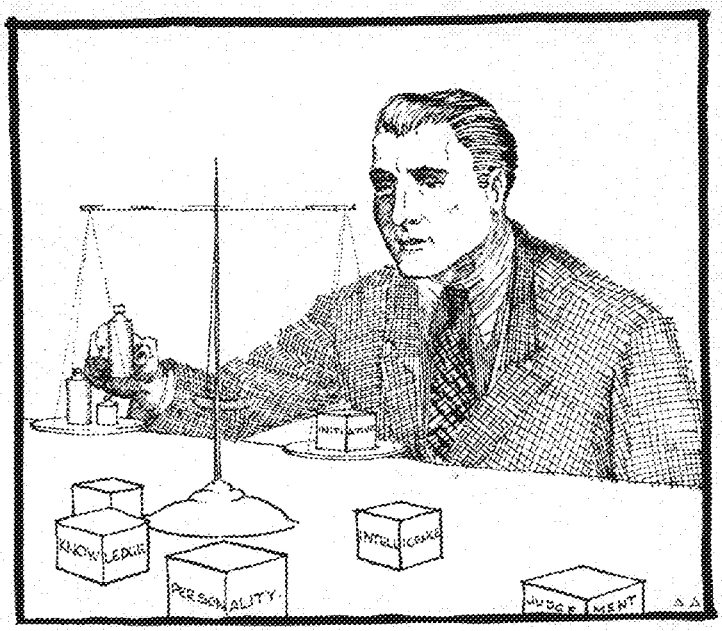
"(1) Character, (2) Intellect, (3) Scientific Foundation, (4) Knowledge of Men, (5) Knowledge of Engineering" —these are the qualifications of a successful engineer, in the order of their relative importance as they were listed by a professor of the great French School of Engineering, University of Zurich. Prominent engineers and engineering educators have ever since been commenting on his wisdom. Our professors are working hard to equip us with respect to scientific foundation and knowledge of engineering. With the exception of intellect, which is innate in the individual, the qualifications for success must be developed by ourselves outside the classroom.

Character vs. Knowledge

We notice again that the personal trait, character, is placed first, while mere knowledge, knowledge of engineering, is placed last. There must be something to this idea. Character, the number one trait, embraces everything from industry to honesty, from ingenuity to dependability, and from self-confidence to adaptability. Small wonder it is placed first. If a man has the other qualifications, he can always acquire the knowledge; whereas the reverse is not at all true. This placing of character before knowledge does not mean that we can relax our knowledge-getting efforts, because character includes the determination, perseverance, ambition and industry necessary for quality scholastic work. While mere knowledge is secondary, mastery of the "engineering method" is of paramount importance.

Of course, all these factors of success are important; the absence of one of them in a reasonable degree would block advancement. On the other hand, there are many exceptions to generalizations. We must remember that the sequence refers to success in engineering; while many engineering graduates get into non- or semi-engineering work. For example, to an engineer-salesman, knowledge of men would be most important, with intellect perhaps least. Salesmen do well to be personable rather than brilliant.

The importance of being able to get along with one's fellows cannot be overemphasized. Today, things are accomplished by coöperation. As T. H. Evans put it, "Organizations are looking for men for their 'team' rather than for individualists." This is why employers are so interested in a man's extra-curricular record, which is an indication of his ability to work with other men.



You will do well to weigh the importance of the various qualities that are necessary for success.

Though the non-technical phases of engineering problems are surprisingly large, engineers tend to be so engrossed in the technical phases of their work that they ignore the psychological reactions of others to the things they say or do. If men were wholly rational, logical, intelligent beings, instead of men with prejudices, ego, fears, ambitions, likes and jealousies, it would be no problem for the logical-minded engineer to get along well with others. It isn't what one says, but how one says it, that counts. Fortunately, there is much good literature on this subject containing the rules and principles one must follow if he is to avoid unnecessarily offending or antagonizing others. Men *can* improve themselves tremendously in this respect, despite what the fortunate, naturally diplomatic fellows may say to the contrary.

We would do well not to over-estimate the value of our college education, or of our value to the company, or to take a superior attitude toward our fellow workers who have not attended college. No one accepts a college man's superiority without his proving he can deliver the goods. It is even necessary to bend over backward to impress non-collegiate fellow workers that one does not feel himself superior to them. Otherwise good coöperation is impossible.

The time to start thinking about what we as young engineers want in life is before graduation. Most of us look on engineering as a respectable, moderately-well-paying profession which will make social activities and various entertainments possible. A few are driven by an intense ambition for recognition, or high material rewards, or both. Fewer yet are motivated by a noble, altruistic desire to leave the world a better place in which to live. Whatever may be your philosophy, the suggestions made in this article can help you achieve your ends with less effort—and you know, efficiency is the engineer's watchword.

Deadwood and Points West

By Millard A. Troxell, Met.E. '39

Illustrated with photos taken by the author

Good old field trip time! Dear to the heart of every junior miner is that season of the year when he can pocket a book for field notes, blow the dust off his hard-shelled hat, and answer the call of the West! Of course, there are certain little incidentals, such as a $50.00 railroad ticket expenditure and a $35.00 deposit with the school, but these served only to whet our interest in the matter. In fact, during the course of the spring, our anticipation grew and grew, until finally Berkner could stand it no longer and left for the station at two o'clock on the afternoon of the eventful day. By the time the train was ready to leave, the boys were secure, settled in their chosen seats and champing at the bit; that is, all except yours truly, who dashed on just as the air brakes were being released, and Olmstead, who was put on board by his St. Paul relatives. Finally, Berkner astounded us all by climbing on all alone near Sleepy Eye, and presto! our party was complete except for John Nelson, who never has had much confidence in trains.

Our chief pastime on the long trek across the prairies of Nebraska and South Dakota on the way to Deadwood was counting jackrabbits. Selected groups of us would sit on one side of the car with our noses glued to the window and count jackrabbits in competition with a like group on the opposite side of the car. This would have been fine and dandy, but we counted rabbits by the honor system, and Berkner's side always won. Berkner played a vicious, waiting game. He'd let you get three or four jackrabbits ahead of him in the tally and then spot a whole family of them, which put him way in the lead. These tactics eventually discouraged even the most resolute opposition.

As we drew near to Deadwood we glimpsed a most arresting phenomenon—a rocky little creek bed carrying the blackest, slimiest, dirtiest-looking liquid you ever laid eyes on. You guessed it! This was slime for the Homestake mill on its way to the slime plant. And if you're tired of being trampled around in this humdrum, work-a-day world, just take a taste of this slime.

Gold in Deadwood

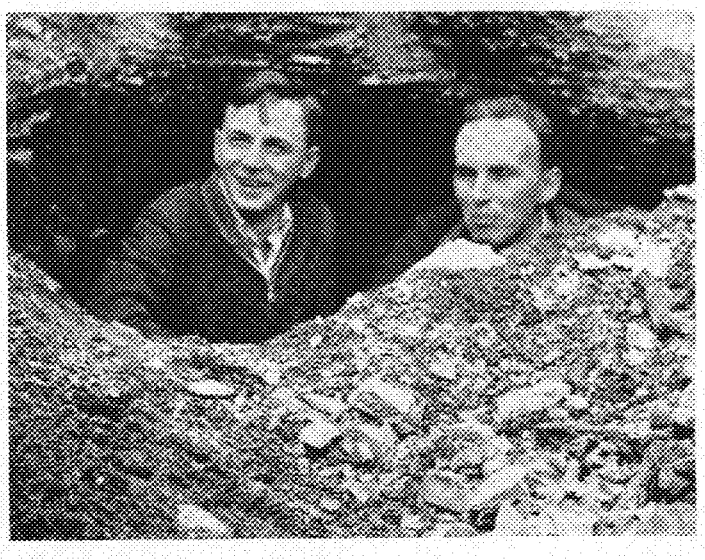
While in Deadwood we visited a great variety of gold mines and mills. The value of the diversified nature of these excursions cannot be over-estimated. In small mills such as the Maitland and the Giltedge we now were able to associate with classroom principles the actual flow of solution and processing of ore, while in the Homestake mills we saw the machinery which most efficiently ground 4,000 tons of ore to pulp every day. Speaking of modern technology, the principle of the stamp mill which the cave man used to grind his grain into flour still is indispensable to the Homestake Mining Company in the grinding of their ore to an impalpable, wet slime.

The workmen in the Krefting mine will never grumble over their lot. Every waking minute of this able young scholar Krefting's is spent in scheming to make the worker's lot a happier one. Consequently, he is filled with remorse whenever he sees some newfangled contrivance such as a mechanical bopper loader putting twenty able-bodied men out of work. He fairly reveled, however, in the mule-drawn mine cars at the Trojan Mine. Poor fellow! He never stopped to think that even those mules were putting men out of work.

Our spare time in the Black Hills was spent very usefully, we feel. Old abandoned drifts and prospect holes always have that aura of mystery about them, even if they are invariably caved in after about twenty feet. There is many a mountain to test the climber's skill and many a dusty pike to be trod before one can emerge onto a craggy ledge and snap a photo or two.

This mountain-climbing business brings us to another sad bend in our field trip trail. An exceptionally promising fellow in every way, this Berkner lad, but he's got a phobia. Moreover, it's not an ordinary everyday garden variety of phobia, but a strange dread of high places called acrophobia. Poor Berkner's face still haunts me as he turned, pale but resolute, away from a vaulting precipice

Exploring old, abandoned drifts and prospect holes proved interesting.



and whispered, "You go ahead, boys; I'll be here when you come back." I can even remember when Leach and Anderson had to help Berkner up a flight of stairs!

After the week had passed we entrained again, this time for Colorado Springs via Denver. The journey was rather uneventful, but had my watch been a minute slower at Alliance, Nebraska, I would have seen all of that double-feature and missed the train.

At Denver, we treated ourselves to seeing the State Capitol and the Historical Museum. I must have spent an hour viewing the rare and colorful mineral specimens. Here was some gold from Wildcat Gulch, running 20,000 oz. to the ton. Here was a great slab of moonstone, with fleeting little hues and sheens darting over its surface in response to vagabond rayleis of sunlight. And over there was the biggest crystal of garnet I've ever seen!

Colorado School of Mines

A few of us rode out to Golden on the trolley and visited the Colorado School of Mines, where we were given a right royal welcome by the students. After being shown through the institution, I emerged with a profound admiration for the Colorado School of Mines. The amount of apparatus they have approaches commercial proportions. For instance, they boast a complete crushing, grinding, and milling set-up and furnish one flotation machine for every two students.

Colorado Springs is my idea of an ideal city in which to live. The air is pure, the people friendly, the prices reasonable and the scenery magnificent. The Garden of the Gods truly makes a photographer's paradise; the priceless scenes I captured with my camera are like golden coins—they will never tarnish. Yet I met a fellow out there who said he was sick of the mountains—he wanted to live in Minnesota where they had some lakes!

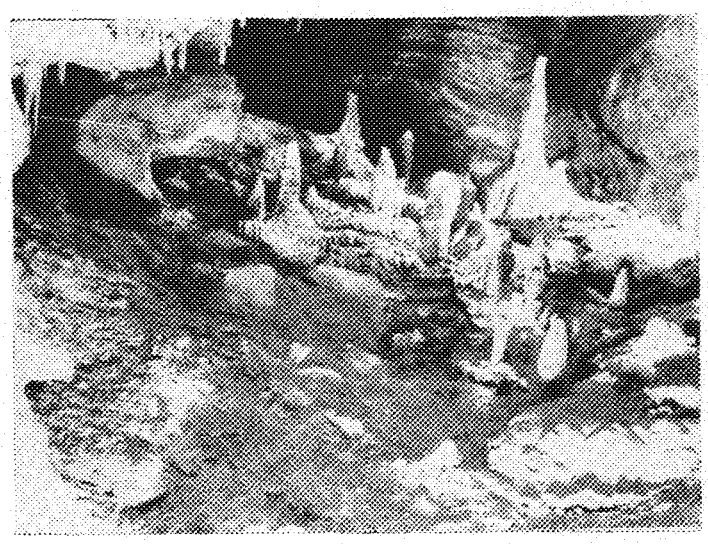
The obliging guide in the Cave of the Winds allowed roommate Larson and me to take three-minute time exposures of the impressive stalactite-stalagmite formations there—the pictures turned out beautifully. Every woman who has passed through the Cave of Winds since its opening in the 1870's has contributed a hairpin for good luck in marriage; now there is a pile about seven feet high and several feet in diameter—just old dirty hairpins accumulating rust like their former owners hoped to accumulate nice husbands.

While we were in Colorado Springs, our official trips were to the Pike View Coal Mine and the Golden Cycle Mill. Oh Machine Age, where art thou? The Golden Cycle still used the ancient Chilean Mill, which works like a medieval millstone. If modern machinery were more efficient, the owners would install it.

It was actually fun riding miles through the coal mine in coal cars, but some impish prankster saw to it that Mr. Heilig rode in the car with the flat-sided wheel. Riding in this car gives one that "it-must-have-been-something-I-et" feeling, and I have no doubt that Mr. Heilig was as glad to see daylight as we were.

We didn't do any jackrabbit counting on the way to Salt Lake City. In the first place, the panorama compelled our attention; in the second place there weren't any jackrabbits. The train stopped at the Royal Gorge so we could marvel at its craggy grandeur. Some of the boys claimed to have seen a couple of mountain goats, while others followed the tortuous path of a mountain torrent. We were a relieved group, though, when the train pulled into Salt Lake City and its unexplored treasures.

The element one really appreciates about a field trip is the spare time allotted him. The Republicans may poke a lot of fun at "the more abundant life," but I'm a firm believer in it—at least for field trips. The first thing Larson and I did was to look up the Theta Tau boys at Utah University—and we promptly got invited to a shindig,



Beautiful rock formations are to be seen in the Cave of the Winds.

complete with rustic cabin, canyon brook, pine trees, and all the fixin's. The next afternoon Leach, Berkner, Anderson, Larson, and I decided to explode the Great Salt Lake myth. This you-can't-sink idea is hooey anyway, I decided. So I went out to swim and promptly found that I not only couldn't sink but I also couldn't swim. Just try to swim with your head above water at one end, your feet floating to the surface at the other, and your stomach sagging down in the middle! Disgusted with swimming (the salt water burns your eyes or any open cuts) we decided to have a mud fight and finally went back to the bath house plastered—with the oolitic limestone which in Great Salt Lake takes the place of the usual sand. This comes in rather handy for nearby smelters—when they need some flux for their acidic ore, they just go down to the lake shore, scoop up some "sand," and they have their flux.

We couldn't forget, however, that our prime object out in Utah was to go through mines, mills, and smelters, so the next day found us gaily setting out to investigate the Utah Copper Company's open pit in Bingham Canyon. This is really a large scale operation; there are twenty-seven benches—or open cut mining levels—and 250,000,000 tons of ore have been removed to date; but don't worry, there are 800,000,000 tons of ore left for the next war that Uncle Sam gets into.

The Lark Mine was the next object of our intentions. This unique mine has good ore and a promising outlook, but the United States Smelting, Refining, and Mining Company does not own the one tunnel leading to their property and consequently pays royalty on every ton of ore removed and on every workman hauled in and out. The management kindly let us dig out the most splendid crystals of galena that I have ever seen and then gave

us all a ride up an inclined shaft in a small ore skip—I spent my traveling time speculating on my immediate future condition should the cable suddenly part.

"Smoke Farmers"

As if the smelters in the Salt Lake City region didn't have enough trouble anyway, there appeared on the scene in the early history of Utah smelting the "smoke farmer." A "smoke farmer" is an agricultural opportunist who knows that sulfurous smelter fumes are bad for his cattle, so he moves as close as he can to the smelter and collects damages for the death of his bovine charges. Things finally got so bad that farmers were actually fighting for choice spots near smelters, but the smelters foxed them and put in "Bag houses" to eliminate the colorless SO_2 and SO_3 fumes from the air. Yet, even now when the harmless black carbon smoke is belching a bit too thickly from the smelter stacks, Si will see in those ugly black fumes a sinister menace to his herd and the Agricultural Department will politely request the smelter to shut down two or three reverberatory furnaces. The smelters get even by making lots of arsenic as a by-product and then praying for a goodly horde of grasshoppers every year so the arsenic can be sold to the farmers for grasshopper poison. All of which firmly convinces me that not even Houdini could make a go of a Farmer-Labor Party in Utah.

One of our most weighty problems was the selection of a suitable eatery wherever we encamped. Brave little groups of students would forage forth into the unknown, ready to pit their strength against any steak which awaited them. Then each evening after supper time we compiled our results and tried to draw the best compromise between quality and price. Once our minds were made up we would pester the lucky proprietor to distraction, leaving the other culinary establishments out in the cold. "Miller's Lunch" drew top honors in Deadwood, while the "Bite and Sip" had quite a following in Salt Lake City. A deplorable discrepancy in western restaurant hospitality was the idea that soup, beverage, and dessert do not come with the meal.

While in Salt Lake City we visited the nearby Toole, Garfield, and Midvale smelters. The Toole smelter is probably the most complete plant in the United States—consisting of a sulfide mill, and oxide mill, and both copper and lead smelters. The Garfield smelter processes copper and molybdenum flotation concentrates from the nearby Magna mill, while the Midvale lead smelter ships away zinc and iron concentrates to other smelters for fluxes.

Bicycling Down a Mountain

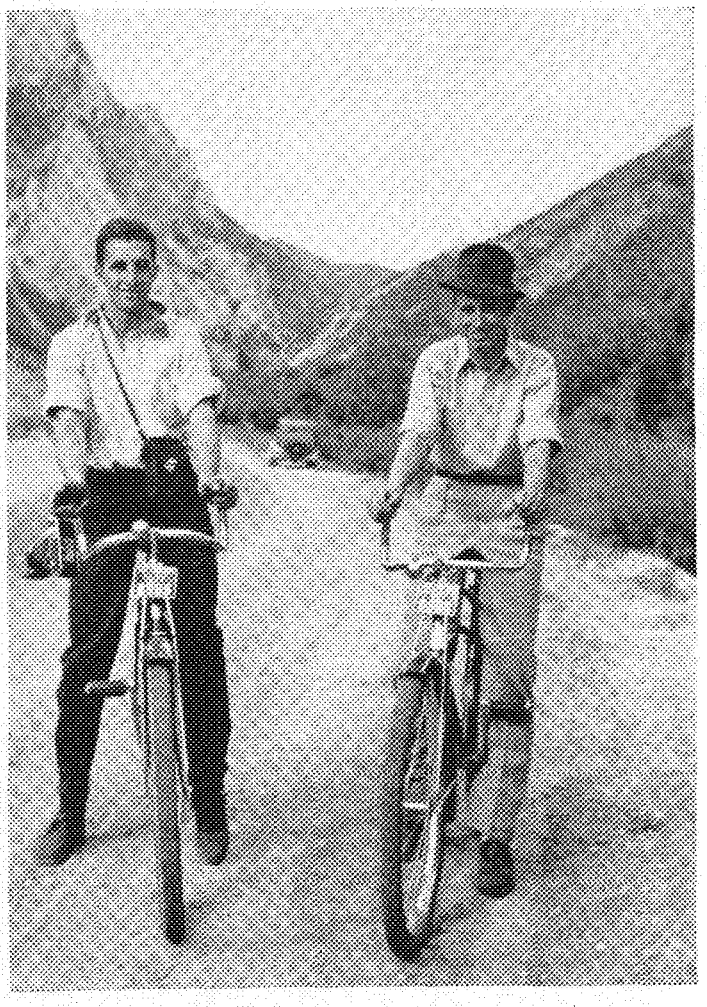
One afternoon six stalwart lads decided to bicycle up into the canyon. Now, I have always thought my endurance was fair, but was I mortified when the lean, unmuscular Helgeson pedaled up a 45 degree slope which had defied me. I picked up some scant crumbs of satisfaction when the rest of the fellows decided to watch the parade of femininity in the park and left the pioneering up to Leach, Helgeson, and me. Nevertheless, several traitorous thoughts kept roaming in and out of my mind when I bicycled up the canyon. "We don't want to take it too fast—it doesn't pay to exert too much at first—throats getting dry; that's a danger sign—this isn't so much fun anyway—hey, Leach, let's go back!" But Leach was unimpressed—he was bound to get his money's worth out of that infernal bicycle. So, on and on we pedaled. And pedaled. And pedaled.

Have you ever ridden five miles downhill on a bicycle? You must try it sometime; try it with your bicycle gaining momentum every minute, that beautiful pageant of mountain and stream whizzing by, the crisp, cool air full in your lungs! You can almost feel the years drop off your shoulders.

Some of the field-trippers were actually entertaining vague ideas such as the possibility of finding mining jobs out west after the field trip was over, but Old Man Depression had blown his icy breath over Utah too. When we saw that half the mines and smelters usually visited were closing up, most of us decided to come back to Minneapolis and enjoy its comparatively rosy prosperity.

At the conclusion of the trip Professor Pease gave us each the $9.00 left from our field trip deposit together with his blessing. It is still a marvel to me how he was able to find us rooms for the three weeks in four different first-class hotels and to arrange to rent a bus carrying us to some desolate outposts every day that we had some place to go—all for $26.00 apiece! I guess it's just the result of judicious, perennial collective bargaining. But we paid for it! We had to act like gentlemen for three whole weeks!

Cyclists Leach and Helgeson pause for a moment's rest.



On the Shores of Cass Lake

By Leslie A. Anderson, C.E. '39, and
Herbert H. Gaustad, C.E.B. '40

Illustrated with photos taken by the authors

Seventy-four boot-clad feet pounded down the tent-row toward the mess hall as another band of civil engineers began their greatest University experience, that of summer surveying camp at Cass Lake, Minn. Thirty-seven sleepy voices of varying tones and volumes echoed "Here" to the first roll call before tangling with one of Albert's 6:20 a.m. breakfasts. A brief few minutes before, the resounding clang of steel bar on buzz saw had aroused them from their first and last good night's sleep.

Six weeks were to follow—weeks of practical experience in the various phases of surveying. Triangulation, railway location, stream measurement, plane table topography, leveling, and mapping—each of these projects was to be encountered by each of the civils in turn under the watchful eyes and competent tutelage of Professors Cutler, Zelner, Boon, and Von Eschen.

For many of us, camping for six weeks in tents on the shores of one of Minnesota's most beautiful Northern lakes was a novel and surprisingly pleasant experience. Located within the Chippewa National Forest, the country surrounding Cass Lake boasts a magnificent growth of virgin Norway pine, a dense undergrowth of brush, and the largest and most ferocious members of the mosquito tribe. Then, too, as some of the fellows soon discovered, the natural beauty of the place had been artificially enhanced by the presence of that quaint clan called "resorters." In fact, Terzich and Bass insist that the latter type of beauty is to be preferred—for who ever heard of a Norway pine that could cook!!

It was a quiet, restful evening in early September. The moon shone brightly from the heavens, casting the shadows of tall pines in ghostlike silhouette. The wind rustled through the trees, hushed in anticipation of some great event to come. The water, sparkling in the moonlight, slowly moved in on the shore creating a murmur of peaceful contentment. The stars were there to complete the picture of nature at its best. What a setting for romance!

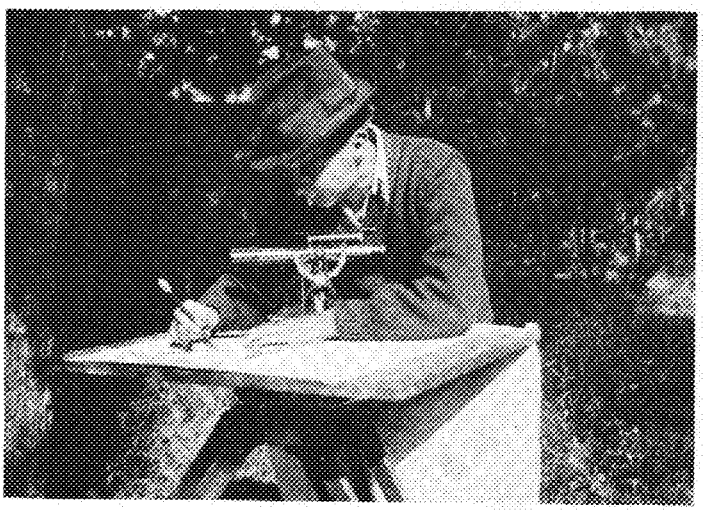
Standing on the shore, gazing intently at the stars, was one who had some purpose there. He sensed the trees, the stars, the moon, and all the beauties of the night, but his was a greater interest. He stood at his post, alert to every change in conditions, watching for the first signs of the fateful moment. He wasn't an astronomer looking for some lost planet; he wasn't a poet seeking some inspiration that might send his name down through the ages; he wasn't a lover lost in the dreams of his loved one. He was just a civil engineer observing on the star Polaris. Then at 9:23.18 p.m. (star time—not whistle time) it came—that one moment for which he had prepared himself—*Eastern Elongation*. His work was done; his vigil ended. His nerves relaxed at the end of a deed well done, and his mind was at rest.

Perhaps there is some question as to the full meaning of these events. Let us explain. By sighting on Polaris and turning an angle to a known point, the true direction of the line to that point may be determined. Such was the task of the civils. They were there that evening in parties of two, equipped with transits, flashlights, mosquito netting, and notebooks. They were waiting for eastern elongation, that moment when the star reaches its farthest eastern position in its swing around the position of true North. When the readings had all been taken and the positions computed, they had solved their problem. They knew where they were! Such is the story of one evening in civil camp. There were other evenings when many of the boys didn't know where they were, but we may come to that later.

You are are now well acquainted with the civil camp of 1939. Before we go further in our tales, perhaps a few more facts and figures might be enlightening. This year there were *37* fellows in camp, together with four faculty men and two cooks. Sleeping in tents pitched over board floors really meant getting close to nature. Each tent was equipped in the best possible manner with benches, cots, table, stove, and lantern. Having arrived at camp early, it was our fortune to obtain the best tent and to fill it with the finest assortment of rustic furniture imaginable—from clothes hangers to orange-crate wash stands. So completely furnished and exquisitely decorated was our abode that the rest of the fellows appropriately dubbed it "Grand Hotel." (After all, fellows, it was a hotel in name only, despite Bill Lowe's efforts to make it appear otherwise) . . . and don't forget, you could always have a good time at the Annex right next door!

Of course the program was all work and no play, work starting at seven o'clock and continuing until four-thirty, to be resumed in the evening from seven until nine on

"Of course, the program was all work and no play . . ."



"This year the camp was assigned the job of mapping the entire shore along Norway Beach . . ."

many occasions. Some of the events to follow will bring out the earnestness with which this set-up was followed.

Of all the jobs at camp, triangulation seemed to be the most attractive to the fellows. An elaborate system of triangulation stations has been established during the many years of camp by the professors and students. This system covers an area of 80 square miles, with parties working as far as ten miles from camp in some instances.

This triangulation system includes many wooden towers from which a great deal of the surrounding country can be seen, sights up to several miles in length being taken. Attempting to manipulate a transit at the top of one of these towers, vibrating in the wind, is a task that would test the mettle of any promising engineer. Parties of two were assigned to triangulate either around the lake or in the town system. It was rumored about camp that the overwhelming enthusiasm for running an outboard motor accounted for the slow (but painstakingly accurate) work of these parties. As an example we cite the case of one party which consumed five gallons of gas in four hours on the lake (supposedly). Perhaps they were trying to extend the triangulation system to Lake Andrusia! Orchids to Prof. Zelner for being so broadminded about the whole thing. . . .

It is traditional that civils leave their mark wherever they go. It may be in the form of bridges, dams, and roads when they retire from the profession; but when they retire from camp, it is in the form of resplendent crimson letters on the Cass Lake water tower. Monday night, before the breakup of camp, was selected for the dastardly deed this year. Plans were formulated well in advance to guarantee a successful job. Five names were drawn from a hat, and five brave engineers stepped forth to assume their solemn duty. Maiers, Rude, Basgen, O'Brien, Van Nest—the finger of Fate pointed to these. At the stroke of midnight, the other members nonchalantly assumed their protective stations around the town. The five men of destiny crept by the fire station across from the tower and climbed the tower ladder, paint and brush in hand.

But alas, the hoped-for excitement and opposition failed to materialize. The job was performed so effectively and the operators were so efficient that the natives slept on, in ignorance of the shameful midnight defacement of their town prize.

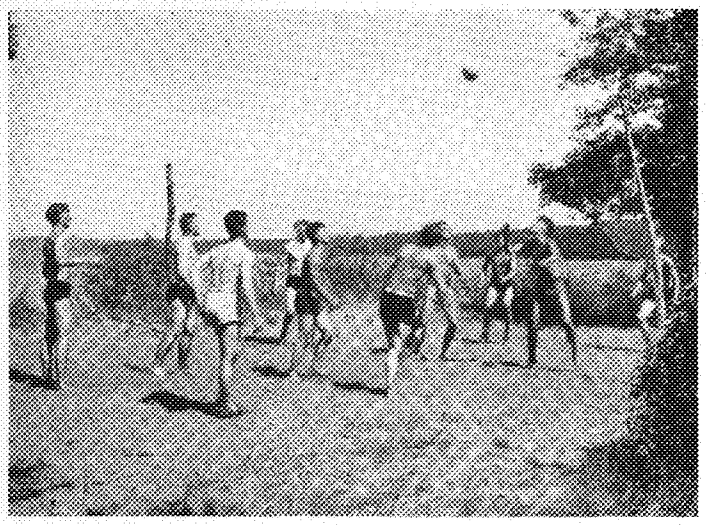
Disappointed by the lack of excitement, the entire group returned to camp to create excitement for themselves. Professor Boon was sound asleep, consequently he was the logical victim of this overflow of enthusiasm. Suddenly, without warning, a weird red light illuminated the grounds. It came from a railroad flare placed in a tree directly under Mr. Boon's window. With war whoops and the explosions of Fourth of July bombs the woods rang as if filled with bloodthirsty Indians. After ten minutes of such carryings-on, the Professor in night attire finally came out of the door to investigate the disturbance. After putting out the flare, he started toward the tent-row, and toward the line of eyes that had been watching. Just about that time, the line broke and fled in panic, each man running for the safety of his tent. They stumbled into their cots with clothes on and pulled the blankets over their heads. In twenty seconds every man in camp was innocently asleep, but from each cot came the gasps of overworked lungs. Of course, Mr. Boon never appeared down the tent-row, so after five minutes, heads were to be seen popping from each tent to survey the situation with sheepish grins. Of course *we* were asleep through it all, but our source was reliable and our information infallible. Hats off to Mr. Boon for being such a good sport about it.

Even if little else had been accomplished at summer camp, it would have been a success in bringing before the public eye three promising young pugilists. The Big Ten boxing title is in sight for Minnesota this year if we can persuade Basgen, Jacobs, and Anderly to forsake their work long enough to step out and win a few important matches for their Alma Mater.

The consensus of opinion among the civils is that it will always remain a mystery to the faculty how black eyes on two civils appeared on the same "morning after." The truth was, it was merely a coincidence, one man proving his mettle at the Red Rooster that night while the other accidentally acquired his by attempting to assist in one of those forced morning dips.

Our third champion, a flyweight, assumed the role of giant killer in taking on 220 pounds of bartender and emerging without a scratch.

It is customary each year to put the fellows to work on some desired project from which will come something valuable to the area, along with the practice it affords the civils. This year the camp was assigned the job of mapping the entire shore along Norway Beach, the map to be used as evidence in the property owners' fight against the government. It seems that the government intends to construct a glorified trailer camp and recreation center along the shore. Realization of this idea will force the removal of camp and all the cottages along that side of the beach. The fact that there is an adequate trailer camp and recreation center there now, especially for the small number of people that are available, seems not to be a factor. How the fight will end is a question, but it was interesting to us to notice how efforts were made to im-



". . . a volleyball court was constructed between the mess hall and the lake . . ."

press Washington officials with the need of such a project. Reports were made that hundreds of people were using the center daily, whereas an accurate count by the cabin owners never exceeded 80 in one day.

Be this as it may, it was our job to conduct the survey. Plane table topography was the method employed, and it proved most interesting. In this method control points are first located on the ground. These points are then plotted on maps and the maps taken right into the field. The details of the country—cabins, trails, contour lines, type of timber—are then sketched in by the instrument man. These points are located in relation to the control points by direction and distances. When the party comes in from the field the map is already drawn with the exception of inking. The advantages of this method are the rapidity of the work and the ability to visualize the map as you go along.

On page four of the General Instructions for Summer Camp appeared the following notation—lunch—12:00, resume Work—12:30. This customary half-hour from 12:00 until 2:00 was the most widely appreciated half-hour of the entire camp life. Of course the fellows had quite a lengthy treatise worked out explaining the advantages of this unusual 30 minutes. As you know from "Modern Labor Economics" a man's efficiency is greatly lessened by fatigue. By noon fatigue had so overcome most of the boys that no longer could they operate at maximum capacity. Rather than waste such valuable ability while operating at a reduced rate, it was thought advisable to give the machine a complete rest to bring it back to normal. This system worked out very effectively. In fact, the efficiency would bound up from zero to quite a high level whenever Mr. Cutler or Mr. Zelner happened around before the half-hour was up.

Classic remark of the camp by Prof. Zelner, "You fellows think so hard you fall right down on the ground."

After the strenuous work of a long day in the field, there was a need for a bit of relaxation in the evening before and after supper. Being athletic minded by nature, the civils hit upon the plan of playing volleyball, informally and by picked teams. Accordingly, a volley ball court was constructed between the mess hall and the lake —and we were ready for action. Under the competent managerial guide of Wilson C. Brown (of Engineer's Day fame) a round-robin tournament was arranged with six teams of five men each, selected as nearly as possible from the same tents. Competition was terrific, with favorite after favorite going down to disgraceful defeat.

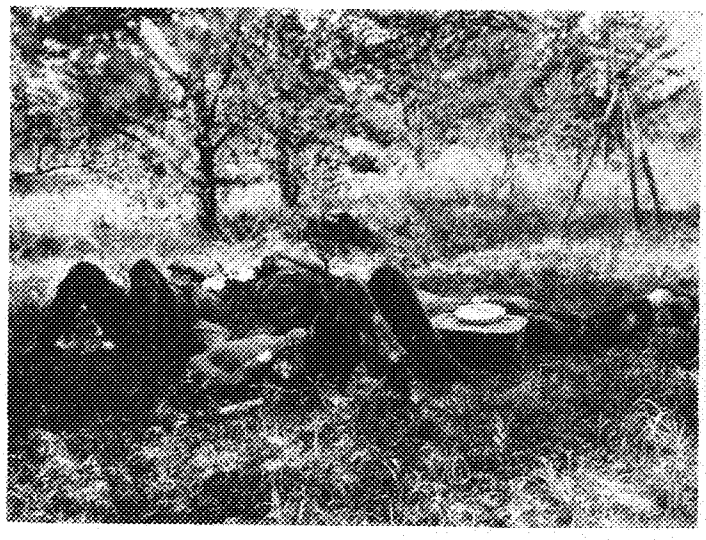
The "Serpentinos," that stalwart band of Brown, O'Brien, Basgen, Anderly, and Rule, although erratic at times, managed to gain the playoffs—but not before provoking more than a few laughs by their quaint antics on the court. So closely matched were the teams that four tied for first place and entered the playoff together. The gallery was packed as the matches began. Hoots and cheers re-echoed as a setup was missed or a good shot made. Even the professors were roused from their usual professorial dignity during the heat of battle.

The finals arrived, and we found the "Serpentinos" matched against a dark horse entry—Bob Longfellow's classy aggregation of ailing athletes. His customary lineup of Hook, Von Eschen, Nyquist, and Ken Anderson had been slightly altered for the final tilt because of a last minute interruption. Prof. Von Eschen took time out between matches to take the fatal dive and marry that "one and only." (Incidentally, cigars were passed out the next day, but only after a little coercion on our parts. Half the camp was sick in the morning. . . . Congratulations, and best wishes to you and your charming wife, Von.)

The game was hard fought, but the "Serpentinos" were finally outclassed, and the dark horse emerged victorious. Rumor has it that the "Serps" were not in their best form, it being a Sunday after the Saturday night before.

Lest our readers gain the impression that it was only a "pleasure camp," we will put all kidding aside and finish on a more somber note. Our six weeks' sojourn at Cass Lake was exceedingly profitable. We know we speak for all the civils when we say that summer camp is the greatest experience of the entire civil engineering course. Credit for the success of Camp may be divided between the faculty for their excellent managing and the students for their coöperation and splendid spirit. This experience is one which all the classes that have gone before will look back on with fond memories and which the class of '40 can well look forward to. Our only hope is that other classes may enjoy as grand a time as we enjoyed.

"By noon, fatigue had so overcome most of the boys that . . ."



The Minnesota Techno-Log

Vol. XIX October, 1938 No. 1

Woolsey Motl Managing Editor
Robert E. McDonald Business Manager

Welcome

Well, here we are starting another year. The TECHNO-LOG extends a welcome and best wishes to you returning engineers; may this year be more successful than any you have enjoyed previously.

The TECHNO-LOG too is starting another year of service to the Engineering students of Minnesota, its 19th to be exact. Throughout this time the purpose and ideals of this magazine have remained the same. Its objects are to keep the students, faculty, alumni, and other interested parties fully informed on the activities of Minnesota engineers, to provide a medium through which engineering students can express their ideas, and to furnish to all students who desire it the experience of working on a publication.

To get the most out of your college life you should take advantage of the opportunity, and each of you has it, to gain experience as part of a going concern. Come over to the office sometime. If you are willing to learn and to work there are places still open on the staff. Will we be seeing *you?*

Why Convocation?

In the news section of this issue you will find a list of the remaining Fall quarter convocations. In that list you will find subjects ranging from "Public Opinion in Great Britain," to "The Art of the Theater in Modern Times." But, sad to say, if you are an average engineer, you will probably say to yourself, "What do I care about the Art of the Theatre, in modern or any other times?" and let it go at that.

The engineering student does not attend convocation because he feels that it is a waste of time. The speakers on these programs are seldom engineers or scientists. Hence he feels that they have no message for him. This is entirely the wrong attitude to take. The purpose of having convocations is to give students a glimpse of as many different phases of life as possible. It is to furnish that breadth of knowledge and outlook that it is so difficult to achieve in this age, which requires specialization in so many fields. The speakers chosen are experts in their own fields besides being good speakers.

Of all the students in the University, you, as an engineer, are in a position to derive the most benefit from listening to these speakers. Your program is probably such that you have little room for elective subjects. Furthermore, it is most likely so heavy that you have a minimum opportunity to get into extracurricular activities. Under these circumstances, convocation offers you the best opportunity to acquire, over and above your technical training, that measure of culture which is so necessary for success, even success in a specialized field. Whether you are a freshman or an upper classman, start now to acquire the convocation habit. It is an easy habit to acquire and one which you will never regret having.

Engineering Organizations

Obviously we are passing through a period of far-reaching social and political change toward more governmental participation in and supervision of industry. The question is: Should engineering organizations take an interest in the formulations of these changes?

Mr. Harrison, president of the American Institute of Electrical Engineers, says no. In a recent editorial he states: "Our future (i.e., that of the A.I.E.E.) depends upon the increase in the knowledge of the electrical sciences and arts and the extent of their application to the service of man, and to me seems clearly to be independent of the forms of social and business organization which administer their application." No one will deny that our technological development is in a considerable measure due to the cooperative pooling of technical knowledge through the various engineering organizations—but must we stop there? Should engineers always take the back seat?

Mr. Harrison must believe that engineers should be concerned about the government's industrial policy individually, but not collectively through an engineering organization. He feels that the conflict of thought and economic intents would destroy the unity of the engineering organizations. But surely engineers are broadminded enough to discuss and make recommendations on these problems without losing unity.

It seems to me that the trend toward more supervision of industry by society demands that engineers *do* take an interest in the forms of social and business organizations which administer engineering applications. Our democracy is sorely in need of greater interest in governmental activities by those whose education and work have made their judgment sound. The formulation of such important changes as are now being effected should not be left entirely to professional politicians and pseudo economists.

Welcome Freshmen

From Dean S. C. Lind

So you wish to be engineers? You have chosen a worthy profession. I wish you all success in preparing it. Your training will be based primarily on mathematics and the sciences, such as physics and chemistry. If you have a taste for these subjects it is an encouraging indication that you may have been "cut out" to be an engineer. If you do not get along well in these fundamental subjects you may well ask yourself whether you, or whoever has guided you in your choice, have not made a mistake. If after due consideration and counsel you decide that you are on the wrong track it is by no means too late for you to change your plans and courses.

But no matter how well you seem "cut out" for engineering, a great deal of trimming and trying will be necessary to fit you to enter the profession. One of the first things you must decide, if you do not already know it, is what kind of an engineer you want to become—civil, mechanical, electrical, mining or metallurgical, chemical, aeronautical, or what have you.

Wide Selection of Courses

Most of the principal engineering branches are represented at Minnesota, though not all of them lead to degrees in that field. For example, courses in Sanitary Engineering are included in Civil Engineering and courses in Industrial Engineering are included in Mechanical Engineering. In a few fields of engineering, such as Marine Engineering and Ceramic Engineering, no courses are given at Minnesota. The student who wishes to enter these fields should go to one of the few institutions in the country that specializes in them.

Often it is not wise to attempt to make a choice of some particular branch of engineering at once but rather to wait until near the end of the first year. In this way the new student has the advantage of contact with members of the faculty and with other students who have already made this choice and can be guided by advice as well as by his own taste or inclinations.

To enable the student to postpone this choice, and still spend his first year profitably, the subjects have been arranged so that the curriculum is the same for most of the branches of engineering during the entire first year. After completion of the first year a student may then go in any direction that he has decided without loss of time.

During the Freshman year students in the Institute of Technology attend a series of Orientation Lectures by members of the faculty. Usually these are given by representatives of the various engineering departments in the University. By hearing these lectures additional information is obtained about the professional practice in the various branches of engineering. These lectures are designed to guide the students who have not already made a selection. But naturally they give those who have chosen a field valuable information about other fields and their relations to each other.

Employment of Graduates

One factor which influences some students in choosing between the engineering curricula is the chance of employment after graduation. Almost everyone is keenly interested in this prospect, although it may not always be the best guide. It fails to take into account the especial talent or preferences of the individual and is subject to great variations from year to year. Personally I should prefer a student to choose that branch of engineering toward which he finds himself most attracted without too much thought of the outlook for employment. In any of the fields he can always feel confident of employment if his record is sufficiently good. In the long run, a man is more likely to achieve success if he chooses the field in which he is really interested rather than the one in which he can most easily secure a position.

As you become more acquainted with the aims and ideals of the engineering profession you will realize the responsibilities that you must assume and the principles that must guide you in entering this profession. The safety of the public is so dependent on the works of engineers that you must not only be worthy of the greatest degree of dependability but you must keep in mind that the engineer is being more and more looked to as the guardian of public safety. We must not only design the things the public wants but they must be made safe and foolproof. The public requires safer highways, safer automobiles, safer food and water, better housing, better acoustics and lighting of public buildings, better city planning, smoke and noise suppression, better recreation and health facilities. You are the engineers that must supply these things. Prepare yourselves to meet the problems, not only as engineers but as broadminded useful citizens and public servants. You are being educated largely at public expense. Be ready to render a more than fair return.

In welcoming you to the University and the Institute of Technology, I invite you to share not only all the privileges of scholarship and the pleasures of fellowship, but also the obligations and high principles of your chosen profession.

"and Tell of Time" by Mrs. Laura Krey

Reviewed by C. I. Haga

Instructor in English

A story of the twenty-odd years after the Civil War, "and Tell of Time," by Laura Krey, is the latest large-scale novel born of that war and the even more devastating Reconstruction following it. We have learned to enjoy long novels these last few years, but it is not always true that these bulky volumes are as full as Mrs. Krey's; and it is this fullness, this largeness of spirit which distinguishes "and Tell of Time." A simple story in outline—Cavin Darcy of the Fourth Texas returns from Georgia with his young bride, his cousin, Lycina Lyttleton, takes over the management of his father's plantation on the Brazos River in southern Texas, raises a large family of children and foster children, leads his neighbors in throwing off the shameful impositions of Reconstruction, plants and harvests and feasts on his rich acres whose abundance is more the fruit of his own strength and thought than the produce of earth and seed, of rain and sun—but in its telling it becomes a story full of all the complex forces that find their focus in such words as husband, father, master, patriot.

But there is more than that. There is a realistic picture of life as it was lived three generations ago in a part of Texas where Southern civilization had a strange and vigorous growth, and there is a romantic dramatization of how this civilization preserved its spirit and its institutions unharmed by the conquerors of its armies. The realism is convincing and the romance is persuasive. By its tokens of achievement, this realistic picture creates a background before which the drama can spin itself out with a greater poetic intensity than would be possible without that support. To me that second quality, the poetic, is the great value of the book, for, lacking that insight, the chronicle would be flat and at best descriptive and analytic, instead of being illuminating as well.

The Greatness of the South

We are a great nation but we cannot say that we have always been great as a nation. At certain times and at certain places, some of us have been greater than the nation as a whole can claim to be. It is this idea which "and Tell of Time" elaborates with an enthusiastic and tender partisanship for the south Texas claim. Like most triumphant expressions of human greatness, this one was simple in its motive. "A man is free when he can choose his own way of living," Shelby Lyttleton reflects, riding his acres in Georgia a few months after the war. A decade later in Texas he says the same to his brother-in-law, Cavin Darcy, ". . . there's always been *one* war going on and only one—a war between the people who want to live on their own land and do as they please, and the other people who want to live jammed up in cities with somebody *telling* them what to do." Such a war outlasts any military pageant marked by declarations and peace treaties and enlists all the powers of men who fight its battles. Their strength is the greater, the more clearly they understand the basis of the struggle—and it is immeasurably greater if, as in Cavin Darcy, this understanding is instinctive and the action it generates is as automatic and unconscious as breathing. Cavin is the type of man who finds satisfaction only in action and, because his sound instincts guarantee that his actions will always be right, he becomes a leader whose followers love him for the purity and simplicity of his motives, motives which they share with him but grasp less clearly or less completely than he does. To sketch thus the springs of action in Cavin does not deny him depth and complexity; rather it emphasizes the integration of his character.

Romance Without Frivolity

This war for freedom continuing long after Appomattox, then, is the challenge Cavin and his neighbors meet and show greatness in winning. All the romantic qualities of Civil War novels are represented—honor and gallantry in the men, virtue and sweetness in the ladies—but without the frivolity they sometimes suggest when the reader knows they are mere accessories or trimming. The sense of seriousness with which Mrs. Krey infuses the lively action, even at its peaks of galloping and shooting, makes us realize again that Southern civilization was not a caricature of itself which any skillful word-spinner can ape. The kind and quality of their education, the nature and the sources of their traditions—both family and political—in short, their culture, shines through all they do and say, however homely or simple, and illuminates the whole scene. It is the author's poetic conception of the problem which makes the realism of the story strike deep root in the actual earth of a living Texas.

It is hard to resist comparing "and Tell of Time" with "Gone With the Wind." Both are long, both are partisan, both mingle realism and romance, and both are extraordinarily popular. The comparison is, paradoxically, to the disadvantage as well as to the advantage of Mrs. Krey's book. The injustice comes from assuming that this novel seeks, like "Gone With the Wind," to entertain and yields no other profit than diversion and amusement. "and Tell of Time" is of a different order of magnitude. It is a story told with passion and tenderness, and demands of the reader qualities of sympathy and sentiment untouched by the slick melodrama of its predecessor. Compare the two and you will find "and Tell of Time" by far the greater novel.

FACULTY SKETCH

By Robert C. Becker, Ch.E. '40

Professor Charles A. Koepke

Administrative Assistant

Professor Koepke is the new administrative assistant in the Institute of Technology, replacing Dr. Straub, who retired from his administrative position last spring. He has been at Minnesota since the fall of 1929, when he came here as the associate professor of mechanical engineering, and during the school year of 1936-37 was appointed as professor of mechanical engineering.

Professor Koepke was born in Garrett, Indiana, and went to school there until he was 14, when he quit with two years of high school unfinished in order to take an apprenticeship course in tool making. Later he went back to complete his high school course and then to matriculate in Purdue University. He received his bachelor's degree in mechanical engineering in 1920 and, after a short period in the industrial field, enrolled at Colorado University, where he received his master's degree after specializing in the field in which he had always been interested—industrial engineering.

Besides doing consulting work in factory management in this district for the past six years, Professor Koepke has worked for Procter and Gamble, Studebaker, Gardner-Denver, and the Newport Shipbuilding and Drydock Company in Virginia. Prior to his coming to Minnesota, Professor Koepke taught at Lewis Institute in Chicago, Purdue University (including two years of instructing in mathematics while still an undergraduate student), Colorado University, the University of Wyoming, and at present has two classes here at Minnesota (Production Control and Time and Motion Study). Incidentally, students in nursing now take a mechanical engineering course in motion study. Hence Professor Koepke is also listed as a member of the Nursing School faculty.

He is a member of the American Society of Mechanical Engineers, The Society for the Promotion of Engineering Education, The American Association of University Professors, and several lesser societies. He is also a member of Sigma Xi, Tau Beta Pi, Triangle, and Pi Tau Sigma fraternities.

Although his greatest interest lies in administrative work, Professor Koepke does find time for his hobbies and for remembering such quotations as "A hobby is something you go goofy over to keep from going nuts." Trout fishing and photography happen to be his sources of consternation. While on a leave of absence last year he visited industrial plants in the east and then went down to Old Mexico, where he took over two thousand pictures to show the contrasting industrial practices to be found in a nation producing goods by handicraft methods.

TECH NEWS

Mines Society Meeting

The School of Mines Society held its first meeting of the year September 29th, at which plans for the annual School of Mines freshman reception were discussed. The date was set for Tuesday, October 11th, at 8:00. The reception was held for the purpose of acquainting freshmen and transfer students with the student body, the faculty, and the traditions of the school. There were refreshments and entertainment. Officers of the School of Mines Society for the year 1938-39 are: Hugh Leach, president; Leland Bachelder, vice president, and Sam Callaway, secretary-treasurer.

Faculty Changes

W. D. Lacabanne, instructor in Petroleum Engineering, will take the place of S. A. Trengove on the School of Mines faculty. Mr. Trengave is now employed by the Oliver Iron Mining Company. V. E. Frank and D. W. Kugler, instructors last year, have also left the School of Mines faculty.

Howard W. Barlow, assistant professor, is working at New York University on an exchange fellowship with Frederick K. Teichmann, who is lecturing here. Both men are working toward Doctors' degrees in Aeronautics. S. M. Serebreny, also of New York University, has been added to the faculty of the department.

O. Wm. Muckenhirn, who received his master's degree at Massachusetts Institute of Technology, will teach sophomore electrical engineering and also some laboratory work. He is the only addition to the department this year.

New Course

The demand that electrical engineers should be better grounded in electronics has been answered by changing the main course of EE 113 and EE 115 from five to three credits and including a fundamental course in electronics of three credits a quarter. A laboratory has been equipped to provide the students with some general experience with the principles and devices encountered in the subject.

Faculty Notes

The faculty of the electrical engineering departments worked hard this summer in the advancement of the interests of their profession. Pro-

fessors Ryan and Bryant were in Washington, D. C., at a meeting of the American Institute of Electrical Engineers, where Professor Bryant presented a paper.

Mr. Johnson attended a conference on illumination at Cleveland and later served on the board of management of the Illumination Engineering Society for their convention which was held in Minneapolis late this summer.

Dr. Webb has been doing research at Cornell, while Dr. Hartig used the summer to publish two papers.

The entire aeronautical faculty attended the National Air Races on September 3, 4, and 5 at Cleveland, Ohio. Mr. Barlow directed the timing staff, since he was the only member of the 1937 timing staff to be present among the timers at this year's races.

Over sixty faculty members and students from the School of Chemistry attended the convention of the American Chemical Society held at Milwaukee recently. A paper presented by Professor L. I. Smith on the work done here at Minnesota on Vitamin E was one of the highlights of the convention.

During the past five years American light users have received a bonus of $16,500,000 from a single type of electric light bulb. Engineers report that because of increased efficiency and reduced prices during this period the common 60-watt lamp has saved the public enough to pay Finland's war debt twice over.

Convocation Schedule

October 20

Professor Ralph D. Casey, Professor of Journalism and Chairman of the Department, University of Minnesota. **Topic:** "Public Opinion in Great Britain."

October 27

Elliott S. Humphrey, Executive Vice President of the Seeing-Eye. **Topic:** "Training the Seeing-Eye Dogs."

November 3

John Haynes Holmes, clergyman, author and sociologist. **Topic:** To be announced.

November 11

Dr. Frank Bohn, author, newspaperman, and expert on international relations. **Topic:** "The Economics and Politics of World Peace."

November 17

Shelden Cheney, actor, author, drama critic, and magazine editor. **Topic:** "The Art of the Theatre in Modern Times."

December 1

Rt. Hon. Margaret Bondfield, former British Secretary of Labor and prominent labor leader. **Topic:** Labor and World Peace."

December 8

Julian Bryan, world traveler and roving camera reporter for the "March of Time." **Topic:** "Inside Nazi Germany." (Talk illustrated with motion pictures.)

Tech Commission Registers Profit

Last year the Technical Commission staged a decided financial comeback. In spite of a loss of $87.10 on that ill-fated venture, the Slide Rule Frolic, the Commission ended the year $167.93 in the black. This was due in a large measure to the fine spirit shown by the students in putting on the big two day Engineers' Day.

Wilson Brown and his cohorts did an excellent job in making up the program and running off the various activities. This, plus the aforementioned student coöperation, yielded a profit of $360.72 on the event. Charged against this are losses of $87.10 on the Slide Rule Frolic, $12.75 on the Senior Stag held in connection with Engineer's Day, Commission expenses, awards, etc., of $76.10, and the deficit at the beginning of the year, which was $41.98. The final balance then becomes:

Income (Engineers' Day plus recovered bank account)	$385.86
Expenses	217.93
Balance	$167.93

An abbreviated balance sheet for Engineers' Day proper follows:

Net income from profitable activities:

Button Sale	$338.82
Brawl	324.45
Dansant	27.75
	$671.02

Expenses:

Open House	$ 98.45
Publicity	79.15
Regalia	23.30
Parade	59.02
Field Meet	25.49
Administration	24.80
	$310.30
Operating profit	$360.72

From the above statement it can be seen that both the button sale and the Brawl were very successful. This plus the economy practiced as evidenced by the low expenses of the other activities yielded the almost unprecedented profit of $360.72. The whole balance sheet serves as an excellent example of what engineers can do when they all pitch in and work together. They can have a good time and make money while they are doing it.

Senior Chem. E.'s Visit Conclave

Ed Joesting, Gordon Griffith, and Robert Logan, all senior chemical engineers, traveled to New Orleans this summer to attend the biennial national conclave of the Alpha Chi Sigma fraternity. The boys report that the southern belles have not been over-rated. Dr. M. C. Rogers of the Chemical Engineering faculty also attended the conclave.

Senior Civil Wins Prize

Congratulations are in order for Leslie Anderson, senior civil engineer (see Author's column), whose essay won third prize in the contest sponsored by the Commercial Investment Trust Company's Safety Foundation. His essay, about 5,000 words long, was written on the subject of highway safety. The prize was a check for $100.

Bookstore Dividends Break Record

The 1937-38 school year was the most prosperous one to date for the Engineers Book Store. Sales recorded to members for participation in dividends amounted to $70,151.76 as compared with the $54,526.92 total of the previous year. A dividend of 14% less a 25c computation fee was paid. The total of the dividends paid was $9,110.29, this being almost $000 greater than the largest previous total. The number of members has risen to 4,340.

In addition to the increased membership, increased dividends, and increased physical space and facilities (which improvements were completed last spring) the Bookstore Board, at a special meeting during the summer, voted to merge with the bookstore in the School of Business. This change, which was approved by the School of Business, the Comptroller, the Board of Regents, and the President, is now in the process of being completed. When this is completely finished the Bookstore will have a stock of books and supplies for engineering, medical, dental, nursing, and business students. It is also planned to change the name of the store to one more consistent with its expanded scope.

Registration Continues to Rise

	1938	1937	1936
Aeronautical Engineering	343	280	235
Agricultural Engineering	33	26	21
Architecture	103	91	99
Civil Engineering	219	188	192
Chemistry	125	139	157
Chem. Engineering	422	437	380
Electrical Engineering	358	310	298
Interior Architecture	7	12	8
Mechanical Engineering	420	356	284
School of Mines (Unclassified)	77	91	93
Engr. of Mines (Mining Seq.)	30	25	31
Engr. of Mines (Geology)	9	14	13
Engr. of Mines (Metallurgy)	31	22	16
Engr. of Mines (Petroleum)	9	8	7
Physics	19	10	7
Pre-Business	40	46	44
Unclassified Freshmen	21	72	77
Unclassified Students	—	—	13
TOTAL	2266	2127	1977

Staff Jobs Still Open

Positions are still open on both the editorial and the business staffs of the TECHNO-LOG, particularly the latter. Circulation, office, and advertising work is available on the business staff. Previous experience, while desirable, is not necessary. Any student who wishes to widen his circle of acquaintances, to gain interesting and practical experience, and to make a valuable addition to the theoretical knowledge he is getting from his books should take advantage of the opportunities business staff work offers.

Editorial staff positions are still open also. Equally valuable experience, though of a different nature, awaits those who enter into this phase of the work.

This Month's AUTHORS

* * *

C. Vernon Olson, E.E.-B. '40, writer of the lead article "For Ambitious Engineers Only," is feature editor of the TECHNO-LOG this year. This is the second article of his to be printed in the TECHNO-LOG. Vern is a member of A.I.E.E. and of the American Management Association. Incidentally, if you have any good ideas for feature articles don't hesitate to drop in at the office and talk them over with him. If that is inconvenient for you, drop a note in his P. O. He will be glad to hear from you.

* * *

Millard A. Troxell, Met. E. '39, chronicler of the Miners' field trip, is a frequent contributor to the TECHNO-LOG, this being his third article. He also writes or helps write Pick and Pan. Besides performing these duties he finds time to be a member of the All-University Council, the A.I.M.E. the A.S.M., The School of Mines Society, and to serve as treasurer of Theta Tau fraternity. He also holds down several part time jobs. What do you do in your spare time, Millard?

* * *

This year's report on Civil Camp, and we assure you that it will interest you whether you are a civil engineer or not, was written by that inseparable pair, Les Anderson and Herb Gaustad.

Herbert Gaustad, C.E.-B. '40, is president of A.S.C.E., this year. He is also vice-president of Chi Epsilon, honorary civil engineering fraternity, and a member of Tau Beta Pi. He worked on the TECHNO-LOG last year as copy editor and on Engineers' Day as publicity chairman. Herb lists as his hobbies golf and tennis. His ambition is to get into management work when he graduates.

Leslie Anderson, C. E. '39, is president of Chi Epsilon, secretary of Tau Beta Pi, and a member of A.S.C.E. Les won the Tau Beta Pi freshman prize two years ago. He has written several other articles for the TECHNO-LOG and has also worked on the staff as a copy reader. His hobbies are tennis and writing. The latter proved quite profitable this summer. Les plans to enter the field of city planning and management when he graduates.

PICK AND PAN

By M. A. Troxell, M. '39

Welcome, happy freshmen! From the high schools of this state and many others you throng, ready to lick that old Engineering course into submission. Here's wishing you all the luck I can in the accomplishment of this goal, but just remember that old man Statistics still rears his ugly head and testifies in rasping tones, "Only half of the freshmen who matriculate at Minnesota will graduate!" Furthermore, there are easier courses than Engineering offered at the University—for this reason many who start out in Engineering do not finish there.

A freshman came up to me during freshman week and pointed down Washington Avenue, with the words, "If I catch that street car downtown where do I catch it to get back?" It took me so much below the belt I haven't got the right answer yet.

One Alfred Geldman, potential non-ferrous metallurgist, is laboring under the delusion that he is musically inclined. So what did this well-meaning jitter-bug do but expend ten of his hard-earned pennies for a tin flute. Day after day he regaled us with merry little tunes—not different ditties, but always the same ones—hoping thereby to make our daily burdens lighter. Finally some public-spirited citizen tested the torsion resistance of Al's flute and silence again reigned supreme.

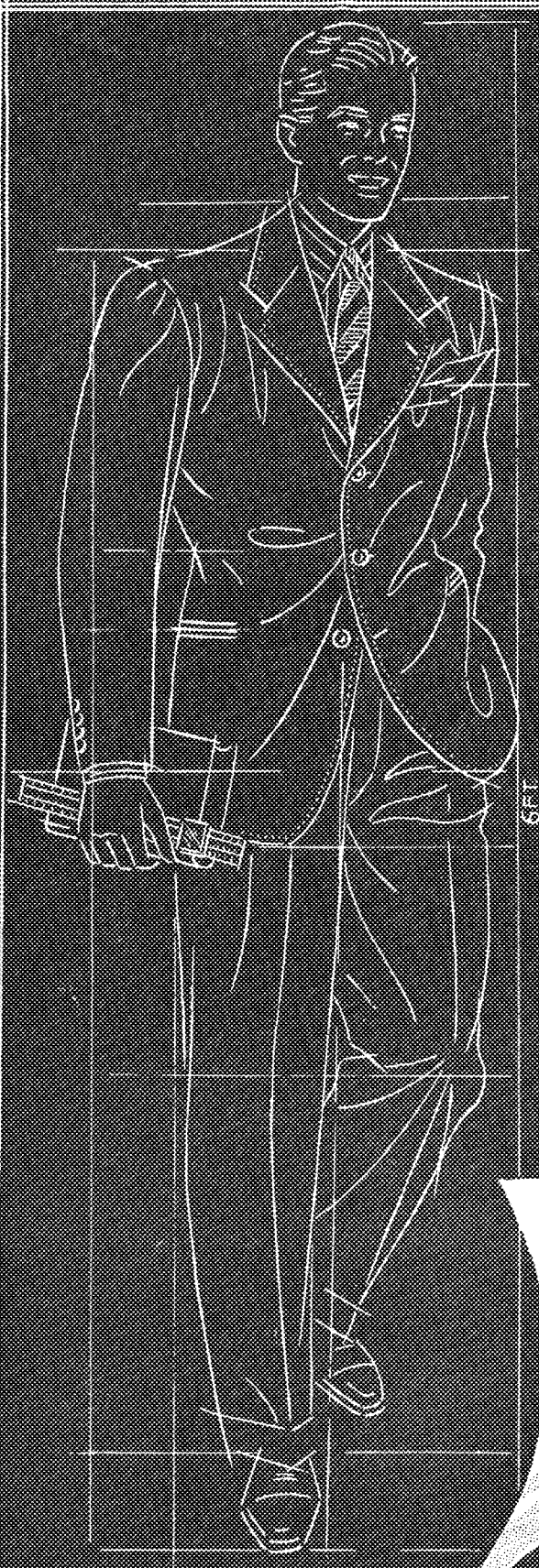
For two days yours truly diligently distributed official Freshman Week programs to prospective Minnesotans in front of the armory. The newcomers were nearly always pleasantly polite—over half of the recipients even thanked me personally! This augurs well for the class of '42.

Professor Richardson of the Engineering English department was placidly dining in the Campus Club one day last summer when who dropped in but Professor Butters of the Botany department. "Hi, Fred," said the jolly Professor Richardson, "Come over here and sit down—I'm leaving for California tomorrow and I won't be seeing you for two months." "Well, fancy that!" returned Professor Butters, "I'm leaving for Grand Marais tomorrow. Then I won't be seeing you for two months *either*!"

Roommate Larson went off and got married. Oh well, if he wants to hunt around for a different roommate, just see if I care.

Advice to Freshmen:

1. None of the campus buildings is for sale.
2. The best time to start working on the TECHNO-LOG is when you're a Freshman.
3. Wear a slide-rule on your belt if you want to look like a Sophomore.
4. Join the Lodgers' League (4th Floor—Union)—you'll get your four-bits back in free or reduced admissions to social events alone.
5. No one will be able to tell you're a Freshman now that Freshman Week is over if you'll just take off your National Honor Society pin.



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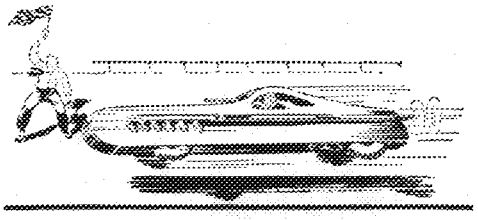
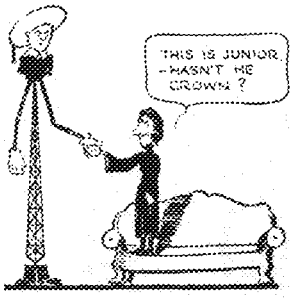


"SPEED DEMON"

HAIL the new speed champion—a champion who has never seen a speedway or flown an airplane. The Olympics mean nothing to him.

"He" is a tiny quartz crystal that has set a new record by vibrating at a pace that puts the hard-working human heart to shame—20,000,000 vibrations a second, or 16,066,666 times faster than the normal human heartbeat.

This speed demon is used in a new oscillator developed by General Electric engineers for maintaining constant frequencies in radio transmitting. Careful mechanical grinding and painstaking polishing by hand reduce the rough crystals to the size required for the particular broadcasting frequency used. Then the simple instrument is installed in the transmitter circuit and goes to work making the station stay on its assigned wave length.



THE BABY GROWS UP

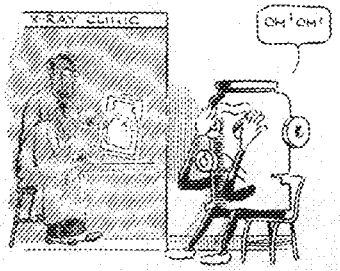
SIXTEEN years ago G-E radio engineers crossed their fingers and snapped a switch in one of the laboratories at Schenectady—and a split second later heard through clumsy earphones, "This is WGY, radio broadcasting station of the General Electric Company, Schenectady, New York."

That was the "birth announcement" for this G-E station, whose rise from swaddling clothes to the lusty strength of sixteen years has paralleled the rise of radio broadcasting from experiment to smooth efficiency.

From the start, WGY was an unusual child. When only three days old, it started pioneering by presenting the first remote-control broadcast. And the pioneering is still going strong. As the station grew, it provided the groundwork for network broadcasting, mobile transmission, coast-to-coast television broadcasts.

This year, WGY celebrates its sixteenth birthday with a new 625-foot nondirectional antenna (70 feet higher than Washington Monument) and a modernistic new studio building with everything from a model kitchen to a large audience studio.

Engineers conduct tests on the young giant day and night. Some are the veterans who started years ago—others are recent graduates of engineering schools assigned to the control rooms and transmitters upon completion of their G-E training courses. Results of the tests these two groups conduct today will appear as refinements in the broadcasting of tomorrow.



ELECTRICAL TROUBLE SHOOTER

TWO men are carefully examining a large x-ray photograph in a darkened room. One of them points to some dark spots, some wavy lines. . . . "There's the trouble."

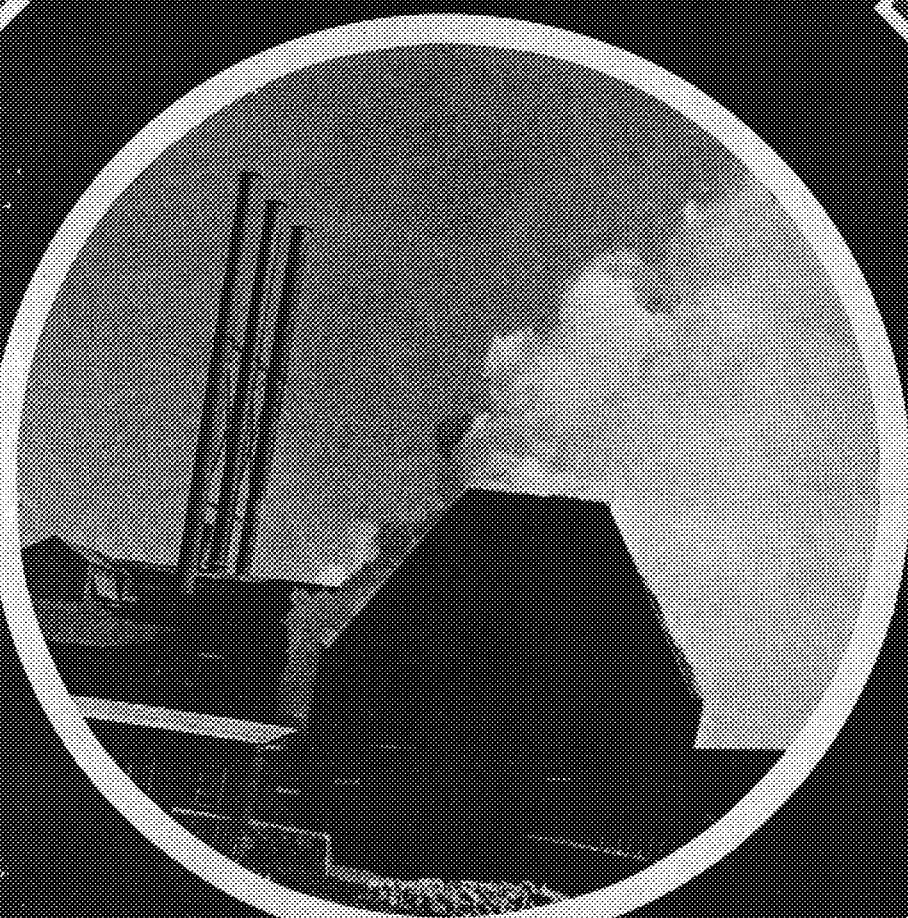
This might well be taking place in a large medical laboratory. Instead, factory production lines and machinery are only a few feet away—it is a testing room in which x-ray photographs of steel castings are examined. In many such rooms, in all parts of the country, other engineers are making like tests—tests that ferret out defects in castings before they can cause trouble.

Knowing in detail the symptoms of every defect, these engineers, guided by the x-ray, detect gas pockets, shrinkage areas, and internal cracks. They eliminate all but "smooth" castings.

Such applications, of which many persons are not aware, are typical results of the constant search by G-E engineers for new uses of the x-ray. And not all of these engineers are veterans—some only a few years ago completed their studies in engineering schools and came on Test with General Electric.

GENERAL ELECTRIC

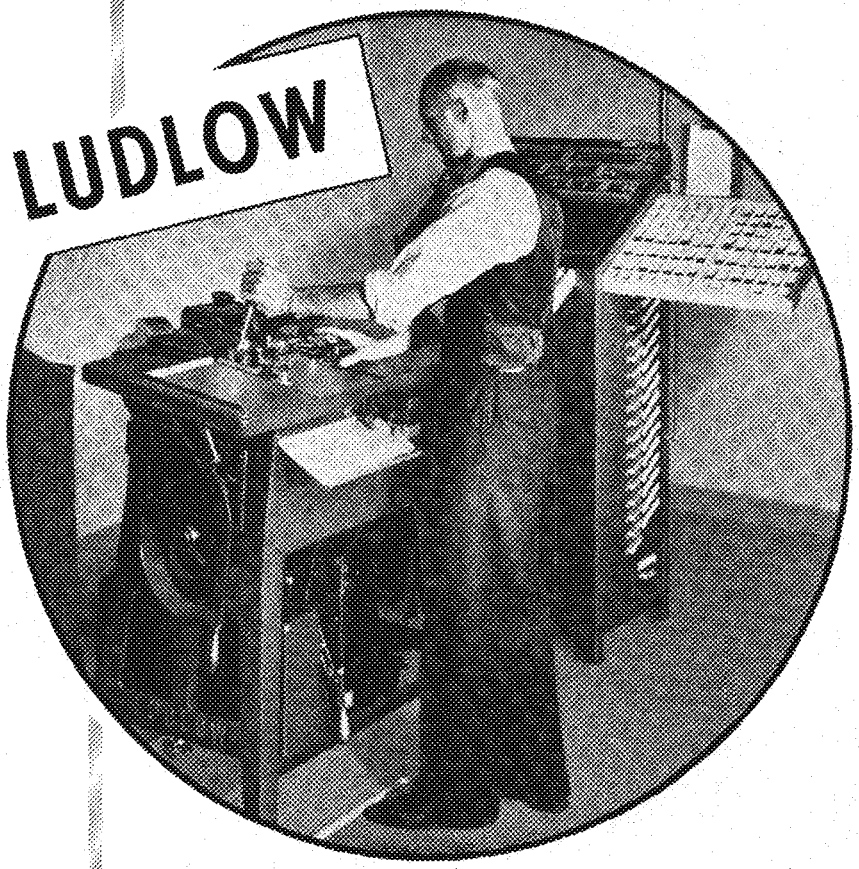
MINERAL TECHNOLOGY



NOVEMBER

1938

THE LUDLOW



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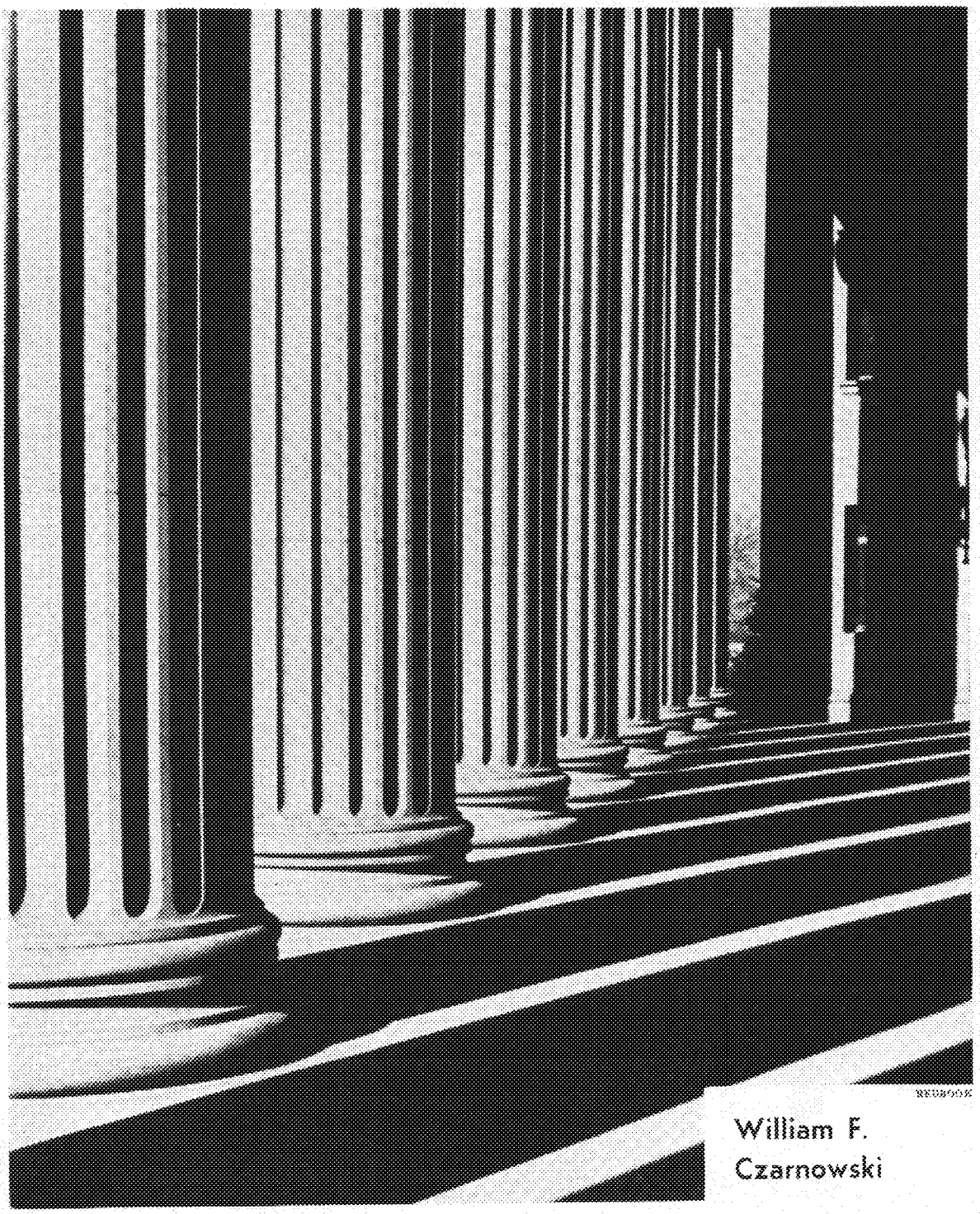


William F. Czarnowski

Northrop Auditorium

Before You Head South . . . .

. . . to seek your fortune in South or Central America where 42° F is cold weather, lizard tail is a delicacy, and the young engineer learns to really appreciate the U.S.A. with its co-educational colleges, read this article by a student who has lived there. You may reconsider.

By Homer S. Anderson, E.M. '39
Illustrated with photos taken by the author

"AND when I graduate, I'm going to get a job in South America and see the world." Do you remember when you were a freshman? Didn't you hear some of your present classmates say something on that order? Or perhaps you are a freshman and are entertaining similar thoughts right now. Usually these thoughts are merely idle dreams, but since we seniors have been confronted with requests for information for personnel sheets, we have begun to realize that at long last we are about to graduate and that the time has come when we must look for that job we dreamed about.

Every year a large number of young graduates in all fields of engineering are offered positions with American companies which are operating in some Latin American country. Therefore, if you are a technical graduate, especially if you have a knowledge of Spanish, you might get one of these jobs. Unquestionably, your chances are better if you do speak Spanish, but a great number of companies do not require this knowledge and provide schools for their men at their South American headquarters. A surprisingly short time is required to learn enough Spanish to get along well with the native workmen, but years of study are required to acquire true fluency in the language. Great fluency in Spanish is rarely required, however. If your interest in far-away places has been aroused by reading romantic travel and adventure books, or by listening to Professor Richardson's tales of his travels, you will find these offers attractive, not only because of the wages offered but because they seem to answer this longing for travel and excitement. Although many students are probably well informed on living conditions in South America, a great majority aren't sure just what they would encounter if they did accept one of these offers. Those who fall in the latter class might find this article of interest. Those who fall in the former class are asked to cease reading at this point. The writer does not want to be contradicted.

Although the writer has yet to experience the thrill of receiving the sheepskin on graduation day, he has worked and lived in Central America for a period of three years. How he got there is a long story and perhaps is better omitted. Suffice it to say that the first year was spent in prospecting for mineral deposits and assisting in the examination of various mining prospects in Honduras and neighboring Central American Republics. The other two years were spent working as a member of the engineering force of a large silver mine at San Juancito, Honduras. The writer feels that he learned much during those three years, especially about life in the tropics. So here goes!

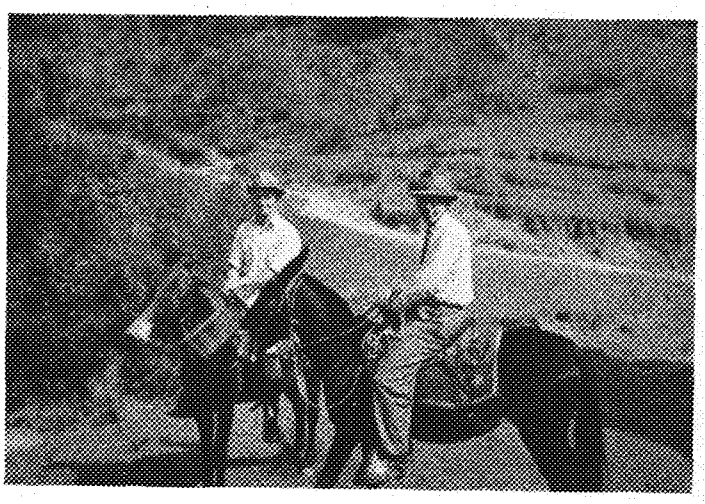
Let us assume, then, that you have received one of these chances to go to South America. No doubt your lust for travel will have abated somewhat by the time you reach your destination so you should be interested in what you will find when you get there. You probably can secure information concerning the geographical location, climate, altitude, and housing conditions from the company that is hiring you, but this is sometimes rather limited information. At any rate, you would be wise to get all the information from all available sources before signing that contract.

Wet Weather

Probably the most important factor to consider before accepting a position in Latin America is the climate of the particular locality. After facing Minnesota's famous cold winters for a number of years the prospect of working in a country which is always warm should appear mighty pleasant. As a matter of fact, one doesn't miss the snow as much as might be expected. Nevertheless, many dismiss the tropics from their minds because they don't like hot weather. However, both hot and cold weather are to be found in Latin America. In all of South and Central America the climate is greatly influenced by the altitude. The low lying coastal regions are hot, and on the Atlantic coast the rainfall is excessive. Low-lying, wet country is malaria country, so, beware! Many stories are told of white men rotting in the steaming, fever-ridden tropics and, while they may be exaggerated, they are not without a foundation of fact. It is true that malaria can be avoided by taking prophylactic doses of quinine, but there are other tropical diseases that are more dangerous or, at least, very annoying. Some of the cities that are on the sea shore are cooled by the ocean breezes and in these the climate is quite pleasant. As a rule, however, the low country is good country to avoid.

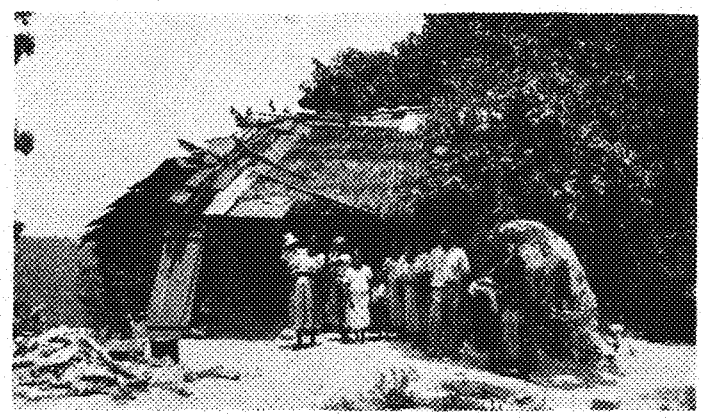
The best climate in Latin America is found between the elevations of 3,500 and 7,000 feet above sea level. The mining camp at which the writer worked was just

Horses are an often used means of transportation. The author is the man on the left.



a little over a mile high. There the average temperature was about seventy degrees and rarely got above eighty-five degrees or below fifty degrees. During the rainy season, however, the temperature once dropped as low as 42 degrees and all of the natives, being unaccustomed to the cold, suffered as much as if they had been exposed to the icy blasts of the Northrop wind tunnel.

Incidentally, the length of the rainy season is an important factor to consider. In most of Latin America there



A typical dwelling of a poorer Latin-American family.

are two seasons, wet and dry. As a general rule, the country west of the continental divide is dry or even arid, while the Atlantic coastal regions are characterized by excessive rainfall which amounts to over 200 inches annually in some places. On an average, the rainy season lasts six months and the dry season for an equal time. At the mining camp where the writer spent two years, the rainy season comprised three-fourths of the year. The rains were exceptionally heavy for only three months, however. Therefore, if you don't mind a little rain, don't worry about the climate. The chances are that you'll find it ideal.

Room and Board

Another important question to consider is that of housing accommodations. Most of the companies provide houses for their foreign employees who are married and dormitories for those who are not. Usually the company operates a hotel where the single employees and guests of the company may dine. The houses for the families may be provided free or for a low rental charge. Often the number of houses is limited, and it is customary for the new man to live singly for a period of six months or so. This, of course, means separation from your wife, if you have acquired one, but that is one thing that you'll just have to face. As a rule both houses and dormitories are modern in every way, although they are usually simple in design. Some of the homes provided for the managers and superintendents are sumptuous affairs with beautiful landscaped lawns.

Of course, the best assurance that your food will be well prepared by a good cook is to marry one and take her with you, but if you are not that fortunate, you'll probably have to eat at the company hotel for a time. The meals obtained in the company hotels do not differ greatly from those obtained in a boarding house in the United States. The Yankee seems to be a bit distrustful of the Latin American's taste in food and, therefore, prefers to eat canned goods brought from the States regardless of cost. Therefore, the chances are that you will find that your living quarters are quite comfortable and that the food is wholesome—while you are at the headquarters of the company.

In the Field

Frequently the young engineer is sent out from the headquarters of the company on reconnaissance work of some sort. The mining engineer will find this especially true in his work, but other engineers are called upon to do similar work. In such cases, the engineer often has to depend upon the natives of the region in which he is working for food and lodging.

The poorer classes in all Latin America live in hovels which we would not consider fit for human habitation and, although many fruits and vegetables grow well in the country, their diet consists chiefly of brown beans and tortillas. Tortillas, you know, are an unleavened bread made of corn and resembling a pancake in shape. While they are hot, the flavor resembles a combination of popcorn and hominy; but, when they are cold, and it seems that they usually are cold, flavor is almost entirely lacking and one has the feeling that he is eating cardboard. These two staples are occasionally supplemented by coffee, meat, and fruits. Oranges, lemons, bananas, mangoes, and pineapples are plentiful, but most other tropical fruits are a bit too sweet for most palates. As for the meat; that might be anything, with emphasis on the "anything." An engineer with whom the writer worked was once treated with a feast of mountain lion; the writer once enjoyed a fine feast of lizard tail. After that he never asked what the meat was—it seemed better not to know.

Despite their poverty, these people have an inborn courtesy and true hospitality that impressed the writer greatly. When a total stranger comes to them seeking food and lodging, they give him the best they have and do everything in their power to make him comfortable. It is a common practice for them to gather fragrant pine boughs and strew them about the room in which you hang your hammock. Would you do that for a foreigner who came knocking at your door in the middle of the night? Yes, the Spanish hospitality is rightly famous.

If you are very sensitive about such things as filth and dirt or are squeamish about the things you eat, don't go wandering about Central or South America. Someone once said that an adventure is an inconvenience rightly considered and that an inconvenience is an adventure wrongly considered. If you follow that creed, perhaps you will enjoy roughing it in the tropics. The writer did.

Since the actual working conditions probably won't differ greatly from those in a similar organization anywhere else, the last but not least important thing to consider is what to do with your spare time. If you are fortunate enough to be located at the headquarters of your company, you will probably find many facilities for recreation. Many of the companies provide tennis courts, swimming pools, golf courses, and club houses for their employees. If you are located near the coast, you might do some deep sea fishing, or, if you are located inland, you should find ample opportunity to do a bit of hunting. Game such as deer, wild turkeys, wild pigs, mountain lions, etc., is plentiful, but hunting them is a really difficult task. There is a great deal of natural cover and

every twig and leaf that you touch is covered with some sort of vermin that hops, crawls or flies. After a few hours in the brush you will probably be so covered with insect bites that you will think you have the measles. That just adds to the sport and is just another of those things that you will get used to.

If you are interested in an avocation such as photography or stamp collecting, you will probably welcome the opportunity to devote a great deal of your time to your hobby. Unusual and interesting subjects for photographs are encountered nearly every day.

Social Life

The center of the social life of the camp is the club composed of the employees of the company. Its headquarters are usually in a club house built by the company and which contains ball rooms, billiard tables, bowling alleys, movie projectors, radios and phonographs. This club house is available for dances, movies, teas, and bridge parties—to say nothing of the poker sessions. It might be a good idea to improve your bridge; it is taken for granted that you already know poker. Small monthly dues are charged and are used to buy new books for the library and new phonograph records. Usually these organizations have fairly large libraries, so you will probably find the time and the opportunity to catch up on your reading. That is one thing that you will never regret.

Night clubs are found only in the larger cities and, except for an occasional vacation, you probably won't spend very much time in the large cities. As a rule, therefore, your night life will be limited to parties and dances given by the club or by individuals. The music for these parties may be provided by a native orchestra or, if the party is less ostentatious, by a phonograph or radio.

Now a great question arises. Whom do you take to these parties? Of course, if you are one of those fortunate ones who has already acquired a blushing bride, your problem has been automatically solved, or should be solved. However, if you are still enjoying your so-

Not breakers, but clouds. A view, from the camp, of the valley on a misty morning.

called single blessedness you are really up against a serious problem. If you are located in or near one of the larger cities, you might meet one of the famed beautiful Spanish senoritas. However, the camps of the large American companies are often somewhat segregated and the native girls living near the camps are either Indian or Negro or a mixture of both. If that is the case, and the chances are that such a condition will exist, you probably won't escort any of the local young ladies to the dances—not the club dances, at any rate.

If you don't like brunettes, that is the very dark type of brunette, you probably won't meet many girls. There might be one female secretary in the camp, although usually men fill such positions, or perhaps a manager's daughter might spend a summer vacation at the camp. No matter how much of a woman hater you are, after you

The concentration mill overlooking the valley.

haven't seen a white girl for a year or so (the writer saw two in three years) the chances are 1,000 to 1 that you will fall like a rock when you do meet one. Oh, yes, we mustn't forget the school teachers. The companies usually operate schools for the foreign employees' children and hire teachers from the States. At the mining camp where the writer worked it was necessary to hire a new teacher nearly every year. The teachers usually quit when they married whichever engineer pleased them most.

By the way, if any of the readers happen to be looking for husbands, they might do well to take up secretarial work, learn a bit of Spanish, and head southward. About one hundred per cent of the engineers who have been away from home for a year or so are pushovers. If the reader is a husband seeker and pretty, she might save time by leaving her name and telephone number in P. O. 6213. (Note to Editor: Do you think it will work?) (If it does, let me know.—Ed.)

If one feels that his social life has been neglected, perhaps he can make it up during his vacation. Your contract will provide for a vacation with pay of at least one month per year. These vacations may be taken at the end of two or three years, depending on the contract. During a three months' period one should be able to do quite a bit of celebrating. About three weeks of this time will be spent in going back and forth from home (this is assuming that you decide to go back again), but boat trips are really grand vacations in themselves and the thrill of putting one's foot on United States sod after an absence of three years is worth the trip.

Thus you can see, South America does offer opportunities for the engineer who is interested in living a somewhat adventurous life. By obtaining sufficient information concerning the climate, the size of the camp, and the size of the community in which he expects to live, the engineer should have a good idea of what to expect of his environment. That he will have to live a life that is in many respects different from his present one should be no drawback, since living conditions are, as you can see, very acceptable.

The Agricultural Engineer

What is an Ag. Engineer? Why is an Ag. Engineer? Who is an Ag. Engineer? For a complete and interesting answer to these questions we refer you to the article below. You'll find among other things that though the profession is young, it is definitely established, and is expanding rapidly.

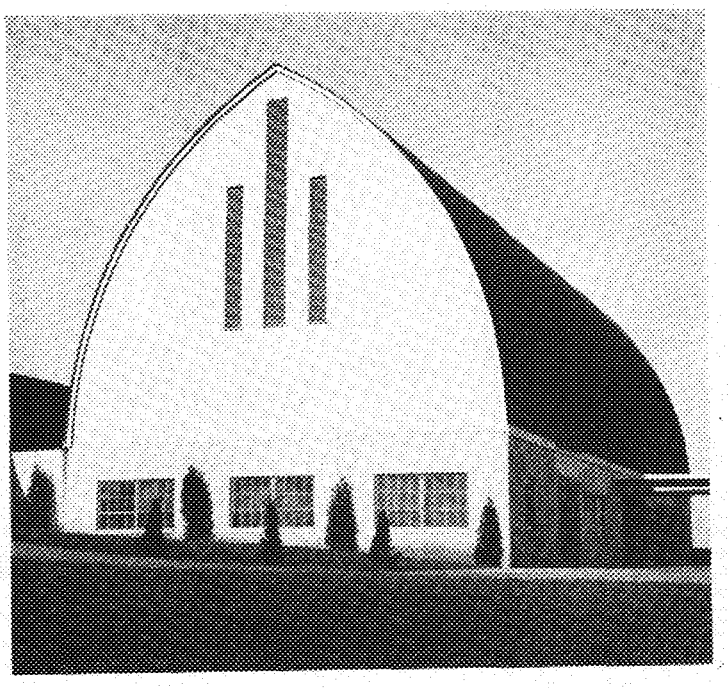
By A. Nelson Dingle, Ag.E. '39

On our Minnesota campus, agricultural engineering is either completely unheard of or it is considered as some freakish hybrid of technical and agricultural courses, the purpose of which is to make a farmer or a first class farm hand of the agricultural engineer. Almost invariably it is necessary for the agricultural engineer to explain to new found acquaintances just what his purpose in life is and what fields are open to him. That is the object, in part, of this article.

The field is divided into three main parts: agricultural machinery, land reclamation, and farm structures. The agricultural machinery field, as would be expected, comprises design, construction, and sales of agricultural machinery. That is principally mechanical engineering, but the engineer must be farmer enough to know, for example, that a tractor for orchard cultivation must be built low and have no upshooting exhaust and vent pipes to catch in the branches, or that a field cultivator is for the sole purpose of cutting off and killing the weeds and should therefore cut only to a depth of one to two inches to reduce both the draft necessary for operation and the chances of injuring the root system of the cultivated crop. In other words, he must know enough of the farm problems to understand what new machinery is needed and wanted on the farm. Naturally, the salesman must understand everyday farm problems. In that respect, then, he must be a farmer, but in his knowledge of machinery, he has to be an engineer—a better engineer than the farmer is. If the agricultural machinery salesman knows and can convince the farmer that he knows why the binder ties loose bundles, or why the combine leaves more grain in the field than it saves for the granary, he is both a good salesman and a good engineer and will probably receive proof of the fact in the form of good commissions.

An example of the work of the agricultural engineer in building design.

PORTLAND CEMENT ASSN.



Land Reclamations

The land reclamation division is probably more nearly what one thinks of when agricultural engineering is mentioned. It is what might be called the civil engineering division of agricultural engineering, dealing with drainage, soil erosion, and irrigation. These fields all demand an intimate knowledge of soils and soil structures; so again the land reclamation man must be both soils scientist and engineer. He must be a civil engineer especially, for in land reclamation work the civil engineer's knowledge of surveying is essential. Soil-saving dams, contour terraces, contour fences for strip-cropped fields (fields of different crops divided on the contour) are only a few of the anti-erosion devices now in use. All of these need the civil engineer's supervision. There are, as a matter of fact, a large number of professional civil engineers now in soil conservation work in positions that agricultural engineers would have filled if there had been more of them available. This fact will illustrate how closely related the two fields are. In land drainage, again, much use is made of the transit to establish proper slopes in the drainage systems. Irrigation work requires similar knowledge, and all three depend primarily on an intimate knowledge of hydraulics, a division of civil engineering.

Farm Machinery

In the machinery field, the best job is selling. With this fact in mind most of the machinery companies (Allis-Chalmers, Case, Caterpillar, McCormick-Deering, Deere and Weber) offer one or two-year training courses to college grads. At present, there are several U. of M. agricultural engineering alumni employed by such concerns. One graduate of last year is employed by the Minnesota Valley Canning Company. These men don't stop at selling, however. The good salesman finds himself stepping from one job to another, possibly with different concerns, but almost always improving his position with each change. True, his life is no bed of roses, but there's a good future.

The farm structures engineer is a combination of the farmer, the architect, and the structural engineer. Wind loads on farm structures are shown to be increasingly important. Combine with that the requirement of space

Strip crop planting such as this has proved useful in soil conservation work.

for feed and hay storage, and the concrete and steel barn of the present day is the outcome. The agricultural engineer must, therefore, know his concrete and steel. But there are other considerations. The farmstead provides shelter for the livestock, as well as storage for feeds and machinery, and a home for the farm family. Not only must the individual buildings be designed and constructed strongly, attractively, and for their various purposes, but they must also be located carefully with respect to each other and to the fields. These considerations comprise in part the duties of the farm structures man.

Now, with some idea of what the agricultural engineer has been trained to do, let's see who hires him and what he does after getting his B.Ag.E. Someone must hire him, for, almost without exception, graduate agricultural engineers have jobs *which they like* and which offer a good future.

The reclamation field also has its advantages. Federal jobs are offered under civil service with salaries ranging from $2,000 a year up, depending on the experience and record of the individual. Federal civil service jobs are known for the steady and reliable income they offer whether in the higher or lower income brackets. In addition, there is much opportunity for irrigationists with the large fruit growers and the irrigating companies of the West.

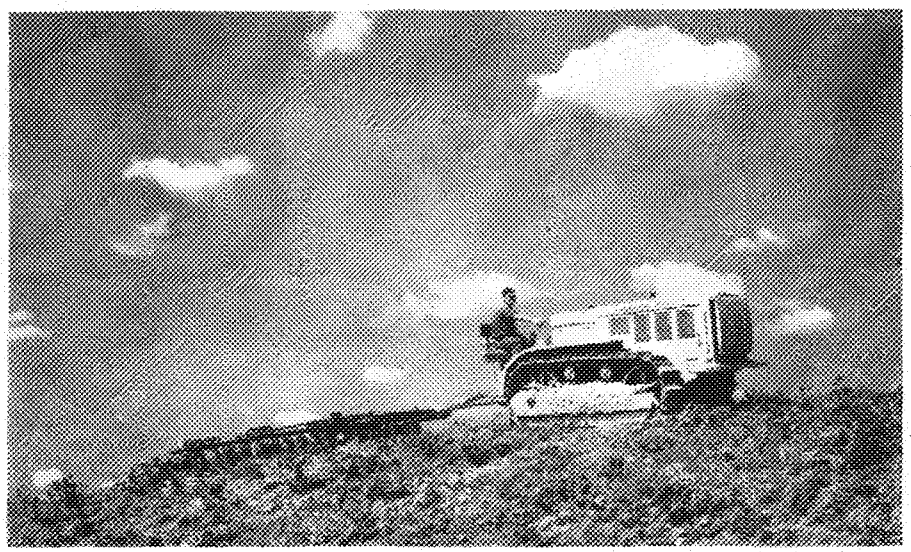
The structures field has had much to offer, especially in recent years. The government has wanted farm structures men for research work in the rural housing program. Some of the brick and tile companies have been looking for graduate engineers to use as field men and in sales work. Some lumber companies have inquired about young agricultural engineers to design and engineer their rural building programs. The State has been looking for farm building appraisers. The barn equipment companies also need structures men to sell, design, and invent new barn equipment devices. Many of these jobs offer training which would soon enable the engineer to set up his own business profitably. It is not hard to understand how an agricultural engineer could run his own farm business far more successfully than most farmers do if he had the inclination to do so; however, there is no necessity for an engineer to make his living by farming.

Agricultural Engineering a Diversified Course at Minnesota

The virtue of the agricultural engineering course as organized at our institution is found more in its diversification of interests and possibilities than in its specialization as contrasted to other courses. The graduate of agricultural engineering has a good general background in civil, mechanical, electrical, and structural engineering, as well as in the most relevant agricultural fields. This enables him to step from college into whatever field may be in need of a man at the time of his graduation. He need not wait for something to break in his particular field.

Just for example, one agricultural engineering graduate of our university is now doing very well as sales engineer in a local and very well founded heating and air-conditioning concern. This work does not sound like agricultural engineering, but the only academic degree this man holds is a bachelor of agricultural engineering. Another alumnus of the same class has established himself as field man for the Portland Cement Association. Others are distributed over the country, most of them in engineering work. They will all admit that agricultural engineering is no get-rich-quick proposition and that work is still the important part of their jobs, but they will also admit that that is what keeps them happy. They did not take up the course for the money there might be in it, but rather for the comfort and satisfaction they knew would come from work they enjoy and for a medium professional income.

With the advent of scientific farming the tractor has become increasingly important.



The Slip Stick or Why Budding Engineers Leave College

By R. W. French
Professor of Drawing and Descriptive Geometry

Illustration by Albert Arneson, Arch. '39

THE slide rule is a gadget carried around by sophomore engineers for the purpose of creating an atmosphere necessary to the functioning of the technical mind. It consists of a leather case inside of which may be found a mysterious instrument that is calculated to strike awe in the casual beholder. Next in importance to the case itself is the highly polished horse buckle which enables the sturdy owner to dangle and otherwise display the whole affair from his belt. When one is trying to explain the existence of the slide rule, one must remember that engineers are not the only male inhabitants of the ordinary campus, so tradition requires that they be marked out or set apart by some means. The slide rule is the most appropriate symbol so it has become the badge of the engineer. It stamps him as a man among men and leaves no doubt in the minds of his admirers that he is a force to be reckoned with and an individual with a future (during which period he may find out something about the confusing array of functional scales marked off on white celluloid, which are housed in this leather box).

The slide rule can be defined, but why bother. It is not a rule and it does not slide. True, its parts slide but the same can be said of an engine. And by the way, Watt, the originator of the steam engine, was the first to design the slide rule for the convenience of the engineer. The slide rule is a combination of functional scales, but let us stop there before mental fatigue overtakes us and remember that this instrument was designed to save mental effort. In the earlier days manufacturers included a package of decimal points with each rule sold. However, no one knew where to put them or what to do with them, so they were soon lost and the practice was discontinued. It is just as well because the modern engineer looks upon a number merely as a series of digits. The first time he becomes decimal point conscious is when he receives his first pay check, if any. However, there are some who have to do more than multiply 2 by 4, and a few such individuals become curious about the decimal point. If they are diligent they find or make up a decimal point rule, and if they are not successful in this they lay the slide rule aside and waste time in long hand work. It is not altogether satisfying to read a sequence of digits on the slide rule and then resort to a semi-guessing process to see whether the answer is 0.00073 or 0.000073.

The Pilgrims Escaped the Slide Rule

It is a surprise to some to find that the slide rule is not a modern invention. Except for the mechanics of construction, practically no improvement has been made in it for about a hundred years. Peter M. Roget, M.D., invented the log log scale in 1815. Farey, however, had used "logarithmic logarithms" in musical computations in 1807. John Napier invented logarithms in 1614 and Edmund Gunter invented logarithmic scales in 1620. History does not record that this had anything to do with the Pilgrim Fathers getting out of England, but by leaving when they did they managed to escape this unholy instrument for a good many years. In fact, the slide rule did not catch up to them or their progeny in the United States until about 1850 or 230 years later. Gunter's invention was called Gunter's lines and as scales they were very crude, although the basic principles of the modern rule were present. During the 18th century various mathematicians contributed to the improvement of the slide rule. In 1683, Thomas Everard made the first rule with an inverted scale. John Robertson (1712-1776) was the first to use the runner or indicator. Various devices were tried to improve the accuracy and convenience of the instrument. Scales were laid down on tapes which were wound on spools and one inventor tried marking a scale in the shape of a screw thread on a cylinder. In 1842, De Morgan wrote, "Twelve or fifteen years ago an instrument maker in Paris laid down a logarithmic scale on the rim of the box and the lid of a common snuff box—" but, either calculators disliked snuff or snuff-takers calculation for the scheme did not seem to answer.

The slide rule was little used in the United States before 1850. In 1851, a French Army officer named Amedee Mannheim designed a straight rule with a selection and arrangement of scales which was especially convenient for routine calculation work. This rule was adopted in the United States about 40 years later.

The Mannheim Rule

The Mannheim slide rule is the simplest practical rule for general computation work. There are more complicated rules bearing such trade names as duplex, polyphase, multiphase, decitrig, vector, et cetera. Early in his career the engineer is faced with the problem of selecting a slide rule. With such an assortment before him he is naturally more or less confused. It is not easy to advise because it is difficult or impossible to anticipate what kind of work one will be called upon to do in the future. However, a few hints may be helpful. In the first place, slide rules of sturdy construction are preferable because they are more apt to retain their adjustment and are therefore probably more uniformly accurate. From the standpoint of strength and rigidity the Mannheim rules are probably the best because of their solid construction.

One of the most serious criticisms of the divided body rule is the fact that it gets out of adjustment easily. Sooner or later the user is bound to drop his slide rule or give it a more or less severe bump. The Mannheim rule will take quite a bit of rough treatment without affecting its adjustment, but the same cannot be said of the wider, more lightly constructed instruments. Even when a rule is purchased new it should be tested for proper alignment of scale indices and proper alignment of indicator lines.

such rules in regular use are in good adjustment. This can be revealed by testing the indices on both faces with the indicator and by testing perfect squares and cubes at intermediate points. The great bulk of the work done on the slide rule consists of multiplying and dividing, and these operations can be performed on any rule. The Mannheim instrument is inexpensive and ideal for the beginner. The vector rule is convenient for certain types of computations which arise in electrical engineering, but inquiry seems to indicate that the need for this type of computation is not great. The log log scales are convenient for work involving fractional exponents and find some use in physics and thermodynamics.

The Mannheim rule carries full length and half length log decks, the Sin and Tan scales and the log scale. Naming in order the next most useful scales which might be added to these is not easy, and there would not be complete agreement on any order given. Some feel that the CI scale (C scale inverted) is of great convenience in multiplying. Next to this might be mentioned the log log scales or the cube scale, and for certain types of work the folded scales are convenient. As to size the 10-inch rule is probably the most popular in spite of the fact that the 6-inch rule is handier and serves practically every need. Round or disc rules are available but they have not proved popular.

That Decimal Point

In the early days of the Mannheim rule, instruction books contained rules for fixing the position of the decimal point in multiplication and division. However, with the complication of the instrument in later years these decimal point rules were lost sight of and the modern student has grown to feel that the placing of the decimal point is something to be worked out as a side problem in case the computation is not simple enough to set the point with some degree of confidence by inspection. This is unfortunate because it has cramped the style of slide rule users when working out problems which are out of the decimal point by inspection class. Simple decimal point rules which do not require any "figuring" or any noting on paper, and which can be applied with practically no additional mental effort, are available for fixing the position of the decimal point in multiplication and division no matter what numbers are involved or how many.

It would not be fair to close this discussion without urging a greater use of the slide rule not only among engineers but also in other professions and in other types of work. Many engineers would use the rule more if they could finish the job with it, that is, if they could place the decimal point in any kind of a problem with confidence and without side calculations. Not many computations require an accuracy greater than 0.2 per cent and this is the average error in computations made on the 10-inch slide rule, yes two tenths of one per cent, not 2 per cent. This is well within the needs of engineering design and just as a matter of curiosity let us apply the slide rule to a typical money problem. Here, if anywhere, the instrument is likely not to be trusted.

Problem: What is the interest on $2,250.00 at 4¼ per cent for 2 years and 5 months.

$2,250.00 × 0.0475 × 2-5/12 = $258.00 (Slide Rule result).

The slide rule result here given is the most inaccurate one selected from ten results each worked by a different person. The correct result to the nearest cent worked long hand is $258.28, so the slide rule error is 0.108 per cent. The actual error is 28 cents. The most accurate result, $258.10, was obtained on a 25-cent slide rule. The error in this latter case is 18 cents or 0.07 per cent. Results as accurate as this even in money matters are definitely serviceable. So engineers, learn how to use your slide rule, then use it! If you neglect to do this you are wasting your own valuable time and energy. Do not attack the problem too indifferently. True, the manipulation of the rule in multiplication and division can be illustrated to an intelligent listener in a few minutes but there is a vast difference between knowing what to do and knowing how to do it. Continued practice with the rule is necessary if one expects to develop confidence in his ability to get complete and correct results with it. And remember that a row of digits without a decimal point is neither complete, correct, nor satisfactory. If one lacks confidence in his slide rule results, this instrument is little more than a symbol or badge as far as he is concerned. And furthermore it is a badge to which the wearer is not entitled.

Research in the Institute

Being the first of a series of articles made up of brief resumés of interesting and important research projects now under way at Minnesota.

By Wesley S. Larson, M.E. '39

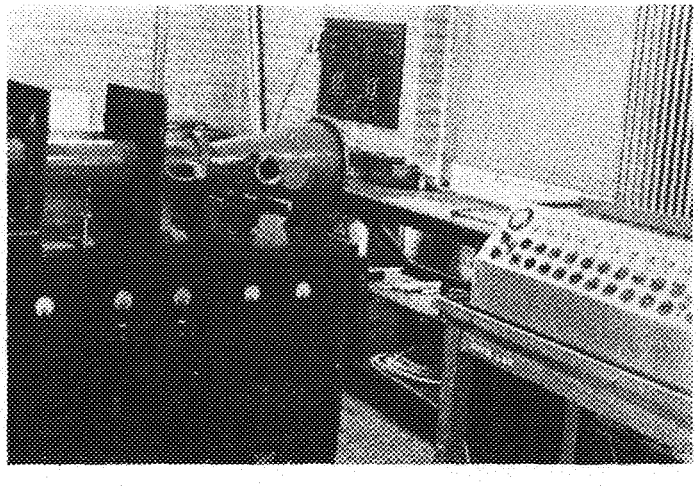
WITHIN the Institute of Technology there is brain power and modern equipment capable of doing the highest type of research work. For some of the industries of this state a relatively small amount of research and development work might make the difference between profit and loss. The problem of getting industry and the University to work together in a mutually beneficial way is being seriously considered by the departmental heads of the Institute at the present time.

Dr. Jewett, president of the Bell Laboratories, said this about the problem to a group of engineers: ". . . the difficulty is to translate the things that come out of research into the things that industrialists use." It is essentially the same problem that is found in every business relationship—that of getting A, who has the product, together with B, who wants the product. In the past this coöperation between industry and research at the Institute has been hindered by the fact that business men did not realize that the Institute is willing and anxious to aid in commercial research and development.

Our faculty has recognized this situation and has now organized a research program taking into account the needs of the industries of the state. The Institute of Technology Dinner, the most recent one of which was held October 24, is one of the means of bringing about desired coördination. The projects being worked on under this program are very numerous. Below is a group of brief descriptions of some of them. In future months the TECHNO-LOG will describe others in the other departments of the Institute.

Measuring ΔT

A COMPANY making lightning arresters found, in the course of their research, a need for a method of measuring time very accurately. They wanted to measure what happened in one-billionth of a second. (That's even less time than it would take a senior to get a $2,000 a year job.) Today you may go over to the electrical engineering building and Professor Bryant will show you photographs of the path of an electron in that interval of time.



CZARNOWSKI

The research was begun two years ago and the need for a method of making fast direct measurements beyond the range of any available commercial machine hastened the work on this apparatus. The work is now being carried on with the help of a research fund established at the University by the Joslyn Company. One of the instruments developed is a cathode ray tube converted for the particular use of recording photographically what happens as a surge current at high voltage is broken down. The path of the moving electrons is traced on a negative which is sealed inside an evacuated radio oscillographic apparatus.

The other method used is known as the electronic method of measuring voltage and current crest values and time lags. The general principle of measuring time lag is this: At intervals along a transmission line there are placed 10 potential recording instruments which respond to positive impulses of a very short time duration. At one end of the line, the surge of positive polarity arrives, and applied at the other end is a negative timing impulse, which is synchronized in relation to the potential causing the surge. Ordinarily, the two waves will meet half way in the line, and one half of the meters will be actuated by the positive surge. The rest of the meters will remain untripped, for the superposition of the large negative timing surge on the positive surge leaves no resultant positive potential to which the polarized surge trip-voltmeter can respond.

In the study of time lag characteristics of a gap, the positive surge could be produced by the breakdown of the gap, and the time lag caused by the formative spark process would delay the arrival of the surge in relation to the timing wave. Then as the timing wave arrives at the center of the transmission line, the surge will be delayed by the time lag, and an additional meter or two will remain untripped. It is clear, therefore, that the number of meters remaining untripped on the positive side of the electrical center indicates the magnitude of the time lag.

Preselection

A SIMILAR project which the electrical engineering department worked on was the origination and development of a preselecting device for the radio. For over a year, a group of selected students, graduates, and faculty men worked on a control unit which will turn the radio on or off at a previously selected time and static

and with automatically controlled volume. The design was originated by men in the electrical engineering department and the plans were drafted by students before the construction was begun. Mechanical engineers checked the design to see that it was satisfactory from a manufacturing point of view, *i.e.*, that every part was easily purchasable or designed for mass production and that it could be readily assembled. Much of the construction was skilled machine work, and this was done largely by students. The radio manufacturers, who were interested in this unit, paid $10,000 to the students and professors who developed it. The model was completed, the design accepted, and all that is holding up production is the necessary financial backing for the manufacturer. This type of research is of direct benefit to the Institute, giving both financial aid and invaluable experience to the students who participated in the work.

Timber Testing

PROFESSOR John A. Henry of the mathematics and mechanics department is working on a set of tables showing the safe working stress of commercial timbers. He is receiving coöperation in this work from the Timber Engineering Corporation, which is, in turn, backed by the National Lumbermen's Manufacturing Association.

With the present system it is customary to design timber structures to a full working stress. No consideration is given to the effect of knots, which are found in all commercial timbers. There is no assurance that the carpenter will reject pieces which might be knotty. Hence there is the possibility of a maximum sized knot occurring at the wrong place so that the actual load capacity of the timber is unknown. The question becomes—will the fastening fail before the timber fails at the knot? The only means of finding this out is by actual tests, such as those Mr. Henry will be working on for the next few months.

Stress Analysis

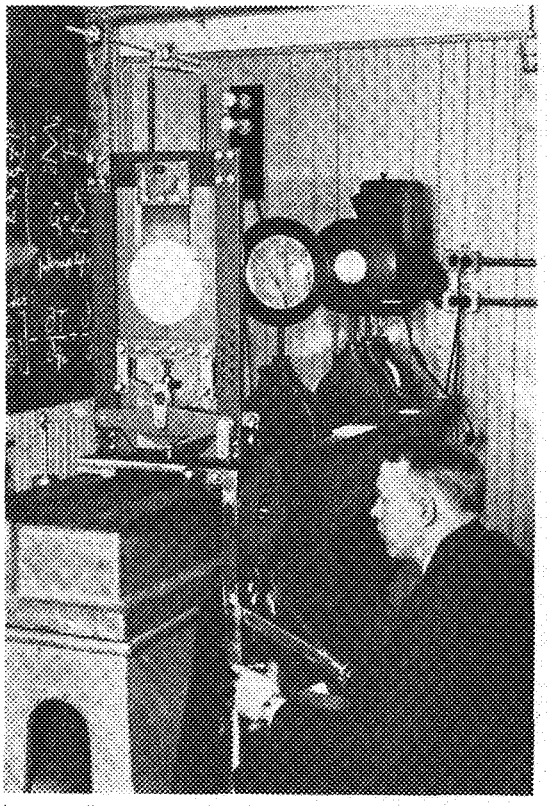
IN THE mechanical engineering machine design laboratories, Professor J. J. Ryan is doing problems in stress determination by photo-elastic analysis. His work, done the last few summers in conjunction with the Allis Chalmers Company in Milwaukee, has been the design of various units for the largest turbo-generator in service. Mr. Ryan's problems were the determination of the critical speeds of the turbine, the stress analysis of the spindle and the blade roots, and the lubrication of the bearings. The work is very extensive and can be covered only briefly here.

The stress analysis was a very interesting phase of the work and was carried on largely with the polariscope shown in the accompanying illustration. Mr. Ryan appears in the lower right-hand corner putting a test specimen through a workout. The photograph shows only a part of the polariscope, which is about 18 feet long and mounted on lathe beds placed on concrete. The lenses are 7 inches in diameter. An 8 x 10 camera for taking full scale photographs is also mounted on the bed. The whole apparatus, with the exception of the lenses and prisms, was designed and built in the machine design laboratory.

Stresses in Fastenings

The problem of determining the stresses in the fastenings which held the turbine blades in position proved to be one of major importance. Blades, 110 of them, must be mounted on the periphery of the 40-inch spindle, so there is very little room for each blade. As the turbine begins to turn at its regular speed of 3600 r.p.m., each 4½-pound blade develops a centrifugal force of 42,000 pounds. In order to analyze accurately the stresses occurring at the root of the blade, Mr. Ryan made accurate models of the tongue and groove fastenings out of transparent plastic material used especially for such work. The models were then set up in the stressing frame and were subjected to a load proportional to that which would be found in actual service. The polarized light, in passing through the stressed plastic model, was separated into bands of different colors dependent upon the stress in the plastic at that point. By noting the position and number of these lines, the stresses at the important points can be determined.

The stresses in a plastic disk representing the spindle of the generator were also determined by running the model at high speed and photographing the concentric rings formed by the polarized light. The disk which Mr. Ryan used for this test was slotted so as to form 26 teeth which represented loads on the circumference. As the disk spun merrily around in one of the runs, the shaft suddenly snapped and a spray of flying teeth emanated from the place where the model had been. Mr. Ryan found 23 of the teeth afterward, but he still doesn't know where the other three are.



Professor Ryan applies a test load to a model set in the photo-elastic analyzer.

The Minnesota Techno-Log

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Successful Arbitration

WE ARE happy to report that no such thing as faculty vs. student government exists in the Institute.

Last spring a flurry of student government reform hit this side of the campus with what was probably a record breaking series of front page news stories in the *Daily*. I refer to the proposal involving the Technical Commission and the Techno-Log and Bookstore boards.

The interest taken by the students was remarkable. At times there was even the threat of a storm. The conflict was not finished last year but was carried over to this fall. With the coöperation of the faculty and the students comprising the boards the moves made by last year's Commission have been invalidated, and students are now working toward a new settlement of the problem.

The interest which the faculty took from the start was inspiring to the students. Knowing that the professors are interested in what goes on in the student world does much to bring the forces within the Institute into closer coöperation. Dean Lind's attitude, in particular, was commendable. How easy it would have been for him to take a definite stand from which the students would have had no appeal. Instead he called a meeting of all the students comprising the boards, before which he stated simply that his desire was not to dictate but merely to advise. It is our problem which we have to solve, he intimated.

The actions and interest of the students are also commendable. Those who brought forth the reform believed, in all sincerity, that theirs was a forward step, which would better student government in the Institute. Whether or not they were right is relatively unimportant. It is important that they had the interest and the initiative to go ahead in the face of opposition.

There have been definite values in the entire incident which should not be overlooked. The fact that the whole thing was handled by the students is fortunate. They will probably never regret the experience obtained in originating and supporting the idea. The discussion which it caused in the student body as a whole was beneficial. A little more interest in the activities of the Institute was the result. Furthermore a fuller realization of the interest of Dean Lind and the faculty in student affairs was reached. Though the proposed reform did not go through, the whole Institute benefited in a way that the proposers of the plan did not fully anticipate.

Your Society

The human race is endowed with a gambling spirit. People are ever anxious to take a chance even against great odds. There are students of this institution that will play a pinball machine time after time where the odds are four to one that they can't break even; yet they are blind to a proposition that "kicks out the jack-pot" ninety-nine out a hundred times. This proposition is your technical society.

Let's look at the picture from the proverbial "dollars and cents" viewpoint. Let's see what the society can offer as an aid in getting a job after graduation. Consider a personnel man who is deciding between two men who seem to be equal in every way except that one has been a member of his society for four years, the other has not belonged to a technical society. The first man has demonstrated his sincere interest in his chosen profession; the other has given an indication of his blindness to opportunities. Which of these men would you choose?

Initiative and the ability to work coöperatively with others is considered by many employers as the most admirable quality of an inexperienced college graduate. The fact that a student takes part in extra-curricular activities is often used as an indication of these qualities. Your society offers a golden opportunity for development along this line.

Whom a person knows is often more important than what he knows in getting a job. The friendships that are formed through contact with your society are considered by many as being most worthwhile in this respect. You are brought into intimate contact with the two groups of people that are most important to your success. They are your faculty and the successful practicing men in your field. You and your professors are brought into a better understanding of each other which can only result in your benefit. The practicing professional men, besides giving you invaluable advice, may often be influential in their company's choice of men.

Why not attend the next meeting of your society and start an association with an organization that will be a guiding influence throughout your entire career? —You *simply can't lose.*

"Isaac Newton" by J. W. N. Sullivan

The latest, and according to many critics, the best, of a number of biographies about that scientist, mathematician, and theologian, Isaac Newton. Here is truly a genius, a man whose life story should be of interest to every engineer.

Reviewed by C. I. Haga

Instructor in English

AMONG the new books in the Engineering Library is J. W. N. Sullivan's "Isaac Newton." This biography is brief, but it leaves with the reader an impression of size and solidity incommensurate with the number of its pages. Although a "popular" book in the sense that it is intended for the layman, it is serious in its avoidance of the cheap and striking effects popularizers so often try for in biography and history. Here is no attempt to "recapture" the life of the times by the vivid devices of fiction, nor is the reader given license to snoop and pry into private lives. Instead Sullivan tells us quite simply that Newton was born, went to school, made a variety of discoveries, worked hard, enjoyed great respect, won some worldly honors, and died at the age of eighty-five. This simple story in such plain dress is, however, full of fact and interpretation—the fact not boring and the interpretation neither officious nor impertinent.

The picture of Newton that we get is, therefore, a convincing one, and in some respects, I am sure, a picture that will seem new to many. If nothing else, the reader will again be amazed that the theory of gravitation, "the greatest of scientific discoveries," should lie unknown in Newton's notebooks for almost twenty years before publication in 1687, and that the forty years of his life following its announcement should be practically empty of important scientific work. Though possessed of a unique genius for scientific work, he appeared to find it uninteresting and even distasteful. As he says in 1679, with the material for the "Principia" already at hand, ". . . I had for some years past been endeavoring to bend myself from philosophy [science] to other studies in so much that I have long grutched the time spent in that study unless it be perhaps at idle hours sometimes for a diversion." One's mind reels to think of Newton's "Principia" and "Optiks" resulting from the diversions of an idle hour, but even more staggering is the realization that the work he "ungrutchingly" turned his immense powers to doing was in an empty theological blind alley whose very name is meaningless today. That astonishing fact is indeed one of the most amazing in the history of science, and the story behind it is as much the story of his century as it is the story of Newton's life. Read the account as Sullivan tells it and you will better understand both the power and the intrinsic limitations of science.

Biography Based on Writings of Newton and His Contemporaries

One way of describing this biography is to say that in it we find all the pertinent facts about Newton's life and works, not hearsay or speculation, but facts alone. The basis of the narrative is contemporary material selected from Newton's papers and letters and from the writings of others who worked with him or knew him. There is nothing second hand in the book, and for that reason it is brief. What makes it seem so large and solid is that, when selected by a man qualified to recognize its value, such material is bound to make a more lasting impression than a longer, livelier book dressed up in all the gaudy color of the Sunday supplement. Selection such as Sullivan practices is in itself interpretation by virtue of the emphasis the particular extracts give to certain qualities of the subject. Further necessary interpretation comes through Sullivan's comments, which are always made so pertinent that they seem but a continuation of Newton's own words.

How to Encompass the Vastness of Modern Science

Comment on "Isaac Newton" must emphasize Sullivan's style and temper. The first is quiet and clear and the second is philosphical and humane. Noting those qualities, one is led to reflecting on the general problem of popularizing science. Not only must the layman be instructed, but nowadays even the scientist and the technologist must be enlightened. So multitudinous and so diverse are the varieties of discovery and invention that no man can be blamed for feeling lost in this embarrassment of riches. What of it can he make his own, what should he know, how can he approach the puzzling, hopeless task—in short, how can he bring order out of this splendid and inviting chaos? Two methods offer the best promise of systematization leading to understanding: history and philosophy. History gives scope because of the sense of continuity it awakes, and philosophy gives depth by indicating cause and effect. That fact furnishes us a touchstone by which we may judge the value of books claiming to be popular interpretations of science. Both history and philosophy are present in Sullivan's "Isaac Newton," as they are also in his other stimulating books, "The Aspects of Science" and "The Limitations of Science." Another book having these qualities is E. T. Bell's "Men of Mathematics." Compare it for style and sense with the far better-known products of, say, Paul De Kruif, and you will know that "popularizing" science is serious work, not a matter of drenching a few textbook facts with catsup and serving hot. When I think of successful popularizations, I think of books by Sullivan or Bell, or of such books as Mills' "A Fugue in Cycles and Bels," Hogben's "The Nature of Living Matter," Julian Huxley's "Essays of a Biologist," and Haldane's "Science and Human Life." Their great virtue is that they require or stimulate serious thought and effort if the reader is to enjoy them. Out of only that kind of enjoyment can grow knowledge of and respect for the century-old adventure called science.

Employment Shows Slight Lag

By Ass't Professor A. S. Levens
Director of the Placement Service

BUSINESS conditions during the past year unfortunately caused a decrease in the placement of our June graduates. Last year 87 per cent were placed by November 1, as compared with 74 per cent this year. The number of companies that sent representatives to interview our senior and graduate students dropped from 61 to 26. Most of the larger institutes of technology and schools of engineering in the United States encountered similar experiences. This fact was brought to light as a result of an investigation made by the Family Economic Bureau of the Northwestern National Life Insurance Company.

A study of this year's placements has revealed the fact that 158 of the 194 employed are working for private companies and the others are in the service of state and federal agencies. Last year 175 of the 196 employed were on private payrolls and the others on state and federal lists. In several instances part of the private work was subsidized by government funds.

Business improvement appears to be indicated, because several companies already have asked for dates that could be used for interviews. A few interviews have been scheduled for this month. At present plans are under way for the preparation of personnel sheets for the members of the class of 1939. Senior and graduate students are urged to complete the data forms for these sheets immediately so there will be no delay in printing. Last year sheets were mailed to 540 companies. The enthusiasm with which these sheets have been received certainly justifies continued use.

We urge you, at this time, to give serious consideration to your impending employment problem. Do not wait until commencement, but start *now*. If you feel that you are interested in a research career, make certain that your scholastic record justifies such a choice. Only recently Dr. F. B. Jewett, president of the Bell Telephone Laboratories, in addressing a group of seniors, pointed out the importance of a thorough training in the basic sciences—mathematics, physics, and chemistry. Coupled with the basic training it is desirable to possess such qualities as dependability, resourcefulness, reliability, trustworthiness, pleasing personality, and what is indeed essential, the ability and willingness to cooperate with others.

Consideration should also be given to other types of work found in many of the industries. Sales engineering, production, management, operation, maintenance, design, etc., demand technical men who have both a good basic training and who possess the proper personal qualities.

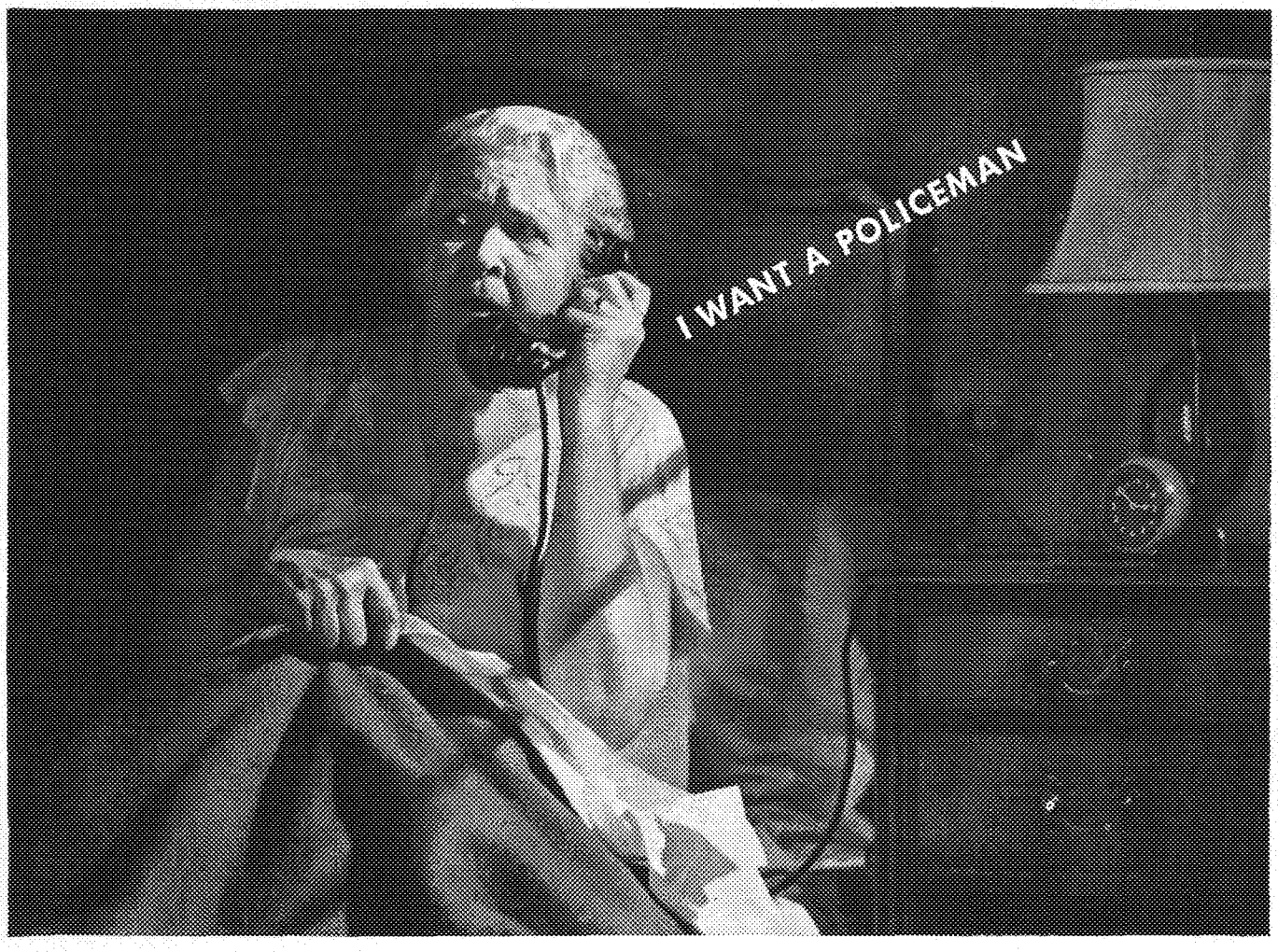
The "have-a-cigar, let's-see-a-show, hand-shaking method" in making technical sales is fast becoming obsolete. Today, it is necessary to have a thorough understanding of the product that is offered for sale. Furthermore, selling "technical services" is just as much a part of selling as a specific piece of equipment; in fact, selling yourself to the prospective employer is of vital importance. Why not attack your employment problem in a scientific manner? The following suggestions are offered for your consideration.

I. Take an Inventory of Yourself

(a) Try to determine your technical and personal qualifications. (b) Analyze your experience record. (c) What good has each job done for you? (d) What type of technical work do you enjoy, and in what fields would you be successful? (e) What subjects are least interesting? (f) Do you like group work or independent work? (g) Is your work hit-or-miss, or is it planned? (h) How is your personal appearance? (i) Are you cooperative,

Employment Data 1935-38

	1938			1937			1936			1935		
	No. in Class	No. Employed	% Employed	No. in Class	No. Employed	% Employed	No. in Class	No. Employed	% Employed	No. in Class	No. Employed	% Employed
Aeronautical Engineering	26	24	92	21	18	86	16	14	88	22	17	77
Agricultural Engineering	3	1	33	..	..	..	2	2	100	4	3	75
Civil Engineering	27	25	93	31	31	100	18	18	100	33	29	88
Electrical Engineering	50	34	68	46	42	91	42	32	76	58	41	70
Mechanical Engineering	40	29	72	35	31	89	43	38	88	29	24	83
Architectural Engineering	..	..	..	..	..	..	4	3	75	7	3	43
Architecture	4	4	100	12	11	92	6	6	100	14	10	71
Interior Architecture	4	..	..	..	..	..	1	1	100	3	2	66
Chemistry	22	8	36	18	10	56	16	8	50	20	6	30
Chemical Engineering	58	45	78	40	33	82	38	27	71	32	23	72
Geology (Mines)	6	6	100	5	4	80	..	..	..	3	2	67
Metallurgical Engineering	6	5	84	7	7	100	8	8	100	7	7	100
Mining Engineering	9	8	89	8	8	100	9	9	100	14	9	64
Petroleum Engineering	3	3	100	2	1	50	2	2	100	2	1	50
	258	192	74	226	196	87	205	168	82	248	177	71



Your telephone *won't let you down*

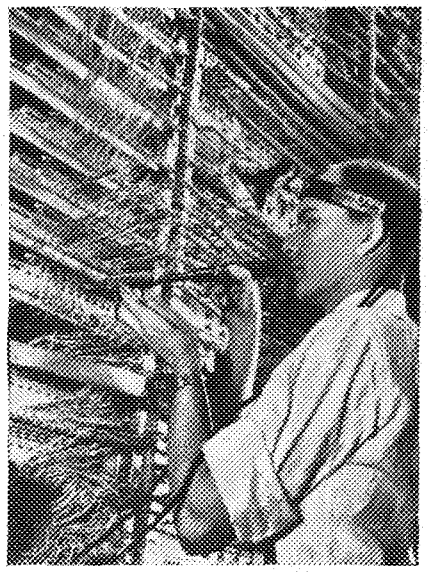
A suspicious noise in the night—you quietly reach for the telephone—you call for help.

Your voice carries through a great network of telephones, wires, cables and switchboards—and your call is answered.

This equipment was designed by Bell Telephone Laboratories and supplied by Western Electric, manufacturing unit of the Bell System.

For more than fifty years Western Electric has been meeting the Bell System's standards for high quality service. Constant improvement in manufacturing methods, and rigid tests at every step of the way, assure telephone equipment you can depend upon.

Every wire in every cable made at Western Electric receives many tests before it is acceptable for your service. Here is one of the final tests after the lead covering is applied.



This skilled worker is performing a delicate operation on equipment for a new telephone exchange. He joins thousands of wires that will carry your voice wherever there are telephones.

Western Electric . . . *made your* BELL TELEPHONE

or do you cause friction? (j) Are you aggressive, do you show initiative, or are you lazy, a get-by man, a retiring sort? (k) Can you be trusted under trying circumstances, or do you depend upon others? (l) Are you honest?

II. Make an Employment Survey

(a) Search for a company that is interested along your lines. If it is railroads, consult the "Railway Officials Guide"; if public utilities, consult the McGraw-Hill "Central Station Directory." Names of other books can be obtained from the Placement office.

(b) Select 40 or 50 companies in your field and write for data on their work. Many of them print booklets, for example: "The Graduating Engineer and Ingersoll-Rand," "Some Employee Policies of the Bell Telephone Company." These and many others are available at the Placement Service office.

(c) Consult again with your instructors, alumni, and local representatives of the companies so you will have a basic plan of intelligent questions to ask when you have an interview.

III. Apply for a Position

(a) The most effective method is to apply in person.

(b) Make a definite appointment for an interview with the man responsible for employing college men. If you have made a careful analysis of the type of work the company does, you will be prepared to answer the questions, "Well son, what can I do for you?" and "Just what would you like to do in our company?"

(c) Where it is not possible to apply in person, write a letter.

(d) Be prepared for personal interviews. Good taste in dress, poise, and appearance are important.

Last year a company representative discussed a group of seniors he had interviewed. He said, "You have fine boys, but there are three distinct types. The average young man will ask questions as to advancement, salary, and permanency of employment. He listens well. There is the fellow who is shy and reticent from whom it is necessary to pump information. Then there is the fellow who babbles on and on, making it almost necessary to shut him off with the remark: 'Send in an application and we will see what we can do.'"

To sell yourself to the employer it is well to follow the advice of Mr. C. A. Phillips, personnel officer of Northwestern Bell Telephone Company. He points out that (1) the student should act like a gentleman; (2) should analyze his strong and weak points; (3) should recognize his limitations; and (4) plan his objective early in college.

(e) Bring your Personnel Sheet along. It is a convenient form of necessary data and affords more time for the actual interview. Bring along samples of your work; capitalizing on any outstanding work you have done in relation to the company you are interviewing.

IV. Try to Attain Desirable Traits Which the Prospective Employer Seeks

(a) Scholastic rating: research—very high, design—very high, general fields—average. (b) Honesty, (c) Judgment, (d) Initiative, (e) Industriousness, (f) Co-operativeness, (g) Appearance.

V. Read a Few Books Pertaining to Employment

(a) Foard, S. S.: Finding Work, Mech. Eng'ring, 1934. (b) Davis, H. L.: The Young Man in Business, John Wiley and Sons. The Placement office has a sizeable list of books of this nature that they are willing to let you read.

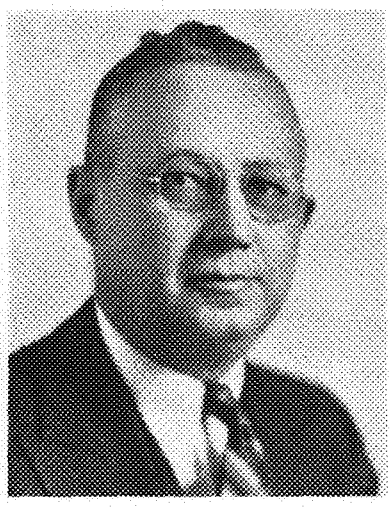
(c) Invest the price of two packages of cigarettes for one of the best treatments of the question "how to prepare for seeking employment." Read Mr. Howard Lee Davis' pamphlet "Preparation for Seeking Employment." Copies are now available in the Engineers' Bookstore.

Heads of departments, faculty members, and the Placement Service are most willing to coöperate with you in helping to solve your employment problem. If you'll do your part you will immeasurably increase your chances for getting a job.

FACULTY SKETCH

By Richard Stone, M.E. '40.

Dr. Lloyd H. Reyerson



Professor of Chemistry and Administrative Assistant

Dr. Reyerson, professor of chemistry and an administrative assistant in the Institute of Technology, was born in Dawson, Minnesota, and received his preliminary schooling there. In 1915 he graduated from Carleton College with a bachelor of arts degree. From there he went to the University of Illinois, where he received his master's degree in 1917. In the fall of that year he was called to Washington, D. C., to work in the civilian division of the Gas Warfare Service. Early in 1918 he received a commission as a Second Lieutenant in the service and held that position until shortly after the end of the war. Both before and after his government service he studied at Johns Hopkins University, where he received his doctor's degree in 1920.

After completing his studies at Johns Hopkins, Professor Reyerson came to Minnesota as an instructor in chemistry. He was made an assistant professor in 1921 and received his full professorship in 1926. During the school year of 1927-1928 he was on sabbatical leave and studied at the Kaiser Wilhelm College of Physical and Electro-Chemistry in Germany on a Guggenheim Memorial fellowship. During the past five years he has been director of the Northwest Research Institute, established by the late President Coffman. With the idea of developing new industries in the northwest, the Institute has recently been experimenting in the production of cellulose from poplar trees and the production of hydrogen from lignite. Dr. Reyerson has been doing his own personal research in the fields of colloids, catalysis, and the use of heavy hydrogen in determining the course of chemical reactions. He has written more than 40 scientific papers on his experiments.

Dr. Reyerson has been very active in organizations in his field. He has been a member of the national colloid symposium for the past five years and during the coming year will be chairman of the colloid division of the American Chemical Society. During the last two years he has served as associate editor of the "Journal of Physical Chemistry." He was president of Sigma Xi for the school year of 1926-1927. He is also a member of Phi Beta Kappa, Phi Lambda Upsilon, honorary chemical fraternity, and Alpha Chi Sigma, professional chemical fraternity.

To relax from his duties at the University, Dr. Reyerson often goes hunting or fishing and, when at home, works in his garden.

BLOW OFFS AND SIDE SLIPS

By Don Frankel, Aero. E. '39. and Bob Wolfe, M.E., '39.

Yes, we know what you're thinking, but you can't insult us—we're too dumb! Seriously though, we're going to try to blow off the lid once in a while and slip in something of interest to youse guys and youse gals. (We've been told that there are some here.)

(Any resemblance to persons living or dead is not only incidental but purely ridiculous.)

A group of senior engineers (list of names upon request) have been enjoying those Saturday afternoon gridiron tussles more than ever this year. Did you ever bring your lunch to a football game? Well, these fellows did and appropriately too. A gallon thermos jug filled with steaming hot dogs and a bag full of buns plus all the trimmings have made them very popular (they think) with the Alpha Phi sorority girls who are seated in back of them.

Mr. C. E. "fourth dimension" Swanson of E.E. and M.&M. fame says, "A genius can be recognized by his ability to distinguish the difference between tweedle dee and tweedle dum." After taking E.E. 46, I think I'll qualify you, Mr. Swanson. . . . Has any one noticed the difference in the way newly elected Professor Glen Peebles walks down the hall since receiving his Ph.D.? It used to be "Hi, Glen," "Hi boys," but now it's "Good morning, Doctor," "Good morning, gentlemen." . . . Professor John Akerman of Aero fame has propounded a new theory on how to tell whether a student cheats on quizzes. After long hours of research and study, he has found that the student who looks over his brother student's shoulder is caused considerable eyestrain. Therefore, Prof. Akerman is giving all his students eye examinations at the end of the quarter.

The latest salutation among senior engineers is, "Hi, brother rag!"

At the homecoming parade, everyone wanted to know what sorority A.S.M.E. stood for. It seems that those M.E. boys chiseled their way into the sorority division. The situation would have been quite complicated had they been awarded the prize. Incidentally, from the looks of that float committee one would suspect them of giving that old still a workout the night before.

Question of the month:

What popular senior civil is threatening to bring suit against a large motion picture corporation because they broke up his date with Anita Louise by sending her on location? The date was for a formal ball given at a fraternity national convention at Berkeley, Cal.

Hint: He often wears a railway engineer's cap with a union button on it.

Says Bob Chote, "the best four years of my life were spent in college—as a sophomore."

Up to this time our averages are under water, that is, below C level.

Extract from a freshman theme: (Technical Description) "Rubbers are somerbing which if your feet are dry you haven't walked in the mud without."

If you ever drop over to the Grill for lunch, notice the company Bud "Cassanova" McCarthy keeps. Methinks he is promoting a harem.

After attending a few metallography classes this quarter, I can easily explain how the Miners get in training for underground work. They hold windows closed so that no fresh air can get in. An outsider may visit the gnomes, but it's a dastardly crime to mention fresh air. . . . Speaking of fresh air, I ran over to the Chemistry building the other day and while wandering around the hall I bumped into a piece of air left from that experiment I did backwards freshman year.

REPORT ON AN EXPERIMENT IN HYDRAULICS

Time: Late one night.

Place: Harvard Grill.

Object: To test the Law of Divided Flow.

Apparatus used: Two "steinies" and a senior engineer whose initials are B.S. (and rightfully so).

Material used: Two pints of that golden brown "nosta of the besta."

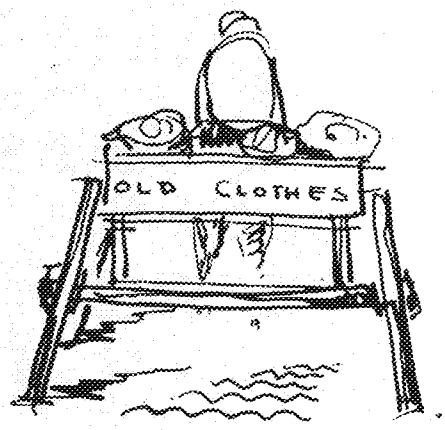
Method: The two steinies filled with the fluid are inverted and allowed to drain into the student's suppressed weir. Inasmuch as the quantity could not be measured directly, the physiological reaction was carefully observed as an index to the quantity Q.

Results: The physiological reaction indicated that the rate of flow and consequently the quantity, Q, had been increased by the factor, 2, which verified the law.

Observed by: One of the younger members of the Hydraulics faculty and his bride of a few weeks together with others too numerous to mention.

What engineers won't do for the advancement of science.

In the parlor stood we three,
She, the parlor lamp, and me.
I said that three's a crowd; no doubt
The parlor light was quite put out.



Occasionally a senior forgets to order personnel sheets.

ALUMNOTES

'05

Dr. Francis C. Frary, Ch., is a candidate for the presidency of the American Chemical Society. Dr. Frary was honored in 1937 when he received the Pittsburgh Award. He is noted for his important contributions to the chemistry and metallurgy of aluminum. Dr. Frary is at present head of the research department of the Aluminum Company of America.

'08

Professor Walter Lucius Badger, Ch., recently completed a six months lecture tour in Germany. Previous to this he was a professor at the University of Michigan.

'30

William Reichow, M.E., is in charge of the Brown Instrument Company's office in Kansas City, Missouri.

'31

Edward G. Clysdale, M.E., heads the Podbielniak Industrial Research Laboratories in Chicago. The company manufacturers chemical equipment.

Oscar Swenson, Ch.E., has accepted a position as assistant professor of chemical engineering at Cornell University.

'32

Maurice Norton, M.E., recently visited the campus during his vacation. He was accompanied by his wife and child. Since completing a two-year postgraduate course in business administration at Harvard, Maurice has been working for the General Electric Company.

'35

Lee Whitson, M.E., who was formerly employed by the Minnesota Mining and Manufacturing Co., recently joined the teaching staff at the University of Minnesota.

Pat McHugh, Met.E., was recentlecently a visitor at the School of Mines. He is employed by the John Deere Tractor Company at Waterloo, Iowa.

'38

Earl A. Wookey, Ch.E., is studying in the School of Chemistry at the University of Lyons, France. He was sent on a Franco-American Fellowship given by the Institute of International Education. This Institute annually sends about two hundred graduates of American colleges to study in foreign universities. It also arranges for foreign students to come to the United States to further their studies.

Ray Sundquist, Met.E., is working in the blast furnace department of the Carnegie-Illinois Steel plant at Gary, Indiana.

Vernon Robinson, Met.E., is employed by the General Motors Corporation.

Graduates of the 1938 class of Mechanical Engineering have accepted the following positions: **John Georgian** is teaching in the machine design department at Cornell. **Willard Dye** is with the United States Steel Corporation in Pittsburgh. **Marvin Bennett** is at the U. S. Engineers office in Omaha, working on flood damage investigation. **John Peterson** is in sales engineering with the Western Pipe and Steel Co. in San Francisco.

TECH NEWS

Technology Dinner

A conference of nearly 100 prominent industrialists of the state was held in the Center for Continuation Study, October 24. The conference was preceded by a dinner at which Dean S. C. Lind was Toastmaster.

The speakers were E. R. Weidlein, director of Mellon Institute, who spoke on "Chemical Research in Industrial Development," and Dr. F. B. Jewett, president of Bell Telephone Laboratories, whose subject was: "The Relation of Research to Business Success."

On the Ag. Campus

A talk by Carl Widseth, an alumnus of the Minnesota Ag. Eng. College, was the main feature of the first fall quarter meeting of the A.S.A.E. chapter. His talk, in which he drew strongly from his experiences as a rural field man for the Portland Cement Association in Minnesota, was encouraging, both to the seniors and the lower classmen. He said that the demand for good professional agricultural engineers is stronger now than ever and shows no sign of decline in the near future.

Another affair of importance was the annual Faculty-Student dinner in the Union Cafeteria Annex, October 28. The main object of this dinner, to introduce new men of the department, was very well taken care of. Six new graduate students were introduced.

The A.S.A.E. regular meetings are held on the second Wednesday of each month. The November meeting featured a talk by Quentin Erlandson, senior Ag. E. The main event of the year for this society will be the national A.S.A.E. convention, which is to be held here next June.

E.C.M.A. Convention

Bob McDonald, business manager, and Woolsey Moll, managing editor of the MINNESOTA TECHNO-LOG, spent a pleasant week-end in Cambridge, Massachusetts, attending the annual E.C.M.A. convention, October 27-28. Here the TECHNO-LOG was awarded second place for the best student article. The article, "From 14,000 Feet," was written by Elwood McGee, C.E.B. '38.

Among other things the association did, was to set up a new system of editorial criticism which will be followed during the 1938-39 school year.

Personnel Sheets

This year marks a new high on orders for Personnel Sheets, and Mr. Levens hopes to have the orders filled by the beginning of winter quarter. Hand in the glossy prints as soon as possible, and speed up the work.

National Metal Congress

The 1939 Metal Congress will be held in Chicago, October 16-20, 1939. This will be attended by several organizations: American Institute of Mining & Metallurgical Engineers; American Institute for Metals; American Welding Society; and the A.S.M.E.

Professors Joseph and Dowdell of the metallurgy department and Mr. Tenenbaum attended 1938 National Congress held in Detroit, October 17-21. Mr. Tenenbaum opened the convention by presenting a paper on work in which he collaborated with Prof. Joseph on the reduction of iron ores under pressure with hydrogen.

Engineers Dominate Elections

Three out of the four class presidents elected this fall were engineers. Does this mean that the engineer has awakened at last? The freshman class president was the lone exception, but then freshmen haven't had time to get to know each other very well, and this probably explains this slip-up. The presidents are all Gopher men, too.

A.C.S. Schedules Speakers

The Minnesota chapter of A.C.S. has been holding regular monthly meetings this year. Already they have had two very good speakers on interesting current subjects. October 19, Dr. H. O. Halvorson talked on his "Researches in Sewage Treatment," and on November 16, Mr. F. C. Whitmore, president of the American Chemical Society, held a very interesting discussion on "Hydrocarbons." Mr. G. L. Parkhurst, of Standard Oil Co., Ind., is to bring forth light on the subject of "Patents," on December 7. On January 5, Mr. H. H. Willard, University of Michigan, will talk on "Ultra Violet Fluorescence and Its Applications."

Non-shrinkable Wool

In 1929, after six years' work, Dr. J. S. Reichert, formerly of Minnesota, and R. W. Peakes perfected a chemical process to make wool non-shrinkable—an achievement which might have relieved one of the washday worries of housewives. But this work was done in the chemical warfare service laboratories at the Englewood Arsenal, N. J., and so the data went into the secret files of the war department to be used as a means of preventing shrinkage in the woolen uniforms of army men.

For nine years now, Dr. Reichert has had to keep his secret. But in the early part of October he was informed by Secretary Woodring of the war department that the secret could be released for general textile use.

For the past ten years Dr. Reichert has been with duPont, where he is a research chemist at the R. & H. division of the plant at Niagara Falls. In his earlier career, he taught chemistry here at Minnesota. He also worked under Major J. B. Conant, now president of Harvard, and he taught for four years at Notre Dame. He is a member of Alpha Chi Sigma, and Sigma Alpha Epsilon fraternities.

Tech Commission Meets

The Tech Commission held a dinner meeting on November 4, and decided to sponsor a series of discussions pertaining to the choice of and application for employment after graduation. They will have C. I. Haga tell how to apply in writing; Lloyd Short on opportunities for employment, and other similar talks.

The Tech Commission is also busy drawing up a new consitution (yes, another one), one of the revisions being the inclusion of three more members elected from the engineering student body at large.

New Rating Charts Proposed

Mr. Levens has drawn up plans for a new type of rating chart, and submitted them to the various members of the faculty to get their opinions. Ten different characteristics are listed with scales opposite them. These scales are divided into ten degrees, and thus a student is very easily graded or scaled in each quality. These charts would only be made up on the request of a company for further information on a student whom they are considering for employment.

Tau Beta Pi to Hold Initiation

Tau Beta Pi, honorary engineering fraternity, will hold its fall quarter initiation December 1 at the Curtis Hotel. Sixteen men will be presented with keys at this time. The speaker for the banquet has not yet been announced.

Hydraulics Lab Dedicated

Minnesota's new hydraulics laboratory (see Techno-Log, October, 1936, May, 1938), probably the finest of its kind in the country, was officially dedicated last night. The program for the dedication exercises consisted of the presentation of a certificate of completion by Acting State WPA Administrator, R. C. Jacobsen; a response from Fred B. Snyder, chairman of the Board of Regents; and speeches by Dr. S. C. Lind, dean of the Institute of Technology, and Corrington Gill, Assistant WPA Administrator, Washington, D. C. Following this there was an inspection of the laboratory conducted by Dr. Straub, who supervised the construction and will be in charge of it now that it is completed.

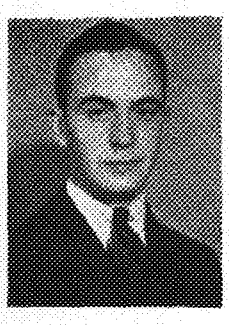
The laboratory will be open to the public for inspection today and Saturday from 9 a. m. to 6 p. m. and Sunday from 2 p. m. to 6 p. m.

Eta Kappa Nu Holds Initiation

Dean Wilford S. Miller, dean of the graduate school, was guest speaker at the formal initiation banquet held by Eta Kappa Nu, last night, at the Curtis Hotel. Dr. Hartig was toastmaster.

Nine members, five seniors and four juniors, were presented with keys. Eta Kappa Nu is an honorary electrical engineering fraternity.

This Month's AUTHORS



Homer Anderson, E.M. '39, is the writer of our lead article this month. It is interesting to note that he got his job in Honduras through another Minnesota grad, Harold Brosious, who graduated from the School of Mines back in 1904. His ambition is to be a hard-rock miner when he graduates.

At present he is a member of the School of Mines Society, cataloguer of Tau Beta Pi, honorary engineering fraternity, and president of Theta Xi fraternity. Material evidence of his skill in his hobby, photography, is to be seen in the photographs illustrating his article.

Professor R. W. French is the author of the interesting article describing the history and uses—also abuses—of the slide rule. Professor French was graduated from the University of Michigan in 1907. He started here at Minnesota in 1910 as an instructor, and now teaches drawing and descriptive geometry and a course on the use of the slide rule (G.E. 70). He is also writing a book on the slide rule which will include an extensive study of its history and considerable data regarding its accuracy.

Our frontispiece this month is the work of **William Czarnowski**, Chem.E. '40. The picture won first prize in a national photography contest sponsored by *Redbook Magazine*. The prize was $50.00. Bill has taken a number of pictures for the TECHNO-LOG, including one in this issue illustrating the article on research.

Nelson Dingle, Ag.E. '39, who tells us about the profession of agricultural engineering this month, is really quite an interesting fellow. It seems he goes to school days and holds down a full time job in the railway mail service nights. It's a good trick if you can do it.

He has been a member of the A.S.A.E. for four years and is at present scribe and TECHNO-LOG reporter for that organization. He was a member of the University Singers in his freshman year. For recreation he does a little woodworking and photography. He plans to go into design or structural work when he graduates.

Wesley Larson, M.E. '39, tracked down the material for this month's two page spread on research. Wes, whose home is in Winthrop, Minnesota, transferred to the University from Hibbing Junior College two years ago. He is looking forward to getting into production work, preferably in the field of plastics, when he graduates.

He is a member of the A.S.M.E. and of Pi Tau Sigma, honorary mechanical engineering fraternity. For hobbies he lists shop work, tennis, and chess.

PICK AND PAN

By Millard Troxell, Met. E. '39,
and Harry Larson, Met. E. '39.

This month's column is dedicated to the New Dealers. These are the resolute lads who, having once known countless hours of pleasure at the Harvard Grill, now aim to burn their lamps long after midnight in the cause of science. Here's to you, boys, but you're fighting a losing battle.

Engineers will chortle merrily at the opinion of New Dealer Geraci: "A Miner is just a disappointed Engineer."

It's been rumored in some channels that Hydraulics is a pipe course, but it's very disturbing to be so weiry and still have to get a head.

We're glad to see that the wheat crop is so large this year. The way money is being spent, we'll need all the dough they can make.

On the Iron Ranges they tell a story about the hard rock in the mines. "The Soudan formation is so hard in places that at the end of an eight hour shift one man is left behind to put his finger on the spot so the next shift can find the drill mark."

"Where's our Nellie?"
"Our Nellie's in them thy'ar hills"
"But thy'ars ba'rs in them thy'ar hills!"
"That's all right, our Nellie rides a bike—she can handlebars!"

Bob Wolfe and Don Frankel have gone in cahoots to write a TECHNO-LOG column. I refer them to Act II, Scene II, of Shakespeare's "Tempest": "A very ancient and fishlike smell." Furthermore, Frankel, I heard some guys talking about you the other day. One of them said you weren't fit to eat with the pigs, but I stuck up for you—I told them that you were.

Al Stock is the only Metallurgist who is the fortunate possessor of an answer book for Electric Power problems. His nightly calls became so numerous that he now posts the answers to the current assignment on the Mines Society bulletin board.

We still claim that a ventilating engineer makes the best draftsman.

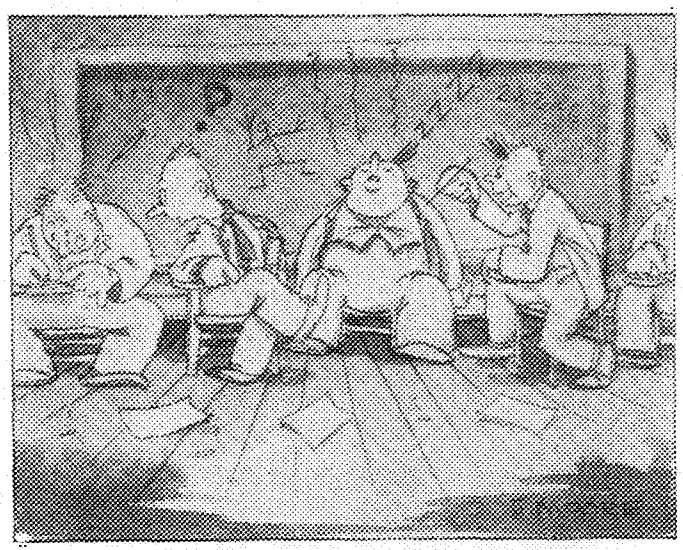
At the Campus Theater last Sunday we waited for an hour to get a seat. Some students ahead of us were pushing and shoving until finally they gave the usher a few unexpected jolts. He about-faced with this remark, "Don't push, you all have seats."

George Washington's first buggy ride was the time he took a hack at the cherry tree.

You could have swept us off our feet the other day. A beautiful young girl dashed up to us, linked her arm in ours and gleefully exclaimed, "Hello, Brother!" She then unbuttoned her coat and proudly displayed a very familiar pin. It gradually dawned upon me that another of the boys over at the house had become engaged.

Draw Your Own Conclusions Dept.

A girl whose dresses button up the back sits directly in front of Bill Hastings during football games.



Which reminds us, final examination time will soon be here.

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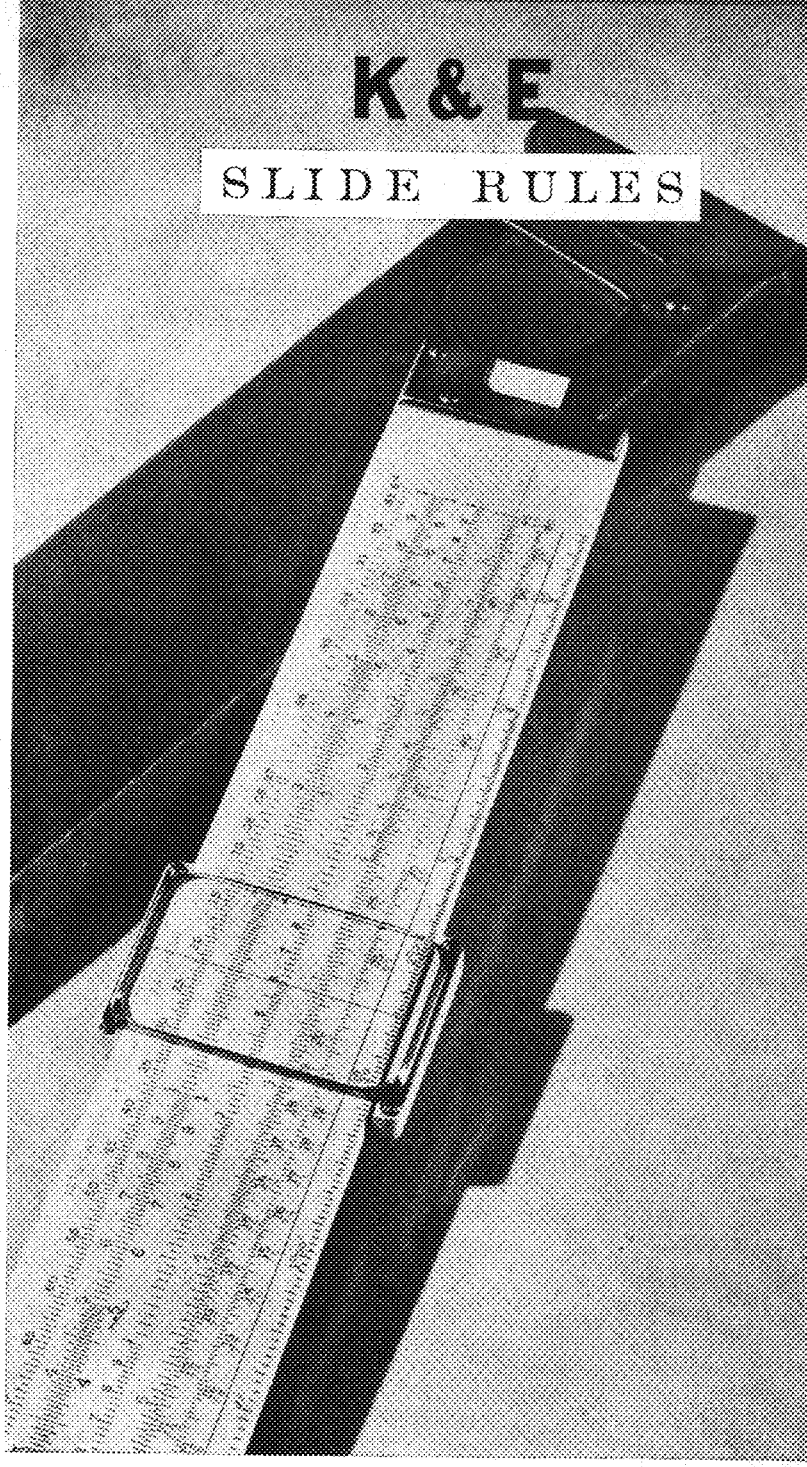

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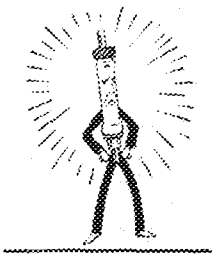
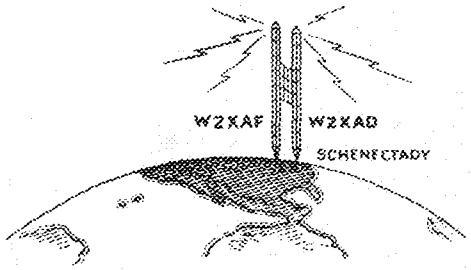


"MIDGET SUN"

FOR years Old Sol has had things pretty much his own way—causing sunburn, having sunspots, and wandering periodically north and south of the equator.

Now a young upstart about the size of a cigarette has been announced by General Electric. It is the new 1000-watt mercury lamp, which, even though many million times smaller than the sun, has one fifth the brilliancy of Old Sol's surface.

Source of the brilliant light is the lamp's highly concentrated arc—12 times more brilliant than the incandescent filament of a 1000-watt standard projection lamp. Laboratory tests show that the "upstart" will be of great value in searchlights, photoengraving, blueprinting, photoenlarging, and as an aid to medical science.



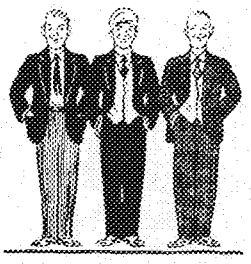
"AMERICA CALLING . . . ."

NEWS reports broadcast via short-wave radio from America told of troop movements in Spain; picked up in Barcelona, they aided forty refugees in escaping a war-torn area. An appeal for emergency contributions to a Red Cross flood-relief fund was heard in South America; Venezuelan oil-field workers answered with a donation.

Behind these events and others of front-page news were the two powerful short-wave stations of General Electric—W2XAD, and W2XAF, in Schenectady, New York. Since they first took the air, 12 years ago, the stations have figured in events of all kinds, have broadcast their programs to all parts of the earth. One of their weekly variety programs is an institution in South America. World Series baseball games have been heard in India and Arabia. The news reports of these stations are heard everywhere.

The steady stream of cards and letters from all over the world asking for information on the programs and congratulating the stations on their service is indicative of the good will that the stations are helping to promote.

The 150-hour-a-week operating schedule, headed by Eugene Darlington, Oregon State '28, ex-Test man, now features broadcasts of all types, on four different frequencies, in six languages—English, Spanish, Portuguese, French, Italian, German.



"FROM AMERICA, FROM INDIA, FROM ENGLAND . . ."

SCANNING the recent rolls of young men on Test with General Electric gives the impression of reading membership lists in an "International House" at some large university. For, intermingled with graduates of engineering schools all over the United States are, for example, Cariapa from Kashmir, in India; Bambery, from " 'way down under" in New Zealand; Gurewitsch, of Roumania; and Chia-Hsu Hou, of China.

But predominating in the picture are picked men from American colleges and universities. Selecting names at random from the various Tests inevitably shows student engineers from widely separated parts of the country working side by side. Miller of Arizona U. and Olsen of Brooklyn Tech, worked together on motor and generator tests. Schmid of Wisconsin ran turbine tests with Norris of Texas Tech. Testing induction motors were Loew of Washington and Owens of Union College.

General Electric's executives look upon this Test training as more than a graduate course in engineering—it is a carefully formulated plan of training young engineers for leadership in industry.

GENERAL ELECTRIC

MINNESOTA TECHNOLOG

DECEMBER

1938

THE *Chemistry* OF PEACE

DOW HAS NEVER INCLUDED in its own program the development and production of chemicals designed expressly for destructive purposes. "Peace hath her victories no less renown'd than war" and the business of Dow has always been and will ever be, short of the imperative demands of national defense, the chemistry of peace.

In inaugurating this policy nearly fifty years ago, the very first effort of the late Dr. Herbert H. Dow was not without its symbolic significance. For his initial undertaking was to develop new and more efficient means for the production of bromine on which so many of our indispensable sedatives are based.

And so down through the years the connotation of chemistry, so far as Dow is concerned, has continued to be products that assist industry in its economic development—products that aid pharmaceutical manufacturers in the alleviation of suffering—products that in every way promote the greater well-being of the American people.

The fruit of this policy is a long line of notable contributions of a constructive nature—more than 300 in all. They include such outstanding achievements as Dowmetal that presents industry with the lightest of all structural alloys—Dowflake Calcium Chloride, the product that makes our gravel roads dustless in summer and combats the hazards of icy highways, sidewalks and steps in winter.

There are also synthetic dyes for the beautification of textiles—crop-protecting insecticides—synthetic rubber—the current and exhaustive efforts in the field of plastics—synthetic solvents that make dry cleaning a finer, faster service than was hitherto possible—and many other products of genuine importance.

It is with a feeling of gratification that Dow looks back on the results of this program and policy. Now at this gracious holiday period of good will, Dow also looks forward to even greater and more helpful contributions that characterize the chemistry of peace.

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FRANCE'S OCEAN-FLYER

Though already more than five years old, this giant six-engined Latecoere 521 flying boat recently spanned the north Atlantic.

Europe—Soon to Be
Our Next Door Neighbor

"Overnight service to Europe will start next summer," "Transcontinental flying time will be cut to 10 hours soon," "———is building a 100-passenger plane that will cruise at 300 miles per hour." You undoubtedly have heard these and similar rumors recently. The artic'e below gives a rather complete survey of planes being planned and built now and of the air transport facilities of the near future. You will be amazed to see how nearly true some of the rumors are.

By Stanford Church, Aero.E. '40

YOUR employer calls you into his office, greets you with the following statement: "Smith, there is to be an important meeting of our European sales managers tomorrow in London. I want you to attend that meeting and introduce our latest products to them."

Ten years ago you would have been well justified in wondering just what stage of insanity had struck your superior. Not so today, however. Recent developments in long-range commercial aircraft, together with present plans for airliners which will rival ocean liners in travel luxury, promise to make overnight travel between Europe and America a reality within a few short years.

First indication of the great strides to be expected appeared last December in the form of a futuristic-sounding letter, copies of which were addressed to eight of the country's largest aircraft producers. It came from the Pan American Airways Technical Committee, headed by Charles Lindbergh; the contents, an invitation to submit plans for 100-passenger aircraft capable of flying 5,000 miles at a cruising speed of at least 200 miles per hour, with 25,000 pounds of pay-load.

Four of the manufacturers accepted the invitation and have since submitted preliminary designs: Boeing Aircraft Company at Seattle; Douglas Aircraft Company at Santa Monica, California, maker of the airplanes in use on most United States airlines today; Consolidated Aircraft Corporation at San Diego, California, which has been supplying the navy with dreadnaughts and patrol boats since 1923; and Sikorsky Aircraft at Bridgeport, Connecticut, pioneer builder of gigantic aircraft. And rather than being the creations of an imaginative Buck Rogers, the new planes will represent sound, realistic developments in engineering which have grown out of our present-day knowledge and experience.

The Douglas DC-4

Work has progressed simultaneously during the past year on two stepping-stones to these giants of tomorrow, namely the Boeing 314 and the Douglas DC-4 (fourth series of Douglas commercial transports). Each in its own right represents a considerable stride in the progress of sea and land planes respectively.

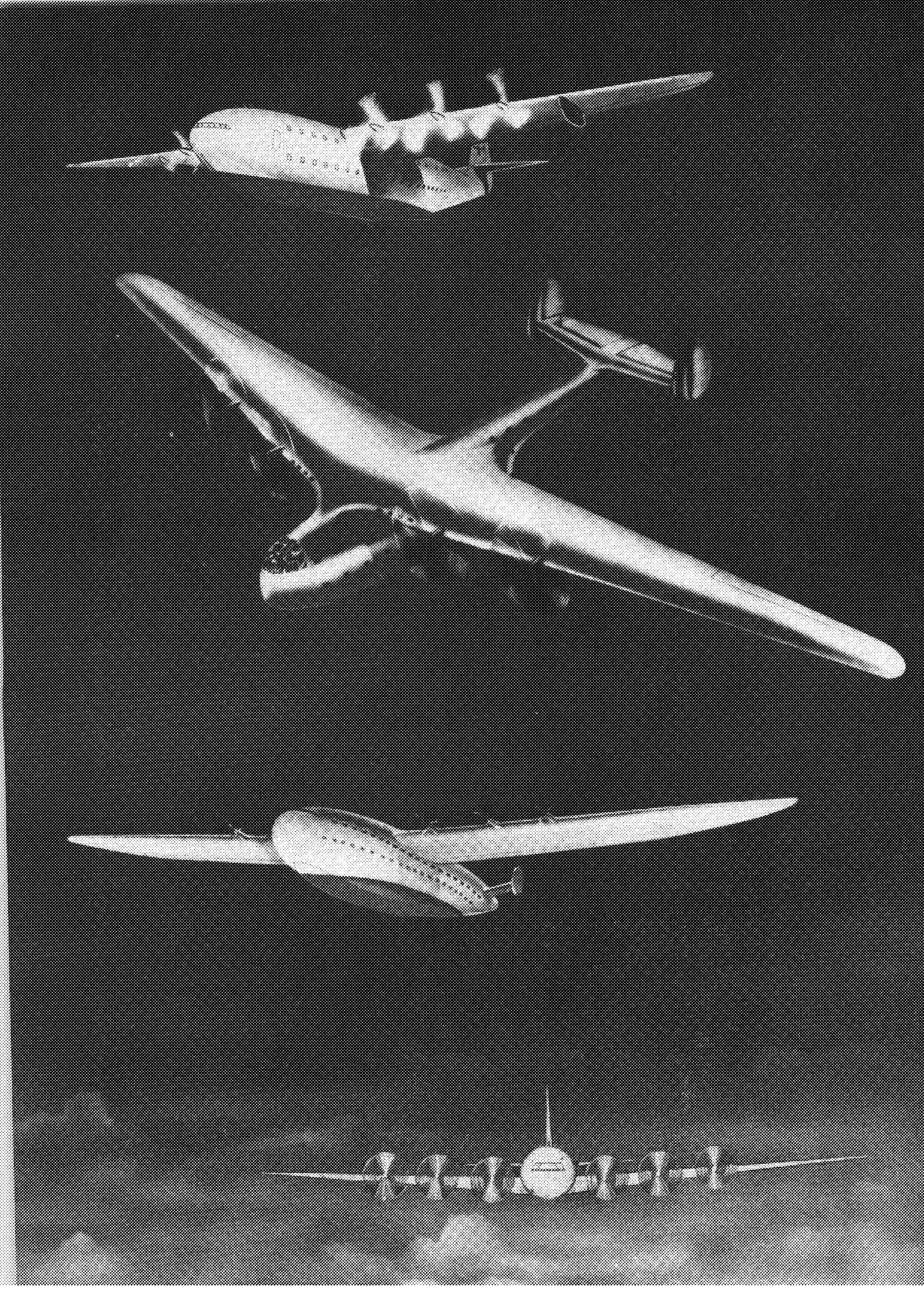
Five airlines—American, Eastern, Pan American, T.W.A., and United—are sharing with the Douglas Company the cost of the first DC-4. With a wingspan of 138 feet 3 inches and weighing 65,000 pounds, it will accommodate 42 daytime passengers, with berths for 30 at night, and a crew of 5. It is the first modern transport to use a tricycle landing gear, and its triple fins and rudders are full cantilever. There are in the plane 1,300,000 rivets, 4 miles of electrical wiring, 113 instruments, and over a mile of control cable. Flush-type riveting is used on all exposed surfaces. This improvement represents a considerable decrease in the drag of the airplane.

Whether or not the tricycle arrangement of landing wheels is a forward step in airplane design is still challenged by some. Its drawbacks are claimed to be the danger of nosing over toward one side and the weight and reliance placed on the nose wheel in the event it should strike an obstruction. On the other hand the tricycle gear makes it possible to "fly right into the field" when landing. This provides safer landings without the necessity of dropping the tail, thus relieving sleeping passengers of the discomfort of sliding into the ends of their berths.

The importance of the fuel problem in modern aviation is shown by the fact that each of the DC-4's Pratt and Whitney twin-row Hornets develops 1,200 horsepower using 87 octane fuel, 1,400 horsepower with 95 octane fuel.

The plane takes up the modern trend in aircraft with a cabin which may be pressurized to provide lower-level atmospheric pressure for passengers and crew at altitudes of 15,000 to 20,000 feet. Since it was test flown last June, the DC-4 has undergone all the multitude of scientific tests which were possible with a craft of its size and power. These include tests of vibration, load distributions, and airflow characteristics under many different flight conditions.

Rival of the DC-4 for spectacular advancement in size is the Boeing 314, being built for Pan American Airways' European and China-New Zealand runs. Weighing 82,500 pounds, twice the gross weight of existing flying boats, it is surpassed in size only by Germany's twelve-engined Dornier DO-X, built in 1929. The 4 twin-row Wright Cyclones develop a total of 6,000 horsepower. It boasts a wingspread of 152 feet and will carry 74 passengers during the day, or 40 at night, plus a crew of 8, up to 2,400 miles. The cabin embodies two decks connected by a spiral stairway. After the first tests were completed it was decided to install twin rudders instead of the original single rudder. With the rudder and the sea-wings changed the ship was put through additional flight tests. The second 314 is about ready for delivery, and the remaining four are in various stages of construction.



Both the 314 and the DC-4 ascended on their initial test flights on June 7 last summer, and both were pronounced extremely satisfactory by their test pilots.

Boeing is well prepared to produce sizeable airplanes. A familiar sight at Seattle last winter was the four-motored Boeing XB-15, or "Flying Fortress," built for the Army Air Corps. This plane, which has a 150-foot wingspread and flies at 250 miles per hour or better, was dubbed by observers on the ground a "small overcast," so huge are its proportions.

Also in production by the same company is the 307-type transport, better known as the "Stratoliner." The first large commercial airplane to be designed for flight in the sub-stratosphere, this plane was developed from the Flying Fortress. Three Stratoliners are being delivered to Pan American, six to TWA, and six more have been ordered by American Airlines. Each ship will carry 33 passengers in daytime use, 25 at night, at altitudes up to 20,000 feet. Mechanical pressure regulators automatically maintain lower-level pressures within the plane regardless of its altitude. Intakes to provide the superchargers with fresh air are located in the leading edge of the wing.

High Altitude Flying

What are the advantages of high-altitude flying, for which the new airplanes are being equipped? The absence of unfavorable weather conditions, which are at present aviation's greatest flying hazard, is one major point in its favor. In the substratosphere flying conditions are for the most part calm and inviting. The greater speeds attainable are another distinct advantage. At sea level the Stratoliners cruise at 183 miles per hour; at 30,000 feet they can do 270 miles per hour.

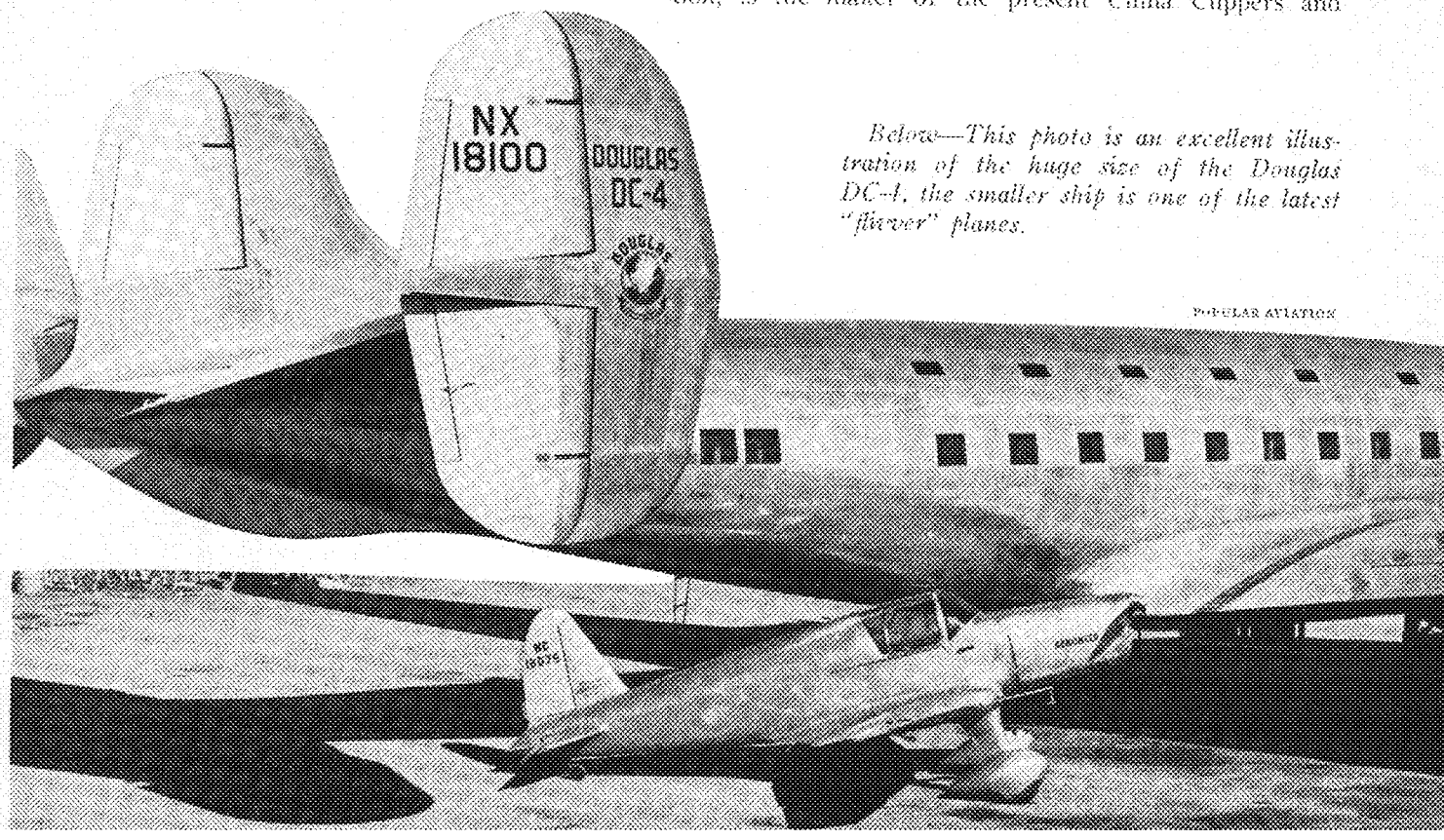
Why, then, you ask, have not commercial transports already been flying at 20,000 feet for years? Technical difficulties are the answer. Since the atmospheric pressure at that altitude is only half its value at sea-level, cabins must be designed to maintain low-altitude pressures. Engines also require a constant mass of intake air with every stroke in order to maintain their sea-level power output. These features in turn require superchargers—and an exhaust-driven supercharger, the most efficient type now in existence, costs about $6,000.

Another high-level technical problem is that of propellor efficiency. In the rarefied air the speed and pitch of the propellor must be increased to maintain the thrust necessary to support the airplane. When propellor tip speeds reach the speed of sound, however, sound waves and masses of air pile up on the blades and rob the propellor of its efficiency. The solution may lie in an added number of blades on each propellor and in increased propellor diameters.

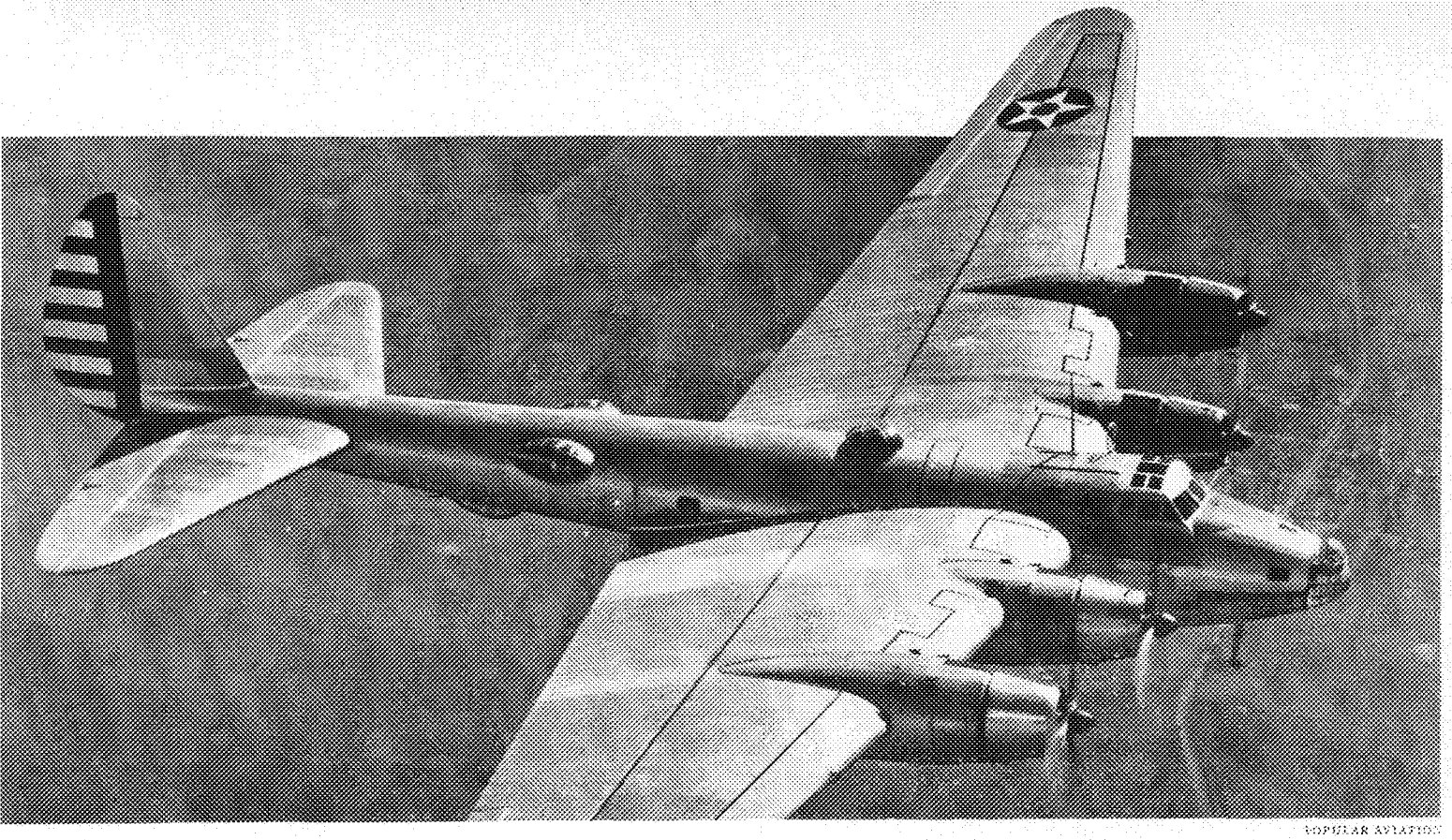
The United States Army Air Corps has recently performed a great deal of commendable investigation in high-level flying at its Wright Field base at Dayton, Ohio. For this purpose the cabin of a Lockheed Electra, sister ship of those in daily use by Northwest Airlines and Mid-Continent Airlines, was made over and fitted with test equipment. The results of this work were published by the War Department and won for the Air Corps the 1938 Collier Trophy, awarded for "the greatest achievement in aviation whose value has been demonstrated in actual use during the previous year."

Besides the manufacturers already mentioned, other producers will probably appear on the big-airplane horizon. The Curtiss-Wright Company is now building its 30-passenger sub-stratosphere "Model 20" transport. In the design of this plane particular emphasis has been placed upon safety features, as a result of extended investigation into the causes of airplane accidents, such as pilot fatigue and structural failure, together with possible methods of eliminating these causes. Glenn L. Martin, who refused to enter Pan American's competition, is the maker of the present China Clippers and

On the left—These are tomorrow's trans-Atlantic transports. These are the four designs submitted to Pan American Airways for consideration. Reading from top to bottom they are the Boeing, the Consolidated, the Sikorsky, and the Douglas designs.



Below—This photo is an excellent illustration of the huge size of the Douglas DC-4, the smaller ship is one of the latest "flivver" planes.



POPULAR AVIATION

From bombers such as this huge "flying fortress" came the basic designs for the Boeing 307 transport better known as the Stratoliner.

has exported a 63,000-pound ocean transport to Russia. He already has partial designs for planes as large as 125 tons. Consolidated itself has announced "the fastest 4-engine boat in the world today" for trans-Atlantic service, and has investigated a 200-ton, 300-passenger plane.

Giants of Tomorrow

What of tomorrow's airplane, the airplane which should put commercial airlines on their feet financially? The profit aspect is important; for since 1934, when federal mail contracts ceased to be a sure source of revenue, the country's major airlines have ended in the red each year except 1936. The airplane can be an economically profitable medium of transportation; its ratio of dead weight to passenger weight is only one-fifth the ratio for a railroad train or ocean liner.*

In appearance the designs submitted to Pan American do not differ radically from the large transports in use at present. (A fifth manufacturer, the de Seversky Corporation at Long Island, tendered an uninvited design which would probably receive little consideration in the competition. It provided for eight 2,000-horsepower engines, twin floats which would retract against the bottoms of the twin fuselages, and construction of shot-welded stainless steel). All the designs except Consolidated's embody six engines and two decks; the Consolidated version would be a four-engined, three-deck craft. Douglas designed a landplane; the others are flying boats. In all the models the engines are accessible for repairs and adjustment during flight; and all can remain in flight with half of their engines in operation. The big planes will probably weigh about 200,000 pounds (the DO-X weighed 116,000 pounds). All are luxuriously appointed to stimulate increased passenger traffic.*

**Fortune, July 1938.*

The airplane of tomorrow will probably fly at altitudes between 20,000 and 30,000 feet. It is certain to provide its designers with an endless number of problems before its plans are complete. Aluminum alloy or stainless steel for hull construction? Aluminum corrodes under the influence of brine; stainless steel is stronger but heavier and harder to work. Air-cooled or liquid-cooled engines? The radial air-cooled engine because of its increased size is providing unwanted drag. As its power is increased the difficulty of cooling is also increased. The liquid-cooled engine, on the other hand, is a good deal heavier per unit of power than the air-cooled engine, although it has not yet approached its limit of power output.*

These and many other questions will occupy the thousands of engineering hours which will be spent in completing the plans for Pan American's big ships. For the present the 314 will uphold the prestige of American aviation on the world's airlanes. And the big planes will assume the responsibility possibly as soon as 1941.

The trans-Atlantic picture also includes airlines of England, Germany, France, Italy, and Holland, in addition to Pan American. England's Imperial Airways has made flying boat survey flights of the north Atlantic, and in July the seaplane "Mercury," upper component of the novel but practically doubtful "picka-back" composite airplane, completed its first round-trip flight. Germany's Lufthansa made weekly trips with clocklike regularity during the last half of the summer, using three Diesel-powered seaplanes; and in August a landplane powered with American engines made the crossing, averaging 200 miles per hour on the return trip. Air France completed its first survey crossing in September.

Another medium of air transportation will probably be seen over the Atlantic: the dirigible. The new

Diesel-powered Graf Zeppelin, sister ship of the recent Hindenburg, has been completed, and the Germans believe they have surmounted the hazards of lighter-than-air flight, despite their inability to obtain non-inflammable helium.

Political difficulties have retarded trans-Atlantic progress almost as much as technical problems. Questions of reciprocal operating-base agreements had to be settled. Pan American is restricted by an agreement not to begin service until Imperial is ready to do so; and the United States government has refused to allow Germany to start service until an American company is prepared to start service to Germany.

Although Pan American has so far had little competition in establishing western-hemisphere air trails, a newcomer has appeared in the field of American trans-oceanic operators. American Export Lines, steamship line operating to the Mediterranean, has established a subsidiary corporation, American Export Air Lines. The plan is to use the company's steamships at sea as sources of weather information for a non-stop air service between New York and Mediterranean ports. After making a three-year study of the project, Export Air Lines recently went into partnership with the Italian airline, Ala Littoria. A Consolidated flying boat has been ordered, and survey flights are scheduled to start next summer.

Thus the day of the commonplace flight to Europe is not far off. Out of the whole complex situation the most certain fact to appear is that such passenger flights will be made. The questions of when, how, and by whom have become minor issues. When the 314 is ready for service the United States can make a strong bid for a place among the leaders. When the ships of tomorrow take the air, American supremacy can show itself in this biggest of new industries just as it has in many others before. And rightfully so, for Americans comprise approximately half the trans-Atlantic passenger traffic. Today's design-room problem, then, instigated by the knowledge and perseverance of the engineer, will very shortly appear as tomorrow's large airplane.

The Farmer Stages a Comeback

Yes, aided by the chemist and the chemical engineer, the farmer is at last starting up the comeback trail. They say that "they don't come back" but, since they have found new markets for his crops and new crops to grow, the farmer is starting to do just that. The article below surveys the gains that have been made in this direction, and attempts to give an idea of what may be achieved in the future. Whether you are an engineer, chemist, farmer, or merely a taxpayer, this problem is of vital importance to you. Read this article—it will enable you to look forward optimistically to the time when the farmer will no longer have to earn his living by not raising corn.

By Alvin Angerhofer, Ch.E. '39

THOSE of you who are inclined to observe industrial developments have probably noticed the recent trend of manufacturing toward the utilization of farm products. An effort has been made by engineers to use surplus crops instead of natural resources whenever possible. Of course, industry has always been using products of the farm, but, for example, the use of vast amounts of cotton for chemical manufacture was not possible before the problem was systematically tackled.

Agriculture is continually faced with the problem of surplus and low prices. The farmer is encouraged to cut down production in order to keep the price where it belongs, but why not put all the land to good use? Surely with chemistry at its present state of development, there is some use for corn and wheat besides food, and surely cotton can be made into something besides clothing. However, if corn and cotton are not going to bring a good price, isn't there some crop that will? Another problem that has always bothered the farmer is the problem of waste. Since just as much effort is necessary to isolate the chaff, corn cobs, and stalks, why shouldn't they be useful as well as the main crop? These and many other difficulties cut down the farmer's income.

Manufacturers are always alert to find raw materials at low prices, or better yet, to find some waste product that can be salvaged cheaply and used as a raw material. Evidence for this is the increasing number of research laboratories being maintained by the large concerns. These laboratories are not only looking for cheaper materials, but they are endeavoring to find products better suited to their needs. Manufacturers require such materials as fermentable carbohydrates, vegetable oils, cellulose, and fibers. It appears then that the farmer and engineer need only to be introduced to each other to solve the problem of surplus, idle lands, agricultural waste, and new, cheap raw materials. The function of farm chemurgy is to encourage cooperation between agriculture and chemistry.

The Dearborn Conference

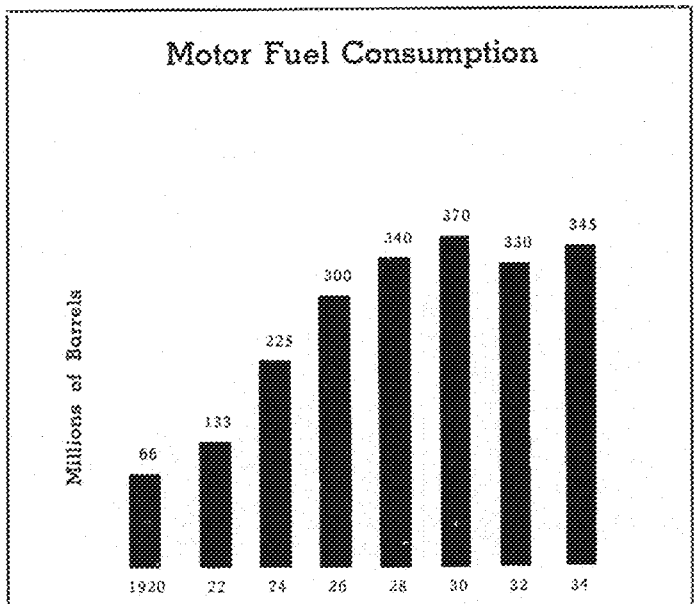
Farm chemurgy is definitely not a crackpot enterprise. The Dearborn Conference of Agriculture, Industry, and Science which began in 1935 at Dearborn, Michigan, brought together representatives of the American Farm Bureau Federation, National Agriculture Conference, The Chemical Foundation, Farm Chemurgic Council, American Chemical Society, American Cyanamid Company, Southeastern Cottons, Inc., American Society of Farm Managers, Dow Chemical Company, Pulp and Paper Laboratory of Savannah, Ford Motor Company, Chicago and N. W. R. R., and E. I. du Pont de Nemours Company. At these annual conferences, the results of research projects were discussed.

The real benefit derived from these conferences was the publicity given to this new division of science and industry. Many American farmers and manufacturers were awakened to the fact that farm chemurgy was actually an industry. People were made to realize that research men in the large concerns had already pushed back the frontier

of this new venture. The U. S. D. A. had already done much to pave the way for chemurgic enterprises.

The manufacture of alcohol is the first thing we think of when farm chemurgy is mentioned. The preparation of power alcohol is the project that really aroused interest in farm chemurgy. Here is an outlet for the corn surplus if only the alcohol yield can be kept high enough to make the alcohol and its by-products pay for the corn and the process. Experiments have shown that at the present alcohol prices, this process can be made feasible only when the price of corn is very low. Since alcohol can be made cheaply from ethylene, a petroleum by-product, the fermentation industry must either look for a cheaper carbohydrate or give up the project as an economic impossibility. Here is where agricultural waste comes in. For years farmers have been bothered by a weed known as the Jerusalem artichoke. This weed looks something like a sunflower, growing to a height of twelve feet at times. The root consists of potato-like tubers, which are rich in fermentable sugar. The weed branches so well along the surface of the ground that all plants below this impenetrable mesh are choked, in the same way that bent grass and clover choke out other kinds of grass. There seems to be no way of destroying the artichoke, so well does it grow. It thrives in the driest ground and survives frost. The tubers make an excellent food for cattle and hogs. But the sugar in the tubers ferments to give a high yield of alcohol. It has been shown that the artichoke can be grown as a crop plant using the same planting and harvesting technique as is used with potatoes. The tubers need not be dug up until winter or even spring. Experiments are still being conducted to determine the best conditions for crops, and to find out how much alcohol will cost if made from artichokes.

Corn is the standard material for making potable alcoholic liquors, but the amount of corn used in the liquor industry per year is fairly constant and could not be increased or decreased to take care of a surplus. Although it is not possible to make power alcohol from corn, special enzymes can be used to produce alcohols useful as solvents. If wood is hydrolyzed with sulfuric acid at high temperature and pressure, the cellulose is changed into fermentable sugars. This takes care of sawdust and some of the farmer's brushwood, and it may give a moderately cheap alcohol, but it does not touch the corn surplus.



Since our petroleum resources are dwindling it is only common sense to begin to develop new fuels, such as alcohol.

The Qualities of Alcohol When Used for Power

In order to be used for power, the alcohol must be rendered anhydrous by distilling with benzene. Anhydrous alcohol is a good fuel in motors, specially built for it. It has good antiknock qualities and a calorific value approaching that of gasoline. It burns cleaner and can be used in cylinders having a high compression ratio. Racing cars have been run on alcohol, and tractors have been designed to use it, but the mere fact that it will run an engine does not overcome the economic obstacle. With alcohol at a cost about three times that of gasoline the project is at a standstill. When alcohol is used as a blending agent in gasoline, it raises the octane number of the gasoline. Such blends are standing up well in tests and promise to increase the use of alcohol somewhat. Some disadvantages are still to be overcome in the blends. For instance, "vapor lock" occurs with these blends when the alcohol vaporizes too readily. Vapor lock is the interference of fuel vapor with the flow of fuel into the cylinders. Special moisture proof tanks must be used for shipping and storing to keep the anhydrous alcohol from taking up water and separating from the gasoline.

It would be quite a blow to farm chemurgy if, while working feverishly at the task of cutting harvesting, fermenting and distilling costs, some other substitute, such as C_2H_2, should be adapted to motor use. Not only is this a very threatening possibility, but the petroleum industry or some other industry might come forward with a new cheap process for the synthesis of alcohol. If fermentation alcohol were to be adopted as a motor fuel, it would mean that an inestimable acreage of farm lands would be turned over to the cultivation of Jerusalem artichokes, or whatever the best carbohydrate plant might be, and many farmers would be able to raise crops other than those of which there is already a surplus.

Thirty years ago soy beans were practically unknown in this country. There were a few thousand acres of the plant, but little oil was produced. Soy bean oil had to be imported from Manchuria, where the plant had been cultivated for years. Today the acreage is something on the magnitude of 40 million. This great increase has taken place largely during the last decade. One of the reasons for the popularity of soy beans among farmers is that it fixes nitrogen into the soil. Its great variety of uses has made it quite a profitable crop.

Processing the Soybean

Soy bean oil is removed by extraction with some kind of solvent, which is then removed by distillation. Another common method of removing the crude oil is that of "expelling." The beans are heated at such high pressures that the bean becomes mushy and the oil merely flows out. According to M. M. Durkee, Staley Company, Decatur, Illinois, expelling at a pressure of 5-10 tons per sq. in. leaves a solid residue containing 42 per cent protein. Hy

draulic presses are often used for removal of the oil. Whatever the method, a crude oil is obtained which must be settled and filtered before going on to other processes. The crude oil, which is slightly acid, is neutralized with NaOH in a heated refining kettle. This causes the fatty acids to come out as sodium salts, the so-called "soap stock." In an improved process the crude oil is neutralized in a centrifuge. The neutral oil is drawn off the top and washed with pure, soft water. Any remaining impurities are removed by cold filtration through a filter press. The oil at this point, having a "grassy" odor, must be steam distilled in a vacuum to remove the gases which cause the unpleasant odor. Oil that has gone through all these processes is good enough to be used in mayonnaise and salad dressings. Certain amounts of cottonseed oil and corn oil are added, depending upon the kind of blend desired and upon the cost of the various oils. About four-fifths of the soy bean oil made is of edible quality and is used for food products, the remainder being used in technical processes. One grade of oil has a dark red color. A small quantity of this red oil imparts a yellow color to a large quantity of margarine, giving it the appearance of real butter. However, a dark refined palm oil with a better color than soy bean oil makes a better artificial butter. The grassy or paint-like odor that soy bean oil acquires on standing is one of its most undesirable qualities. The steam and vacuum distillation is supposed to remove this odor, but the odor is developed again after standing for some time. Even when fresh the oil has an odor of beans.

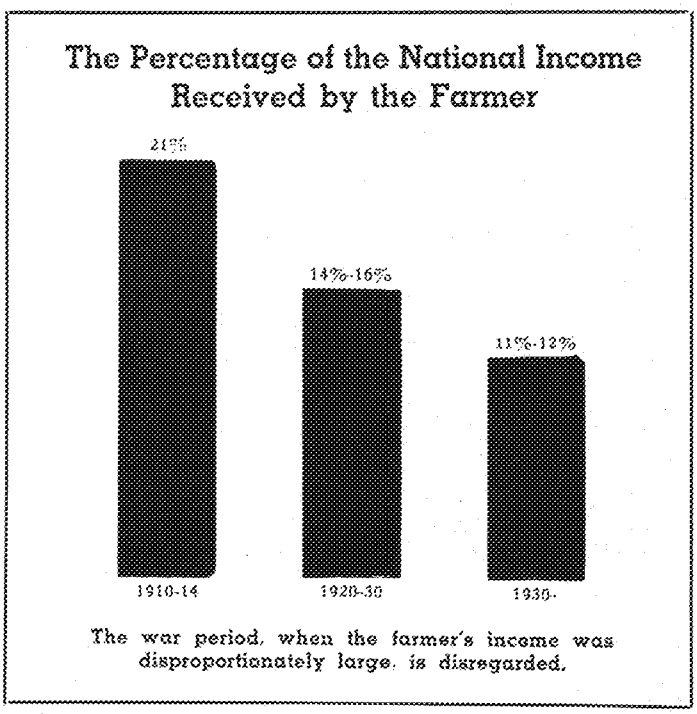
By far the most important technical use of soy bean oil is as a drying oil in the paint industry. Unfortunately, when the oil dries it retains some tackiness, but the same property that causes tackiness causes the surface of the paint to be elastic. Most drying oils tend to turn yellow with age, but soy bean oil does not. In order to prepare a drying oil with less of the tackiness of soy bean oil and less of the yellowing qualities of other oils, blends are made with linseed oil, perilla oil, tung oil, and others. If some research group is able to develop a drying oil that uses soy bean oil and still dries completely, remains colorless, and resists water, the production of this crop may be greatly increased.

Soy bean oil is used in foundries as a bond for cores. This demand represents a considerable portion of the technical oil consumption. The by-product of soy bean oil is the residue that remains after extraction, pressing, or expulsion. This is pressed into cakes and is an excellent food for cattle because of its high protein content.

Utilizing Southern Crops

A crop that is frequently produced in excess is cotton. This surplus problem is on the way to solution right now because more and more cellulose products are being made from cotton. Other sources of cellulose are lumber and sugar cane fiber. Pine can be raised like any other crop in the South. When grown as a yearly crop, Georgia pine can be used for making paper. This is a significant step toward the preservation of our forests.

Bagasse from sugar cane used to be a problem for sugar manufacturers because of its great bulk. They used it to heat their boilers until someone conceived the idea of using it in an insulation board. The result was Celotex, with which we are all familiar as an insulation in homes. The Celotex industry now operates on an enormous scale, using not natural resources but waste from the sugar industry.



The drop in farm income, illustrated above, has had a strong tendency to hamper the efficient functioning of our economic system.

Since molasses from sugar is used for making alcohol, here is an example of a possible bad effect of the artichoke alcohol project. The new process would probably replace the old process and have a disturbing effect on the sugar refining industry. It is evident that the adoption of soy bean oil as a drying oil would harm the linseed oil industry. Unless there should be a sudden shortage of petroleum, the substitution of alcohol as a motor fuel would affect the petroleum industry.

The advantages to be realized through chemurgy far outweigh any loss that might be suffered by competing industries. Farm chemurgy is not conducting a selfish enterprise. Surely the enterprise merits support if it can preserve our natural resources. Sunshine is supplying more energy than we need to our crops if we will only make greater use of surplus crops for heat and power. Chemurgy does point the way to utilization of farm surplus and of as much more produce as the farmer can raise. At present there are not enough uses for certain alternative crops to induce the farmer to raise them instead of standard crops. Here is an opportunity for a chemical engineer or a chemist to get on the bandwagon and help develop products using as raw materials corn, soy beans, cellulose, and other farm products that are plentiful.

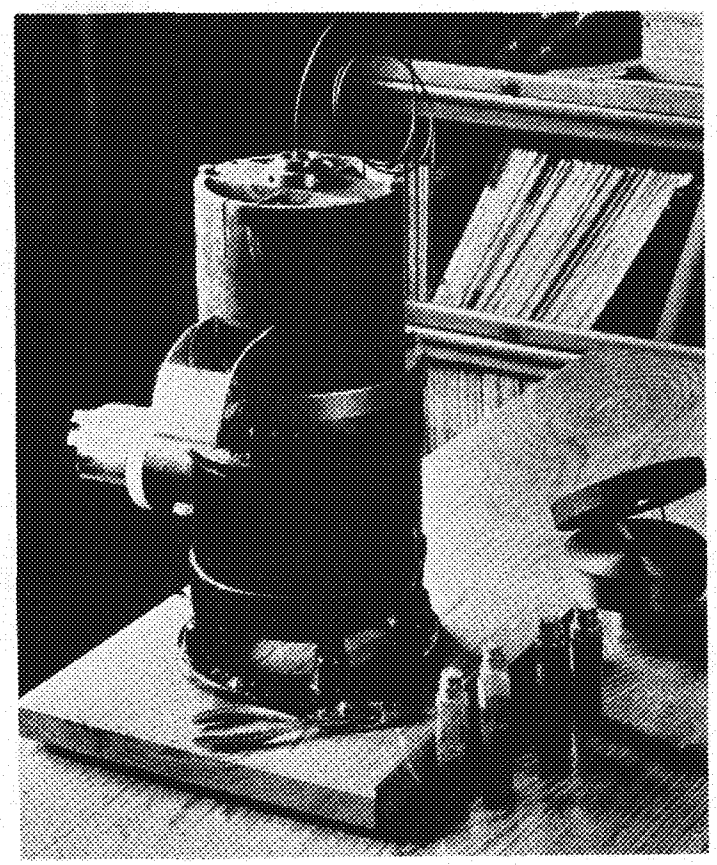
Much of the above material, including that presented graphically, was obtained from the proceedings of the first and the second Dearborn conferences. If you are interested in investigating the subjects further I would strongly recommend that you get these from the library and read them. They are very interesting, and they present a complete picture of the chemurgic work being done.—The Editor.

Research in the Institute

Lead Poisoning

MARSH areas inhabited by waterfowl are liberally peppered with lead shot each year. Since all waterfowl eat a certain quantity of grit, they often pick up a few lead pellets. It has been found that six of these pellets constitute a fatal dose of lead and that even a single piece of No. 6 shot will sometimes cause death. The United States Biological Survey estimates that as many ducks die of lead poisoning in this way as are shot each year.

With this problem in mind, Professor Dowdell of the School of Mines and Dr. Green of the Medical School started work on a non-poisonous alloy which could be used for making shot. Preliminary experiments led them to the study of lead-magnesium alloys. Pellets made of these metals disintegrated rapidly in marsh water due to the action of the magnesium. The small particles of lead left are not likely to be eaten by waterfowl, but even if they are eaten, the pieces are too small to be trapped by the bird's gizzard and they are quickly eliminated. Whole pellets eaten by the bird decompose into small fragments which are almost completely eliminated in 48 hours.



The shot rolling mill with its grooved disk and vials containing shot made in it.

The most suitable magnesium content for the alloy is about 1.5 per cent. This amount produces only a small decrease in density below that of pure lead. However, the lead-magnesium alloys cannot be made into shot in the ordinary shot tower, since the magnesium interferes with the rounding process. Professor Dowdell is now experimenting with inert gases in shot towers to try to overcome this effect. In case towers cannot be used, Professor Dowdell can offer a rolling mill which he has invented and patented. In its present form the mill can turn out 1,150 pellets a minute within a size tolerance of 0.002 in. Pieces of the alloy in wire form are sheared off inside the machine and spun around a spiral groove in the face of a steel disc. The illustration shows this spiral groove on the disc and some finished pellets alongside of the rolling machine.

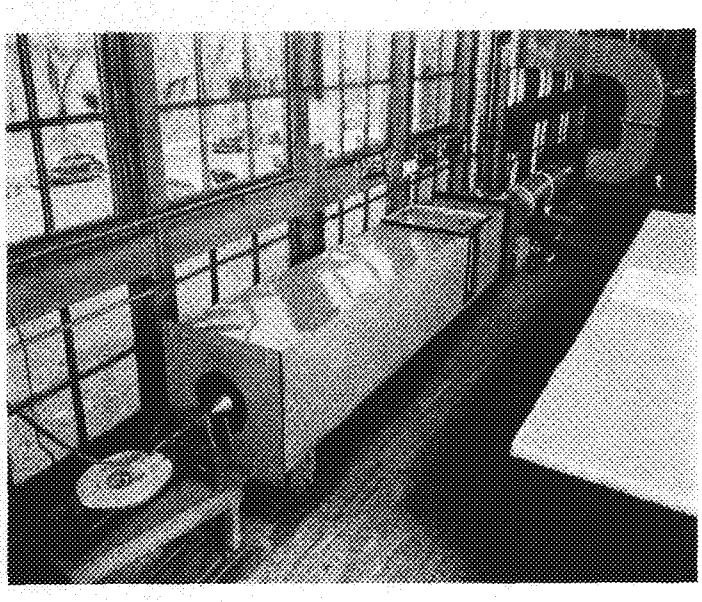
The laboratory work will by no means conclude the efforts of Professor Dowdell and Dr. Green. With the aid of the United States Biological Survey they intend to gain the coöperation of hunters and shot manufacturers, probably by means of legislation, and eliminate this needless waste of valuable waterfowl.

For Better Buildings

DR. ROWLEY, head of the engineering experiment station, is directing research on several problems of great importance to the air-conditioning and building-insulation industries. The most extensive of these projects is an investigation of heat transmission through building materials. Dr. Rowley and his associates are also doing work on air filter performance, moisture condensation within walls, and the measurement of dust in air. The first of these projects, heat transmission through building materials, has been in progress for several years, and many important phases of the problem have been developed. Dr. Rowley and Mr. Algren have built apparatus for determining the thermal conductivity of different types of building and insulating materials. In three different coöperative research projects they determined the thermal conductivity coefficients for 200 types of wall construction and insulation, the thermal conductivities of 30 species of lumber, and the thermal properties of several types of concrete walls and concrete materials.

During the past few years Dr. Rowley and Mr. Jordan have done extensive research on the relative efficiency of various methods of removing dust from the air and the effect of different types of dust on the filters now in use. The apparatus used for this work is shown in the illustration. At present the various types of dust in air are being studied. When this work is completed, a standard synthetic dust can be compounded for testing and comparing filters under conditions comparable with those met in service.

Dr. Rowley, Mr. Algren and Mr. Lund, are doing their work on moisture condensation within walls in an especially constructed room at the engineering experiment station. The room is kept at a temperature of —25 degrees



A view of the apparatus used in testing air filters.

F. Then test "houses" made of the building material under investigation are placed in this room and conditioned air is circulated through them. After each test the houses are dissembled and the moisture conditions within the walls determined. Using this method much valuable data has been gathered.

Rapid Analysis

DR. KOLTHOFF and Dr. Lingane, of the department of chemistry, have been doing some important research during the past few years on a new method of chemical analysis known as polarography. The method is almost as sensitive as the spectroscope for making qualitative analyses and is even better for quantitative work. It gives promise of becoming an important new analytical tool in the various branches of chemistry, particularly in organic chemistry.

Polarography is a rather complex science, but its principles are not hard to understand. All polarographic analyses are made in a cell in which one electrode consists of small drops of mercury falling slowly from a very thin tube. A gradually increasing e.m.f. is applied to a solution of a substance in this cell, but no current flows until the e.m.f. reaches the decomposition potential of the particular substance in solution. At this point the current begins to rise sharply and soon reaches a limiting value which any further increase in e.m.f. will not affect. The decomposition potential is peculiar to each ion and the limiting current value is proportional to the concentration of the solution. These two facts form respectively the bases for qualitative and quantitative analysis using the polarographic method. When an analysis of either type is to be made, the current-voltage curves of the unknown substance are compared with known curves.

Dr. Lingane's work has been done on electro-reducible substances for the most part, but he intends to investigate electro-oxidizable substances later on.

The current-voltage curves are obtained with an instrument called the polarograph, which records the curves automatically on a photographic film. The instrument records a complete current-voltage curve or "polarogram" in ten minutes or less.

Corrosion Control

CORROSION losses constitute a $500,000,000 headache for Americans annually. Dr. Mann, head of the division of chemical engineering, has been working for several years to decrease these losses by discovering a group of organic compounds which permit acids to dissolve surface oxides and deposits on metals without attacking the metal itself. His work has led to some gratifying results, as many manufacturers and chemists can affirm. One manufacturer, whose whole shipload of nuts and bolts had rusted when the ship sprang a leak, came to Dr. Mann for advice. He was advised to treat the cargo with a strong acid mixed with a small amount of an organic inhibitor of corrosion. The manufacturer did this at a cost of $2.50 and found that not a single bolt had become acid pitted although all the rust had been effectively removed. Organic corrosion inhibitors, such as this one, are used in rolling mills where it is important to have a clean surface on the metal, free from acid pits; in heating plants where scale often needs to be removed from boilers and pipes; and wherever metal surfaces have to be prepared for painting, lacquering, or enameling.

Dr. Mann and his associates have investigated the corrosion inhibiting properties of many different types of organic compounds. All of these compounds have at least one atom in groups V or VI of the periodic table, and all form ionizable salts with a corroding acid. The nitrogen-containing inhibitors are the most common. These include aromatic and aliphatic amines, hetero-cyclic compounds like pyridine and quinoline, various amino-acids, and the substitution products of all these compounds. Formaldehyde and certain ketones are valuable oxygen-containing inhibitors.

The Theory of Inhibitors

Dr. Mann's theory of inhibiting action, which is well supported by experiment, is briefly as follows: When metals are attacked by acids, positive hydrogen ions replace metal ions, the metal goes into solution, and hydrogen passes off as a gas, leaving the metal corroded. If the acid contains the positive ions of an organic inhibitor, these ions will replace the first formed metal ions, but, unlike the hydrogen ions, they adhere to the surface electrostatically. Gradually a layer of these protective ions is built up. If the layer is impervious to hydrogen ions, the metal will be protected against acid corrosion. The imperviousness of this layer increases as the cross sectional area of the ions, projected on the metal surface, increases. In other words, a layer in which the ions were more closely packed on the surface would be a better inhibitor than one in which ions of similar size were loosely packed on the surface. The impenetrability of the layer increases as the ions are packed closer together. The inclination of the ions to the surface of the metal has some effect in determining this latter factor. The inclination, in turn, is dependent upon the structure of the molecule. For example, a layer composed of methyl aniline would be a better inhibitor than one of aniline, since its molecule is unbalanced and inclines to the surface of the metal.

Is Success Necessary?

Do we need successful people or should they be eliminated for being anti-social? Is the man who builds a better mousetrap than his neighbor—thereby putting his neighbor out of business and causing his neighbor's employees to lose their jobs—a benefactor of society or its enemy? It is an interesting point and one well worth discussing. The question of the need for having above-average individuals or companies and the rewards to be paid them is very much a current issue now. The present attitude towards success and the effect of this attitude on public and private life is the subject of this article. Read it—then draw your own conclusions as to whether success is necessary.

By George Lund, Ch.E. '39

Illustrations by Albert Arneson, Arch. '39

THE present attitude toward success is marked with a feeling of scorn and derision by many. This is in direct contrast to what it has been in the past. This trend has proceeded in two ways, firstly, an attack on those who are already successful, and, secondly, assistance to others, either openly or covertly so that they may neglect any attempt toward success—usually at the expense of those who do try.

The direct attack on successful people is clearly evident in the business world. Of this, Wesbrook Pegler said in substance: A man should not be put under suspicion for doing well financially. He should not be considered as being unsportsmanlike or unpatriotic because he can make money while others can not. He may not deserve to be cheered but he certainly is entitled to more respect than given by the present administration. Economic disaster is courted whenever the brakes are put on ambitious people, because without their initiative there would be no jobs or even a possibility for recovery under capitalism. Though Pegler's attitude is somewhat biased, there is truth in what he says.

Boake Carter had the following to say after he inspected a certain automobile company, "All men in executive positions of this particular automobile corporation rose through the mill. Twenty-five years ago, the days were twelve hours long and there were few labor saving tools. They occupy executive positions today because they took pride in the jobs they used to perform. Yet they are the men who today are lashed as oppressors by political demagogues, who for the most part don't know what work is. The tragedy is that emotionalists, agitators, and peanut politicians damn this kind of man and promulgate propaganda for laws which would cripple enterprise and force down the ambitious workers to the low level of efficiency set by the indifference of deadpan what-the-hell-do-we-care workers."

Business men and others have been indirectly attacked by laws, regulations, and taxes, applied without apparent thought of the damage they might do—or else possibly, purposely to do this damage. Another prominent author, Channing Pollock, brings out this fact by the use of several examples. A man tried to keep his garage business going, but when the depression started he had to employ several extra men because of government influence in order to get any trade at all. The result was bankruptcy. Today, he and his former employees are all on relief. A taxi driver in a small town invested money in a second mortgage on a large farm. The mortgagee spent the money freely and let the land run down. Today the second mortgage is worth nothing. The man was ridiculed when he attempted to foreclose the mortgage to get something out of his investment. Another man put money in his own business to build it up. Now with increased governmental control and higher taxes he is losing money; his yearly loss is equal to his taxes.

It is interesting to note the effect this attitude is having on public life. For instance, this change in attitude toward success is characterized by a lack of regard for craftsmanship and achievement. Officeholders who urge that the government try to pull itself together and balance its affairs to some extent are just laughed at. Unscrupulous politicians vie with each other openly promising bigger and better pensions to those who will support them. They threaten to suspend all aid from those needy people who fail to vote for them.

Supreme Court Justices used to be chosen for their knowledge of the law. It was felt that this was necessary since a majority of the cases brought up before this court involve fine points of law and procedure and it was thought that in order that the court be able to make just decisions it was necessary that its members be expert legal craftsmen. However, now the most important qualification that a candidate for this respected position can have is a record of having voted the right way at the proper time.

Many young men, although having the opportunity, do not try even to finish high school, which should be the minimum education for all people. They assume that either relief or unemployment insurance will always be available to supply their needs.

In the past men and women seldom considered marriage and the raising of a family until financial obstacles had been overcome. At the present time marriage has been undertaken in some cases solely because the husband was then eligible for WPA work. The raising of families has been undertaken because relief allowances are considerably higher for families with children. One couple in the city of Minneapolis has had four children in the last six years while being supported solely by relief.

The previous policy of saving money has reverted to one of spending. The present policy is to spend your own money and when broke get more from the governmen

by relief, etc. The government policy is to borrow money continually without making any provision to pay it back. The attitude of students toward government methods of producing employment is typified in the banner carried by a high school graduating class which said, "WPA, Here We Come."

Not so long ago, and even at the present time, people were urged to "own their own home." Numerous advantages were claimed for this system, but when economic conditions became uncertain, it was difficult for people who had attempted to follow this advice to pay for the upkeep, taxes, and mortgages. Consequently, they lost their homes to the government or to the mortgage company. Renting homes and letting the landlord worry is the modern answer to this state of affairs.

The pension system has also reversed itself. An example of how state pension systems are conducted is in the state of Missouri. Before their pension legislation was enacted, the estimate by the bill's proponents was 9,000 eligible people, costing $2,000,000 a year (this number possibly representing those who actually needed and deserved this pension). Actually, the number is now 75,000 people and the cost is $40,000,000 a year, the predicted individual pensions having to be cut. The relief situation is in similar circumstances.

There may have been some cause for attacks on business men, because some have not been noticeably considerate of their employees or of the public. Robinson discusses this view as follows: "Fraser's Golden Bough states that many generations ago there always was a tribal scapegoat who was scourged with stones to atone for the people's sins. Now when calamity and depressions happen, the business man must bear the blame. This may be necessary for mob control but certainly does no good toward the country as a whole. The business man is supposed to put profit first and skimp on all else, he being a thing of evil. It is generally recognized that the business man has brought most of the progress to date—things

Success—New Style

Success—Old Style

such as wages, working hours, and advancement of culture."

The appearance of social illness is the result and not the cause of the trouble. Thoreau stated that there are one hundred men striking at the branches of evil to one striking at its root.

Those who attack businessmen forget that they are in a situation similar in both consideration and attitude to that of the housewife to the servant, the University to its employees. Politicians are notorious for their disregard of the wishes of the voters except at election time. Doctors sometimes uphold their code of ethics, often to the detriment of the patient. Lawyers assist criminals to evade justice, in order to fatten their own pocketbooks.

Although this trend in attitude toward success has accompanied an economic depression, other depressions in the past have not been accompanied by such a wholesale change of general attitude. Many of the opinions and examples of this matter are colored by a political tinge. However, this is only to be expected, since a complete political change occurred just after the start of the present depression, and, of course, the party in power never criticizes its own work or conditions for which it is responsible.

It must be admitted that this criticism of success and the retrogression of ambition have been far greater and of a more general nature than has ever occurred before at any time. Whether this trend will decline and the general attitude toward success revert to its former position at the end of the present depression, only time can tell. However, it is to be hoped that in the future the successful man will not have to hang his head in shame merely because he has been successful.

The Minnesota Techno-Log

Vol. XIX December, 1938 No. 3

A Necessity

IN spite of the economic panic that has for ten years attempted to curb advancement all over the world, the University of Minnesota can look back on a very prosperous decade; not prosperous in a monetary sense, but rich with advancement in service. Not only have great contributions been made to the arts and sciences, but also greater numbers of people have had the opportunity to study and prepare themselves for future work.

To take care of the large increases in enrollment the University has carried on an extensive building program. All of the buildings constructed were needed very gravely, but the one building that has long been the most inadequate one on the main campus has, as yet, received no worthwhile consideration. This is the mechanical engineering building. This problem is of prime interest to the entire Institute of Technology, because the majority of the technical departments require a large number of mechanical engineering courses in their curricula.

We are not asking for a new building just because we feel that as long as so many are being built we may as well get one too. Those directly affected have been very tolerant of their situation. Having a full realization of the other financial obligations of the University, they have long overlooked the inconveniences of the old building and have refrained from campaigning for a new one. But the time has come when it is necessary to point out that the present structure is not only a great inconvenience but also a menace to the physical well-being of the students. A definite campaign is being carried on by interested parties in the mechanical engineering department. It is not a radical campaign, because they respect and concur in the actions of the authorities. We feel we need only present the situation as it really stands.

The mechanical engineering building has long been overcrowded; yet in the last five years the enrollment in the department has increased 150 per cent; 420 students are now registered in mechanical engineering alone, not to mention the number of students of other departments who are taking mechanical engineering courses. The overcrowded situation has become so grave that in many cases the class hours had to be reduced and courses cancelled because of lack of space. Faculty research, furthermore, is almost impossible because of lack of space and other facilities. The electric lines throughout the building are much too light to carry the extra burden of the new machines and other equipment that has been added since the structure was wired. Just recently a line was overloaded to such an extent that a small fire was started, and a near-panic resulted before it was put out. The lighting throughout the building is far inferior to that required for good health and it can't be improved because the electric lines will not carry a greater load. The danger of this fire hazard cannot be denied.

The work carried on in the shops is hazardous because there is no fireproof material surrounding these areas. The forge shop has thirty forced draft open furnaces, and welding facilities for ten men, all of which are constantly in use. Metal is melted and poured by the students in the foundry shop. What could be done in case a fire should break out? The entire inside structure is of wood and there is no sprinkler system. The stairways are of wood and in some cases are only three feet wide. The arrangement of the building is such that escape from many rooms could easily become impossible. To go from one side of the building to the other it is necessary to pass through at least one laboratory, a dark three-foot hallway and stairway, the men's locker room, wash room and dressing room, the men's latrine, and another wooden stairway. Sparingly hung small fire extinguishers are the only means of fire prevention. To make the situation more alarming, many of the doors swing inward, in violation of city and state ordinances.

Yes, President Ford's opinion that the building is an "eyesore" is correct, but more important than this is the fact that it is a threat to the lives of our students and a worn out gear in the machine of advancement. It really needs replacement and we hope that the necessary funds will be forthcoming soon. If anyone doubts that a new building is badly needed let him go over and go through the present one. He will soon be convinced.

"Library Guide for the Chemist"

By Byron Soule

Reviewed by C. I. Haga
Instructor in English

THOUGH most of us know how to use books, some strange panic seems to affect us when they mass themselves by the thousands in libraries. Then, all too often, our eagerness to read is thwarted or baffled by the apparently formidable systems librarians devise for keeping order. Timid souls may be forgiven if at first they feel that librarians by assembling books for Everyman have made them available to Nonan. Such shy persons should be told at once that librarians as a class are always helpful and as persons are most solicitous of the reader's convenience and profit, and that a library is as easy to get acquainted with as a single book. Anyone who can find and use the table of contents and the index in a book and who can ask questions has wit enough to learn the workings of a library.

How necessary it is that students familiarize themselves with libraries early becomes apparent from some estimates in Byron Soule's "Library Guide for the Chemist." In chemistry alone the mass of printed material is vast: each year some 400 books and 40,000 articles in 2,800 journals come pouring from the presses. When to that heap are added other mountains from other sciences and other branches of engineering, we begin to realize that without libraries and librarians no one would have time even to count the publications, much less to use them intelligently. Such intelligent use is possible only after the reader has made himself familiar with the plan and contents of the libraries at hand.

Given the superlatively good special libraries our students enjoy in the Institute of Technology, it is astonishing how often they seem little aware of their good fortune. How any particular student should supplement his regular class work with independent reading is a problem I make no pretence of solving, but how all students may turn to our libraries confidently and intelligently can be suggested by an examination of Soule's "Library Guide." From his perusal of this book the average student will derive two benefits—the first, a general notion of the organization of our libraries with all their reference devices such as indexes and the like, and the second, a genuinely stimulating encouragement to form regular and workmanlike habits of associating with reference works of the highest authority. The first, a matter of mechanical details, is fundamental, but the second is perhaps the more important since its results will have a value directly proportionate to the intelligence, ambition, and industry of the student.

A brief resumé of the organization of the "Library Guide" will make clearer what I mean by these two values. After two concise and helpful chapters on the organization of the library and of the card catalogue, the "Guide" devotes a chapter to biography, justifying reference to that subject by a quotation from E. T. Bell, "When asked how he had done so much in his short life, Abel (eminent mathematician, 1802-1829) replied, 'By studying the masters, not the pupils.'" Then follow several chapters on periodical material in all its forms (journals, abstracts, reviews, etc.) and on dictionaries and encyclopedias. The remainder of the book (better than sixty per cent of the whole) devotes longer chapters to the four main divisions of chemistry—inorganic, organic, analytical, and physical chemistry—and to patents and government publications.

Only a chemist is qualified to comment on the reliability of Soule's bibliographies in each chapter or on the practical aid offered by the precepts and suggestions accompanying them. My brashness in claiming for them both breadth and exactness is justified by my belief that a guide of this nature should answer specifically for a number of books the question "What is in the books?" Soule's "Library Guide" does that. Sometimes the answer is but a phrase or a sentence, and sometimes it is several pages of outline and description—but whatever the answer, the questioner can quickly decide how useful the book may prove to be. If he is a student engaged in research, it is obvious what advantage he will gain from the "Guide" by running down his sources with the least expenditure of time and effort. If he is just a student, just an eager, ambitious youngster giving the leash to his curiosity and learning to find his way about, the advantage, though less specific, is almost equally great. He too can learn by going to the masters.

The source of my only complaint is, paradoxically, that this "Library Guide for the Chemist" is just what its title promises. Though I know how impracticable and unnecessary any supplement to the "Guide" would be, I feel that such a book should be complemented by another handbook doing for chemistry, or science and technology in general, what Spahr and Swenson's "Methods and Status of Scientific Research" does for the social sciences. Many times I have referred engineering students to Spahr and Swenson for lack of anything comparable designed especially for engineering research. That they have been able to use this handbook profitably argues well for its utility despite the handicaps it necessarily imposes by requiring that the engineer translate its illustrative material into the appropriate engineering or scientific context. With engineers increasingly called upon to deal with data from the social sciences, with economics, politics, history, it is not surprising that a book intended primarily for social scientists can also be helpful to technologists.

But though such a book has not yet been written for engineers or chemists, there is now Soule's "Library Guide for the Chemist," a book whose acquaintance I am convinced will benefit every student in the Institute. So crammed with fact that it almost deserves the rapturous praise the elder Henry James gave one of Swedenborg's books, "It is insipid with veracity!" The "Guide" is so well-planned and so smoothly-written that its reading gives one pleasure as well as profit. Believe it or not, I read it at a sitting, so fascinating did Soule make the book by virtue of his style and his command of the subject.

ALUMNOTES

'23

Dr. E. L. McMillen, Chem. E. (Ph.D. '31), resigned his position at Ames to becomes head of the newly organized chemical engineering department at Lafayette College in Easton, Pa. Dr. McMillen was an assistant professor at Ames. He was formerly an assistant in chemical engineering at the University of Minnesota.

'26

George M. Huck, Met. E., was a recent visitor at the School of Mines. He has been put in charge of the Los Angeles office of the Bethlehem Steel Company and stopped off at the school on his way there.

'30

Lloyd Weston, E.E., recently visited on the campus.

Dr. Irvin Lavine, Chem. E. (Ph. D.), did research work in the School of Chemistry this past summer. He worked with Dr. Mann on the subject "Development of Peat as a Fuel." Dr. Lavine resumed his duties this fall as professor at the University of North Dakota at Grand Forks, N. D.

'31

Dr. B. F. Ruth, Chem. E. (Ph.D.), who was at Texas A. and M. is now an assistant professor at Ames, Iowa. Dr. Ruth is known for his researches on filtration.

'32

J. H. Willox, E.E., came back to visit his former professors. He is with the Joslyn Manufacturing and Supply Company of Chicago experimenting on lightning arresters.

Dr. Harold Graves, Chem. E. (Ph. D. '35), who was at the head of chemical engineering work at Mississippi State College, recently resigned his job to become an instructor in chemical engineering at Yale University.

Joe P. Sullivan, E.M., recently accepted a position as sales engineer for the Goodman Company, Chicago, selling mining machinery. Joe is on a trip to Canada for the company at the present time.

'33

Wilmot F. Shinners, E.M., has also accepted a job with the Goodman Company selling mining machinery.

Harluf C. Peterson, E.M., is now employed by the Freeport Sulfur Co. in New Orleans, Louisiana.

Paul Erickson, E. E., and **Adolph Kupka,** E.E., were recent visitors on the Engineering campus. Paul was chairman of the A.I.E.E. during his undergraduate days. He is now working with the Cutler-Hammer Co. in Milwaukee. His classmate Adolph Kupka is with the Northwestern Telephone and Telegraph Co. in Minneapolis.

John R. Vincent, Chem. E., left recently to take a position with the Du Pont Company. He will receive his Ph.D. degree at the end of the fall quarter.

Cledo Brunetti, E.E., who received the first Ph.D. ('33) given here in electrical engineering, is teaching at Lehigh. Last summer he was married to Miss Villmyer of Robbinsdale.

'34

E. H. Kloss, E.M., is working with the U. S. Engineers at Fort Peck, Montana.

Dr. E. Litkenhous, Chem. E. (Ph.D.), is an associate professor of chemical engineering at Louisville. Odd to say, Dr. Litkenhous has probably received more fame for his rating of football games than for his experiments in chemistry. He uses his own copyrighted "Difference-by-Score" system. His ratings are used by a syndicate working out of Louisville.

'36

Tom Cooper, M.E., recently returned for a short visit. He is in sales office of the Air Reduction Sales Co. of Oklahoma City.

Brad Baker, Aero. E., has been appointed a second lieutenant in the United States Army and is stationed at Scott Field, St. Louis, Missouri.

Milo Bolstad, M.E., received his M.S. degree at the Massachusetts Institute of Technology last June. He is now teaching at the University of Missouri.

'37

Harold Doxey, M.E., is now engineer in charge of the Minneapolis district for the Ocean Accident and Guarantee Insurance Corporation. The company insures boilers and machinery.

Bernhardt Petry, Aero. E., was in Minneapolis for the Thanksgiving holidays. With him was **Russell Carlson,** Aero. E. '38. Bernhardt and Russell are both employed by the Stearman Aircraft Company in Wichita, Kansas.

Gerry Mitchell, M.E., visited the campus this summer. Gerry is with the Aluminum Company of America on production work. **Marvin Lee** was also a visitor here, and is also employed by A.C.A.

Virgil E. Frank, E.M., was a recent visitor at the School of Mines and Metallurgy. He was on his way to Galax, Virginia, where he will be employed in the mining department of the General Chemical Company.

'38

George Hurd, Aero. E., is working with the Pan American Airlines in Alameda, California. Working with him are his classmates, **Randall Kirk, David Weeks,** and **Harold Schmidt.**

Jack Mace, Aero. E., is with Pan American Airlines in Brownsville, Texas.

Howard Middendorp, Met. E., is employed by the Caterpillar Tractor Company at Peoria, Illinois.

Donald Benson, Lloyd Nelson, and **Robert Wagner,** all Aero. E., have been employed by the Northwest Airlines in St. Paul.

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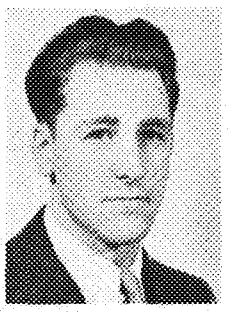
This Month's AUTHORS

Photos by G. A. Halseth, Ch.E. '40 and J. J. McBrady, Ch. '38.

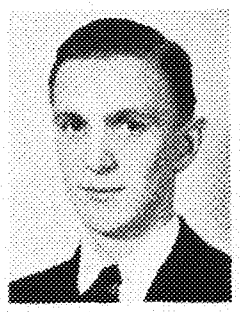
Stanford Church, Aero.E. '40, wrote our lead article this month on air transport in the near future. When you read the article you will be surprised to find that the only remaining obstacles to regular trans-Atlantic service are economic and political. Engineers can build, in fact are building, planes capable of safely spanning the Atlantic. All that remains to be done is to settle on routes, landing places, mail rates, etc.

Stan, who is a member of the Institute of the Aeronautical Sciences, says that his favorite subject is mathematics. He would like to do research in aeronautics or physics when he graduates. For hobbies he lists photography, handball, and badminton, and, like any engineer, he says a hobby is something you wish you had time to do. Incidentally he won the L.A.S. scholarship prize awarded last spring.



George Lund, Ch.E. '39, is the author of that interesting essay dealing with success and the recent changes in the attitude toward it. The essay is an unusual discussion of a problem that will have to be faced eventually. It is the problem of deciding whether or not we should all stay at the level of efficency reached by the most inefficient person.

George is quite a student, having been elected to both Tau Beta Pi, honorary engineering fraternity, and Phi Lambda Upsilon, honorary chemistry fraternity. Being a cautious fellow, he says that since he has had no practical experience in chemical engineering he doesn't know which branch he likes best.



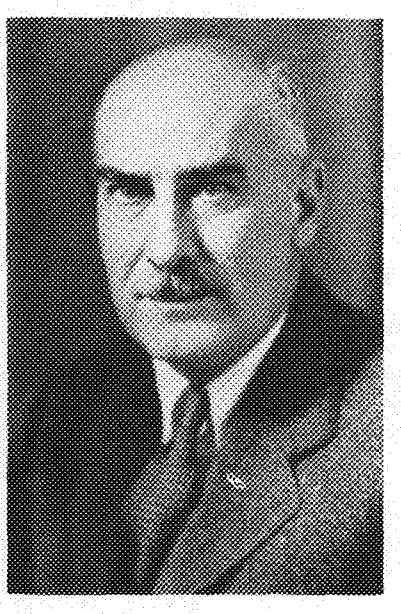
Alvin Angerhofer, Ch.E., '39, compiled the interesting survey of that new but important field, chemurgy.

He is a member of that famous (or notorious) firm of Kemp and Angerhofer who, last summer, took things into their own hands so to speak and pulled the manufacturers of chemical glassware out of the red. They received some slight assistance from a few other senior Chem.E's. Besides this activity he is a member of the Minnesota band. Hiking and skiing are his hobbies. He would like to do research on heat transfer when he graduates.

FACULTY SKETCH

By Wesley Larson, M.E., '39

Dr. Charles A. Mann



Chief of the Department of Chemical Engineering

PROFESSOR Mann is No. 1 chemical engineer here at Minnesota. As would be expected, he believes that the opportunities open to chemical engineers are unlimited, and are better than ever before. And just between you and me, he should know.

After spending his childhood days in the city of Milwaukee, he began his college training at the University of Wisconsin. There he acquired his Ph.D., and also an instructorship in chemical engineering. In 1916 he began teaching at Iowa State College, and three years later moved to Minnesota to take the position he has held ever since.

Dr. Mann's work in research here at the University has been outstanding. Some of the recent projects which he has supervised are as follows: the use of zeolites, a study of plastics and plasticizers, the recovery of manganese from low grade ores by the wet process, the use of organic inhibitors of corrosion, and the study of agitation in water and sewage treatment.

Proof of the recognition given him in research and educational fields are his listings in "Chemical Who's Who," "Who's Who in American Education," "Who's Who in America," "Who's Who in Engineering," and "American Men of Science." He is also a member of the American Institute of Chemical Engineers, the American Society for the Promotion of Engineering Education, the American Association of University Professors, the Minnesota Academy of Science, the Minneapolis Engineers' Club, and many others. He is a member of Sigma Xi, Tau Beta Pi, Phi Lambda Upsilon, and Alpha Chi Sigma.

His hobbies are golf, gardening, and playing the cello.

TECH NEWS

Tech Commission News

At a meeting November 24 the Tech Commission transacted several important pieces of business which are of vital interest to all Institute students:

(1) They set the date for the 1939 Engineer's Day at May 12-13.

(2) They decided to sponsor a series of evening lectures during the winter quarter to be given by executives and personnel men from eastern and local concerns. This series of four lectures will be followed by an Employment Conference, which it was tentatively decided will consist of discussions in the afternoon, dinner, and more discussions or speeches in the evening of a single day. All juniors and seniors in the Institute would be excused from afternoon classes. This conference is to be sponsored in conjunction with Mr. Levens and the Placement Service.

(3) They decided to release "The Story of Steel," a technicolor sound picture by the U. S. Steel Corp., as an all-University attraction in Northrop Auditorium. This picture was reserved by the A.I.Ch.E. for January 17, and this society has very generously turned it over to the Commission.

A.S.C.E. News

The final A.S.C.E. meeting of the quarter was held Tuesday, November 29, in the Minnesota Union. Mr. A. C. Godward, consulting engineer for the Hennepin County Good Roads Association, spoke on "What to Expect After School." Other activities of the quarter included a smoker and the traditional annual "bean feed." The bean feed, presided over by Professor Wilcox of the mathematics department, had as its feature attraction, a bean-eating contest between the defending champion, Ed Cohen and the challenger, John Titus—Titus was crowned the new champion.

Plans for next quarter will center around a series of discussions by outstanding civil engineers on employment possibilities and the problems in the various branches of the field. The civils also plan to have basketball and hockey teams, and welcome challenges from any other societies.

Ch.E.'s Visit Sewage Plant

Saturday afternoon, November 26 two bus-loads of chemical engineers left the Chemistry building for the Twin City Sewage Disposal Plant. About 100 professors and students were shown through the buildings and laboratories by guides who described all points of interest. The inspection of this plant, the largest of its kind in the world, caught the interest of fresbman and senior alike—even the bus-drivers. The whole system was explained, and each piece of equipment was demonstrated.

E.E. Show Chairman Elected

The chairman named for the 193 Electrical Show is Henry R. Rebmann. Dick is a senior in electrical engineering and is majoring in power. He is also the secretary-treasurer of the A.I.E.E. and a member of Eta Kappa Nu, national honorary electrical engineering fraternity.

Although plans are not very far advanced yet, Dick claims that the show will be designed to amaze, amuse, and educate the public. He is now busy organizing committee chairmen. The show will be held April 21 and 22.

A.I.M.M.E. to Hold Meeting

The Minnesota section of the American Institute of Mining and Metallurgical Engineers will hold its annual meeting December 13, at the School of Mines building. Mr. T. B. Counselman, engineer for the Dorr Company, will present a paper on "Flotation of Mesabi Washing Plant Tailings." Other speakers will include Elmer Johnson, blast furnace superintendent at the Inland Steel Company, and Dr. J. W. Gruner of the geology department. The meeting will consist of a morning and afternoon session, with a noon luncheon at the Minnesota Union.

A.S.A.E. Convention

The annual A.S.A.E. convention was held in Chicago, November 29 to December 3. Four agricultural engineering professors attended: Wm. Boss, professor emeritus; J. B. Torrance, A. J. Schwantes, and H. B. White, professors.

A.C.S. Hears Dr. Adkins

The Minnesota section of the American Chemical Society held its monthly meeting on Tuesday, November 15, in the Union. After the dinner, Dr. Homer S. Adkins, of the University of Wisconsin, spoke on the subject of catalysis, particularly in organic chemistry. He outlined the properties of good catalysis and explained their properties on the basis of Langmuir's theory.

Tuesday, November 29, Dr. J. S. Andrews, of General Mills' research department, addressed the group on "Vitamins."

A.I.E.E. Contest Opens

An opportunity for student electrical engineers to gain recognition in their fields has become realized in the A.I.E.E. prize paper contest. The object of this contest is to give the student experience in writing a paper and presenting it before a large technical group. Besides the recognition and experience gained in preparing this paper, the four students having the best papers will be presented with substantial cash prizes by the senior section of the A.I.E.E.

Coffin Fellowships Open

The Charles A. Coffin Fellowships in electricity, physics, and physical chemistry, which amount to $5,000, are open to graduates and seniors doing research in these fields. Those who are interested should apply at the graduate school office, Administration building, before January 15, 1939.

Frosh Names Bookstore

Alexander H. Leighton, Tech freshman, won the Bookstore Name Contest with his suggestion of the "Professional Bookstore." The prize took the form of a railroad ticket to the Wisconsin football game.

PICK AND PAN

By M. A. Troxell, Met.E. '39, and H. A. Larson, E.M. '39

One Saturday afternoon Don Berkner and Hugh Leach, the Spanish athletes, were hunting pheasants down near Berkner's stronghold in Sleepy Eye. Suddenly Leach, who hails from farmless Hibbing, spied a bull rapidly reducing the distance between them. Now Berkner was never the one to be afraid of a little bull, but Leach began to make tracks for the fence. When halfway over the fence, an expression of anguish came into Hugh's face, and he cried, "Hey, Berkner, I can't go in here, there're *pigs* in here!"

Let's just say that Leach was stymied.

George Montillon thinks that sex is something you carry groceries in.

Jack Kelly came out the other day with his column and fervently sang about some copper mine up in the Michigan country. Eloquently he described a shaft outlined against the sunset and became well-nigh ecstatic on the subject. Wonder if J. K. has found out yet that a shaft is nothing more than a hole in the ground.

A sticky problem for the Aeros: Wouldn't fly-paper make good kites?

The booths, counters, faucets, and New Dealer Storberg are all fixtures at the Harvard Grill. During one of his little sojourns in this haven of forgotten sorrows, he heard proprietor Walt Filipek say, "My best business is after a football game. If we win, everyone comes in to celebrate; if we lose, everyone drops around to drown his sorrows."

Some one over in the School of Chemistry said they have more graduates than any other department on the campus.

"Honduras" Homer Anderson is still looking for a girl who can cook. He has received so many replies to his application that he has narrowed down the selection to girls with a car with a nice chassis.

Dale Shephard, Campus Club manager, claims that his waiters are always bothering him with trayfuls.

BLOW OFFS AND SIDE SLIPS

By Don Frankel, Aero. E. '39, and Bob Wolfe, M.E., '39.

Engineer: Do you like short skirts, Mike?

Miner: Naw, dey git lipstick on me shoit when I dance wit 'em.

I wonder how many of you are aware of the terpsichorean talents of Bob McDonald, E.E.B. '40 and business manager of the TECHNO-LOG. At a recent formal ball, the entire floor was cleared for a demonstration of the Lambeth walk by him and his inspiration. We're convinced, however, that his frequent trips to the punch-bowl had a lot to do with his remarkable grace and poise.

During the explanation of cannons to the senior ROTC class, Capt. Zimmer said, "You can adjust these carriages to shoot (He meant 'suit') yourselves."

Yes, we suppose we can, Captain, but why?

My spies just told me about a girl over in the Business School who is taking Labor Problems and Production Management.

Interesting facts dept.:

Rube Olson and Ralph Menning stood in the P.O. for an hour one day trying to sell dollar bills for eighty-nine cents. Every one thought there was a catch to it and consequently they sold none. . . . Don Flynn says that he is a day older than is indicated by the calendar because he travelled around the world from east to west and consequently had to skip a day. We think he's daffy but we haven't found out why.

It seems that Sam Stein, M.E. '39, was disappointed after he had failed electricity for the third time. Prof. Zeleny tried to comfort him with the fact that one student had to take it seven times before he passed it. Sam came back with "Mr. Zeleny, I'm not out to break any records." Sam says that he and Mr. Zeleny had quite an endurance contest to see who was going to last the longest. It ended in a tie, however. Sam passed and Prof. Zeleny retired.

A college student defined "parent" as the "kin you love to touch."

We Aeros are pretty good these days, what with fighting wars in China, photographing dog fights, undergoing terrific hardships and excruciating pains from a wounded wrist, transport flying in Japan, acting as a consulting engineer for the Chinese Nationalists, ably handling the 1932 Cleveland Air Races, Flying in an air circus, with time out for decoration from the U.S.A. Engineers. (For reference: *Minnesota Daily*, November 22, 1938.) It was reported that old timers in the South St. Paul stock yards twenty miles away noticed an extraneous odor on the morning of the above edition. Woe be unto the first person that says we're good with the shovel also.

Corona Silent

A Christmas Gift Suggestion:

Every student wants to own a good typewriter; the best is Corona:—

- Portable
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Investigate Our Rental Purchase Plan

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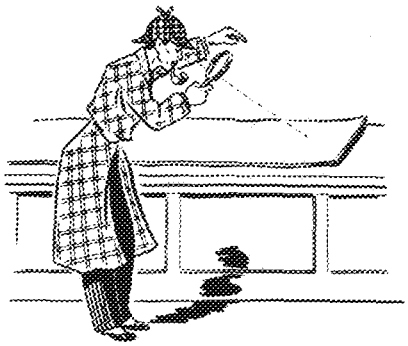
G-E Campus News



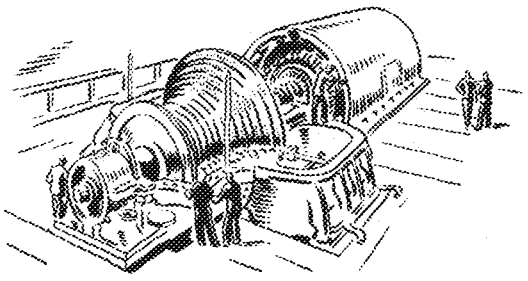
"PINHOLE DETECTOR"

COUNTING traffic, guarding jewels, opening doors—all are in the day's work for photoelectric relays.

But in a great rolling mill one is acting in the unusual role of pinhole detector, a role developed by General Electric at the suggestion of the Bethlehem Steel Company. As steel strips, a yard wide, leave the uncoiling machine at a speed sometimes approaching 900 feet a minute, the G-E relay looks for defects—"pinholes."

When the light beam of the unit, aimed at the strip, hits any defects, a diverter mechanism goes into action and throws faulty sections off the production line.

On that part of the G-E Test course known as "Industrial Control Test," student engineers sometimes work with these ingenious devices, testing and experimenting in a search for new applications.



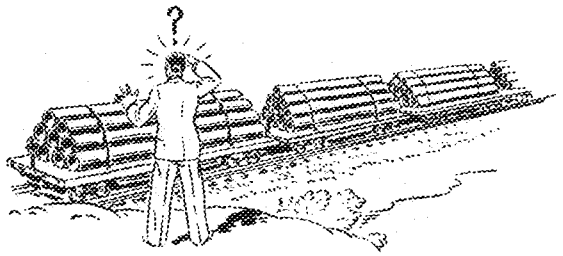
100,000 HORSEPOWER

AN 80,000-kilowatt turbine-generator, using steam at a pressure of 1250 pounds per square inch and at 900 F in a single cylinder to generate 100,000 horsepower, is being built at General Electric's Schenectady Works. It will be installed in a new $9,500,000 steam-electric station at Oswego, N. Y.

The latest results of constant research and experiment by G-E turbine engineers are embodied in this new unit. It will be the first large 1200-pound condensing unit built in a single casing; the generator will be hydrogen-cooled to reduce windage losses; special alloys are being used to meet high pressures and temperatures.

The gigantic boiler is as large as a 9-story building 36 feet wide and 54 feet deep. Steam will shoot from it into the turbine at a pressure of 1250 pounds per square inch. One twentieth of a second later the steam will be cool water, the effect of the amazing change being to drive the unit's rotor at 1800 revolutions a minute.

Soon the foremen will report—"work completed." Tests will begin, calling into action student engineers—recent graduates of engineering schools and colleges. Then, an estimated 14 months after work began, the turbine will be shipped from Schenectady.



FROM MODERNISTIC CABINETS TO 36-INCH STEEL PIPE

WHEN inspectors of the City of Los Angeles Water Department were confronted by 13,000 feet of steel pipe waiting for their inspection, they were dismayed. For inspection meant checking every square foot of the pipe to see that the layers of enamel were of a specified thickness on both the inner and the outer surfaces.

It meant the tedious task of stripping and micrometering samples of the pipe at random, the accepted but not infallible method.

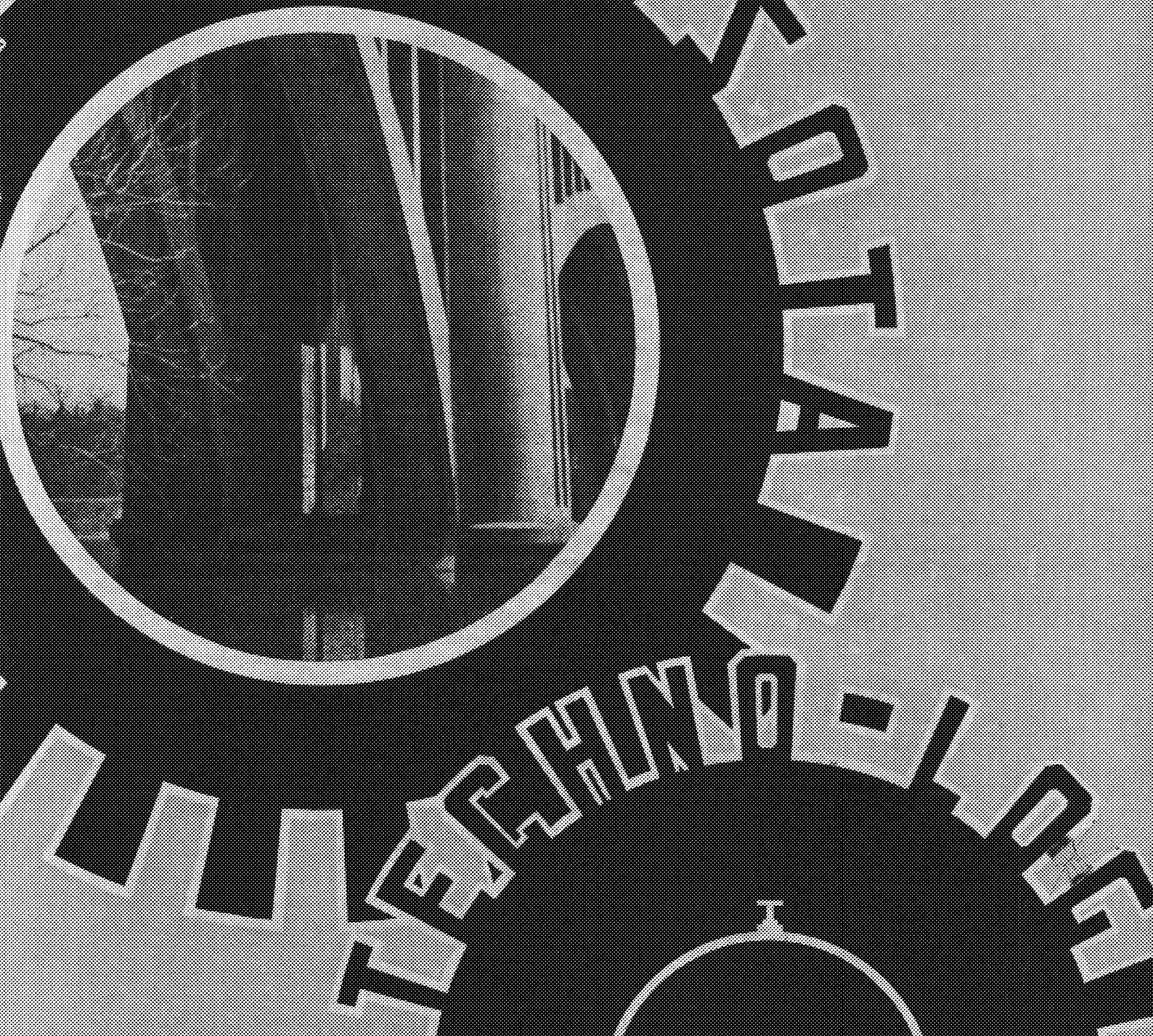
On a search for a better way went one of the inspectors. He found a magazine article about General Electric's electromagnetic thickness gages being used to measure, without marring, the thickness of the enamel coating on refrigerator cabinets. The aesthetic difference between a modernistic cabinet and a steel pipe didn't bother the inspector—he simply bridged the gap with his imagination.

A gage was adjusted to the requirements of the unusual situation; with it the inspectors did the job better, more quickly, more accurately, and more easily. Not only did the gage, with its fingers of magnetic flux, check the entire surface of the pipe, but it reported back the thicknesses with an accuracy of a thousandth of an inch.

GENERAL ELECTRIC

99-103DH

MINE EXPLORATION TECHNOLOGY



JANUARY

1939

The Minnesota Techno-Log

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University of Minnesota, Minneapolis

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Managing Editor

ROBERT E. McDONALD
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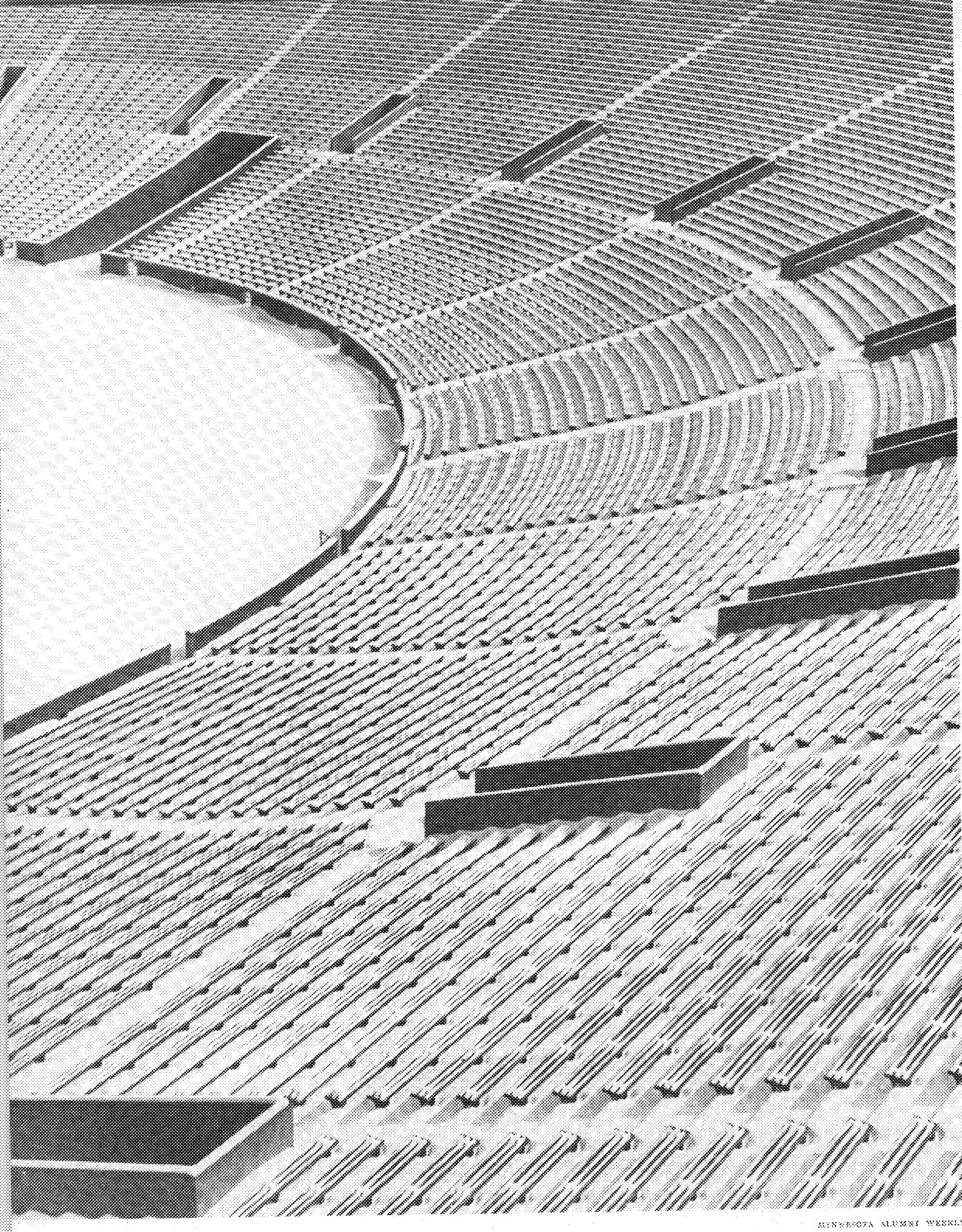


MINNESOTA ALUMNI WEEKLY

Stadium Scene

When War is Declared—

What will you, as an engineer, be called on to do? If you have ever wondered just how a war would affect you or your profession this article will be of interest.

By Arnold A. Jensen, Phys. '39

Illustrations courtesy "The Military Engineer"

WAR is an art carried on by the instruments and developments of science and engineering. War is not a science because it is not governed by any natural laws. It is controlled by human minds pitted one against the other. This makes it an art. However, the war of today becomes more and more technical and is carried on at a greater and greater range. It becomes more and more costly in a monetary way, but less and less costly in the expenditure of human lives. There are fewer casualties in the warfare of today than ever before in the history of the world (attacks on totally unprepared countries cannot be called the warfare of today). Hardships other than the loss of life which are brought about by war are, of course, tremendous. However, this article will deal only with the aspect of war of interest to the engineering profession and the profession's part in war.

Because war continues to become more and more technical, the part that the engineer plays becomes more and more important. In considering future warfare, it is apparent that the ground forces will have to dig into the ground for defense against aircraft. The Maginot Line, carefully built by civil engineers, is an example of this trend. Such measures require a great deal of the engineering profession. Communications, plumbing, and sanitation are all of primary importance. Aircraft are, of course, the field of the aeronautical engineer. The importance of engineering and science in war may be illustrated by the fact that in all history, when an industrial nation was pitted against an agricultural nation, the industrial nation prevailed. An example may be found in our Civil War where the South was consistently successful on the field of battle for the first two years, but, because of the breakdown of their transportation system it did them no good. Thus, there must be a sufficient supply of engineering skill to support military operations.

A Variety of Positions Are Open

There are several paths the engineer might follow in a future war. An engineer or scientist employed in any position of importance in a company or corporation serving the war needs of the nation would be exempt from the draft for military service since he is of more value to his country where he is. It would be foolish to send an expert in radio research into the field to maintain telephone lines in the theatre of operations. Such men will come under what is called the "industrial mobilization plan" which will absorb its quota of men, especially specialists. They will, therefore, be drawn from the theatre of operations into the zone of the interior.

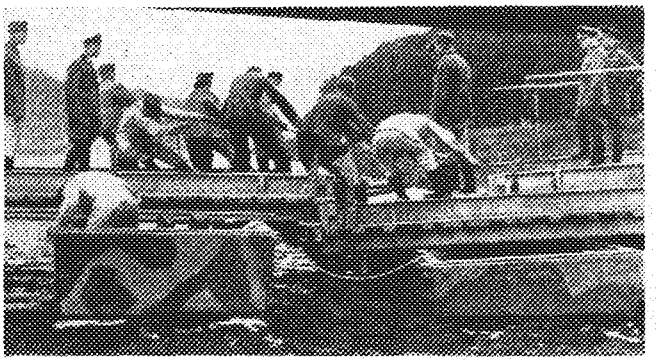
To receive a commission in some branch of the service the engineer would be required to have military training such as ROTC or CMTC. During the last war many engineers went to officers' training camps to receive commissions. There would also be those who would go into the service as enlisted men under the draft.

Since the navy is kept very close to a wartime basis and because of the large reserve, it is not probable that any engineers would receive commissions as naval officers except perhaps as civil engineers for maintenance of docks and yards.

Most of the electrical engineers going into the army would go into the Signal Corps. The mission of the Signal Corps is to maintain communication between the units closest to the front lines. Some would also go into the engineer corps, where there are such functions as the construction and maintenance of power plants and lighting equipment. The ordnance department would also absorb a few electrical engineers, although it is made up mostly of mechanical engineers. The importance of communication in carrying on a campaign is very great. The Signal Corps makes the claim that the Germans lost the World War in 1914, on the western front, in the drive through Belgium, because of the breakdown of communications between Von Kluck's first army and Von Bulow's second army. Each army had to radio back to Aix-la-Chapelle to communicate with the other even though they were only a few miles apart.

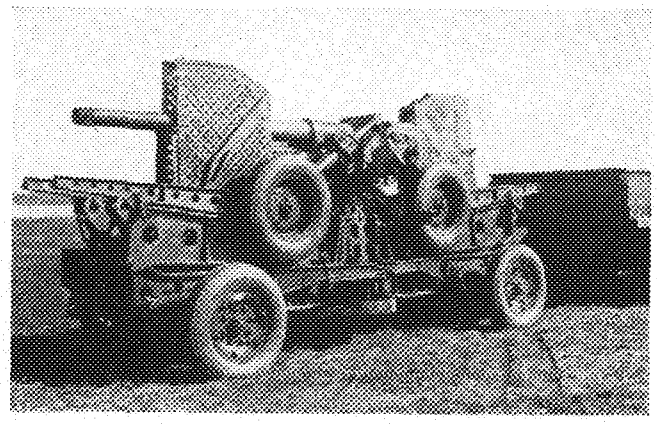
The artilleryman must be a combination of several kinds of engineer. He must be a civil engineer in orientation and gunnery, a mechanical engineer in the maintenance and operation of materiel, an electrical engineer in the maintenance of communication, and a chemist of some sort in the use of the explosives and chemical agents used by artillery.

In war operations the mission of the corps of engineers is to assist the operation of the field forces by engineering works. The most important function of the corps of engineers is the maintenance, improvement, and construction of routes of communication and movement. The importance of maintenance of good roads cannot be overestimated. General Ludendorf has said "In the last war the French truck beat the German railroad." Since the last war the increase in the use of trucks in military operations has been very marked. Thus, work on routes of communication becomes a constant operation and requires the largest part of the engineer personnel. Economy of



". . . ponton bridges of various sorts are used . . ."

time, material, transportation, and labor requires the maximum utilization of the existing road system. New road construction is held to the minimum by the repairing and maintaining of existing roads. Increased demands are met by increasing the capacity of existing roads rather than by constructing new roads. Under the heavy and continuous



". . . war continues to become more and more technical . . ."

traffic of operations, maintenance alone entails a large supply of materials. Experience has shown, however, that certain new road construction is necessary in connection with base establishments, and in major operations new roads of emergency construction are often required to facilitate the movement of supplies and artillery. Road traffic is at a maximum during offensive operations when, in addition to food, storage, and oil, demands for ammunition and engineering materials are at their highest. The attainment of a tactical success requires that the advance of troops should not be halted by a lack of supplies because of road failure. The roads in the forward areas must therefore be made passable as soon as practicable for animal-drawn vehicles, field and combat trains, and field artillery. A great many of these roads have to be built in what we call "no man's land." This, of course, makes the work very difficult because of attack by enemy air force and artillery. Combat engineers engaged in this work are armed to fight as infantry. The combat engineers saw their first action in the World War on November 30, 1917, at Gouzeaucourt in the record phase of the Cambrai engagement when they were called upon to support the British.

Rivers Must Be Crossed

Necessary bridges must be constructed along with the roads. Bridges, because of their vulnerability and great necessity, are often the targets of enemy bombardment and artillery fire. Hence types are used that can be constructed rapidly and easily. This last consideration indicates the reason that ponton bridges of various sorts are used in conjunction with the regular fixed bridges in military operations. Ponton bridges, in the more general sense of a floating bridge, may be supported by anything from kapok pillows to barges.

Railroads are, of course, of great importance in military operations. This line of service requires the mechanical engineer as well as the civil engineer for maintenance. The electrical engineer is also needed in the maintenance of railway communications as in any other military communication. Obviously, peace time civil lines are used in wartime as military lines. The military railroad has some differences from the civil railroad. Quick results for a short period of time are the first consideration. Speed requirements are only moderate and are uniform for all traffic. A civil road is operated on the assumption that the track is *safe*; a military road must be operated on the opposite assumption—that the track is unsafe. In the construction of military railways the rapidity of construction takes precedence over other considerations, and the proportion of temporary work is high, because of the necessity for getting traffic over the line in a hurry.

It is of interest to note at this point that many of the first railroads in this country were built by military engineers. The first trans-continental railroads were built by army engineers. General McClellan, who was an army engineer, became president of the Illinois Central Railroad.

Another function of the corps of engineers in the field is the construction of camouflage and field fortifications. The latter, however, are usually done by the troops themselves, perhaps under supervision of engineers. The engineers also carry on demolitions, that is, blow up bridges, block roads, and carry on mine warfare.

One of the greatest jobs of the engineers' corps in time of war is what might be called general construction. During the World War they built all the bases for the Services of Supply. This included dredging and construction of ports and construction of port facilities. In connection with the construction work, the corps of engineers engaged in extensive lumbering operations producing 200,000,000 feet of lumber, 4,000,000 railroad ties, 300,000 cords of fuel wood, 35,000 pieces of piling, and large quantities of miscellaneous products.

In considering the effects of a war on the engineering profession, it appears that we must accept the fact that in a large measure, the waging of war is advantageous to the profession. Circumstances arising from war bring about this fact. It has already been stated that the engineering job in wartime is tremendous. The engineer works under great stress. Improvisation is the rule. Often, the usually required materials are not obtainable. The engineer must use his own ingenuity to get him by the obstacles. War provides an excellent proving ground for new ideas. It is an opportunity to test new ideas at public expense. From the point of view of the engineer this is an advantage, because in time of peace expense is one of the greatest obstacles to the development of new ideas.

It is true, of course, that war halts almost entirely many branches of purely scientific research. Research of some kinds, however, receives an impetus arising from necessity just as does engineering research. An outstanding example from the last war was the development of the manufacture of dyes in this country which had come before from Germany.

The result of war to each engineer ranges between two opposites. In the last war there were $25,000 a year engineers who gave up their jobs for $250 a month commissions as captains in the Engineer Corps. There were also many engineers who were without good engineering jobs and were offered by the war a fine chance to prepare themselves for jobs after the war. The effect of war upon the individual depends upon who or what he is.

Trucking Iron Ore

A Profitable Innovation

Modern engineering is producing new methods of mining iron ore. Mine operators are deserting the locomotive in favor of the more mobile truck. Other systems such as belt conveyers are also being used. These changes constitute an interesting example of how alert and progressive management can save money by merely utilizing tools already available. It is not always necessary to invent new ones.

By Harry A. Larson, E.M. '39

IRON has always been a prime factor in the advance of civilization. Iron ore is plentiful over all the earth, but deposits containing only small amounts of impurity are in demand more than others of a lower grade. The Mesabi and Cuyuna ores are at a premium at the present time because of their small amounts of phosphorous, silica, aluminum, sulfur, and moisture they contain, and because they possess an advantageous location in regard to a market. There is a minimum of difficulty in transportation—loaded trains can have a down grade to the ports of Duluth, Superior, and Two Harbors; the empty trains are pulled upgrade to the mines. Thus the ore is very cheap, the average price being $5.10 per ton delivered at the lower lake ports. That an enormous amount of material needs to be moved is emphasized by the fact that 47,000,000 tons of concentrate ore were shipped from Minnesota in 1937. Beneficiated ore having roughly a 30 per cent recovery, a conservative estimate would place the total ore removed from the pits at some 90,000,000 tons. This can still be further increased by considering several million cubic yards of stripping (*i.e.* topsoil containing a negligible amount of iron ore) that need to be removed to uncover the ore. A figure well over 100,000,000 tons of removed material results. Obviously, to conduct such a business, mine operators must be masters in the art of moving earth.

Transportation is the main factor contributing to the cost of delivering a ton of concentrate at the lower lake ports. Taxes of one sort or another are also a major item of dead expense which cannot be eliminated by any efficiency expert. The cost of transporting ore to the lower lake ports is hard to reduce unless some better method of concentration is used, which also costs money. The principal remaining reducible factor is the cost of transporting ore from the pit.

It has been a time-honored practice to haul ore from the open pits by steam or electric locomotives which travel around the periphery of the pit. This ties up the ore in track benches, tail tracks, switches, and similar places. One pit in the central part of the range requires nine miles of winding track to reach from the bottom to the crest of the pit. When mining men heard of the installation of a fleet of trucks in a scramming operation (removing the ore present in small pockets, windrows, spills, benches, et cetera) they thought it a little unusual, but dismissed it from their minds. Five months later, rumors prevalent on the range credited the operator of these trucks with making several thousand dollars profit in five months of operation. This made an impression on the efficiency experts, for here was an opportunity to remove ore previously inaccessible to trains, and no additional stripping was needed. The depression had given a stimulus to greater efficiency—a realization of progress in industrial technique unthought of before 1930. Probably, the use of trucks and cat wagons might never have been considered in the years preceding the depression, but now a saving of a few cents per ton of ore removed looms large on the profit side of an operation removing two or three million tons of ore every season.

At the present time, new methods make it possible to strip small deposits, scram once exhausted pits, and install equipment other than locomotives in pits that are too deep for economical locomotive haulage. This increases the life of the different operations and realizes better returns for the man who is a regular investor in the mining game.

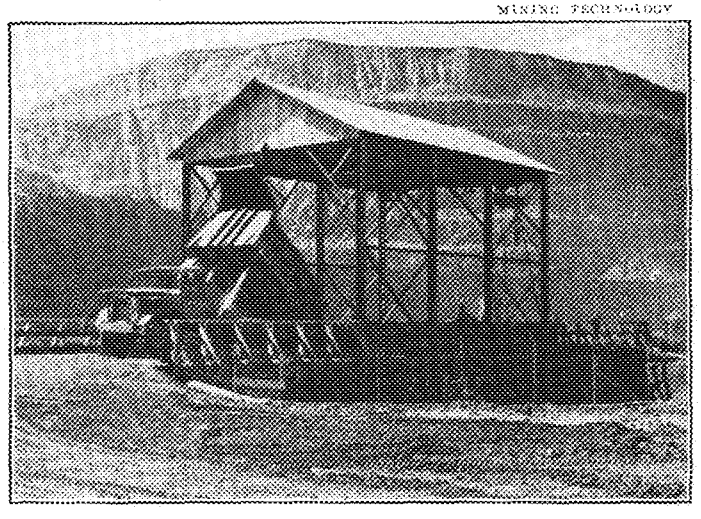
Trucks Now Used by Twelve Companies

Truck haulage has been used by twelve mining companies on the iron ranges for two years. Prior to 1937, the Charleson Iron Mining Company was a pioneer in trucking, using small trucks of six to ten tons and operating over short hauls of 400 to 1200 feet. By the end of 1936, these trucks operated on grades as high as 15 per cent for ore haulage and 17 per cent for rock dumping. A novel feature of one type of truck used was a four speed reversible transmission which eliminated turning around for each trip.

Another haulage system is used at the Spruce Mine

Trucks are making ore accessible which could not be economically hauled with trains.

MINING TECHNOLOGY



A tractor can operate under nearly any conditions; good roads are not necessary.

at Eveleth. Here, a modified milling operation to pull the ore to a central conveyor belt is in effect. Three shafts have been sunk in the pit floor, each one connecting to an underground conveyor system set on the bed rock 100 feet to 120 feet below the surface of the present ore. The conveyor system is 4,481 feet long and is constructed of nine separate, continuous parts, each powered by its own electric motor. An essential requirement for trouble free operation of a belt conveyor system is that it be devoid of large chunks; consequently, at each raise a scalping grizzly and crushing plant have been installed. Two of the shafts at this pit have 100-foot towers over them with scraper systems attached. The anchor towers for the scrapers run on cats powered by 15 horsepower motors and ballasted with 40,000 pounds of iron. The 3200 pound scrapers have a three cubic yard capacity and operate between the two towers. The average radius of operation is 170 feet, although it can be extended to 700 feet. The third shaft has truck haulage, using 25-ton trucks which dump into a 500-ton bin. Each of the four trucks averages four trips an hour and operates on the level pit floor. Engineers think that this type of operation bids fair to compete with any locomotive haulage on large operation.

The cost of removing ore by belt conveyor from a pit should be less than two cents per ton. This is divided into the following parts: one-half cent for power to elevate ore, three-fourths cent for belt costs, one-half cent for depreciation of the conveyor system, and one-fourth cent for maintenance. A six-ton truck has an operating cost of $2.00 an hour, while a twenty-ton truck costs $4.00 an hour. If a locomotive haulage system is used, we have a lapse of time at the shovel between each train, necessitating the use of more shovels. A locomotive costs $50.00 to steam each shift; add to this figure the costs of maintaining a track, switch yard, and other equipment and we find that this method of transportation is relatively expensive.

Trucks have an immense advantage over locomotives because they are able to climb grades up to 15 per cent, hence, less ore is tied up in ore benches. They are also able to turn on a curve with a 50-foot radius, while a locomotive requires a long turn. Trucks are able to mine small ore bodies because of their flexibility in traveling in small ore pockets and around rock pillars. They are cheaper than locomotives on a stripping operation if the stripping dump is near the pit. However, in stripping operations the trucks have the disadvantage of not being able to work efficiently in wet weather, or in removing wet paint rock. If the ore is a wash ore or a clean merch ore, trucks will operate in wet weather without loss of time in hauling ore.

Trucking is in its infancy on the ranges, but two years of service have proved the merit of this type of equipment for iron mining service. Experience has shown a revamped highway truck is not suitable; it takes a specially designed truck to stand the heavy service and abuse incidental to this type of operation.

Diesel and gasoline units have been tested, and all the advantages are found to be on the side of a Diesel drive. A Diesel unit will consume approximately three gallons of fuel oil per hour under average operating conditions against five and three quarters gallons of gasoline per hour per gasoline equipped unit. The smoke produced by the Diesel unit was a serious problem, especially at night when the smoke obscured the vision of the driver while backing up to dump. However, this has been overcome simply by placing the exhaust pipe over the top of the cab. Another disadvantage of the Diesel unit is the possibility of racing the engine; overspeed will ruin a Diesel unit. To detect this, tachometers, which lock at the maximum engine speed and which can be set back only by the foreman at the end of the shift, have now been installed.

An Example of a Truck Layout

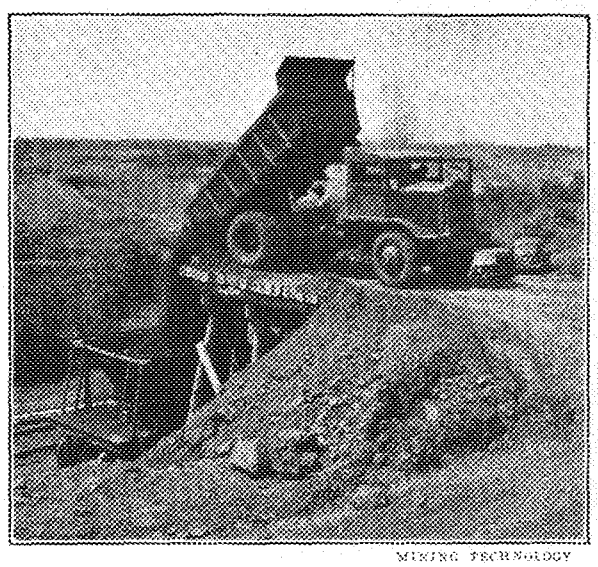
The Harrison Mine system at Cooley, Minnesota—operated by Butler Brothers—is an excellent example of a truck layout. This company is well in the fore in utilizing trucks, having installed them in all their pits except one. The six and ten wheel trucks they use for transporting the ore are of both 15 and 20-ton capacity. The ten-wheel unit was thought to be more adaptable during the first year of operation at the Halobe Mine, since it was easier on the roads. However, the last year has seen improvements in road building by the use of jig tailing, constant grading, and watering. This development has given the six-wheel unit such advantages as: (1) greater ability to negotiate sharp curves; (2) greater tire economy—tires are 13.50 by 24, and cost $250 to $300 apiece; and (3) decreased service time required. These trucks have a ten-speed transmission and a 100 to 150 h.p. Diesel motor. They cost $10,000 to $15,000 each. They will operate 3,000 hours without overhauling, which is comparable to 90,000 miles of service in a road truck. The life of the trucks is approximately 10,000 hours apiece, and can be extended with good care. In open pit work, the life of

a tire is 4,000 hours, or an equivalent of 18,000 miles of highway service, but immediate care of cuts and bruises is very important.

At the Harrison pit, nine trucks were operated, with one truck held for service at the garage. Servicing including refueling, greasing and oiling, checking the tires, inspection of brakes and the hydraulic dumps. The eight trucks loaded at two shovels; one a four-yard and the other a two-yard. Preference was given to the larger shovel when the truck returned empty. It had been thought that loading the six-wheel trucks with a four-yard shovel would cause bruising of the tires, but experience has shown this to be erroneous. The total haul was 4,200 to 4,600 feet; an 8 per cent grade was used for 1,800 feet, and a 20 per cent grade for 800 feet of a separate return road. The roads finally met and trucks passed in both directions for a distance of 1,000 feet. The road at the bottom of the pit varied in grades; for 400 feet it was rough, mushy, and wet. As a safety measure, the trucks never traveled over 10 m.p.h. On the 8 per cent grade they were able to travel only 5 to 6 m.p.h. The vertical lift at the Harrison pit was 155 feet, and most of this was traveled in the 1,800 feet of 8 per cent grade. On the other hand, a locomotive could only travel at a 2 or 2½ per cent grade, hence it would require over a mile of track on this operation.

When the road was first opened for truck haulage it was noticed that four-fifths of the trucks had to shift gears about 200 feet from the pocket. A check-up with the transit showed the grade to be a foot low near one of the curves. This small difference in grade necessitated a shift of gears at a standstill, occasioning the loss of two or three seconds in the loading cycle. Continuous movement of the equipment is an important item to remember in any operation; hence, the road was built a little higher, and the trucks were able to haul a few tons more each shift.

The trucks are kept in garages, hence, are started easily in the cold weather. Sub-zero weather slows down stripping operations slightly because traveling conditions are poorer. On one of the stripping operations the trucks worked at 20 to 30 degrees below zero, loading a 25-foot bank with 18 to 24 inches of frost. The material was very chunky and clayey. The time for a complete haul of about 4,000 feet was 9.33 minutes, compared to a 9.6 minute cycle at the Harrison Mine. However, the haul while stripping was over level ground.



MINING TECHNOLOGY

An end-dump truck with dual rear-wheel drive.

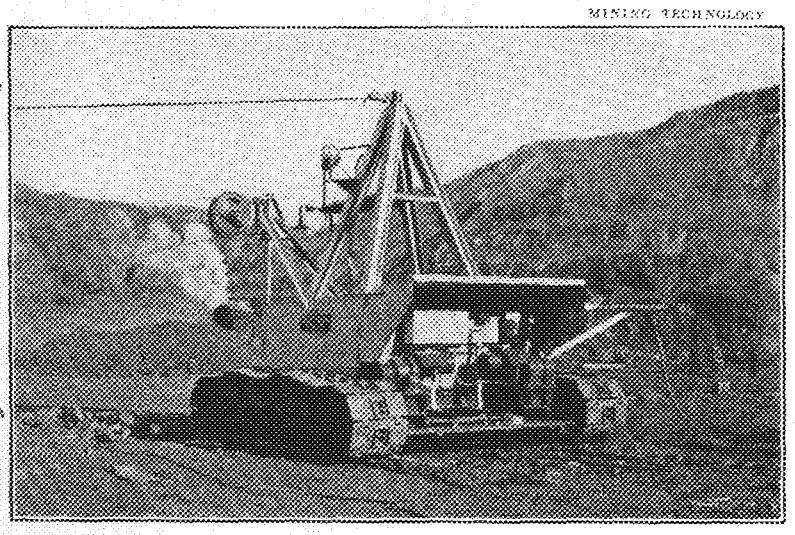
Tractor haulage also shows advantages in pit work. Tractors show superiority over a truck unit on hauls of 1,000 feet or less. A twenty-ton cat is able to operate in the pit where there are no roads except those that have been made by a bulldozer, and they can travel over very irregular roads because the caterpillar treads adapt themselves to the rough terrain. On a scramming operation in the Halobe Mine, three cats and wagons were used to keep a small shovel busy. The haul averaged about 600 feet, with the shovel operating in different sections of the pit at the direction of an ore grader. Tractors hauled out the small pockets of ore the large shovel could not remove for fear of spoiling the grade for the trains. This operation recovered several thousand tons of wash ore that would otherwise be unrecoverable.

Some of the pits are very dry and others have springs that keep them quite wet all summer. One of the photographs shown is a cat and wagon operation in one of the pits after a heavy rainfall. Tractors are able to operate in wet weather if the road bed is solid, but their great weight has caused trouble in some stripping operations.

Trucks and caterpillar tractor haulage have proven their worth on the Minnesota Ranges in the last few years. The cost of installation of the new equipment is heavy, but the savings in haulage costs have made companies reconsider the possibilities of truck haulage. Most of the pits on the ranges have become so deep that the use of locomotive haulage in the future is doubtful because of the excessive cost of track upkeep and fuel to drive the train over miles of track. No long range predictions can be made concerning the final extent of the use of trucks and tractors in the future, but qualified observers are positive that this type of haulage is here to stay.

One of the mobile anchor towers used in connection with the scraper system.

MINING TECHNOLOGY



The author is indebted to the several range mining companies, including the Charleson Iron Mining Company, Oliver interests, and Butler Brothers, for their assistance in sending technical data and pictures.

Water Softening—How and Why

From eliminating bath tub rings to decreasing boiler scale — advantages such as these will result when Minneapolis starts using soft water. The article below, prepared with the assistance of J. A. Jensen, supervisor of the Minneapolis Water Works Department, presents a picture of the plant's construction, operation, and advantages.

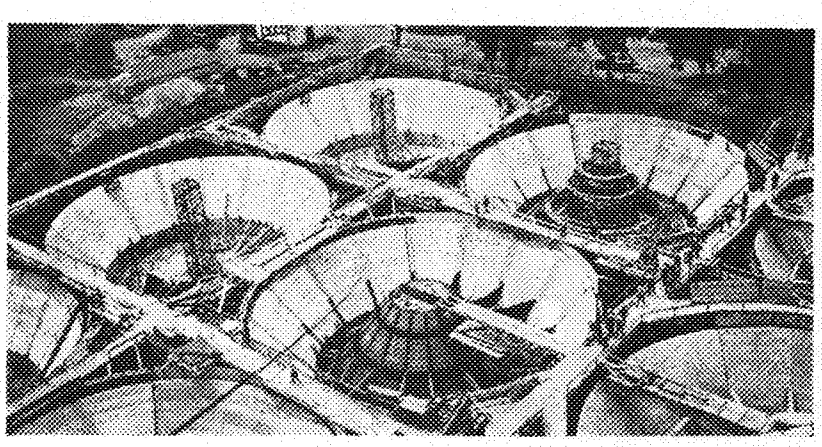
By Leslie A. Anderson, C.E. '39

Illustrations courtesy Journal of the American Water Works Association

A BOON to the Minneapolis housewife and industrialist alike, the new $2,500,000 water softening plant at Fridley just north of the city limits is now in the final stages of construction. When it is completed within a few months, the familiar nuisances of clogged-up hot water pipes and streaks in bath tubs will practically disappear. In addition, soap bills and skin irritation from washing and shaving will be materially decreased, and those periods of slightly objectionable water taste will be a thing of the past.

The drainage from the Mississippi river basin above Minneapolis consists of surface run-off, lake and marsh overflow, and seepage from the river drift and its tributaries. Winter stream flow derived chiefly from ground water produces water of maximum hardness and minimum organic content. Dilution in spring and summer by run-off water from melting snow and rains results in water of maximum coloration and minimum hardness. Organic material from marshy areas contributes to this coloring. Algæ growth and sewage from upstream towns cause additional contamination, although at present the latter results in no serious filter loadings at the Minneapolis plants. According to Mr. Jensen, these communities will eventually be required to provide adequate sewage disposal facilities for the protection of downstream water supplies.

For the past 25 years, the city water supply has been clarified with $Al_2(SO_4)_3$ (aluminum sulphate), passed through rapid sand filters, and then sterilized with chlorine. Chloramines and activated carbon have also been used when special water conditions arose. With the completion of the Fridley softening plant, the city will have a five million dollar system, including the two existing filtration plants at Columbia Heights and Fridley. The Columbia Heights plant, with a capacity of 78 million gallons daily, delivers its filtered water to the easterly portion of the distribution system by gravity. The Fridley plant with a capacity of 80 m.g.d. delivers its supply to the western portion of the system by direct pumping. The new softening plant will have a capacity of 120 m.g.d.



Looking down on the precipitators during construction.

Purification and softening of natural surface water is necessary in order to obtain a water free from disease bacteria, objectionable taste or odor, color, turbidity, and excessive hardness. In view of the ever-increasing demand for such water, and the corresponding increase in the number of purification and softening plants, it is important to know that capital invested in this way is justifiable and does offer adequate returns to the taxpayer.

The problem at Minneapolis is to reduce the calcium and magnesium carbonate content to a hardness of 75 parts per million gallons from a present average hardness of 172 p.p.m. Additional treatment to maintain color at not more than 10 p.p.m. in the finished water will usually be needed during the early summer months. Since experimental work has shown that the normal treatment with CaO (calcium oxide) will reduce the color to the proposed standard provided the original color does not exceed 75 p.p.m., a study of records for the past 23 years indicates that such auxiliary treatment will be required approximately 24 days each year to reduce the color content to 75 p.p.m.

Normally, therefore, the process will consist of reducing the hardness by lime and auxiliary coagulation. The effluent, after leaving the carbonation chamber, will then be divided and delivered to the two filtration plants. At the plants ordinary coagulation, filtration, and sterilization will occur before the water is ready for use.

When coloration exceeds 75 p.p.m., as determined by tests, the plan is to have all the water bypass the softening plant and flow directly into the Fridley mixing chambers and coagulation basins. Here, treatment with $Al_2(SO_4)_3$ will reduce the color to 75 p.p.m., and the normal treatment may then be given the water.

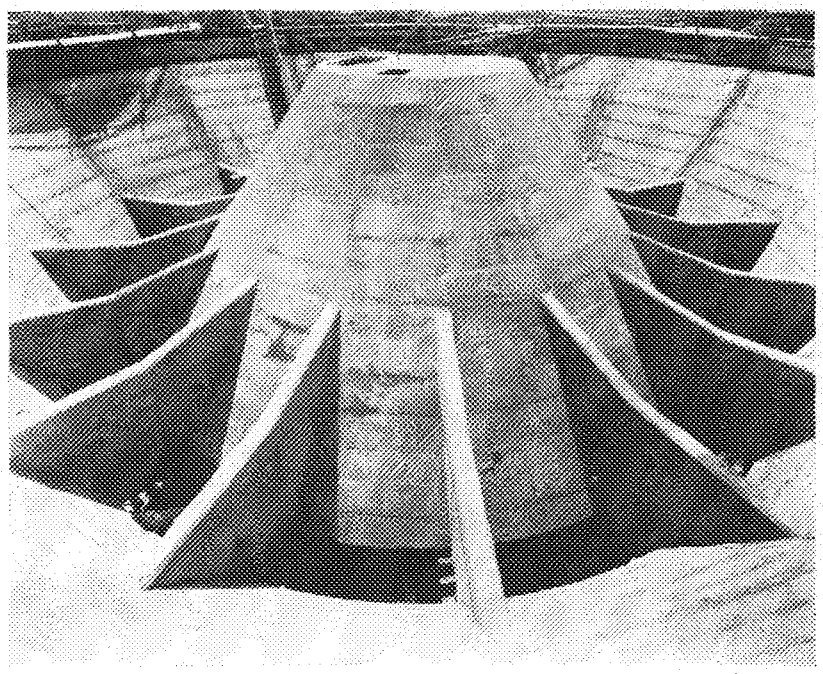
Lest the reader gain the impression that the method of treatment was arrived at with little or no difficulty, it should be emphasized that extensive experimental work on both plant and process has been in progress for over four years. To meet the peculiar problems connected with treating this specific water, various combinations of treatment and clarification using different types of basins and clarifiers and varying forms of agitation have been tried.

To produce the greatest degree of softening consistent with greatest economy, a funnel form tank known as the Spaulding precipitator was chosen for the Minneapolis plant. A vertical flow upward through this funnel-shaped tank will have a decreasing velocity as the cross-sectional area of the tank increases. Thus, a self-selective level to to which the rising water carries its flocculent precipitate

is reached, according to the carrying power of the water at any particular velocity and the size and weight of particles. The water enters the inner baffle-supported cone, where agitation occurs, and then rises in the outer cone. At the equilibrium level, the sludge may be kept at any desired concentration in the tank.

The softening plant proper is located on the river between the pumping station and the Fridley filters. When completed, it will comprise twelve precipitators, a low service pumping station, a chemical house, an influent and effluent conduit system, carbonation chambers, and disposal beds, together with all necessary mechanical equipment. To prevent freezing at the water surface, the basins will be enclosed in a building.

Because of the complexity of the construction details and the operating problems of the plant, discussion of these must necessarily be brief. Suffice it to say that the form and design of the precipitators alone presented a novel problem in form work and reinforced concrete construction. This fact, together with the extensive research work expended in arriving at the best method of operation, makes the Minneapolis softening plant unique. The manner in which problems of both construction and operation have been handled indicates that upon completion the city will have a water supply plant of which it may be justly proud. Credit should be given the officials and the engineering group of the Minneapolis Water Department, under whose supervision all plans and details were worked out and all construction carried on.



Interior of one of the Spaulding precipitators.

As future engineers interested in the design and construction of engineering projects, we should also be interested in the advantages and benefits accruing from any public engineering work. The past depression, if it served no other purpose, has emphasized the need for economy and efficiency. Decreased municipal revenue in the past few years has focused public attention to a greater extent upon the dollars and cents value of government improvements. That the new softening plant is financially justifiable and beneficial to the public it will serve may be readily proved.

The first and all-important question the taxpayer usually asks is: "What is it going to cost?" With the total estimated cost of construction fixed at $2,500,000, an estimate of the combined cost of softening and filtration was found to total $20.52 per million gallons, on the basis of preliminary experiments. Since the present actual cost of filtration alone is $13.51, this means an added cost of $7.01 per m.g. for softening. This is a total annual added cost of operation of $140,200 when the average of 20,000 m.g. yearly of softened water is used.

With the above fixed and operating charges given, let us investigate any possible savings due to softening. Mention was made earlier of a reduction to be expected in the annual soap bill. Any chemistry student knows the softening action of soap in water which is necessary before any appreciable cleansing action can occur. However, just how much soap pre-softened water will save the consumer cannot be readily determined.

A recent survey of soap costs in various cities by H. W. Hudson of the University of Illinois revealed that in Superior, Wisconsin, where Lake Superior water is used, the annual cost per capita for soap was $3.75 for water with a hardness of 45 parts per million gallons. The other extreme noted, water with a hardness of 555 p.p.m. used in Chicago Heights, Illinois, showed an annual soap cost per capita of $7.50.

From a curve plotted, using Professor Hudson's data, it can be estimated that the present Minneapolis water with a hardness of 172 p.p.m. results in an annual soap cost per capita of $5.20. By reducing this hardness to 75 p.p.m., the soap cost is reduced 95 cents per person to $4.25. This results in a surprisingly large total savings annually to the city's residents of $451,000 for soap alone; a saving which is over three times the annual added cost of $140,200 for softening.

To the owners of power and heating plants, a large saving in the form of decreased fuel bills results because of the smaller quantity of fuel needed for heating where a non-scale water is used. Investigations indicate this saving varies from 5 to 10 per cent of the annual fuel bill. It is thus apparent that softened water is a strong civic asset. Cities with soft water are able to assure new industries of reduced operating costs. Of interest, also, is the fact that municipal softening may be accomplished along with filtration at only a slight added cost.

The housewife also profits by using softened water. Because a milder soap solution may be used for the weekly wash, shirts and linens can make many more trips to the family washer before disintegration of the cloth fibers due to the action of soap lye occurs.

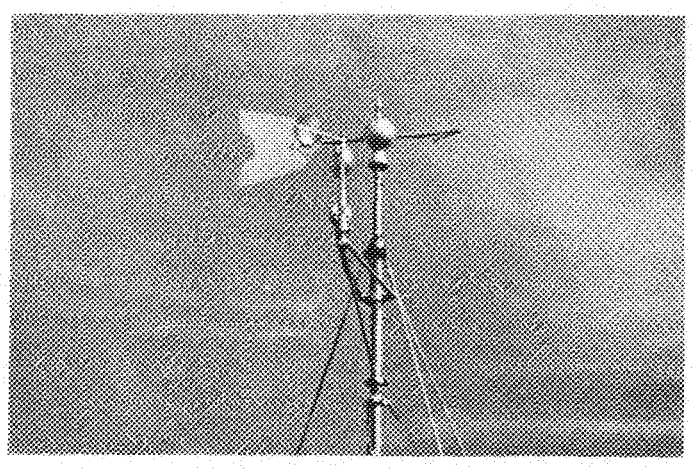
Any discussion of the advantages of soft water would be incomplete without mention of the improvement in the quality of our drinking water. Water softening and filtration are elimination processes. The chemicals added cause an almost complete precipitation of minerals, algæ, and other turbidity causing substances, with the resultant production of a sparkling water, moderate in minerals, and free from taste, odor, disease bacteria, and other impurities.

Research in the Institute

Frozen Instruments

MUCH of the research conducted by the aeronautical engineering department has been in the field of meteorology. The meteorological equipment has been gradually augmented during recent years, so that at the present time the department is fully equipped to make both upper air and lower air observations.

One difficulty frequently encountered by weather observers is the freezing of the rotating-cup anemometers, used to indicate wind direction and velocity. This problem is being attacked by Mr. Sidney Serebreny, who



Anemometer and wind vane under ideal conditions.

directed for a year the activities of the government's meteorological observation station on Whiteface Mountain, near Lake Placid, New York. He is replacing the wind-driven anemometer with an electrically-heated Pitot tube of the type in use on transport airplanes. An enlarged, specially-made heating element has been substituted for the element usually used. The static-pressure and total-pressure tubes are concentric, one within the other, and project downward into a mercury bath. Smaller stationary tubes extend up through the bath, one into each pressure tube, and transmit the static pressure and total pressure, respectively, to the indicating instrument, which is calibrated in miles per hour. With this construction the Pitot tube is able to rotate about a vertical axis.

A wind vane, its sides protected by heating elements, will be attached to the unit to keep the tube headed into the wind. The axial position of the tube will be shown by a pointer moving over a circular dial, allowing the indicator to register any possible wind direction.

Electric current will pass automatically through the heating elements whenever the temperature falls below 36 degrees Fahrenheit. Another feature of the instrument is that, since the indicators are operated by electric current, both the velocity and direction indicators can be located at any desired distance from the point at which the Pitot tube is installed.

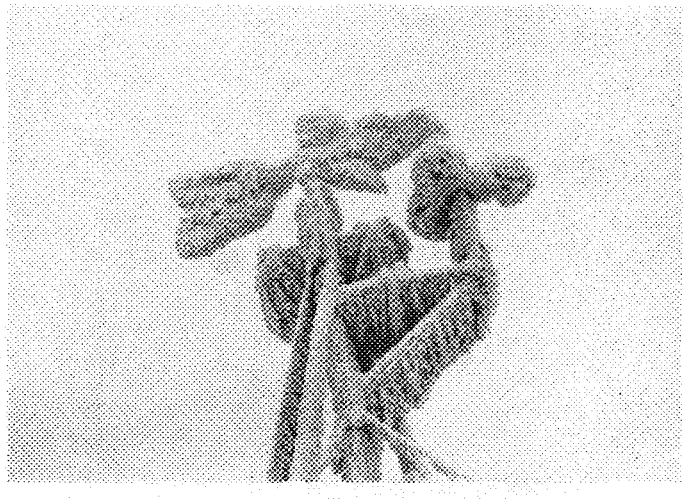
Dr. Piccard is completing another meteorological project, namely the radio meteorograph. This is a small radio transmitter which is conveyed aloft by a rubber sounding balloon. At three-second intervals it transmits Morse code signals indicating the temperature, pressure, and humidity of the atmosphere at the location of the balloon. This method of gathering weather data eliminates the necessity of sending a pilot aloft periodically to take the various readings.

The fact that the apparatus transmits pre-designated Morse code signals makes it possible for the signals to be received and interpreted by any amateur short-wave operator. Previously the signals could be understood only by the base station from which the balloon was sent aloft.

Hearing Aids

THE efficiency of commercial hearing aids has been tested in investigations carried on since 1934 by Professor Henry Hartig of the electrical engineering department in collaboration with Dr. Horace Newhart of the Medical School. These tests are concerned with the performance characteristics of the portable carbon microphone hearing aids available on the commercial market. These devices may be of either the air conduction type or the bone conduction type.

Up to the present time, the loss of hearing has been measured by determining the least intensity of sound which a person is able to perceive at several different vibration frequencies within the audible frequency range. Also, it has been assumed that since loss of hearing as



The same instrument that is shown in the left-hand column, in sub-freezing weather.

determined by this method may vary with the frequency, the amount of sound amplification provided by any hearing apparatus should also vary with the frequency according to some similar relationship. Therefore a person's hearing would be restored to normal throughout the entire range of hearing insofar as the least perceivable intensities are concerned.

Professor Hartig points out that this is not the only requisite for compensation for hearing loss. Since a person who could not hear faint sounds might exhibit

normal hearing at the intensity level of ordinary conversation, the action of the amplifier would have to be greatest at low intensities rather than varying with the frequency. Thus the amplifier would function as an automatic volume control. The exact nature of this variation of hearing loss is difficult to determine, however, particularly for a person who is hard of hearing. In the present state of the art the best prescription of a hearing aid must be made by an actual trial of the instrument.

The test equipment for air conduction amplifiers includes a wooden chamber about five feet square, lined with acoustic celotex and balsam wool. A loud-speaker which may carry speech sounds or single frequency tones is installed within the chamber at one end. The microphone of the hearing aid undergoing the test and a standard microphone are placed within the chamber, both at the same distance from the loud-speaker. An oscillograph is used with the standard microphone to measure the intensity of sound emitted by the loud-speaker. The output of the hearing aid is led into an artificial ear and its intensity compared with the standard by means of the oscillograph. When voice sounds are transmitted by the loud-speaker the two outputs are alternately connected to a receiver to be compared by observers for loudness and intelligibility. In this manner, quite a satisfactory determination of the relative merits of hearing aids can be made.

Cheaper Cellulose

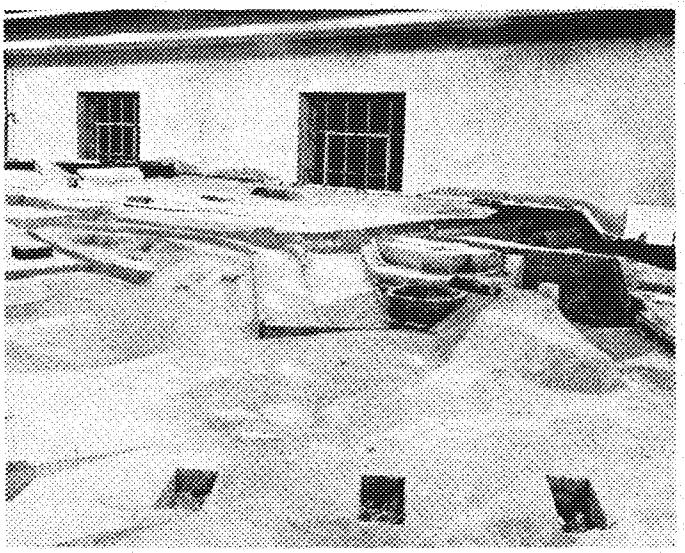
A WELL-KNOWN phenomenon of forestry is the rapid growth of small poplar trees and brush in areas from which the original forest growth has been cut or burned. This popple, which forms a protective growth for the slower-growing fir and pine, is of no use for lumber or firewood, and its fibers are too short for paper manufacture. A use has been found for it, however, by Dr. Ralph Montonna of the chemical engineering department. His work was carried out as a result of an attempt made during the depression to utilize to a greater extent the natural resources of the north central states. At that time President Coffman appointed a commission for this purpose, and the work has been carried on by the Northwest Research Foundation, a non-profit organization of Minnesota business men.

By means of a pulping process which uses first dilute nitric acid and then sodium hydroxide, Dr. Montonna has produced alpha cellulose of about 99 per cent purity. Alpha cellulose is the main constituent of rayon, lacquer, cellophane, and similar commodities. At present most of the country's supply is obtained from cotton, which is almost entirely cellulose, and spruce wood. The du-Pont Chemical Corporation, which alone uses 40,000 tons annually, pays from $70 to $150 per ton for cellulose which is of lower purity than that produced by Dr. Montonna. His process is carried on in an open vessel, whereas the commercial product is produced in pressure cookers which break down the structure of the substance into undesirable impurities.

It has been estimated that the replaceable supply of popple in Minnesota alone is three million cords annually. Therefore, the commercial production of cellulose would be of tremendous value to Minnesota and the neighboring states. At present the laboratory stage has been perfected and the project is awaiting only the financial backing necessary to produce the substance on a commercial scale.

Upper Harbor

DR. LORENZ G. STRAUB is directing several avenues of hydraulic research in connection with the development of the Upper Mississippi River Navigation project. A model of the St. Anthony Falls section of the river is being constructed in the newly erected



Portion of the partially-constructed river model showing the new hydraulics laboratory in the background and wells for the Great Northern bridge piers in the foreground.

hydraulics laboratory on Hennepin Island. Engineers of the United States Engineering Department and WPA engineers and draftsmen are coöperating with Dr. Straub on the construction of the model.

It is being built to a scale of 1 to 50, and represents the portion of the river extending from the Hennepin avenue bridge to the coal platform opposite the University. The built-up sections are constructed of building tile, and the river bed and various physical features are of concrete applied over the tile. From the head to the foot of the model there will be a drop in the water level of slightly less than two feet, representing a drop of almost one hundred feet in the actual river channel. Contour maps used in the project were made by Army engineers from very accurate soundings, and the model is being constructed to an accuracy of one-tenth of an inch.

The river model will serve to assist in determining a suitable design for the navigation project and to provide a means of studying defects and limitations of the design. The upper harbor development has already received technical and congressional approval and is now awaiting an appropriation to finance the project.

Additional investigation is being done in regard to the stability of sand dams for use in the upper river development. These dams embody concrete structures containing the locks located in the center of the river, the ends of the dam being of sand construction and extending to the river banks.

The Evolution of the Eraser

By Robert Pitcher, I.T. '41

Illustrations by Fredrick Roth, Arch. '40

In a discussion of the eraser it is well to understand thoroughly what is meant by the term. Such a knowledge prevents rambling and illogical discourse by sharply limiting the argument to the definition. Mr. Noah Webster, an authority on definition, in his valuable work has this to say of the eraser. It is, in his own words, "a device for rubbing out."

Let us consider Mr. Webster's definition. He says, "a device for rubbing out." First and foremost, we have that efficacious product of modern science, the machine, or tommy gun.

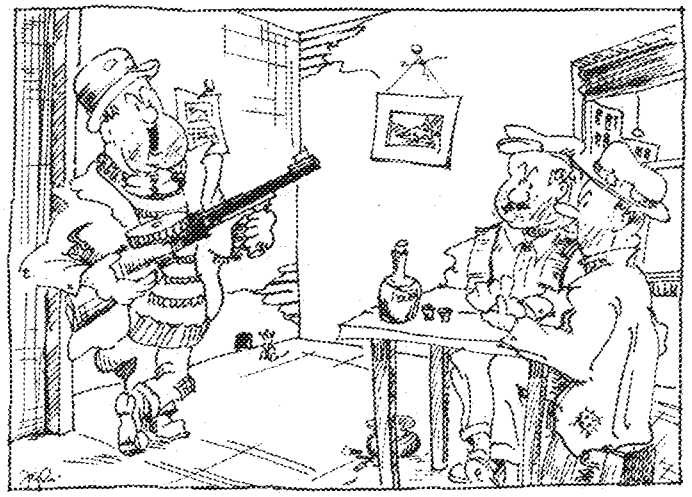
Mr. Butch Palozza, eminent operator of this device, speaks highly of its utility. In collaboration with the District Attorney of Cook County, Illinois, Mr. Palozza produced an interesting brochure entitled "The People of the State of Illinois vs. Butch Palozza, Defendant." We quote the following extract as summarizing neatly Mr. Palozza's belief in the efficiency of the tommy gun as a device for rubbing out. Says Mr. Palozza, "So I say to dese four punks, 'Youse guys is all done muscling in, see. Line up against dat wall.' Den I ups wit my tommy gun and rubs 'em out." Remarkable neatness and despatch! One is tempted to use that venerable bromide, "Will the miracle of science never cease?"

Second among devices for rubbing out, we place the bits of rubber used for eradicating pen or pencil markings. These, in turn, may be subdivided further into rubbers attached to the ends of pencils and rubbers with no attachment at all.

The earliest form of rubber eraser, to take them in chronological order, is the rubber attached to the end of a pencil. The inventor, Judge Ben D. Lowst, had a nervous habit of tapping his front teeth with his pencil. Upon the discovery of rubber, he immediately recognized it as the ideal substance for tipping his pencils to protect his front teeth, as he had knocked out two in moments of perturbation. At the time he had no idea he was making an invaluable contribution to erring mankind; however, being highly human, he was prone to error.

Acting as scorekeeper in a friendly game of bridge at one tenth of a cent a point, he was horrified to find he had given his opponents full credit for a grand slam. It seemed as though he was caught for a pretty penny when, casting about in his mind for some means of rectifying his mistake, he bethought himself of the rubber pad on his pencil. In desperation, he used it to rub out the points credited in his opponents' column, and then it was a simple matter to transfer the same points to his own benefit. Thus he saved himself ninety cents and gave the world the eraser.

Judge Ben D. Lowst's erasers were, however, attached to pencils and it was several years before unattached erasers came into being. This discovery came about in so

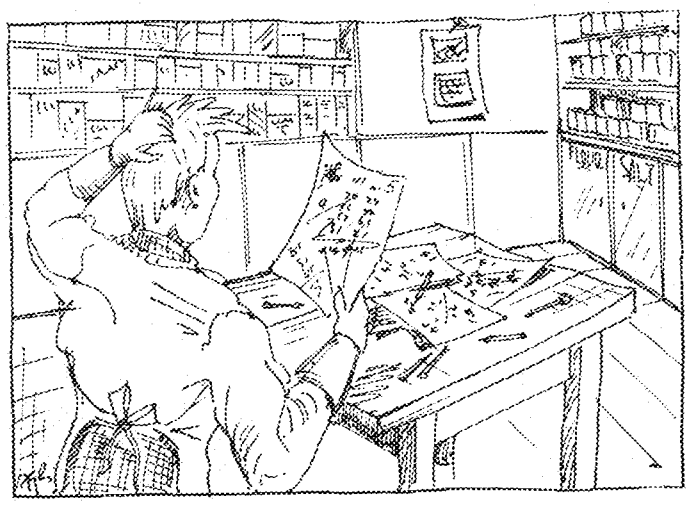


"Den I ups wit my tommy gun . . ."

interesting a fashion that we must include it at the risk of introducing extraneous matter.

It seems a young grocery clerk, Joe Aloysius Dalrymple, had endless trouble with his mathematics. If he added the same column four times, he had four different answers. His subtractions were worse. As a result he had many occasions to use his eraser. Matters went from bad to worse and at last, necessity mothering invention, Joe conceived a brilliant idea. As he used his eraser more than his pencil, he dispensed with the pencil entirely and carried only an eraser. It seems a simple solution in the light of present day knowledge, but until Joe Aloysius Dalrymple cut the Gordian knot, no one had thought of an eraser separated from a pencil.

Thus, in summarizing our treatise, we find three groups of devices that conform to Mr. Webster's definition of an eraser: the machine gun, the eraser attached to the pencil, and the unattached eraser. We have paid passing tribute to pioneers in the development of erasers. Without the eraser, we of the present day would be no better off than Shakespeare, the immortal Bard of Avon. Eraserless and confronted presumably by the work of a sputtery post office pen, he sings glumly, "Out, damned spot," which may have comforted him but could have had little real effect in removing the blot. Let us turn to that modern poet who says, "To err is human or what's an eraser for?"



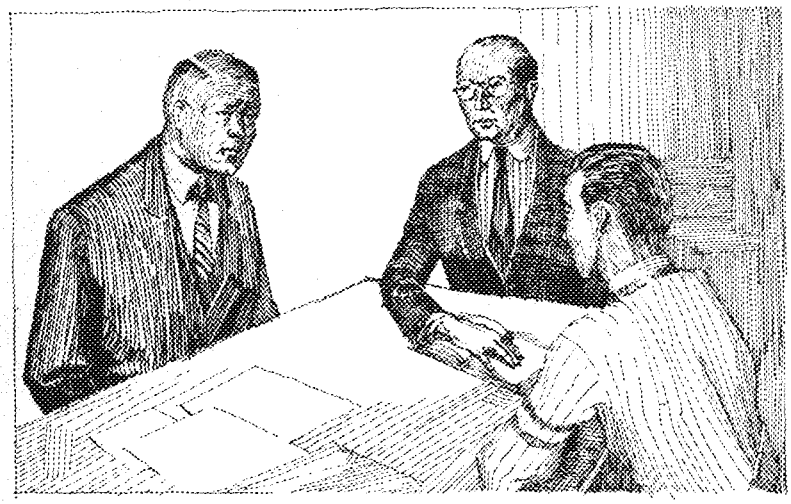
". . . Dalrymple had endless trouble with his mathematics."

Sharpen Your Axe

By C. Vernon Olson, E.E.B. '40
Illustration by Albert Arneson

WE ENGINEERS are asked to support a number of projects, organizations, and groups of various kinds, but rarely do we have the opportunity to support a project so valuable to every one of us as the employment discussions organized by Wilson Brown and sponsored by Mr. Levens, of the Placement Service, and the Technical Commission. Subjects of vital importance will be discussed at the three evening meetings and the final conference to be held on Feb. 16.

Employment is the concern not only of the seniors (surely every senior will turn out), but of freshmen, sophomores, and juniors as well. The sooner we start thinking about and planning for that job, the better. Underclassmen may feel that graduation is a long way off, leaving plenty of time to think about job-getting, but to wait until graduation time to find out what various employers look for in young engineers is just as illogical as waiting until after felling a tree to sharpen one's axe. It is the planning and development we do while in college that largely determines how eligible we will be for employment upon graduation.



The employment discussions will give us the employer's viewpoint on young engineers—that's what counts!

We must not forget that no matter on what theoretical basis employing should be done, personnel directors do the employing as they see fit. It is the viewpoint of these personnel men that is so all-important to us young, expectant engineers. Of course, the bases for employing used by the various employment directors differ considerably, and the whole process is based principally on personal judgment—a judgment founded on long years of observation and experience.

A student must have a distorted sense of values to spend four years preparing himself for an engineering job without taking the opportunities offered to find out what these men, who will decide whether or not to hire him, look for in job applicants. Now, the purpose of these employment discussions is to offer engineering students an opportunity to hear prominent and distinguished employers of engineers, and also certain faculty members who are well informed on certain phases of employment, speak on what their observation and experience has made them feel is important to young engineers.

The tentative program consists of evening meetings on three consecutive Thursdays, Jan. 19, Jan. 26, and Feb. 2, in the physics auditorium, followed by an afternoon conference on Feb. 16. It is impossible to outline the entire program at this time, but the first two evening meetings are definitely arranged. The plan will be to have two speakers lay the framework for the discussion by speaking half an hour each. It is likely that many of the more valuable things we will learn will come as a result of questions we students will ask the speakers after their short talks.

At the first meeting, Jan. 19, the speakers will be Mr. Matthew J. Dunfey, president of the L. S. Donaldson Co.; and his assistant, Theodore R. Brouillette, Minnesota aeronautical engineering graduate. The subject will be, "What Business Has the Engineer in Business?" Mr. Dunfey is no stranger on the campus, having spoken to the engineering seniors before. His ideas will prove new and surprising to many of us. He believes that the training an engineer receives will fit him for clear-cut rational thinking, which is as necessary in business as in engineering. He is on the lookout for engineers who are fitted for work in other than purely technical fields. Theodore R. Brouillette, being an engineering graduate, will also have many practical and worth-while things to tell us. We cannot afford to miss hearing the viewpoints of these two men.

Mr. Haga of the engineering English department will be one of the speakers at the second meeting, Jan. 26. He will handle the subject of letters of application. We all know Mr. Haga, and those of us who have heard him talk to seniors before know that in his casual, caustic, humorous way of saying things he will give us some extremely important pointers.

At the third meeting, Feb. 2, Mr. C. A. Phillips, for thirty years connected with the Northwestern Bell Telephone Co., will discuss the question, "What Does Industry Require of the Young Technical Graduate?" Mr. Phillips is one of the outstanding personnel men in the Northwest, hence is especially well qualified to speak on this subject. Do not make the mistake of thinking that what he will have to say will be of interest only to electricals, because the Bell Telephone Co. employs all kinds of engineers. After students' questions have been discussed, Mr. Phillips will show two educational motion pictures of particular interest to engineers.

So, if you have an axe to grind—I mean sharpen—be sure to be there, Thursday, 7:30 p. m. Everyone else will.

The Minnesota Techno-Log

Vol. XIX January, 1939 No. 4

Congratulations Dean Lind

IN AN election held late last fall, in which more than 22,000 members of the American Chemical Society participated, Dean Lind was elected president for the year 1940. The Techno-Log, speaking for students of the Institute of Technology, extends to him its sincerest congratulations.

This election to the presidency of one of the largest scientific societies in the world is deserved recognition of his work as a scientist and as an educator. During his varied career he has studied at Leipzig, Paris, and Vienna. He has worked with the Bureau of Mines and with the Fixed Nitrogen Research Laboratories in Washington, D. C., and he has taught at the Massachusetts Institute of Technology, at the University of Michigan, and, for the past 13 years, at Minnesota. The Institute of Technology feels honored to have a scientist who is so highly esteemed by his fellow scientists at its head.

A Hobby that is Different

WE ALL have our hobbies. Some collect stamps, others work on photography, but for a vital, interesting, and inexpensive hobby, reading the newspapers can't be beat. Of course, by this I don't mean merely the cursory scanning of the headlines, the sports, and the funnies that the average person does, but rather an analytical study of the local, national, and international news.

We engineers pride ourselves on our ability to think logically, on our ability to take a given amount of data, "process" it with our slide rules and our formulas, and get from it the right answer. In a sense this pride is justifiable; we do receive a training in clear methods of thinking that is unequaled in any other course. But can we transfer these habits of thought, can we apply them to non-engineering problems? Taking up newspaper reading as a hobby furnishes a good chance to find out.

To make a hobby of this routine process it is necessary first that you read the papers regularly. Next, select one or more interesting subjects and read every item that pertains to them. It is best to choose subjects that will be written about more or less continuously, as the Spanish civil war, the war in China, Nazi Germany, or the WPA. Now what you should attempt to do is first, to get at the facts of the matter being studied and second, from these facts to predict what will happen in the near future. Or, to put it into engineering parlance, you are attempting to gather data and, having the data at hand, to solve the problem.

Obviously this is very difficult to do. You are never entirely certain of your data, nor is there any exact formula for producing an answer from it. An interesting way to check your results is to make a written analysis of the situation you are following, once a month. Then, by reading these in subsequent months and comparing them with actual developments you can estimate your skill.

About now you may be wondering what benefits may be derived from the pursuit of this hobby. The answer to this question lies solely in yourself. If you have no real interest in your fellow men and their doings, if your range of vision encompasses only a slide rule, a textbook, and a bottle of beer, then you would neither enjoy it nor would you profit by it. However, if you are interested in this changing world, if in its chaotic conditions you can sense the implied challenge to the order-creating, scientific method, you will find new hobbies more interesting. Furthermore the knowledge of humanity and its foibles and the mental training that you acquire while pursuing this hobby may well turn out to be as valuable to you as your textbook learning.

Don't Weaken

If you are an average engineer you probably started out this quarter with a firm resolution really to study and get good marks. Furthermore, if you are an average engineer, you are starting to slip about now. Don't weaken! Remember that though there are other contributing factors, personnel men still pay off on A's.

Who Makes History?

The statesman? The general? The politician? The dictator? In his recent book, "March of the Iron Men," reviewed below, Roger Burlingame presents and supports the theory that it is none of these but rather the scientist. You will be interested to see just how he supports this hypothesis.

By C. I. Haga

Instructor in English

ROGER Burlingame's "March of the Iron Men" is an ambitious and interesting book whose subtitle suggests the difficulty of the problem it takes up. Almost everyone recognizes in some degree the interdependence of mechanical invention and social development, but not everyone would venture to demonstrate that a political and social phenomenon such as the unification of the United States after the Civil War had its principal cause in a mechanical technology specifically conditioned by the social and geographical influences peculiar to the United States. A complex problem of such magnitude can be worked out in a popular book only if the writer is willing to run the risk of simplifying both the statement of the problem and the means of solving it—and if the reader is willing to accept the necessary lack of qualification and the frequent omissions. The plan must be simple. As the author says, he has tried to show "first a picture of the groups of people whose every gregarious effort was thwarted by the savage continent which confronted them; next of the demand of these people for whatever inventions would aid them in the conquest of that continent; and then of how those inventions bred others of such force and magnitude that they established patterns of union to which the people must finally conform."

The Machine, a Communal Product

When told in this fashion, the story of mechanical invention becomes something more informative than when it is broken up into those more familiar disconnected legends whose heroes are Franklin or Whitney or Morse. An examination of the relevant social, economic, political, and geographical influences develops the significance of a particular machine far more dramatically than the better-known, popular treatment in which there are but two heroes, the inventor and the machine. Instead of being only one man's child, the machine is a communal product, and instead of serving only one purpose—to reap grain or to pump water—it can as readily bring about social and economic changes which in retrospect are recognized as revolutionary. When social or political institutions are faced by new conditions, but lack the power of adapting themselves by harmonious and orderly development, it would not be too fanciful to say that the group mind invents a machine which will do the job suddenly with revolutionary effect. The great revolutionary, then, is not the orator or the general; he is the man in the shop or laboratory. A new way of earning a living has a greater and more lasting effect on a community than a new way of being taxed.

It is a strange kind of history that we read when the machine becomes the hero and subordinates men and social forces. According to Burlingame, it was the rifle and not Washington or the millions France lent us that won the Revolution for the Colonies; and it was the newspaper printing press and the telegraph, the railroad and the reaper that ended the Civil War. Whether we accept or refuse such a schematic interpretation of history, we can yet admit there is much real value in retelling the familiar events from this point of view.

Two striking examples of Burlingame's method are his accounts of the rifle and the Colt's revolver. The first was developed because the woodsman, having to live off the country, had to make every bit of the small store of powder and shot he could carry on his person count. The other was invented when the lone plainsman had to match himself against unequal numbers. After satisfying their antecedent or causal needs, both devices in turn created new wants and new motives. Tracing out the consequences with Burlingame, we are not surprised "That, in private hands in a wide, wild, incommunicado and largely lawless country, it [the revolver] should turn from defense to the opposite." The patent on Colt's revolver granted in 1836 could as well have been titled "A Patent for Gangsters." I over-emphasize Burlingame's simplifications because their possibilities amuse me: McCormick invented the reaper and, consequently, the Farmer-Labor Party—and the Farmer-Labor Party, crying out to be born, invented the instrument of its delivery eighty-five years before it saw the light of day.

"March of the Iron Men" is not such a muddle as I may have suggested by my last flippancy. The book has both plan and body, and most of its points are made reasonable since neither the author nor the reader is simple enough to think that the chain of cause and effect is forged link by link. Human life is a web whose pattern is shifting and strange because its lines follow hidden tensions and fluxions. The lines which we see have one mode of connection and conformity; those forces which we cannot see have another. It is when these two elements of the pattern are related and explained that history takes on a complexity and liveliness we find as bewildering as it is stimulating.

It is for its stimulating value that I recommend "March of the Iron Men." For technology students it should be particularly rewarding, since I hope it may become a means of leading them to history. More than one student has asked me for help in organizing a reading program, and each time I am delighted to find that he wants it to include two things: literature and history. The reason for that choice is obviously the intelligent man's interest in life. Such an appetite cannot always be satisfied by the spotty pasturage of random reading. Therefore, if it is history the student wants to read, let him use such oblique approaches as "March of the Iron Men" and follow its bibliography, or let him take the direct road as marked by Allan Nevins' "Gateway to History" with its excellent bibliographies.

ALUMNOTES

'08

Professor H. B. Roe, Eng., was recently appointed acting chief of the division of agricultural engineering on the farm campus. He was formerly an assistant professor in the division. Professor Roe is taking the place of Professor William Boss, who retired from active service last June.

'29

J. Robert Ginnaty, E.E., was in to see Mr. Bryant in the electrical engineering office during the holidays. After graduation he worked first with the Westinghouse Company, then with the Honeywell Company of Minneapolis. Robert is now a manufacturer's agent selling different types of engineering equipment. He was business manager of the TECHNO-LOG while a student.

'31

Dr. Andrew Hustrulid, E.E. (Ph.D. in physics), has been transferred to the ag campus. He was formerly an assistant in the department of physics.

'32

Earl R. Young, Ag. E. (M.S. June, 1938) is an instructor in agricultural engineering at the University of Kentucky in Lexington, Kentucky. He says that Lexington has a population of about 60,000 and has never known a depression because it is the center of the blooded horse industry. Earl is kept very busy teaching courses in drawing, wood shop, farm shop, farm machinery, and farm motors.

'33

Carl Widseth, Ag. E., is with the Portland Cement Association. He is working out of the Minneapolis office. The nature of the work is educational and promotional, working with farm groups in the interest of improved concrete construction. Carl is married and has a family of three children.

Frank Ventura, M.E., is personnel manager of the American Can Co. in St. Paul, Minnesota.

'34

Loyal A. Johnson, Ag. E., is with the Minnesota Department of Conservation, division of drainage and waters. Loyal is a hydraulic engineer, and his work consists of hydrological and hydraulic surveys, studies, and designs. He is married and is still interested in a farm in Kandiyohi County.

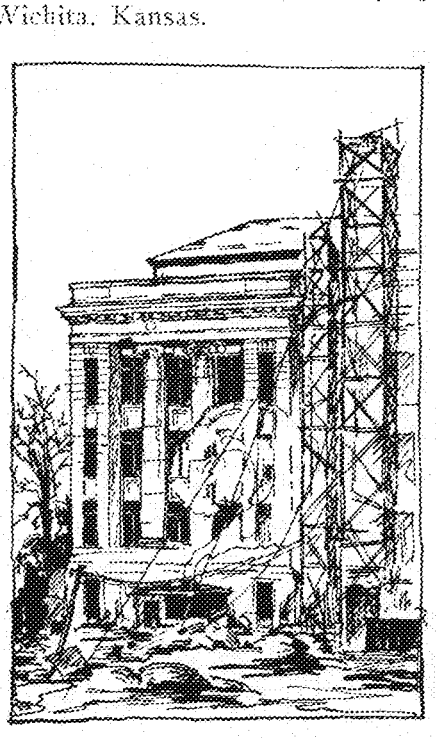
'35

Henry R. Kimball, E.E., was also on the campus during the holidays. Henry is with the Magnolia Petroleum Company in Houston, Texas.

'36

Albert G. Oswald, E.E. (M.S. Physics), is now an instructor in the Michigan School of Mines and Technology in Houghton, Michigan. Albert was in the Twin Cities visiting recently.

Russell Carlson, Aero E. (M.S. '38), is looking forward to a happy New Year. On January 3 he began working for the Chance-Vought Company in East Hartford, Connecticut. Russell formerly worked for the Stearman Aircraft Company, Wichita, Kansas.



Alden W. Carpenter, Ag. E., is with the Northern Pacific Railway Company office in St. Paul. His work consists of surveying and drafting for the purpose of furnishing the Interstate Commerce Commission with an up-to-date valuation of the company's properties. Alden was recently married and lives in Minneapolis.

Ronald Robertson, Mines, has been working in South America for the past two years. After serving as an assistant engineer with the Aramayo Mining Company in Bolivia, he was recently made superintendent of a tungsten mine at the company's branch in Argentina.

'37

Bob Olson, E.E., was back on the campus during the Christmas holidays. Bob is now working on geophysical research for the Magnolia Petroleum Company in Dallas, Texas. With him was **William Boese,** E.E., who is also working in Dallas. Bill, however, is working for the Federal Communications Commission's branch office.

Adolph Melzian, M.E. (M.S.), recently received a position with the Standard Oil Company. He was formerly on the staff at Tulane University as an instructor in mechanical engineering.

'38

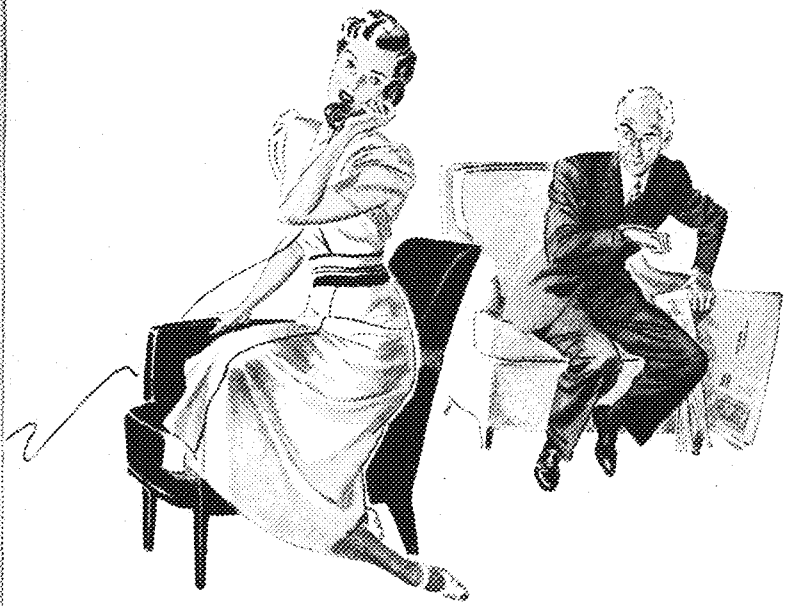
Wilfred Cadwell, M.E., is now with the Caterpillar Tractor Co. He was an assistant in the forge shop during his senior year.

Hugo A. Hesse, E.E., and **Lennard Johnson,** E.E., have both registered for graduate work at the University.

Jacob Schmidt, Aero. E., is now working for the Allison Engineering Company in Indianapolis, Indiana.

W. S. Dyer, Chem., is now an instructor in chemistry at the University of Arkansas. He was formerly an instructor in the School of Chemistry.

They can't talk those telephones to death



. . . *because Bell telephones can "take it"*

Every piece of apparatus used in making a telephone call must pass many tests at Western Electric, the manufacturing unit of the Bell System.

These tests begin with the raw materials and are carried through each stage of manufacture. They range from simple visual inspections to complicated chemical, electrical and mechanical tests.

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A Western Electric machine which puts telephones through their paces. Here representative samples receive a test which, in a few weeks, is equivalent to a lifetime of actual service.

Western Electric . . . *made your* BELL TELEPHONE

YOUR FUTURE INFLUENCE

•

You who are engineering students today will be the users of engineering equipment tomorrow. Some of you will be purchasing agents, designers, or in some other position where you will be specifying equipment manufactured by a variety of companies. Far-sighted manufacturers realize the value of your future influence and are acquainting you now with their products through advertising in the Minnesota Techno-Log. Each month national advertisers bring you information concerning their products, services, and organizations. These advertisers, who are the most progressive ones in their respective fields, maintain high standards of honesty in advertising. Their advertising messages are not of the "high pressure" type but carry information which you can rely upon.

ROBERT E. McDONALD,
Business Manager

FACULTY SKETCH

By Wesley Larson, M.E., '3

Professor J. R. DuPriest

Head of the Department of Mechanical Engineering

PROFESSOR D Priest, from his birth and early education i Virginia, has come long way to occupy hi present position as hea of the mechanical en gineering department En route, he seems t have been nearly every where and to have don nearly everything.

In 1901, Professo DuPriest earned his B.S degree in electrical engineering at Virginia Polytechnic In stitute. He then taught mathematics and shop work in high schools in South Carolina and Pennsylvania until 1905 The next six years were spent as a designer and enginee for such companies as General Electric, Ingersoll Rand C. & G. Cooper Co., and the Columbus Machine Co. I 1911, he returned to teaching as an instructor in machine design at Cornell. While at Cornell, he received hi bachelor's and his master's degree in mechanical engineer ing. Since 1913, Professor DuPriest has been an instruc tor in the various phases of machine design, hydraulics and steam and gas engineering in these schools: th University of Wisconsin (1913-1915), the University o Idaho (1915-1917), the Rensselaer Polytechnic Institut (1917-1920), Oregon State College (1921-1927), and th University of Minnesota since 1927.

During this period, he did considerable work in re search and acted as a consulting engineer. As consulting engineer for the Port of Portland, he helped design th largest Diesel-electric dredge ever built. He has don considerable research work in engine design and on hy draulic machinery. During the war he did military re search for the government at Washington and also serve on the Fuel Administration Board.

Professor DuPriest is a fellow of the American Asso ciation for the Advancement of Science, the America Society of Mechanical Engineers, the American Societ for the Promotion of Engineering Education, the Amer can Association of University Professors, and the Min neapolis Engineers Club. He also holds membership i Sigma Xi, Phi Kappa Phi, Pi Tau Sigma, Tau Beta P and Triangle.

Looking into his private life we find that he is marrie and lives in Prospect Park. His two sons are attendin the University—one taking up engineering, the othe medicine. He has always been very active in sports bu in the past few years has engaged mainly in fishing an skating.

TECH NEWS

Ag. Engineers Run Information Booth

The most recent meeting of the agricultural engineers' society had as its feature a talk by C. N. Hinkel of the Standard Oil Company's technical department. Mr. Hinkel is also one of the speakers on the program of the Farm and Home Week, January 16 to 20.

If you have missed the Ag. E.'s on the main campus this week, it is because they have been occupied at the information booth on the farm campus. Members of the society run this booth during Farm and Home Week to assist in directing the visitors about the campus. The week is devoted to the instruction of farmers and their wives, by means of a widely varied series of lectures, on subjects pertinent to farming and farm life.

A.S.C.E. Makes Plans

Plans for the quarter include a series of employment discussions, two field trips, and a sleigh ride party. Speakers on the employment program will stress opportunities in the various fields of civil engineering, with helpful hints as to how to get these jobs, how to prepare for them, and what to expect from them.

In addition to technical meetings the civils also find time for recreation. The A.S.C.E. is represented by a hockey team. The seniors are represented by both a hockey team and a basketball team. As usual they expect to lead the league.

For Freshman Engineers

Freshmen—opportunity is knocking at your door! With the successful completion of your first quarter in school you are now eligible to become members of the Techno-Log staff. To ambitious and far-sighted freshmen the Techno-Log extends an invitation to join the staff now. If you are interested drop in at the office and introduce yourself to the Editor or the Business Manager. Or if you'd rather, just put a note in P. O. 7060. They will be glad to get in touch with you.

More than 20,000,000 molded plastic products with full color images of Mickey Mouse and his zany crew have been produced in three years by a single manufacturer in Bridgeport, Conn.

Problem Contest

The A.I.Ch.E. student contest problem for 1939 may be obtained at Dr. Mann's office in the chemistry building. The student must be an undergraduate, and he must complete the solution of the problem during twenty-one consecutive days. All entries must be mailed in before midnight of March 15, 1939. The author of the best solution of the problem will receive a cash prize of $100.

Honor Society Initiates

A total of 50 new members were initiated during fall quarter by the Minnesota chapters of the honorary engineering fraternities. There were 16 juniors, 32 seniors, and 2 graduate students.

Tau Beta Pi, national honorary all-engineering fraternity, held its initiation at the Curtis Hotel on December 1, at which time 15 new members were initiated. Guest speakers were Professor Herbert Heaton of the history department and C. H. Spencer, national president of the fraternity.

The new initiates are:

Juniors: George Montillon, Richard Stone. Seniors: Joshua Premack, Charles Bergsland, E. Francis Jacobs, Blaine McKusick, Jack Hyde, Earl Lofstrom, Gerald Hermann, Wilson Brown, George Lund, Charles Hedlund, Harold Haaland, Hugh Leach, Dana Singer.

Robert Harvey will be initiated during winter quarter.

The Tau Beta Pi prize essay contest was won by George Montillon, mechanical engineering junior.

Pi Tau Sigma, national honorary mechanical engineering fraternity, initiated seven juniors and four seniors at a formal initiation November 28. The initiation at the mechanical engineering building was followed by a dinner at the Curtis Hotel.

The initiates are:

Juniors: George Montillon, Richard Stone, David Thomas, Anton Chryst, Philip P. Johnson, Hayden Pickering, Louis Droel. Seniors: Charles Bergsland, George Edwards, Wesley Larson, Raymond Lesch.

The national convention of the fraternity was held recently at Oklahoma A. & M. College, Stillwater, Oklahoma. Wallace Lien was the delegate of the fraternity. Also attending were Robert Harvey, Wesley Larson, Philip P. Johnson, and Raymond Lesch.

Eta Kappa Nu, national honorary electrical engineering fraternity, initiated nine new members, five of them juniors and four seniors, on November 17.

Initiates are:

Juniors: Hayden Pickering, Walter Moe, Theodore Specht, Douglas Schroeder, Eugene Lampi. Seniors: Henry Rehmann, Gerald Hermann, Walter Schwedes, Mahlon Sandberg.

Phi Lambda Upsilon, national chemical fraternity, held its initiation December 5, when eight seniors and two graduate students were taken into the fraternity. Initiates are:

Seniors: Edgar B. Hall, William F. Johnson, Harold S. Kemp, Stanley P. Rowland, Donald O. Swan, Donovan G. Weiblen, Herbert J. Cole, Donald S. Melstrom. Graduates: James W. Evans, Albert H. Bushey.

Chi Epsilon, national honorary civil engineering fraternity, initiated five members, two of them juniors and three seniors, at a formal initiation November 23. Initiates are:

Juniors: Lester Hauge, Maurice Woxland. Seniors: Earl Nyquist, John Guthrie, Louis Larson.

Leslie Anderson was a delegate to the national convention of the fraternity which was held in Madison, Wisconsin, the week end of November 19.

Welding Course

Professors Hughes and Koepke of the mechanical engineering department are in charge of arrangements for an advanced course in welding problems which will be held at the University Continuation Study Center February 9 through 12, 1939. This course will involve design, metallurgy and metallography, testing and inspection, stress analysis, and the economics of welding. It is designed to meet the needs of en-

gineers who desire knowledge of the latest developments in welding and to educate them to its possibilities.

Dr. Dowdell and Professor Joseph of the School of Mines will give talks, and several nationally-known authorities, among whom will be Mr. M. A. Grossman and Mr. L. C. Bibber, will also address the group.

The course, which is being sponsored in cooperation with the Northwest Chapter of the American Welding Society, is the first one of its kind in the country.

Dr. R. L. Dowdell of the School of Mines is chairman of the American Society of Metals handbook committee. The handbook, which is triennial, has gone to press and will be ready for distribution early this year.

A.I.Ch.E. Plans

At the meeting of A.I.Ch.E. held January 10 arrangements were made for the third annual Student-Faculty Banquet. Eben Finger was appointed general chairman of the banquet. It is to be held Tuesday evening, January 31, in the Minnesota Union. Tickets for the banquet are free to all members whose dues are paid.

Plans were also made for an inspection trip through the Ford Plant, on Saturday, January 21. Bus transportation will be supplied as usual.

After the business meeting, Dr. H. O. Halvorson, of the bacteriology department, entertained the members with unusual discussion on the importance of bacteriology to the chemical engineer.

Technicolor Movie

The Technical Commission is sponsoring the showing of the technicolor sound picture, "Steel — Man's Servant," in Northrop Auditorium, Thursday, January 19. This picture was made by a Hollywood producer for the U. S. Steel Corp., and the voice of Edwin C. Hill follows the different processes from the mines through the rolling mills. The romance of the steel industry is embodied in this spectacular picture; it shows men at work in the mines, the tapping of huge blast furnaces, giant rolling mills in operation!

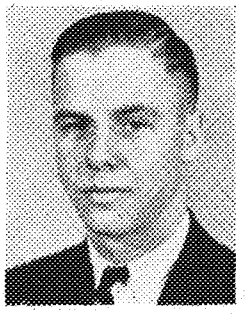
Remember! Thursday, January 19 at 3:30 and 4:30 in Northrop Auditorium. Admission is free to everyone!

Attention Seniors

Call for your personnel sheets at the main office in the main engineering building!

This Month's AUTHORS

Photos by G. A. Halseth, Ch. '40, and J. J. McBrady, Ch. '38.



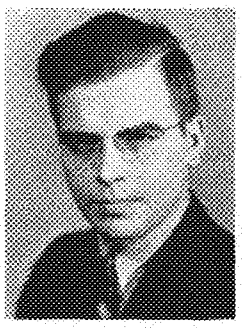
Arnold A. Jensen, Physics '39, wrote our lead article this month. It is a discussion of a particularly timely topic, since we are all interested in what will happen to us when war is declared. The article was written in collaboration with Colonel Potts and others in the military department.

Arnold, who is a cadet captain in the Coast Artillery Corps, is a member of Phalanx military fraternity. His hobbies are outdoor sports and scout work. He says that he intends to do graduate work in physics when he completes the regular course.

Leslie A. Anderson, C.E. '39, is one of our more regular contributors. This month he points out the advantages that the new water-softening plant will bring to Minneapolis. He also discusses some of the features of construction and operation that are to be found in this project. His information was gathered with the help of Mr. Jensen, supervisor of the waterworks.

For those of you who might not have read the item about Les in the October issue, it might be well to repeat that he is a member of the A.S.C.E. (what Civil isn't), of Chi Epsilon, and of Tau Beta Pi. He is president of Chi Epsilon and secretary of Tau Bete.

His hobby, which is writing, earned him $100 in a national essay contest this summer. He plans to go into city planning or management when he graduates.



Harry A. Larson, E.M. '39, is the author of that interesting article on new methods of open pit mining. He is really well qualified to write on this subject since he worked for one of the companies that is experimenting with these methods last summer.

Harry has participated in a number of activities during his college career. He has been a member of the Concert Band, of the All-University Council, and of the Tech Commission. He has also worked on Freshman Week, Homecoming, and Engineers' Day committees. He has belonged to the School of Mines Society and Theta Tau fraternity for the past three years and is, at present, president of Theta Tau. His ambition is to get into iron mining when he graduates, particularly into cost analysis work. His hobbies are tennis and music.

BLOW OFFS AND SIDE SLIPS

By Don Frankel, Aero.E. '39, and Bob Wolfe, M.E. '39

We don't like to expose our former friend, Sam Stein, again, but credit must be given where credit is due. It seems that some of the fellows were a bit worried at final exam time in Prof. Peeble's class, and thought that rubbing off a little dust from the proverbial apple could do no harm. One fellow brought a bottle of (censored) and another a cigar. Sam was apparently caught with his trousers at half-mast, but he surprised even himself with his quick thinking. His offer was an unused match.

Up until the other day, we took both of those compliments in earnest, but when a fraternity brother compliments us on a joke that appeared in the other fellows' column (inhale, Troxell), it just goes to show what civil engineering will do to a man's mind (relax, Trox).

At last we have found out why "Pick" and "Pan" are miners instead of engineers. At the time they started school as freshmen the following excerpt from an official University bulletin was in effect. Sec. 10 of "Special Information to Entering Freshmen" read: "For those people who cannot enroll in the College of Engineering and Architecture, or School of Chemistry because of low high school rank there are two courses open:

"A. Registration in the General College

"B. Registration in the School of Mines and Metallurgy"

Evidently they flipped a coin and General College won.

The metallography department cordially invites all coeds to come up and see their etchings.

By the way, do you know what good clean fun is? (Ed. note: I'll bite, what good is it?)

According to Ed Cornwall, M. E. '39, Christmas trees were not the only things lit-up at the Christmas Charity Ball. You should know, Ed.

Famous last words: This quarter I'm going to study hard and get good marks.

Well, dear readers (statistics show two—Wolfe and Frankel), we must close now and go see our profs about our probations so that we can sling some more next month.

PICK AND PAN

By M. A. Troxell, Met.E. '39, and H. A. Larson, E.M. '39

"It's so simple," modestly exclaims Charles Walton, "to hook up electric power circuits. I merely fasten leads on terminals and pull the switch. If the motor runs, we take our readings. If it smokes, we sneak it back and get another one!"

And always be sure that the supply tank is well filled with inductance.

Color Play

What color is marriage?	Wed
What color is a giggle?	Laughender
What color is a ghost?	Boo
What color is gelatine?	Jello
What color is shampoo?	Drene
What color is indigestion?	Purple

More on request

Leach thinks the story of the bull should appear again—he doubts if anyone caught on the first time.

"Maybe dame Fortune will smile upon me some day," sighs Bob Felt. "Here I am, on the threshold of graduation, and I'm just a cookbook chemist, a blueprint surveyor, and a formula engineer!"

One of the local wits was paying a nocturnal visit to the White Castle. Before him was placed the customary glass of water, which he downed in one gulp. "Have a hamburger?" queried the attendant. "What!" rejoined our hero. "Spoil a good drink of water?"

'Twas the night after finals, and Don Frankel was exceedingly exuberant. "I'm going out tonight!" he proudly stated. "I'm going to have a large beer instead of a small one!"

Someone ought to christen George Nelson the Dead End Kid. The boys filled his stool in the drafting room with water the other day, but Dead End sat there for a full seven seconds, smiling with us before noticing just what all the fellows were smirking about.

C. B. Ohman has found a three season bed during his long sojourn at the U—one with no spring.

Another miner has finally succumbed to wiles of the opposite sex. Ward Simmons is now a happily married man. Wonder why he is so secretive about his wife.

Cribbing blunders have been found for years. There was the student who handed in his crib notes with his blue exam book, and also the man who left a roll of crib notes ten feet long for the teacher to pick off the floor, but this one has just happened. During one of the last finals a student borrowed some crib notes from a close friend. While he was using the notes, the friend walked out. The poor student looked at the sheets of information, noticed that they were marked 1 & 2. He thought they belonged to the friend's paper, as they were numbered, and all in a dither he walked to the front of the room and tried to pin the sheets to the exam of the other fellow—under the teacher's watchful eyes. Failing in pinning the sheets together, he finally left them laying there and hied off to tell his friend about the sheets he forgot to hand in. Two weeks of worry certainly have added gray hairs to both craniums.

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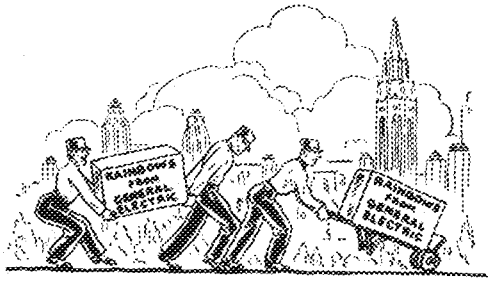


RAINBOW-COLORED COURTS

SAN FRANCISCO built the island—now, General Electric is lighting it in all the colors of the rainbow.

The lighting of the Golden Gate International Exposition, which will open in February on man-made Treasure Island in San Francisco Bay, will be the most colorful ever undertaken. For it will illuminate in all the rainbow's colors the many buildings and beautiful "courts" on the island—the Court of the Moon, the Court of the Seven Seas, and others. More than 9000 floodlights are being used. The illumination is under the direction of A. F. Dickerson, Texas A. and M. 1910, Manager of the General Electric Illuminating Laboratory, at Schenectady.

The "rainbow of light" for the San Francisco Fair will be another in a series of General Electric lighting projects that have illuminated Chicago's Century of Progress, Brazil's Centennial Exposition, the Texas Centennial, and others. And as G-E engineers develop the project for San Francisco, again they are being aided by recent engineering college graduates and ex-Test men—the men who will design the brilliant exposition lighting of the future.

OPPORTUNITY FOR RESEARCH

SELECTED graduates of American colleges carry on research work each year in chemistry, physics, and physical chemistry with the aid of Charles A. Coffin Foundation Fellowships. These fellowships were established by General Electric in 1922 in honor of the Company's first President, Charles A. Coffin.

The awards are made by a committee of distinguished men. This year the committee consists of Dr. Bergen Davis, representing the National Academy of Sciences; Dr. Karl T. Compton, of the Society for the Promotion of Engineering Education; and Dr. John C. Parker, of the American Institute of Electrical Engineers. The candidates' applications, together with the faculty recommendations forwarded to General Electric by the various colleges, are the basis for the awards.

This year, applications for the fellowships must be in the hands of the Secretary of the Charles A. Coffin Foundation Committee, at Schenectady, on January 15, 1939.

HAWAII IN NEW YORK

TWO men sat down at a table recently and decided to air-condition Hawaii.

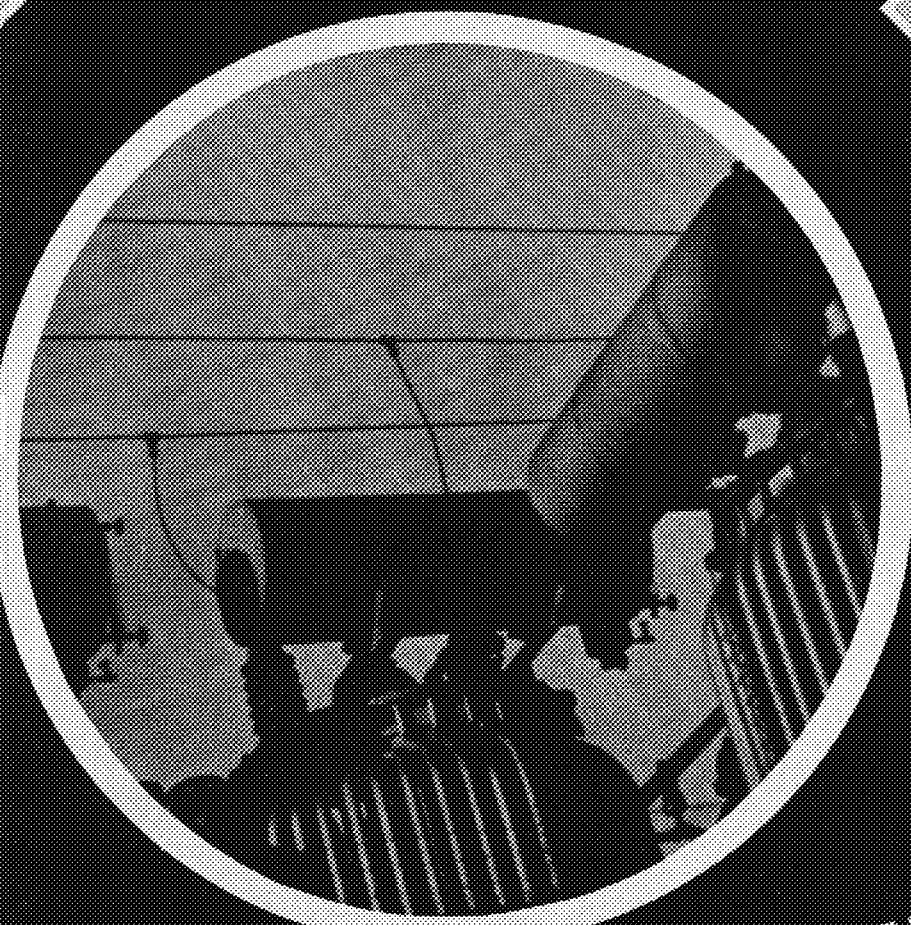
But they weren't concerned with changing the atmosphere above Diamond Head Mountain or the "Beach at Waikiki." Their problem was centered in Manhattan; "Hawaii" is the Hawaiian Room of New York's Hotel Lexington, where a 120-ton G-E air-conditioning system is being installed. Not only will it assure greater comfort for the patrons, but it will preserve an Hawaiian atmosphere—heretofore the atmosphere varied with New York's seasons.

The many Test men and ex-Test men assigned to air-conditioning work are ever seeking new applications for this G-E equipment. The results of their efforts can be seen in all parts of the country. Cliff House in San Francisco, overlooking the famous Seal Rocks, recently made its air-conditioned debut. "The Cradle," haven of homeless infants in Evanston, Illinois, is being similarly equipped, the equipment aiding in protecting the babies against infection by air-borne germs.

GENERAL ELECTRIC

98-108DB

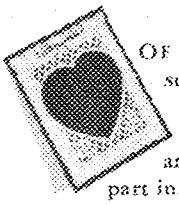
MINERAL TECHNOLOGY



FEBRUARY

1939

The "Romance" of dry cleaning



OF THE THOUSANDS of suits and dresses delivered by dry cleaners every day, how many are destined to play their part in encouraging romance? It's an interesting speculation.

When "boy meets girl" both are eager to look their best.

Appearance has so much to do with the success of that great adventure. And so the dry cleaner, in delivering freshly cleaned and pressed clothes at a specific hour, is often hand in hand with Dan Cupid.

But the "romance" of dry cleaning goes much farther than that. Few people realize the true nature and extent of the remarkable service the dry cleaner is rendering. Clothes are not merely "sloshed" in some commonplace liquid, wrung out, dried and pressed, like a family wash.

The modern dry cleaner is a skilled technician who understands the nature and peculiarities of textiles and textures, of dyes, of prints, of wools, silks, rayons, acetates and mixtures. He knows his chemistry and what to do with troublesome spots. He knows the problems of shrinking and stretching and what to do about them. In fact he practices a scientific operation.

In the advancement of this essential business Dow technicians have played a conspicuous part by the development of Dowclene. This dry cleaning solvent, in addition to speeding up the process, makes dry cleaning absolutely odorless. It leaves no oily film to attract new dirt. It makes clothes cleaner, fresher, brighter, wear longer.

Beyond these invaluable results is the immensely important fact that Dowclene is nonflammable and non-explosive.

The utilization of Dowclene solvent is now national in scope and Dow considers it among the most important of all its more than three hundred contributions to industry.

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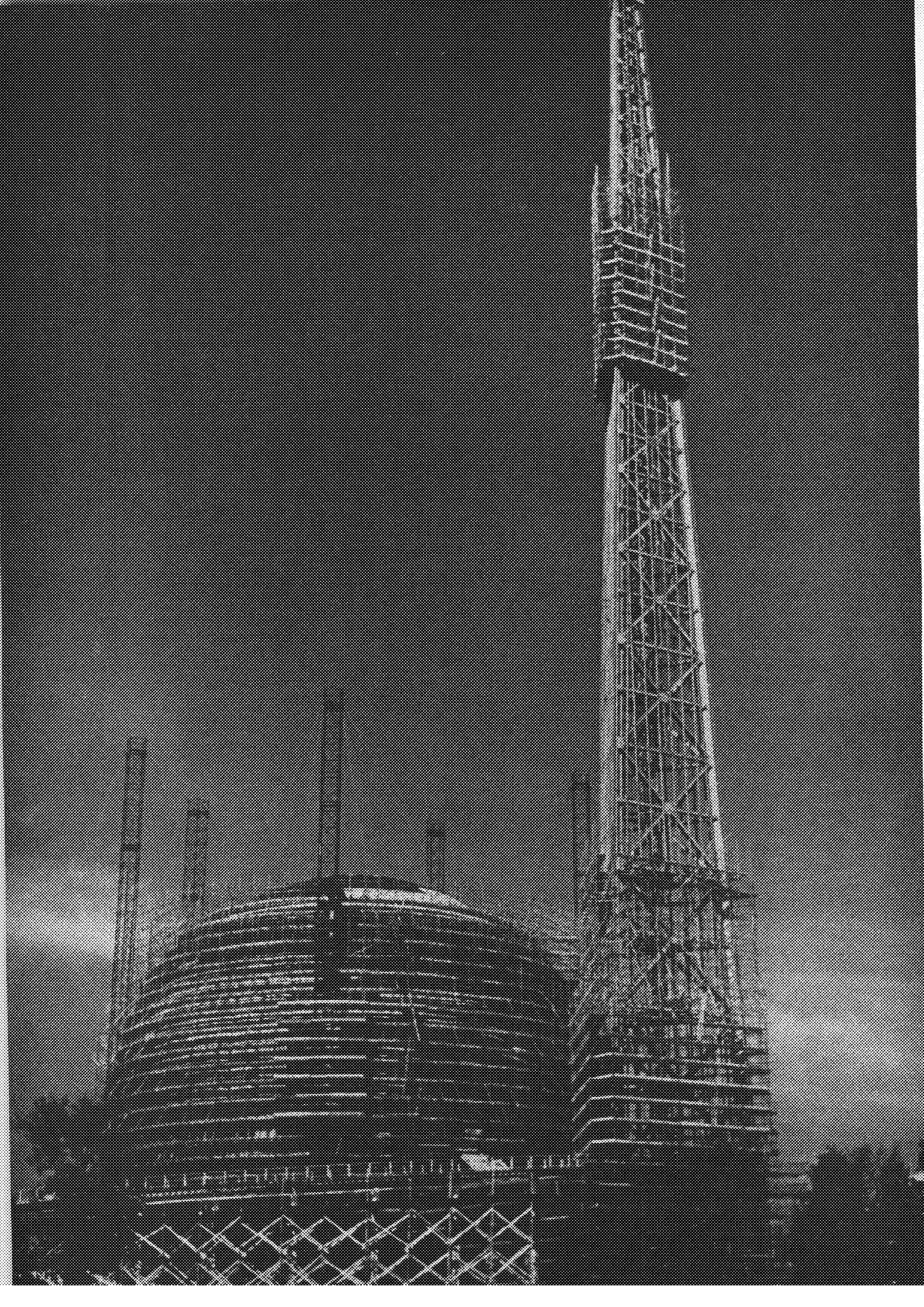


The U. S. Merchant Marine

What is its present status? Why is it necessary? What are its future plans? The ten year, $1,250,000,000 maritime program is planned to provide a naval reserve as well as to rejuvenate our merchant marine. Read, in this article, the particulars of some of the ships to be built under the program.

By Alvin Isaacs, C. E. '41

Illustrations courtesy "Marine Engineer and Shipping Review"

TWENTY years after the First World War, with America leading the globe in every field of science, industry, and invention, and supreme in land and air transportation, we still find ourselves left far astern on the seas. In 1919, with vessels hurriedly built to rush troops and materiel to France, we inaugurated a merchant marine fleet and expected our seamen to restore to us the prestige of our famous Clippers of the 1850's. Then for twenty years we forgot all about them.

Meanwhile other nations designed and subsidized fleets of modern vessels that soon cut into our commerce and tourist trade. We, the richest nation in the world, whose foreign trade is exceeded by that of only one other country, now stand only fourth in ships, sixth in speed, and seventh in age among the foreign trade fleets of the eight principal maritime nations. In 1937, the value of our foreign trade was nearly six and a half billion dollars, the largest since 1930. American ships carried only 35 per cent of this traffic! In the same year 366,500 American citizens traveled overseas, but only 30 per cent of them traveled on American ships!

Today, however, shipyards on both coasts are working day and night to create a new and super-modern merchant marine fleet to carry again the American flag swiftly and proudly to the farthest corners of the globe with its rightful share of world's commerce. Spurred on by progressive seamen and shipping companies, favorable legislation, and the need of an auxiliary navy, the government created a United States Maritime Commission a year ago to investigate our conditions and to oversee the rejuvenation. With the financial backing of the government, the Maritime Commission has subsidized the private companies for repairing the best of our present liners, and with its own staff of marine architects and engineers, in coöperation with the industry, has designed three standardized types of ships to pattern the new fleet. These new vessels are the last word in modern engineering.

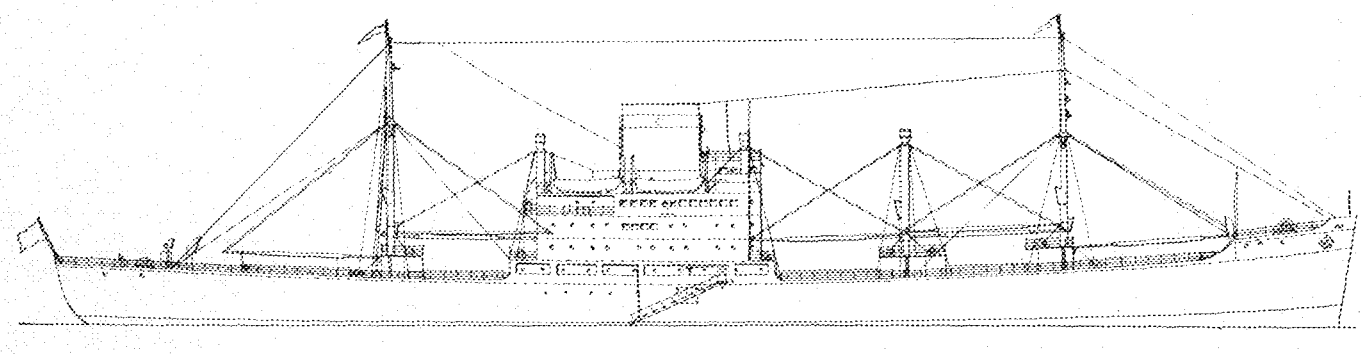
In designing these new ships, which will be the backbone of the American merchant marine, the Commission had three definite objectives: to develop a reasonably fast, economically operated cargo vessel which could compete, with the help of a government subsidy, with the vessels of other nations; to promote lowest possible first cost by the standardization of design and equipment; and to develop a vessel with sufficient speed and stability for use as a naval auxiliary in time of national emergency. Added to these, is the job of training seamen and officers to man the fleet.

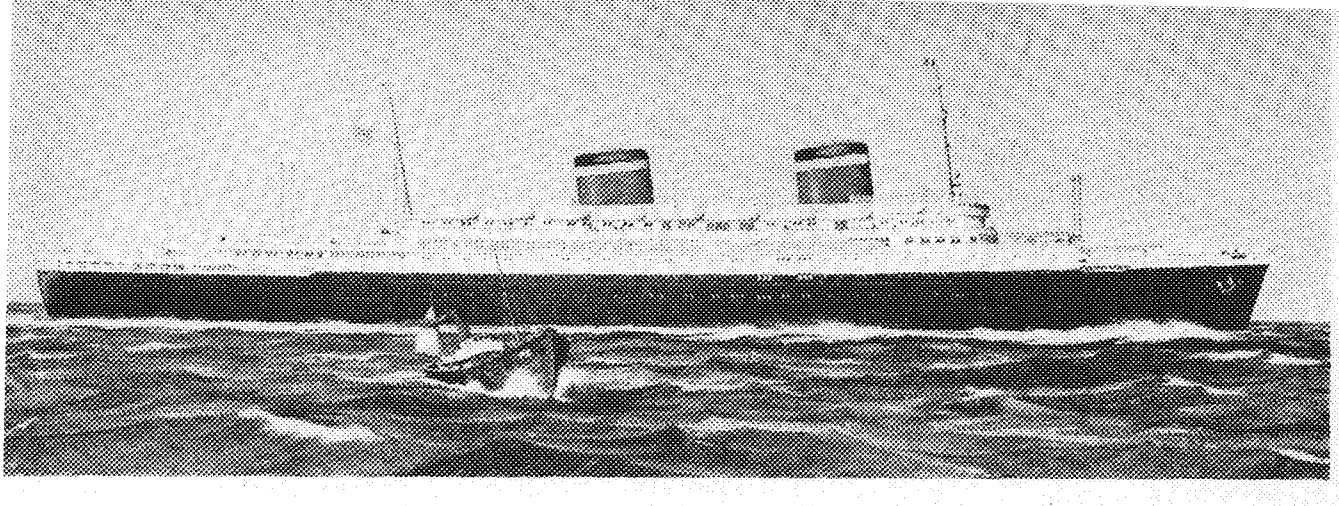
500 Ships to be Built

To replace entirely our aging fleet of merchant ships would require 261 ships per year for the next five years at a cost of $2,500,000,000. The actual program of the Maritime Commission is more modest. It calls for the building of 500 ships in the next ten years at a cost of approximately $1,250,000,000. This represents the minimum requirements of our commerce and national defense.

Before going into the engineering details of the standardized vessels, a description of the few other ships being constructed is of interest. To replace the scrapped Leviathan as the flagship of our North Atlantic service, the Commission is now building, at the Newport News Shipbuilding & Dry Dock Company, a 27,000 ton cabin liner. This vessel, to be named the America, will be completed about February, 1940, and will be a 22 knot, model safety liner 723 feet long and 92 feet wide, built not to compete with the non-profiting luxury liners of the Queen

Outboard profile of C-3 combination passenger and cargo vessel.





Artist's conception of the new liner America.

Mary or Normandie class but to be a practical example of American engineering and industry.

The progress of trans-oceanic aviation looms as a main case against the building of superliners. The reliability of aircraft, and their ability to maintain schedules, have become increasingly impressive. Aircraft designs now available (See TECHNO-LOG, Dec., 1938) for immediate construction would enable a fleet of 18 flying boats, on a daily service of 3 planes a day, to offer the same total passenger capacity per year as a superliner, at a production cost for building the planes estimated at $18,000,000 against an American production cost of $50,000,000 for a superliner. Except for some possible loss of mail revenue, it is not believed that aircraft will injure to any extent the types of passenger vessels recommended for the American merchant marine, which do not include superliners. Aviation obviously will have no effect so far as freight vessels are concerned.

Other less pretentious vessels now under way are three for the Panama service and four for the Mediterranean. New South American vessels to run from the Gulf are projected, and also contemplated are several trans-Pacific luxury liners.

Tankers Included in Program

These passenger ships cover only a very small percentage of the Commission's program. A slightly larger group is the tankers. It is true, due to the large profits in the oil industry, that our tanker fleet equals that of any other nation, but because the immediate needs of the Navy call for fast auxiliary vessels, several dozen 18 knot ships are being built. These will be distributed to whichever private companies wish to operate them during peace time. They will be constructed from a standard design, prepared by experts of the oil companies, the Commission, and the Navy. The contracts require these vessels to develop a speed of 18 knots, while their sustained sea speed, fully loaded, is to be 16½ knots, as against the 12½ knots of the present commercial tanker. The ships will have a tonnage of 16,300 deadweight; a length of 525 feet; a cargo capacity of approximately 150,000 barrels of oil; and will be equipped with twin-screw, steam-turbine engines developing a shaft horsepower of 12,800. Gun foundations and magazine spaces will be built in.

But the real pride of our new merchant fleet will be the three standardized types of ocean-going cargo and combination passenger and cargo vessels which are being developed by the Commission. These three classes, known as the C-1, C-2, and C-3, are similar in design, differing mainly in size and speed. They will have a raked stem, cruiser stern, full shelter deck, and housing 'midships above the engine-room. In the design are incorporated all the latest improvements in ship construction and arrangement of machinery (engines being located abaft the longitudinal center of buoyancy), the national defense features required by law, and provisions for commodious quarters for both officers and crew.

Already under construction at this moment are two score of the C-2 and C-3 ships, with the program calling for the C-1 to be started early this year. The C-2 and C-3 are each being built with Diesel or steam-turbine power, the majority of the vessels, however, getting the steam power, as the cost of Diesel fuels exceeds that of the fuel oils for steam plants by 60 per cent. The hulls and decks are transversely framed, and will be riveted at seams and butts. Much high-tensile steel is to be used on these ships, since corrosion tests under sea conditions have proved that this material gives one-third to one-half longer life than the plain carbon or copper steels. Each vessel will have five cargo holds, three forward of the engines, and two abaft. The cargo gear calls for herring-bone geared electric winches, which will be a decided improvement over the rickety steam winches of present vessels. The 5-ton cargo booms, constructed of drawn-steel tubes, are to be fitted to king-posts, each being about 60 feet long. In addition, a 30-ton heavy lift boom will be set in a socket at the forward end of No. 3 hatch, and a similar installation will be located at the after end of No. 4. Deep tanks are to be provided forward and aft in No. 2 and No. 4 holds for carrying oil or liquid cargoes, water ballast, or ordinary general cargo.

Cargo spaces, lamp and paint lockers, and machinery space will be protected against fire by a CO_2 smothering system. In addition, a smoke detecting device will be installed in the cargo holds with the detector cabinet located in the wheelhouse. Above the shelter deck a manual fire alarm system will be installed. This system, when used will automatically ring gongs in the wheelhouse, the engine-room, and the crew's quarters, and will stop all ventilation and exhaust fans except in the engine-room.

The entire crew is bunked in the deck housing amidships. The seamen, the engine-room force, and the stewards are berthed on the shelter deck in rooms containing not more than four persons. The writer remembers one liner he shipped on which bunked eighteen men in one foc'sle! These new ships are taking into consideration the welfare of the crew, and will give the seamen the same high living standards that every American has a right to enjoy. At the forward end of the housing on the shelter deck a large mess room is provided for the deck and engine-room gangs. Recreation rooms are

located on both the port and starboard sides. Modern sanitation facilities are being provided, including showers and wash basins.

The engineers and deck officers are located on the boat deck, with their mess room also installed at the forward end of the house. The captain's accommodations are located on the bridge deck along with the wheelhouse, chart room, gyro room, radio operator's quarters, and fan room. Hot and cold fresh water is supplied to both the crew's and officers' rooms and baths. Each member of the crew is to be provided with two metal lockers. Mechanical ventilation will be provided for all living quarters in the ship.

Design of the C-2 Ships

The C-2 design calls for a vessel 459 feet long overall, 63 feet beam, with a load draft of 25 feet 9 inches. The total displacement is 13,900 tons, the light-weight of the vessel being about 4680 tons. The ship will have a sustained cruising radius of 13,000 miles at a speed of 15½ knots, which is about 50 per cent faster than the average American freighter of today.

Both the steam turbine and Diesel power plants will develop 6000 shaft horsepower at a propeller speed of 92 revolutions per minute under normal conditions. They must be capable of a 10 per cent continuous overload and 25 per cent overload over a period of two hours. For commercial operation at a service speed of 15½ knots, it is estimated that 5600 shaft horsepower will be required, the excess in power being provided for heavy weather, and emergency operation such as might be required during wartimes.

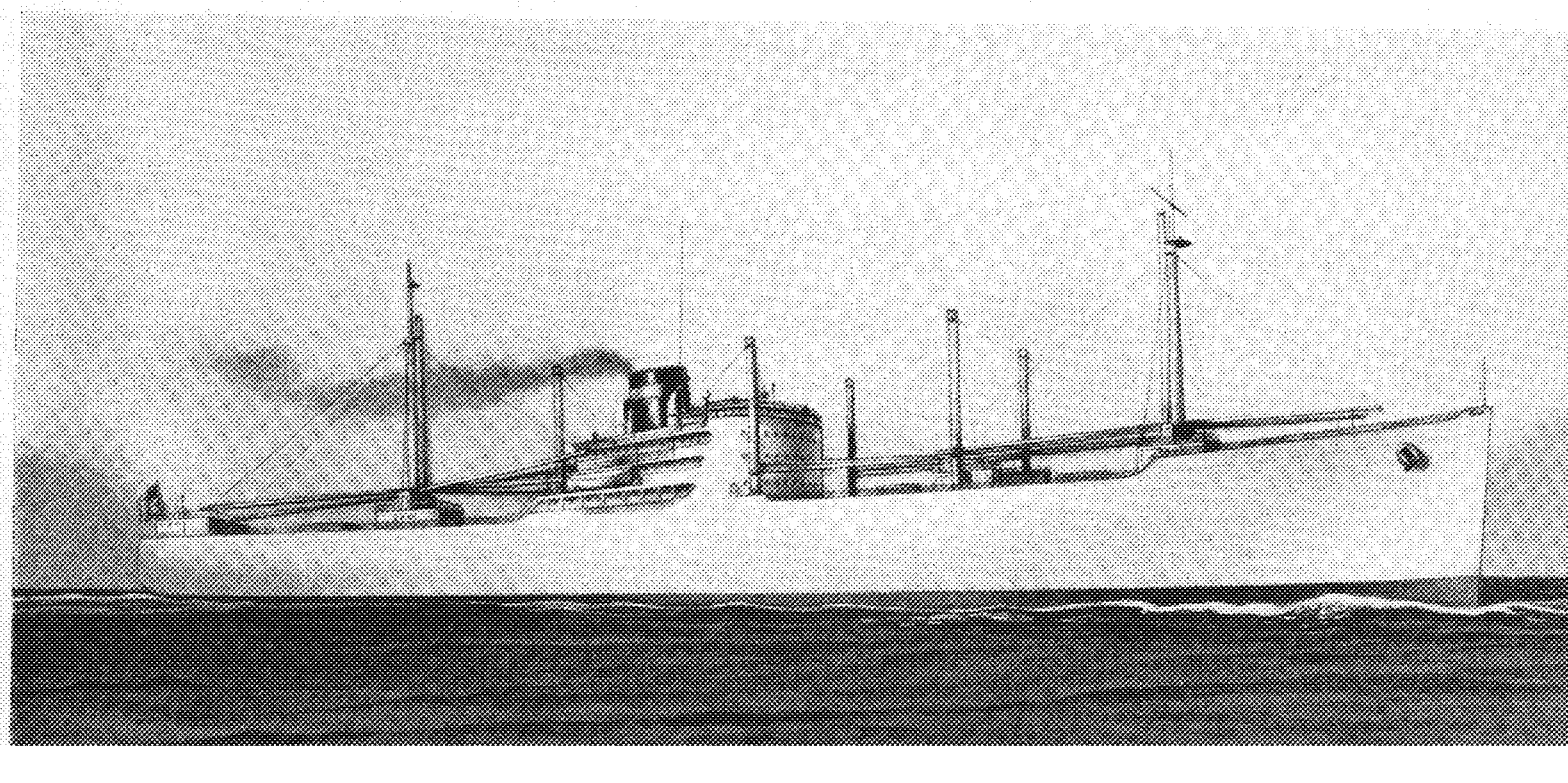
The C-2's being constructed now use either the geared turbine or the direct-drive Diesel propelling type machinery. On the steamers, plans call for a high-speed, cross-compound, double-reduction, geared turbine. Steam is to be supplied by two watertube oil-burning boilers having an efficiency of at least 87 per cent and with a total water heating surface combined with superheating surface sufficient to evaporate 53,000 pounds of steam per hour at 450 pounds gage pressure and 750 degrees F. The boilers are to be built for a pressure of 500 pounds per square inch on the drum, and convection type superheaters will be used to get the required 750 degree steam.

The C-2 motorships were originally designed to have the main propelling plant consisting of two multi-cylinder, solid injection, single-acting, two-cycle Diesel engines connected to single-reduction gears by means of flexible mechanical couplings. The ships being built, however, are using the direct-drive for economy. Power will be equal to that of the steamships of the same class, but using 19,500 B.t.u. oils, there will be an overall fuel consumption of only 0.41 pound per shaft horsepower per hour on the Diesel. Salt water cooling will be used for the cylinder jackets, and the pistons will be cooled by lubricating oil. Compressed air for starting and maneuvering purposes is to be supplied by independently driven air compressors. This air is to be stored in reservoirs with sufficient capacity to start the engines at least twelve times.

The C-3 has an overall length of 492 feet and a beam of 69 feet 6 inches. The draft will be 27 feet 3 inches. The ship will have a displacement of 16,636 tons, and the engines will be expected to give a shaft horsepower of 8500 and a sustained sea speed of 16½ knots. An added distinction between the C-2 and C-3 is that the latter can have quarters for from 12 to 50 passengers, depending on the route of the vessel's operator. These passenger staterooms will be on the boat deck along with the officers' cabins.

The Maritime Commission, in the name of the United States government, has begun this gigantic rejuvenation program. A lot of work, a lot of thought, and a lot of money is being put into it, so that our country can regain its rightful share of commerce and have an efficient naval auxiliary. But the success of the new merchant marine fleet is going to depend entirely upon the citizens of this nation. American goods must go into American ships, and American tourists must choose our liners when they travel abroad. In this era of nationalism, loyalty to our own great democracy must be complete. And we know and expect that the ships we launch at the end of the program will be exceeding even tomorrow's vessel through American engineering progress.

Sketch of one of the new C-3 ships to be built to reëstablish our merchant marine.



The Minnesota Campus —

Past — Present — Future

Why is the new union being built at the south end of the mall? Why will journalism be across the street from main engineering? Is all this according to a plan, or does the University just grow? In this article a young architect traces the plan of the campus since its inception.

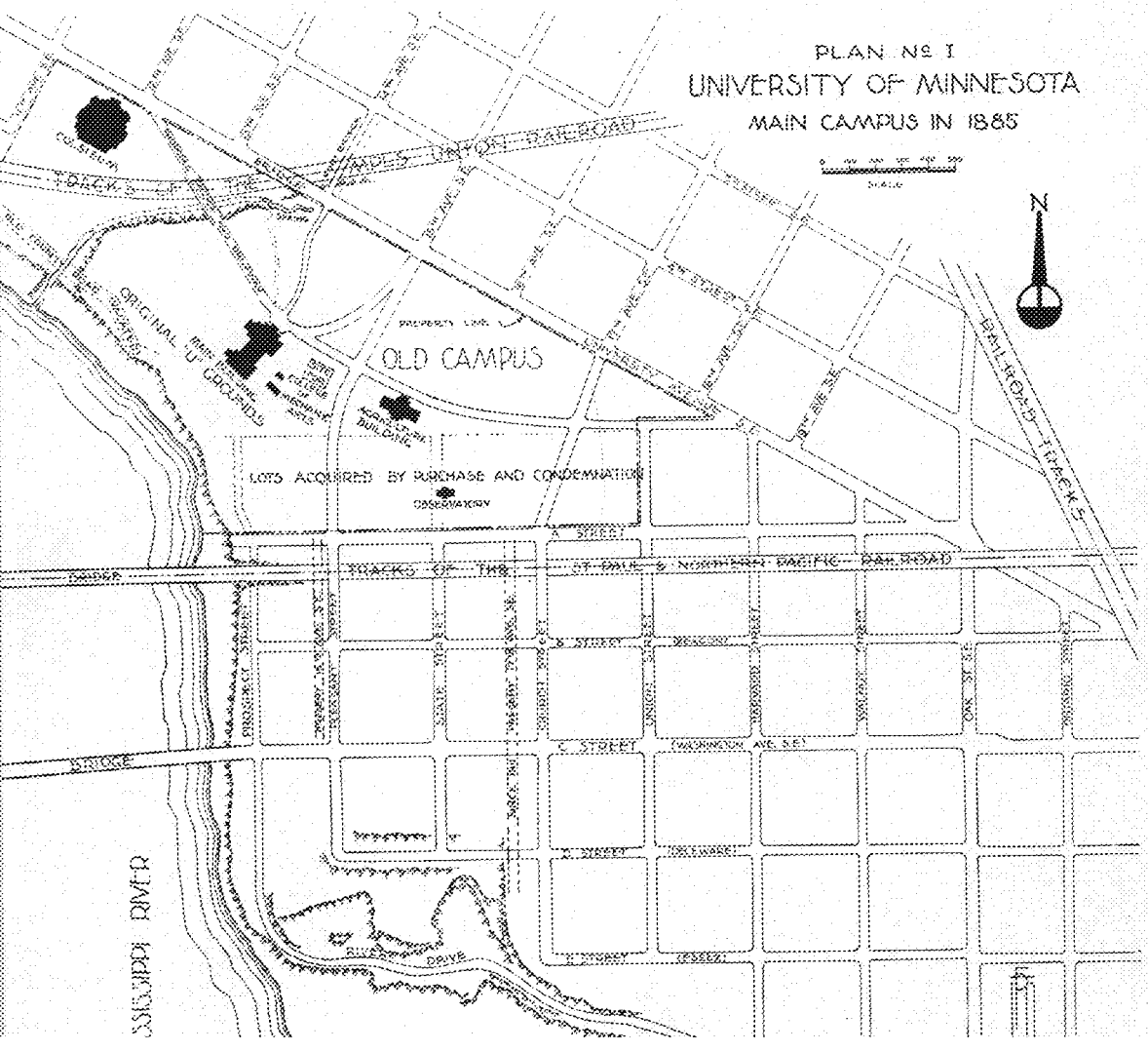
By Francis Meisch, Arch. '39

Illustrations by the Author

THE Greater University Plan now rapidly nearing completion was once the dream of a few far-sighted individuals. With the construction of the new Minnesota Union and several other buildings, either under construction or anticipated, the plan will be brought a step nearer to its goal. The carrying out of such a plan has demanded great foresight and energy, because it has always been the center of attack by some college or department. Inasmuch as the University has been an active and expanding institution for the last half a century, departures have been necessary to keep pace with the times.

In 1869, about seventeen years after its establishment, the University achieved recognition as an institution of higher learning, and with very limited funds started on its career of expansion. Growth at first was slow; the campus consisted of some twenty-five acres which had been purchased for $6,000. The acquisition of more land was soon recognized to be an important factor in the University's growth. The Regents continued to purchase land in a fragmentary fashion from year to year, until in 1885 all the land belonging to the old campus was in the hands of the University. Land, however, was cheaper than buildings, and construction continued to lag far behind land purchases. In 1881 a grant of $180,000 initiated a six-year building program.

The earliest map of the campus now in possession of the department of buildings and grounds is a survey dated 1885 (see Plan I). It is of considerable interest, for it shows the existence of four buildings, the Coliseum, main building, agriculture building, and the observatory, and the site for the College of Mechanic Arts building. This site was utilized in 1886 when the present Eddy Hall, now the oldest building on the campus, was built for the College of Mechanic Arts, which occupied it until 1912. The campus at that time was bounded on the south by the St. Paul and Northern Pacific Railroad tracks.

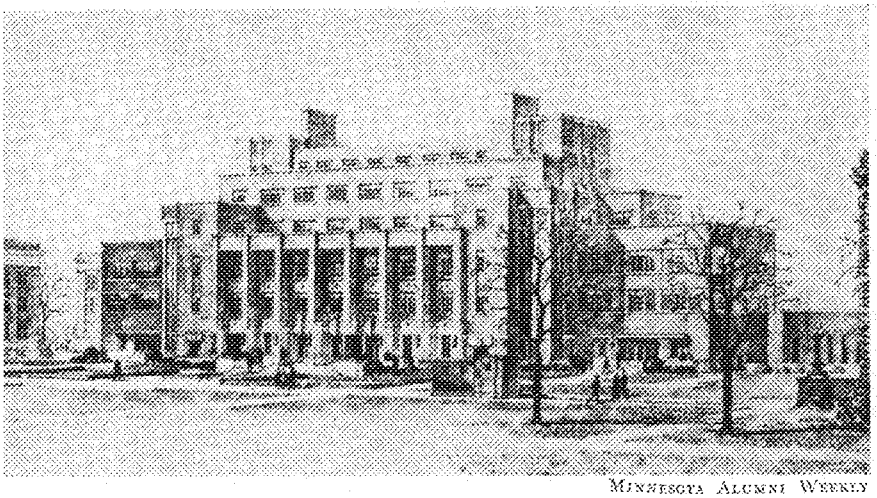


The old campus continued to grow. The present child welfare building was erected in 1888 as the music building for the old campus. In 1889, Pillsbury Hall was erected as the science building. The same year Pattee Hall was erected to serve as the Law School building. The present Minnesota Union was erected in 1890 to house the departments of chemistry and physics. The pharmacy building was built in 1892 and was known at that time as Millard Hall. The astronomical observatory was also built that year.

Two buildings now removed were the shops, erected in 1890, and the University storehouse, erected in 1893. The shops were formerly used as the heating plant and were located on the site of the present music building. The storehouse was originally the medical chemistry building and was located just south of Wesbrook Hall. Bur-

tion Hall, constructed in 1895, was used as the library. Wesbrook Hall was built in 1896 to serve as the dentistry building. The Armory was erected the same year. The present Jones Hall was built in 1901 to house the department of physics. The same year the electrical building was constructed on a site between the mechanical engineering building and Pillsbury Hall.

With the acquisition by purchase and right of eminent domain of a considerable amount of additional territory lying south of the St. Paul and Northern Pacific Railroad tracks in 1907, the Regents pursued a new course of action. They decided to adopt a definite plan for the campus, and to secure an architect who would give an aesthetic as well as a practical solution for the problem. Although the University had been in existence for some forty years, the Regents first realized at that time that a general plan should have been adopted from the start. In 1908 the Regents authorized a competition to select an architect who would later prepare a plan by a method determined after the competition.



Minnesota Alumni Weekly

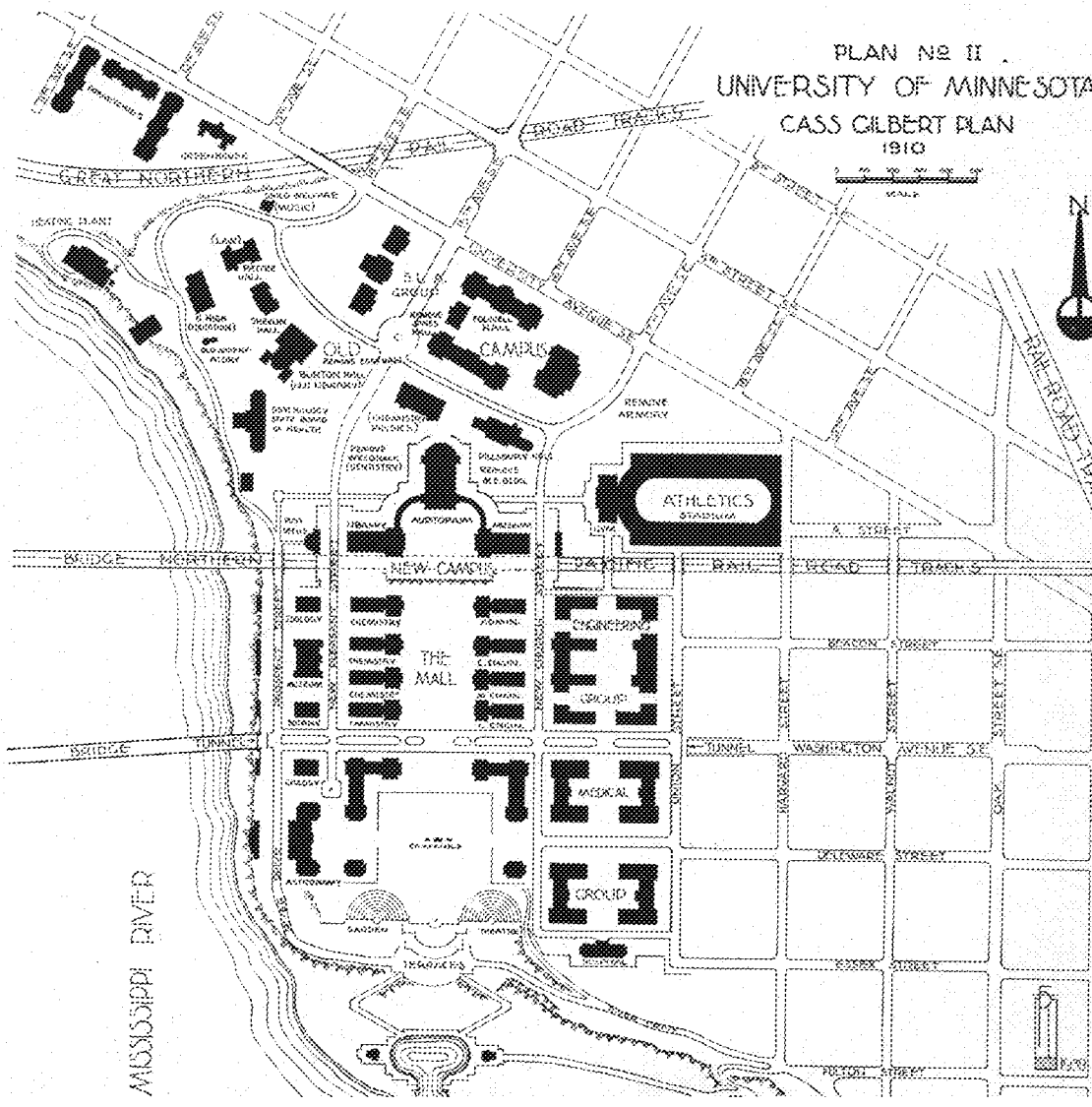
Architect's sketch of the new Minnesota Union which will close the south end of the mall.

First place in this competition was won by Cass Gilbert of St. Paul and New York, and second place by Dillon and Beadel of New York, with cash prizes of $1,000 and $500 respectively. The advisory board of architects who adjudicated the competition drawings was composed of some of the most eminent architects of America. There were Daniel H. Burnham of Chicago, Walter Cook of New York, and William M. Kenyon of Minneapolis.

Some interesting facts are embodied in the conditions of the competition. It was expressly stated that the winner of the competition was to house the University properly and suitably, though not expensively, in a plan which would unite the old and the new portions harmoniously. There was no guarantee that the winning architect's plans would ever be carried out or that he would be given the supervision of the actual working out of his plans or any buildings incident thereto. The first reason for this was that the University, being controlled by the State, was dependent upon legislative action for limited appropriations for the development of buildings and grounds. The second reason was that all University buildings were constructed under the State Board of Control, which employed its own architect.

By 1910 Cass Gilbert had completed his studies for the Greater University Plan. This plan (see Plan II) was quite different from his original competitive plan which featured a large domed structure to be known as the University Hall on the site now selected for the new Minnesota Union.

The Cass Gilbert plan for the campus called for the lowering and tunneling of Washington Avenue and of the Northern Pacific Railroad tracks under the new campus. It also called for some changes in the old campus which were later rejected in order to maintain some of the fine open spaces prevalent there until recent years. The new campus was to be separated from the old by a terrace, and many of the old streets had to be relocated to conform to the new plan. The main feature of the new



campus was to be a mall with a large auditorium at the upper or north end and buildings on either side sweeping down toward the river. Because of the uncertain and problematical growth of the University, many of the buildings were not assigned to any one department. Buildings definitely called for were a post office, library, auditorium, museums, and zoology, botany, geology, astronomical, administrative and engineering buildings.

The plan on a whole was arranged so as to group the major divisions of the University into definite localities. On the Oak Street side of the mall were to be the medicine, engineering, and athletics buildings. Although Gilbert's plan called for some of the engineering buildings to be located on the mall, this idea was later rejected for one in which only buildings housing functions vital to the entire University were to be incorporated on the mall.

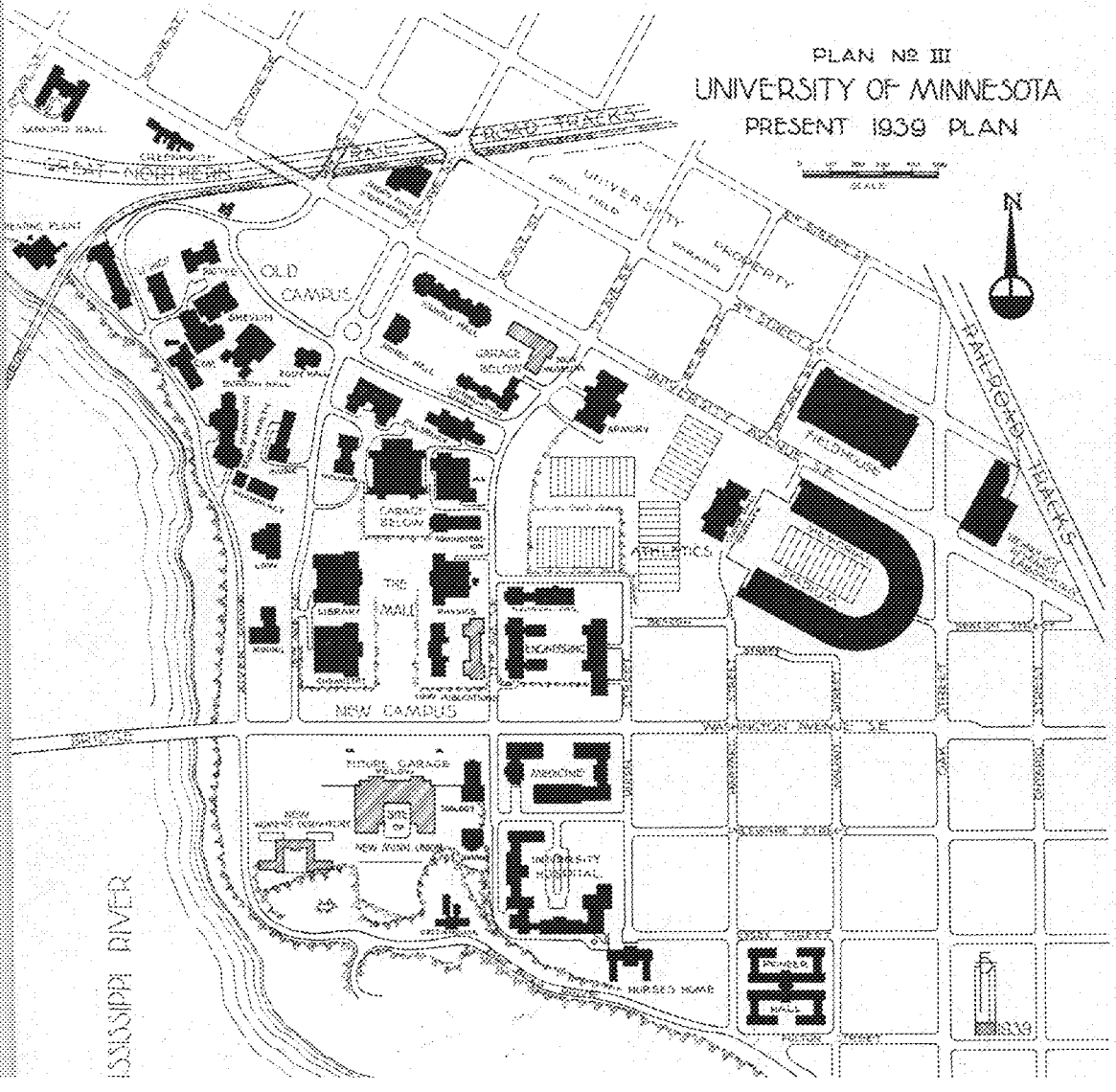
The structures on the river side of the mall buildings were to be given over to the smaller departments or schools. His plan also called for an elaborate treatment of the grounds from the end of the mall to the river. Here he utilized a terraced botanical garden and a Greek open-air theatre to complete the transition. On the river bank itself he proposed a lagoon and boat houses for small sailing vessels and other craft. The whole was to be united by grand staircases, walks, promenades, and landscaping. At the lower end of the mall and on a cross axis of the medical group was a site for a campanile. This is the site now selected for the new Union.

After the completion of this set of plans, Cass Gilbert was dismissed by the Regents because his plans were considered too expensive to serve the University as a scheme of development. Few individuals could foresee that in thirty years the campus would reach a state in which the plans prepared by Cass Gilbert would seem inadequate to meet the growing demands of the institution. At once the Regents began searching for another architect to take Mr. Gilbert's place, and that same year Edwin H. Hewitt was appointed to pick up the Greater University Plan where Cass Gilbert had laid it down. At this time the faculty, with its training in engineering and architecture, was considered by the Regents to have the ability to supervise the carrying out of the campus plans. Immediately the Cass Gilbert plan became a focal point for attack. The amount of space allotted to the Elliot Hospital was criticized by the medical faculty as being too small for the functions of that department, and the Regents decided in one stroke that the whole medical group of buildings was to be disarranged.

Greater Expansion Began in 1911

About this time C. H. Johnston and E. H. Hewitt settled the differences in the medical group and the Regents backed them by demanding adherence to the Cass Gilbert plan. In 1911 the University began its period of greater expansion with the building of the Elliot Memorial Hospital, experimental engineering building, main engineering building, anatomy building, the present Millard Hall, and the chemistry building. Surprisingly enough, the original plans of Cass Gilbert with minor modifications were the accepted guides for this construction. The main engineering building was erected within five feet of its original assigned position, and even the general dimensions of the original building on the Cass Gilbert plan were followed. The chemistry building deviated from the Cass Gilbert plan in that two of the buildings originally called for were united to form one large unit. This was to obtain greater efficiency in the School of Chemistry, but it put a barrier across one of the fine vistas.

One of the greatest handicaps in the development of plans for the campus had been the Northern Pacific Railroad tracks dividing the old campus and the new campus. Then in 1924 the Northern Pacific Railroad tracks were finally relocated, making it unnecessary to tunnel them under the campus mall. This allowed the expansion of the new campus to take place more freely. First Memorial Stadium was constructed, but not on lines laid down by the Cass Gilbert plan. Then Cyrus North-



rop Memorial Auditorium and other buildings followed. On the new campus were to be located only those buildings of importance to the entire University, and by this means the center of student life and activities was to be transferred from the old campus to the new. This is the major reason for the location of the new Minnesota Union at the end of the mall. Contingencies had been continuously arising, such as the burning of the School of Mines building and the rapid expansion of various departments due to modern social and economic trends. Under circumstances like this the campus has developed.

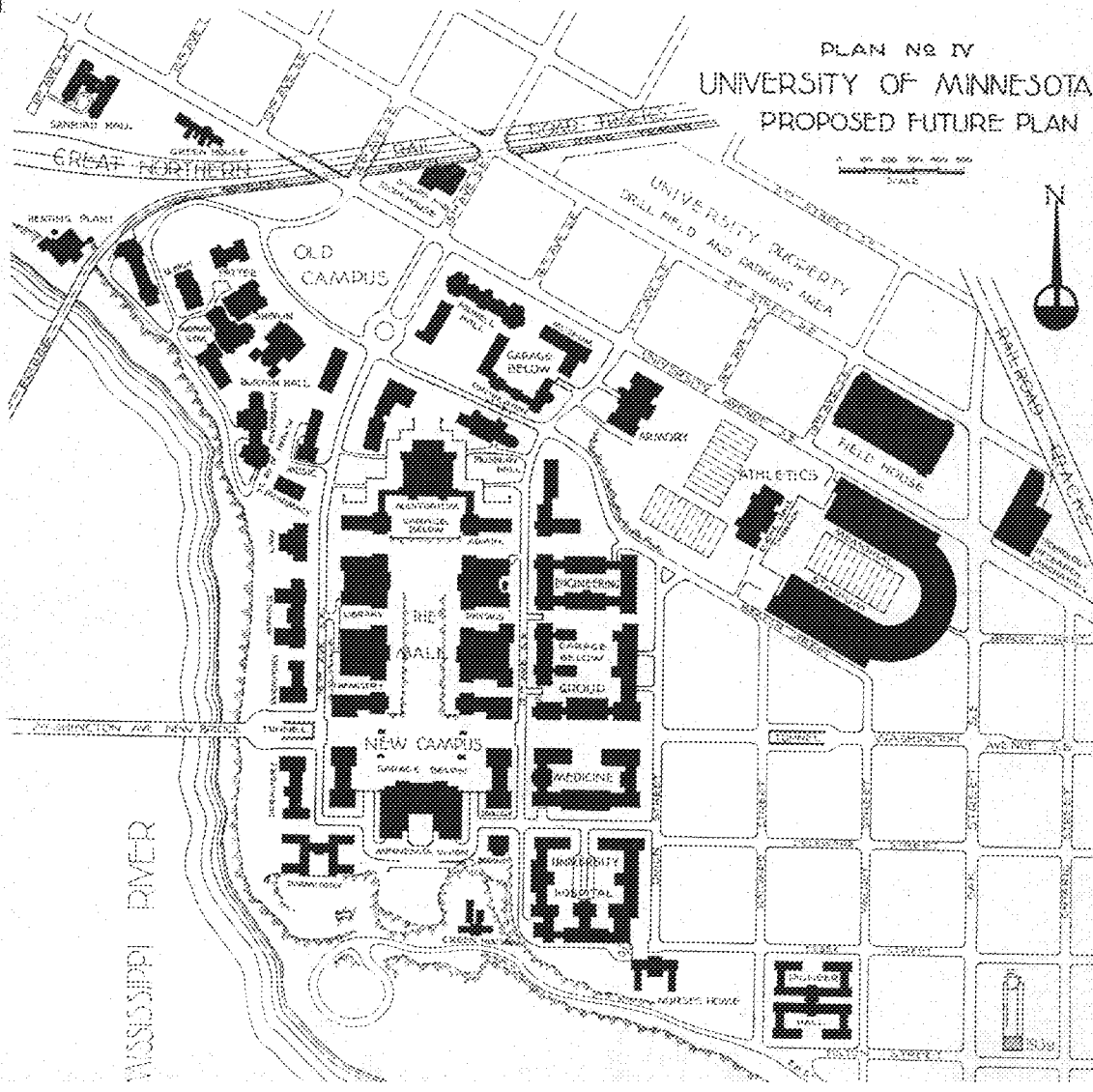
Future Plans Not Definite

The proposed future plan (see Plan IV) is in many respects a matter of conjecture. Many of the buildings shown in Plan IV have not yet been assigned. The various departments of the University will be assigned to these buildings according to their needs and to their logical location. For example, the building just south of the chemistry building will undoubtedly house chemical engineering when it is built, since chemical engineering needs a building of about that size and that is certainly the logical place to put it. The new Minnesota Union will provide a scheme of development for the lower end of the mall which as recently as 1930 lacked any definite detailed plan. The construction of a tunnel for Washington Avenue under the mall and a new bridge across the river will be an essential feature in the final completion of this scheme. Multi-story women's dormitories, to be located on each side of Washington Avenue at the end of the new river bridge, will act as entrance pylons to the University campus and serve as architectural features for the termination of the new bridge. Another probable development will be the erection of a skyscraper administrative unit for the University Hospital directly in front of the present Elliot Hospital building. Another possibility will be the creation of an underground garage in the courtyard of the main engineering group of buildings. Increased demands upon the capacity of Memorial Stadium such as have arisen during the past few years may result in the erection of another deck over the north and south wings of the present stadium. The demolition of a number of old buildings and the use of their sites for new buildings or to provide open areas for vistas is an essential feature of the Greater University Plan. Wesbrook Hall and the present mechanical engineering building have long been doomed under this plan. The straightening, removal, and relocation of a number of streets will be necessary for the final termination of any future scheme. In the main, any campus plan represents an approximation, especially in an institution whose growth has been extending over half a century. Strict adherence to set plans after a lapse of a quarter of a century of phenomenal development would not have resulted in a functional and organic plan.

A number of persons have been influential in the development of the campus. Although C. H. Johnston has been the architect for most of the campus buildings, Elliot Hospital was designed by Edwin H. Hewitt, Memorial Stadium by F. M. Mann, R. C. Jones, and Leon Arnal, and the New State Board of Health Building by William Ingemann. The plan of the campus by Cass Gilbert has been the underlying scheme for the present plan, the control of which lies in the hands of the Board of Regents.

James A. Forsythe served as consulting architect from 1920 to 1925, and Frederick M. Mann, from 1925 to 1936. Mr. K. C. Jones, the present consulting architect, is chiefly concerned with the designing of the new Union and the development of the lower end of the mall. Mr. Morell and Mr. Nichols are the landscape architects for the campus.

Politics, economics, and a swiftly moving world have all played their part in the acquisition of lands, funds, and buildings essential to the realization of the Greater University Plan. "A university is an active, vigorous, and dynamic institution if it is functioning properly," wrote L. D. Coffman, late president of the University. In no respect is this mirrored so clearly as in the architecture, the plans, and the development of the Greater University.



Research in the Institute

Sewage Disposal

DURING recent years in Minnesota, agitation by taxpayers and conservationists has made the need for a new and cheaper method of sewage treatment increasingly imperative. In the search for cheaper methods, several chemical processes of sewage disposal have been developed. Although these are relatively cheap, the degree of purification is in many cases too low. Dr. H. O. Halvorson of the department of bacteriology had this problem in mind when, five years ago, he began a study of biological methods of sewage treatment. Later, Dr. Piret of the department of chemical engineering coöperated with him on certain phases of the work.

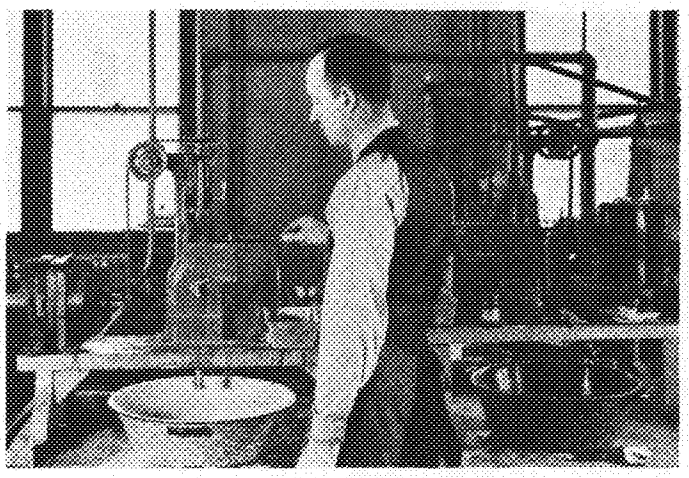
The most reliable and extensively used biological method of sewage treatment is the trickling filter. Sewage to be treated in such a plant is allowed to settle for two hours in a settling tank. Then the supernatant liquid is sprayed over the filter beds. These are gravel beds with bacteria growing on the pieces of gravel. The bacteria feed on the organic matter in the liquid, leaving it fairly clean. After settling in another tank, the liquid is pure enough to be disposed of in a lake or stream.

Since the bacteria in the filter need air to live, aeration is an important factor in trickling filter operation. Dr. Piret investigated aeration with a test filter and found that large temperature differences between the air and the filter resulted in good air circulation. In the spring and fall when temperature differences are small, the air flow often becomes too slow. Previous to the work of Dr. Halvorson and Dr. Piret, sanitary engineers generally believed that trickling filters should be operated intermittently in order to give the bacteria a rest. It was also believed that the maximum capacity of the filter was four million gallons per acre per day. However, the research done by Dr. Halvorson and his associates showed that the filter was just as efficient when operated full time. They also proved that although the filter clogged above a four million gallon dosage, the clogging materials were flushed out and high purification resulted when the application was increased to twenty million gallons. These discoveries are important because they have greatly decreased the cost of a trickling filter plant without decreasing the net purification.

Iron Ore Flotation

MOST of the beneficiated iron ore shipped from the northern Minnesota ranges is concentrated by washing with water to remove clay, sand, and other impurities. This washing process eliminates about 35 per cent of the original crude ore tonnage. All of this waste material or "tailing," is thrown away even though it contains about 22 per cent of iron. Professor John N. Searles of the department of metallurgy, School of Mines, has developed a process through several years of research for producing a merchantable concentrate from this waste product. The process embodies removing exceedingly fine clay or slime from the tailing and concentrating the deslimed material by means of flotation.

The tailings from the washer pass into the desliming unit or hydroseparator, which removes the small clay particles sticking to the iron ore. The separator is a large shallow cylindrical tank in which a current of water rises slowly from the bottom and flows over a circular launder at the top. The fine particles of clay, sand, and ore from the washer are fed into the center



Professor Searles completing a test run with a laboratory flotation machine.

of the tank. The current is just rapid enough to remove the fine clay and carry it off over the top of the tank, but slow enough to allow the iron ore and sand to settle to the bottom where they are removed.

From the desliming unit the ore and sand go to the flotation cells. The impure ore, suspended in about three times its weight of water, flows to the cells where definite amounts of sodium carbonate and oleic acid are added. The mixture is then agitated until a good froth forms. Air bubbles in the froth adhere to the particles of iron ore, causing them to float. The particles of sand sink to the bottom since no air bubbles become attached to them. The flotation takes place in two steps. The first step gives a clean tailing and a low grade concentrate. The latter is re-floated, giving a clean concentrate and tails still containing some recoverable iron. The tailings from this second step are returned to the first flotation unit along with the original feed. A closed circuit is thus established from which clean concentrates and tailings are removed.

The iron content of the ore which is floated off from the cells ranges from 55 to 60 per cent. This content is well above the average of 51.5 per cent for direct shipping ore from the Lake Superior district. The over-all recovery of iron from the original wash ore tailings is between 30 and 70 per cent, depending upon the particular sample of ore. It has been calculated that a 40 per cent recovery would warrant an expenditure of $85,000 for a flotation plant to treat wash ore tailings.

The particles of ore from the flotation cells are too small to be used in the blast furnace, and consequently,

they must be agglomerated by sintering or fusing them into large porous masses. This method is a standard process and offers no difficulties.

At present, Professor Searles is studying other flotation reagents and is making improvements on the desliming process. No definite plans for commercial application of the process have been made yet, but several ore-dressing concerns are interested in it.

Vitamin E

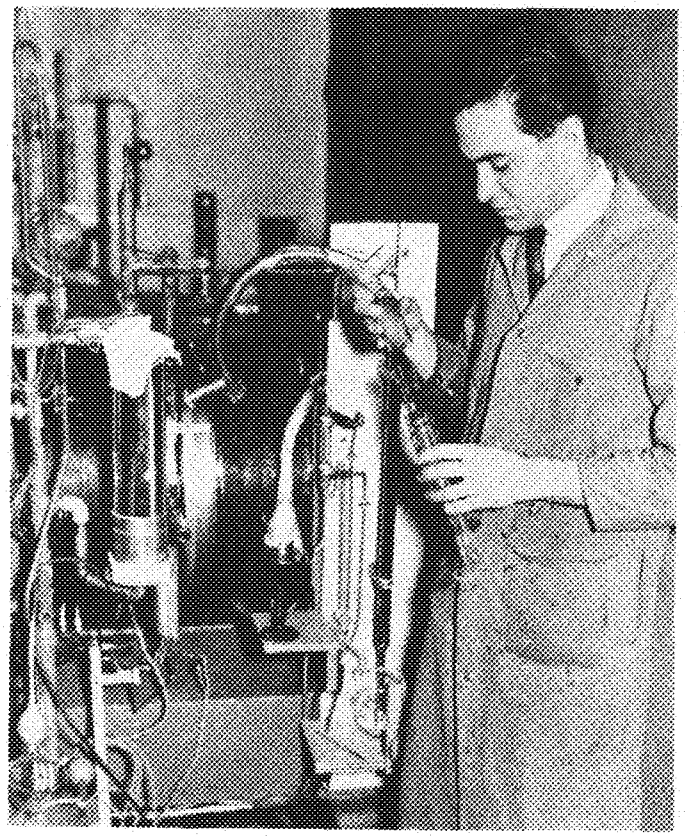
RESEARCH with vitamin E has always been hindered by the scarcity of the pure substance. Ever since its discovery scientists all over the world have been trying to synthesize it. The first success was reported just last year by Dr. Karrer, a Swiss scientist. Soon after this announcement, Dr. Smith, Dr. Unghade and Dr. Prichard of the department of chemistry, together with scientists at the University of California and the Merck and Company laboratories, decided to confirm and extend the work of the Swiss scientist. The synthetic work was done by Dr. Smith and his associates, and the work of testing the compound was done at the other two institutions.

Vitamin E is really a mixture of certain chemical compounds called alpha, beta, gamma, etc., tocopherols. Laboratory tests have shown that if the vitamin is removed from the diet of some animals, these animals develop sterility, and that if replaced in the diet, the animals regain their fertility. If vitamin E turns out to be the cure for sterility that these tests show it to be, it would not only have enormous value in human applications, but would be of great value to farmers, stock breeders, and poultry men in increasing the fertility of animals and fowl. Dr. Smith is negotiating at present with a well-known chemical firm and, if all goes smoothly, the vitamin may soon be available to research laboratories all over the United States.

Atomic Weights

PROFESSOR NEIR, of the physics department, has received a good deal of publicity lately about his work with isotopes and the mass-spectrometer. The newspapers, however, gave very little information about the apparatus or the actual work being done with it. Professor Neir has been working at Harvard University for the past three years with a mass spectrometer similar to the one he is using now. At Harvard he discovered two rare isotopes of calcium with molecular weights of 46 and 48. He also discovered osmium-184 potassium-40 and sulfur-36. At present he is beginning work to determine the relative abundance of beryllium-8. Determining the amounts of the various isotopes makes possible very accurate atomic weight determination.

The largest part of the two-ton mass-spectrometer which is used in this work is the electro-magnet capable of producing a 10,000 gauss field. The pole pieces of the magnet are steel discs one and a half feet in diameter, placed about two inches from each other. The spectrometer tube, one of the most important parts of the apparatus, is supported between these pole pieces. It is a piece of one-inch glass tubing bent to form a semi-circle. At one end of the tube electrons from a hot filament ionize the rarefied gas to be studied. A group of controlling and accelerating plates near the filament direct the ions through a slit in the end of a semi-circular copper tube fitted inside of the glass tube. The mass-spectrometer operates on the principle that all charged bodies moving under the influence of a magnetic field travel in curved paths. Their radii of curvature depend upon their mass, speed, and the strength of the magnetic field. If the gas to be studied contains isotopes, each isotope will have a different radius of curvature, depending on its weight, when the field strength and the ionic velocity are constant. Therefore, the field strength and the charge on the accelerating plates can be adjusted so that an ion of a certain weight will have the same radius of curvature as the copper tube. When these adjustments have been made, the ions which travel through the tube impinge upon a metal plate. In retrieving electrons, they



Professor Neir holding the ion source and the spectrometer tube. The vacuum pump and magnet are to the left.

produce a charge on the plate. This charge is impressed on the control grid of a very sensitive amplifying tube. The plate current of this tube is measured and the abundance of the isotope is computed.

Professor Neir has several projects in mind for future research. One of these is to alter the isotopic composition of carbon and use the changed element in the form of one of its compounds as a "tracer" atom for biological experiments. This research will probably be done in coöperation with the physiology department. Another project is to determine the relative abundance of isotopes 206 and 207 in the lead found in radioactive minerals. From this determination, Professor Neir can calculate the age of the earth.

The Minnesota Techno-Log

Vol. XIX February, 1939 No. 5

The New Union

RIGHT now the new Union is a subject being rather vigorously debated. Your attitude on the matter depends basically on your estimate of the value of organized social life to a University. If you are one of those who believes that the University should provide for the social needs of its students as completely as it does for their intellectual needs, then obviously you will support the new Union. If, however, you are a member of that group that feels that the University duty to its students consists solely in training minds, that each student should provide for his own social needs, then, of course, you will not back this project. But most of you probably belong to that large in-between group of persons who feel that both mental training and social life are a necessary part of a University but are a little confused as to what their proper proportion is. I ask those of you who are in this state of mind to consider these basic facts before you make any decision on the matter.

The active movement for a new Union started in 1936 when over 100 student organizations petitioned the late President Coffman to provide an adequate center for campus activities.

The new Union is not using up funds that might otherwise be devoted to extending our educational facilities. Of the total cost of $1,975,000, only $400,000 is coming from the University's funds. This money, which is made up of profits from the athletic department and the various several enterprises, could never, by a rigid University policy of long standing, be devoted to the improvement of an individual department.

I ask those of you who are in favor of the Union in principle but are objecting to it because the ballroom is too large (or too small), there are too many lounges (or too few) or the architecture is too modern (or too old style) to consider this fact: The Union, its plans, and its location have been the subject of much careful consideration and study on the part of its planners. It has been designed to incorporate the features that have been most popular at other Unions throughout the country. Obviously in the planning of such a building you can't please everyone, so if you are basically in favor of the Union please consider this and don't oppose it because some minor detail doesn't suit you.

WILSON BROWN, C.E. '39.

William T. Ryan

NO Man is indispensable or irreplaceable, but with the sudden passing of Professor William T. Ryan, the electrical engineering department, and the Institute of Technology, lost one of their most respected and well-liked leaders. To the last he seemed as young and nervously active as ever.

Professor Ryan had been a part of the electrical engineering department practically all his life. When, in 1905, he graduated and became an instructor, electrical engineering in general, as well as the electrical engineering department, was in its infancy. Professor Ryan was the last of three men (the others being Shepardson and Springer) who can be said to have built and framed the policies of the electrical engineering department.

Professor Ryan served the University in many capacities outside the classroom, acting on numerous boards and committees. His professional activities were extensive, including such positions as Vice President, A.I.E.E., 1928-29; Adviser to Engineering Department, Minnesota Tax Commission, 1923 to date; President, the Engineers Club of Minneapolis, 1923; President, Minnesota Federation of Architectural and Engineering Societies, 1925; full member of A.I.E.E.; and several others.

It was always a great source of pleasure to him to meet and talk with his many graduates at various society meetings around the country. Having no children of his own, he took a paternal interest in "his boys," the men that he taught and guided through college. His greatest thrill was to find, in his class, a man who was the son of one of his former "boys."

We will always remember Professor Ryan as a genial, smiling, interested, well-liked and diplomatic man; as an emphatic, active, and entertaining speaker. He left his mark on a great many students during his long teaching career. His passing leaves "his boys" with a sense of a real loss.

Modern Physics Simplified

Do you have "a complete lack of any concrete knowledge of physics and mathematics?" If so, you can qualify as the perfect reader for "The Evolution of Physics" by Einstein and Infeld, reviewed below. However, such a condition will definitely not exist when you have finished the book.

By C. I. Haga
Instructor in English

"THE Evolution of Physics," by Albert Einstein and Leopold Infeld, is an inviting and encouraging book to read. It is made inviting by the authors' modest disavowal of writing "a systematic course in elementary physical facts and theories." Instead they describe "the attempts of the human mind to find a connection between the world of ideas and the world of phenomena," and "the active forces which compel science to invent ideas corresponding to the reality of our world." Attracted by the simplicity with which the purpose is defined, one is encouraged in equal degree by the neat specifications the authors give for their ideal reader. In addition to "a complete lack of any concrete knowledge of physics and mathematics," he need have only interest, patience, and application.

It is well to emphasize this modesty of the authors, for legend has clothed the name of Einstein with connotations of an abstruseness and a profundity which place his ideas beyond sharing by ordinary men. Let us not get the impression that this is Einstein explaining Einstein. It is more than an illumination of a single problem in physics. Although its title reads "physics" and its matter is the data of physics, I find that the book explains the working of the human mind to the same degree as it measures the progress of physics.

The Evolution Proceeded in Four Stages

By simplifying their history, the authors picture in four chapters as many stages of evolution: The Rise of the Mechanical View; The Decline of the Mechanical View; Field, Relativity; and Quanta. In the beginning, physics emphasized substance and its goal was prediction, but now its increasing acuity of intuition and experiment has so refined the phenomena studied that individuals are no longer observable and only statistical probabilities are measurable. In the past, common sense and common-sense experience were not entirely unrelated to the results of even the most refined analysis. Today, in describing a world of the incredibly small measure by quantities whose order of magnitudes defies telling, modern physics baffles and confuses those who once found it so easy to move with Newton from falling apples to science. The layman's loss of confidence in his power to share the scientist's triumphs in correlating reality and ideas is a sad loss. Any means of restoring that confidence, any illumination bright enough to blot out the confusing detail of observations and calculations—any and all such efforts are now as necessary to our minds as light and air are to our bodies.

This general problem of the function of modern science—its purposes, methods, and values—in the life of men is what most clearly emerges as one considers the success of "The Evolution of Physics." It succeeds not by placing in the reader's hand the formulæ of physics, not by instructing him in the art of performing experiments, but by informing him of the organization of intellectual activity. By showing the mind at work, it enlists both the admiration and the sympathy of the reader. Given even a germ of sympathy and the right to participation such a feeling establishes, the layman can feel growing that confidence he seeks.

An Informal Reading Program

Consequently, since I seldom think of a book as an isolated device for killing time (at least not publicly and officially), I find "The Evolution of Physics" tempting me to sketch an informal reading program. One reading program that suggests itself is concerned with what I have called the general problem of permitting the layman to share in the adventure of science. The books I have in mind are not the De Kruif sagas of fancy and frenzy, but those which aim higher by trying to relate the specialized activity of science to the great problem of human living and thinking. Call it philosophical or call it historical—in fact, call this point of view what you will—any person knows that it is in such terms that he must describe the quest of that integrating spirit in which he may gather into himself all that the world can offer.

Taking the clue offered by this book in emphasizing intellectual activity, we can find in Henri Poincare's "The Foundations of Science" a well-titled introduction to the nature and the results of the mind at work. Shorter, simpler, and less tiring, H. Levy's "The Universe of Science" leads the reader to a fruitful examination of the link between science and society. This hint of the social power and responsibility of science will make more tempting (and more forgiveable) the violence and heat of Hogben's "Retreat from Reason," a ripsnorting revival sermon anathematizing the moral and intellectual shortcomings of our political and economic masters. One aspect of Hogben's proposals (sounded earlier and as vigorously in Soddy's "Science and Life") can be studied in the specialized and local Russian interpretation of "Science at the Crossroads." Should this taste of science diluted by Marxist dogma make science seem over-weening, there is the calm criticism of J. W. N. Sullivan's "The Limitations of Science" to serve as a healthful antidote. But the technique of critical evaluation, of weighing and shaping ideas, is specifically the philosopher's task. Therefore I abruptly conclude this informal, meandering list with Santayana's "Reason in Science," whose stimulating ideas are illuminated by a style unmatched by that of any other commentator on the rough-and-tumble adventure called science.

ALUMNOTES

'00

John G. Flynn, E.M., 1900, died at Bisbee, Arizona, December 15, 1938. Mr. Flynn was a guard on Dr. Williams' first Minnesota team, and during his third year on the team was captain. At the time of his death he was general manager of the Shattuck, Denn Corporation at Bisbee.

'26

Dr. Harold Bunger, Chem. Eng. (Ph.D. '35), is head of the chemical engineering department of the Georgia School of Technology. Dr. Bunger will return next summer to teach a course in chemical manufacture. He was formerly with the Hercules Powder Co.

'27

John Beal, Chem. E. (Ph.D. '34), is an associate professor of chemical engineering at Montana State College. Dr. Beal was formerly at the Goodrich Rubber Co. He also taught at Iowa for several years.

'31

George H. Taft, Chem., former editor of the TECHNO-LOG ('31), is now located at Cuyahoga Falls, in Ohio. He is with the Koroseal development division of the B. F. Goodrich Co. of Akron. Koroseal is a new plastic material. Working with him are two other Minnesota graduates, **Don Benson**, Ch. E. ('30), and **Archie Japs**, Ch. E. ('33).

'34

The Civil Engineers of '34 recently met for their annual reunion. Following a dinner, there ensued a free-for-all discussion of old times, present employment, and personalities. It is encouraging to note that all members of the class are employed in engineering or allied work. Among those who attended from the Twin Cities were: **Philip Kilpatrick, Robert Fefferman, Harry Mayeron**, and **Lewis Martin**. Also present were **Fred Haverland** from Winebago, Nebraska; and **Wallace Gruenhagen**, Rock Island, Ill.

Ernest Olsen, Ag. Eng., is with the Oliver Farm Equipment Company in Springfield, Ohio. He is in charge of time study, processing, cost reduction, and analysis of new machines from a cost standpoint.

'35

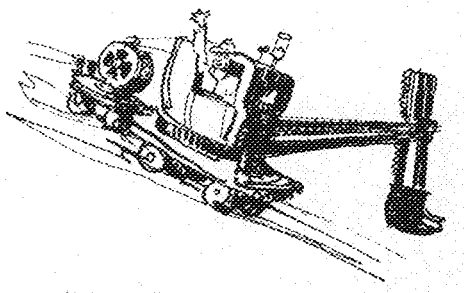
William J. Promersberger, Ag. E., is an assistant professor of agricultural engineering at the North Dakota State Agricultural College in Fargo, N. D. He was married last year.

Willis R. Swanson, Ag. E., is a junior engineer for the division of structures, U. S. Department of Agriculture. His work consists of experimental grain storage studies in Kansas and Iowa. Willis says he still has two hobbies—pictures and sound. Being a little cramped for space he uses the closet as a dark room, the bath tub for solutions, and the front door for the motion picture screen. His office is in Ames, Iowa.

Ernest H. Kidder, Ag. E., is with the Soil Conservation Service in Plainview, Minnesota. He is in charge of writing up coöperative agreements and the execution of plans on the coöperation farms.

'36

Russell Cornell, C.E. (M.S. '38), is now teaching in the civil engineering department at Columbia University.



William Schoell, C.E., was in to visit Professor Zelner recently. William was leaving to accept a job with the U. S. Engineers at Baltimore. He was appointed through the Civil Service Commission. At Baltimore he will work on flood control. **Loren Frickland**, C.E. ('37), works in the same office.

Robert Currie, Ag. E., is a student engineer with the Allis Chalmers Manufacturing Co. In the school he visits various plant works in the shops and engineering departments, and becomes generally acquainted with the company. Within a few months he will be trained to enter either sales, engineering, or production service with the company.

'37

Frank Sandgren, Aero. E., will become an instructor in the department of aeronautical engineering at New York University in University Heights, New York. Frank is to begin his new job February 1, 1939. During the past year he has been studying here, and he hopes to receive his master's degree before leaving for New York.

'38

Donald Scott, Mines, is now working on a fellowship from the United States Bureau of Mines. He is stationed in Tuscaloosa, Alabama.

Phillip E. Carlson, Chem. E., is with the Twin Cities Sanitary Commission and is working at the sewage plant on Pig's Eye Island.

John C. Georgian, M.E., visited the M.E. office during the Christmas holidays. He got married here during the holidays.

Howard Nordquist, Met. E., and **Sam Millunchick**, Met. E., are employed by the Inland Steel Company. Nordquist works in the open hearth department and Millunchick in the new high speed rolling mill.

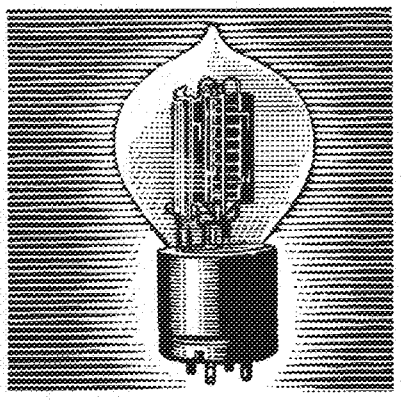
The following were visitors at the School of Mines during the Christmas holidays: **Roland Erickson**, E.M. '30; **Harlan Christensen**, E.M. '37; **Harry Caldwell**, Met. E. '34; **John Edwin**, E.M. '20; **Adolph Scheid**, Met. E. '23; **George Russe**, E.M. '34; **Orville Lundstrom**, E.M. '38; **Howard Eilers**, Met. E. '3; **Ray Dervey**, E.M. '38, **Charles Durham** E.M. '35; **Robert Rasmusse** E.M. '38; **Donald Scott** E.M. '38.

RIGHT OR WRONG?

A 2-minute test for telephone users

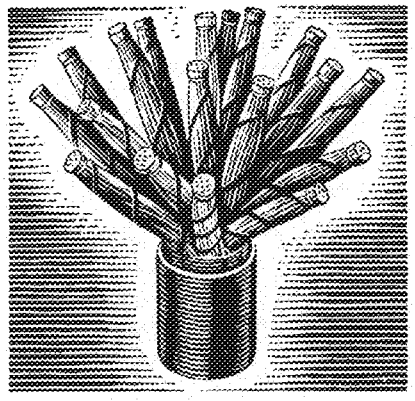
1. The Bell System handles about 48,000 telephone calls per minute, on the average.

RIGHT ☐ **WRONG** ☐



2. One of the first uses of vacuum tubes was in telephony — years before commercial radio telephony.

RIGHT ☐ **WRONG** ☐

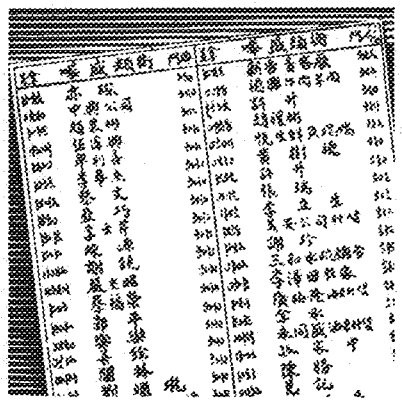


3. The largest telephone cable used by the Bell System contains 2424 wires.

RIGHT ☐ **WRONG** ☐

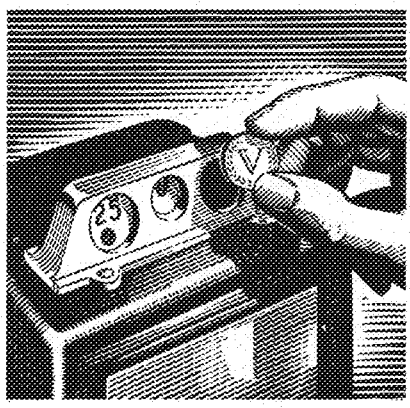
4. The Bell System employs about as many people as live in the city of Dayton, Ohio.

RIGHT ☐ **WRONG** ☐



5. This is part of a page taken from a telephone directory published in the United States.

RIGHT ☐ **WRONG** ☐



6. Lowest rates to most out-of-town points are available every night after 7 P.M. and all day Sunday.

RIGHT ☐ **WRONG** ☐

ANSWERS

1. *Right.* In 1938 the average number of calls per day was about 70 million.

2. *Right.* The repeater tube, which makes possible long distance telephony, was first used in 1913.

3. *Wrong.* 3636 wires are packed into a cable about the size of a man's wrist.

4. *Wrong.* The population of Dayton is about 200,000 — while there are nearly 300,000 telephone employees.

5. *Right.* It is from San Francisco's Chinatown telephone directory.

6. *Right.* Why not telephone family and distant friends oftener?

AMERICAN TELEPHONE & TELEGRAPH CO. BELL SYSTEM 130 ASSOCIATED COMPANIES

BELL TELEPHONE SYSTEM

FACULTY SKETCH

By C. Vernon Olson, E.E.B. '40

Professor J. M. Bryant

Head of the Department of Electrical Engineering.

BEING head of the University of Minnesota's highly rated department of electrical engineering is a far cry from Professor Bryant's first professional job. It was in 1901, upon graduation, that he worked for General Electric on the test floor and in the drafting room at the rate of 12½ cents per hour, ten hours a day.

A few years later he left to take a teaching job. During the thirty-six years since then, Professor Bryant has been moulding the minds of students. He feels that teaching has a reward which industry doesn't offer. In production one's product must merely meet specifications, but in teaching one's product (students) has volition of itself and a gratifying way of achieving things.

Professor Bryant's life has always been a full and active one as evidenced by the amount of space given to John Myron Bryant in various publications such as "Who's Who in Engineering," and "Who's Who in America." He is a past Director of the A.I.E.E. and the Society for Promotion of Engineering Education, a member of the A.I.E.E., Illuminating Engineering Society, A.A.A.S., S.P.E.E., A.A.U.P., Sigma Xi, Tau Beta Pi, Eta Kappa Nu (Hon.), Kappa Eta Kappa, the Mason and Shrine organizations, and the Minneapolis Engineers' Club.

The present governmental project to teach flying at a number of universities around the country brings back vivid memories to Professor Bryant. He had an especially important and interesting job during the war as the head of the United States Army School of Military Aeronautics at the University of Texas. Though he started out in a small office doing his own typing, when the war ended he had an $8,000,000 business and had trained 14,000 men, of whom 6,000 were pilots. (Who said that an electrical engineer can do nothing but electrical engineering?)

In 1925 Professor Bryant returned to General Electric for four years to help develop the advanced course given to promising young engineers in the company, and to work out certain machine development research problems.

It was eleven years ago (1928) that Professor Bryant gave up his job as head of the university's electrical engineering department in sunny Texas to brave the wintry blasts on the University of Minnesota campus. We're glad he did.

TECH NEWS

Scientific Housing

The twelfth annual series of Sigma Xi lectures is being given by the University faculty members of the society. The topic of the series this year is "Man and His House."

Professor Roy Jones opened the series Friday, Feb. 3, with a discussion, "Every Man's House." He was followed by Professor Frank B. Rowley on Friday, Feb. 10, with "Housing and Climate." This Friday, Feb. 17, Professor Robert T. Jones will discuss the subject: "Housing and the Expanding City." Professor Frederic Bass will close the series, Friday, Feb. 24, with "Housing and the Construction Industry."

These lectures are held in Northrop Auditorium at 8:15 p. m. The Minnesota Symphony Orchestra entertains for a half hour preceding each lecture.

Ag.E.'s Hold Banquet

Besides the regular monthly meeting, the A.S.A.E. features this month a student sponsored, student-faculty party, to be held in the farm campus Union, February 24. This party will give the freshmen an opportunity to meet the upper-classmen and the professors.

The department of agricultural engineering in the Institute is active in research work on the Ag. Campus. E. G. Carlson, a graduate student from Utah State College, is making an investigation of the relation of the stable granular structure of soils to the erosability of soils. Stewart Forsaith is making a study of heat conductivity in peat soils. Philip Manson is investigating the effect of the drainage properties of soil on root development. D. G. Miller, of the U. S. Department of Agriculture, is coöperating with the agricultural engineering department to determine the effect of acids on cement stave silos. Joseph K. Parks, instructor in agricultural engineering, spoke at the Red River Valley Winter Show and Northwest Farmers' Week, February 10, on "Water Supply and Irrigation in Northwestern Minnesota."

A.S.M.E. Holds Bean Feed

The recent A.S.M.E. bean feed drew one of the most successful turnouts of the year. The program was composed entirely of local talent. Professor Shoop, famous campus magician, was the major attraction of the evening. He defied Professor Erickson's physical phenomena, much to the amusement of those present. From an entertainment standpoint he was ably assisted by Professor J. J. Ryan. Reuben Olson, senior M.E., who plays occasionally with the Minneapolis Symphony, was vigorously applauded for his popular renditions on the ocarina (sweet-potato). Each faculty member was called on to tell his favorite joke; some very spicy offerings resulted. Movies, including a Donald Duck comedy, completed the program of fun. One hundred and twenty students and faculty members were served.

Engineers' Day Coming

Juniors—though Engineers' Day seems a long way off it is not too early to start thinking about it. The junior class will be put in charge of the whole show. The Tech Commission will be asking candidates for the chairmanship to submit their platforms soon. Start thinking now, you'll have to go some to beat last year's show!

Employment Conference

Seniors in the Institute of Technology will have their last chance to obtain first hand information and advice from prominent personnel men about what industry expects of them at 1:45, Thursday afternoon, February 16. At that time the final meeting in the series of employment discussions which have been held this quarter will be held in the auditorium of the physics building. Two very prominent personnel men from the East will be present to give talks and lead the discussions. The first speaker will be Mr. M. J. Maiers of the Commonwealth Edison Company who will speak on, "The Adjustment of the Young Technical Graduate to Industry." Mr. Maiers is well qualified to speak to the seniors. He took his electrical engineering degree at the Milwaukee School of Engineering following which he spent one year with the Milwaukee Light and Electric Railway Company. Mr. Maiers taught engineering courses for two years at the Milwaukee Engineering School, and from there went to the Chicago Central Station Institute, a subsidiary of Commonwealth Edison. For the past two years he has been on the executive committee of that company and has been visiting the University of Minnesota as an interviewer since 1925.

The second talk will be given by Mr. Kenneth R. Meade of General Motors Corporation on, "How Does Industry Select the Young Technical Graduate?" Mr. Meade is a graduate of Michigan State Normal College, and has a M.S. degree in physics at the University of Michigan. He was a teacher of physics and engineering mechanics at the General Motors Institute. Since that time he has been head of the physics department and, at present, is director of education and training in the research laboratories of General Motors.

All seniors should plan to attend this conference as these men are sure to present interesting and helpful viewpoints on employment problems and give advice that will be invaluable to them after graduation.

A.I.E.E. to View Movies

Movies produced by the General Electric Co. will be shown at the March 2 meeting of the A.I.E.E., according to Elmer Brickman, vice president, in charge of this event. This meeting is being planned entirely by the junior class. In addition to the General Electric movies, a Mickey Mouse short will be shown.

A short talk on the prize paper contest will be given by C. H. Nelson, chairman of the Minnesota branch of the A.I.E.E. The papers are due April 1, and Mr. Nelson will give much valuable information concerning the final writing of the papers.

An attempt is also being made to secure a magician to perform as the final feature of the program.

The student chapter of the A.I.E.E. inspected the electrical equipment at the Twin City Sewage Disposal plant and the Seeger Refrigeration Company. More trips are being planned for the rest of this quarter, according to Burton Wyman, chairman of the inspection trip committee.

Enlarged Laboratory

The completion of a new enlargement to the old laboratory has greatly increased the laboratory space in the metallurgy department of the School of Mines and Metallurgy. Increased enrollment in the past few years made the old laboratory space insufficient to accommodate adequately those who were enrolled in ferrous metallurgy. Frank W. Scott, instructor in ferrous metallurgy, designed the new addition and supervised the remodeling of the laboratory, which will be used mainly by seniors and graduate students.

Aero Take-Off Feb. 21

The ninth Annual Aero Take-Off will be held in the Minnesota Union Ballroom, February 21. Dancing will be from 9:30 p. m. to 1 a. m. at $1.10 per couple. Freddy Rick's or-

chestra will swing it. Stan Church and Elmer Hollar are general chairmen of the dance, which is sponsored by the Minnesota Flying Club and the Institute of Aeronautical Sciences.

Metals Society Meeting

The third meeting of the educational course conducted by the American Society for Metals was held Tuesday, January 31, in the chemistry auditorium. Dr. G. H. Montillon gave a lecture on corrosion control. The remaining seven meetings of the course will take up the subjects of welding, plastics, hardening of metals, cast iron, and several other topics of practical value to shopmen, welders, steel workers, foremen, and engineers.

Committeemen Chosen

Committeemen for the Electrical Show to be held April 21 and 22 are now being chosen by the chairman, Dick Rebmann. There are still numerous positions open. Interested applicants should see Dick in his office, room 124, in the electrical engineering building.

A.I.Ch.E. Banquet

The Annual Chemistry Banquet, sponsored by the student chapter of the A.I.Ch.E., was held Tuesday evening, January 31. Dr. Rogers, toastmaster for the evening, introduced the heads of the various departments in the School of Chemistry, who, in turn, introduced their respective staffs. Dr. J. Morrell, past chairman of the Chicago chapter of the A.C.S., gave a very interesting talk on "Recent Developments in the Chemistry of Hydrocarbons" based on his experiences in the research department of the Universal Oil Products Co.

Two skits by the senior and junior classes, an impersonation by George L. Johnson, and group singing led by Bob Logan, provided additional entertainment.

The membership drive, with George MacDougall as chairman, was very successful, and the paid membership was raised from 80 to 165.

The banquet was a success in all phases, due to the very fine coöperation of those working on committees under the leadership of Eben Finger. The attendance was 230.

Other men who worked on the banquet and membership committees were: John Shannon, Bill Mitchell, Don Swan, and Martin Farkas.

Miners' Shindig Feb. 18

The Miners' Shindig, dance sponsored annually by the School of Mines Society, will be held next Saturday, February 18, at the Dyckman Hotel. Chairmen of the committees are: general arrangements, Don Johnson; invitations, Homer Anderson; orchestra, Ernie Andberg; tickets, Steve Purcell; and publicity, Harry Larson. Freddy Rick's orchestra will play.

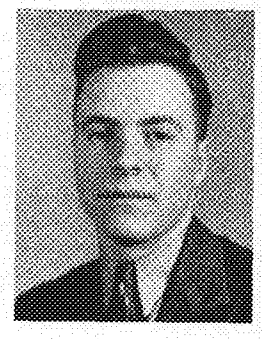
Geology Advances Discussed

Mr. Irving Levorson, a consulting petroleum geologist, spoke on the subject of frontiers in petroleum geology in the Engineering auditorium, Feb. 10. Mr. Levorson outlined five of the subjects which will be of most importance to oil prospectors in the future. The subjects were: the methods of soil gas analysis; the microscopic analysis of drillings; "layer cake" geology; ways of drilling exploratory holes quickly and cheaply; and the discovery of wedge-shaped formations of oil-bearing sand.

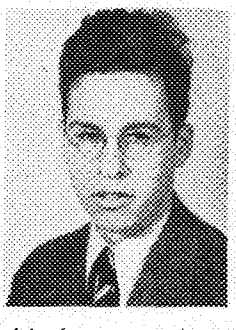
This Month's AUTHORS

By John Shannon, Ch.E. '40 Photos by G. A. Halseth, Ch. 40, and J. J. McBrady, Ch. '38

Francis Meisch, Arch. '39, delved into the records to uncover for us the history of the campus and its architectural plan in this issue. Francis, after being out of school last quarter, is returning to the campus and the TECHNO-LOG. He served as art adviser last year. He is a member of the Architectural Society, Comaccini, honorary society for architects, and Plumb Bob, senior honorary fraternity. He won the Horton Arts Scholarship two years ago and entered the Paris Prize competition last spring. Etching and water coloring occupy Francis' spare time (what he has of it). He is working his way through school, utilizing photography to help with his architectural problems. Graduate work at Massachusetts Institute of Technology will occupy his time after he is graduated at the end of winter quarter.



Alvin Isaacs, C. E. '41, is an old TECHNO-LOG standby, having written two articles previous to this month's—both of them connected with the sea, incidentally. In his latest effort he explains the Maritime Commission's plan for a new United States merchant marine. Alvin is a dyed in the wool seaman and has spent two years as a sailor during which he touched nearly every important country in the world. He got his A. B. papers but lacked the eyesight requirements to pass a mate's examination. Al lists navigation, writing, and hiking as his hobbies. He has hitch-hiked a total of 6,000 miles. He is a member of Sigma Alpha Sigma fraternity and now is trying to figure how to work his civil engineering training in with navigation when he graduates.



Donald McClure, Ch. '42, came all the way from Yonkers, N. Y., to enroll as a Freshman this fall. The fact that he has an uncle on the faculty helped him to choose Minnesota as the place for his scholastic endeavors. By the way, he puts his O.K. on Minnesota weather. Don snooped around the mines, physics, and chemical engineering departments this last month to give you the up-to-date information on Institute Research. This is his second attempt at writing the research news for us, having turned out the article in the December issue. He is a member of the M.S.C.S. and drops over to Cooke hall now and then to indulge in fencing and swimming. When Don graduates, he wants to be a physicist or research chemist.

To pace their memories with the speed of electrons, research engineers have perfected a machine that remembers. Called a memnoscope, it photographs any fleeting second of electrical behavior as shown on an oscillograph, which changes electrical waves to visual waves, together with a record of conditions before and after.

PICK AND PAN

By M. A. Troxell, Met.E. '39, and H. A. Larson, E.M. '39

Paul Cummings, the Inter-Pro kid, maintains that it considerably dampens one's ardor to arrive home in the incipient hours of the new day only to find the covers of one's bed adulterated with aqua pura. "At that time of the morning," said he, "I did not care to look water in the face, but with the aid of towels, imagination, and appropriate language I was able to toss off into a fretful sleep."

Being miners, we recommend the steady drip, drip, drip of water from the water chamber of a carbide lamp upon the countenance of the slumbering Ohman —perpetrator of the dastardly deed. 'Tis said that the drip of water will wear away the hardest rock.

A telephone girl of our acquaintance has been taking a census of the pestiferous palookas who, inspired by the current tune, call up and playfully ask for BRYANT 709. She merely informs them "There is no such number," but wouldn't it be interesting to be the hypothetical Annie in a hypothetical city with the hypothetical phone number BRYANT 709?

Figure this one out.

If we are not what we think we are, but we are what we think, then if we are what we think, what we think we are, we are, are we not?

Bob Wolfe—Guest Philosopher

Freshman English.

A hive is an apiary, an apiary is the home of bees, bees are very busy creatures, so when you have the hives, you are as busy as a bee.

"I'll get the devil for this," said Joe Geraci as he swiped half the angel food cake out of the icebox.

From the Sunday Journal: "There I lay in the bottom of a gondola on a canal, drinking it all in. Life never seemed so full before!"

"The other things I learned in Strength of Materials may fade away," discloses Verne Peterson, "but I'll never forget Ritter's Rational Relationship for Round Rigid Riveted Ratchet Wrenches!"

I metcha
Before, I betcha
Again. And just look
What I'd have been
If I hadn't
A metcha.
But when I metcha
I letcha,
And I betcha
If I metcha
Again, I'd letcha
I betcha.

Three men were out in a boat fishing. They had four cigarettes, but no matches. How did they manage to light their fags? Give up?

They threw one away and made the boat a cigarette lighter.

Mary had a pair of skates
And on the ice did frisk,
Don't you think she was foolish
*Her little *?*

BLOW OFFS AND SIDE SLIPS

By Don Frankel, Aero.E. '39, and Bob Wolfe, M.E. '39

I went over to the Health Service the other night to take the Pilot Training physical exam. Imagine my surprise when I saw our big husky engineers unstrap their wooden legs, remove their toupés, and unhook their false teeth. The doc's made us look like a bunch of overstressed toothpicks. The term "orthophoria" appeared on many of our sheets. I understand this means we are mildly insane. I vote that they change that beauteous brunette to some other department than pulse count.

It's been rumored that someone told a clean joke in the basement corridor of the E.E. building.

(Ed. note: Somebody tell it to Wolfe or Frankel. They have to get something past the blue pencil.)

At last we have discovered the secret of becoming a genius: but have decided to remain in the more common lower bracket. Between the halves at one of the basketball games, we had the pleasure of watching one of our beloved instructors in structural engineering work problems from a book entitled "The Functions of the Complex Variable." It certainly takes all kinds of people to make a faculty.

OPHER GOOEY

Opher Gooey was his name,
A little worm was he,
He sat upon the railroad track,
The train he did not see—
Opher Gooey!

At a recent session of the marriage course, the following question was asked, "Is it true that 'opposites' form a happier married couple?" Herb Gaustad, A.S.C.E. pres., explained, "They gotta be; it just wouldn't be any fun if they were both men or both women."

Prof. Robertson, in an internal combustion class, asked if there was any external work done when a gas expands by a non-reversible adiabatic process. Bill Snyder, M.E. '39, replied that it compressed the atmosphere. We think he's right but we will leave it up to him to find a method of reclaiming that pressure energy.

We were amused by this table heading for some statistical data as it appeared in the 1938 World Almanac. The heading read: "Persons gainfully occupied, by sex." It just goes to show that punctuation is very important at times.

Prof. Koepke's class in time and motion studies made an inspection trip to Mueller Tube and Box Co. The boys gathered a half page of notes and two pages of telephone numbers. The popularity of the campus coeds seems to be getting even lower.

Mother: "Has Sir Gordan asked for thine hand in wedlock yet, my dear?"
Daughter: "No, but the knight is still young."

FEBRUARY WISDOM

They've about taken the horse out of warfare, why not the human beings?

•

Democracies advance by a process of trial and error; dictatorships by trail and terror.

•

The Bible says "Eat, drink, and be merry," but it doesn't say over-eat, over-drink, or over-marry.

•

Tell me,
For goodness sakes,
Why night falls
But never breaks,
Then when next
The sun calls—
Why day breaks
But never falls!

•

We used to want to make the world safe for Democracy—now we want to make it bomb-proof.

•

At a railroad station you take a train. But try to take something from an oil station!

No Third Term
Upon our soil;
But what a lot
Of Third Termoil.

•

The Republicans might beat the New Deal with a New Ideal.

•

The new nickel shows Mr. Jefferson looking left.

•

There would be more just nations, were there more "just folks."

•

"I'm living the life of Riley,"
Said he with the bread and beef
Which was easy
to see through
For he knew
That I knew
That Riley is on relief!

•

It isn't the highways that bother us, it's the driver's ways.

— A page plucked from the pocket-size COMPANY MAGAZINE of the

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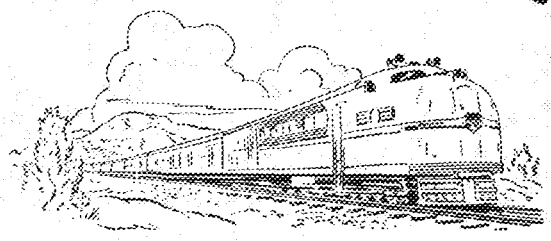
G-E Campus News

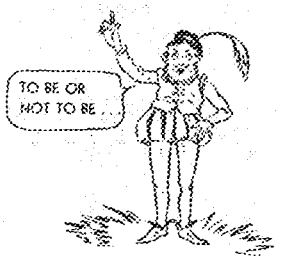


NEW-TYPE STREAMLINER

A NEW-TYPE 125-mile-an-hour streamliner—the 5000 horsepower steam-electric train now being put through its final tests by G-E engineers—soon will be speeding on its first westward run over the Union Pacific's historic "Overland Route."

Nearly two years have been spent by General Electric and Union Pacific engineers in designing and building the streamliner. The result is that the power plant of the new train is capable of doing twice the work of a conventional steam locomotive for each pound of fuel used, and of making three times the mileage without stopping for fuel or water. Six large motors in each of the two cabs drive the locomotive, the electricity being supplied by a geared turbine-electric generating unit similar to those used on many ships.

As the new 15-car streamliner speeds between Chicago and the Pacific Coast, at times winding through passes more than 7000 feet above sea level, it will be another symbol of the constant search by General Electric's transportation engineers for more efficient means of travel. This search is one in which the engineer with years of experience gives invaluable training to the Test men—young student engineers recently graduated from college—who assist him.

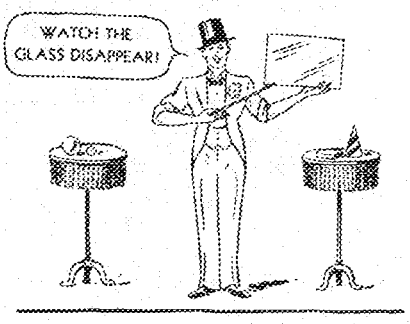


TELEVISION AT THE NEW YORK WORLD'S FAIR

IF YOU have a favorite line or two from Kipling or a famous Shakespearean speech you like to give now and then, consider the *ne plus ultra* of settings for the presentation—a complete television studio, with an audience as standard equipment, recently announced by Dr. W. R. G. Baker, Union '16, managing engineer of the General Electric radio division and an ex-Test man.

For you are invited to turn actor in the G-E building at "The World of Tomorrow," the New York World's Fair. At your service will be a program director, who will initiate you into the experience of acting before the camera, and complete television equipment of the latest design—receivers, camera, transmitter. And between acts you will be able to see and listen to programs that are being broadcast by television stations throughout the New York area.

Demonstrating television to the public is not new to General Electric engineers. Nine years ago, Dr. E. F. W. Alexanderson—one of the G-E consulting engineers and an ex-Test man—and his assistants demonstrated television to a theater audience in Schenectady. But great advances have been made since then, and when you act for your friends at New York you will be using the latest equipment that science has to offer.



NOW YOU SEE IT—NOW YOU DON'T

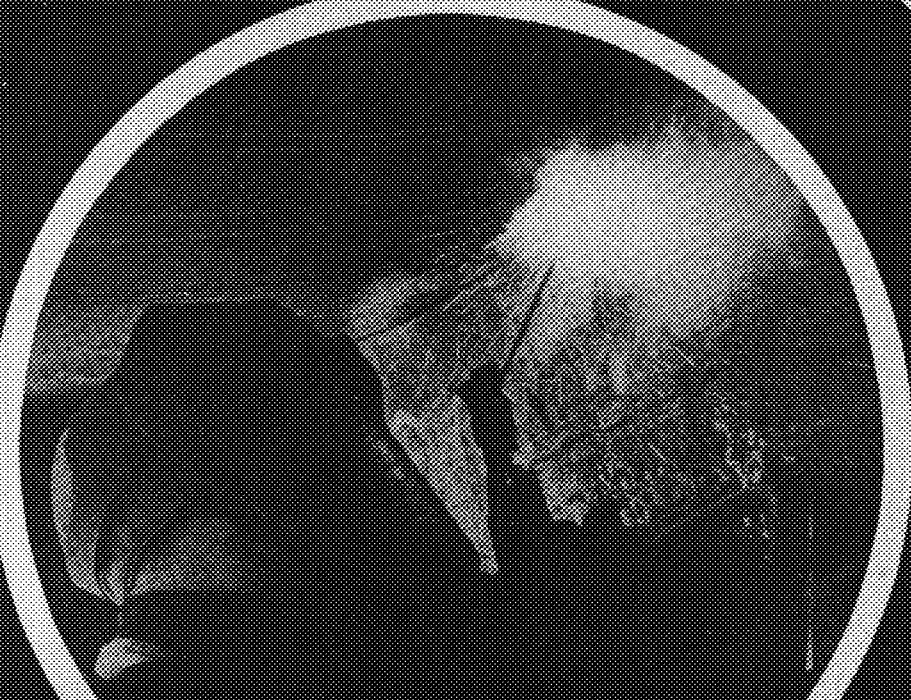
IN THE G-E Research Laboratory, at Schenectady, there is a framed photograph which at first glance does not appear to be unusual in any way. But when it is viewed from an angle at which the glare of light reflected from the glass becomes noticeable, the picture does tricks—part of it becomes almost obscured by the glare, yet the rest remains clearly visible.

The explanation is that each surface of the clear portions of the glass is coated with a transparent film—a film four millionths of an inch thick, or one-quarter wave length of light, and having the proper refractive index. These films, recently developed by G-E scientists, cause the light rays reflected from the film surfaces to counteract one another. The reflection of light from the glass is thereby prevented.

Whereas the process is still in the laboratory stage, it is believed that it will soon be available for many optical uses.

GENERAL ELECTRIC

MINE SAFETY APPLIANCES



TECHNICAL REVIEW

MARCH

1939

FEBRUARY WISDOM

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•

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For goodness sakes,
Why night falls
But never breaks,
Then when next
The sun calls—
Why day breaks
But never falls!

•

We used to want to make the world safe for Democracy—now we want to make it bomb-proof.

•

At a railroad station you take a train. But try to take something from an oil station!

No Third Term
Upon our soil;
But what a lot
Of Third Termoil.

•

The Republicans might beat the New Deal with a New Ideal.

•

The new nickel shows Mr. Jefferson looking left.

•

There would be more just nations, were there more "just folks."

•

"I'm living the life of Riley,"
Said he with the bread and beef
Which was easy
to see through
For he knew
That I knew
That Riley is on relief!

•

It isn't the highways that bother us, it's the driver's ways.

— A page plucked from the pocket-size COMPANY MAGAZINE of the WOOLERY MACHINE CO., Minneapolis, Minn.

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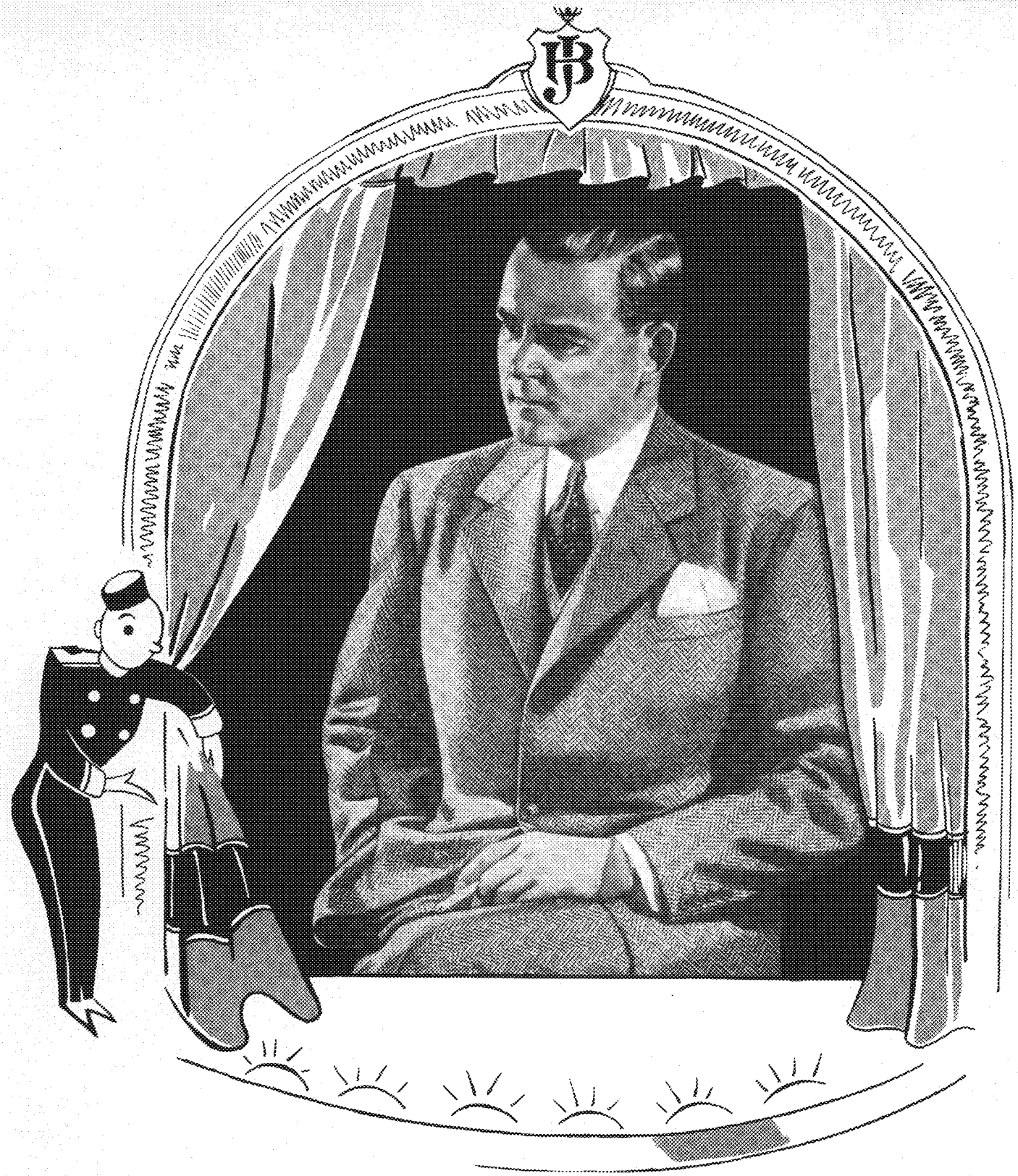

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JUSTER BROS

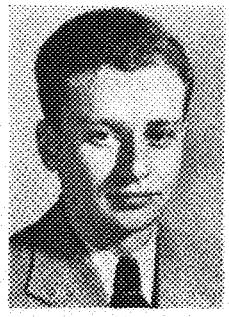
On Sixth Street . . . Just Off Nicollet

This Month's AUTHOR

By John Shannon, Ch.E. '40. Photos by G. A. Halseth, Ch. '40, and J. J. McBrady, Ch. '38

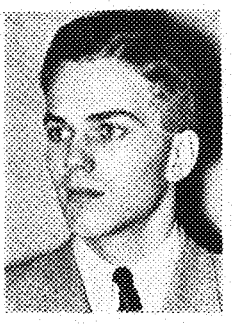
Ben Palmer, Law '13, brings to the attention of the engineer another problem to be dealt with in engineering practice, that of legal limitations. "Beware of Curbstone Law" is Mr. Palmer's first article for the TECHNO-LOG but by no means his first attempt at writing. He has written many law reviews and a manual of Minnesota Law.

Mr. Palmer is a lecturer on business law in the Institute of Technology and divides his time between that and a private law practice. He is a past president of the Hennepin County Bar Association, a member of the Minneapolis Library Board, and vice president of the General Alumni Association, having received his B.A., M.A., and LL.B. degrees here at Minnesota. As a student he was a member of Phi Delta Phi, legal fraternity, and was elected to Phi Beta Kappa. Mr. Palmer lists reading and writing with a leaning toward historical subjects as his forms of recreation.



Marius Cohn, Phys. '41, in "Television—In 1939?" presents a subject which we feel only a physicist is qualified to present. Television has been just around the corner for the last ten years, but in spite of the diligent research that has been carried on in the field it has failed to make the turn. This article discusses the latest developments.

Marius claims that his course occupies just about all of his time but that he tears himself away now and then to play tennis for recreation and to indulge in photography as a hobby. He is a member of Sigma Alpha Sigma engineering fraternity and plans to take graduate work in physics when he completes the regular course.



Harold Ferrin, Chem.E.B. '40, composed the article on facsimile transmission, which is a method of getting the daily paper out of the radio instead of being dependent on the local newsboy. Of course, it isn't as simple as all that, but as it is pointed out in "Your Newspaper Takes Wing," the idea is well on its way through the experimental stage.

"Hod" is digressing from his regular TECHNO-LOG duties on the copy staff this month to write his first feature article. He has no special hobby but likes to dabble in photography now and then. "Hod" prefers sports that get him into the great outdoors and lists skiing, hiking, hunting, and fishing among these. We might add that he is an A.I.Ch.E. member.

The Minnesota Techno-Log

37 Electrical Engineering Building

University of Minnesota, Minneapolis

WOOLSEY MOTL
Managing Editor

ROBERT E. McDONALD
Business Manager

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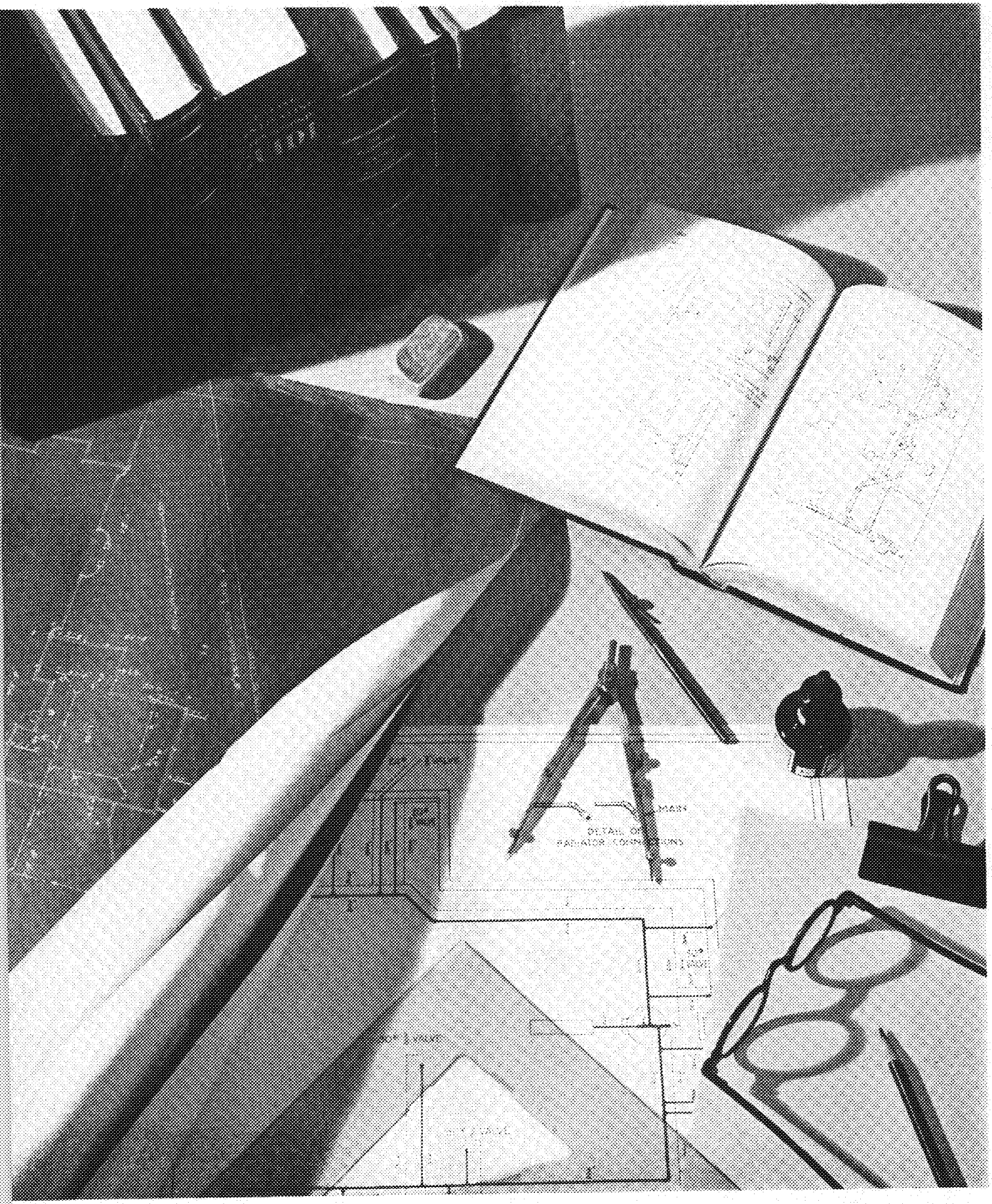


PLUMBING AND HEATING JOURNAL

Time Out

Beware of Curbstone Law

Here's your chance to sit down with a well-known lawyer and have him relate, in his inimitable, breezy way, the growth of profuseness and complexity in modern law, quirks and puzzling paradoxes in law, the fallacies of curbstone law, and the wisdom of preventive legal consultation.

By Ben W. Palmer

Lecturer in Engineers' Business Law

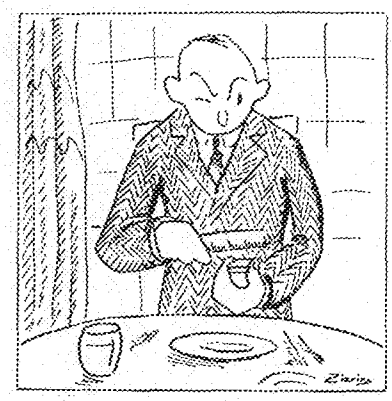
Illustrations by Walter Ziering, Arch. '41

WRITING this article during the month of February, one is led inescapably to Washington and to Lincoln. The one is sometimes called an engineer; the other is always thought of as a lawyer. This helps to bring the two professions together just as they came together when the Roman Empire reached its glory largely through the cooperation of the lawyer and the engineer.

Can we visualize Washington, the boy surveyor, called by courtesy an engineer, standing in a modern engineering laboratory or watching the construction of the Empire State Building or the bridge across the Golden Gate? Can we imagine Lincoln struggling with the mass of modern law?

When he was admitted to practice in 1836, the statutes of Illinois were few and comparatively simple. The decisions of its supreme court were contained in one volume, issued in 1831. Now a vast mass of statutes are in force in Lincoln's state, and the decisions of its appellate courts approach 600 volumes. Of these over 300 have been issued since the Civil War.

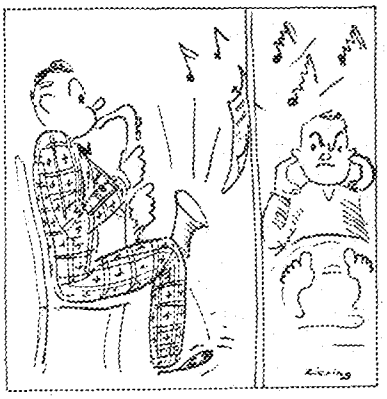
In Minnesota we attempt by law to regulate bath tubs, bed bugs, storm windows, the size and cleanliness of sheets in hotels, the size of benzine cans, berry boxes and blackberry containers, the number of matches in a box, the manufacture and sale of cotton duck or canvas and mattresses. We forbid discrimination in the sale of mohair, purchases by junk dealers from minors, the throwing of dishwater on the ground near hotels or lodging houses. A few years ago it was reported that an irate legislator, angered at the size of the portion of butter served him in his hotel, introduced a bill to regulate the size of butter balls in public eating places. The result is that in a state not predominately urban, such as Minnesota, there are potentially operative on the citizen approximately 3,000,000 words of state statutes, 3,000,000 in acts of Congress, perhaps a million in city ordinances, and about 45,000,000 in decisions of the state supreme court. The volumes of that court now exceed 200.



Furthermore, there are innumerable rules of conduct imposed on the citizen by administrative boards or bodies. There are a myriad of state railroad, warehouse, public utility, banking, insurance, pure food, health, tax, workmen's compensation, social security, securities exchange, blue sky, and labor relations authorities. These flood the land with regulations of conduct thicker than leaves in the vale of Vallambrosa. The result is that we live under a veritable rein of law.

Opposition is Futile

However, complaints against the situation are neither new nor effective. Since the time of Tacitus great men, such as Burke, Hallam, James Kent, and Gibbon, have decried this trend but to no avail.



The reasons for this flood of law are many. Plainly the greatest cause is the changed character of our civilization from an agricultural or small town society of the wide open spaces to a complex, highly organized, closely integrated, urban civilization of specialization. An idea of the extent of this trend can be gained from the fact that during the past 130 years, while the total population of the United States has increased 27 times, the urban population, that is the number of persons living in cities of greater than 8,000, increased 352 times. The contrast between a saxophone in a 40-acre field and one in a two-by-four city apartment with papier mache partitions makes manifest the need of increasing legal controls.

The power that any legislator has of introducing as many bills as he wishes into the legislature and the increasing effectiveness of lobbyists and pressure groups have also served to increase the bulk of our statute books. Another factor has been the natural growth of constitution and statutes by legal interpretation. For example, innumerable disputes arise as to what constitutes "liberty," or "property" or "due process" in the legal sense. What is an "accident" in the sense in which the word is used in the workman's compensation act?

If a brick falls from a hod-carrier's shoulder as he is going up a ladder and lands on your head, it is an accident. But suppose you get into an argument with him over the theory of relativity or the comparative merits of Beethoven and Tschaikowsky, or Giotto and Cimabue, and he hits you with a brick. Is this an accident?

Law is conceived of partly as a means of laying down

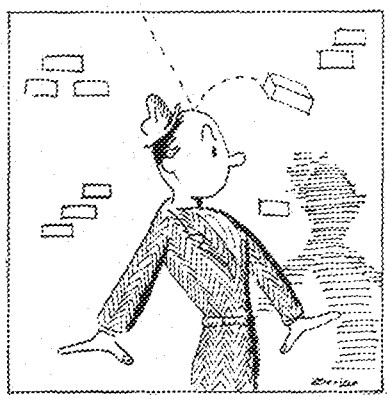
rules for the struggle for existence; that it will insure the survival of the most desirable types, ethically and socially. Nature, red in tooth and claw, is not permitted an undisputed sway which will result, in many cases, in the survival of the most brutal and most unscrupulous. There are to be more and more rules of the game. Law is conceived of as a means of individual and social progress, as an engine for making man as much the master of his social environment as he is of the physical world.

What has all this to do with the engineer?

Simply this, that the engineer must realize that changes in the legal structure, increasing its complexity and bringing it closer to the practice of his profession, the control of the business enterprise with which he is associated, have kept pace with changes in engineering education and technique since the days of Washington and of Lincoln. The frontier is gone and with it simple ways of life. The law is now an active participant in every man's affairs; indeed, it stands at his very fireside. It is no longer possible, it is no longer safe for anyone to blunder along by guess and by gosh through the meshes of a complex legally organized society. The pure heart alone will not suffice. Good intentions, honesty of purpose, high ideals of conduct, will protect the engineer no more than anyone else against disastrous legal consequences resulting from the valor or the indifference of an unjustified and unnecessary ignorance. They will not protect his clients or his employers or associates against criminal prosecution or financial loss, perhaps irretrievable ruin.

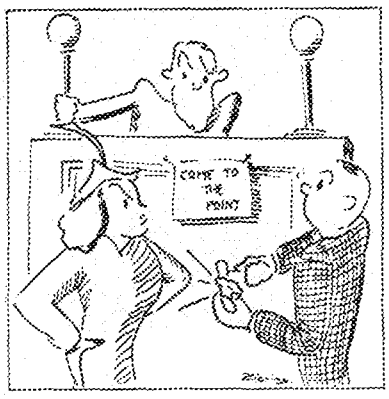
Ignorance is No Excuse

A paradox of the law is that everyone is presumed to know the law and that ignorance is no excuse. This is true even although the most diligent research, the most learned arguments in lower and appellate courts, the study of the problem by counsel and by courts for years, may be necessary before a final decision in a doubtful case may tell us what the law is. That decision having been made, it is presumed, generally speaking, that all parties involved knew from the beginning what the decision was going to be, that is to say, what the law is. This rule may seem harsh but plainly it is unavoidable. For otherwise any one of us at any time would have it within his power to blink a legal rule out of existence by shutting his eyes to it and preserving a calculated ignorance.



The moral of all this is that every engineer should be aware of the wisdom of preventive law. He should realize that law is increasingly important and that few domains of human conduct are now beyond its reach. He should not, of course, attempt the impossible. He should not try to be his own lawyer. Heaven knows that even the lawyers themselves, including the most diligent and scholarly, have difficulty at times in keeping abreast of the new rules governing their client's affairs. But at least the engineer can learn a few rudimentary principles. He can take a bird's-eye view of the legal terrain. He can mark a few of the most conspicuous landmarks of danger. He can establish a contact for legal advice as he goes along, particularly before he signs on the dotted line. He should always remember the wisdom of locking his car before the garage is stolen.

He should also be careful to get his legal advice from a lawyer and not from a blacksmith. He should not get it from the casual reading of the ordinary newspaper story of a lawsuit or legal incident. The American newspaper is a marvel of accuracy, generally speaking, particularly considering the haste with which it must gather and report news. But its reporters, obviously, cannot be trained in the technique or terminology of every profession whose affairs they bring before their readers. More important than that, a newspaper that is not read is dead. To preserve its existence a newspaper must be interesting, and that interest is primarily a human interest. You are not interested as a newspaper reader in the niceties of legal procedure or terminological exactitude. Consequently, you read a headline or an article which may give you the impression that if you criticize your wife's biscuits by an analogic reference, subtle or otherwise, to granite boulders, or say that her pudding looks like something dragged in by the cat, she is entitled to a divorce ipso facto (that is to say, by that mere fact alone). So also the mere fact that a jury gave a man $20,000 for the loss of a leg doesn't mean that legs are always worth $20,000 apiece.



He should also be careful of curbstone law. This is the sort of law that may pass down from generation to generation by word of mouth. Possibly there was an original basis of true law like the pearl in an oyster, but the pearl may have been removed, that is to say, the law repealed, or there may have been a marked twistification of the rule of law in its retelling, either in the teller's tongue or the listener's ear. When I was a boy there was a tradition that it was a state prison offense to hit a boy with glasses. There still persist various notions such as that you cannot put a tenant out in the winter time; that if you make an offer you can not withdraw it if you have agreed to hold it open; that unforeseen difficulties excuse delay or nonperformance of a contract; that you can avoid a contract if you get no benefit out of it. There is the idea that if you agree to pay for something more than it is really worth and the disproportion is substantial, the transaction is "unfair" and you can get out of it. There is the belief that a husband can never make any kind of contract with his wife, or that all contracts made on Sunday are void. These are but a few of those erroneous or perverted forms of curbstone law which should be shunned, if not like the plague, at least with a cold shoulder, a very cold shoulder.

The engineer then should realize the importance, the omnipresence of law, the necessity of securing information about the law from those who ought to know by training what it is, and the wisdom of the preventive ounce.

Utopia via Science—Oh Yeah?

A currently popular belief is that science promotes the advance of civilization. However, some recent developments tend to place this belief in question. For example, the radio and the airplane, both products of science, are, in the opinion of the author, having definitely the opposite effect. At any rate it's an interesting question and is very interestingly discussed below.

By Roderick W. Siler

Assistant Professor in Mathematics

THERE is always danger, I think, of students in technological lines giving too much weight to purely technical accomplishment in passing judgment on the past, present, and future. Someone, somewhere, once delivered a sentiment to the effect that "hope springs eternal in the human breast." I suppose it is this tendency of the human breast to inflate easily that is chiefly responsible for the feeling that the more we invent the nearer we are to heaven on earth.

I have before me a clipping from a newspaper of some time ago reciting the prophecies made by a speaker before a meeting of inventors gathered to consider what the world was coming to, and how. Prophecy Number One was that, along with other ills and trials of mankind, indigestion is to be eliminated. This because of the discovery of what it is in the insides of a boa constrictor that allows him to digest his meals the way he does. A boa, I believe, is one of those lucky individuals who can swallow a goat—horns, hide, whiskers and all—with less inconvenience than most of us can swallow a hard boiled egg. Another interesting prophecy was that clothing would be very cheap, and as a specific example of the effect of this drop in clothing prices it was mentioned that a man, on getting up in the morning, would throw his pajamas in the waste basket. Not in the clothes bag, nor on the floor for his mother or wife to pick up, but in the waste basket. The idea being that he was done with the pajamas, it being cheaper to buy new ones than have the originals laundered. Another forecast was concerning what were referred to as "dream pills." By taking a couple of these pellets before retiring a person will have dreams; not the hair raisers we have today with our present digestions, but delightful, stimulating dreams.

Boa Constrictor Appetites

These are some of the things we are coming to. These and a good many more, for the prophet did not exaggerate one bit in his forecasts. But the things no one speaks of, and probably no one can more than vaguely foresee, are the consequences and ramifications of the new developments. For instance, if boa constrictor digestions are followed by boa constrictor appetites, as it is reasonable to assume will be the case, the new discovery may cause more pain than pleasure if, as now, it finds a good many of us, instead of wanting to increase our appetites, trying to find a way to satisfy the ones we have. Throwing away our pajamas and nightshirts each and every morning may at first thought appear a step forward in human life, but it is not hard to see that laundrymen, especially if animated by improved appetites, may take a different view of the matter.

People still young enough to walk without a stick can remember when such things as radio, movies and aeroplanes were in what was called their "infancy." A good deal was once expected of the infants which their later development has failed to justify. In those days, when radio fans listened to programs in what looked like earmuffs, universal education by radio was solemnly discussed, and it was assumed that a man, drowsing in his socks before his radio on winter evenings, could absorb the knowledge of the ages and develop the mind of an Aristotle. But we have found since that time that radio, the world over, seems more concerned with controlling thought than stimulating it. Aeroplanes in the beginning were regarded as the future means of wafting travelers from here to there, pleasantly and cheaply. At present the most evident purpose of planes seems to be to see how quickly they can transport a load of bombs and get back for more, with no particular profit to anyone, unless it be the doctors and undertakers.

Men Haven't Changed Since Adam

Admitting that these are the gloomy conclusions characteristic of ancients looking back from fifty years or more, they do, nevertheless, have a significance in that they indicate what may be the opinions of present day students thirty years from now. They also indicate a growing disinclination of the world to enthuse over technological advance. People once listened with respect to the talk that the developments of science and technology were based on desire to improve the world, but they begin to suspect they are based on something else. As proof of this, here is an extract from an article published in a newspaper a few days ago: "The ingenious scientists, once the end of that shambles (the World War) was proclaimed, kept right on working and have been hard at it ever since, devising inhuman and deadly weapons to win wars."

For more reasons than one this new trend in public attitude is of importance to students in technical schools. The trend is largely the result of a former common belief that the perfecting of machines would perfect men. But it is realized now that improving a machine is less of a job that improving the users of it and that, in a world of variables, Man with his needs and desires is the one constant. The aeroplane has been developed in forty years. History indicates that Man, except for some improvement in his table manners, hasn't changed much since Adam.

Probably nothing that a student can do will change the course of history to the extent of preventing the invention of a single new can opener. But a greater study and consideration of human psychology and economics while in school might help matters. It will at least do something to lessen disillusion in later years.

Television—In 1939?

When will it be here? That's what we all want to know about television. We have heard it's coming for some time now, but we have yet to see it perform commercially. Perhaps a little look behind the scenes will tell us why.

By Marius Cohn, Phys. '41

Illustrations courtesy "Communications"

TELEVISION is not quite as new as some of us believe. In 1873 a telegraph operator named May discovered that the electrical resistance of selenium varied with the amount of light falling upon it. Here was a real clue, and in less than two years some devices were produced which actually were able to send pictures over a wire. Only in the last decade, however, has television become a practicable thing.

Even the earliest experimenters recognized that the best and probably the only way to send an image over a wire or through the air was to break it into a number of small elements. The relative intensity of the light on each element could then be used to send out a corresponding electrical impulse, and at the receiving end the impulse might again be transformed into a picture element in its proper position. All the first devices employed some mechanical method of dividing the image into small elements, but their mechanical limitations prevented their ultimate success.

In 1875 Carey demonstrated one system. He used a bank of many small photoelectric cells upon which he focused an image. The current in each cell was proportional to the amount of light falling upon it, and each cell was connected to a small lamp in a corresponding position. The illumination of each lamp was then proportional to the current from the cell, and the result was a rough reproduction of the original image. Since each cell and lamp could control only one degree of illumination, this system was limited by the number and size of the individual lamps and cells. Each cell, in addition, required a separate connection to its lamp, making the apparatus quite complicated. This system, obviously, was not very practical.

A more practicable system was invented by Nipkow, a Polish scientist, in 1884. His system employed a perforated disk which made it possible to divide an image into a very large number of small elements. This device was improved upon, and until about 1930 was considered the most promising system of television.

It remained for the advancement of science to make possible a far superior method of television. This came in the invention of the emitron tube and the cathode ray tube which made possible an all-electronic method of dividing a picture into a great many small elements, and yet the total division of the picture could be accomplished rapidly enough to permit the transmission of images of moving objects.

The modern television systems consist of two main units, the sender and the receiver. The sending unit converts variations in light intensity into electrical variations, and the receiver converts electrical variations into variations in light intensity.

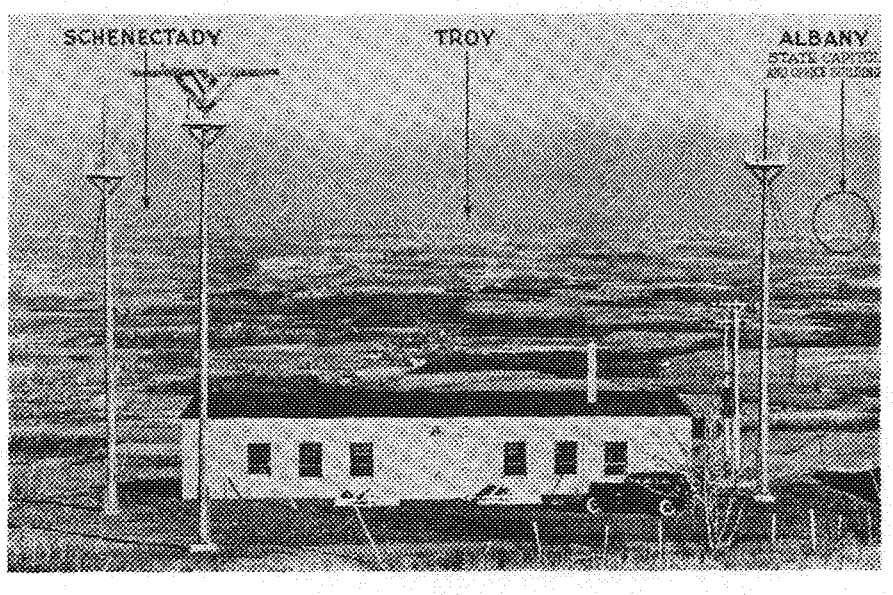
The essential part of the sending unit is some form of the emitron tube. This is a highly evacuated tube with a mosaic of silver and cæsium globules on one side of a sheet of mica, a metal back plate on the other side of the mica sheet, and an electron gun focused on the mosaic. The image is formed on the mosaic and the electron beam scans the image in a series of fine lines.

Emission of Electrons

The mosaic corresponds to the film of a camera. As the image is focused on the mosaic, each individual bead, which in itself forms one element of the picture, gives off a stream of electrons proportional to the amount of light incident upon that element. This emission of negatively charged electrons causes each element of the picture to acquire a positive charge in proportion to the amount of light it receives. The positive charge on the mosaic induces a negative charge on the metal back plate. It is at this stage that the beam from the electron gun does its part.

The electron beam rapidly scans the image in a series of horizontal lines. As this stream of electrons strikes each element of the mosaic it neutralizes the charge on that element and therefore causes a variation in the net charge on the metal back plate also. Since these varia-

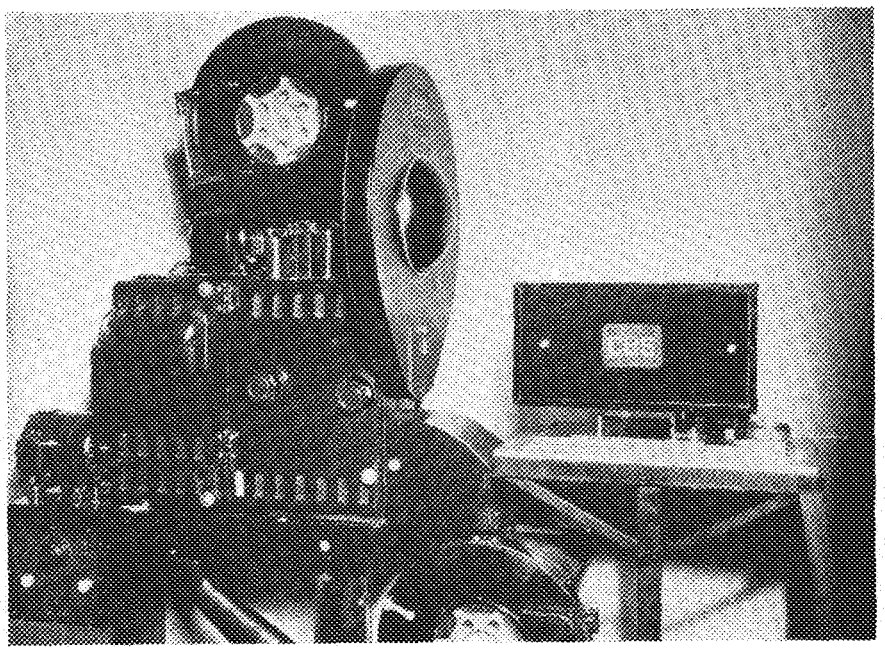
General Electric's ten kilowatt experimental transmitter. The cities indicated show its range.



tions are proportional to the original charge, the metal plate will then send out a continually varying current whose variations will be directly proportional to the intensity of the light on each element of the mosaic as it is struck by the electron beam.

The electron beam itself is made to scan the image by passing two electric coils set at right angles to each other. An alternating current in the coils causes a regular reversal in the magnetic effect of each coil, and the effect of one coil moves the beam back and forth across the image while the other coil moves the beam vertically from line to line. The rate of scanning is constant and as rapid as the current can be made to alternate.

The receiving set employs a cathode ray tube which also has an electron beam moving in synchrony with the scanning beam of the sending set. The intensity of this beam, however, varies with the current impulses it receives from the sending unit. This beam is focused on a luminescent material coated on the flattened end of the tube. As this beam strikes the coating it produces light corresponding in brightness to the intensity of the beam. Thus if the two scanning beams are properly synchronized, we have an accurate reproduction of the original image.



One of the latest types of television senders, showing a 35-millimeter scanner with pick-up equipment.

Difficulties Encountered

The first difficulty was to divide the picture into a very large number of small elements and at the same time to be able to send the electrical impulses for all the elements rapidly enough to allow the television of moving objects. The use of the mosaic of silver and cæsium globules with an electron scanning beam has successfully solved the problem of dividing the image into a sufficient number of small elements.

A little trickery was resorted to, however, to make possible the high-speed sharp transmission of the modern equipment. The electron beam scans the picture in a series of horizontal lines, covering the entire picture in a thirtieth of a second. Between the lines, however, a space is left equal to the width of one line. On its next trip over the image the electron beam scans the spaces left open the previous time. The resulting impression is equivalent to scanning the picture sixty times a second, too rapid for the eye to notice flickering.

The extreme rapidity of the scanning naturally brings up the problem of synchronization between the sending and receiving units in television. The problem of synchronizing contributed to the failure of many of the early television devices and was a real test for the engineering of the modern equipment. The scanning beams in the sending and receiving sets are now kept in perfect harmony by the sending of special impulses at the end of each line and a still different impulse at the end of each complete picture frame.

The great range of impulses and the rapidity with which they must be sent causes another major problem of television. To transmit all these impulses, television stations must operate on much higher frequencies than sound broadcasting stations, and in addition they must have the freedom of a much wider range of frequencies. The net result is that one television station requires a broadcasting channel equal to that of 500 ordinary radio stations.

The high frequencies used create still another problem. It now becomes necessary for television broadcasters to use ultra-short wave lengths. These waves are in some ways similar to light waves, for they cannot effectively be sent beyond the horizon. Television stations can serve only local areas, and nationwide programs must be relayed from one station to the next, the country over. Even the high tower atop the Empire State building is limited to a radius of forty miles.

This last difficulty has been the greatest hindrance to large scale television broadcasting. Although practical receiving sets are now available, a great many complex and expensive installations would have to be made in order to broadcast television programs. The expense that would be involved in setting up facilities for network broadcasts prevents any immediate large scale television. In order to avoid such expenses, radio engineers have been conducting extensive research on the possibility of transmitting television broadcasts by cable. Their work has led to the development of co-axial cables which hold much promise, but have not yet been sufficiently developed to warrant nationwide installations.

All this leaves us wondering when we will have television on a large scale. Unless some new and feasible developments are made toward network television broadcasting, we may not expect much television in the immediate future. It is more likely that beginning this year we shall see a gradual and steady growth of television broadcasting, beginning in the largest cities and later working out to the smaller towns. Right now the broadcasting companies, both here and abroad, plan to present about two hours of television broadcasts daily in those areas where the equipment is available. Perhaps it will not be long before television gives each of us a ringside seat at the great events of the world.

Your Newspaper Takes Wing

Now, by facsimile, you can have your morning newspaper delivered to your bedside, hot off the air. This new development, now commercially available as a supplement to your newspaper and radio programs, brings into your home a reproduction of printed and pictorial matter.

By Harold Ferrin, Ch.E.B. '40

FOR the past few years photographs have been sped around the world by a commercial concern which sells its services to newspapers. This company races against time by using telephone circuits to send its photographs to any part of the United States and Canada and radio circuits to send them to and from Europe and Asia. Using a slightly modified version of the radio circuit used, facsimiles of news photos and printed news may now be received anywhere that a radio will work. Receivers can be designed to operate in a home, automobile, airplane, or ship on direct or alternating current of any common voltage. The reproductions, known as facsimiles, were formerly black and red but are now black and white reproductions of printed copy. They are produced on a roll of treated paper four inches wide and resemble a good carbon copy of a typewritten page. The image is actually built up of horizontal lines 1/100 of an inch from top to bottom and of any length up to the width of the paper. Facsimiles are permanent and may be compared to a newspaper containing both printed and pictorial matter.

The receiving of a facsimile is entirely automatic—no person is needed to start, stop, or watch it. The record remains on the receiver until torn off, and in this way is in direct contrast to its first cousin, television. Television is more comparable to a motion picture; its images are dynamic and must be viewed as received. After reception there is no record of what was received, and unless there is a person present to turn the radio on and view the program, it is lost.

Some of the leading broadcasting stations of America now send out daily news facsimile transmission as much on time as a clock's tick and as helpful in understanding foreign news as the latest map of Europe, for it may be just that! At present 16 stations in the United States have licenses to operate facsimile transmitters. These stations function as usual in sending out their regular broadcast programs of music and voice and, in addition, send out facsimile transmissions of pictures, news, cartoons, weather reports, and even weather maps to planes in flight. A multitude of uses for these transmissions is planned, and as soon as enough people purchase receivers to make extensive programs worth while, educational as well as entertainment programs may be expected.

All radio stations are finding it increasingly difficult to have program schedules printed correctly in the newspapers. A facsimile transmitted during the early morning hours before the audible programs start would be an easy solution. The receiver, controlled by a time clock to turn it on and off at predetermined times, would not disturb even the lightest of sleepers for it is entirely automatic and silent. Corrections to the program could be added during the day and attention called to especially interesting audible programs.

A news facsimile transmitted about 6 o'clock in the morning would assure the average citizen recent news with his breakfast at whatever time he chooses to eat and with no more effort than it takes to walk to the radio and tear a strip of paper off the rack, after the clock controlled receiver had silently recorded it. The hours during which the regular facsimile transmissions are to be made are determined in advance, so that once the time clock is set, the only attention necessary is to replace the rolls of paper as they become exhausted.

Station WLW of Cincinnati leads the stations of America in facsimile transmission. WLW not only sends out nightly programs simultaneously on two different frequencies but also sells receivers. The receivers, manufactured by the Crosley Radio Corporation, are being turned out at the rate of 500 a week and sell at $75 under the name of Reads sets. The programs of WLW may be received in the Twin Cities on almost any night and on clear nights stations as far away as Nashville may be received on broadcast frequencies with good readability.

KSTP Runs Tests

Late in 1937 station KSTP of Saint Paul started nightly programs to determine the results that could be obtained with their transmitter. Receivers were not being turned out in production quantities at that time, so the only sets capable of receiving KSTP in the northwest were the five that were owned and operated by

Reproduction of part of a facsimile sent by station W9XZY.

RADIO AND TELEVISION

Today's News Today

ST. LOUIS POST-DISPATCH

By Radio from Station W9XZY

VOL. I. St. Louis, December 6, 1938

AGITATION MAY GO ON IN ITALY FOR TUNISIA

Pan-American Conference Opens; to Discuss Defense

the station. The advantages and limitations of facsimile were determined, and transmissions have now been temporarily discontinued until a sufficient number of Reads sets are purchased in this community to warrant nightly programs by a local station. Facsimile has the same range as any other radio broadcast on the same frequency, but because they are now sent when most stations are off the air, interference from stations on nearby frequencies is eliminated. When KSTP was operating, the material they sent was received in Nashville (another of the few owners of receivers at that time) with good readability.

Present Transmissions

Present transmissions on broadcast frequencies take place between 1 a.m. and 5 a.m. because of Federal Communications Commission rulings. Any transmission at hours other than these must be done on high frequencies. Most facsimiles are now sent on broadcast frequencies, or regular short wave frequencies, but some use is being made of the higher frequencies to send weather maps during the day.

A facsimile differs from a radio newsphoto in one important respect. It is made on an electro-sensitive paper, while the newsphoto is made on a photo-sensitive paper. The facsimile receiver operates in daylight and makes reproductions by passing an electric current from a stylus through the coating on the paper while the news-photo system requires a dark room and makes its reproductions by varying the intensity of a small beam of light that strikes a photographic paper. After exposure, this paper must be developed the same as other photographic papers.

Although the photographic method gives better results, it obviously could not be used in homes, so the electro-chemical method is used. This method produces a black and white reproduction, called a facsimile, on a dry, non-smudgy, roll of paper. The facsimile is ready for viewing immediately after it has been received and is permanent.

Several systems of transmission and reception may be employed, but the most common one is that devised by the Finch Telecommunication Laboratories of New York. This system is employed in the Reads sets and also by KSTP. The transmitter converts copy into electrical impulses to be sent over ordinary broadcast transmission apparatus. The copy may be a diagram, a sharp-focus photograph, or material typed on a special typewriter which has only upper case letters. Experience has shown that lower case letters, soft-focus photographs, and photographs with large black areas do not reproduce well. The receiver passes the electrical impulses through an ordinary broadcast band receiver with the speaker replaced by a facsimile receiver which changes the impulses into a facsimile of the original copy.

The transmitting unit consists of a scanning machine and an ordinary transmitter. The scanning machine takes the place of a microphone, and the signals from it are fed first to an amplifier, then to the transmitter proper. The copy is placed in a copy head, which operates much like the carriage on a typewriter, advancing the copy from left to right in front of a stationary scanning head. The scanning head focuses a sharp beam of light on the copy and a photo-electric cell converts the reflected light into electrical impulses to be amplified and broadcast. The copy head advances a strip of copy four inches wide at the rate of one linear inch per minute, and in so doing makes 100 trips from left to right. Before each trip, a very short signal tone is given to synchronize the receiver to the transmitter. The receiver amplifies the incoming signal in the same manner that an audible program is amplified, but the amplified current is fed to a facsimile receiver instead of to a speaker.

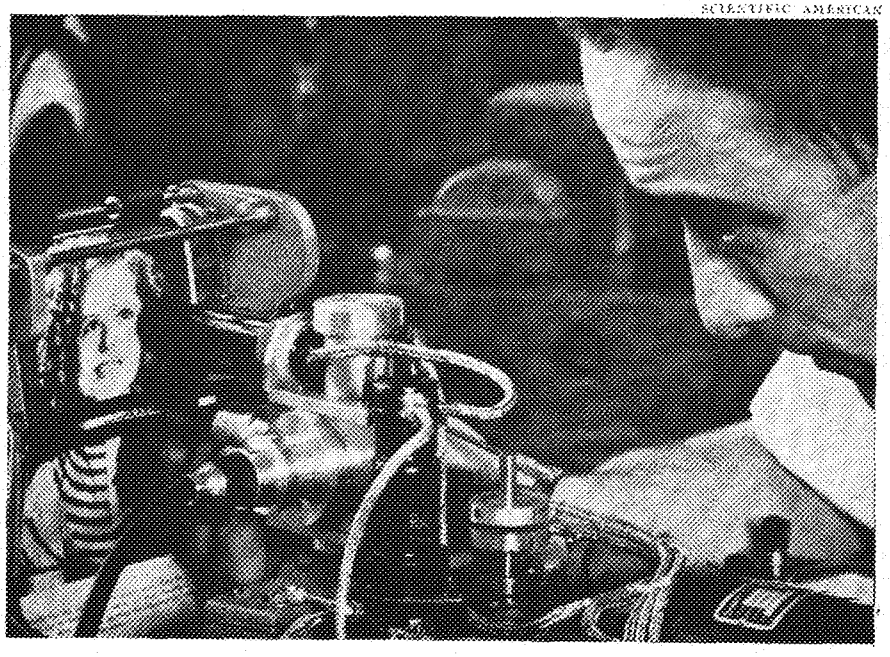
The receiver consists of a copy head and recording stylus, and a roll of electro-sensitized paper. The copy head in the receiver is stationary, and the stylus travels in horizontal trips from left to right in exact synchronization with the scanning machine. The stylus is in contact with the paper all of the time, but produces a mark only when a current travels from it through the paper. The current causes a chemical reaction on the white paper, producing a black mark, the intensity and length of which is dependent upon the current. The marks are all of a constant height from top to bottom, one hundred of them making one inch. The stylus is driven by a constant speed motor through a clutch arrangement which is disengaged at the beginning of each trip until the signal tone is received, thus synchronizing the receiver to the transmitter, 100 times a minute.

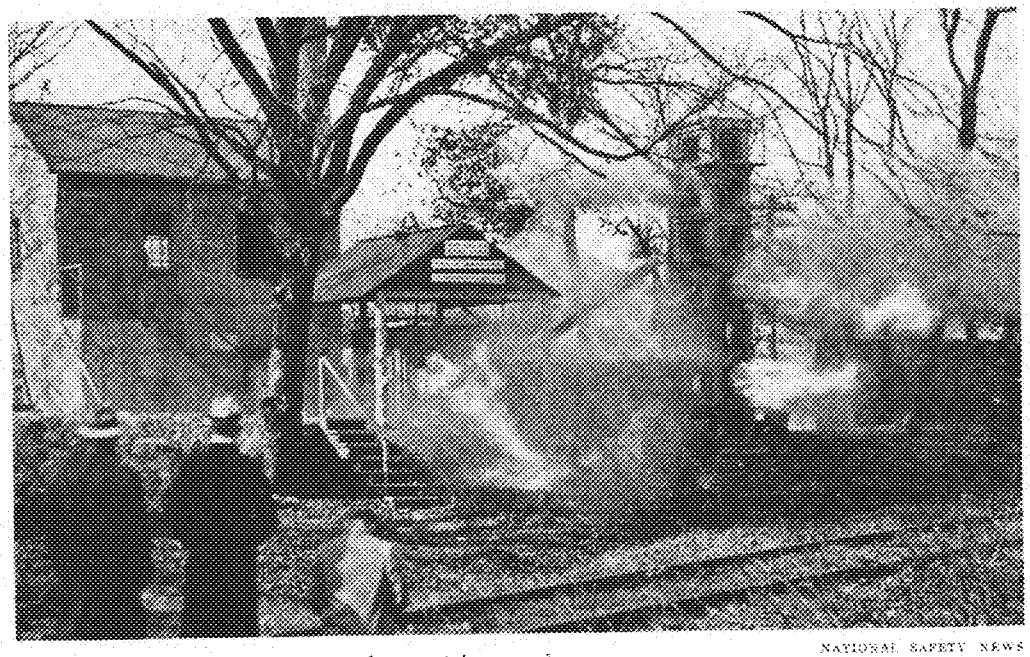
Perhaps one of facsimile's larger uses will be to send weather maps to ships and airplanes. In recent experiments a strip of paper 8½ inches wide had been used. If the map is sent with its shorter dimension across the paper, and occupying the full 8½ inches, an easily read map results.

Newspapers need have no fear of facsimile usurping their regular business, for the rate of transmission is only about ⅛ of an ordinary newspaper page per hour. Regular news broadcasts and special news flashes on the audible programs have already done away with all but a few of the street corner extras. Facsimile may be expected to remove those that do remain, but it can never replace the regular daily paper.

Photograph being scanned by transmitter.

SCIENTIFIC AMERICAN





NATIONAL SAFETY NEWS

It's a big headache to nearby residents when dust explosion tests are carried on at this explosion testing station at Arlington, Virginia.

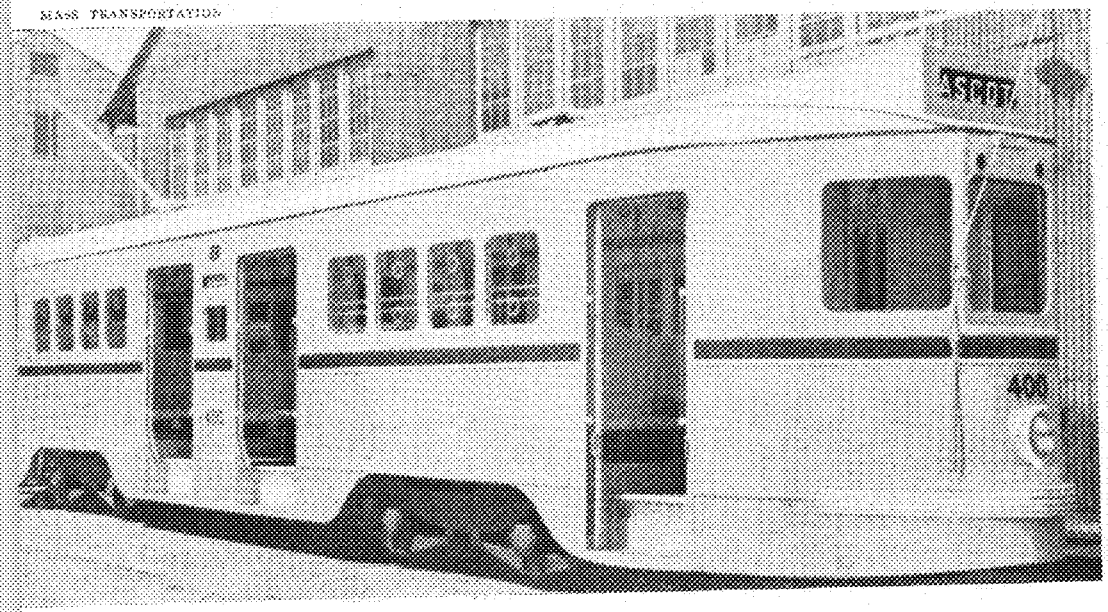
Enginee

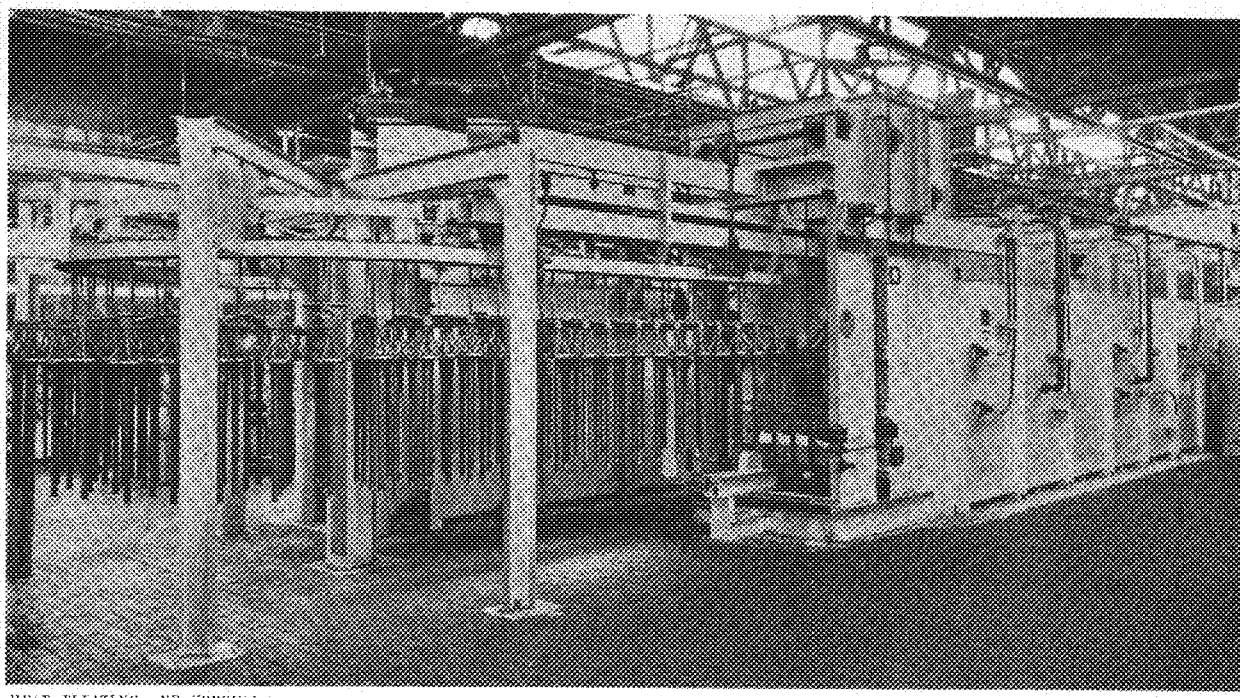
DEVEL

Night blindness! This dangerous characteristic is tested by staring at the bright light in the box and then measuring the time which elapses until a dimmer light can be seen.

"Motorman Bill" must be proud to drive this new streamlined street car in service in Brisbane, Australia.

MASS TRANSPORTATION





HEAT TREATING AND FORGING

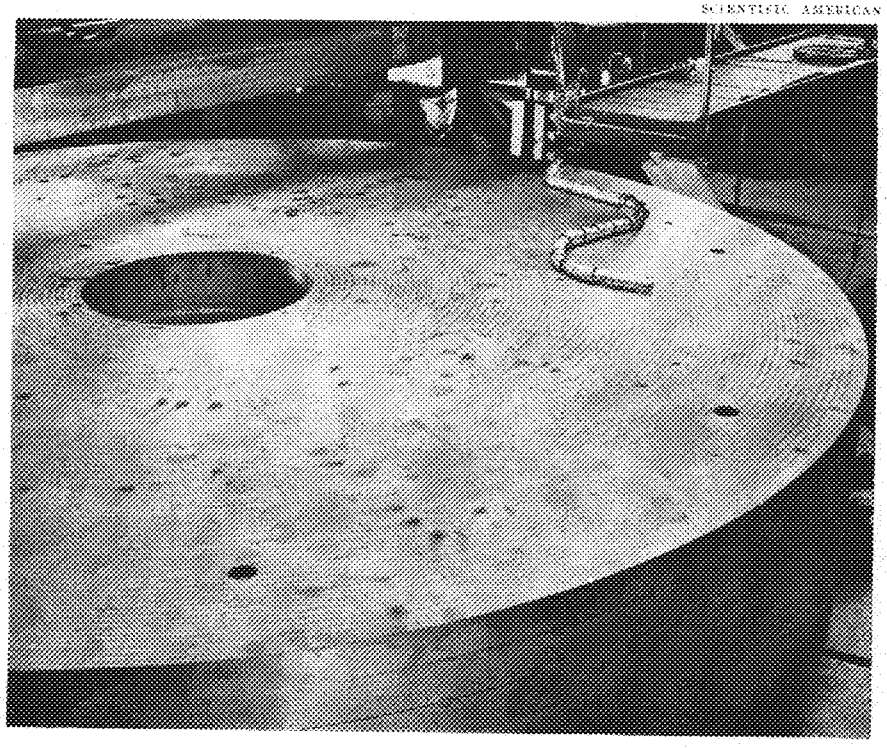
IENTS

The axles in your new car will be stronger if they were treated in this latest type of controlled atmosphere furnace for scale-free hardening.

IRON AGE

There's lots of Wr² in this 190,000-pound flywheel being machined for use as a shock absorber in a steel mill.

SCIENTIFIC AMERICAN



Research in the Institute

Separation of Isotopes

RECENT achievements in the separation of isotopes have tremendously increased the uses and the importance of isotopes in many branches of scientific research. Among the scientists who have aided this advancement is Dr. T. I. Taylor, recently appointed to the staff of the department of inorganic chemistry. Last year, Dr. Taylor was working with Professor H. C. Urey at Columbia University. His present work on the separation of isotopes is a continuation of last year's research.

Although his work centers about the separation of the isotopes of certain elements, Dr. Taylor's research includes several other problems. At present, he is working on the separation of the isotopes of potassium and lithium. In one set of experiments a long column filled with zeolite is used to effect a partial separation. Electrolytic separation is used in another. In order to have an accurate means of isotope analysis, Dr. Taylor is building a mass-spectrometer. The parts of the magnet have been completed and the apparatus will be assembled soon. Dr. Visscher and Dr. Söllner of the biology department are cooperating with him in a study of certain plant and animal membranes which have the power to separate the isotopes of potassium. Finally, in order to perfect his zeolite fractionation method, Dr. Taylor is studying the general problem of the exchange of alkali elements in various zeolites.

Sixty Foot Column

The methods Dr. Taylor is using depend upon slight differences in the chemical and physical properties of the isotopes of an element. The zeolite column, the best apparatus used so far, is a 60-foot length of hard rubber tubing packed with sodium zeolite or a similar compound. It is located in the east stairwell of the chemistry building. If the isotopes of lithium are to be separated, a solution of lithium chloride is poured down the tube at the rate of about 2 to 3 c.c. per minute. The normal ratio of lithium 7 to lithium 6 is 11.7 to 1. When the lithium chloride comes into contact with the sodium zeolite, the two cations change places. The lighter isotope, however, forms a more stable compound, and hence the first sample through the column has a higher concentration of Li-7. As the lithium replaces the sodium in the zeolite, the isotopic ratio sinks to its normal value of 11.7 because Li-6 is removed from the solution less rapidly. When most of the zeolite has been converted into lithium zeolite there is a sharp decline from the normal ratio because the Li-7 in the solution begins to change places with the Li-6 in the zeolite. Thus the first sample through the column contains more than the average Li-7 content, while the last sample has more than the average Li-6 content. In the case of lithium the separation has been about 25 per cent and potassium about 10 per cent. While this separation is sufficient for some uses, a greater separation of the potassium isotopes is needed for biological work.

Elements whose isotopic constitutions have been changed in this way are being used in many branches of research. In nuclear physics they will be found useful because isotopes undergo different nuclear reactions. In chemistry they can be used to study the course of reactions. In biology they are useful as tracer atoms, and in physiology they will be used to study the diffusion of electrolytes through membranes.

Cast Iron Pavement

HALF a mile of highway in St. Louis county will be paved with cast iron bricks this summer. This project will terminate a series of tests on cast iron paving blocks which have been directed by Mr. E. W. Davis, head of the Mines Experiment Station.

The stretch of road to be paved lies between Eveleth and the Hibbing cut-off on the Duluth-Mesabi highway, where the road is being reconstructed to underpass a railroad. Since most of the iron used in the United States is mined in St. Louis County, the county officials made a $15,000 appropriation for building the iron surfaced road. The state highway department supplemented this with $7,500. After the paving is in, records will be made of its reactions under changing seasonal and traffic conditions. If it is satisfactory in wearing qualities, riding comfort, and safety, the results of the work will be published and popularization will be started. Popularizing will be important, because, in order to compete in price with other surfacing materials, the cast iron blocks must be made in large quantities at a special foundry.

The laboratory work has included tests of tire and road wear, skidding on wet and dry iron surfaces with both old and new tires, and tests of vibration and noise. Since

Workman laying cast iron paving blocks on 17th Street southeast, near Washington avenue.

this has led to the design of only the type of block needed during the summer, the future laboratory work will include a study of the fundamental properties needed by all cast iron paving blocks. This knowledge will form the basis for designing a block to meet any specified set of requirements.

The paving brick which was found to have the best characteristics for the St. Louis county road is six inches square and about two inches deep. Its top ⅜ inch is grilled to prevent skidding and the bottom is hollowed out to a depth of 1¼ inches. The bricks are laid on a concrete backing and sand is spread over them. The sand sinks down into the cracks between the bricks, made by the foundry draft, and wedges the blocks together. Then the excess sand is swept or washed off.

Cast iron bricks will probably be used for paving city streets, since they are easily laid and repair work on them is comparatively simple and neat. If the Mesabi highway bears out the indications of the laboratory tests, cast iron paving may come into widespread use.

Strength of Welded Joints

DUCTILITY and tensile strength are the most important properties of a welded joint. With the coated welding rods now in use, both these properties can be attained to a high degree. With existing methods, however, there is no standard way to test and compare the ductility of welds. Mr. T. P. Hughes of the department of mechanical engineering decided several years ago to study this problem.

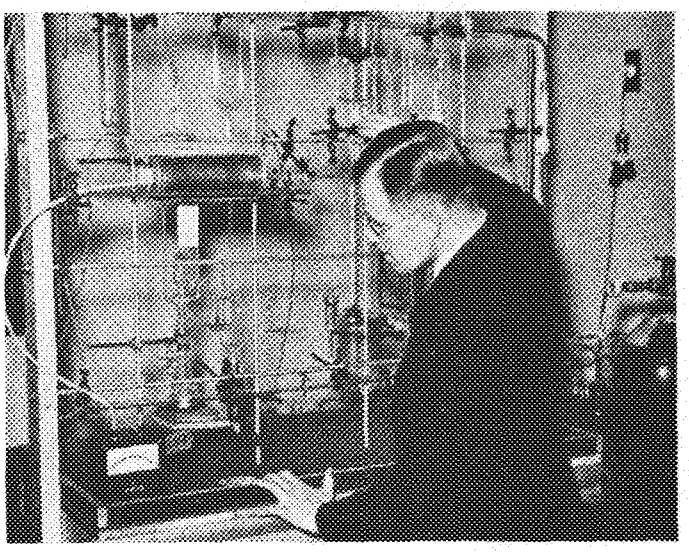
The first step in the research is to find whether a correlation exists between the ductility of welded joints as shown by static tension tests and by free bend tests. If these two important tests give uncorrelated results, the problem will be to find which is the more correct one. This part of the work has not been completed as yet. In the free bend test, the force needed to produce a certain elongation on one side of the bend is taken as a measure of the ductility. The results of these tests are compared with those of the ordinary static tension test in which welded plates are pulled apart and the reduction in area is taken as a measure of ductility.

Professor R. L. Dowdell of the department of metallurgy suggested a cold rolling test for welded joints which he is carrying out with the cold rolling mill in the School of Mines building. The amount of cold working which the weld can endure is a measure of its ductility. The samples are given reductions in the mill of one, two or four ten-thousandths of an inch on each passage through the rolls. The results of this test will be compared with the others. When enough tests have been made, and sufficient correlation is found between any of them, a standard test for all welds can be devised.

Complex Metallic Hydrides

DR. Klug, of the department of inorganic chemistry, is working on a problem which at first sight seems purely theoretical but which is vitally connected with many major industrial problems. He is investigating the structure of the hydrides of the transition elements. The tantalum hydrides are his main concern at present.

Many ferrous alloys, including cast iron and steel, are structurally related to compounds like the tantalum hydrides. In these compounds, the less metallic component such as hydrogen or carbon forms an interstitial solid solution with the metal, that is, the solute atoms go into the interstices of the crystal lattice of the solvent. In ordinary solid solution formation, the solute atoms replace solvent atoms on the lattice of the solvent. In general, with increasing solute content, solid solutions are formed first and then additional phases are formed, some of which may be considered actual compounds.



Dr. Klug with the apparatus used to make tantalum hydride. He is admitting hydrogen to the heated tube on the left.

The hydrides are made by heating the metal at high temperatures in an evacuated vessel to remove the occluded gases and then admitting a definite quantity of hydrogen. Three distinct tantalum-hydrogen phases can be made by varying the amount of hydrogen. The alpha phase is saturated when the metal has dissolved 12 atomic per cent of hydrogen. Any addition beyond this amount initiates the beta phase, which is homogeneous at 33.5 atomic per cent. A gamma phase appears at still higher concentrations. The first phase has the same crystal structure as the metal, but the last two have definite crystal structures of their own. This seems to indicate that a true compound is not formed until the second phase is reached. Dr. Klug is studing these structures with X-ray powder photographs.

Similar to the hydrides are the nitrides, carbides, and borides, many of which are extremely important to industry. All four elements have the effect of hardening a metal, increasing its electrical resistance, and forming several interstitial compounds with it. The hardening effect is made use of in case hardening and in making high speed tools. Tantalum carbide, for example, is the hardest tool facing known. The well known alpha to gamma transformation in the iron-carbon alloys is a change from one interstitial compound to another.

Looking at Dr. Klug's work from another viewpoint, it may be an important aid in reaching an understanding of adsorption and catalytic phenomena. Many catalysts such as palladium and vanadium adsorb gases during reactions and release them again in a seemingly more active state. No one knows why they adsorb and release the gases in this way, but a study of the hydrides of these metals may clarify the matter.

The Minnesota Techno-Log

Vol. XIX March, 1939 No. 6

Techno-Log Readers Speak

AS WE see it, the TECHNO-LOG has two important reasons for existing. In the first place, the TECHNO-LOG offers technology students an opportunity—and an invaluable opportunity it is—to get writing, selling, and working-with-others experience. Second, and more important, the TECHNO-LOG exists for the purpose of putting in the hands of its readers as interesting, valuable, and worthwhile magazine as is humanly possible under the circumstances. Now, just what should be included in the magazine to make it most interesting and most worthwhile to the greatest number has always been decided in terms of the editor's estimate of what the readers want. Editors have always wished they *knew* just what you read and what you want.

In an effort to improve the magazine and with the intention of supplementing personal opinion, we have lately been using a tool, the Gallup method, to determine reader interest in the various articles and departments. Not only are we able to check our own hunches, but those responsible for particular features have an added incentive in the form of a tangible measure of success at which to aim.

Last month the articles and departments "read," "scanned," and "not read," were determined in a small but representative sample consisting of 25 men from the school of chemistry, 18 mechanicals, 13 aeros, 13 electricals, 9 civils, 8 engineering-business men, 7 miners, 5 architects, 1 agricultural engineer, and 1 physics man, distributed among the four classes.

Some interesting general conclusions can be drawn. You have indicated that the two humor columns enjoy an overwhelming percentage of readers. You also indicated a definite preference for student-written articles, for articles of general interest to all engineers, and for about the same proportion of pictures to reading matter as there now is.

Thanks is due those of you interviewed who helped make the reader interest poll a success last month. In the future, please coöperate as whole-heartedly and conscientiously as you have in the past. The project is worth your support.

The TECHNO-LOG is your magazine. We eagerly welcome any suggestion or indication of what you want. In the reader interest poll we feel we have a device by which a more and more worthy magazine can be put in your hands.

C. V. O.

Ho-Hum

HAVING adequately discussed our new means for finding out just what you fellows want in your TECHNO-LOG we were wondering what might be a suitable subject for our second editorial this month. One harassed senior remarked cynically, "Leave the space blank—everyone is so busy getting their pre-final cramming done that no one will notice the difference."

We didn't fully agree with him since our poll showed that quite a few fellows read the editorials so we considered the suggestion of a staff member that we discuss the subject of final examinations. However, since one of our contemporaries, the *Pennsylvania Triangle,* in a recent editorial devoted over a page to the subject without covering it fully we were loath to attack it within the narrow confines of the 300-word space at our command.

Another student came forth with a suggestion, one typical of members of his department, "Why don't you write about politics?" You guessed it—he was a civil engineer. He wanted us to write about that reorganization and investigation that is going on over in the highway department now. He said that since several of the new men, including Mr. M. J. Hoffman, the new commissioner, are graduates of Minnesota's civil engineering department, we ought to write something about it. Well, we didn't know all the details, but rather than display our ignorance we told him firmly that the TECHNO-LOG is above dabbling in political scandals, so that subject is out.

Since there was apparently nothing important to write on, someone suggested we write about women. Well, we figured that rather than let it come to that, which would practically amount to having the TECHNO-LOG sink to the level of the *Ski-U-Mah,* we'd let it go and have no second editorial this month.

So, rather than write an editorial we will merely wish you luck on your final examinations and a pleasant vacation. We'll be seeing you again, spring quarter.

Science's Greatest Need Is—

Coördination, according to Lancelot Hogben in "Science for the Citizen," reviewed below. How this will be achieved and its probable result when achieved are interesting questions I think you'll agree when you read this review.

By C. I. Haga
Instructor in English

IN writing "Science for the Citizen," Lancelot Hogben justly merits his own fine tribute to Sidney and Beatrice Webb, whose life-work he describes as a "unified pattern of workmanship and enthusiasm." Hogben's workmanship is attested by his contributions to biology in the special fields of genetics and physiology. Thus qualified to explain the nature and values of science, he has found in his understanding of science the justification for an enthusiasm not bounded by the four walls of his laboratory. Outside his laboratory he has seen a world we know only too well for its waste and confusion and trouble. More clearly than laymen can see, he has perceived it pitifully unblest by the full value of that sense of direction and that feeling for wholesome action which he is convinced only science can offer today. In his eyes the great social problem is specifically one of education, of animating citizenship with the same spirit that ideally guides the scientist. This spirit, he believes, draws its strength from a well-founded optimism and expresses itself in a workmanlike adaptability to new ideas and new devices or institutions. The subtitle of his book gives a clue to both his purpose and his method, "A Self-Educator based on the Social Backgrounds of Scientific Discovery," and he calls it one of the "Primers for the Age of Plenty," the first of which he wrote two years ago in "Mathematics for the Million."

A Man of Incredible Industry

Convinced, therefore, of Hogben's "workmanship and enthusiasm," we naturally expect to find a strongly compelling purpose behind the almost incredible industry leading him to publish some two thousand pages in two short years. Excerpts from two lectures delivered in the last year or two indicate his purpose. The "Retreat from Reason," an earlier lecture, refers to the "expensively uneducated classes" dominating both Capital and Labor and finds especially deplorable their enslavement to technical experts untrained in social responsibility. In a second recent lecture, "The Naturalistic Sciences in the Education of the Citizen," he notes the ambiguity of the term "cultural" and its consequent confusion of educational practice. Here his special scorn is poured upon "ostentatious refinement appropriate to a leisured class" and on out-moded political rationalizations which "exclude the study of the resources of modern welfare" at our command. In short, we do not always teach for use, nor do we use for measurable benefit; and superstition in staggering variety—social, political, economic, moral—wastes our energies and spoils our gains.

Single-handed, "Science for the Citizen" attempts to redirect the current of life and education. Since it emphasizes social backgrounds, it employs a historical development cutting across the strict lines marking off physics, chemistry, biology and their heiratic subdivisions. Grouped under five heads—"The Conquest of Time Reckoning and Space Measurement," "The Conquest of Substitutes," "The Conquest of Power," "The Conquest of Hunger and Disease," and "The Conquest of Behaviour"—the successive chapters lead the reader through formulas and equations, give him problems to work out, instruct him in the art of observation and application, and at every step show him how interwoven are the causes and effects of that which we call progress. Each succeeding account of discovery or of invention emphasizes, with cumulative effect, the principle that science is social (i.e., humane) in origin and its aim is action; and that "It is an active prescription for human conduct." Hogben even goes so far as to dispose of the idea of "pure science" as science for its own sake, for he claims that "great theoretical developments arise in response to the requirements of everyday life, and occur when the scientist is in close contact with the world's work."

It is these common responsibilities that Hogben finally summarizes in a "social contract of scientific humanism," an all-inclusive program based on the "recognition that the sufficient basis for rational coöperation between citizens is scientific investigation of the common needs of mankind, a scientific inventory of resources available for satisfying them, and a realistic survey of how modern social institutions contribute to or militate against the use of such resources for the satisfaction of fundamental human needs. The new social contract demands a new orientation of educational values and new qualifications for civic responsibility." The ends for which this contract is framed will be reached only by a new synthesis of all the naturalistic and social sciences and all the technics each has developed. This synthesis will first absorb into mechanical technology the results of the biological and social sciences and thus create a new culture and a new civilization based on what we are learning to call biotechnics.

A Stimulant for Engineers

Hogben's "Science for the Citizen" is, therefore, both a handbook and a tract. I can think of nothing better than its general science for those engineering students whose knowledge of the sciences is all too frequently limited by its basis of three textbooks, two laboratory manuals, one slide rule, and a wholly superfluous contempt for arts students. For those others whose osmotic permeability has been the greatest, the tractarian overtones will have most appeal. For such students Hogben's persuasive vehemence may well serve as the spark needed to set off and send to completion that reaction between technical and social responsibilities which he has shown us must soon become the acknowledged goal of education for citizenship in the Age of Plenty. I recommend not only "Science for the Citizen," but everything else of the same nature that Hogben has written. If the next great advance in technology is to be this new synthesis, biotechnics, no better catalyst can be found than Hogben's peculiar combination of enthusiasm, daring, and skill.

ALUMNOTES

'08

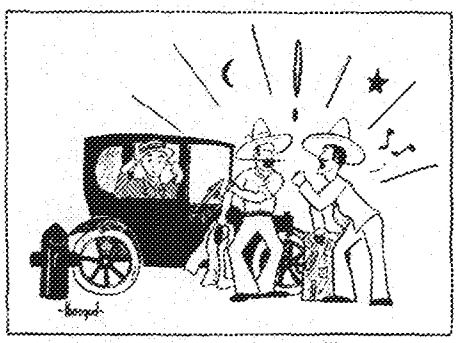
Walter L. Badger, Chem. (M.S. '09), returned to the campus on February 16 to address the Minnesota section of the American Chemical Society. His subject was "History of Unit Operations of Chemical Engineering." Mr. Badger is at present employed by the Dow Chemical Company in Midland, Michigan.

'11

M. J. Hoffman, C.E., was recently appointed state highway commissioner of Minnesota.

'22

Harry E. Brown, Eng., has just been made district manager for the Fairbanks-Morse Company in Cleveland, Ohio. He has been with the company for the past 15 years. He is married and has four daughters.



Nels S. Anderson, C.E., visited the campus recently. Nels is located at Pipestone, Minnesota, where he works on field engineering drafting for the Minnesota Highway Department. He is married, but there are no future engineers in the family. **Paul Velz,** C.E., (M.S. '30,) and **Reuben C. Wieseke,** C.E. '30, are employed on the same crew.

'32

Herbert M. Woolery, Ag. Eng., is a senior foreman in the Soil Conservation Service and is stationed at Red Wing, Minnesota. He is in charge of such engineering work as the construction of temporary dams of brush and rock, of permanent dams of reinforced concrete and masonry, of dikes, and of terraces and terrace outlets. Herbert says he would still like to get into farm machinery work.

Arno R. Schwantes, Ag. Eng., is with the Waterman-Waterbury Company in Minneapolis as a service and sales engineer. His work consists of training new salesmen and calling on sales accounts not covered by the regular salesmen.

'33

G. Russell Carpenter, Ag. Eng., is a secretary and mechanical engineer with Burlingame, Hitchcock, and Estrabook, Inc., in Minneapolis. His work consists of preliminary survey work, design and drafting, supervision of construction, inspection, some material and cost estimation, and other work in connection with the engineering of steam and Diesel generation of electricity.

Dr. Charles Roe, Chem. (Ph.D.), visited on the campus recently. Dr. Roe is employed by the United States Rubber Company in Passiac, New Jersey.

Robert O. Haxby, Eng., was awarded one of the first five Westinghouse research fellowships. He will work in the field of nuclear physics at the Westinghouse research laboratories in East Pittsburgh. While at the University, Robert was a member of Tau Beta Pi.

John J. Lenz, Ag. Eng., is with the Soil Conservation Service in Waterville, Minnesota. He is directing C.C.C. crews in the construction of water conservation control dams. John is married and has one child.

'34

Sigurd H. Anderson, Ag. Eng., is doing experimental work on the campus in the new hydraulics laboratory. Sigurd experiments on river hydraulics and the transportation of bed sediment in open channels.

'35

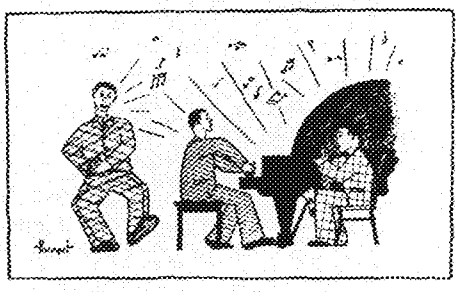
Otto Dahl, C.E., was in to visit Mr. Zelner recently. Otto is working for the State Highway Department on bridge construction and grading at St. Cloud and Mora. Otto is not lonesome, because working with him are his classmates, **Fred Bartel, Oscar England, Amos Sutton, Delbert Dressner, Tom O'Loughlin, Elmer Lindquist, Goodwin Kolstad,** and **Ed Vaurio.**

Maxine Burmeister, Chem., returned to the campus recently for a visit with her former professors. Maxine is married and brought her two-year-old son with her. She now lives in Schenectady, New York, where her husband is employed by the General Electric Co.

Leonard J. Larson, Ag. Eng., is a senior agricultural engineer with the Soil Conservation Service at Lake City, Minnesota. His duties consist of design and technical supervision of engineering structures and terracing for erosion control on farms. Leonard was formerly located at Red Wing, Minnesota.

'36

Dr. George Naponen, Chem. (Ph. D.), is now with the Minnesota Mining and Manufacturing Company in St. Paul. Dr. Naponen was formerly employed by the Eastman Kodak Company in Rochester, N. Y.



Lee E. Baldwin, Ag. Eng., is chief draftsman with the Smith Meter Company in Los Angeles, California. He takes care of all drafting and production details, including pattern and foundry work.

'38

Jack Anthes, Chem. (Ph.D.), who has completed the work necessary for an advanced degree in chemistry, has left for California. There he will work for the Union Oil Company in Los Angeles.

Younger brothers of your telephone

This one helps entertain and instruct millions

Did you know that talking pictures are a product of Bell Telephone Laboratories research? And that the majority of pictures today are both recorded in the principal studios and reproduced in thousands of theatres by means of Western Electric sound equipment?

(Above is a section of film, with the sound track at left of picture).

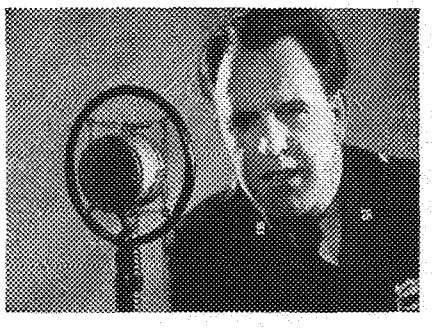
This one helps the hard-of-hearing to hear

If your hearing is impaired, you'll be interested in Western Electric's new Ortho-Technic Audiphone. Another outgrowth of Bell System research, this instrument is built on entirely new principles in hearing aid design. It does things no previous aid could do. It will bring easier hearing and greater happiness to thousands.

This one helps people to fly on schedule

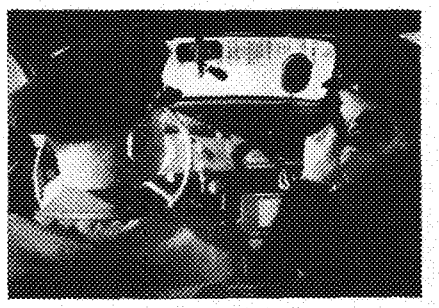
When you travel on any of the nation's major airlines, the air-minded brother of your Bell Telephone flies with you. Western Electric radio telephones keep pilots and airports in touch—help to

make possible today's splendid airline service. More and more private planes, too, are being equipped with the flying telephone.



This one helps to catch more criminals

When police use Western Electric radio, arrests increase and crimes decrease. Your Bell Telephone makers pioneered in the police radio field. Today Western Electric equipment is giving added protection to 45 million people. Has your community this law enforcement aid?



All these benefits and more came out of the telephone

Since 1882 Western Electric has been the manufacturer for the Bell System, and this is still its major activity.

Experience in the field of sound-transmission has frequently enabled the Company to apply its skill in the making of other sound equipment that plays an important part in daily living.

Western Electric . . . made your BELL TELEPHONE

TECH NEWS

Seniors to Take Trips

On March 22, 90 senior chemical engineers will leave on a 10-day inspection trip. This trip, which is an annual affair, consists of visits to about 20 plants in the vicinity of Milwaukee and Chicago. Drs. Montonna, Rogers, and Piret of the chemical engineering faculty will head the group.

This trip, which, in the Institute bulletin is given the single title of Ch.E. 187s—Inspection Trip, is a required course in the chemical engineering curriculum. It is probably the only course that the average student would willingly repeat without credit.

March 24, thirty-five aeronautical engineering seniors are going on a thirteen-day inspection tour of eastern airplane factories. Faculty members, John D. Akerman, Edward E. Brush, B. J. Robertson, Carl Swanson, and Horbert Ruszaj will head the group. The itinerary includes visits to airplane, engine, propellor, and accessory factories as well as both the Army and Navy testing bases.

The tour, held every spring, is required for graduation. The cost of $75 per student covers the transportation, food, and hotel costs. A detailed study of the financial set-up, organization, equipment, and policy of all of these plants has been made. Each student will carry a prepared inspection outline during the tour of each plant. Very little note taking will be necessary. On the return to Minneapolis, each student will prepare a report of the tour.

E.E.'s to Charge Admission

The thirteenth biennual Electrical Show will be held April 21 and 22. This year, for the first time, there will be a small admission charge of 10 cents. This fee will include checking, souvenirs, and, according to the show chairman, "Papa" Dick Rehmann, a much "bigger and better" show than any of the others.

Jim Thompson, chairman of student exhibits, says this show will feature many spectacular displays, such as an electric chair, kissometer, personality tester, high tension display, lie detector, and frozen motion.

Visitors will thrill to the sight of a man "taking" flashes of 2,000,000 volts of electricity in an electric chair. No one will be killed though (they hope). The kissometer has been developed by Jack Hyde. He states that it measures the internal electromotive force produced by the contact potentials. The personality tester is claimed to measure introvertness, dominance, and many other factors useful in determining the personality of the individual. The high tension display, sometimes confused with the kissometer, will give an exhibition of vivid flashes of light, accompanied by a deafening roar, not unlike thunder, as the sparks leap across the gap. The frozen motion exhibit will slow down and stop rapidly moving fans, running water, and other moving objects.

A dance will be held April 28, a week after the show, to recognize and reward the work done by the students in the show. This dance is to replace the one formerly held on the opening night of the show.

There will also be many interesting commercial exhibits showing the latest developments in the electrical industry. Among the exhibits is a weighing scale which is so sensitive that it will record your heart beat when you stand on it, an air cleaner that removes very close to 100 per cent of the dust in the air by the use of electrical charges, a new electric organ, called the Novachord, which can reproduce the music of a piano, violin or cello, guitar, various horns and also reed instruments. An electronic temperature measuring device that will control temperatures

within a hundredth of a degree will also be on display.

Chem. Dance Makes Profit

The annual Chemistry Ball, sponsored by the A.I.Ch.E., was held at the Radisson Hotel, Saturday evening, March 4, with Freddie Rick's boys swinging it. Bill Stuefer was general arrangements chairman, Don Swan was in charge of tickets, and John Shannon was in charge of publicity. The ball was a great success from every point of view. Approximately 120 couples attended, which netted a tidy profit.

The March meeting of the A.I.Ch.E. was held on the evening of March 7, and several important business items were discussed before it was turned over to Mr. Green, one of the vice presidents of the Federation of Architects, Engineers, Chemists & Technicians, a C. I. O. union for technical men. He gave a short talk which was followed by an open discussion on unions and their benefits.

The chapter voted a sum of $25.00 to the union, after a pep-talk by Robert Lundborg. George MacDougall was appointed to head a committee to arbitrate for a club room in the chemistry building. Also, plans for an open house and chemistry show to be held as a part of the annual Engineers' Day were discussed.

Ag's to Hold Convention

At the last meeting of the local student branch of the A.S.A.E., the Ag engineers discussed preparations for the national convention of the society, which will be held at the University Farm campus, June 19-22. The local branch will present a student program during the first day of the convention. On March 7, Mr. Raymond Olney, secretary of the A.S.A.E., presided at a luncheon at which preliminary plans for the convention were discussed.

Of interest to engineers was a one-day Farm Structures Conference, March 3, in the agricultural engineering building. At this conference builders and dealers in building materials heard a program on timely subjects and at the same time saw materials and methods which were discussed by specialists.

P. A. Wells, a Minnesota graduate of the class of '28, has been appointed director of the Department of Agriculture's eastern laboratory to be erected in Philadelphia, Pa. O. E. May, also a former Minnesota student, has been made director of the Department's northern laboratory.

Institute Graduates Organize

Recently a group of men decided that the graduates from the Institute of Technology should organize and form a definite group with regular meetings.

The first meeting was held on Feb. 10, at which time a board of directors was elected, consisting of one member from each school who is in no way connected with the University at present. The officers elected were: Mr. H. E. Gerrish, M.E. '05, president; E. P. Burch, E.E. '92, vice president; and C. O. Anderson, B.S.M.E. '32, secretary-treasurer. The second meeting of the board is scheduled for March 10.

The main objective of the organization is to offer whatever coöperation it can to assist the Dean of the Institute and the heads of the departments in turning out better trained graduates, to facilitate their entrance into the business world, and to maintain a high standard compared with the other technical colleges. They plan to have an open banquet some time in May, at which time they will extend invitations to all who desire to join. This organization has very high aims, and deserves whole-hearted support, since it should serve both the students and the graduates.

Taylor Speaks on Isotopes

On Tuesday, Feb. 21, the Minnesota Student Chemical Society held its monthly meeting. Dr. T. I. Taylor spoke on chemical methods for the separation of isotopes. Dr. Taylor is continuing work on isotopes which he and Professor Urey were doing at Columbia University last year.

FACULTY SKETCH

By Carl Georgian, Ch.E. '41

Professor John D. Akerman

Head of the Department of Aeronautical Engineering

JOHN D. AKERMAN, energetic head of the department of aeronautical engineering, is always alert to further the progress of aeronautical education and industry, a fact that is borne out through the adaptation by other schools and the United States government of many ideas developed first at Minnesota under his leadership. His education at European and American universities in the science of aeronautics, together with his wide experience in the industry, has given him a broad outlook on the problems of aviation.

Professor Akerman was born at Jelgava, Latvia, in 1897. His aeronautical education began at the Moscow Aeronautical School, from which he graduated in 1916. In 1925 he received a B.S. degree in aeronautical engineering from the University of Michigan.

Design of aircraft is Professor Akerman's specialty. As chief engineer for the Hamilton Metalplane Company, he received for his designs the first approved type certificate issued by the Department of Commerce for all-metal aircraft design in this country. During 1929-30 he developed, for Mohawk Aircraft, a twin-engined cabin monoplane, capable of sustaining flight on one engine, which is now a leading type of aircraft. Incidentally, the Thompson Trophy race winner, last September, flew a ship designed by Akerman and Barlow of our University.

Before coming to Minnesota in 1929, Professor Akerman held the following positions: engineer for Stout-Ford All-Metal Aircraft Co., special designer for the aerodynamical laboratory of the University of Michigan; chief engineer for the Hamilton Metalplane Co., and chief engineer for the Mohawk Aircraft Corporation.

In 1935 he made a personal trip to France, Germany, Latvia, and the U.S.S.R. to inspect the plane designs of those countries. He plans to make another trip to the above countries this summer.

Professor Akerman's activities have not gone unnoticed. He is listed in "Who's Who in Engineering," "American Men of Science," and "Who's Who in Aeronautical Engineering." He has recently been elected to the Advisory Board of the Institute of Aeronautical Sciences and is governor of the Minnesota state chapter of the National Aeronautics Association. Professor Akerman is an Associate Fellow in the Royal Aeronautical Society, London, England, and in the Institute of the Aeronautical Sciences. He is a member of Iota Alpha, honorary research fraternity, University of Michigan.

His book "Problems in Airplane Structural Analysis" is being kept up to date yearly in spite of rapid changes in the industry, and is used as a reference by several schools of aeronautics.

This is Professor Akerman's tenth year at Minnesota. During these ten years both aviation and education have progressed rapidly. However, Minnesota's department has kept pace with these developments and is now ranked among the top four aeronautical engineering schools.

In line with this progressive policy, lately Professor Akerman has been working with the federal government on their civilian flight training program. Minnesota is one of seven or eight schools chosen to carry on the experimental work necessary to develop a system capable of turning out several hundred pilots a year.

BLOW OFFS AND SIDE SLIPS

By Don Frankel, Aero.E. '39, and Bob Wolfe, M.E. '39

For the benefit of the person who sent me one of those clever little valentines with a mirror and the words "I love you," may I repeat that you can't insult me—I'm too dumb.

Speaking of valentines, here is a little story that a fellow told me the other day upon the promise that I wouldn't let it get around, so if you promise not to tell a soul, I'll let you in on it. There are two senior M.E.'s whose feeling toward each other has been quite antagonistic for some time. With the help of a fellow named Ed, they each received a nasty valentine signed by the other. As far as we know, there hasn't been a fight yet, but we're still hoping.

My love has flew
Her did me dirt.
I did not know
Her was a flirt
so
Let's love forbid
Lest you get done
Like I been did.

Wes Larson, senior M.E., has become "the purchasing agent's son" at a number of downtown conventions. By pretending to be interested in the salesman's wares, he finds it very simple to get his fill of the very finest of liquors.

"Shay, did you shee Snow White and the seven dwarfs?"
"Yeah."
"Which way did they go?"

We understand that there is to be a new organization formed on the campus. It's to be called the "Joke O' Rein'" club. Its motto is: Whatever it is we're agin it.

Al Raudenbush tells of the fellow in business statistics who ruined a mechanical calculator. He divided a number by zero and burned out the bearings.

Then there's the one about the young engineer who sat down on a hot casting while visiting a foundry. Upon rising, he knocked a hole in the ceiling.

One of the local newspapers carried the following headline the other day, "Hitler gives the world twenty-four hours to get out!"

Prof. Algren compared a certain type of boiler to a shyster—one gut clear through!

We know a lot of dirt about a prof in M.E. but we can't blackmail him because his wife doesn't care.

My inspiration says I have only one friend but he adores me. (I didn't know that angels could be that mean.)

When asked to explain why he wouldn't buy his wife some peanuts at the hockey game, "Uncle Fully" Holtby, instructor in the foundry, replied, "If I buy her a bag of peanuts she'll get thirsty and want a bottle of pop."

Then there was the electrical engineer who jumped up from his chair because he had amps in his pants.

PICK AND PAN

By M. A. Troxell, Met.E. '39, and H. A. Larson, E.M. '39

This Month's Column is a plagiarist's Paradise. Cynics (Ed. note: Or critics) will note an improvement over previous efforts.

POST-SHINDIG LAMENT

The morning after, he lay in bed
An ice-bag propped upon his head

He dimly recalled the night before
How he staggered at last to the bedroom door

He remembered laughing at the bar
Without a care for the loss of his car

He thought about feeling rightfully proud
As he managed to stand in the midst of the crowd

"Oh the miner's life is the life for me
In the land of the brave and the home of the free!"

Then he hiccoughed gently one, two or three
And passed out very quietly.

D. A. A.

We wonder if Dalton realizes that pennies do not work in a nickel slot machine and the jack pot will never be forthcoming if the machine is not a slot machine in the first place. Hastings ought to set his friends on the right track—if only back to the dance floor.

Who was the practical joker that took the liberty of calling Squire Anderson's fraternity house and informing them that one honorable member of the domicile—namely Squire—requested bail at the local bailiwick for infringement on stability requirements in walking. They found out it was only another hoax (after a frantic search for the necessary dough), when Anderson appeared.

"I have a faint rumbling in my stomach."
"Must be that truck you ate for dinner."

UNDER THIS STONE LIES MURPHY
THEY BURIED HIM TODAY
HE LIVED THE LIFE OF RILEY
WHILE RILEY WAS AWAY.

She: Do you know what they have been saying about me?

He: What do you think I'm here for?

It was a beautiful night in June. As they sat there he could see the light waves in reflectory gleaming beauty on the surface of the water. Hardly a breeze was stirring and the night was one of those "just right" summer evenings.

She cuddled closer to him as he hugged her tighter—while holding her in a tender embrace, he dropped one arm to reach down into the water—the limpid liquid seemed almost lukewarm to his tingling fingers—as her lips brushed his ear, she whispered softly, indistinguishably. He withdrew his hand from the water and caressed her fondly—slowly, not disturbing the reverent peacefulness of the occasion, his hands awkwardly fumbling at the fasteners on her dress—a thought of resistance that crossed her mind evidenced itself in a plaintive whisper—but was lost as she surrendered to his persistent persuasion and entrusted herself to him completely—before either of them realized it, his awkward hands had slid her dress over her head and pushed it aside—bolstered by his accomplishment and her passiveness, he soon had removed the remaining bits of clothing from her tender body. Tears flooded her eyes as she anticipated his next move, but for the moment he stared at her while his thoughts turned to his young wife who was spending two nights some 100 miles away with her parents—but only for a moment did the thought of his wife hold his attention—again the young female form before his eyes filled his mind. His hand dropped to the water again: to him it seemed dangerously hot—but how was he to know the right temperature? This was the first time he had ever attempted to give his two-year-old daughter a bath.

Once upon a time there were two Irishmen. There are lots of them now. . . .

Standard References:

Webster's Collegiate Dictionary	**$3.50**
Hudson's Engineers' Manual (new edition)	**2.75**
Handbook of Chemistry and Physics	**3.50**
Mark's Handbook for Mechanical Engineers	**7.00**
Standard Handbook for Electrical Engineers	**7.00**
Merriman Handbook for Civil Engineers	**8.00**
Peele Handbook for Mining Engineers	**10.00**
Perry Handbook for Chemical Engineers	**6.75**

Wiley Handbook Series:

Eshbach Handbook of Engineering Fundamentals	**4.00**
Kent Handbook for Mechanical Engineers—Power	**5.00**
Kent Handbook for Mechanical Engineers—Design	**5.00**
Pender Handbook for Electrical Engineers—Power	**6.00**
Pender Handbook for Electrical Engineers—Communications	**5.00**
Urquhart Handbook for Civil Engineers	**5.00**

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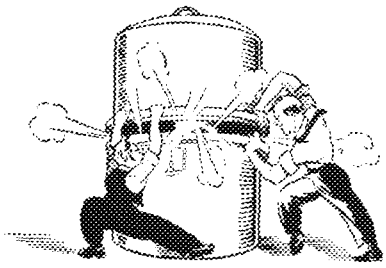
G-E Campus News



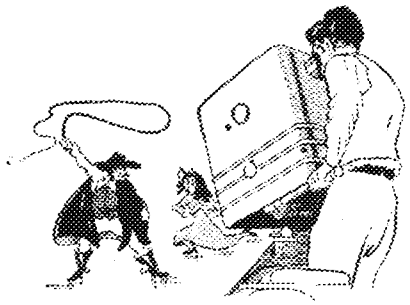
A BIG SQUEEZE

IT TAKES a lot of squeeze to put a 1,000,000-volt x-ray equipment in a container only four feet in diameter and seven feet long, especially when its less-powerful predecessors required a special building 62 feet long, 32 feet wide, and 36 feet high. But recently, G-E scientists applied the necessary squeeze and completed some surprisingly compact x-ray equipment.

Such squeezing naturally involves a few innovations in design. So innovations were introduced. The 11-section x-ray tube was put inside the novel transformer, in the space normally taken by an iron core. Gas having an impressive-sounding name, dichlorodifluoromethane, was used instead of oil as an insulating medium, 100 pounds of this gas doing the work of six tons of conventional oil.

Then the equipment was mounted in the grounded metal container, thereby enclosing the 1,000,000-volt circuit and eliminating the hazard of electric shock. Looking at the apparatus, you note a striking absence of moving parts, for the control of the apparatus is essentially electrical.

The first of the new units will be installed this spring in Memorial Hospital, New York City, providing medical science with another powerful weapon in its constant war on disease.



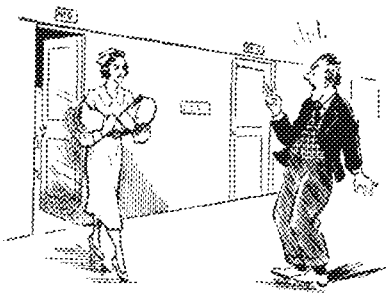
LIGHTS! ACTION! CAMERA!

IN A specially constructed room alongside the studios of the G-E international short-wave stations, the familiar words, "Lights! Action! Camera!" will soon be heard.

For General Electric's new television station at Schenectady is nearing completion.

The television transmitter, perched atop the Helderberg Hills 12 miles outside the city, will be at least 250 feet higher than the station in the tower of the Empire State building, New York. And, broadcasting with 10,000 watts, it will be the most powerful television station in the United States.

There will be—literally—no strings to the transmitter. C. A. Priest, Maine '22 and an ex-Test man, Engineer of the Radio Transmitter Engineering Department of General Electric, has announced that an ultra-short-wave transmitter will be used instead of the usual cable to relay the images from the Schenectady studios to the main transmitter in the Helderbergs.



THE "HOUSE OF MAGIC" BECOMES TWINS

THE world-famous G-E "House of Magic" show has become twins. It had to, for it was placed in the predicament of having to be in two places at one time—the New York and the San Francisco Fairs.

One twin—directed by R. L. Smallman, Calif. Tech '33 and ex-Test man—is already holding court on San Francisco's Treasure Island, site of the Pageant of the Pacific. The other makes its bow April 30, opening day of the New York World's Fair. Its director is W. A. Gluesing, Wisconsin '23, also an ex-Test man.

The thousands of visitors to these Fairs will see such feats of modern magic as a voice-controlled toy train, a magic carpet, zigzagging pictures of sound. They will see the stroboscope, which makes it possible to see the spokes of a whirling wheel just as if the wheel were motionless. They will see a light beam sawed by the teeth of a comb.

However, entertaining as these demonstrations are, they represent far more than mere tricks of modern magic. They symbolize the work in pure science that is constantly taking place in G-E research laboratories—work which is the basis of General Electric's contributions to the world of the future.

GENERAL ELECTRIC

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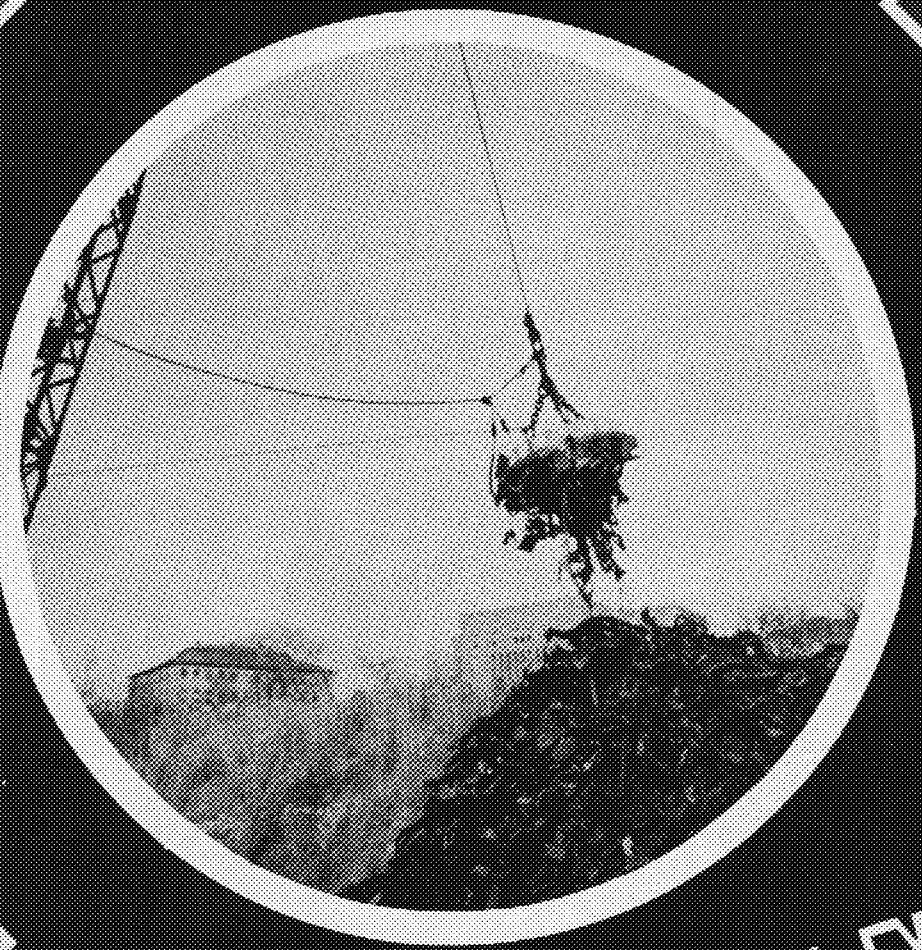
MINNESOTA ENGINEER



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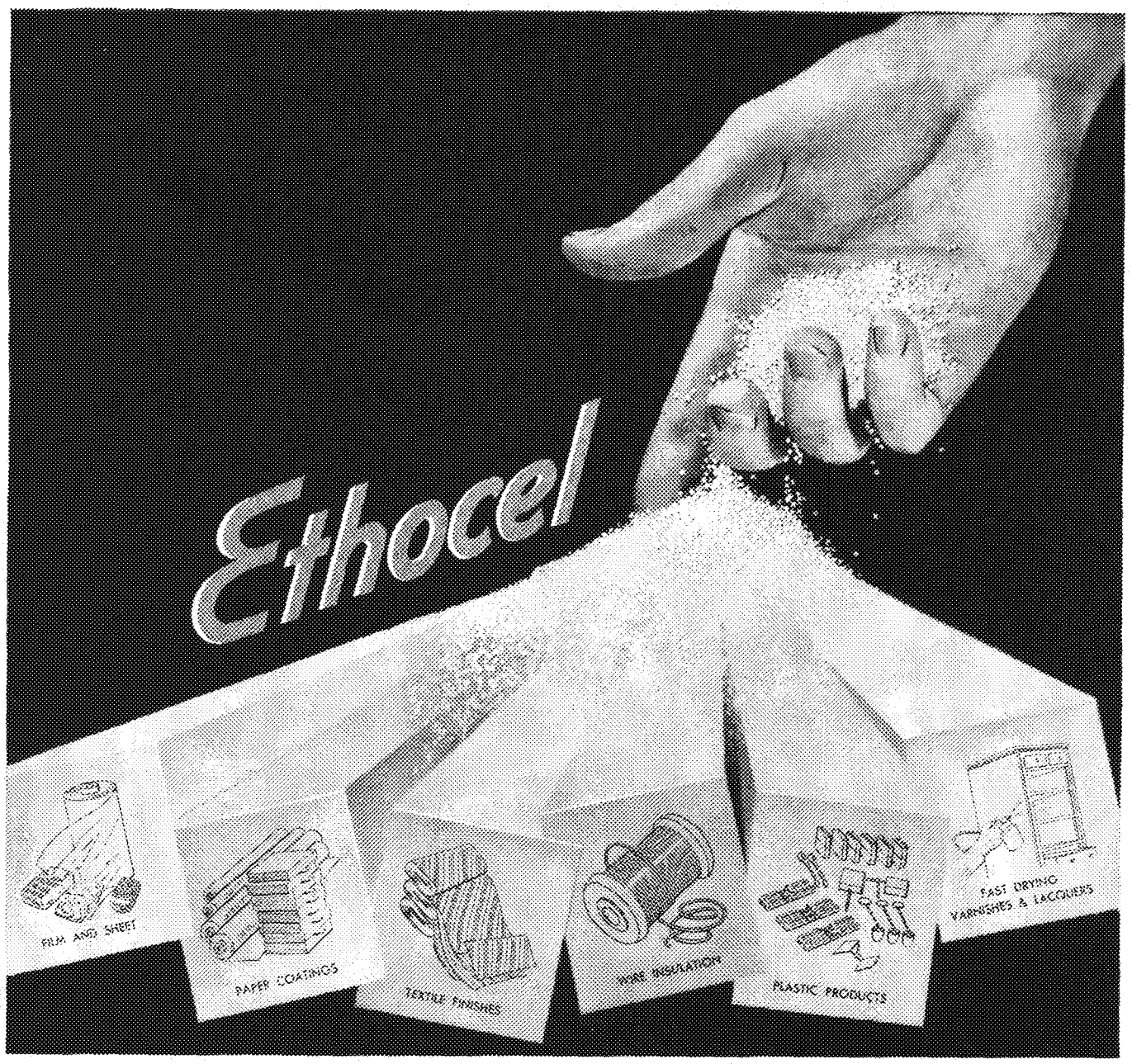
1939



LITTLE GRANULES OF GREAT VALUE

ONE REASON Ethocel*, a recent Dow development, is so much in the public eye is its adaptability to a great variety of products.

Ethocel, the trade name of Dow Ethyl Cellulose, is a colorless, odorless, tasteless, nontoxic member of the cellulose family. It has already demonstrated its right to exceptional distinction.

Ethocel is the only cellulose derivative possessing both stability to heat and solubility in a wide range of low-cost solvents. It is bringing new qualities to fast-drying varnishes and lacquers; adding lustre and toughness to paper coatings; providing protective finish to textiles. Makers of wire insulation welcome its flexibility and dielectric properties.

Still other qualities that recommend Ethocel to designers and manufacturers of moulded products are dimensional stability, resistance to dilute acids and alkalies, low flammability and high resistance to sunlight and humidity. Ethocel film and sheet provide special advantages for packaging and other purposes.

And so in the little white granules of Ethocel you find a material of truly amazing versatility, as well as manifold virtues. Probably no other product among the more than three hundred Dow developments so greatly stimulates the imagination or makes a more useful contribution to industry.

*Reg. U. S. Pat. Off.

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DOW

CHEMICALS INDISPENSABLE TO INDUSTRY

Three Seniors Show You New Spring Clothes from Dayton's

Don Lampland, all-University senior class prexy, likes a 3-button Suit made of green tweed. It has a "shooter's" collar, $35.

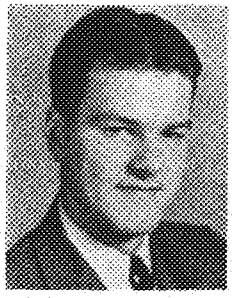
All this merchandise available in Dayton's Varsity Shop, downtown, as well as on the campus.

Dick Forberg, putting in the finishing touches on a chemical engineering course, wears a natural tan covert cloth Suit, 3-button, single-breasted style, with hand-pricked lapel, $35.

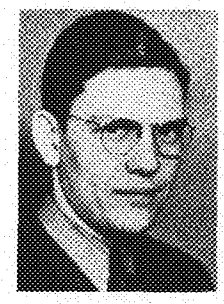
Herb Gaustad, president of the American Society of Civil Engineers, in a sleeveless Sweater, $2.50, a brown tweed sports Jacket, $17.50, and a pair of gabardine Slacks in contrasting green, $8.50.

This Month's AUTHORS

By John Shannon, Ch.E. '40. Photos by G. A. Halseth, Ch. '40, and J. J. McBrady, Ch. '38



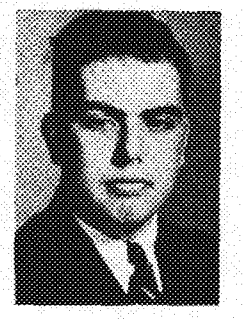
Burke Martz, C.E. '41, writing for the TECHNO-LOG the first time, describes the opportunities for up-and-coming young engineers in civil service fields. He is well qualified to present this subject in that he is taking the public service curriculum in civil engineering and plans to enter the civil service as soon as possible after graduation. Burke is interested in all sports in general but basketball is his favorite. For his own enjoyment now and then he likes to swing out on the slush pump (trombone to the layman). He is a member of Delta Tau Delta, academic fraternity.



Byron Ertsgaard, M.E. '40, finds it one of his duties as chairman of this year's Engineers' Day to write for the TECHNO-LOG explaining the Engineers' Day tradition and giving some advance information on the plans for the 1939 celebration. In "Colossal! Stupendous!" he attempts to arouse some of the enthusiasm which is necessary to make this year's event the "best ever." Byron states that school occupies practically all of his time, spare and otherwise, and therefore he does not indulge in hobbies. He has time, however, to be program director of the A.S.M.E.; secretary of Scabbard and Blade, military fraternity; and is generally active in the R.O.T.C. For recreation and relaxation he enjoys skiing in the winter, and swimming and tennis in the summer.

George Bower, E.E. '40, in writing for the TECHNO-LOG this month, gives a preview of the coming Electrical Show. George is a member of the TECHNO-LOG staff and has written other feature articles for the magazine. He finds time, aside from his studies, to be active in the A.I.E.E. and to work on his hobby, which is photography. In the line of sports he prefers either tennis or basketball. George's plans for the future do not include graduate work, for he plans to enter industry either in research or in production work.

Jean Nemec, Int. Arch. '39, and **George Levin,** Arch. Eng. '39, joined forces to give you "A Free Trip to the Fair" in which they point out the sights to see if you should decide to visit the World's Fair this summer. Jean is quite active in extra-curricular activities, listing among these work on Engineers' Day committees and membership in the Architectural Society and in Alpha Alpha Gamma, architectural sorority. Her ambition for the present is to obtain work as an interior decorator and designer after graduation.



George is interested in the structural phase of architecture and is registered in University College so that he can take more courses which bear upon that subject. He is a member of the Architectural Society and of Sigma Alpha Sigma, engineering fraternity. Photography is George's main hobby, but he also likes to draw and to paint. His plans for the present call for a number of years spent doing graduate work.

The Minnesota Techno-Log

37 Electrical Engineering Building

University of Minnesota, Minneapolis

WOOLSEY MOTL
Managing Editor

ROBERT E. McDONALD
Business Manager

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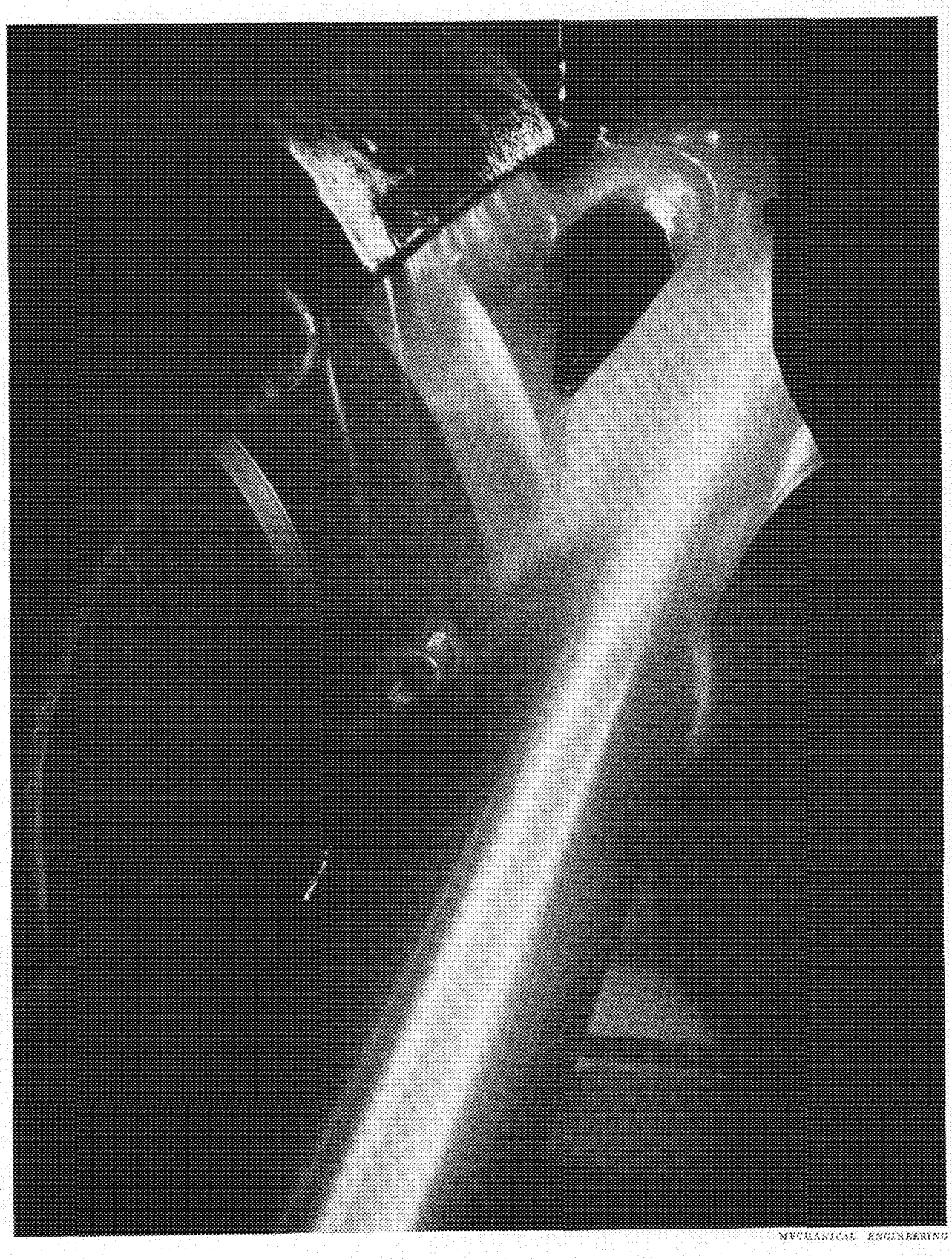


MECHANICAL ENGINEERING

Centerless Grinding

10,000 Engineering Jobs

A government job is good, but what chance is there for advancement? Will I be pigeon-holed in the first position I get? Our author has looked up the answers to questions such as these and presents them in this article on the engineer's place in civil service.

By Burke Martz, C.E. '41

THE opportunity now exists, as it has never existed before in this country, for an engineer to make a career in the field of public service. Government is assuming new responsibilities, many of them of complex character. Skilled technicians are needed to take over these responsibilities.

There are at least 10,000 positions of a definitely professional character subject to the United States Civil Service law, which are filled by the recruiting of graduate engineers. In attempting to recruit to the government service the persons best fitted to fill the various classes of professional and scientific positions, it is natural that the Civil Service Commission should turn to the universities of the country for trained personnel. The aim of the Civil Service Commission is not merely to secure good employes; it endeavors to procure the best available. A recruiting system has been developed which literally combs the country to bring the most capable men and women into Uncle Sam's workshops and laboratories.

Leonard D. White, professor at the University of Chicago and former member of the United States Civil Service Commission, says that the examiners of the future will be roaming the country in a constant search for the most promising material for government offices. They will do for government what the personnel experts of the Standard Oil Company, the United States Steel Corp., and other great corporations do for industry.

Mayor Frank T. Shaw of Los Angeles has proposed an apprenticeship plan for career service in the city's civil service system. His proposal calls for annual examinations, open to any resident between 18 and 25 years of age, with preparatory study arranged in coöperation with local schools and colleges. To all intents and purposes, it would be a period of genuine apprenticeship and of continued training under actual job conditions. Material of the highest type would be insured for positions as they became available.

President Roosevelt is studying suggestions for a third service academy to train civil servants for all branches of public service. The result would be the creation of a real career service with properly attractive salaries and other advantages such as apply in the case of the army and the navy.

The United States Civil Service Commission, too, has realized the importance of attracting outstanding young engineers to the government service. Last year they set up a new classification with the graduating classes of colleges and universities as the principal source of recruits. This classification has the title of Junior Professional Assistant and carries a salary of $2,000.00 a year. To qualify for this position, one must have successfully completed a four-year course leading to a bachelor's degree from a college or university of recognized standing. Applications will be accepted from senior students now in attendance at institutions of recognized standing, subject to their furnishing proof of successful completion of the required college course. The examination for this position will consist of two subjects: one a general test for all competitors, and the other a test on the fundamentals of a particular profession. The applicant's place on the register will be determined by the numerical grade received. The register to which he will be assigned will be determined by the degree he has received. A person who majored in civil engineering would be placed on the civil engineering register; one who majored in chemical engineering would be placed on the chemical engineering register, etc.

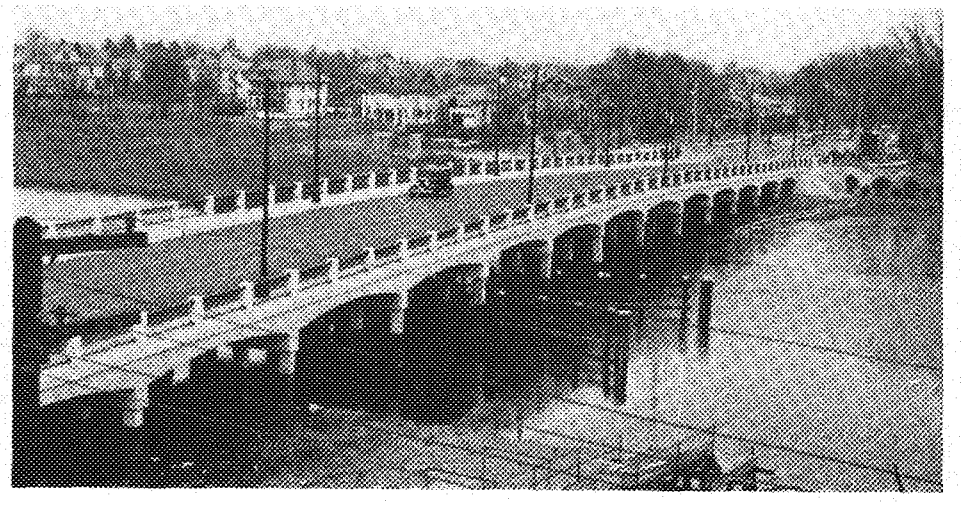
Opportunities in Many Departments

What government departments will use these registers of engineers? Actually almost every department will use them. Here are a few of the departments that will offer excellent opportunities to young, ambitious engineers.

Bureau of Chemistry—Investigations concerning dust explosions and fires are good examples of the work of this department. It has been estimated that at least 21,000

One of the largest fields in the civil service is that open to civil engineers.

CONCRETE

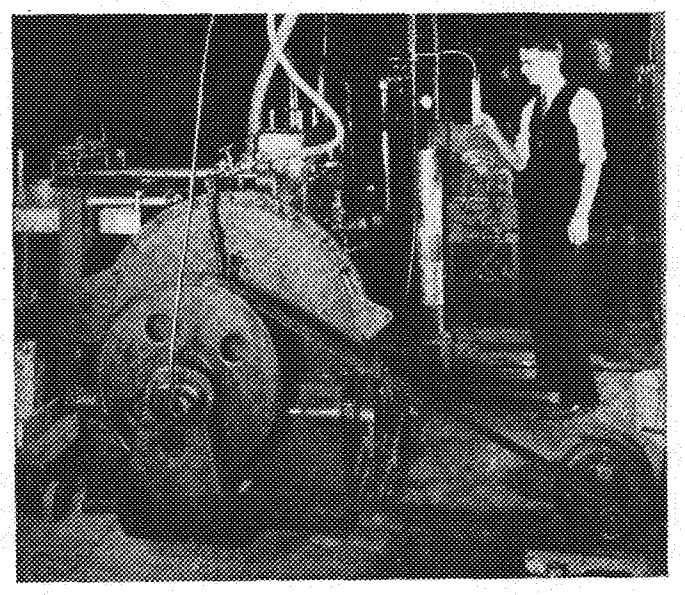


industrial firms manufacturing products valued at nearly $7,000,000,000 annually, are subject to dust explosions.

The Bureau of Public Roads—The Bureau of Public Roads employs more than 500 engineers whose work carries them into every state, Alaska and Hawaii. The bureau studies systems of road finance, administration, construction and maintenance; tests road materials; and conducts research solely with its own forces and in coöperation with colleges and state highway departments to determine the causes of road depreciation and to devise better methods of road design. There are many cases of exceptional advancement in the Bureau of Public Roads.

The Bureau of Mines—In addition to its safety work, the Bureau of Mines is charged with the study of more efficient methods of mining, treatment, and utilization of mineral materials. The bureau is constantly studying ways of increasing the production of the nation's oil and natural gas by improving petroleum engineering methods. To carry on this work, the bureau maintains an extensive research institution at Pittsburgh, Pennsylvania, and a large petroleum research station at Bartlesville, Oklahoma.

The Bureau of Standards—The Bureau of Standards is the largest testing and research laboratory in the world. The work of this bureau includes every branch of engineering from ceramic to photometric. New and improved processes are developed for special industries such as methods of producing metal enameled ware. Engineers



Civil service offers engineers the opportunity of doing graduate work.

in this department serve as advisors to the government in a wide range of scientific and technical problems. Its extensive facilities offer an engineer a unique opportunity for research and development.

Bureau of Public Health—Among the problems assigned the engineers in this department are the investigation of stream pollution, methods of malaria control, and milk and shellfish sanitation. The sanitary engineers in this bureau are associated with some of the most fundamental research now in progress in this country and take a prominent part in the meetings and publications of technical societies.

The Air Service—The War Department employs many civilian engineers in the Air Service. It maintains at McCook Field, Dayton, Ohio, an unusually well equipped laboratory. Its precision instruments, propellor test rig, wind tunnels, and static and dynameter laboratories are well known throughout the country. Many air developments of great importance have resulted from the work of engineers in this department.

Engineering Department at Large—More than 600 civilian engineers are employed by the Engineering Department at Large. All of these civilian assistants are appointed as a result of civil service examinations. The work of this department is primarily concerned with the maintenance and improvement of rivers and harbors, flood control, lock and dam construction, operation and care of canals, and the construction and repair of fortifications.

Advancement Based on Merit

Advancement to higher positions in the government service is based on merit. As soon as a young engineer has shown himself to be capable of handling new responsibilities, he is promoted to a higher position which, of course, carries an increase in salary. Following is the promotion scale and the salary of each advanced engineering position in the United States Civil Service:

Junior Engineer	$2,000-$2,600
Assistant Engineer	2,600- 3,200
Associate Engineer	3,200- 3,800
Engineer	3,800- 4,600
Senior Engineer	4,600- 5,400
Principal Engineer	5,600- 6,400
Head Engineer	6,500- 7,500
Chief Engineer	8,000- 9,000

An attractive feature of employment in the civil service, from the viewpoint of the ambitious junior engineer, is the opportunity afforded to pursue post-graduate college work. A number of government field stations and laboratories are maintained in connection with universities and technical schools where employes may arrange for special courses. Reports made to government bureaus on technical problems are accepted in many cases as theses toward master's or doctor's degrees.

In addition to courses in colleges and universities, the Bureau of Standards, the National Advisory Committee for Aeronautics, and other government institutions give valuable courses in technical and professional subjects. These courses are accepted by a number of universities as credit toward higher degrees.

Employment in the government service offers a young engineer the opportunity to come in contact with men of national and international reputation, whose collective interests cover essentially the entire field of engineering. The work of junior engineers is carried on under the guidance of men skilled in their profession. Meetings of scientific associations in Washington and in other cities where the government has engineering activities offer engineers the opportunity to hear scientific problems discussed by recognized authorities from all over the world.

A young engineer who enters the government service now and in later years will find a very promising future awaiting him. He may acquire an executive position, if he has the ability, that will bring him prestige and distinction as well as a good salary and a liberal retirement pension. Very few industrial organizations have as much to offer an engineer as the government service.

Ghosting on Lake Pepin

Do you want fame, honor, reputation? Then establish a Lake Pepin ghost, for Lake Pepin, the wildest, weirdest waste of western waters, is the logical ghosting ground for a first class spook and it is still ghostless.

By Roderick W. Siler

Assistant Professor in Mathematics

IT IS a fact, established upon the authority of persons who have made a study of the conduct of ghosts, that the spirits have certain definite preferences as to when and where they will put in an appearance. As to the time, even an amateur in ghostology knows that they like a dark night, the darker the better. As to the place, spooks enjoy dodging about a region in which, at a previous time, and in a material form, they have cut some figure. This last is worth noting: in nine cases out of ten a ghost, whether he, she, or it, was formerly a prominent character in the region haunted.

Such being the case, I was impressed last September when at Lake Pepin in observing what a splendid ghosting ground it was. There were the surrounding bluffs, lofty, bold, timbered, not much changed from a century ago. There were the villages along the shore much as they were in the former famous years, picturesque by day, glimmering with lights by night. There was the old lake itself, miles wide and placid. It was beautiful and decidedly lonesome at night. But that is what ghosts like.

The Old Flying Dutchman

Everyone has heard of the Flying Dutchman, that phantom craft which appears periodically off the Cape of Good Hope in foul weather. This ghost has been famous for centuries because her ancestor in the flesh—or in the wood, perhaps I should say—sailed the seas when the Dutch were a great maritime power. The Flying Dutchman is a symbol of a past, a unique period, when people thought and acted and dressed in a way different from any other time, and when ships were built almost as wide as they were long, so that only a sailor could tell one from a house.

From the above case it appears that what a ghost needs to gain more than a local reputation is, in the first place, an authentic, historic background. Looking back just eighty years, to 1860 and the preceding decade, we find such a background in that time when 2000 steamboats plied the Mississippi and its tributaries. These boats provided a vivid spectacle to which there is nothing quite similar in history. The human element of the boats dressed and acted for their part—as did the ancient Dutch—in a way not to be confused with any other time, past or present. Ladies wore hoopskirts. Gents went to the other extreme and sported trousers so tight they could not pull them over their boots. Boats carried bars and barber shops which were patronized only by males. Men gambled, but not against slot machines. There was adventure and tragedy peculiar to the scene. For instance, on the upper Mississippi in the 1840-1860 period, more than twenty per cent of the boats were destroyed by accidents. Snags, fire, ice, collision, in that order, took them off. A fewer number were destroyed by boiler explosions. This is contrary to the teachings of the writers and the movies, who dote on explosions, but history is history.

In individuality of appearance and construction, a river steamboat need not take a back seat for any ancient sailing ship. Reduced to its elements it was a flat bottomed scow, upon which were set engine and boilers. Stanchions supported an upper deck, upon which the small cabins were arranged about the great saloon. Over all towered the chimneys and the glass-enclosed pilot house. Almost as simple a mechanism as the Dutchman, it did the business. Besides, it was nearly as amphibious as an alligator. At the bow there was often a contrivance formed of two timbers, something like sheer legs. Boats often drew as little as one or two feet of water, but in reaching a spot with less liquid than that the lower ends of the timbers were set on the ground, the upper ends attached by a chain to the deck, the boat lifted, paddlewheels set in motion, and the obstacle overcome. This peculiarity makes one almost expect to meet the ghost of a steamboat coming down the road.

An authentic and unique background, a shape not to be confused with anything else on earth—what more can the creation of a first class ghost require? And what better haunting ground can there be than Lake Pepin, the widest stretch on the Western rivers, where a phantom steamboat can kick up her heels and show the speed that only a spook has?

A Ghost Must have Background

Since the Pepinites have done nothing, it seems to me that here is a splendid opportunity for someone with ambition and imagination to make a mark for himself. Let him spend a couple of weeks at Pepin next summer, sleeping by day, keeping an eye out for the Pepin Ghost by night. There is, by the way, pretty good fishing on the lake. The Ghost, if it runs true to form, will appear on a dark night, and the watcher should remember that. If the specter gives forth sound it will be a soft churning of the paddlewheels, the subdued exhaust of steam from the 'scape pipes, a tinkle of bells signaling from pilot house to engine room. To the eye, the Ghost's complexion will probably seem more reddish than whitish. Just above the water, over the low main deck, will appear the glare of the furnaces as fuel is fed. Far higher—and this is important to note—will show two fiery streamers, the trails of sparks from the chimney tops. It will be awesome, but unmistakable.

The person who sees and hears such as this and who will vouch for it and stand by his guns later, will gain a reputation second only to that of the Pepin Ghost. The lake needs a good ghost. It already has the fish and the scenery. But the Ghost needs someone to introduce it to its public.

A Free Trip to the Fair

We take you to the New York World's Fair via your imagination. It is the quickest and cheapest way, and, although this article can be no substitute for actually seeing the fair, it gives you a picture of it and its principal features from an architect's point of view.

By Jean Nemec, Int.Arch. '39, and George Levin, Arch.E. '39

Illustrations by Walter Ziering, Arch. '41

BEING only human we cannot resist a bit of wishful thinking about the world of tomorrow. As things move rapidly in this streamlined age, the future is telescoped into the present, and the world of tomorrow is the reality of today at the New York World's Fair. The vacation-minded (and who hasn't a bit of gypsy in him?) will rise to the lure of posters, travel pamphlets, special rates et al; the bait flung into the sea of commercial advertising by the promoters and contributing utilities of the exposition. The Trylon and Perisphere, World's Fair theme motif; "World of Tomorrow," fair slogan; jokes anent Grover Whalen versus San Francisco's Treasure Island; and publicity about advertising on the New York State auto licenses are about the only World's Fair details, until this month, to impress themselves upon the mind of the average person west of the Alleghenies.

Opportunity to See "Big Town"

America reacts favorably to invitations of this sort. Most people have a hazy idea that they'll go to see the "big town" sometime and that this is a fine opportunity. We suspect that there will be an eastward migration, against Horace Greeley's best advice, and why not? He once said, "Go west, young man." But Horace wasn't on speaking terms with Grover Whalen. He just didn't know that Mr. Whalen was going to build the World of Tomorrow in the middle of a swamp at Flushing, Long Island, so if you want to see the fair this summer you'll have to disregard Mr. Greeley's advice.

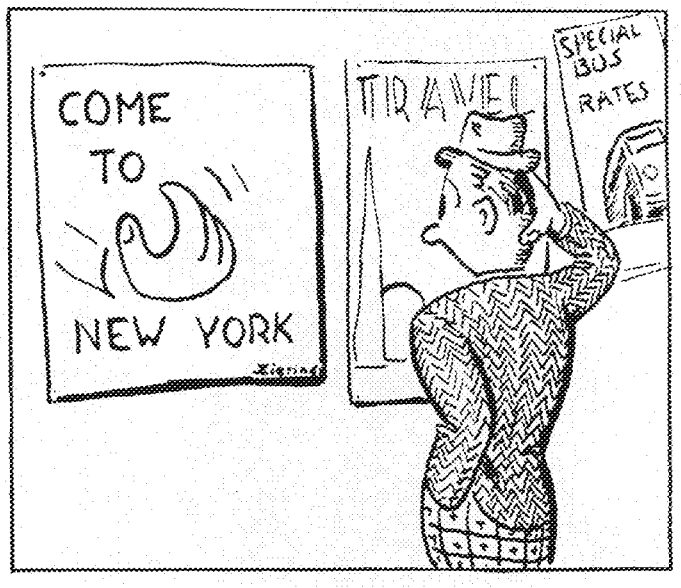
In order to see the fair you'll have to be there, and you have a choice of six methods of getting there. They are railroad, airplane, bus, automobile, thumb, and imagination. We are going to use the last mentioned method until we can obtain the fare to the fair. Incidentally, a round trip ticket by bus to New York from Minneapolis is slightly more than thirty dollars and admission to the fair is seventy-five cents. Incidentals will vary. This trip costs you nothing.

At first glance the impression is one of a nearly flat area dotted with colorful buildings, placed among trees, fountains, and lawns, planned on the free organic principles of contemporary design, and dominated by the theme center of the Trylon and Perisphere. However, from this view one cannot read the price tag, so we will have to tell you that it is marked $150,000,000.00. In return for this expenditure, the World's Fair Corporation (headed by Grover Whalen, ex-New York police commissioner) gives you 17 miles of road, 45 miles of footpaths, and 300 buildings that are supported on 4,000,000 linear feet of piling over a 1,216-acre tract, on which 7,000,000 cubic yards of dirt have been moved.

As you can see, the theme center is the most prominent architectural feature of the fair. That white sphere apparently poised on a cluster of fountains (actually supported on eight columns) is 200 feet high, and the triangular obelisk flanking it is 700 feet high. The forms of the sphere and triangle were selected because they are geometry's simplest and most fundamental forms. To describe these new buildings the word Trylon from "tri" and pylon, and Perisphere, from "peri" (meaning beyond, all around, about) and sphere, were invented. The estimated cost of the two buildings is $1,200,000. The Perisphere weighs 9,000,000 pounds, rises 18 stories above the fair grounds, and is as broad as a city block. The interior is twice the size of Radio City Music Hall, and its design is essentially that of a theater. In this theater, however, the audience moves slowly about the center while the show goes on above it, below it and all around it. A day of life in the "City of Tomorrow," a model modern city of green belt satellite plan, is the central exhibit of the panorama. The audience stands on two balconies which revolve in opposite directions, seemingly unsupported in space. In the short period of five and one-half minutes, time required for one revolution of the platforms, the clouds, stars, sunrise, and sunset, everything that goes into a twenty-four hour cycle is completed.

The theme buildings are near the center of the grounds at the head of Constitution Mall, the central esplanade

". . . rise to the lure of posters, travel pamphlets, and special rates. . . ."



that extends 2,500 feet to the Lagoon of Nations, beyond which is the Court of Peace surrounded by the buildings of the United States and foreign countries.

Here, at the Lagoon of Nations, will occur the nightly fireworks and colored fountain displays. Streams of water as high as 150 feet can be shot from jets to aid in carrying out the compositions accompanied by flame and sound. The esplanade will have the air of an out-of-door sculpture display. Large scale groups by Paul Manship, his fifty-foot sundial, and James Earle Fraser's sixty-foot statue of George Washington are the main features.

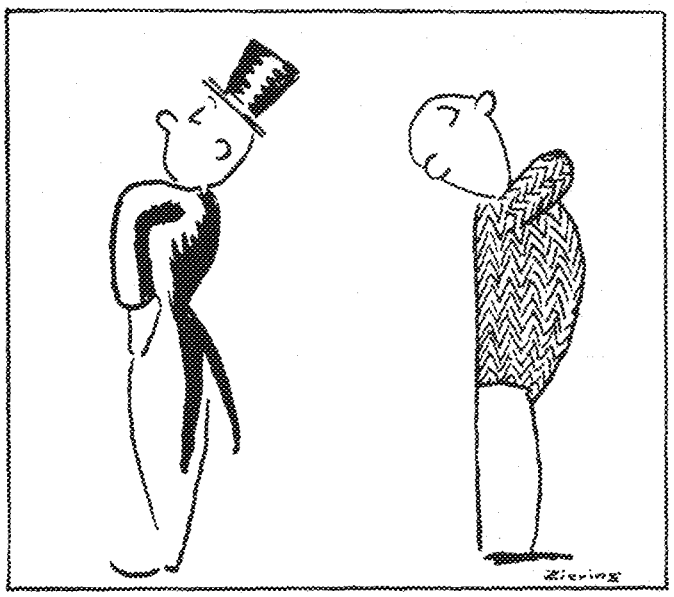
The members of the board of design include such men as Stephen F. Voorhees, Robert D. Kahn, William A. Delano, Richard H. Shreve, and Walter Dorwin Teague. This board controlled the master plan, unified color schemes, set up standards of construction and judged plans presented by separate interests for their buildings. It is necessary to remember that the fair grounds will eventually become a unit in Greater New York's Public Park system. This means that few of the buildings are of a permanent nature. The City of New York Exhibit building will be converted into an indoor winter sports arena, and the New York State Fountain Lake amphitheater seating 10,000 will be retained. The landscaping is also permanent, having been planned in such a manner as to be effective even without the foil of gay buildings.

In order further to unify the fair, five major buildings act as focal points. These represent transportation, communications, community interests, food, and production and distribution. A sixth focal point is the group of government buildings mentioned before. These buildings are further subdivided into fourteen zones, one for each significant phase of modern life. They are: government, production, distribution, transportation, communication, business administration, shelter, clothing and cosmetics, food, health and public welfare, education, recreation, arts, and religion. Within these zones are commercial exhibits housed in temporary structures of ingenious modern design, the work of prominent designers and architects.

Advertising Remains in Background

Visitors will appreciate the truly informative value of these exhibits where advertising remains discreetly in the background. Buildings of notable interest include: Gas Exhibits, Inc., Distilled Spirits, Inc., Glass, Inc., General Motors, E. I. Dupont de Nemours and Co., United States Steel, Aviation, and the Ford Motor Company. These buildings are all of light steel construction and employ a wide range of structural and finish materials, such as steel, glass, wood, and metals, in a variety of new ways.

Organic design, lighting, sound, and color all contribute toward creating the desired effect. These are controlled by the board of design in the interest of the visitor. For example, sound is restricted to use in only two ways, as a background to create atmosphere, or as part of an artistic presentation to the public. Even the barker has no place in the World of Tomorrow. The fair does, however, control a very complete public address system and broadcasting studio which are used to illustrate modern radio technique to visitors in the communications building. New and novel lighting effects include the use of capillary mercury tubes to illuminate landscaping, moving light on the exterior of the Perisphere to make it take on the



"But Horace wasn't on speaking terms with Grover Whalen."

appearance of a huge revolving bubble filled with mist instead of the very substantial building that it is in the daytime, and the entirely new treatment of night display to be used in the fountains at Lagoon of Nations and Meadow Lake. Exhibitors' lighting has been restricted with the aim of having it contribute to the general effect and modified to the extent that no exhibit will interfere with those surrounding it. Color is prismatically related in pleasing combinations, harmonies and contrasts. Landscaping acts throughout as a unifying factor.

Circulation to, as well as within, the fair grounds has been planned to accommodate the 70,000,000 people expected to visit the fair during the season. The fair has its own subway station, parking facilities for 40,000 cars, and access from the water and an adjacent airport. It has been planned so that visitors may see the fair with the minimum amount of fatigue. Busses and individual modes of transportation will be provided within the grounds. There will be plenty of opportunity to rest, facilities to avoid crowding, and sufficient guide posts to prevent confusion and unnecessary walking. Most of the exhibits are on a single level; those that are two stories or more provide escalators or ramps to save aching feet.

The fair is scheduled to open on April 30, exactly 150 years after the inauguration of George Washington. It has an air of patriotism, and desires to demonstrate the blessings of democracy, but its dominant expressed aim is the betterment of mankind. As a business getter it is potent advertising for New York business men, who expect visitors to spend a billion dollars in their city.

People crave amusement. This the fair seeks to furnish, and through this medium to educate. It sets before itself the task of illustrating an idea; the idea of the interdependence and interrelation of modern society, and the progress of thought uniting art and science. It serves as an exhibition platform upon which to display the material and spiritual achievements of the recent years for you to judge. Public opinion and public inertia determine the speed at which progress can be made, and true forward progress is only as fast as the slowest level of thought. Here you have a chance to catch up with the leaders.

Research in the Institute

Electro-Deposition

ELECTRO-DEPOSITION research in chemical engineering has been carried on to investigate the possibility of using thiosulfate baths instead of cyanide baths for plating metals and alloys on iron and steel. Although metals, when electro-deposited from solutions of cyano-complexes, give dense, adherent coatings, the cyanide baths have a low current efficiency and a high voltage drop. In addition, the cyanide salts used cost more than ordinary salts and they must be handled with extreme care because of their toxicity. Two graduate students carried on the research under the direction of Dr. G. H. Montillon, professor of chemical engineering.

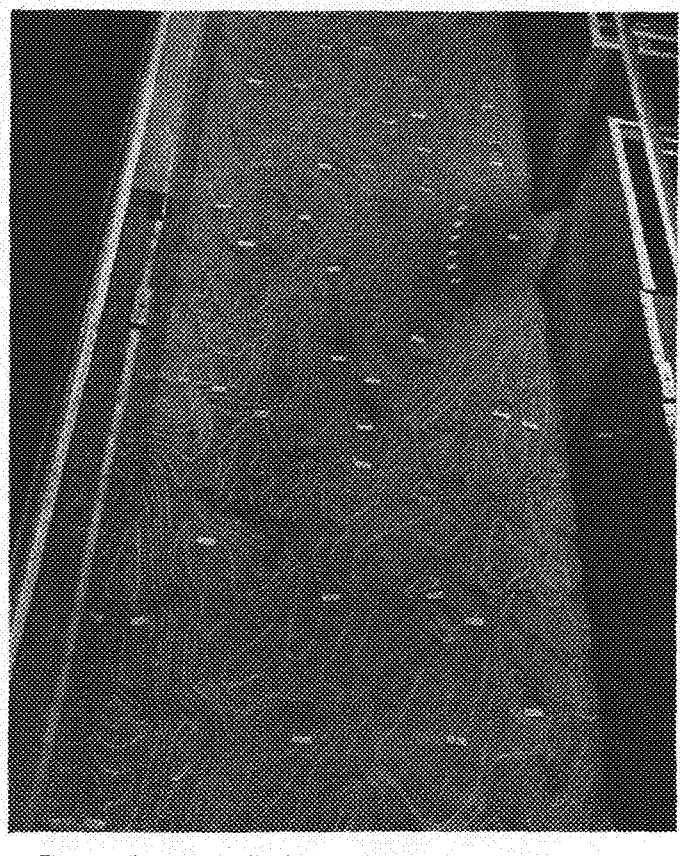
Of the several compounds which form complexes with the salts of metals to be plated, sodium thiosulfate was considered to be the best from a practical and theoretical point of view. The study was confined to the alloys of copper with cadmium, nickel and zinc and to these metals in the free state. It is very important that these metals do not plate on immersion, since a soft, non-adherent metal sludge is formed on the object to be plated. This is one reason for using complex salts. Another reason is that a greater current density is required to deposit metals from complexes, and hence they are deposited with greater force.

It was found that the thiosulfate baths have very good electrical properties. The current efficiency is high and the potential drop is very low. However, there is a maximum current density which must not be exceeded, since sulfur is deposited from the bath above this value. Copper, zinc, cadmium, and several alloys can be deposited in dense, adherent form. Further research will attempt to ascertain the commercial possibilities of thiosulfate baths.

Sedimentation Study

AMONG the studies in hydraulics which are in progress in the new laboratory at Saint Anthony Falls is an investigation of fundamental data on sedimentation. The work is in charge of Mr. Robert Gedney, research fellow in hydraulics.

The problem is to find out how the silt distribution at the junction of two rivers varies with the speed of the water, the amount of silt, and the angle between the two rivers. The apparatus is a simplified river 100 feet long and three feet wide with a tributary joining it at the halfway mark. Sand, corresponding to the silt a natural river would be carrying, is spread evenly over the bottom of the apparatus at the beginning of the test and water is sent in at a definite rate. The sand carried out at the end of the river is caught and weighed under water in a special apparatus. After the test has run for several days, the amount of sand put in equals the amount carried out. This corresponds to the condition of equilibrium existing in a natural river. After equilibrium has been reached, the river bottom remains the same in every detail and the water is drained off. The contours in the sand are then outlined with white string in order to make better photographs, and the ridges in



The main channel of the experimental river near the tributary. The contours in the bed caused by the flowing water are shown by the white lines.

the vicinity of the confluence of the two rivers are drawn accurately on a contour map. A study of enough of these maps, each representing a different set of conditions, will show how the silt distribution varies as the controlling factors change. In the last test, the quantity flowing was half a cubic foot per second. Sand was added to the source at the rate of 75 pounds per hour in this test. The water in the tributary flowed at the rate of .15 cubic feet per second and sand was added at the rate of 25 pounds per hour.

The recently completed test run is the first in a long series of similar experiments. The results may lead to a knowledge of the as yet unknown physical principles governing sedimentation in nature. Another part of the study will attempt to find how debris is carried down rivers. Most of the conservation work in which this is an important factor has been very crude, but the exact knowledge which this study will lead to will make these efforts more efficient.

Foundry Research

NINE research projects are being carried out in the foundry laboratory under the direction of Mr. Fulton Holtby, instructor in foundry practice. Papers on many of them will be published before next winter.

An investigation of the accuracy of various temperature measuring devices used in the foundry led to the development of the tungsten-graphite thermocouple. The optical pyrometer and the platinum-rhodium thermocouple were

also investigated, but the accuracy of the optical pyrometer was found to be affected by the presence of smoke and slag, and the platinum couple, in addition to being very expensive, cannot be used above 2900 deg. F. The tungsten-graphite couples can be used to at least 3300 deg. F., and since they can be made smaller than other couples they do not extract appreciable heat from experimental quantities of molten metal. The measurements can be made in 70 seconds or less. A small resistance furnace built to calibrate and anneal the couples reaches temperatures up to 3300 deg. F.

Another project is an investigation of the effects of various amounts of carbon, silicon, sulfur, manganese and phosphorus on the physical and chemical properties of cast iron when melted in a cupola and an electric furnace under various degrees of superheat. The work on sulfur is almost complete and a paper will be published on it this summer. Although the approximate effect of all these elements is known, no exact data are available.

Cast-Iron Analysis

Rapid but accurate methods of cast iron analysis are being investigated. These analyses must be made in under ten minutes while the metal in the furnace remains hot. With the present equipment and methods, a half dozen sulfur analyses can be made in fifteen minutes, manganese determinations take only a little longer, and one carbon or silicon analysis takes from a quarter to a half an hour. Ordinarily, the foundryman cannot run an analysis on the metal in his furnace before it loses its necessary superheat, so it is necessary to rely on the analysis calculated from the charges put in at the charging door. However, if practicable methods of rapid analysis can be developed, the composition of foundry metals can be controlled much more accurately.

The construction of a small cupola furnace has been started and will be finished in about a month. It will have a 15-inch inside diameter and will stand 12 feet high. Its average capacity will be 1000 pounds per hour. All the parts, including the shell, will be made easily removable for instruction purposes. The tuyeres can be raised and lowered so that the most efficient height can be established, the blower can be controlled accurately, and in addition, the weight of the air blown in can be measured.

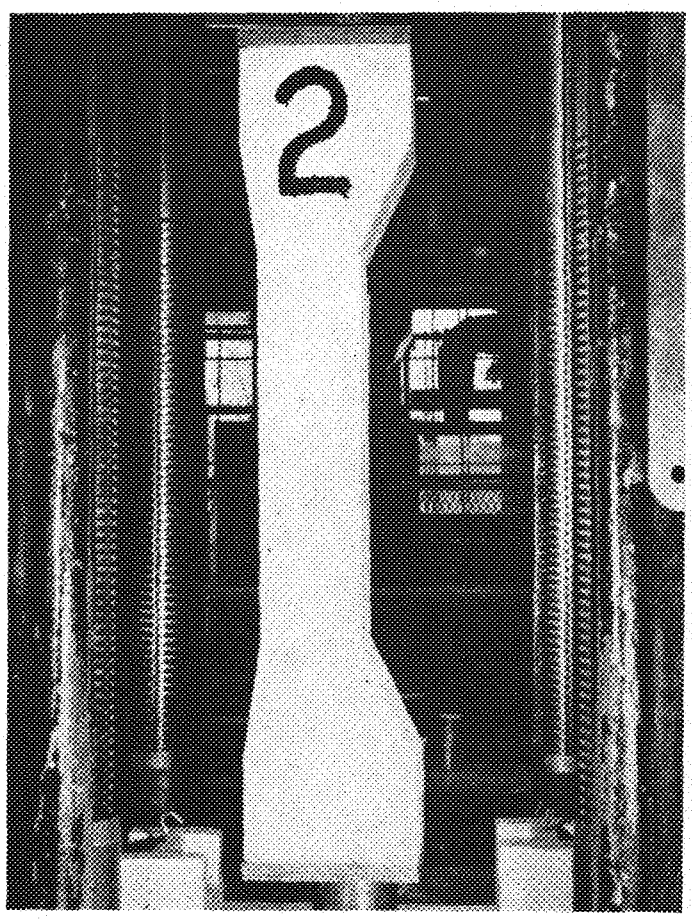
Stress Distribution

THREE methods of computing the stress distribution in reënforced concrete have been devised by civil engineers, and, although each has certain limitations, there is still uncertainty as to their relative degrees of accuracy. This is the problem which Mr. C. E. Cutts of the department of civil engineering has been studying, under the direction of Dr. Paul Anderson, for the past few months.

Although concrete is well suited for withstanding compressive strains, it cannot stand up under tensile stress, so steel is embedded in the concrete columns to take that stress. The test members which Mr. Cutts is using are concrete columns four feet long and six inches square, reenforced with round steel bars. These are tested in a compression machine under loads added in increments of 10,000 pounds. When the load is applied to one side of the center, a compressive strain is developed on one side and a tensile strain is set up along the other. During the actual test runs, three members are tested concentrically and three are tested at each of three different eccentricities, namely, one and a half, two, and three inches. Deformation readings in ten-thousandths of an inch are taken on the tension and compression faces of the columns after each load increment. The actual stress present in the member at each phase of the loading is computed by multiplying the strain, registered on the dial of the strain gage, by the modulus of elasticity of the concrete. The modulus of elasticity, or unit stress per unit strain, is computed from six by twelve inch concrete control cylinders poured at the same time as the test members. These are tested concentrically with loading increments the same as for the test members. The stresses found from experiment in this way are compared with those calculated from the three theoretical equations to see how well each theory represents its particular use.

According to the straight line theory, the strain produced is directly proportional to the stress. This seems to be true only for light loads. The second theory, which is true for intermediate and heavy loads, states that the stress distribution takes a parabolic form on the section. The last theory was devised by Whitney, a Chicago civil engineer.

Although this fundamental research will have only a few immediate practical applications, it will result in more accurate and economical design. At present, engineers have to make allowances for the inaccuracies of the formulæ by using larger construction members and greater reënforcing. More accurate formulæ will eliminate this necessity and result in greater economy.



Eccentrically loaded concrete test member in the compression apparatus.

The Minnesota Techno-Log

Vol. XIX April, 1939 No. 7

A Needed Revision

ON PAGE 163 of this TECHNO-LOG you will find printed in full the proposed Technical Association constitution which will be voted on by the students of the Institute in a referendum on May 24, 1939.

If you are bewildered by the confusion and uncertainty which surrounded the Technical Commission last spring and early this fall you may be sure that you are not the only one. Perhaps the best way to clarify the situation is to go back and relate the changes making revision of the constitution necessary.

The old Technical Commission included the three representatives on the All-University Council in addition to the presidents of the various technical societies. With the uniting of the College of Engineering and Architecture, the School of Chemistry, and the School of Mines and Metallurgy into the Institute of Technology in the fall of 1935; and with the change of the method of selecting All-University Council members to that of P. R. (proportional representation), the old Technical Association constitution obviously became obsolete. To add to the chaos, the proposal of last year's Technical Commission, in the interest of economy and efficiency, to handle the duties of the Bookstore Board and the TECHNO-LOG Board was thrown out on a technicality though it was approved by the students in a referendum.

The Technical Commission, composed of our society presidents, has been working hard all year to bring the constitution up to date, to give the Institute better student government. In justice to the men who have put so much time and thought into the proposed constitution, do not consider it as "this-week's" Technical Association constitution. It is much more than that.

Notice that every Technology student will be a member of the new Technical Association. While the technical society members will be represented by their presidents, the non-society members will have representation through the three Technical Commission men elected at large.

Notice that while technically the various technical societies are liable for Commission deficits, any assessment is highly improbable. Engineers' Day profits thoroughly cover expenses. Further, Wallace Wilcox, Tech Commission president, is proposing the setting up of a reserve fund to take care of the possibility of an unprofitable Engineers' Day. This proposal will, undoubtedly, be accepted.

Notice that a constitutional change cannot be made on the whim of the members of the Technical Commission, but to become effective must also be submitted to the societies for approval and to the students in a referendum. A three-fourths majority of votes cast must favor the change before it can be effected.

Summarizing, we may say that the changes are four in number.

(1) The Institute of Technology, rather than the various engineering schools and colleges, is the basis of the organization.

(2) All technology students, not only society members, will become members of the Technical Association.

(3) Three Technical Commission members will be elected at large to give representation to non-society members.

(4) The Technical Commission will no longer be able to change the constitution without a student referendum.

The new constitution will enable us Technology students to forge ahead to new levels of coöperation, unity, and efficiency in acting on the many matters in which we have a common interest. Let's get behind it!

Vote!

WHY? Well, that may seem a bit difficult to answer. It is true, judging from past records, it will make very little difference to the students or to the University who is elected to the All-U. Council. However, the proportional representation system affords us an excellent opportunity of finding out for sure whether this is true. Under this system we could, conceivably, elect as many as eight engineers if the number of ballots cast by the rest of the campus is as light as usual. Possibly with that many engineers on the Council things would be different. We think it's worth a try, so we urge you to *get out and vote—vote for the candidates who are engineers!*

Leonardo da Vinci—Engineer

Da Vinci's notebooks, reviewed below, ably mirror his amazing versatility. Through them one gets an incredible, yet true, picture of this remarkable man.

By C. I. Haga, Instructor in English

TWO handsome volumes just added to the engineering library, "The Notebooks of Leonardo da Vinci," have already begun to exert a strange and powerful attraction. In part, this attraction is due to the extraordinary variety of subjects under which the material is classified—a variety exactly mirroring Leonardo's fabulous versatility which even those who associate little more with his name than the Mona Lisa and the Last Supper can dimly appreciate. But more impressive and more truly explanatory of the interest the "Notebooks" have for us is his ever-amazing combination of great powers of expression with a consistently and acutely analytic mind. Leonardo's genius may be beyond description, but how that genius sought expression is not beyond our appreciation as we read here and there in the "Notebooks."

SATURDAY REVIEW OF LITERATURE

Leonardo da Vinci—self portrait.

This legend of Leonardo's versatility is the great popular monument to his fame. Painter, sculptor, architect, engineer, anatomist, physicist, chemist, geologist—all these may be listed after his name, and in most of these callings he did work which showed, as one biographer says, "practical inspirations centuries ahead of his time." That he was a genius we know, but that his genius was more than ordinarily miraculous is a discovery we make only when we examine his writings and compare their conclusions with what was, in his time, the accepted summary of knowledge and practice in the many arts and sciences he mastered. Taking the most obvious examples offered by his physical and mechanical investigations, we find him on the point of preparing oxygen three centuries before Priestley's experiment, or describing exactly the fundamental principles of precise, automatic manufacture three-and-a-half centuries before Maudsley or Whitney. In each instance (as is true of practically every discovery he made) Leonardo's conclusion was based on exact experiment—with all that that term means in the way of a consistent hypothesis, a suitable means of controlling observation either by sound reasoning or by appropriate instruments and apparatus, and the testing of the results by applying them to new problems. Our wonder grows, therefore, as these remarkable instances of his discoveries multiply. Superficially distinguished by variety and versatility, they are even more notable as evidence of a singularly genial combination of a wide-ranging mind, at once powerful and precise, with a command of language which could put down on paper the form of his thought and the exact result of his observation, and a practical, manual dexterity which could shape from wood and metal the means of translating his daring intentions into measurable effects.

All that and more the "Notebooks" show us. Among the many speculations raised by his work is the one that emphasizes the paradox of Leonardo's indubitable genius and the apparent failure of his discoveries to advance either knowledge or practice in his own time. Indeed, most of his discoveries from which we have profited are credited to other later researchers who, quite often, knew nothing of Leonardo's results. An explanation of the frequently-recurring phenomenon of profitless priority of discovery or invention was once given me by a chemist to whom I turned for help after learning that many modern concepts had been hinted at or developed centuries, even millenia, before they were rediscovered and applied. Said my friend, "Those lads didn't belong to the Society of the One Idea"—a cryptic answer I have interpreted as meaning that intelligence is a social institution as well as an individual gift, that without a society organized to need what a genius can give it, that man's genius must lie fallow or be lost entirely. To a certain extent, this explanation coincides with Hogben's positive declaration (cited here last month) that all intellectual activity is conditioned by society, and that each benefits the other by what should be a nourishing interchange of impulses and energies. If that explanation is valid, an interest in Leonardo aroused by his "Notebooks" will inevitably lead one to his biography and, I hope, to the history of his times.

One of the easiest ways of branching out in this fashion is by turning to fiction and reading Merejkowski's "Romance of Leonardo da Vinci." A surprising parallel to this novel is a recent biography, "Leonardo da Vinci," by Antonina Vallentin. Besides informing us about Leonardo, these books succeed in giving a taste of the world he lived in—of the Renaissance in Florence, Milan, Rome, France. No reader who gets such a taste can fail to discover a thirst for knowledge of the Renaissance.

Colossal! Stupendous!

Yes, the 1939 Engineers' Day will be worthy of these and any other superlatives you can think of. With plans like these below it can't miss.

By Byron Ertsgaard, M.E. '40
Engineers' Day Chairman

IT'S COMING—the 1939 Engineers' Day! Friday, May 12, and Saturday, May 13, have been set aside as the days when all loyal engineers will put aside their slide rules and their textbooks and dedicate their time to the honoring of their patron saint, Saint Patrick.

Saint Patrick was an engineer, and for the past 37 years the engineers at the University of Minnesota have been paying homage to him. It all started back in 1903 while excavation work for the engineering annex was going on. A group of engineering seniors were watching the work when a stone fell from a nearby wagon and rolled to their feet. Much to their astonishment the words "Erin Go Bräugh" were inscribed on the stone. After considerable study these words were translated to mean "Saint Patrick was an Engineer."

This group of seniors decided that their unusual experience was a sign that they should do something in honor of Saint Patrick. It was decided that they would hold an All-Engineering dance in the Armory.

Then, in the year 1910, a young man made his debut on the engineering faculty and started working for a bigger and better Engineers' Day. These efforts brought results in the year 1914 when the order of events as we now enjoy them was introduced. The man responsible for this change was none other than the first Saint Pat of the University of Minnesota engineering campus, Professor George C. Priester.

The 1939 Engineers' Day will be officially opened at 9:30 Friday, May 12. Immediately thereafter, the knighting ceremonies will take place on the steps of Northrop Auditorium. Preliminary to the knighting of the seniors by the Queen there will be short talks by the Queen, St. Pat, and possibly Dean Lind. After all the seniors have been dubbed as knights in the order of St. Pat, the Blarney Stone will, with due ceremony, be placed on a special float and the parade will begin.

There will be two distinct divisions in float design and a prize will be awarded to the best float in each division. The technical societies will form one division and will compete for the best float of general engineering nature. All other groups will form the other division and will compete for the most humorous and original float. A set of rules governing float design and construction will be published at a later date.

The Open House exhibits will be opened to the public at 2:00 p. m. on Friday and remain open until 10:00 p. m. that evening. There will be an abundance of souvenirs this year and a large number of interesting exhibits. All students are urged to invite their friends and their families to the open house.

Many interesting field events are being planned and numerous prizes will be awarded. There will be both departmental and individual competition. The climaxing feature will be a faculty-student baseball game in the afternoon. As yet no definite place has been decided upon, but should it be necessary to hold the event off the campus, transportation will be provided.

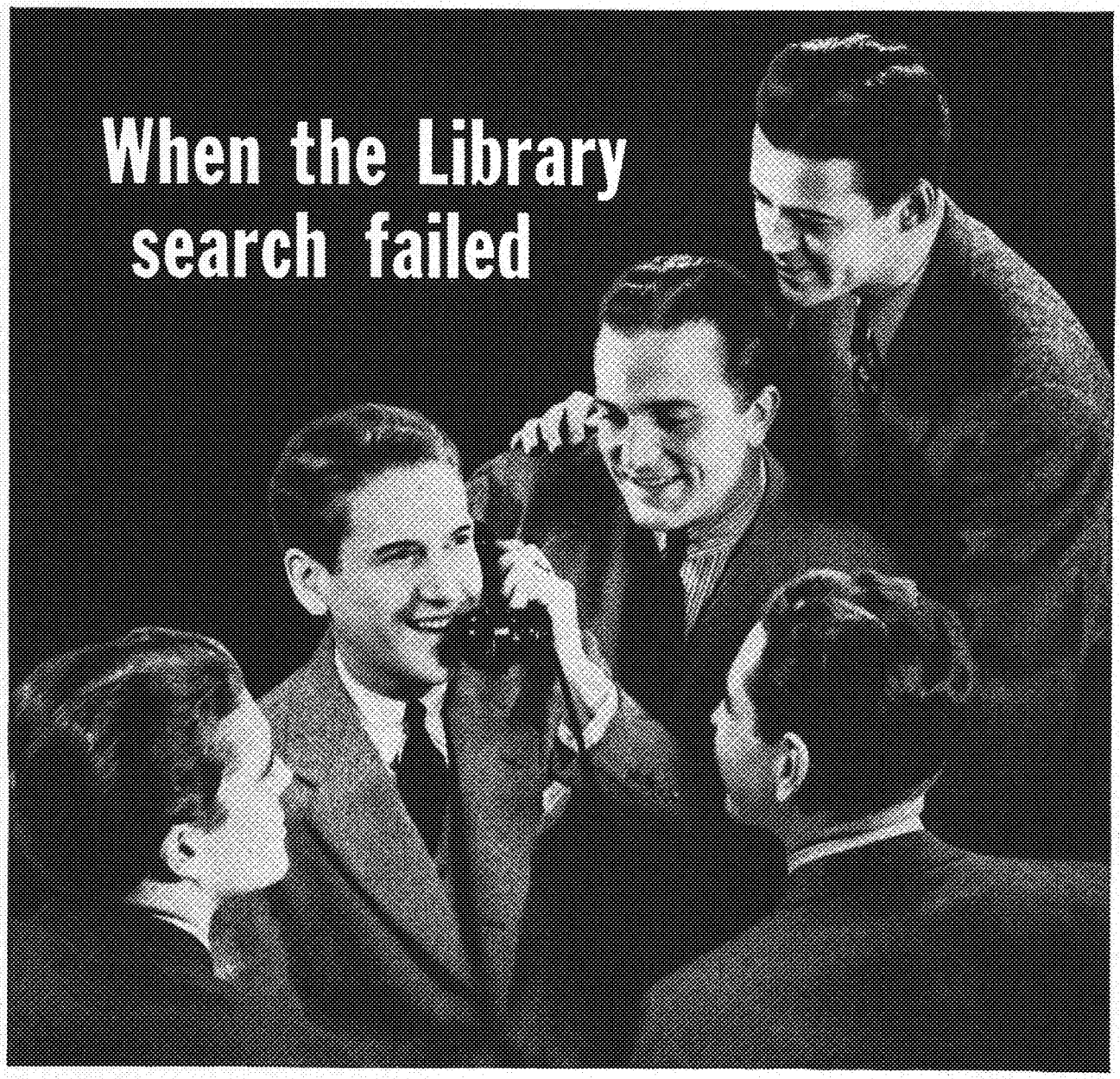
This year's brawl will be made more colorful than the previous one through the use of decorations. The location for the brawl has not been decided, but tickets will be sold for usual price of $1.25. Ticket sales will be limited and a larger ballroom than last year is being sought.

Executive Committee

The executive committee has been very carefully chosen. Each member is willing to do more than his share of the work in order that the 1939 Engineers' Day will be the biggest and most successful celebration this campus has ever seen. If this high degree of success is to be attained, however, there must be the whole-hearted coöpera-

Front row—Harold Hansen, treasurer; Byron Ertsgaard, general chairman; Elmer Hollar, open house. Second row—Leland Batchelder, brawl; Erick Schonstedt, field events; Robert Lundborg, buttons. Third row—Vernon Hoden, publicity; John Shannon, knighting ceremonies; John Liggett, parade.

tion of every member of the Institute of Technology. Although some of the general committees have been appointed, there are still a number of positions open. Groups planning on having floats in the parade should start organization immediately in order that their ideas may be approved by the float committee. The button sale competition will be inter-departmental with prizes offered for individual sales. There is also a great deal of planning and work to be done on the open house exhibits. In short, there is plenty of work for every interested person. St. Patrick is calling all loyal subjects to come to his aid, and no true engineer can disregard the call of his patron saint. So stop at the Engineers' Day office in the Union *today*. No one is a real engineer at Minnesota unless he does his part for the honor of St. Pat.



...the telephone *succeeded!*

FIVE sophomores at a New England university had been assigned to report on the residential districts of a southern city, its principal products and the location of its plantations.

Hour after hour they thumbed through book after book in the library—all to no avail. Then one of them had a happy idea—why not telephone the city's Mayor? They did—and in a few minutes had all the information they needed.

No matter what the question—in college, in social life, in business—you'll find the telephone is often the quickest, most economical way to get the answer.

How about a telephone call to dad? Rates to most points are lowest any time after 7 P. M. and all day Sunday.

BELL TELEPHONE SYSTEM

1939 Electrical Show

Tension Will Be High as Potentialities Indicate a Shocking Time at the . . .

By George Bower, E.E. '40

Dick Rehmann

THE tension will be high as 2,500,000 volts surge out of the condensers and thunder deafeningly across a 12-foot air gap accompanied by a brilliant flash of light when the high tension laboratory goes into action on April 21 and 22, the date of the 1939 Electrical Show. The high voltage laboratory, in the rear of the main laboratory of the electrical engineering building, presents a maze of huge condensers, towering insulators, and glowing high voltage rectifiers. Somewhere in this maze of equipment, the spark can be expected to flash, following the path of ionized air, on its leap across the gap.

Another example of tension with shocking potentialities is the "Kissometer." This instrument is designed to measure the sum of the contact potentials and generated electromotive forces present when the positive and negative are brought together. It has proved very popular during the past shows and it is expected to be as good this year. Last year, two West high school seniors tried the meter and were disappointed in the results indicated. On the way out, the girl was heard to say, "I don't know what was the matter; I certainly gave it all I had."

The atom smasher will be open for inspection and one is apt to be amazed at the amount of huge and grotesque equipment necessary to smash the infinitesimal atom. Air compressors, vacuum pumps, rectifiers, and deflecting magnets all serve to bewilder the innocent bystander.

A stroboscope will be used to perform many interesting experiments. A fan will appear to be standing still, although it is running at full speed; vibrating strings will be slowed down so one can see how sound waves are made; and drops of water will appear to originate in the sink and fall upwards to the faucets. This is one of the most spectacular exhibits of the show.

A radio controlled wagon is being constructed to illustrate remote control. This is especially interesting in these times because remote control is often associated with military operations and modern warfare. When watching the little wagon perform its maneuvers, one needs little imagination to realize how the use of remote control might be extended to tanks, ships, and even airplanes.

Fluorescent lighting will be the main exhibit of the illumination section. This type of lighting has gone through a considerable development period and has many desirable characteristics which the ordinary incandescent lighting lacks. In the first place, the color components of the light are much easier to control, resulting in more suitable light for certain types of work. Secondly, the lights are made in long tubes which are suitable for lighting without shadows. Thirdly, they use little current. The last characteristic is somewhat of a disadvantage in that a reactance is used to limit the current. This results in a high power factor, which is very unfavorable to the power companies.

Evidence that the engineering professions are helping in the study of sociological problems is seen in the lie detector and the personality meter. (The kissometer might also be included in this group.) The lie detector is really an instrument to measure the change in respiration and pulse rate when the human mind is exposed to vital stimuli.

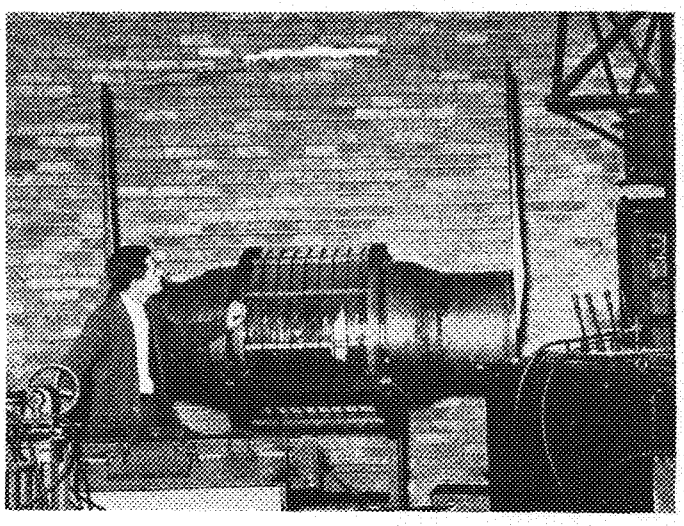
Personality Meter

The personality meter is supposed to measure that mysterious something that everybody wants to have, but no one seems able to define. The inner workings of this instrument have so far been kept in the dark, but they will be brought out very soon.

An encroachment into the esthetic field by the engineers has been predicted by many visitors to the shows, after seeing and hearing the Singing Arclight. Many people have gone away with ideas in their minds of starting a "Singing Arclight Promotion Club" with a motto such as: "Every corner an amphitheater, every arclight an orchestra."

Besides the above exhibits, there will be others far too numerous to mention. There will be approximately one hundred, ranging from the sober educational type to the light, entertaining type. All evidence, so far, assures a very spectacular show that will be high in educational and entertainment value. The show will be open Friday evening, April 21, and Saturday afternoon and evening, April 22.

Electricity jumps when Dick cracks the whip.



ALUMNOTES

'22

M. F. Wickman, E.E., has recently been appointed general plant manager in Minnesota for the Northwestern Bell Telephone Company. He will have charge of plant construction and maintenance operations for the company throughout the state. He was formerly engineer of the Iowa area plant.

'23

D. R. Ranger, C.E., was back on the campus recently. At present, he is working for the U. S. Department of Agriculture's bureau of public roads in Pierre, South Dakota. Donald is married and lists hunting as his hobby.

'25

Clarence W. Blue, C.E., is with the A. C. Ochs Brick & Tile Company in Springfield, Minnesota. His work consists of both selling and engineering, and his hobby is candid camera photography. He is still a bachelor.

'30

Byron C. Colby, Ag. Eng., is an assistant engineer with the U. S. Geological Survey in California. During the past year, he has been busy surveying the variation in stream beds caused by the record-breaking floods.

'32

Vir James, E.E., is now employed by the Columbia Broadcasting System. He recently had a paper on the measurement of reverberation times of auditoriums published in the Journal of the Acoustical Society of America.

'33

Kenneth C. Shaw, E.M., was a recent visitor at the School of Mines. Ken is now doing consultation work in Fort William, Ontario. He was, previously, an engineer at the Dorval Siscoe Gold Mines.

'34

Fred W. Kesler, Ag. Eng., is superintendent of a C.C.C. camp at Rochester, Minnesota. He is married and states that he is thoroughly sold on the institution.

Verne Osmundsen, C.E., is now working for his M.S. degree in structural engineering at Massachusetts Institute of Technology. He expects to complete his work and receive his degree in the fall.

'37

Frank Sandgren, Aero Eng. (M. S., Jan. '39), has recently been appointed an instructor in the department of aeronautical engineering of New York University at University Heights, New York.

John D. Savage, Pet. Eng., formerly with the Shell Petroleum Corporation in Rumania, has lately been transferred to Los Angeles, California, where he is employed by Shell Union of California. He was a recent visitor at the School of Mines.

'38

Ardell Birgvall, Chem. Eng., has accepted a position with the Monsanto Chemical Company at St. Louis, Missouri. He was the first chemical engineer from this campus to go with this company. Evidently, he is making good, because they have already hired another graduate from here. Nice work, Ardell.

TECH NEWS

Engineers to Entertain Seniors

The Minneapolis Engineers' Club is inviting some of the seniors of the Institute to a dinner, Monday, April 24. Members of the club will act as hosts to the individual seniors. Since there are more seniors in the Institute than there were members of the club planning to attend the dinner, the names of the seniors to be invited were selected by chance. A proportionate number of seniors were selected from each department. There will be about 150 invitations issued, and those seniors receiving them are requested to respond immediately in order to facilitate arrangements.

Attention Seniors!

Remember your friends and relatives at graduation time by sending them announcements.

The 1939 official class announcement went on sale Monday in the post office. Sales will continue for this week only in the post office and at a table in the main engineering building. The cost of announcements is 10 cents each or $1.00 a dozen.

Proposed Constitution

Below is the text of the constitution which the Tech Commission, after nearly a year of consideration, will submit to the students at the May elections. A discussion of the differences between this and the old one appears on the editorial page.

Article I.

Section 1. The name of this organization shall be the Technical Association of the University of Minnesota.

Article II.

Section 1. The purpose of this association shall be to provide a federation of departments in the Institute of Technology and to enable the students of the various departments to act as a unit in all matters of general interest to these colleges and to the University.

Article III. Membership

Section 1. All students in the Institute of Technology shall be active members of the Technical Association.

Article IV. Government

Section 1. The executive body of the Technical Association shall be the Technical Commission, composed of the presideuts of the recognized departmental societies, three members elected at large from the Institute, and three faculty members who shall be appointed by the Dean of the Institute for two year terms. The three members at large shall be elected at the regular spring Technology election: these members shall be juniors or seniors and no two of these three shall be from the same department. This body shall hold office for one year.

The recognized societies are:

1. American Institute of Chemical Engineers.
2. American Institute of Electrical Engineers.
3. American Society of Agricultural Engineers.
4. American Society of Civil Engineers.
5. American Society of Mechanical Engineers.
6. The Architectural Society.
7. Institute of Aeronautical Sciences.
8. The Mines Society.
9. The Minnesota Student Chemical Society.

Societies may be added with the unanimous approval of the Commission.

Section 2. The Technical Commission shall be the student governing body of the Institute. The Commission shall have authority to act for its members in matters pertaining to the Institute.

Section 3. The duties of the Technical Commission shall be:

1. To select from among its members a temporary chairman at a meeting to be held not later than two weeks previous to the June Commencement. The regular of-

officers shall be elected at the beginning of the fall quarter.

2. To foster student enterprises until such time as they are in a position to operate independently.

3. To supervise Engineers' Day and elect a chairman to conduct the activities.

4. To call at any time, for any purpose that it sees fit, a meeting of any or all members of the Technical Association.

5. To collaborate with the All-University Council for the welfare of the University.

6. To act on matters of general interest to all members of the Association.

7. To conduct all regular or special elections of the Institute of Technology.

8. To act with the faculty upon special request on matters of student discipline.

Article V. Finance

Section 1. The funds of the Association shall be maintained by the net operating profits of Engineers' Day. These funds shall be disbursed only for Association purposes on the basis of a budget suggested by the retiring commission.

Section 2. If the financial obligations of the Association are such that the above provision does not give sufficient funds with which to operate, an assessment may be levied against the treasuries of the departmental societies. The amount of this assessment shall be proportional to the membership of each society and sufficient to meet the financial obligation of the Association and provide a minimum operating reserve; provided, that this assessment shall not exceed $0.25 per individual member.

Section 3. The fiscal year of the Technical Association shall end on May 25 of each year. The accounts shall be audited and a report submitted not later than June 5. The financial report of the Commission shall be published in the TECHNO-LOG in the fall quarter.

Article VI. Amendments

Section 1. The constitution may be amended only with the approval of all of the departmental member societies and a three-fourths majority of the votes cast by the students in the Institute of Technology.

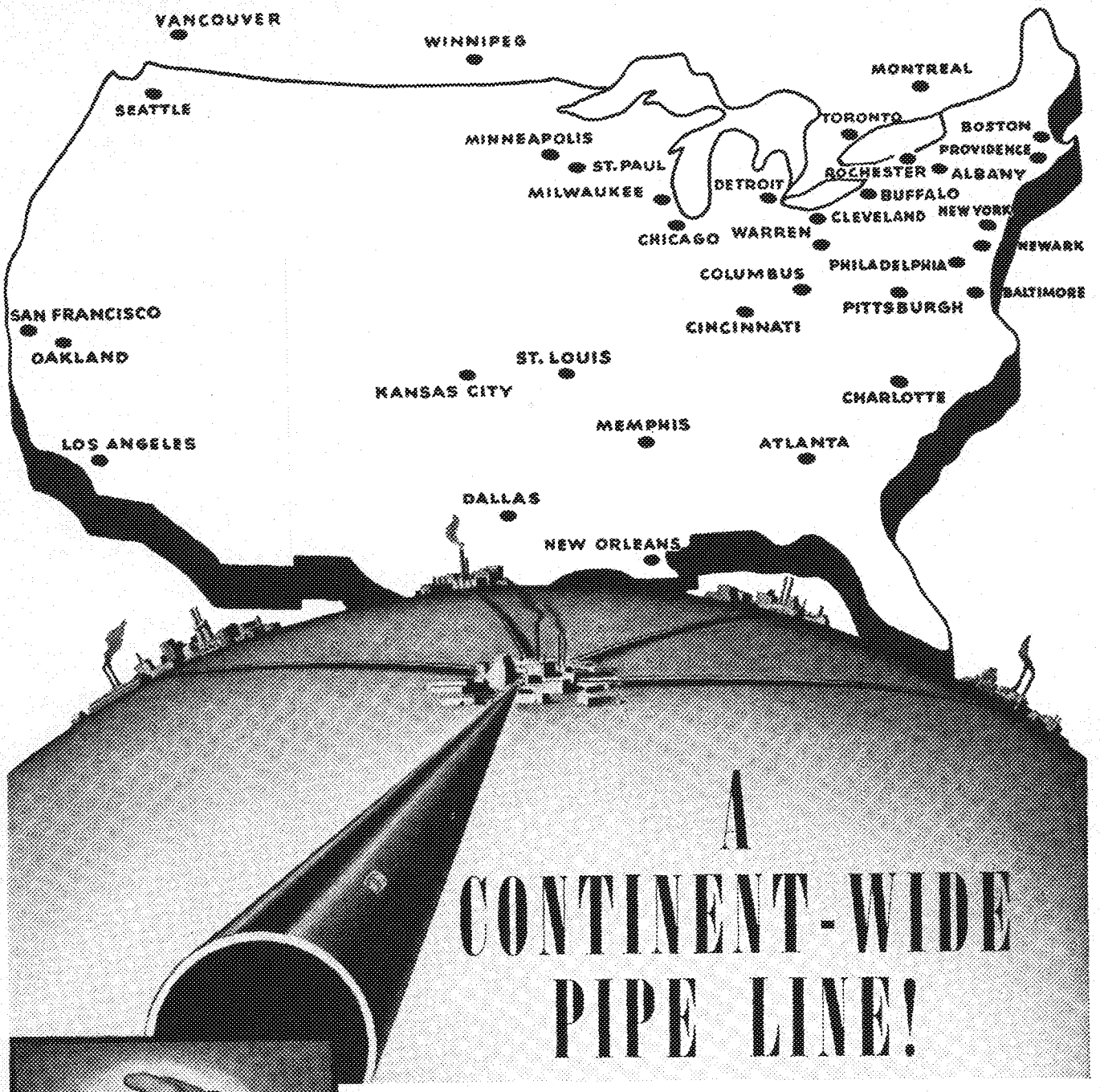
Section 2. Amendments of or additions to the by-laws of the Technical Association shall require a three-fourths majority vote of the Technical Commission, and any proposal to amend or add to the by-laws must be submitted in writing to all Technical Commission members at least three days before the Commission shall take any action.

Article VII. Procedure

Section 1. The deliberations of the Commission shall be governed by Roberts' Rules of Order.

Article VIII. Adoption

Section 1. This constitution shall replace the former constitution of the Technical Commission.



A CONTINENT-WIDE PIPE LINE!

There Is A Grinnell Office As Near As Your Telephone

To the architect, engineer or contractor planning the installation of fire protection, piping, heating or humidification, prompt and helpful service from a nearby Grinnell office means a lot.

But the scope of Grinnell service is important in more than planning alone. It is a *complete* piping service, including automatic sprinkler fire protection, prefabricated piping, welding fittings, pipe hangers, Thermolier Unit Heaters, and Amco Humidification. To the owner of Grinnell equipment, it means prompt attention to routine or emergency demands.

That is why "The Industry Built on Piping" maintains seven strategically-located plants, thirteen branch warehouses and thirty-four sales offices. Specify Grinnell *whenever piping is involved.* Grinnell Company, Inc., Executive Offices, Providence, R. I., Branch offices in principal cities of the United States and Canada.

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FACULTY SKETCH

By Carl Georgian, Ch.E. '41

Professor Frederic C. Bass

MINNESOTA ALUMNI WEEKLY

Head of the Department of Civil Engineering

FREDERIC C. BASS, head of the civil engineering department and eminent professor of municipal and sanitation engineering, came to the University of Minnesota in 1901 as the result of a "shot-in-the-dark" answer to an advertisement by the University in the Engineering News magazine for a civil engineering instructor.

After finishing his sophomore year at the Massachusetts Institute of Technology, Mr. Bass went to work at sea for a year to improve his health, and the following year he took a position with the Metropolitan Water Works of Massachusetts as an engineering assistant in the construction of a dam, aqueduct, and filtration plant. In 1900 he went back and finished his education at M. I. T. and received a B.S. degree in civil engineering. In 1901 he again went to work for the Metropolitan Water Works, and while on this job he received a penciled, informal notification that he had been appointed as an instructor in civil engineering at the University of Minnesota.

Mr. Bass's main interest centers around municipal sanitation. During the Minneapolis typhoid epidemic of 1904, which affected over one-fourth of the University students, Mr. Bass, in coöperation with the health director of the University, was instrumental in causing the shut-down of the East-side pumping stations which were pumping raw river water into the water mains. Incidentally, there were about three sewers from the typhoid infected Nicollet Island area discharging into the river above the pumping stations. It was during this period that the drive for a filtration plant for the city of Minneapolis was begun. Mr. Bass took a leading part in this campaign. During the 1910 typhoid epidemic Professor Bass became interested in the problem of purifying water with chemicals. He set up a small plant, using bichloride of lime as the disinfectant to test out the idea. In a very short time a sharp decline in new typhoid cases was noted. This experiment, however, slowed up the drive for a filtration plant because some of the Minneapolis council members reasoned, "Why should we build an expensive filtration plant when we can kill the bacteria so cheaply with a chemical?" The filtration plant was finally built in 1914.

Valuable work in civil and sanitary engineering like the above has made Professor Bass an authority in these fields and has brought him many honors and appointments. In 1906 he was appointed director of the engineering division of the Minnesota State Board of Health. He is now president of this important state service.

Prof. Bass's activities do not end here. He is an active member of Sigma Xi and presented a paper entitled "Housing and the Construction Industry" at this year's series of Sigma Xi lectures on "Man and His House." He is a member of the A.S.C.E.; the American Water Works Association; the Society for the Promotion of Engineering Education, and Chi Epsilon. All of these activities have more than justified his being listed in "Who's Who in Engineering," "American Men of Science," "Leaders in Education" and "Who's Who in America."

PICK AND PAN

By M. A. Troxell, Met.E. '39, and H. A. Larson, E.M. '39

What Mines Senior lost his thesis in a beer joint and is now trying to do five months work in two weeks?

The quickee of the age is attributed to Professor Pease. Sagely counseled he: "Measure out cyanide solution in graduates, not pipettes. If you use pipettes, we won't have any graduates!!"

Math Prof.: "Now, watch the blackboard while I run through it once more."

Gee, how ugly I are,
My face ain't no shining star,
But then I don't mind it,
'Cause I'm right behind it,
You people out front get the jar.

We suppose that all the engineers have heard the one as to why the girls around the campus wear these close fitting sweaters. One reason is to keep warm, and the other two are obvious.

After listening to the heated discussion at the Union for the several different parties we have now thought it time to bring the whole situation out into the open. Our party platform will consist of the one phrase "Everything for us'ins, we promise nothins." After all, what authority has any party on the campus in dictating just what they want to put in the fore! Our Executive Council shall consist of 2,200 engineers and there shall be 50 chairmanships open to the loyal men of the party. If the engineers would get behind a movement of this sort—who can foretell of the fireworks to come.

In India, monkey business is a government monopoly.

Charles Walton put his finger in the pie the other day to pull out a plum, but the thing backfired and grabbed his thumb in a vice-like grip. Those crushing rolls are no things for the unwary to be cleaning when they are in gear.

Excerpt from a speech by the president of the University of Chicago: It is not so important to be serious as it is to be serious about important things. The monkey wears an expression of seriousness which would do credit to any college student, but the monkey is serious because he itches.

After watching the coeds of the campus dress in their spring finery and inaugurate the newest styles it seems as though they dress so as to be seen only in the best places.

BLOW OFFS AND SIDE SLIPS

By Bob Wolfe, M.E. '39

One fellow in Prof. Summers' lab. class misspelled the word "bourdon" in the report on bourdon gages. The title of the report read, "The Calibration of a Bourbon Gage."

Spring with its fashion,
Sunshine and cheer.
Spring with its passion,
Ah lass, it is here.
It's fun for you—could be heaven for me,
For I've fallen in love with an Angel, you see.
But away with spring and all of its cheer,
I can't be in heaven—I'm an *engineer*.
So I'll study real hard, before it's too late,
And when spring is over, I may graduate.

A number of years ago, when the steam tunnels at the university were being dug, Professors Shoop and Zelner were making an inspection. One of them picked up an "empty" dynamite box and tossed it out of the tunnel only to get a shower of dirt from the subsequent explosion. I wonder who would have been heads of their respective departments had they decided to kick the box out of the way instead of throw it.

A pessimist is a man that thinks all women are immoral,
An optimist is one who merely hopes so.

Dick Stone, make-up editor, of the "LOG", called the other night for a news item about the M.E. field trip to Chicago. He thinks the fact that M.E.'s are leaving town should be good news to everyone.

He: What's the secret of your popularity?
She: I give up.

I found a portion of a Geology lesson so interesting that I thought you readers would like it too. The following quotation is from "Geology," by Emmons, et al. It is the textbook used in general geology 1w. It is a description of a glacier. It may be found on page 168.

"The gently curving surfaces which break with abrupt edges into dark abysses, or sink gently to soft depressions, or meet one another in ridges, the delicate shadows in the curved hollows, the lanes of light on the crests, the suggestion of easy movement in the forms, the snowy white with an occasional tinge of the most delicate pink, make up a scene of which no picture or photograph can give more than a very inadequate impression."

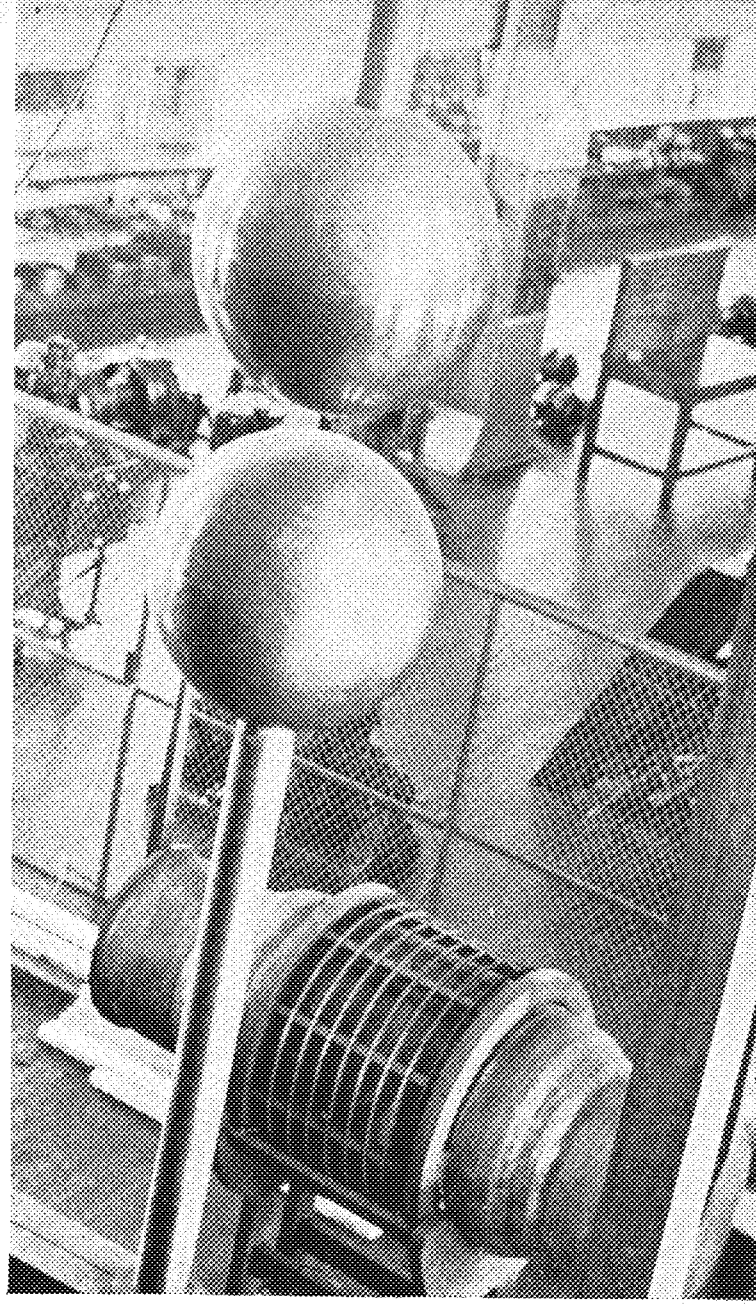
"She laughed when I sat down to play"—I didn't know she was ticklish.

13th Biennial

April 21-22

ELECTRICAL SHOW

The show will be open Friday evening and Saturday afternoon and evening



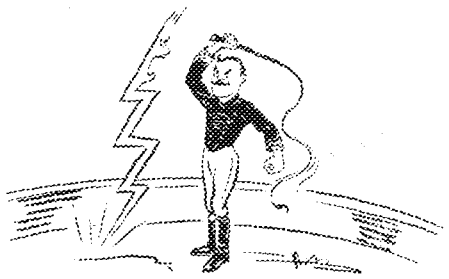
There will be everything from automatic drinking fountains to 2,000,000-volt sparks. Over 100 interesting and entertaining exhibits have been set up. Admission 10c, including checking and souvenirs. A Good Time Guaranteed.

The E. E.'s "ATOM SMASH" Dance Will Be Held on April 28

ckets 75c per couple if purchased with
o admissions to the show. After the show
e tickets will be $1.00.

Apr 1939

G-E Campus News



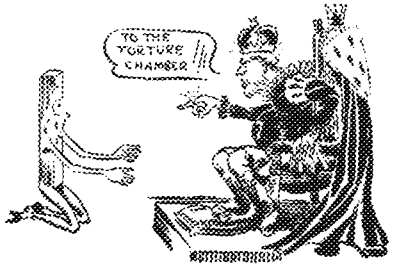
LIGHTNING TAMERS

ALADDIN had his lamp, and Robinson Crusoe had his man Friday. But they run poor seconds to General Electric's lightning makers, as visitors to the New York World's Fair will see.

For years at the world-famous G-E high-voltage laboratory in Pittsfield, Mass., visitors have seen powerful man-made lightning crash across 30-foot gaps, and power arcs twist and curl their way into the air. But the apparatus does more than produce merely spectacular demonstrations. It makes possible many experiments that provide data for the constant improvement of transmission equipment.

The star of the public demonstrations has been a 10,000,000-volt generator. Now the star has had her face lifted, and the lightning makers have a new streamlined unit. It will be a feature of the G-E building at the New York Fair. Housed in Steinmetz Hall, it will be a tribute to that great G-E pioneer in artificial-lightning experimentation—the late Charles P. Steinmetz.

Karl B. McEachron, Ohio Northern '13 and ex-Test man, noted lightning investigator for General Electric, is in charge of the exhibit. A specially trained group of engineers will assist him in presenting the more than 4000 shows planned for the fair.



MODERN TORTURE

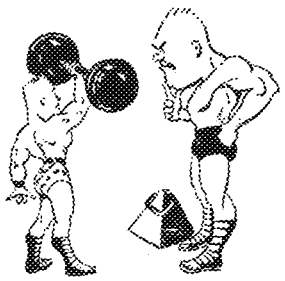
THEY ARE hung by their thumbs, pulled by their toes, and put into furnaces for ten years.

These are the well-organized tortures conducted not by villains of a medieval novel but by G-E engineers. They are the "creep" tests conducted on sample rods of various steels before these steels are used in the manufacture of turbines.

As explained by E. L. Robinson, St. Lawrence, '11, Harvard Engineering School, '14, G-E engineer, the excessive heat under which a turbine operates softens the metal of which it is made, and the metal extends, or creeps. If this creeping exceeds a dimensional change of a hundred-millionth part per hour, or is not symmetrical and uniform, the turbine shell may leak or the speeding rotor may get out of line.

To avoid these troubles, types of alloyed steels that restrict creeping must be used. Therefore, the creep tests. Sample rods are held fast and stretched until they break. They are put into electric furnaces and kept there for as long as 10 years; temperatures as high as 1200 F being maintained. Careful inspection of the results shows whether the steel is of the proper type.

This creep test is only one of the many made on each G-E turbine. For many other engineers—veterans and Test men alike—conduct other exacting tests.



WORLD'S CHAMPION

SITTING complacently on his new throne in the G-E Research Laboratory is the new midget weight-lifting champion. Not only does he completely outclass other contenders, but it seems probable that he will continue to do so for some time.

This champion is the world's most powerful permanent magnet for its size. Even though he weighs only 1/250th of a pound, he is capable of lifting nearly 1500 times his own weight.

The midget is made of a material known as Alnico, introduced by the Research Laboratory as a heat-resisting alloy. Alnico magnets have been used for some time in radios, motors, generators, and other electric equipment, replacing electromagnets, which require current for their operation.

GENERAL ELECTRIC

99-836C

MINNESOTA TECHNOLOGY

MAY

1939

BEG PARDON

Hitler won't punch
Our noses, perhaps,
But look what he's doing
To all of our maps!

•

The government can only give what the people give up.

•

Dandelions are yellow, but they always come up for mower.

•

Too few politicians are foresighted; too many are 1940-sighted.

•

Actors won't joke about WPA. Humor is an irresistible force and should avoid an immovable body.

•

Women can keep a secret just as well as men—the only difference is that it takes more of them to do it.

•

Time for government to give business the breaks, not the brakes.

New Dealers see WPA in action. Conservatives see WPA inaction.

•

I tossed some pretzels
In the air,
They landed on
Milady's hair;
She tied them with
A veil somehow
And claims her new
Spring hat's a wow!

•

Seems like it is no longer rude to be nude.

•

When you get your garden seeded and as smooth as a dance floor, the neighbor's chickens come over and start truckin'.

"Beg Pardon" is plucked from the April issue of Brownie Digest, published by the Brown Steel Tank Co., Minneapolis, Minn.

WHEN A PIECE OF PIPE STARTS OUT TO GO SOMEWHERE

This Trade Mark Makes A Good Guide

And "the industry built on piping" backs these products with an organization experienced in every phase of piping application . . . . With unequalled plant facilities, strategically located . . . . Continent-wide service . . . . and the continuous research that is required of any company that leads its industry. Grinnell Company, Inc., Executive offices, Providence, R. I. Branch offices in principal cities.

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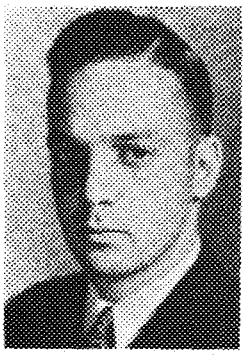
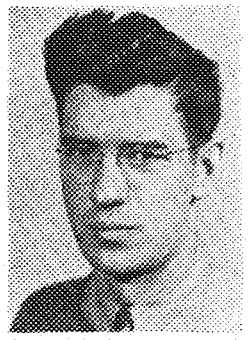
This Month's AUTHORS

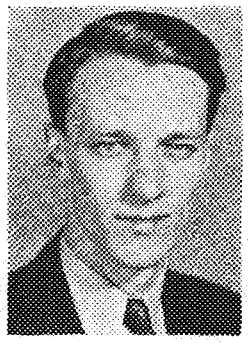
By John Shannon, Ch. E. '40. Photos by G. A. Halseth, Ch. '40, and J. J. McBrady, Ch. '38



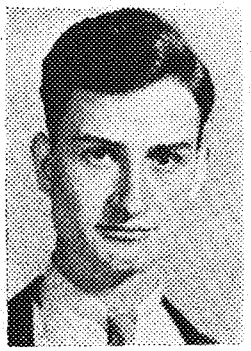
Don Frankel, AeroE. '39, wrote the humorous article on fuels which is entitled "An Analysis of Liquid Fuels." Don is a regular contributor to the TECHNO-LOG, being partly responsible for the literature which is disseminated under the heading of Blow Offs and Side Slips. He is quite active in the military department and is Cadet Major of the Coast Artillery Corps, historian of Scabbard and Blade, and a member of Mortar and Ball. He is at the present taking the civilian flight training course and has the distinction of being the only graduating senior enrolled.



John Sayer, M.E. '40, calls upon his experiences as an electrical appliance repairman to bring you "But Madame—". As you can discover by reading the article, John's work has put him in many unusual and amusing predicaments. He has done this type of work off and on for the past five years, having spent an entire year on it after his graduation from high school. He says the work is all right for odd jobs and working your way through school but doesn't think there is much future in it. He is a member of the A.S.M.E., the Y.M.C.A., and Triangle engineering fraternity.



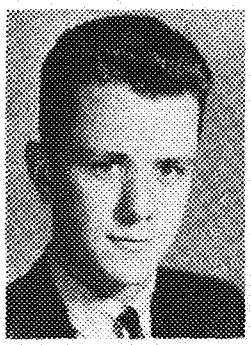
Paul Thompson, E.E. '40, is one of the co-authors of "That Radio-Controlled Car" in which the operation of the radio controlled car which was featured at the Electrical Show is explained in detail. Paul is interested in electrical work and puts down short wave radio as one of his hobbies. Paul is working his way at school but is not too busy to be an A.I.E.E. member. The car was built and operated by Paul, Walter Moe, who drew the diagram illustrating the article, and **Joseph Gellings**, E.E. '40, who is the other collaborator on the article.



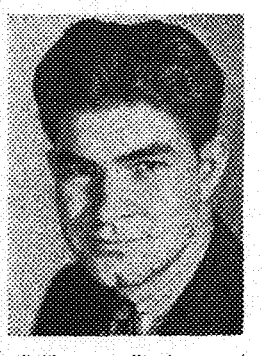
Joe is also a working man and has consequently not indulged in many extra activities. Short wave radio is his hobby and he can boast an operator's license. Whether or not he uses this method to keep in touch with the folks back home in Idaho is a question. Joe expects to be graduated next year and would like to get into telephone work.

Professor A. S. Levens, C.E. '22, is the genial head of the Institute Placement Service who in this issue gives some counsel and advice concerning jobs which should be of interest to every prospective engineer, especially so to the seniors. Professor Levens has written previously for the TECHNO-LOG on the subject of employment, and his articles are always welcomed. Besides his placement work, Mr. Levens is professor of drawing and descriptive geometry, having been on the faculty since 1922. He was graduated from the University in civil engineering in 1922 and received his master's degree two years later. In 1927 he received the professional civil engineer's degree. Professor Levens finds time outside his regular duties to be a member of the Masonic Order, the Society for the Promotion of Engineering Education, and Tau Beta Pi.

Charles Hedlund, Ch.E.B. '40, went on the recent Chemical Engineering inspection trip and passes on some of the more interesting incidents which occurred on the trip to the TECHNO-LOG readers. It seems that the Chemicals started out equipped to have a good time and in most cases succeeded in doing so. Chuck works quite a bit outside of school but still finds time to hold membership in the A.I.Ch.E., Tau Beta Pi, and Phi Lambda Upsilon, honorary chemical fraternity.



Allan Raudenbush, AeroE. '39, in his section of "When Seniors Go Sightseeing," describes high spots of the recent senior aero trip made by approximately 34 men and a girl. The purpose of the trip is to give the seniors a chance to get acquainted with the industry and to make contacts with prospective employers. Al thinks the trip is a very important part of his course and advises any discouraged freshman that the trip is well worth sticking it out for. At the present Al is a member of the TECHNO-LOG business staff and is treasurer of the I.A.S.



Robert Wolfe, M.E. '39. This (the M.E. trip) is Bob's first feature offering to the Log although he has for the past year been the other half of that literary team of Frankel and Wolfe which "blows off and side slips" once a month. Organizations is Bob's hobby and from all indications he is devoted to it. He is president of the A.S.M.E., treasurer of the Tech Commission, treasurer of Scabbard and Blade, treasurer of the Cadet Officers Club, and last year was on the Engineers' Day Executive Committee.

The Minnesota Techno-Log

37 Electrical Engineering Building

University of Minnesota, Minneapolis

WOOLSEY MOTL
Managing Editor

ROBERT E. McDONALD
Business Manager

Volume XIX — May — Number 8

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Treas., Wilson Brown

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Corr. Sec., Jack Hyde
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Rec. Sec., Harold S. Kemp
Corres. Sec., Leslie A. Anderson
Cataloguer, Homer Anderson

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V. Pres., George McDougall
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Treas., Ralph Van Hoven

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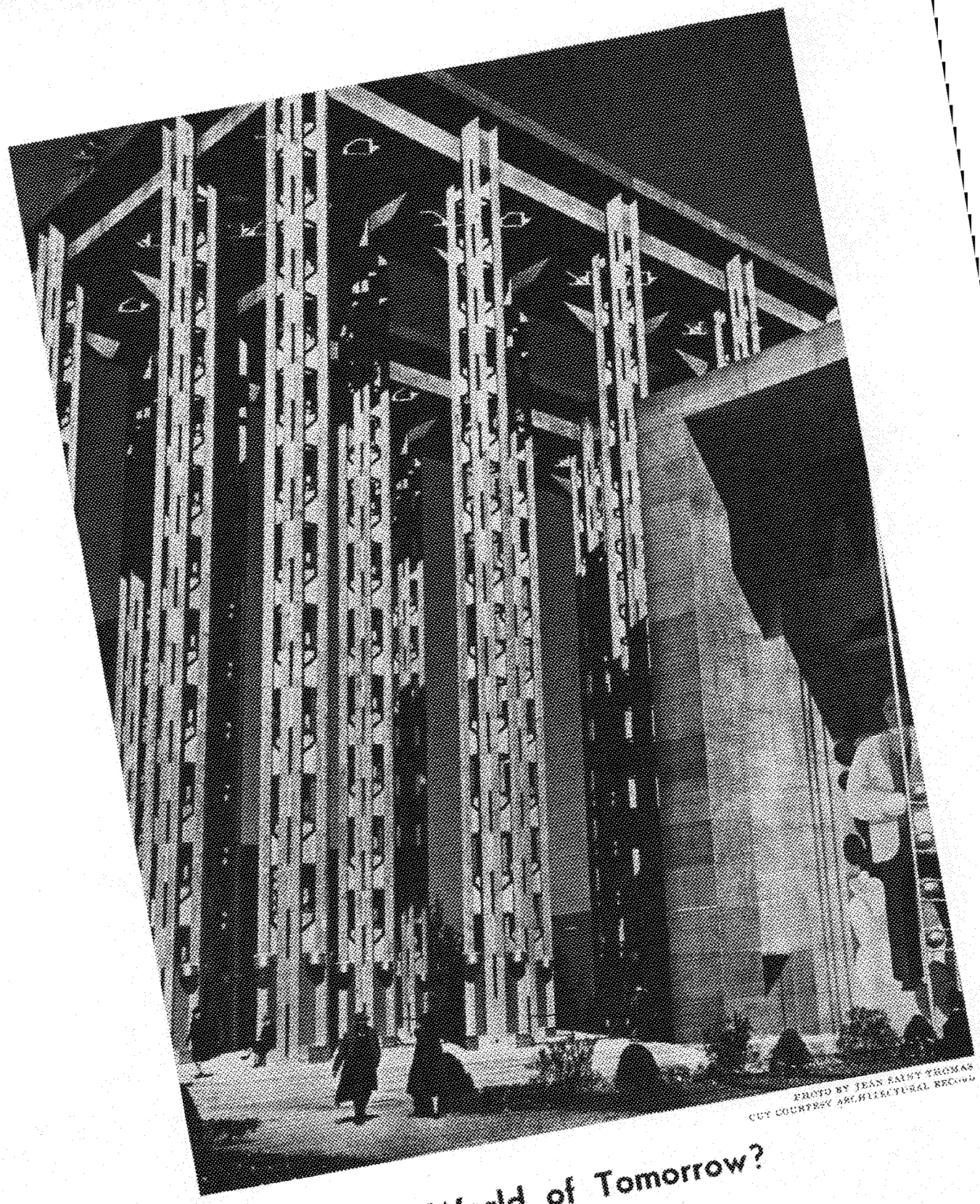
V. Pres., Leland Batcheider
Sec.-Treas., Sam Callaway



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CUT COURTESY ARCHITECTURAL RECORD

World of Tomorrow?

Mr. Graduating Senior—

Have You Got a Job Yet?

If not, you'll undoubtedly be interested in the various hints offered below by the director of our Placement Service. This article was specially written by him to give tangible assistance to you seniors in search of that elusive, yet all-important, job.

By Alex S. Levens

Director of the Placement Service
Illustration by Walter N. Ziering, Arch. '41

UNDOUBTEDLY a number of you are quite concerned about the possibility of attaching yourself to someone's payroll shortly after graduation. Many of you have had interviews with company representatives who have visited the Institute of Technology during the past few months. It may interest you to know that, before May first, thirty representatives visited the Institute. Several more will be here during the remainder of the school year.

Of the representatives that have been here, fifteen have not as yet made selections. A number of graduating seniors have already accepted positions to become effective shortly after commencement.

We wish that it were possible to assure all of you a job before graduation. Unfortunately, the "good old days" when practically all seniors had one offer and some had several offers, have not returned. It is not even possible to include all of you for interviews. The specifications set up by the companies—coupled with a limited visit by the representative—definitely fix the number that can be interviewed. For example, those companies that seek men for research, design, and development work usually request that those to be interviewed be chosen from a group in the upper quarter of the class scholastically and having desirable character and personality traits. In other fields, such as sales, management, production, promotion, etc., a good scholastic record and especially good character and personality are the usual prerequisites.

Know Your Profs

Department heads and other members of the faculty are consulted before the interview schedule is made. This is done because the members of the various departments are usually well acquainted with the seniors. Occasionally, a man who does not possess the specific qualifications set up by the company is permitted to be interviewed because members of the faculty may feel that he does have the potential ability to make good.

It is quite important for you to know that faculty members' opinions of you are frequently requested by the interviewer. After all, the company representative knows that the fifteen minute interview cannot tell him very much about you. He depends largely upon available records, faculty ratings, and recommendations.

Perhaps you have had some difficulties with some of your instructors. Perhaps they don't really know you. Why not make it your job to get acquainted with them? They may then evaluate you in a much fairer way. After all, you might as well make up your mind that one of the most vital factors for successful living is your ability to get along with others—including your instructors. You may be one of the best men in the technical field, but unless others can live and work with you, and thereby receive the benefits of your wisdom, the opportunities for your development are apt to be quite limited.

Let's look into the employment problem together. What can you do to improve your chances of getting a job before graduation or shortly thereafter? First, let me ask you what you have done. Frankly, how many of you have, as yet, mailed 25 personnel sheets? How many of you have called on firms in the Twin City area? How many of you have read pamphlets which describe the work and organization of industrial concerns?

Perhaps you have been too busy or more likely you haven't given your employment problem much thought. Why not get started immediately? Efforts have been made to acquaint you with the qualifications that are most essential to successful employment. The discussions which were conducted during the winter quarter should have given you many valuable suggestions. You will recall the meetings held in the physics auditorium during the period from January 19 to February 16. Topics discussed included "What Business Has the Engineer in Business?," "Applying For a Job," "The Engineer Thru the Eyes of the Psychologist," "What Industry Expects of the College Graduate," "How Does Industry Select the Young Technical Graduate?," and "The Adjustment of the Young Technical Graduate to Industry."

Some of you have asked about the names of companies to whom you might send personnel sheets. A few suggestions were made in the November TECHNO-LOG. Following is a more complete list of sources of information about companies. The sources are available in the engineers' library unless otherwise specified.

Placement Service Mailing List—available in 133 main engineering building.

Railway Officials Guide

McGraw-Hill Central Stations Directory—Business Men's Library, 2nd Avenue South between 5th & 6th Streets, Minneapolis.

The Thomas Register—Lists the names of companies in many fields.

Mac Rae's Blue Book—America's greatest buying guide.

Mailing List Directory—by Dana, Morley, and Kight. This book includes a classified index to trade directories.

Guide to Reference Books—by I. G. Mudge, see pages 152-158.

E. I. C. Engineering Catalogue—published by the Engineering Institute of Canada.

Engineers—published by the Neo-Technic Research Corporation. This book lists engineers of corporations, giving their official titles, duties, and connections. It contains a very concise collection of data pertaining to every branch of engineering.

Mechanical Catalogue—published by the American Society of Mechanical Engineers. It contains a very good classified index to manufacturers.

Sweet Catalogues—A file of manufacturers' catalogues of build-

ing materials, equipment and services. *Engineering Library.*

Census of Manufacturers—Gov't Printing Office, Washington, D. C.

Department of Commerce Yearbook—Gov't Printing Office, Washington, D. C.

The Green Book—Oil Paint and Drug Reporter, Chemistry Library.

Chemical Guide—Chemistry Library.

Chemical Catalog—Chemistry Library.

Catalogue Studies—One of the most complete sets of company catalogues. Ask Miss Veblen about them. Your time will be well spent.

Advertisements in Technical Periodicals—Here you get an opportunity to contact companies that are apparently alive. The April 13 issue of the *Engineering News Record*, pp. 38, lists Civil Service examinations which do not require residence. In addition the issue contains the directory of engineers as well as an advertisers index, which lists well over 125 companies.

Advertiser's Index—Any issue of the *Saturday Evening Post.*

Heating-Piping and Air Conditioning—Examine the January, 1939, Directory Number. Hundreds of companies are listed in this issue.

From the above mentioned references you should have no difficulty in making up an effective mailing list.

Having done that, additional information concerning the work of the companies can usually be obtained by writing for pamphlets and brochures which many concerns have available. First, it might be well to check over the ones we have in the Engineering Library. A list can be found on one of the bulletin boards.

Consult with your instructors, alumni, and local representatives of different companies. You can get some valuable tips from these sources.

After you have decided upon the companies that you are particularly interested in, start your selling campaign immediately. If you wonder whether or not a letter should accompany your personnel sheet, what kind of a letter to write, or to whom it should be addressed, why not get acquainted with the members of the English department? All of them have coöperated splendidly in the past and are willing to help you now.

In line with writing that letter it might be well to consider the following statement by Mr. C. T. Reid, assistant chief draftsman, Douglas Aircraft Co., Inc.:

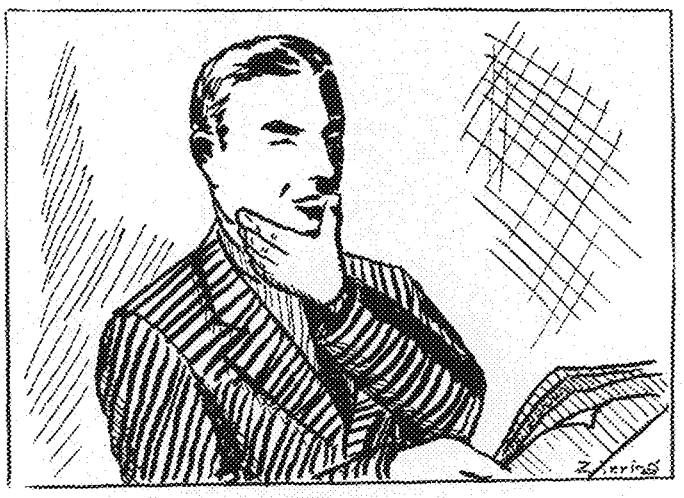
> The young engineer should have ability to express himself well in writing—not only with good grammatical construction, but also in a neat hand and with scrupulously correct spelling. If spelling is a weak point, the student should invariably be required to do special work to bring it up to standard before being considered for a diploma. A beautifully printed but sadly misspelled word staring one in the face from the middle of a drawing or engineering report is an abominable thing. You may be surprised to hear that frequently a college graduate returns our application form to us so marred by misspelled words throughout that it is immediately relegated to a very low classification of eligibility, if not consigned to the waste paper basket.

If it is possible to apply in person, do so. It is to your advantage to interview those who are responsible for employing college men. By all means make a definite appointment. Don't drop in any time and say, "You don't need an engineer do you?" Having made the appointment, be sure to keep it—or at least notify the official that a change of date is desired because of conditions over which you have no control. Be prepared for the personal interview. Good taste in dress, poise and personal appearance will be quite important. Look as neat and bright as you would if you were calling on "the" lady friend. Remember, you have a selling job to do. It is not amiss to bring samples of some of your work; drawings, reports, or a paper you have written. Capitalize on any outstanding work that you have accomplished, especially if it has some bearing on the work of the company. Do not overlook the excellent booklet, "Preparation for Seeking Employment," written by Mr. Howard Lee Davis, for valuable information concerning the problem of "selling" yourself to the employer. Copies are available in the Professional Colleges' Bookstore at $0.25, the price of two packages of cigarettes.

Mr. Davis establishes some very important fundamentals. It is pointed out that (a) every job-seeker is a salesman; (b) successful salesmen understand the products they offer for sale; (c) the most effective way for a job-seeker to impress a prospective employer with his ability to do satisfactory work is for him to demonstrate thorough consideration and execution of his own personally important job-hunting problem; (d) the employer has no sure means of classifying the job-seeker and placing him in work most suitable to him. The job-seeker should share fully in that determination; (e) during his lifetime every person must make decisions that are based upon incomplete data. He must do the best he can with such information as is available at the time each decision must be made.

If the interview does not result in an offer or promise of a job within a reasonable length of time, and you feel that you are still interested in that company, then certainly follow up several weeks later. If you keep a record of the date of interview, the name of the official, and other pertinent information, you will find it much easier to bring the interviewer's attention to your last visit.

It is recognized that it is not a simple matter for you to answer the question, "Just what type of work do you want to pursue?" But then, it is not advisable for a graduate to limit his choice too much. We believe that, if you make a real effort to get the facts about each company and give them the thought they deserve, you can make a proper selection. True, economic conditions do make inroads upon one's plan. It may be necessary to



". . . every person must make decisions that are based upon incomplete data."

accept a stop-gap position while preparing for the opportunity to enter the field for which you are best prepared. In most cases preparation must continue long after graduation.

Remember, job-getting is your personal problem. The assistance given by the faculty, alumni, and Placement Service is not intended to be "spoon-feeding" in character—rather, it is an effort to help you help yourself.

When Seniors Go Sightseeing

What does actually happen on those spring trips? One hears so many different stories. Below are somewhat expurgated versions of this year's Aero., Chem. E., and M. E. trips. You'll find them quite interesting.

The Chem. E. Trip

By Charles Hedlund, Ch.E.S. '40

IT WAS with mingled feelings of relief and anticipation that eighty-nine senior chemical engineers gathered at the west door of the chemistry building on the morning of Wednesday, March 22.

We climbed into our three chartered busses and started for Wausau, Wisconsin, the first stop. Bridge games, crap games, bull sessions, and barber shop quartettes sprang up in no time, and by the time we reached the city limits the bus looked more like a bunch of boys on a vacation than a group of embryo engineers taking Chem. E. 187s.

At Wausau the Minnesota Mining and Manufacturing Company played host to the gang. A free dinner was included on the program, and several of the boys practically foundered themselves trying to get their money's worth. We traveled on to Appleton to spend the night, but not in sleep. The fellows turned out en masse to take the town apart and did very well, too. Lundquist and Kellar caused the Appleton police force no end of trouble by insisting on trying to flatten every "No Parking" sign in sight. It was in this burg that Joe Vodonick earned the nickname "Smoothie," a title that he then proceeded to live up to during the remainder of the trip.

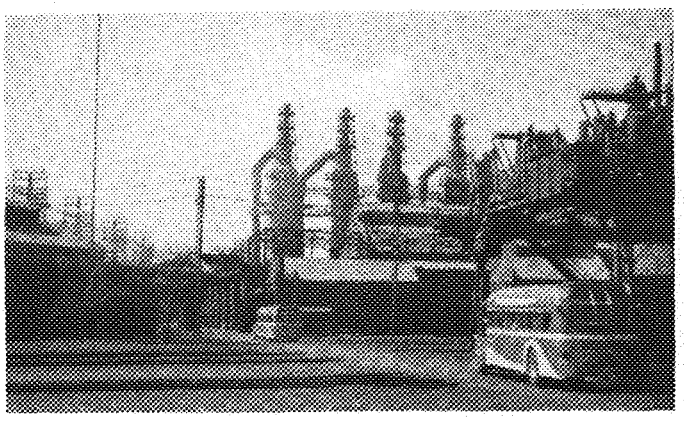
On Thursday we visited paper plants. Bill Playman, Ch. E. '37, acted as guide for our group at Kimberly-Clark, but he did us dirt. I don't suppose that it was his fault that they built their five story plant with so few elevators, but I blame him entirely for dragging us and our tired feet up and down all five flights several times. Four paper plants that day nearly finished the bunch after their sleepless night at Appleton, and snores were loud and long as we rode on to Milwaukee late that afternoon. Some of the more wakeful riders on the third bus organized a jack pot, the winner to be the one who could guess most closely the time of arrival at the hotel in Milwaukee. Ray, the bus driver, drove up to the hotel with perfect timing, only seconds away from his predicted time, and claimed the prize money amid shouts of "Fraud!" from his disgruntled victims.

A tannery was included in the next day's itinerary. It was interesting but rather difficult for those with sensitive noses. The hides are handled in sort of a race, with the tanner one jump ahead of the putrefying bacteria. They say that every hide that loses the race is used for gelatin. I'm not sure that such is the case, but after we had seen the scrapings and scraps that are used for gelatin, not even Jack Benny could have sold a Jello dessert to us that evening.

Saturday afternoon, to most of us, represented a chance to catch up on some much needed sleep and prepare for a big night at Kitty Davis' famous rendezvous. Angerhofer set a new record that night at Kitty's by downing six beers in one minute and fifteen seconds. In doing so he won the grand prize—a bottle of beer. To the delight of all, Blank (After all, I've got to have my report accepted yet.) arose and explained how a chemical engineering professor would run the country if he were elected president. As his reward he was allowed to kiss the prettiest girl in the house. (He did it, too!)

In the meantime we visited some plants, too. On Monday we inspected the South Chicago plant of Carnegie-Illinois Steel Corporation. It was an impressive experience to stand in the shadow of a huge blast furnace as tons of white hot, molten steel flowed from the tap hole amid a shower of sparks. The huge size of the equipment and operations of a steel plant is difficult to describe, but if I say that they were even larger than Kellar's imagination, most Ch.E.'s will understand.

On Tuesday it was noted that Pearson's pedometer recorded a total walking distance of thirty-five miles thus far, but it seemed as though that figure had doubled before evening. The guide told us that there were forty-five miles of railroad tracks in the Standard Oil refinery, and Johnson swears he stepped on every tie. We bid goodbye to Chicago on Wednesday morning, and I, for one, was not sorry. It is a dirty, noisy, windy, hustling metropolis, nearly every part of which is claimed to be the world's largest something-or-other.



Chem.E.'s inspecting the huge U. S. Steel plant in South Chicago.

The Hiram Walker distillery was visited in Peoria. After showing us around their plant, the guide conducted us to the company bar for free samples of their products. Every time I looked around I saw Swan setting down an empty glass and heading for the bar.

At Cedar Rapids, Iowa, we finished our inspection trip with a visit to a plant that is really a chemical engineer's dream. It was the Quaker Oats plant, where furfural, an organic solvent, is extracted from oat hulls. The extraction of 240 tons of oat hulls per day is controlled by one man at a central control board. Steam heat is utilized and to the utmost, too. The B.t.u. that escape from the complex heat exchanger system are few and far between.

The swan song of the eleven day adventure was sung

that night in Cedar Rapids. Among other things, some merrymaking engineer poured a pitcher of water on the head of a policeman standing beneath a hotel window and incited a mild uproar in this quiet Iowa town.

A nine hour drive the next day brought us back home, a wiser group in more ways than one than the one that had started out.

The M. E. Trip

By Robert Wolfe, M.E. '39

THE much anticipated Saturday morning of April 15 had finally arrived, and the first cargo of senior M.E.'s were on their way to the climax of their four year professional preparation. Some thirty fellows were forced to wait until the following Sunday to make the trip. Some of these attended their Saturday classes; many more packed their baggage and dreamed of the pleasures of the week to come.

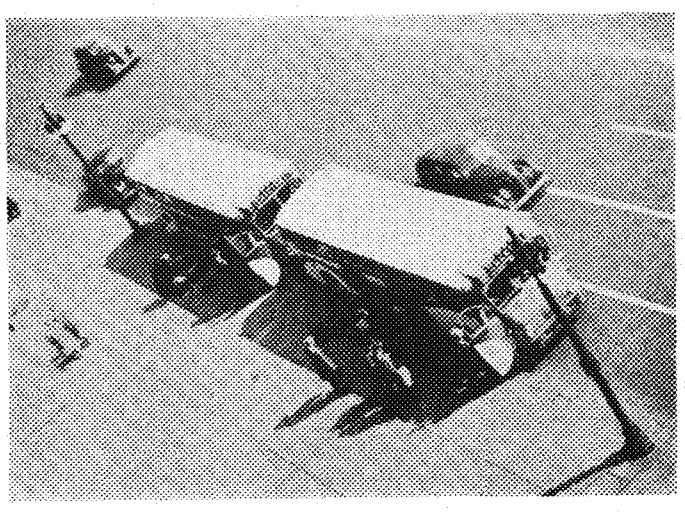
The arrival in Chicago of the Sunday bus drew inviting tales of night life in the big city from fellows who had already spent a full day and night there. After a period of registration and a bath and dinner, we dropped in at the A.S.M.E. Midwest convention headquarters to meet and chat with our convention hosts, the men of Lewis Institute.

Monday morning we were aroused at 7:00 a.m. to be taken out to the Western Electric plant. Although this meant five hours of walking, there were few regrets, for our minds were awakened to a realization that we had heretofore only been told of. The enormity of industry and the seeming complications of mass production struck its first blow.

The convention got underway during the afternoon with a technical session. This was followed by a banquet, after which the class made a trip to the N.B.C. studios to see the "Contented" program originate. Although this lasted until 10:00 p.m., the boys still had an abundance of energy for having fun. Many of them crashed a free dance and malt beverage party given by another convention in the same hotel.

At a private party in one of the rooms at the hotel a group of fellows reversed the common situation by educating one of the profs. In two hours we had all of his coin.

M.E.'s embarking on a day's journey.



At the Inland Steel Company we viewed what we had seen only in pictures before. The tapping of a 150-ton open hearth furnace and the rolling of mammoth steel billets created a thrill that few can realize. This company employs 13,000 men; yet they are sparsely placed among tons upon tons of machinery.

From Inland Steel we went to the Wyman Sardan Company, which manufactures the greater portion of the crank shafts for the automotive industry. Crank shafts are the exclusive product of the plant. Every process from forging to balancing is part of a fast-moving mass production schedule.

A trip to the State Line Power Plant, where we saw the largest turbo-generator in the world, completed the day. The evening's entertainment included everything from Shakespeare's "Othello" to a strip tease act at the Trocadero.

We drove up to Elgin, Illinois, to go through the Elgin watch factory. Can you imagine mass production and a product that involves the use of drills 0.0032-0.0002 inches in diameter? Screws which can hardly be seen with the naked eye are produced on an automatic screw machine.

From Elgin we drove on to Milwaukee. Here we held a dinner party at a very realistic German restaurant. Louie Quast led the group in some songs, including "Ist das nicht eine Schnitzel Bank?" while your truly consumed two complete pork shanks. With our pocket books gradually growing flatter, night life was suffering a slow, inevitable death. Professor DuPriest demonstrated his athletic talents by rolling 179 to win top honors in a bowling party. "Pro" Callaway seemed to have an off night. The trip to the A. O. Smith Company and the famous 12 million dollar machine was viewed with interest. This machine can produce 17,000 complete auto frames per day.

After seeing the making of watches, we sensed a feeling analogous to skipping from the infinitesimal to the infinite when we saw the Allis Chalmers plant. One of a group of butterfly valves for Boulder Dam weighs 150 tons. At the Nordberg Diesel Engine Company we saw a 3750 h.p. Diesel under construction.

Our next visit was by this time a much anticipated one, the Schlitz Brewing Company. After a hurried glance at the bottling works, the power plant, and the storage space, we were cordially escorted to the Rathskeller. Well, by this time we were very thirsty and we couldn't find a water fountain so—

By the time we reached Smith's Shanty at Port Washington we had organized some very close harmony. A delicious fish dinner and an extemporaneous group talent program provided a very pleasant evening. Rube Olson "blew the lid" by drinking a glass of Schlitz and smoking a cigar. We were rushed off too soon to visit the Port Washington Power Plant, which is said to be the most efficient in the world. The following morning we were off to Madison to see the Gisholt Machine Company. Then off for home, sorry that the week must end but glad to get some much needed rest.

Yes, we learned much about engineering in industry, but we feel that the development of fellowship within the class was of much greater importance. It's distressing to realize that very soon the class will disband after really knowing itself for only two months. The experience of meeting new people and getting along well with each other was of more value to us than can be measured.

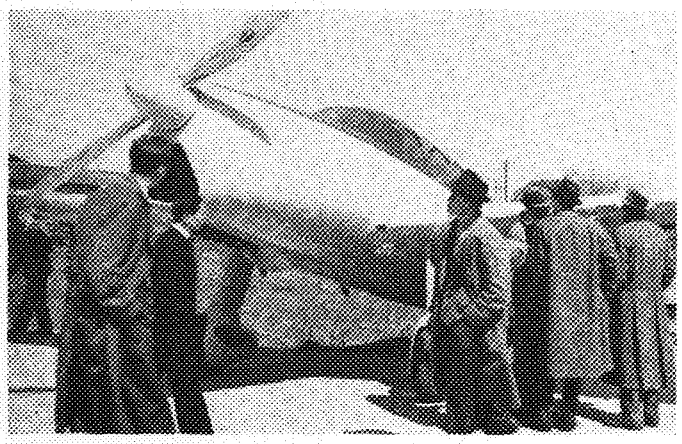
The Aero Trip

By Allan Raudenbush, Aero.E. '39

TO almost any Aero the spring trip is the climax of his four or five year career in college as an undergraduate engineer. Since we were freshmen, stories have drifted down to us about the senior spring trip; so it was an eager group that congregated outside the Armory, amid a confusion of suitcases, cameras, and wearing apparel, on the morning of March 24. We had each deposited seventy-five dollars with John D. Akerman's efficient secretary to cover the expense of transportation, food, and lodging, and with a few more dollars to handle "sundry expenses" in the rear pocket (excepting "Tweeps," who discreetly used a purse) we were ready to set forth on the big venture.

Approximately twelve hours later we rolled down Michigan Boulevard into the heart of the Windy City. Here we were faced with the pleasant prospect of spending an hour and a half while the bus was made ready for the all-night jaunt to Wayne, Michigan. For just one hour and a half, I would say we did all right in Chicago. So did the proprietor of that place on Wabash Avenue!

Seven a.m. the next morning found all thirty-five of us hammering on the door of a neat but none too commodious municipal rest room maintained by the town of Wayne, Michigan, which was immediately dubbed the "Wayne Biltmore." That morning we inspected our first plant, the Stinson Aircraft Corporation in Wayne.

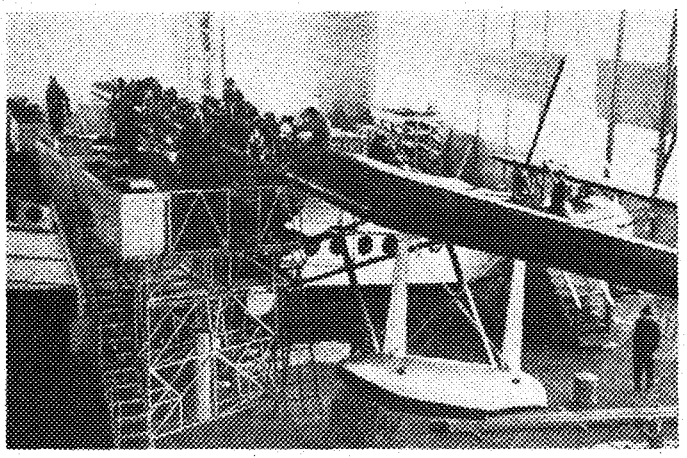


Aero's inspecting the experimental plastic plane at Farmingdale, L. I.

Sunday, March 26, we made an attempt to enter Canada but were politely repelled because of international complications which arose; so we shuffled off to Buffalo, N. Y., by way of Ohio, Pennsylvania, and New York states.

Monday morning was spent very profitably in the Curtiss Aircraft Corporation's plant in Buffalo. Among other things, we chatted with Lloyd Childs, chief test pilot for Curtiss, who modestly told us about his recent dive of better than 575 m.p.h. Said he: "The specifications called for at least 500 m.p.h. The ship behaved so beautifully at that speed that I thought I would see what it would really do." Extrapolation of the diving test curves indicated a top speed of about 605 m.p.h. After several hours in the Curtiss factory, we boarded the bus and struck out toward Niagara Falls.

Lunch at Niagara for eight of us consisted of "good-a spaghett'" which the Italian proprietor assured us repeatedly was the best that could be bought. Before leaving we promised to see him again on our honeymoon trips and to bring our wives in for a dish of his "spaghett'".



A Pan American flying boat being serviced at Baltimore.

Our journey across New York state was a long affair, particularly since we were held up at Albany at 4:00 in the morning because of severe icing conditions on the highway. We reached East Hartford, Connecticut, Tuesday morning, where we inspected the Pratt and Whitney engine plant and the Hamilton Standard Propeller factory. Noticeable in these two plants was the "esprit de corps" among those men whom we met. Many of them were just a few years out of school. Early that afternoon, we bade farewell to these fine people and boarded the bounding Greyhound to seek adventure elsewhere—namely, New York.

The next day we arose at 7:00 a.m. and, after a short trip by subway and bus, arrived at Farmingdale, Long Island. Here we visited the Grumman and Seversky aircraft plants. On the field adjoining the Seversky plant, we were fortunate in getting a chance to inspect one of the few plastic molded planes which have just been released.

Friday morning we were routed out early as usual, but the honey dripping voice on the other end of the line was the kind you couldn't swear at; so there was only one thing to do—i.e., get up. We were held up for a minute at the bus depot waiting for Frank, who finally arrived underneath a pile of luggage in a cab which he had taken from the hotel a block and a half away—cost, $1.60.

A long trip brought us to the outskirts of Baltimore by evening, and there we spent the night in tourist cabins hand picked by John D. himself. The grey dawn found us at the Pan American Airways base on Chesapeake Bay in time to see the departure of the Atlantic Clipper, one of Boeing's new four-engined flying boats being put into service on the trans-Atlantic run this summer.

Homeward bound the next morning, after a brief stop to see government aeronautics officials in Washington, the Greyhound headed west towards Hagerstown, Md., where we inspected the Fairchild aircraft plant. We reached Dayton the following morning and spent an entire day at the Army's Wright Field. The next day, the thirteenth since our departure from Minneapolis, we climbed aboard for the non-stop trip home.

This was the Aero spring trip. Not one of us would have traded the memories of these fourteen days together for a king's ransom. Well, almost!

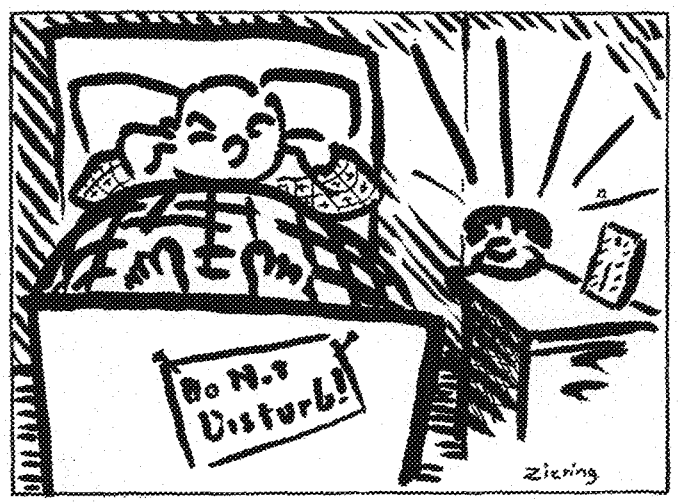
"But Madame — —"

The various devices, the radio, electric refrigerator, etc., which are the product of our machine age, strangely enough, are not perfect. Hence the necessity for the man known as the service man; hence the material for this amusing article.

By John Sayer, M.E. '40

Illustrations by Walter N. Ziering, Arch. '41

SOMETIMES as the sun steals the last few steps over the edge of the prairie and jumps into bed, a sad and somewhat depressing thought comes to us, as we are herding the little Ford over the road after a hard day's work to home and food. Because we are diligent electrical appliance servicemen, we find it difficult to comprehend why such men as Volta, Faraday, de Forest, Edison, and such kindred souls devoted their lives to inventing and perfecting electrical devices. For at times we are positive that these devices were invented not for the benefit of



". . . with a great deal of clamor the telephone broke into our dreams . . ."

mankind but rather to furnish housewives with a means of plaguing servicemen with complaints and "Columbus-like" discoveries. It is true, however, that whether or not this thought is riding with us depends on whether the last housewife whose vocal volume played in our ears presented us with a large piece of chocolate cake or whether her child gleefully dropped our favorite wrench down the well.

But such thoughts are short and soon forgotten. There are many things to do on spring evenings when one has no books whose aimless discourse must be pursued. So it is the mornings and not the evenings that furnish the hardship in the day's affairs. For one thing, and perhaps the most important, the timeclock just has to be punched by 8:15; such things as timeclocks should really be ponched. But there are always those incidents like one that occurred one blustery early spring day that put timeclocks in the class of lovely things.

It was 6:30, a time of day when people should be in bed sleeping, when with a great deal of clamor the telephone broke into our dreams of refrigerators that had improper grid bias and radios that the "ground" would frost back. After five minutes spent in fighting sleep and a couple more trying to locate the left slipper, until we remembered that we had a new pup, we answered the phone. Lifting the receiver we had a feeling that Mr. de Forest had again failed us. A gossipy voice came over the wire with—

"Is this the home of the serviceman?"

Chivalry gained an upper hand as we downed a desire to answer that it was the police station.

"Yes, it is, madam," we replied.

"Could you come out and fix my radio right away," the voice requested.

"But, madam, it is hardly seven o'clock," we exclaimed, now fully aware of the danger we had encountered.

"I know that, but it looks like it may rain this morning, and I do not want to send my children to school if it is going to rain," we got for a reply.

With that, chivalry lost; the telephone company never could understand how one could hang up a French phone with enough violence to crack the receiver.

Much Tact Is Necessary

It was often the case on mornings like this that we would encounter some of the more quick-witted of the local populace. They would come plowing into our place of business with their shiny boots on and a look of grim determination in their eyes meaning to acquire from us some new-found knowledge. There was the proud gentleman who came to us with the complaint that his radio was too loud. With tact and diplomacy that would have put the courts of Europe to shame, we conveyed to him the thought that he should turn down the volume. He departed much pleased. Perhaps it was the same sort of gentleman to whom we could never quite convey the reasons why he could listen to radio stations which were to the south of him, when the wind blew from the north. Then there was one of the more wealthy of our brave people who, on his return from the Pacific coast, demanded that we take back his much abused car radio and refund him the full purchase price. His reason for this outrageous request was that the radio was defective, and his proof for this was that the closer he got to the west coast, the easier it became to tune in western stations and the more difficult it became to receive eastern stations.

Even in the more difficult situations and for the most disagreeable housewife, we endeavored to give first-class service, though there were times when it was a Houdini's services they needed and not a serviceman's. We had the misfortune to have one of our refrigerators purchased by such a housewife. The refrigerator had been out but two days when we received a complaint that the box was no

cold enough. After checking the cycle of the box and finding it worked perfectly, we set the temperature down several degrees, feeling sure that this would please even Byrd. Within two days the same housewife entered the identical complaint. Knowing that by now the box was so cold that when the door was opened all the water pipes in the house must surely freeze, we were in a quandary as to the reasons that precipitated this complaint. With our heart full of service and our kit full of tools, we left for her domicile. After checking the refrigerator and finding it was much colder than we had anticipated, the housewife made known to us the basis for her complaint. It seemed that a neighbor of hers had kept some cooked carrots in her refrigerator for three weeks, and, since her dog would not eat them, she gave them to our complainer. She put the "fresh" carrots in her own box, and after keeping them for two weeks she just couldn't understand why they were not eatable! After slowly closing our tool kits and looking at her, we remarked, "Lady, it is not a refrigerator you want; it's a canning factory."

Who Was the Lucky Winner?

The worst mistake a housewife could make was to have a defective refrigerator at supper time. For it was always the policy of the company to answer service calls on refrigerators at any hour, though we only serviced other appliances during business hours. One late afternoon we answered a service call and found the lady of the house preparing supper for forty-nine relatives and the kitchen overflowing with food. Most of her coming meal was very much in our way—particularly a large cake just ready for the oven. While changing the refrigerator unit we kindly asked for a little room but were very much ignored. When we were ready to leave, we found it necessary to lift an entire unit across the table. While the unit was suspended over the table—with a hand and a prayer—it tilted, and six nuts, but not the kind of nuts you usually put in cake, sank to the bottom of the freshly mixed cake. Needless to say, this accelerated our departure, and to this day we wonder which of the relatives received the prize in that cake.

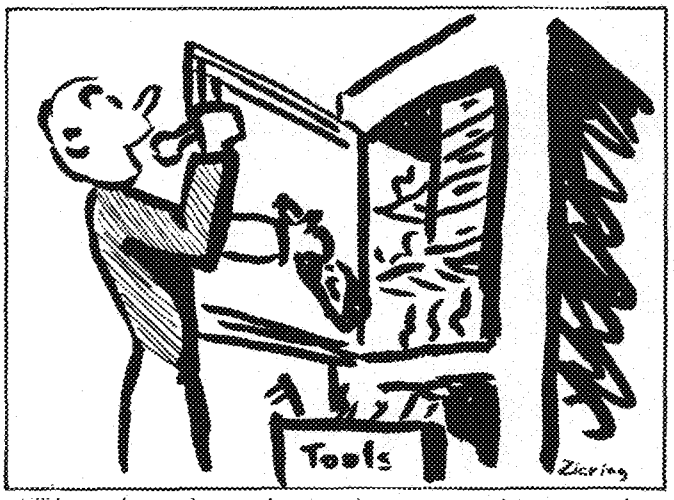
Sometimes it is slightly disastrous for a well-stocked refrigerator when we make a service call at six o'clock after a busy afternoon. For it is too much like tempting fate to keep pieces of cold chicken or cake in front of a hungry serviceman. There have been times when temptation proved too great and the pangs of hunger were satisfied. It has been rumored that a serviceman even went so far as to eat half a delicious pie, wash the plate, and put it in its place in the cupboard. Did the housewife ever suspect, or did her wrath all descend on the poor innocent husband?

Sometimes one meets owners who are going to save money by fixing their own appliances. They usually save money like the gentleman who oiled his own refrigerator compressor. When we were called to service a stuck compressor, we asked to see the oil that he had used. It was furniture polish! Total charges—$18.00. We often meet agriculturists who service their own radios by hooking the B batteries in the wrong circuit and paralyzing the tubes. Then there are those who want a gallon and a half of cream for each gallon of milk put into their separator, and after continual adjustment of the cream screw, they have the tins out of balance. We replace unbalanced tins for nine dollars.

Sometimes long trips are made for no other reason than that of forgetfulness on the part of the appliance owner. An outstanding example of this was a one-hundred-mile trip on the complaint that a refrigerator would not run. The service rendered the owner was the strenuous task of plugging the cord into the wall socket. All that the trip netted us was an apology from the owner that she must have removed the plug when she vacuumed the floor.

When boxes are shipped to customers out of town, the unit is bolted to the frame and to each bolt a tag is attached which reads, "Remove shipping bolts before starting motor." Once when answering a complaint that a box was noisy, we arrived finding no one at home, and we removed the shipping tags and bolts, that were found intact, which caused the box to vibrate. The housewife, entering the front door and hearing someone in the kitchen, shrieked, and, dropping all her bundles, fled. Within a few minutes she returned with the sheriff, and it took several minutes' explanation to account for our presence to the embarrassed housewife and a militant sheriff. Our explanations proved satisfactory and we did not spend that night in jail.

These occurrences are the exceptions and not the rule to the routine of service work. They prove annoying when they occur even though they make interesting reminiscences. Routine service work calls for much more tact and diplomacy than is usually displayed during such incidents. For on the shoulders of a service man rests the burden of not only giving excellent appliance service but



"There have been times when temptation proved too great and . . ."

of maintaining the customer's good will for his company. Through the actions and attitudes that a serviceman displays, he can either gain or lose customers for his company.

Maintaining efficient service by servicemen requires both an accumulation of varied technical knowledge and the results of much experience. Perhaps experience plays the greater role in routine servicing than technical knowledge, though technical knowledge is by no means unnecessary. In this work, however, as in other semi-technical or technical work, knowledge is a decided prerequisite for advancement. For even the most brilliant of servicemen in supervisory positions will encounter service troubles that are difficult to account for and correct.

Research in the Institute

Counting Sub-Atomic Particles

COUNTING sub-atomic particles and measuring their energy is an important job for the research physicist. Most of the work done with the mass-spectograph depends upon the accuracy of these measurements. Cosmic ray investigations, atom smashing, determinations of electron scattering and plotting the beta ray spectrum, all utilize counting devices of one sort or another. The most extensively used of these instruments, the Geiger-Müller counter, the point counter, and the ionization chamber, measure the ionization the particle produces in a gas.

The principal difficulty with a counter of this type lies in the fact that the gas is at or near atmospheric pressure. Since most of the sub-atomic particles observed in an experiment are produced in a vacuum, it is necessary to send them through a window heavy enough to stand the difference in pressure. This not only causes losses in accuracy, but makes impossible the observation of particles below a certain energy level.

This problem was brought to the attention of J. S. Allen, research assistant in physics, last fall, in connection with the atom-smashing which is to begin soon. Out of this research has come the development of a secondary electron multiplier tube, based on the same principles as Zworkyn's ionoscope television tube. The fundamental principle is that when an electron strikes a metal plate with sufficient energy, it releases several secondary electrons from the plate. When there is a high enough ratio of secondary to primary electrons, the secondary emission can be utilized to amplify the original current. In Mr. Allen's present tube, there are twelve secondary plates arranged so that the electrons zig-zag from one plate to the next, each one producing a number of secondary electrons which in turn release electrons from the next plate, and so on. The amplification of the original current attained in this way is of the order of one hundred thousand. Through careful design and shielding, the background current has been reduced to practically zero, permitting accurate counting of electrons and ions. High secondary emission and minimum photo-sensitivity are obtained by coating the plates with beryllium. An ordinary amplifying system is used to amplify the resulting current and to drive an oscillograph or a counting meter. Since each type of particle produces a characteristic pulse in the output current, it is possible to tell what ions or particles are being counted.

One of the first applications of the tube will be in the determination of the types of particles coming from the mass-spectrograph. It is a hundred to a thousand times as sensitive as the tubes used for this purpose at present. Among the several uses it will have in this connection, the tube will be used to detect minute quantities of rare isotopes. It is so sensitive that it can detect the current produced by one electron passing a given point per minute. This is less than 10^{-20} amperes. Another advantage of the tube is that it can be connected directly to a vacuum system, thus dispensing with the pressure window. In addition to this, its output needs much less amplification than the other types of counters need. Mr. Allen's tube will probably displace the other types of counters in many of their uses, and make possible many previously impossible experiments.

Carbon Control

STAINLESS steels, enameling steels, and other special steels need very accurately controlled carbon content—within 0.002 per cent of specifications. A slight change in carbon analysis will markedly alter the properties of one of these special steels, therefore an accurate method of carbon analysis is very important to industry. In the present gravimetric method of carbon analysis, the sample is heated in a stream of pure oxygen at 1100 deg. C., and the carbon dioxide coming off is absorbed in ascarite. The increase in weight of the absorption tower after the test is the weight of the carbon dioxide. In a one gram sample of steel containing 0.1 per cent carbon, only 3.6 milligrams of carbon dioxide are produced. Therefore the balances must be very sensitive—an accuracy of 0.07 milligrams is required, which approaches the sensitivity of the analytical balance. In addition, vibration and changes in temperature and barometric pressure affect the accuracy of the measurements.

The new method which Professor T. L. Joseph, head of the department of metallurgy, and M. H. Kalina, a graduate student, have developed, eliminates all of these difficulties and takes only a few minutes longer to carry out. It has been perfected to a high degree of accuracy and is now being tested by several steel companies. Professor Joseph described the method before the February meeting of the American Institute of Mining and Metallurgical Engineers, where it aroused a good deal of interest. The April number of the magazine *Blast Furnace and Steel Plant* contained a complete description of the new procedure.

The method consists in absorbing carbon dioxide from the combustion furnace in a barium hydroxide solution and titrating with standard hydrochloric acid, using thymol blue as the indicator. Entirely new apparatus had to be designed to meet the requirements of the new method. The hydroxide has to be kept away from air or any other extraneous source of carbon dioxide while in storage and during the tests. It was necessary to design an accurate capillary pipette for titration directly in the absorption tower. The apparatus was found to be sensitive to 0.0015 milligrams of carbon. This far exceeds the sensitivity of the older method. The determinations, reproducible within 0.002 per cent, are much more accurate than the results by the gravimetric method.

Concrete Shrinkage

AFTER structural concrete members are in place and under loads, they gradually undergo a certain amount of deformation. This is caused by shrinkage, which increases with age, and plastic flow, which increases with the magnitude and duration of loading.

Mr. I. C. Hillman, research assistant in structural en-

gineering, under the direction of Professor C. A. Hughes, has been working on the problems connected with these properties of concrete. He is using twenty concrete beams as test members. These are four by eight inch beams about sixteen feet long, supported horizontally by two concrete pedestals placed two feet on either side of the center. An equal bending moment throughout the center section is created by loads of equal size hung on each end. The magnitude of deflection at the center is measured with a strain gage at various periods during the test. The amount of plastic flow and shrinkage is calculated from these measurements. The differences in the amount of plastic flow and shrinkage with changes in time and loading are found from a number of these tests.

Since shrinkage occurs coincidentally with plastic flow in the tests, it must be taken into account when calculating the flow. This is the reason for another investigation in which the shrinkage changes with age, independent of loading, are being determined. However, there is a difficulty in this, since shrinkage also sets up a plastic flow in the concrete member. If the tests are successful, it will be possible to make allowances for both these factors in the plastic flow tests.

This research is of fundamental importance to the understanding of concrete structure, although it will have few immediate practical applications. After Mr. Hillman has written his thesis on the first stages of the work, Professor Hughes plans to continue the investigation.

A Review and a Prediction

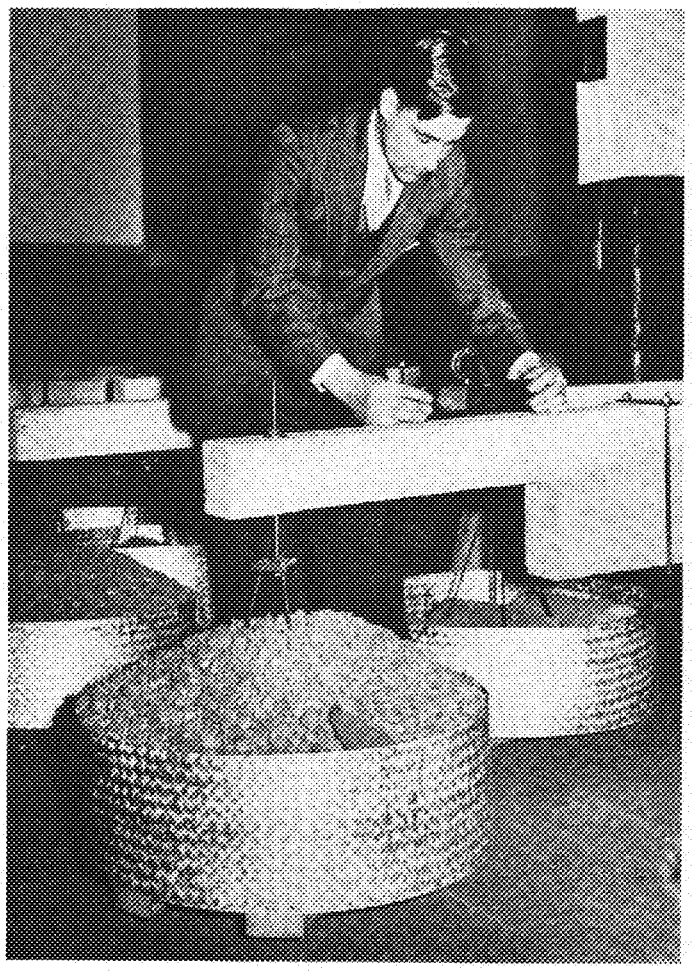
HUNDREDS of problems have been studied in the research laboratories of the University this year. Many of the investigations have been completed, many more are still in progress and more still are yet to be begun. The greater part of the research is done by graduate students under the supervision of faculty advisors. A large number of the faculty members are also working on research problems.

"Research in the Institute" this year has attempted to explain the more important of these projects when it was possible to publish any information about them. But, in spite of the large number of researches, it was a hard job to get as few as four articles together each month. The most general reason for this difficulty is that very few research men allow any of their work to be published until they themselves have written a paper on it. In the case of a graduate student working on his thesis, little or nothing can be said about his work until the thesis has been completed. If a particular process or instrument is the subject of study, patent rights or discovery rights could be interfered with through any premature publication. Much of the research is far too technical or of too little general interest for this department. But, there are dozens of research problems which are about to be completed. These will, if possible, be presented in the TECHNO-LOG next year when papers on them have been published. The remainder of this article will give you a taste of what to expect from the research laboratories of the Institute of Technology next year.

Many new developments will come from the Engineering Experiment Station next year. Several projects are to be completed before summer, and publications on longer ones will be made from time to time as the work proceeds. Professor B. J. Robertson has completed the apparatus to be used in testing automobile oil filters and is beginning the actual tests. The apparatus wears out lubricating oil in the same way as does a motor. The investigation will determine the components of a good oil filter.

Many problems of greater or less importance to industry are being investigated in the department of chemical engineering. One is a new method of preparing pure linseed oil by extracting it with a suitable solvent. A good solvent has been found, but the results have not been published yet. Problems in lubrication, corrosion, and preparation of zeolites as industrial vapor absorbers are being investigated.

The research in organic chemistry is chiefly of theoretical interest. Dr. Arnold will soon complete an investigation of the chemical evidence for the oscillating bond structure of the benzene ring. He has obtained some definite chemical evidence that such a structure exists. Dr.



Mr. Hillman taking a deflection measurement with a strain gage.

Lauer's work on the mechanism of rancidification in fats may be of commercial importance.

Mr. G. L. Von Eschen, a graduate student, under the direction of Professor Ackerman, has been studying the effect of the fuselage of a plane on the span-wise air load distribution. The experimental part of this work was done during spring vacation, but the investigation is a part of a thesis which will not be completed until next year.

It's More Fun to Know

This essay, a very interesting analysis of propaganda and its uses, was selected as the best among those submitted by the recent Tau Beta Pi initiates. It presents a somewhat different slant upon a subject which is a challenge to civilization.

By Stanford Church, Aero.E. '40

Illustrations by Walter N. Ziering, Arch. '41

"Words are like leaves; and where they most abound,
Much fruit of sense beneath is rarely found."
—*Alexander Pope.*

MODERN civilization has brought with it social, economic, and political forces which in complexity and vastness of effect have been unparalleled in previous ages. Not the least of these is the power of the printed and spoken word to direct and control the opinions and sentiment, not just of individuals or of localized groups, but of large masses of people.

The utilization of modern tools—the press, the radio, and the motion picture—in fomenting strife and discontent demands the attention of every conscientious citizen. War is as old as man himself; but these agents of society are new, and their use for selfish ends has created problems with which sociologic advances have failed to keep pace. One has but to consider their function in the autocratic state of Germany to realize the truth of this. Powerful German broadcasting stations are constantly pouring out German propaganda, while the only opinions which are allowed to be expressed in Germany are those of the unopposed Nazi party.

The term "propaganda" defies all-inclusive definition. The word itself arouses in many minds sinister meanings such as "overthrow," "Red," "dictator"; yet a school teacher who upholds in the classroom the ideals of American democracy might be branded a propagandist. There is, nevertheless, a distinction between propaganda which the majority of citizens would think is right and would call "education," and propaganda which they would think is wrong and would call "propaganda."[1] It is the latter sense which this discussion intends to consider.

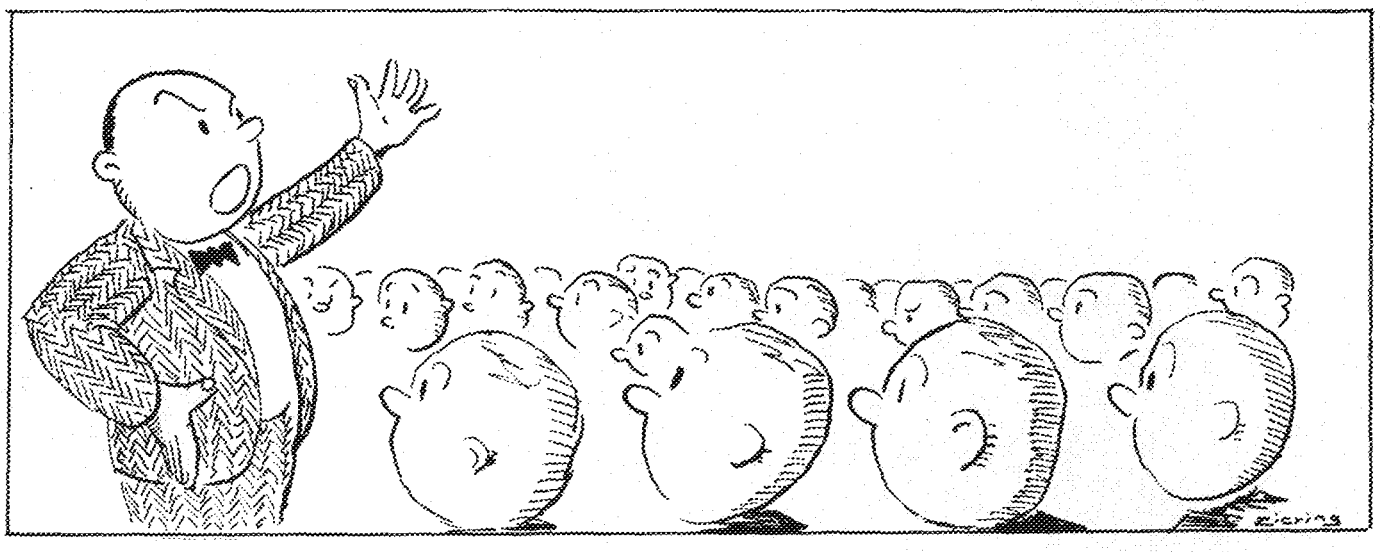
Is this sort of propaganda actually so extensive and so effective as to be dangerous? One needs to let his curiosity lead him only a short distance into an investigation of the subject to conclude that it is. The basic freedoms upon which American democracy is founded make possible propagandism of a nature which would not be tolerated by most European powers if it were to be attempted within their borders.

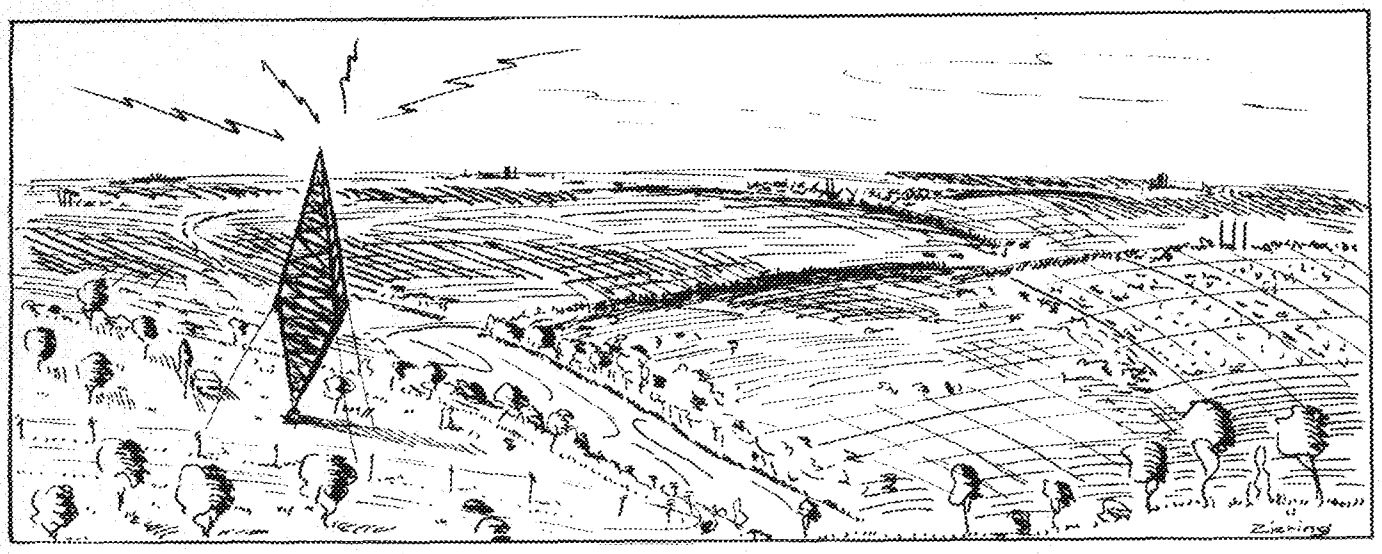
That British propaganda was instrumental in drawing the United States into the World War is no secret. Even today there are many pro-British groups at work in this country, ostensibly strengthening the friendly relations between England and America, but in reality working for objectives of material benefit to the British Empire. Quincy Howe, an editor and Harvard graduate, has recently published a book the title of which alone suggests the influences to which Americans are subjected: "England Expects Every American to Do His Duty."[2]

Propaganda a Problem Here Too?

Not all the propaganda in the United States is of foreign origin, for our own agency of government employs similar methods in furthering its own objectives. One sharply drawn issue at present is the licensing of radio broadcast stations by the Federal Communications Commission, a body of seven presidential appointees. Licenses are issued by the Commission on the basis of service to "public interest, convenience, and necessity," for periods not exceeding six months, at the end of which time they must be renewed. Thus, the government possesses, by implication at least, almost dictatorial powers of censorship. The head of one broadcasting company has stated that because of their subservience to the Commission, broadcasters refuse to allow criticism of the New Deal to

Modern propaganda methods have rendered the soap box orator obsolete.





One man can now influence millions of others simultaneously.

go on the air.[3] A political writer of national prominence has said that "no administration in history ever remotely approached this one in the number of publicity agents employed; . . . the degree to which the moving-picture industry is utilized and the radio dominated."[4]

After the extent of the forces of propaganda has been realized, there arises the problem of defending against them, which in turn requires a knowledge of the methods of propaganda. The Institute for Propaganda Analysis has listed these,[5] some of which are (1) "name calling," which makes use of widespread dislike for such terms as "Fascist" and "dictator"; (2) "glittering generalities," or association with virtue words, as "liberty," "social justice"; and (3) "card stacking" against the facts. The last may mean anything from misplaced emphasis to downright lies, and is probably the hardest to detect.

Propaganda bases its effectiveness on its ability to excite the emotions of its targets to a high degree, while deliberately avoiding any appeal to their intellect or ability to reason. In this manner it produces action without leaving time for examination or analysis on the part of its victims. The Institute for Propaganda Analysis suggests that "the most effective way to deal with propaganda, once we recognize it, is *to suspend our judgment until we obtain essential facts and implications involved in the propaganda.*"[6]

A Challenge to Propaganda

A technical education is notable for the logical, straightforward manner of thinking which it develops. Science and technology have advanced in the past because their workers have permitted no compromise with truth, have toiled long hours in painstaking analysis; and that same analytical curiosity, that same desire to get at the truth is injected into present-day engineering curricula. Evidently, then, engineering students are well equipped to break down the false reasoning of propaganda and to detect the subterfuges and misplaced emphasis upon which it depends. Their training should enable them to analyze controversial questions logically and intelligently.

There is, however, a definite limitation to the capacity of the technical person to draw intelligent conclusions concerning questions of public interest. This is due to the absence from the backgrounds of most engineers of any acquaintance with topics not directly concerned with technology. Far too often their intellectual horizons are limited to natural phenomena and their applications; while a successful resistance to propaganda demands a well-informed society educated in the history and sociology of our civilization. President James B. Conant of Harvard University, in his address entitled "Defenses Against Propaganda,"[7] has advocated a society of individuals so steeped in the history and traditions of our country as to make impossible any inroads of alien thinking.

It is encouraging to note that propaganda is not running unchallenged in the United States. Public reaction to investigations now being conducted has indicated the fear with which citizens regard menacing alien activities as well as war propaganda. And well they may be alarmed, for persons familiar with the happenings of that time perceive a striking parallel between events which took place before the World War and those which have transpired during recent years. Despite an apparently intense resentment on the part of its citizens toward the United States' entrance into a war, they say that when the time is ripe, the work of a few propagandists, coupled with public indignation over some incidents which infringe upon the country's national dignity, will lead the nation into someone else's war with accelerated rapidity. Unrest existing at present threatens to engulf the world in a conflict more devastating than the last—probably just as fruitless. If such happens, a liberty-loving nation will have everything to lose, nothing to gain. Americans must treasure highly the institutions with which they are endowed and their government "of the people, by the people, for the people." There is no richer heritage on earth.

1. "Propaganda in a Democracy," University of Chicago Round Table broadcast, August 14, 1938.
2. New York, Simon and Schuster, 1937.
3. "Propaganda Technique," round table discussion led by George A. Benson, reported in Minneapolis *Journal*, March 25, 1934.
4. Frank Kent, "The Great Game of Politics," syndicated newspaper column, May 7, 1935.
5. "Propaganda Analysis," Institute for Propaganda Analysis, Inc., New York City, November, 1937.
6. "Propaganda Analysis," December, 1937.
7. Published in Vital Speeches, June 15, 1938, v. 4, p. 542.

The Minnesota Techno-Log

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It's Been Fun

WELL, here it is, your big Engineers' Day TECHNO-LOG. It's a little bit different than the others this year, more pages, more pictures, and "lighter" feature articles. We felt that around this time of the year you'd prefer this type of material to that of a more serious nature so here it is, we hope you like it.

Since this is the last issue of the year we'd like to extend that statement to include all of the previous ones. We hope you liked them too. We, the TECHNO-LOG staff and myself, have had a pleasant year producing the magazine. We've done our best to give you the kind of a TECHNO-LOG you wanted, and if we've failed in any respect, it is not because we haven't tried.

This being the last issue, I'd like to take this opportunity to thank all of those people who have helped to put out your magazine. As you can readily realize, a magazine such as the TECHNO-LOG is not a one-man job. It is necessary to have a large staff of efficient assistants. I was fortunate enough to have that, and I hereby extend my thanks to Dick Stone, make-up editor, whose hard work is reflected in the attractive appearance of the magazine; to Vernon Olson, feature editor and next year's editor, who provided a constant source of new and different ideas; to George Montillon, copy editor, whose painstaking care is reflected in the lack of errors in this year's magazine; to Al Arneson, illustrations editor, who, though he gave me some anxious moments, managed to provide uniformly excellent cover pictures and frontispieces; to Gordon Griffith, your persistent news editor; and to all the other fellows who have worked at reading copy and proof, pasting the dummy, and doing the numerous other jobs that must be done if a magazine is to be produced and without whom this year's TECHNO-LOG would not have been possible.

Thanks are also due the men of Bruce Publishing Co., our printers—George Johnson, Herb Fuller, and all the rest—for their patience with the eccentricities of an amateur and for the excellent manner in which they coöperated with us throughout the year.

As a final thought I would like to wish next year's editor, Vernon Olson, all the luck in the world. Vern is a conscientious worker and also full of original ideas, as you will undoubtedly find out. I feel confident that he will put out an excellent TECHNO-LOG. I sincerely hope that he will receive the excellent support from the students, faculty, and others that I was fortunate enough to enjoy. Good luck, Vern!

WOOLSEY MOTL.

Engineers' Day

ENGINEERS' DAY is fun!

No one who has gotten into the spirit of the day and experienced it has any doubt about that. Many of us feel, though, that unless we get more from our Engineers' Day than merely a period of merrymaking and festivity, it is not quite worth what it costs us in time and effort.

Our educational institutions necessarily place almost their entire emphasis on academic, intellectual training. Since such is the case, a large proportion of students (judging from campus surveys) overlook the importance of experience in working with others and of being sociable, fraternal individuals. The practical application of the theoretical knowledge which we come to college to get usually requires a considerable amount of getting-along-with-others skill.

No matter how idealistically logical we young intellectuals would like people (including ourselves) to be, the fact remains that we are all human beings subject to all the prejudices, emotions, and idiosyncrasies of human beings. We must accept the world as it is, which includes accepting the fact that learning the difficult lesson of working with people is as important to us as learning to work with things and ideas. One of the chief purposes of Engineers' Day is to furnish students with an opportunity to learn that lesson. Chairmen who shoulder the responsibilities for a particular phase of the affair are bound to get a lesson in working with others. Those who turn out to enjoy Engineers' Day will find an enriching experience.

Furthermore, it is fun—in the field events, for instance, to see how far apart two-man teams can stand while they toss back and forth a strictly fresh egg without breaking it—whether it is an educational experience or not. These two days are our days, let's enjoy them!

That Radio-Controlled Car—

How does it work? You saw it at the E. E. show or, if you missed it, you'll get a chance to see it at the Open House. It aroused the curiosity of so many people that we present this description of it by its builders.

By Joseph G. Gellings, E.E. '40, and Paul Thompson, E.E. '40

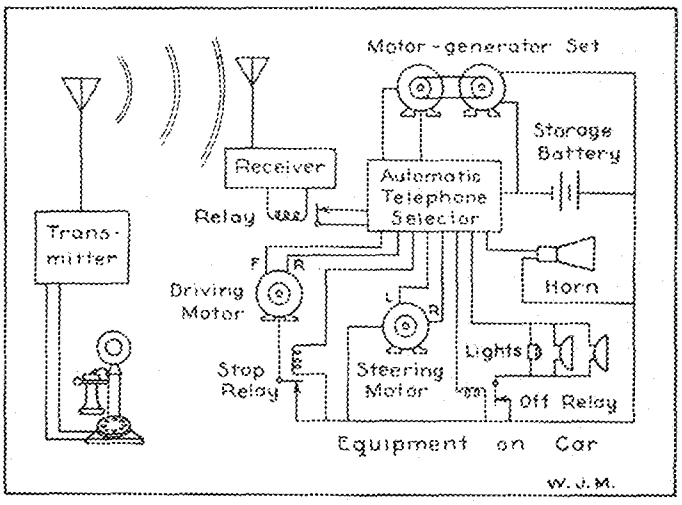
Illustration by Walter Moe, E.E. '40

THE car described on this page was one of the exhibits at the recent Electrical Show. It was constructed in the spare time of the builders and incorporated no complex theory or equipment with the exception of the automatic telephone selector switch. This device, which is one of the most important units in the automatic dial telephone system, made possible the selection of any one of a large number of circuits at will and thus constituted the "brain" of the car.

The transmitter used was a simple Hartley oscillator, operated on the 80 meter band. It employed an 801 tube capable of putting out 20 watts as an oscillator. A five meter transmitter and receiver were employed at first, but so much trouble was experienced with the instability of the transmitter at such a high frequency that they were abandoned. The transmitter was keyed with an ordinary telephone dial, which is merely a device for breaking an electric circuit a number of times corresponding to the number dialed. Thus, when the transmitter was in operation and the number five was dialed, the waves emitted from the antenna were interrupted five times in rapid succession. When this train of radio waves was impressed on the antenna of the receiver mounted in the car, the detector was so biased that practically no current flowed in the final plate circuit. When the waves were interrupted, however, the bias was removed and the plate current rose to its full value. A relay connected in the plate circuit of the final stage could then be made to operate whenever the train of waves from the transmitter was interrupted. Thus by dialing any number, the relay on the car was operated the same number of times, and with the telephone selector connected to the relay, it was made to operate as though the dial itself were connected to the selector. The selector required 48 volts for operation, so, to avoid the weight of batteries, we built a motor-generator set which supplied the voltage required and operated on the 12 volts derived from two storage batteries in series.

The telephone selector, made for communication purposes, could not pass a heavy current like that required to turn the driving motor (about 15 amps. at 6 volts), so auxiliary relay systems were used in each circuit to accommodate heavier currents. We also made use of an auxiliary relay system to allow operation of more than one circuit at once so that the car might be steered, the horn blown, or the lights turned on without stopping the car. The simplest relays we could find for the purpose were the old automobile generator cut-outs which served the purpose very well.

The frame of the car was made of two by fours mounted on three coaster wagon wheels. All motors used were old automobile generators which were somewhat inefficient, but were satisfactory for the short length of time that we used them. The driving power was transmitted to the rear axle through a system of pulleys which gave a reduction of about 11 to 1. One of the rear wheels were attached rigidly to the axle; the other turned freely. The single front wheel was mounted in a sawed-off bicycle fork adapted to fit the shaft on which the wheel turned. At the top of the steering post where ordinarily the handlebars of a bicycle would be attached we mounted a 10 in. pulley which was connected to the steering motor through another pulley and a worm gear which gave us a speed reduction of about 200 to 1 and thus allowed a sufficient degree of control in turning.



A simplified diagram of the circuit used.

The body was constructed in three decks. On the lower deck was the driving pulley reduction shaft and one of the two storage batteries. The second deck held the steering arrangement, the driving motor, the motor-generator for supplying the telephone selector, and the second storage battery. The third deck held the radio receiver with its associated relay and batteries. The telephone selector was mounted amidships between the first and third decks. The whole thing was covered with cardboard and lights were mounted in front and rear.

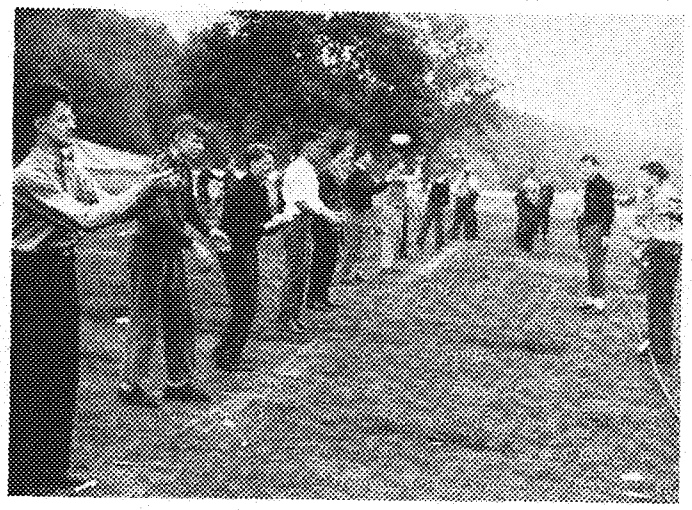
We had no great difficulty in building or operating the car except that the rubber tire on the front wheel persisted in coming off at crucial moments, embarrassing us no end.

This type of control, as one may understand, could be used to great advantage in warfare, to control tanks, guns, airplanes, or any operation where human life is endangered. Then, too, as one farmer who saw the car suggested, it could be fixed up to guide the tractor around and do the plowing while he sat in the shade at home.

May the Best Men Win!

By Larry Miller, M.E., '40

THE engineers' field day will be held at Riverside Park Saturday, May 13, as the second part of the annual two-day holiday in honor of St. Pat. The field day is being held off the campus this year to provide adequate facilities for the 500 or more that are expected to attend. Riverside Park offers everything to be desired for this



part of the celebration. There are tennis courts and volleyball courts available, as well as a large field with plenty of room for track events and diamondball games.

The main event of the morning is the student-faculty diamondball game starting at 9:30 a. m. The faculty are out to avenge the 7-6 defeat suffered last year. The game last year was scheduled for five innings, but since the two sides were tied at the end of that time, the game was continued until the students won. Phil Teeter promises to give each side a fair deal so that the faculty "fanners" can have no recourse if they lose to the I.T. "all-stars."

Immediately following this game a program of track and field events will start. The program includes jousting, an African bag race, an egg throwing contest, a three-legged race, a bag race, a tug-of-war, rope climbing, and several other events. Jousting is a game in which four engineers form two horse and rider teams, the loser being the one who is unseated first. The African bag race is a track event in which teams of two race with a "heavy" bag. The climax of this event comes when the race proper is finished. The men are divided into two teams which must secure as many bags as possible from the total which are placed in a line in the center of the field. The egg throwing consists of throwing an egg between two men who move apart after each throw. The trick is to get several hundred feet apart without breaking the egg. The more common three legged race and tug-of-war follow these events and are climaxed by the always spectacular rope climb. Prizes and points toward the departmental trophy will be awarded for these games.

At noon all events will stop for lunch. Groups will bring picnic lunches in addition to free refreshments to be served by the committee. All groups are urged to form their own picnic groups so as to better enjoy the outstanding facilities available. The grounds are well shaded with many ideal spots for lounging and lunching. There are many beautiful rock formations in addition to the shady grassy plots. The park has just been fixed and is in perfect shape.

After lunch the feature attraction will be the inter-departmental diamond ball games which have a great deal to do with determining the winner of the loving cup. The Chems will be on hand to defend their title against the other departments. The other departments will attempt to lift the title which the Chems won by virtue of their victory in the diamondball game and superiority in the other events last year.

So come one and all. Your presence is needed to make this the biggest and best field day ever held by St. Pat. "Erin go Bragh" might be translated to mean, "May the best men win."

These Men Made Your Engineers' Day Possible

Byron Ertsgaard, General Chairman

Buttons

Robert Lundberg, Chairman
Harold Ferrin, Assistant Chairman
David Seymour, Assistant Chairman
Doris Ekman, Architecture
Ralph Schreiber, Aeronautical
Marvin Warner, Civil
Nicholas Kenjoski, Agricultural
George Memillon, Mechanical
Robert Skoog, Electrical
Eben Finger, Chem. and Chem. Eng.
Drew Holbrook, Mines

Dances

Leland Batchelder, Brawl Chairman
Richard Daley, Chaperons
Priscilla Wrenn, Dessant Chairman
Edward Arntsen, Decorations Co-Chairman
Rodney Dalton, Decorations Co-Chairman
Sam Calloway, Ticket Chairman
Stanford Church, Aeronautical
Eugene Hickey, Architecture
Roger Nordby, Electrical
Henry Peterson, School of Chemistry
Wilson Davis, Mechanical
Edwin Teter, Mines
Walter Smith, Civil
Donald Moorhead, Eng. Pre-Bus.
Fred Runicker, Tech Fraternities

Open House

Elmer Hollar, Chairman
Peter Fritsch, Architecture
Robert Lundy, Aeronautical
Walter Lischeid, Civil
Blaine McKusick, Chem., and Chem. Eng.
Homer McGhie, Agricultural
Evert Jernberg, Mechanical
Howard Schoonover, Electrical

Publicity

Vernon Hoden, Chairman
Lawrence Miller, On-Campus
James Erickson, Off-Campus
Allen Smith, Radio
Grover Dimond, Poster Make-Up
John Kabrud, Poster Location
Gordon Haiseth, Photography

Knighting Ceremonies

John Shannon, Chairman
Sam McIver, Awards
Howard Bushnell, Program
Burke Moritz, Equipment
Vincent Gibney, Costumes
Lloyd Bredvold, Senior Contact

Field Day

Erick Schonstedt, Chairman
Phil Teeter, Diamondball Events
Archie Peterson, Picnic
William Mitchell, Field Events

Parade

John Liggett, Chairman
Lewis Gasiak, Organization Contact
Robert English, Trucks
Cy Sheehy, Route
Armour Stanley, Signs
Charles Zoubek, Construction

Departmental Floats

David Griswold, Architecture
Ralph Schreiber, Aeronautical
Norvin Ekrem, Civil
Louis Evans, Agricultural
Marvin Cohen, Mechanical
Elmer Brickman, Electrical

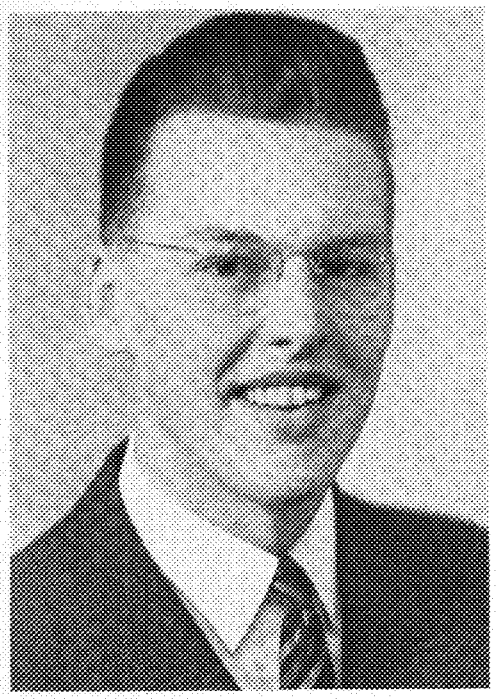
Green Tea

Ethel Mae Lindsey, Chairman

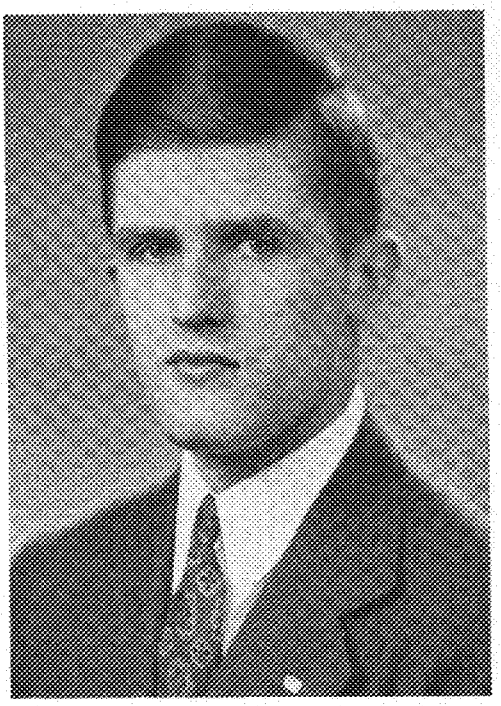
Office

Arthur Brickman

The Editor and Business Manager for 1939-40



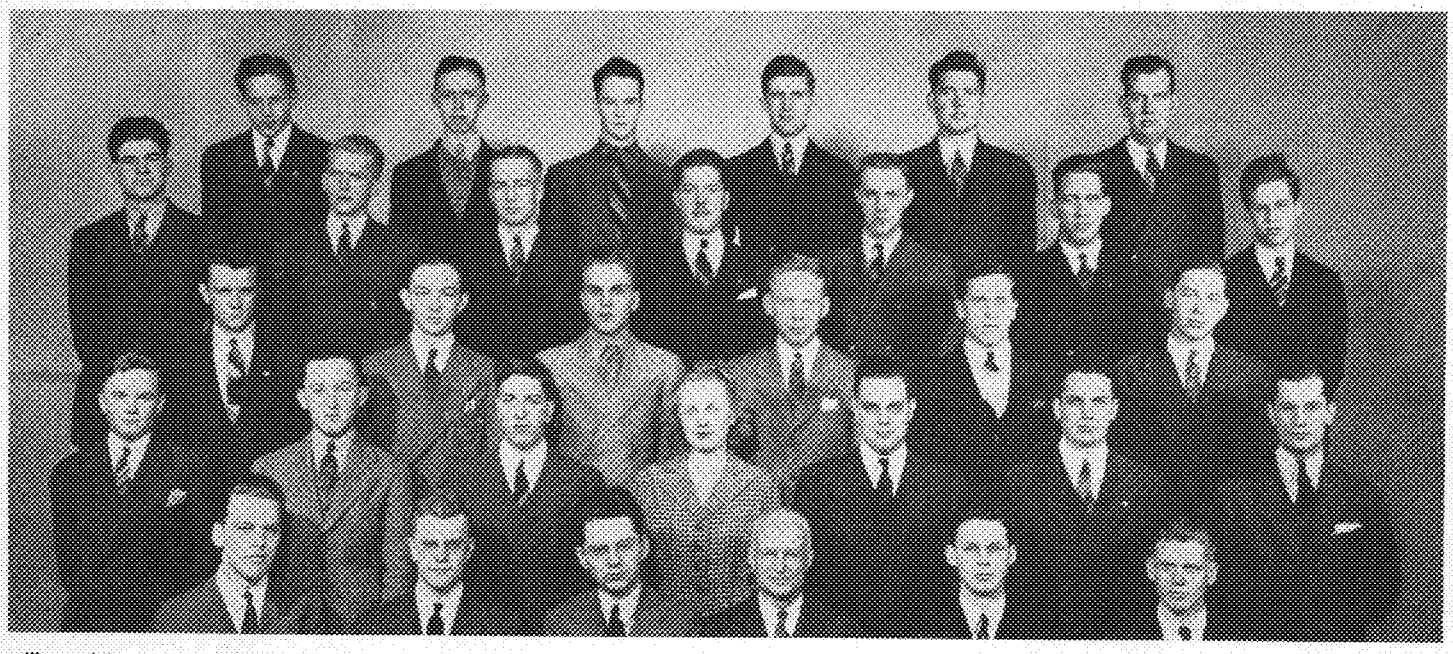
Heading next year's editorial staff will be **Carl Vernon Olson,** a junior in the five-year combined course. His engineering degree will be in Electrical Engineering. Vern, more familiarly known as C.V., has been on the staff for the past two years, serving this year as feature editor. He is also the Institute's representative on the All-University Board of Publications and a member of the student branch of the American Institute of Electrical Engineers.



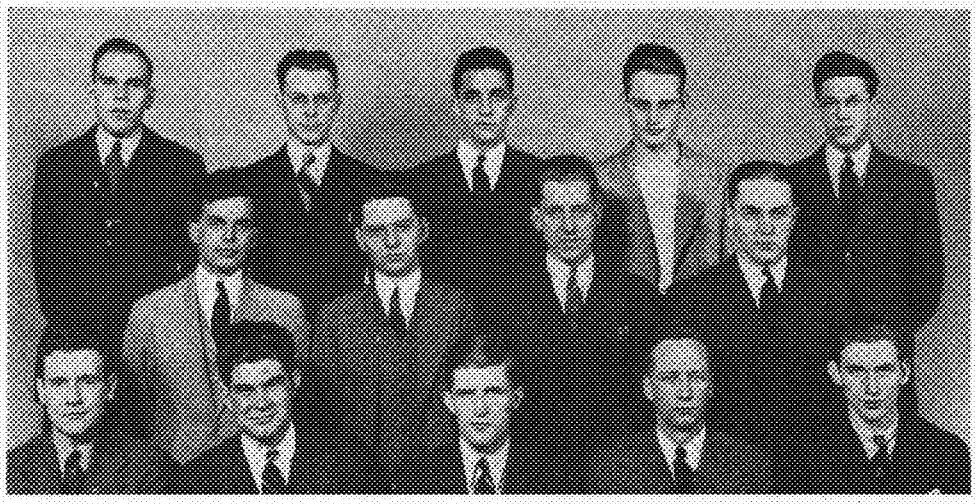
Keeping a close check on the financial end of next year's magazine will be **Wallace Wilcox,** a senior in the five-year combined course of Aeronautical Engineering and Business Administration. Wally has worked on the TECHNO-LOG for the past three years, the last two years as advertising representative. He is president of The Institute of Aeronautical Sciences and of The Technical Commission. He is also a member of Acacia, academic fraternity, and of Tau Beta Pi, honorary engineering fraternity.

The Techno-Log Staff, 1938-39

Back row: Belin, Hoden, Livingston, Wilcox, Shannon, Quist. Fourth row: Wolfe, Church, Nelson, Griffith, Clemens, Strom, McClure. Third row: Raudenbush, Paquin, Ferrin, Kahrad, Haiik, Callaway. Second row: Schonstedt, Wasley, Wray, Lindsey, Hopper, Frankel, Arneson. Front row: Olson, Stone, Moti, Richardson, McDonald, Monillion.

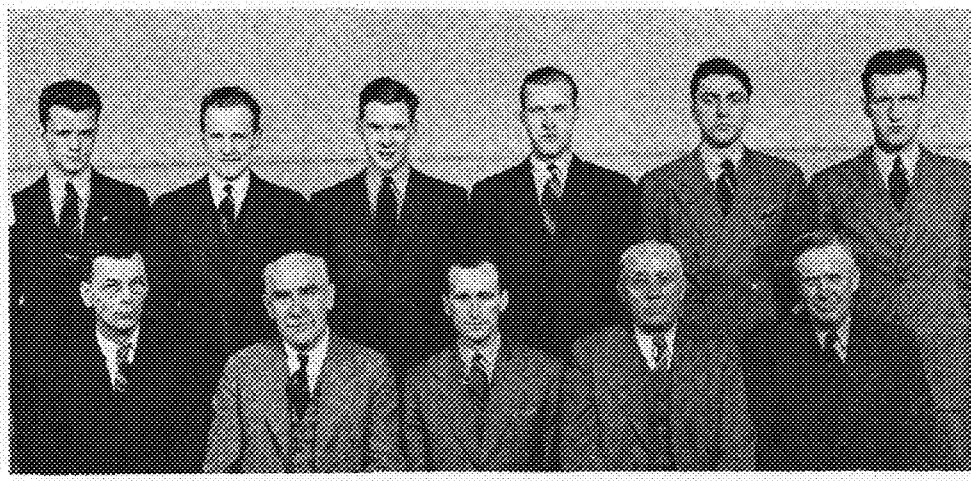


Technical Commission



Back row: J. Kreitinger, E. Hagen, H. Leach, M. Troxell, F. Roth. Second row: F. Larson, W. Motl, H. Gaustad, G. Ridings. First row: B. Durrenberger, R. Wolfe, W. Wilcox, R. Marvin, L. Anderson.

Bookstore Board

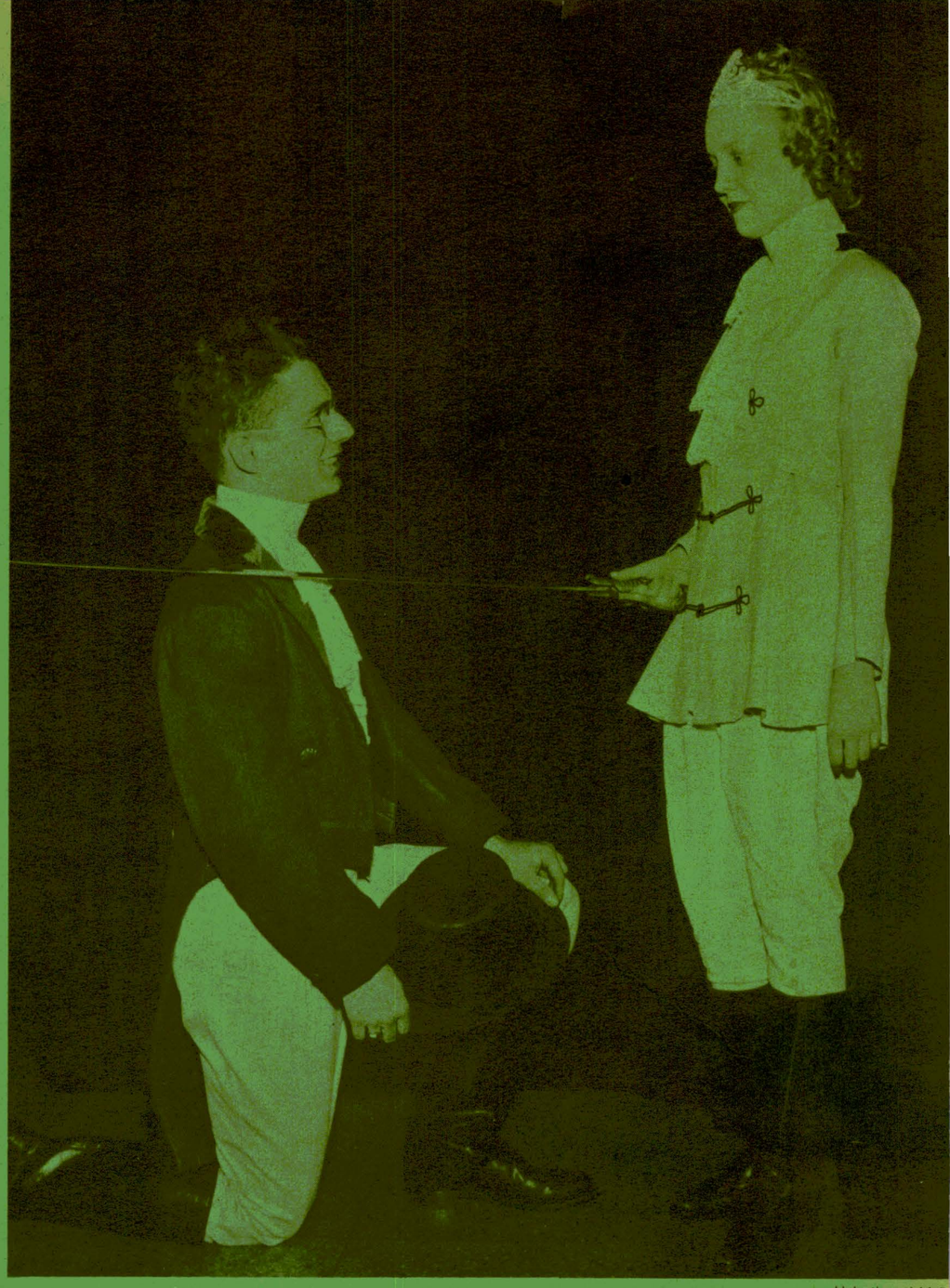


Back row: Baudenbush, Morris, Rogers, Jensen, Nathanson, Lien. Front row: Smith, Mann, Maiers, Comstock, Zeiner.

Techno-Log Board

Left to right: Anderson, Kreitinger, Dean Comstock, Harsiem, McDonald, Dowdell, Osmundson, Motl, Peterson, Dr. Straub.

St. Pat and His Queen



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MARY JEAN LINDSEY

Czarnowski

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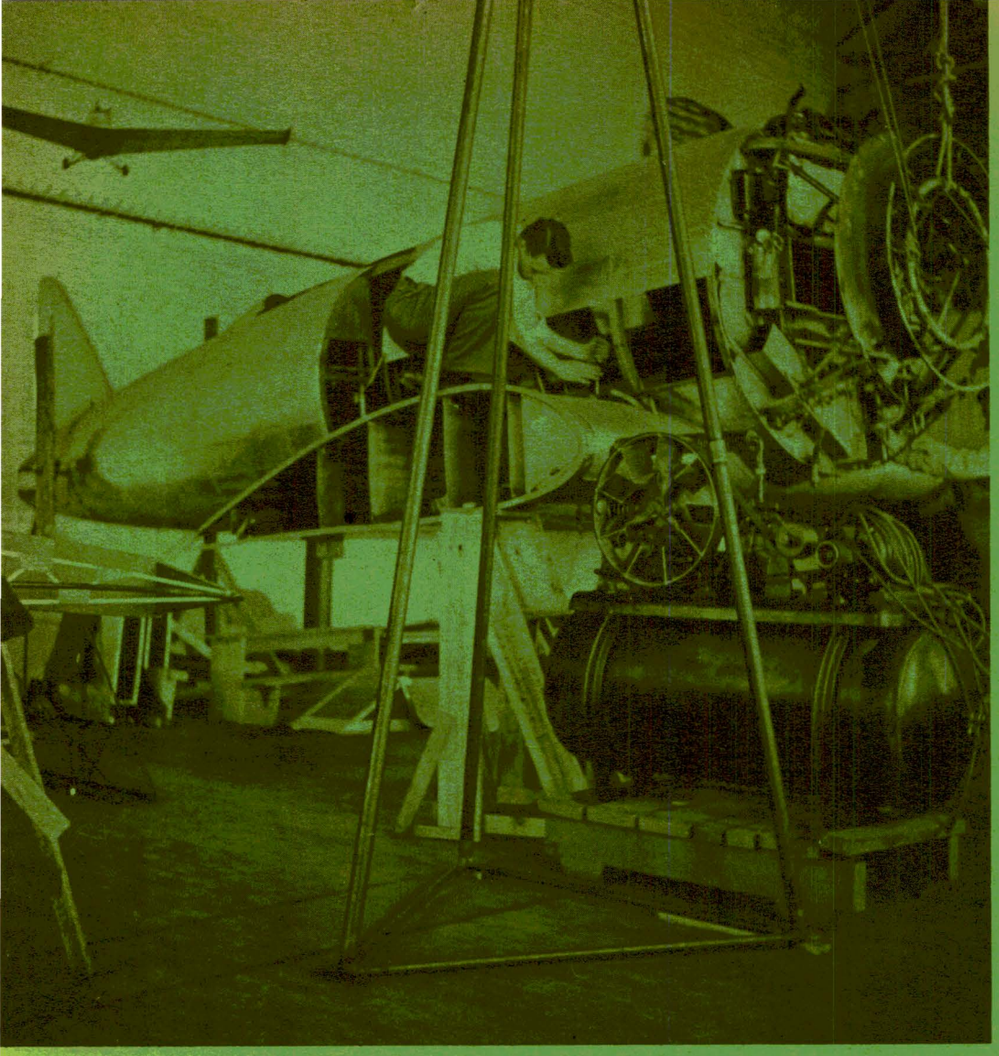

Open H

THE INSTI

Photograph

Among the outstanding exhi

Ag. Engineering Exhibits
Binding mechanism and

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Electrical Exhibits
Radio sound effects lect

Mechanical Exhibits
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Assaying laboratory—rec

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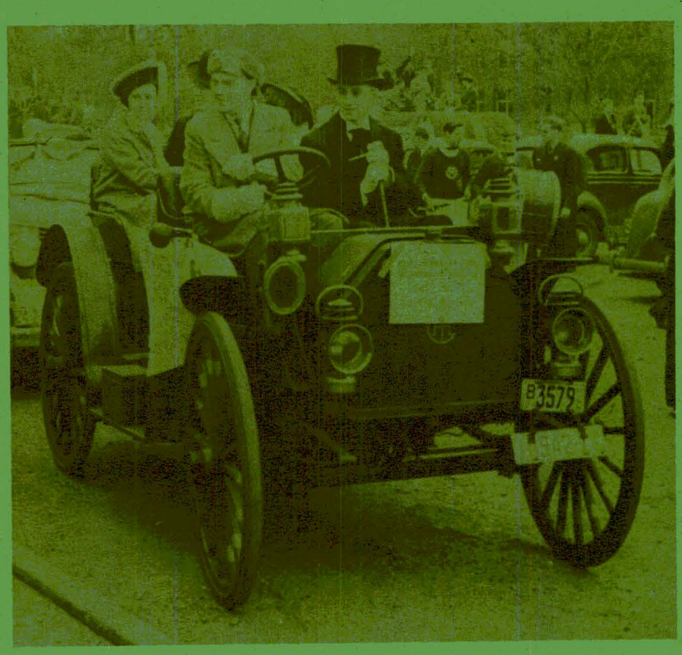
ADAV SMAS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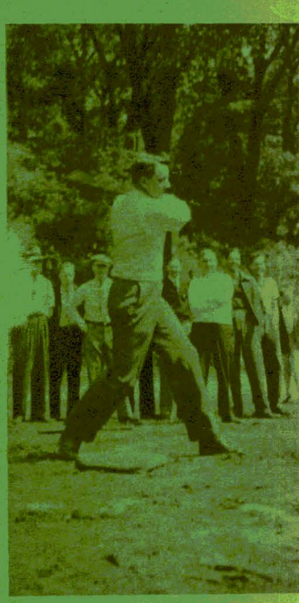
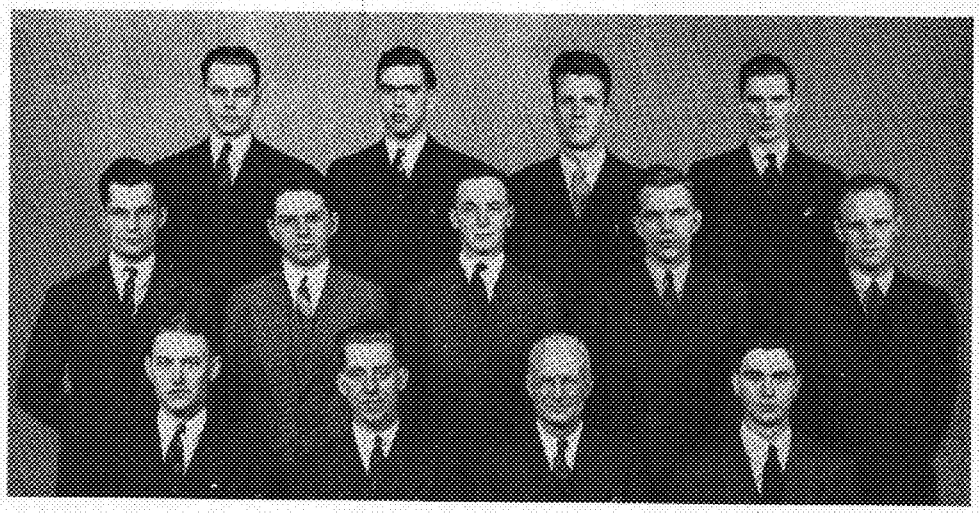



A12-768

Plumb Bob

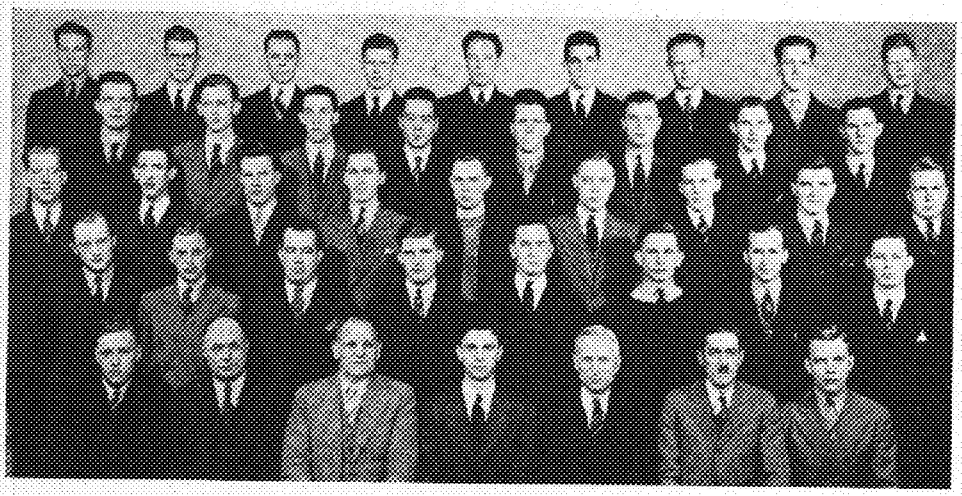
HONORARY SENIOR FRATERNITY



Back row: Erling Hagen, Nelson Dingle, Rowland Retrum, Leslie Anderson. Second row: Albert Arneson, Woolsey Mott, Homer Anderson, Reuben Olson, Wilson Brown. First row: Donald Lampland, Herbert Gaustad, Prof. Harlow C. Richardson, Gordon Brierley.

Tau Beta Pi

HONORARY ENGINEERING FRATERNITY

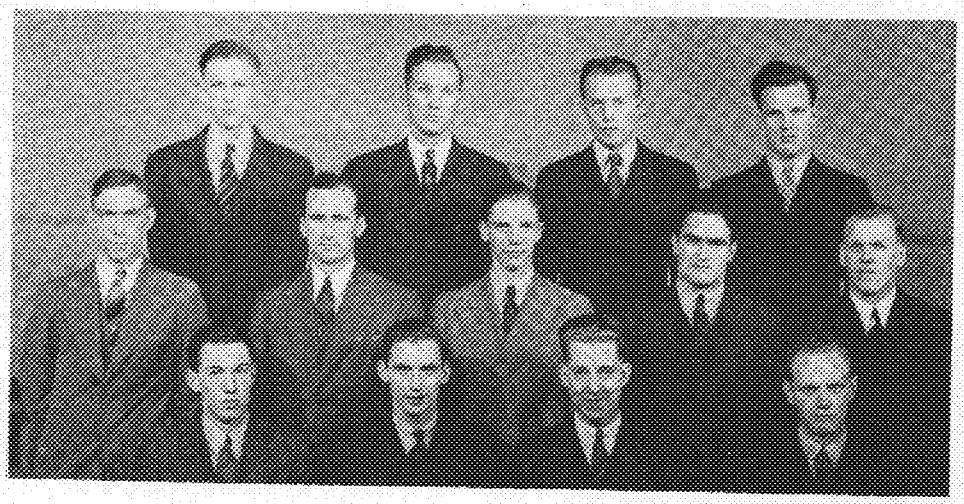


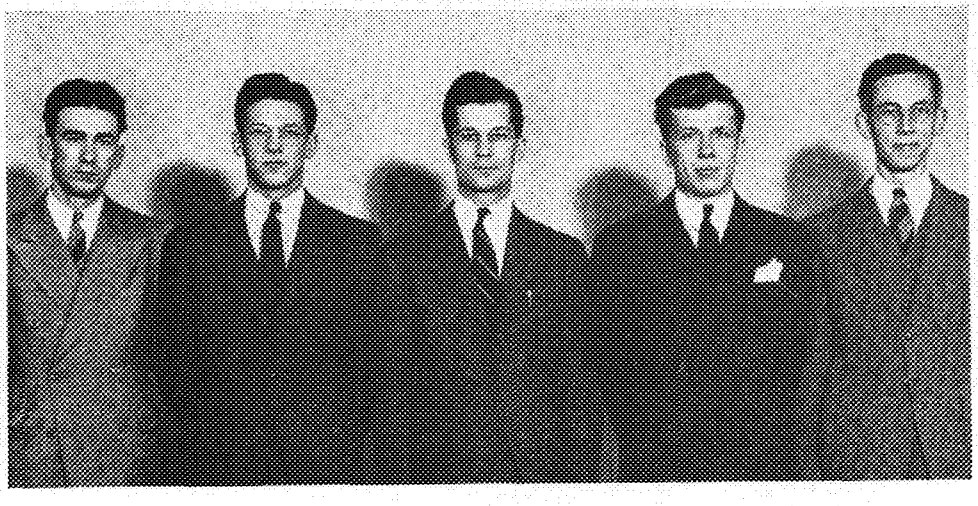
Back row: Haaland, Stone, Hagen, G. Montillon, Onstad, Leach, Brown, Lund, McKusick. Fourth row: Folletsmd, Sorensen, Hook, Fremack, Retrum, Johnson, L. Anderson, Singer. Third row: Gaustad, Hyde, Jacobs, Meyer, Bergsland, Eriandson, Stillwell, Hall, Lofstrom. Second row: Hermann, Hedlund, Swan, Wilcox, H. Anderson, Hage, Maiers, McDonald. First row: Kemp, W. T. Ryan, G. C. Priester, Brierley, G. H. Montillon, J. H. Kuhlmann, Olson.

Chi Epsilon

HONORARY CIVIL ENGINEERING FRATERNITY

Back row: Sorenson, Olson, Hauge, Jacobs. Second row: Nyquist, Maiers, Larson, Guthrie, Woxland. First row: Hook, Anderson, Gaustad, Brown.





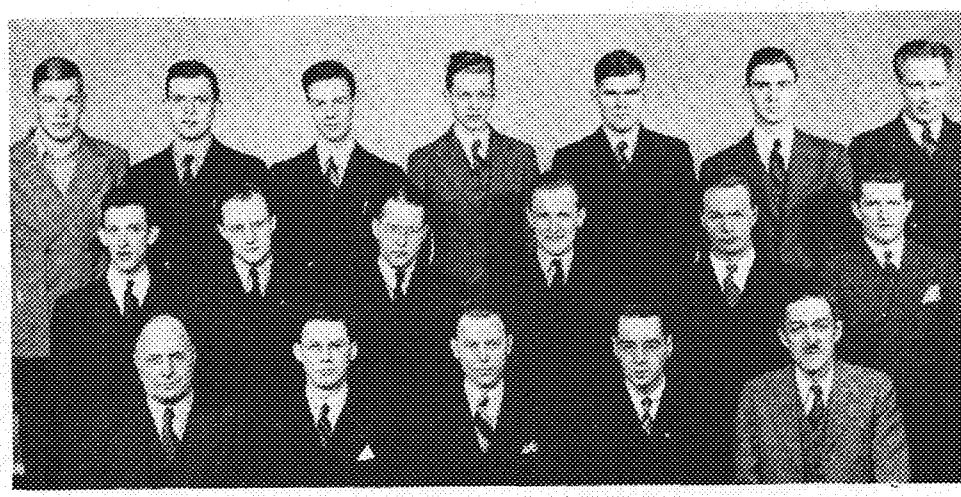
Van Keuren, Roth, Arneson, Marshall, Kirkpatrick

Commacini

HONORARY ARCHITECTURAL FRATERNITY

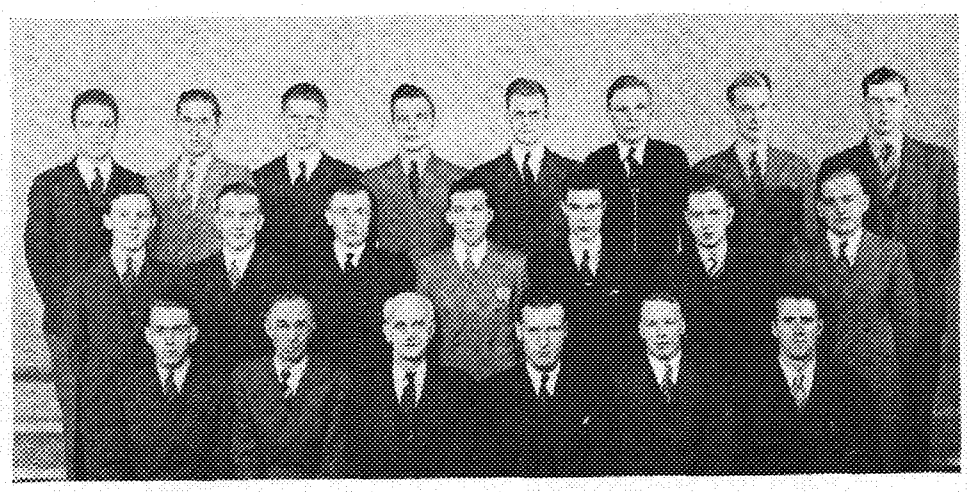
Eta Kappa Nu

HONORARY ELECTRICAL ENGINEERING FRATERNITY



Back row: Schroeder, Tollefsrud, Wyman, Moe, Specht, Brierley, Onstad. Second row: Hyde, Hermann, Sandberg, Morris, Lampi, Rebmann. First row: Ryan, McDonald, Hagen, Premack, Kuhlmann.

Back row: Edwards, Meyer, Monillon, Olson, Stone, Harvey, Chryst, Larson. Second row: Flinn, Beugberg, Thomas, Leech, Druel, Bergsland, Johnson. First row: Reed, Prof. Rowley, Prof. Marxmis, Lien, Prof. Ryan, Retrum.

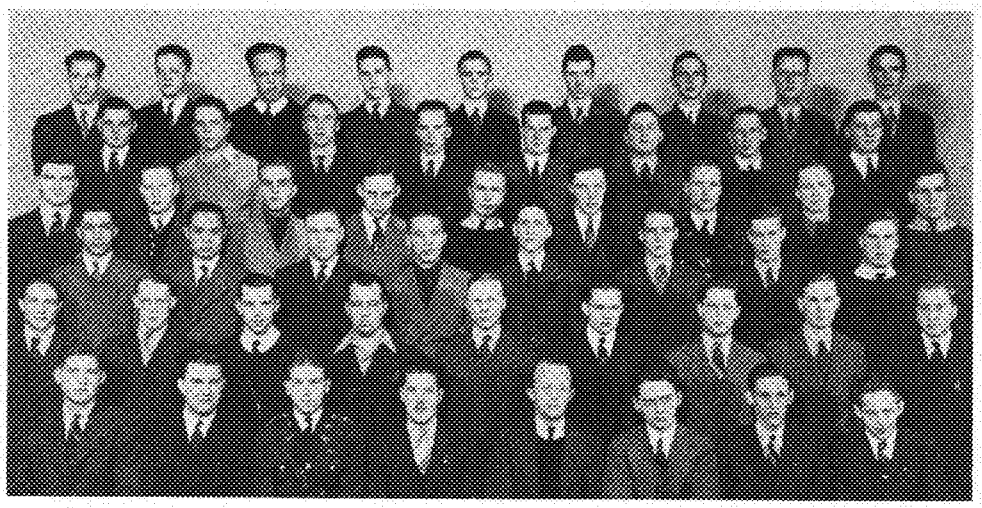


Pi Tau Sigma

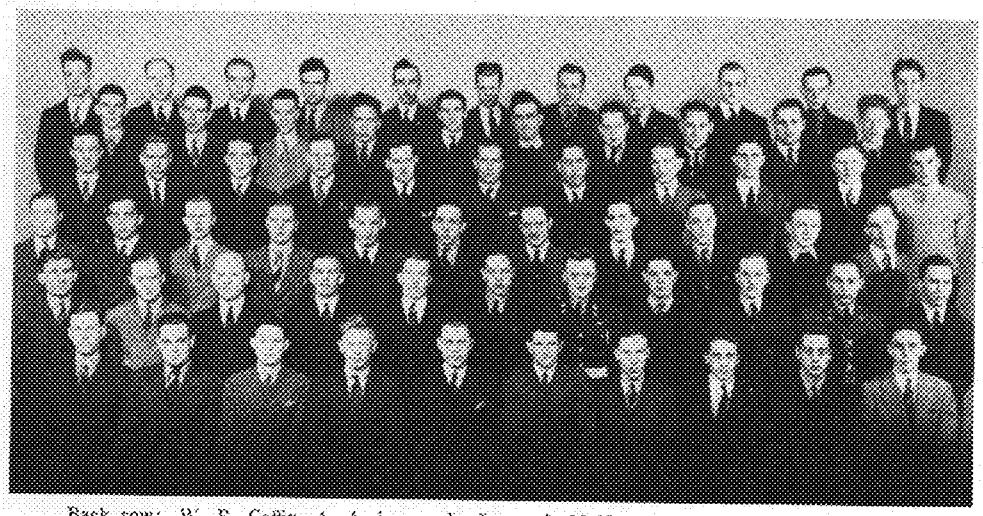
HONORARY MECHANICAL ENGINEERING FRATERNITY

A.I.Ch.E.

MINNESOTA STUDENT BRANCH OF THE AMERICAN INSTITUTE OF CHEMICAL ENGINEERS



Back row: G. Lund, D. Vorum, R. Logan, E. Peterson, A. Angerhofer, P. Pinther, R. Nicol, T. Schad, T. Valenty. Fifth row: V. Waters, H. Johnston, R. Lundberg, D. Meistrom, J. Ballard, W. Poppe, E. Hawkinson, G. Cermak. Fourth row: E. Hall, M. Roth, H. Ferrin, R. Jensen, E. Loistrom, P. Husen, C. Olson, A. Nelson, G. Lawless. Third row: A. West, Y. T. Chang, H. Kemp, E. Paulson, J. Fahrer, R. Winters, R. Abrams, B. Carlson. Second row: N. Ross, C. Schmitz, P. Kvmiser, D. Swan, R. Fredrickson, N. Schultz, J. Merrill, W. Stamman. First row: J. Shannon, T. Zajac, B. Haaland, H. Griffith, G. McDougall, W. Mosi, R. Van Hoven, W. Helm.

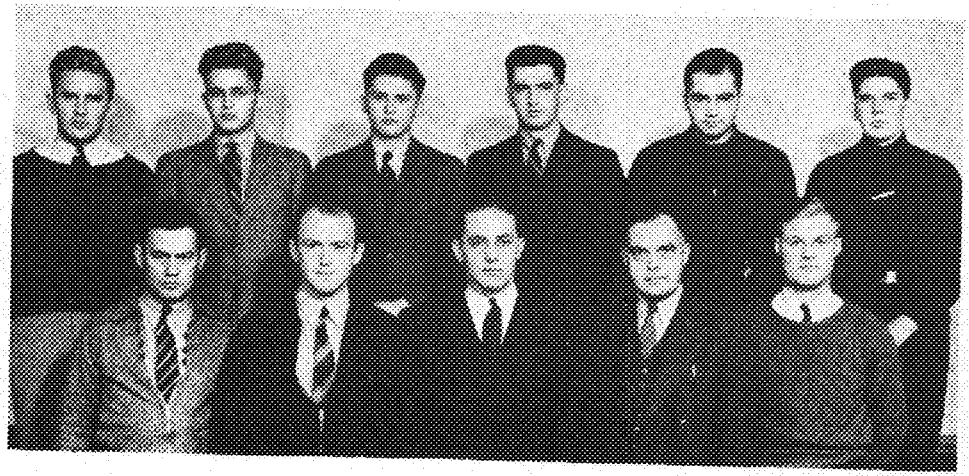


Back row: W. R. Coffin, A. Anderson, L. Jones, J. McNamara, O. K. Jacobson, W. Moe, R. L. Stark, A. N. Eliason, E. Thompson, R. L. Anderson, H. Kaehn. Fifth row: G. Anderson, R. S. Ford, P. Thompson, R. Odden, S. Sultany, R. Auten, M. Sandberg, C. H. Lund, K. Bower, O. Gabrielson. Fourth row: W. Peterson, H. Larson, P. Feyereisen, J. Kerrey, R. E. Skoog, S. Strand, C. Strom, E. Spellman, G. Brierley, E. Heinen, P. Wiener. Third row: J. Mitchell, R. Ohman, W. Osmundsen, J. Thompson, A. Pellinen, F. O. Anderson, G. Goldfarb, J. Hyde, J. Brinda, T. Smith, F. Wolfsberg. Second row: F. O. Kaiser, G. Heymann, C. Wall, J. Miller, G. K. Culbertson, G. Kuhlberg, J. D. Elmp, E. Arntsen, P. Morris, M. Bromer. Front row: R. Wyman, R. Hopper, R. E. McDonald, E. Brickman, E. M. Hagen, Releviann, J. Dahlberg, Watterburg, J. Premack, P. Warren.

A.I.E.E.

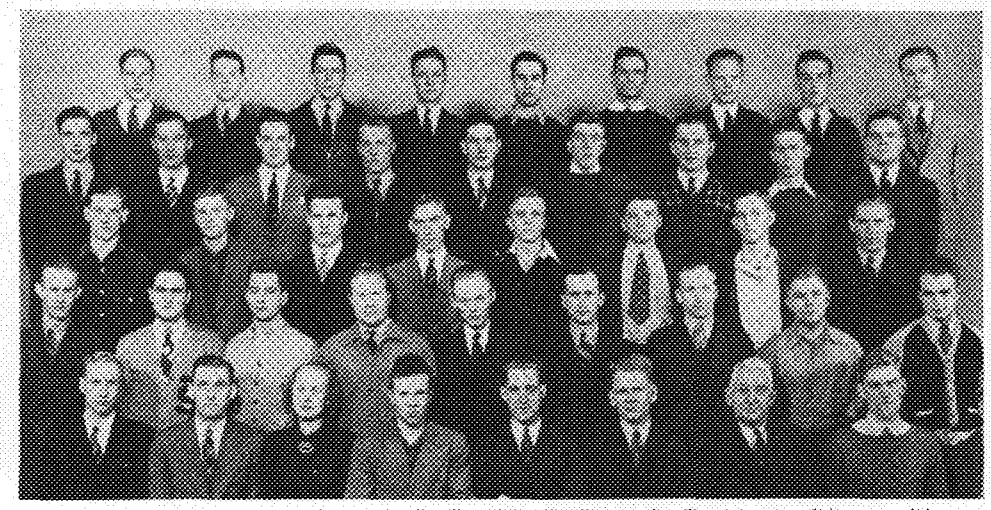
MINNESOTA STUDENT BRANCH OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Back row: Thornburg, Lindow, Gardner, Hostager, Hesli, Evans. Front row: Anderson, McGhee, Ridings, Prof. Schwantes, Kenjoski.



A.S.A.E.

MINNESOTA STUDENT BRANCH OF THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS



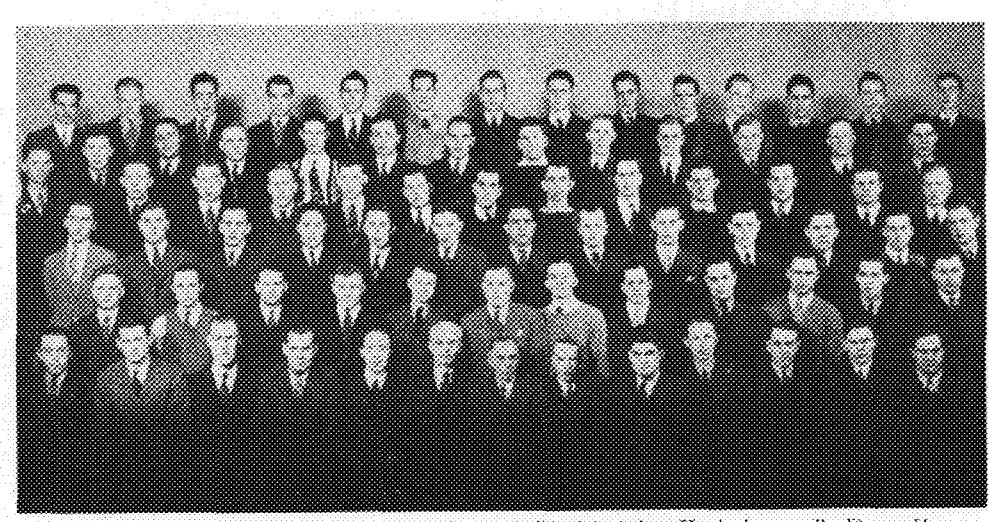
Back row: H. Monson, C. Hook, E. Tomsich, N. Ekren, L. Terzich, A. Chilstrom, W. Brown, D. Basgen, A. Lahti. Third row: L. Anderson, W. Olson, H. Raum, L. Hauge, E. Rosenthal, P. Pratt, E. Cohen, A. Andersen, J. Webster. Second row: M. Smithman, R. Gerber, E. Jacobs, E. Nyquist, E. Axelson, I. Dahlstrom, M. Warner, K. Anderson. First row: C. Van Nest, J. Guthrie, J. White, F. Rule, E. Carlson, H. Maiers, W. Johnson, F. Anderly, F. Colletti, J. Lindsey, R. Postels, M. Lindsey, K. O'Brien, H. Gaustad, B. Hansen, A. Cutler, R. Johnson.

A.S.C.E.

MINNESOTA STUDENT BRANCH OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS

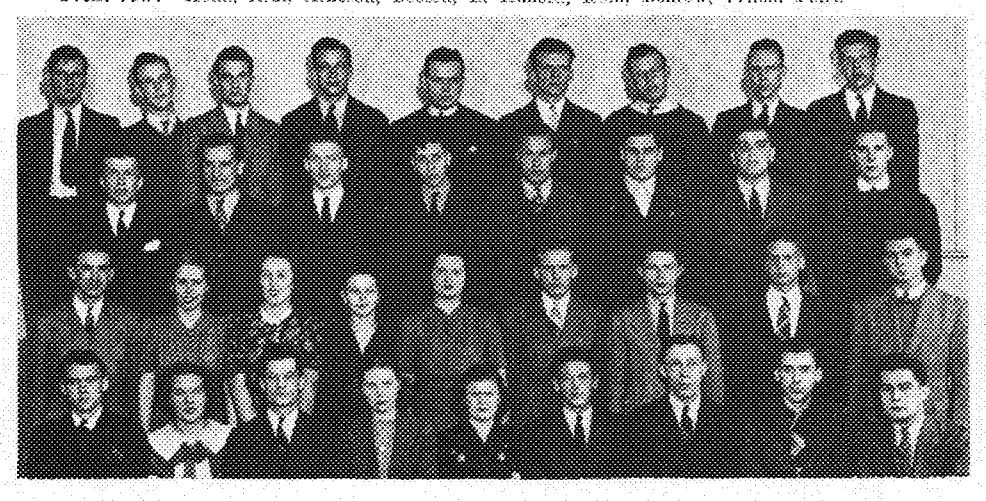
A.S.M.E.

MINNESOTA STUDENT BRANCH OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS



Back row: W. Snyder, H. Nelson, E. Cornwall, W. Schwieder, H. Anderson, R. Flagg, H. Mueller, G. Montillon, E. Starkey, R. Leger, L. Vest, E. Jernberg, R. M. Olson, R. Menning. Fifth row: E. Gimple, R. Larson, N. Ginsberg, R. Harvey, N. Nimios, R. Meyers, J. Kreitinger, P. Teeter, L. Miller, R. Stone, G. Jarvis, C. R. Morse, R. Dickey. Fourth row: B. Huettl, W. Ersted, H. Rasmussen, W. Larson, W. Baggerly, W. Beehler, R. Winter, L. Otto, A. Erickson, G. Ekland, R. Wilson, E. Franzen. Third row: R. Meyer, D. Schnack, W. Shaffer, W. Bozis, S. I. Anderson, J. Leha, S. Stein, O. Kravik, H. Mahle, J. Peed, R. Peterson, R. Leech, C. Bergsland. Second row: E. Schonstedt, J. G. Strauss, C. Landblad, W. Fitzke, J. Kiefie, R. Callaway, M. Swenson, H. Netkow, R. Hopper, S. Lindsey, J. Parsons, D. Thomas. First row: M. Feinberg, E. Farnham, E. Waltz, S. Quist, F. Powers, J. V. Martenis, F. B. Rowley, J. J. Ryan, R. Wolfe, I. Anderson, D. Reed, B. Ertsgaard, N. Marcum.

Back row: Flynn, Skinner, Wenzel, S. Johnson, Lindstrom, Nelson, W. Johnson, Dimond, Lie. Third row: Marshall, Brogge, West, Cushman, Olson, Levin, Jones. Second row: Van Keuren, Eckman, Thompson, Nemec, McManus, Lundgren, Hickey, Graffunder, Hanson. Front row: Holm, Asai, Arneson, Bossen, E. Hansen, Roth, Bentow, Frush, Petri.

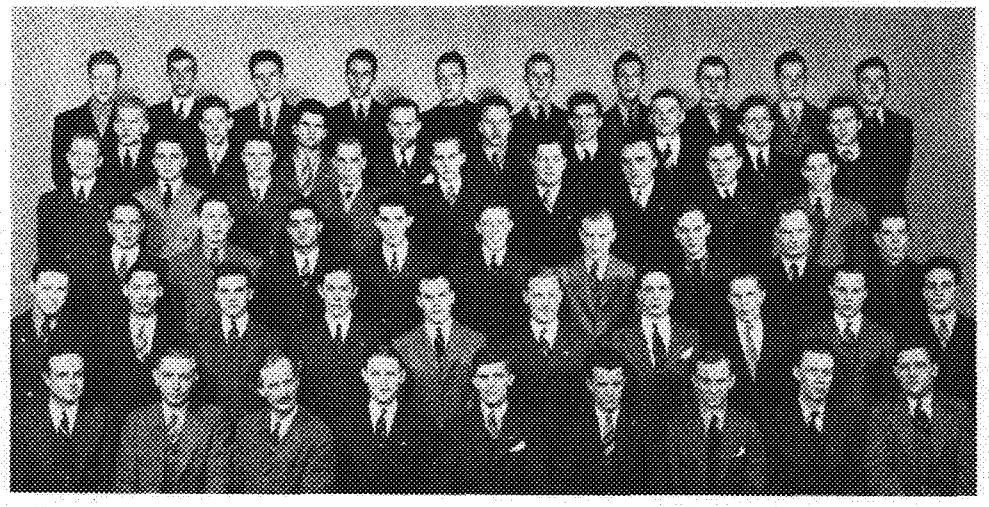


Architectural Society

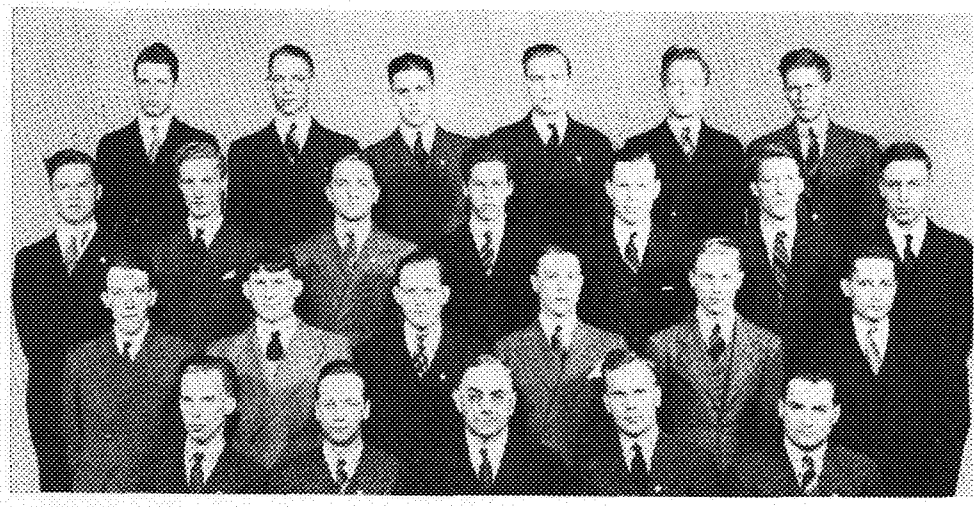
MINNESOTA SOCIETY OF ARCHITECTURE STUDENTS

I.Ae.S.

MINNESOTA STUDENT BRANCH OF THE INSTITUTE OF AERONAUTICAL SCIENCES



Back row: C. Jackson, B. Thigpen, J. Tucker, E. Harsiem, W. Parker, D. Cone, K. Winker, N. Erickson, A. Erickson, E. LaClaire. Fifth row: S. Church, V. Walstrom, J. McCarthy, R. Jahnke, R. Ross, D. McGinnis, C. Hall, S. Tunis, M. Clarkson. Fourth row: R. Straub, N. Haseby, D. Crisman, J. Cameron, B. Stillwell, L. Stowe, R. Richter, W. Lothrop, R. Weld. Third row: D. Frankel, B. Beemer, D. Flushman, P. Flynn, E. Hollar, J. Rutcher, D. Platt, B. Nash, C. Hickman. Second row: E. Briggs, H. Lee, C. Fowle, L. Swanson, W. Coons, W. Kircher, K. Anderson, L. Clifford, R. Schreiber, F. Kreidler. First row: F. Teichman, J. Wise, J. Piccard, D. Lampland, W. Wilcox, A. Randenbush, J. Akerman, E. Brush, S. Serebreny.



M.S.C.S.

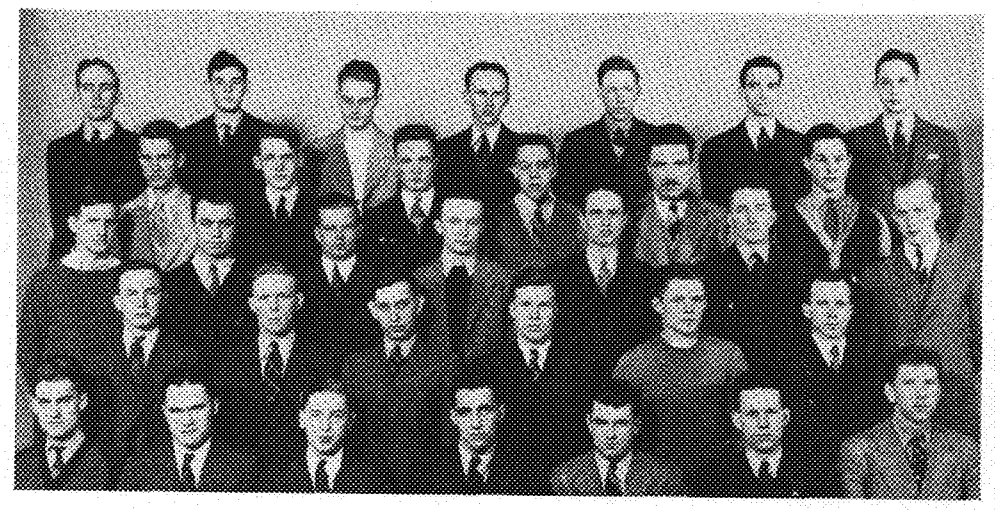
MINNESOTA STUDENT CHEMICAL SOCIETY

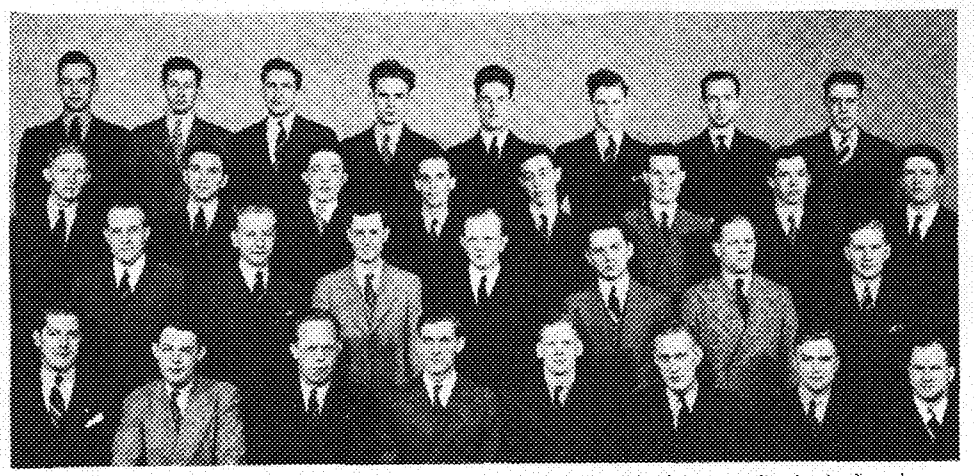
Back row: P. Ramstad, P. A. Lindahl, E. R. Peterson, C. Anker, E. Westrum, R. Arneson. Third row: A. Hamala, R. Francel, J. Findlon, D. McClure, R. Halverson, J. Hilton, L. Zolldan. Second row: R. Brown, P. Nahinsky, V. Winkelman, R. A. Matthews, P. Santrier, C. Williams. First row: D. Melstrom, R. Marvin, Dr. G. Glockler, R. Nordgren, G. Patrias.

Back row: T. Olson, M. Fine, M. Troxell, D. Berkner, J. R. Johnson, W. Hastings, R. D. Johnson. Fourth row: R. Helgeson, W. McNeily, J. Dalton, W. Brennan, W. Mackay, L. Kelman. Third row: S. Purcell, K. Bickford, F. Larson, R. Chommie, G. Crosby, L. Campbell, F. Gustafson. Second row: H. Anderson, G. Nelson, A. Stock, J. Nelson, R. D. Johnson, R. McCorquodale. First row: M. Brown, R. Alkire, S. Callaway, H. Leach, C. L. Batchelder, V. Krause, W. Whiting.

Mines Society

MINNESOTA SOCIETY OF MINES STUDENTS





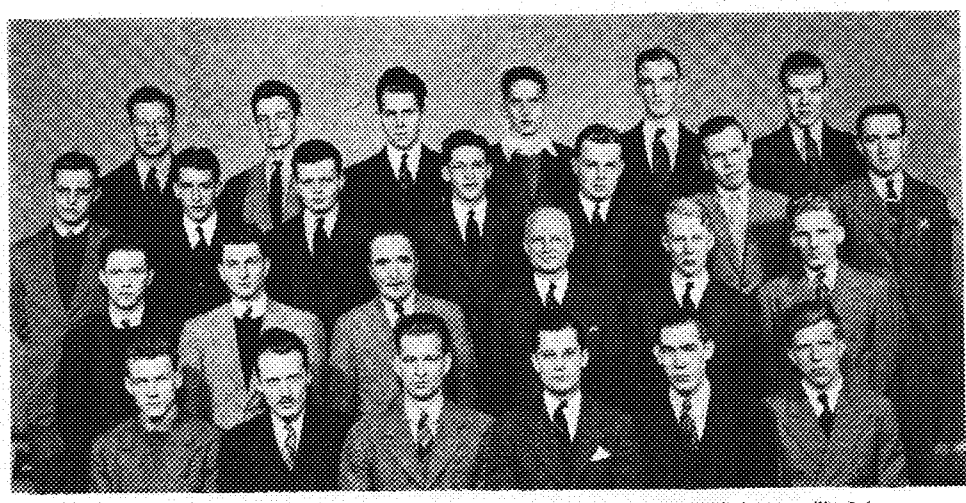
Back row: Sheeks, Janssen, Sherwood, Jurgensen, McDonald, Johnson, Rowland, Joseph. Third row: R. Anderson, Miller, Schilling, Carlin, Mathy, Ballard, Tyler, Clarke. Second row: Zaugg, Nystrom, Sartell, H. Anderson, Mott, Meile, Stassman. First row: Griffith, McMullen, Logan, Joesting, McKusick, Simpson, Lynch, Arper.

Alpha Chi Sigma

PROFESSIONAL CHEMICAL FRATERNIT

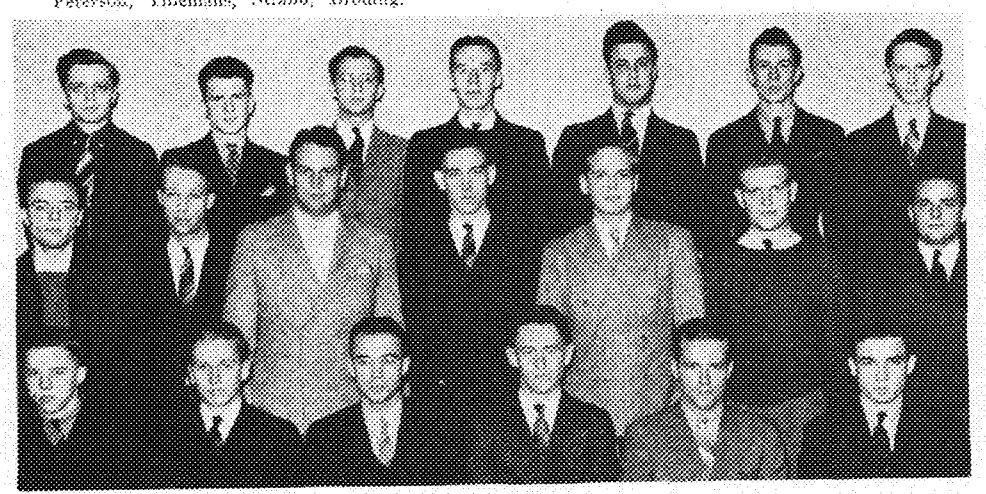
Alpha Rho Chi

HONORARY ARCHITECTURAL FRATERNITY



Back row: S. Johnson, Wiley, Dropping, Ziering, Shimer, Bergman. Third row: B. Johnson, Taylor, Behm, Refi, Lindstrom, W. Johnson, McGrann. Second row: Carmody, Hamm, Arnal, Richardson, Kvet, Lundgren. First row: Holm, Segerstrom, Hegg, Arneson, Kremer, Lie.

Back row: Erickson, Liston, Busse, Dahlberg, Rudisuhle, Clark, Molenaar. Second row: Smith, Jacobs, Smythe, Carlson, Boekhoff, Storm, Kessler. Front row: Weden, Chalmers, Peterson, Tillemans, Strand, Broding.

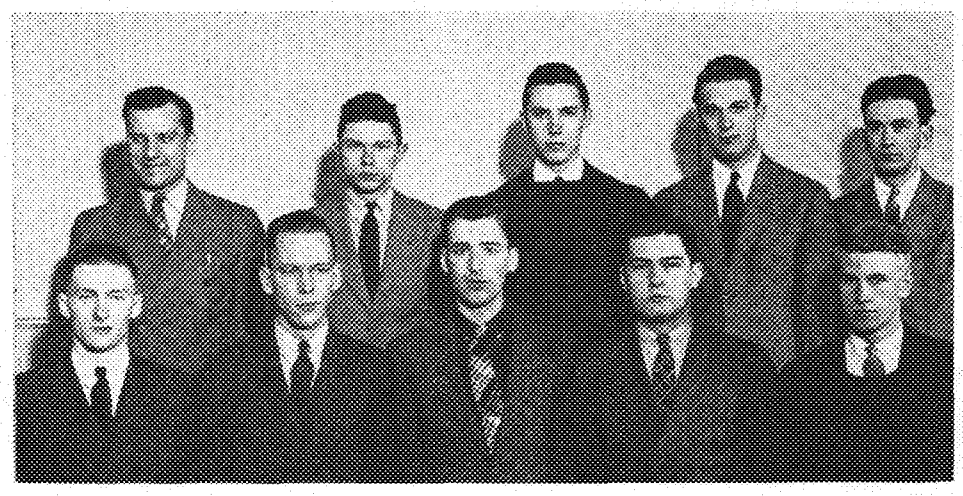


Kappa Eta Kappa

PROFESSIONAL ELECTRICAL ENGINEE ING FRATERNITY

Scarab

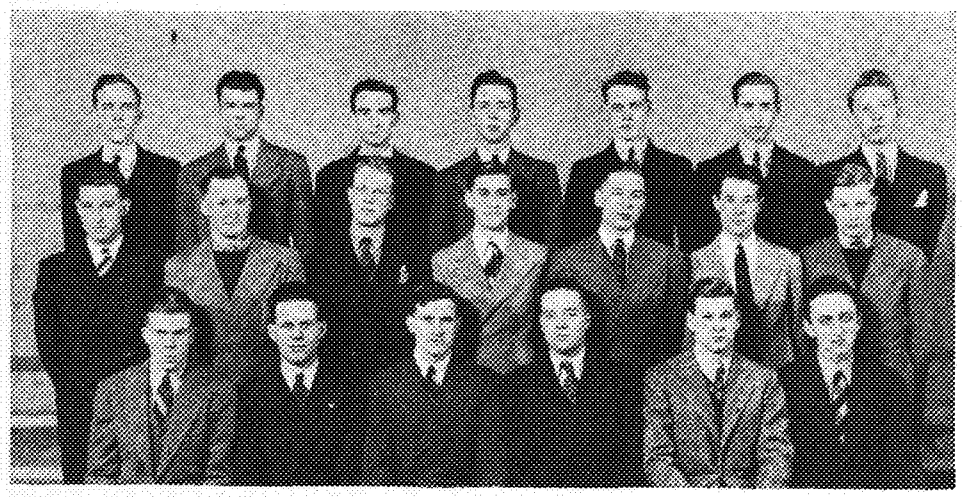
PROFESSIONAL ARCHITECTURAL FRATERNITY



Back row: Briggs, Hickey, Jones, Wenzel, Van Kenren. Front row: West, Dimond, Fritsch, Pietri, Griswold.

Sigma Rho

PROFESSIONAL MINES FRATERNITY

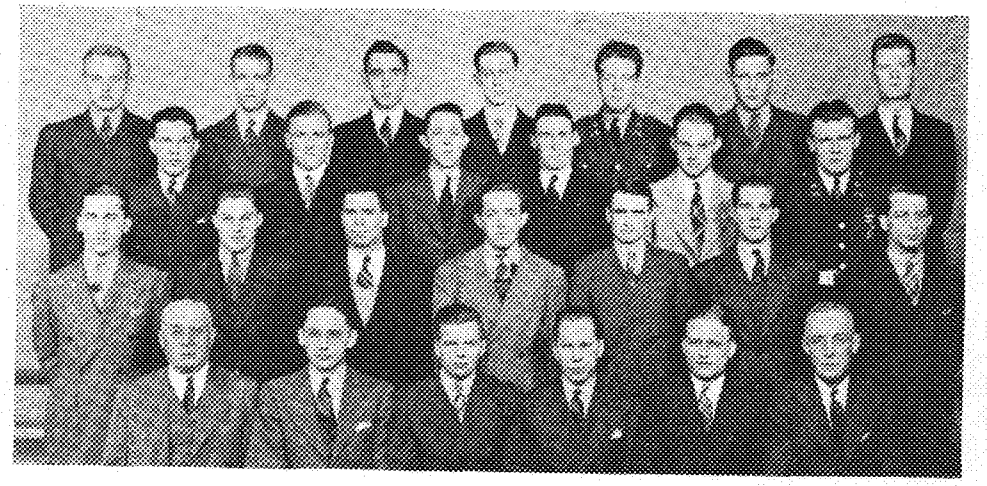


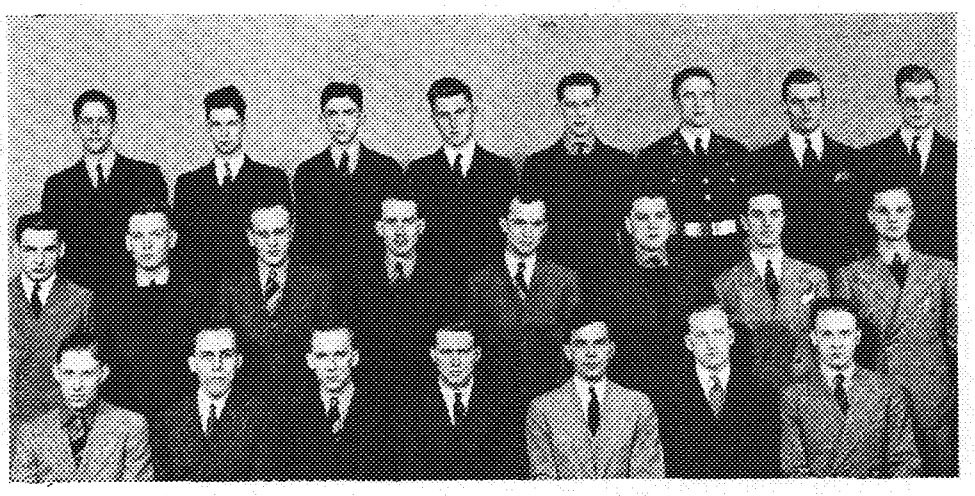
Back row: Olson, Batchelder, Hastings, Flynn, McNelly, Holbrook, Magnuson. Second row: Turner, Felton, Felt, Lilligren, Callaway, Parker, Erickson. First row: Holton, Krause, Purcell, Tweehings, Pfaff, Miller.

Theta Tau

PROFESSIONAL ENGINEERING FRATERNITY

Back row: Duncanson, St. Vincent, Erhart, Boyum, Nygren, S. Johnson, Cummings. Third row: Tyler, Storberg, I. Johnson, Fenne, Troxell, Lischied. Second row: Meyer, Peterson, Gerani, Berquist, Erickson, Coulston, McMillen. First row: Comstock, D. Johnson, Larson, Ranta, Skovholt, Holman.

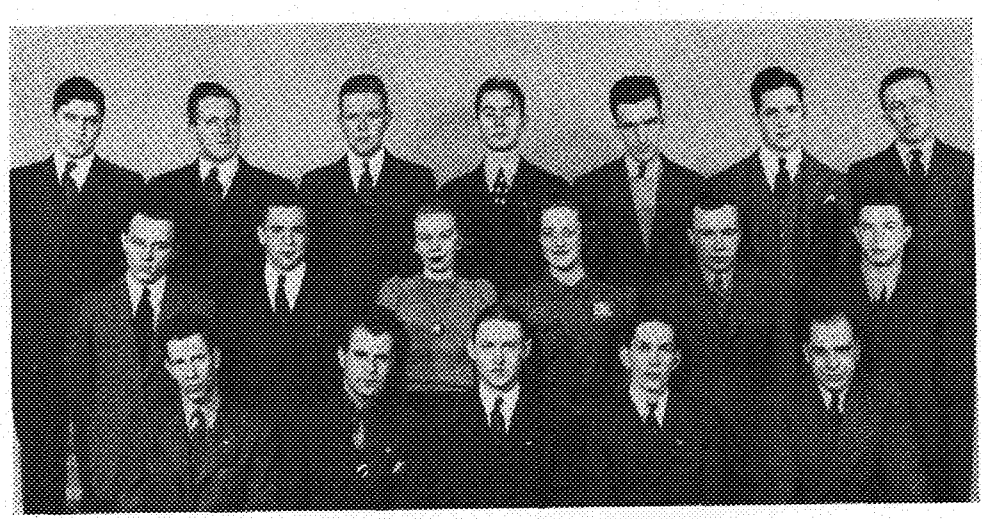




Back row: Thompson, Nimlos, G. Johnson, Anderson, Sexton, Hoglund, Gustafson, Stone. Second row: Kaercher, Curry, L. Larson, Miller, Hallin, Peterson, Ziegler, Morken. First row: Webb, Bredvold, Daley, Wiltrout, F. Larson, C. Johnson, Brewer.

Triangle

PROFESSIONAL ENGINEERING FRATERNITY

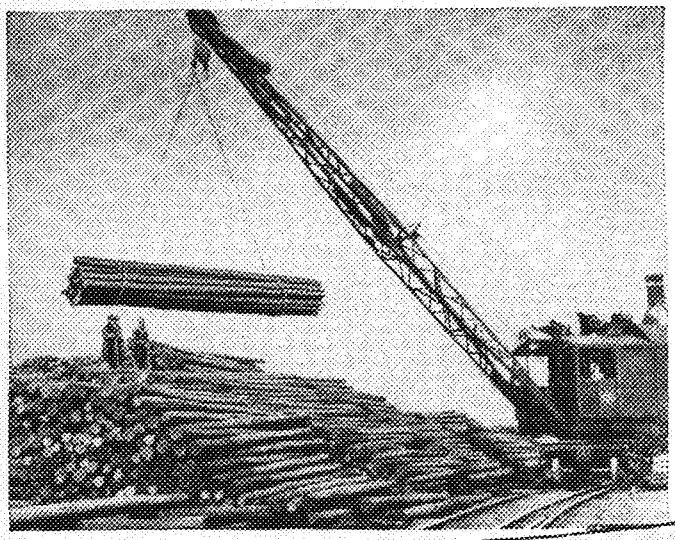


Back row: L. Wilcox, F. Hannaford, W. Parker, H. Jobe, R. Nelson, F. Rugni, Donald Ekman. Second row: R. Schreiber, C. Lockerby, F. Wrenn, J. Whelan, H. Thurston, A. Schmidt. First row: R. Rowley, F. Stiles, D. Lampland, A. Onsgard, J. Cameron.

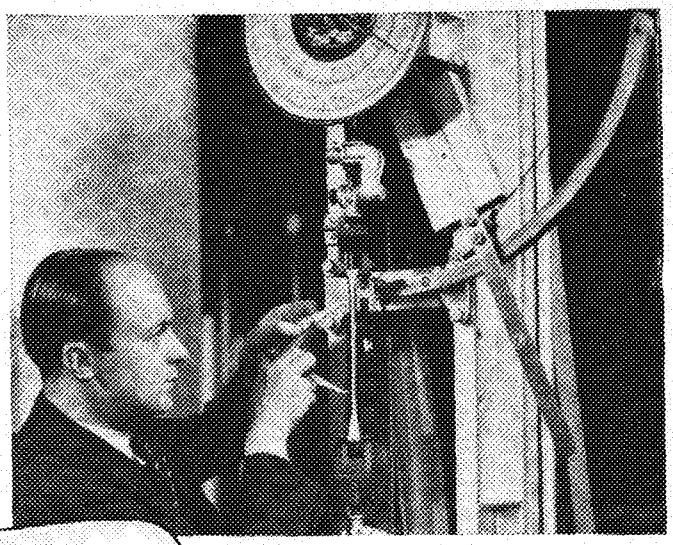
Flying Club

CLUB OF MINNESOTA STUDENTS INTERESTED IN FLYING

ALL OF THE GROUP PICTURES IN THIS SECTION ARE USED THROUGH THE COURTESY OF THE GOPHER EXCEPT THOSE OF THE A.S.A.E., ARCHITECTURAL SOCIETY, KAPPA ETA KAPPA, SCARAB, AND COMMACINI WHICH WERE TAKEN BY HALLETH AND MURRAY.



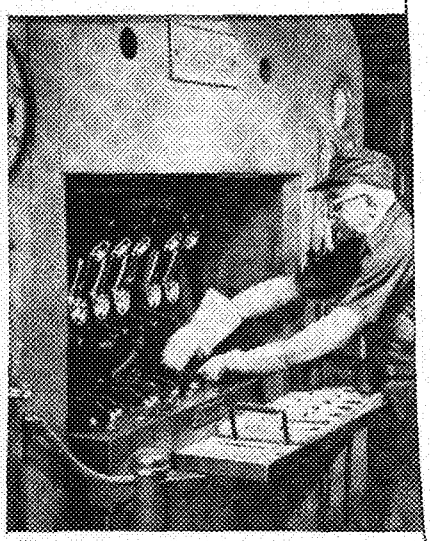
(1) Poles are only one of the hundreds of items which Western Electric supplies.



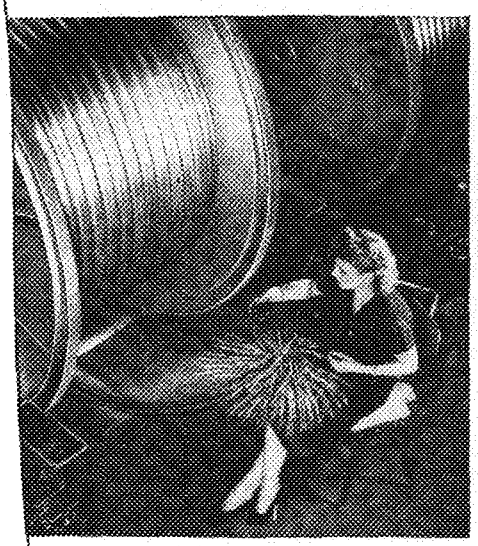
(2) All materials must pass severe tests. Here an engineer tests a sample of that important little item — rubber tape.

Some things Western Electric does . . . so you can say . . .

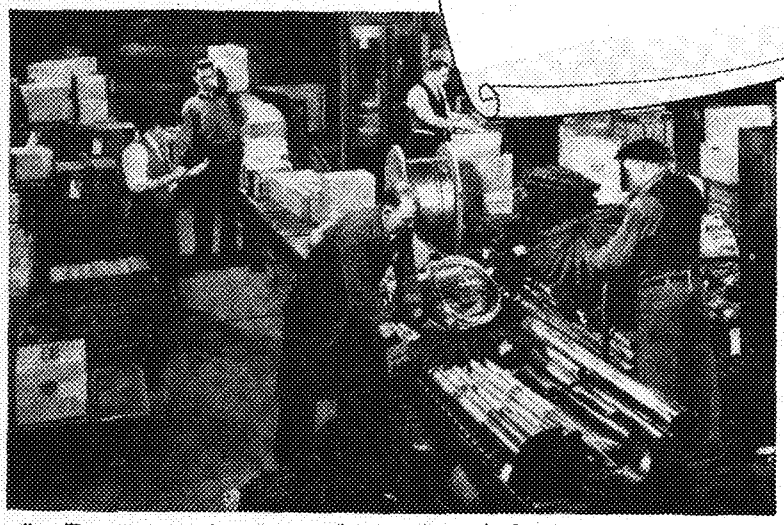
"It's good to hear your voice"



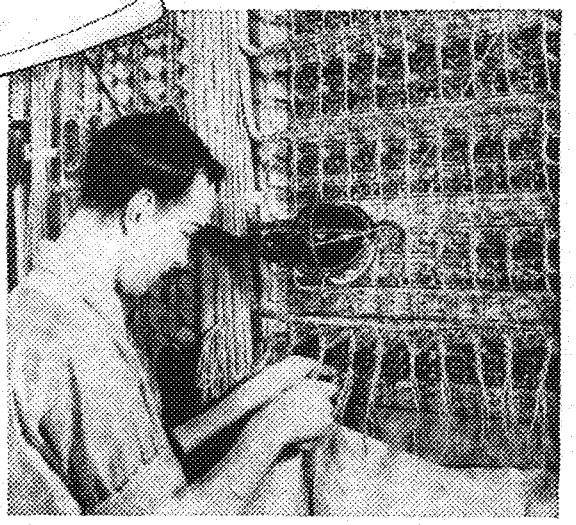
(3) Moulding handles for telephone handsets—one of 248 parts in your Bell telephone.



(4) Each of the three thousand, six hundred thirty-six wires in this cable is given a thorough electrical test.



(5) Twenty-nine distributing houses furnish the Bell Telephone companies with practically everything they require.



(6) And the Company installs the equipment in telephone exchanges.

Western Electric

. . . made your BELL TELEPHONE

An Analysis of Liquid Fuels

This is the second in a series of interviews by D. P. McSwiggen, BME, formerly chief engineer of the United Brewing Corporation and now chief fuel test engineer of the A. B. McNasty Oil Corporation, as told to Donald P. Frankel, Aero., 1939. Any resemblance to persons living or dead is not only incidental, but purely ridiculous.

Illustration by Carl O. Graffunder, Arch. '41

INTERNAL combustion engine fuels may be divided into two classes, non-sustaining fuels and sustaining fuels. This article will analyze each class, give some well known fuels common to each class, and show how these fuels are used in some of the better known internal combustion engines of the day.

I. Non-Sustaining Fuels

Non-sustaining fuels are those fuels whose effect of combustion is instantaneous with no lingering after-results. They are used chiefly in very low compression engines due to their noncorrosive qualities. Non-sustaining fuels have a syrup base and a liquid constituent of dilute carbonic acid. The one-to-five mixture of syrup and dilute carbonic acid makes an adequate explosive mixture for very low compression engines, but is not at all satisfactory in the higher compression high speed engines.

A good example of an engine burning a non-sustaining fuel is the Zelenac engine. It is designed to use Cheri-Koke fuel. This fuel consists of one part mixture of Cherry and Koke syrup and five parts dilute carbonic acid. The Zelenac Engine is known for its complete elimination of smoke.

The advantages of non-sustaining fuels are their ability to keep an engine cool in hot weather and their cheapness of manufacture. Five cents worth of fuel will last three to four hours under average conditions.

The disadvantage of non-sustaining fuel is its inability to take the place of a sustaining fuel in high compression work as proven by the repeal of the 18th Amendment.

II. Sustaining Fuels

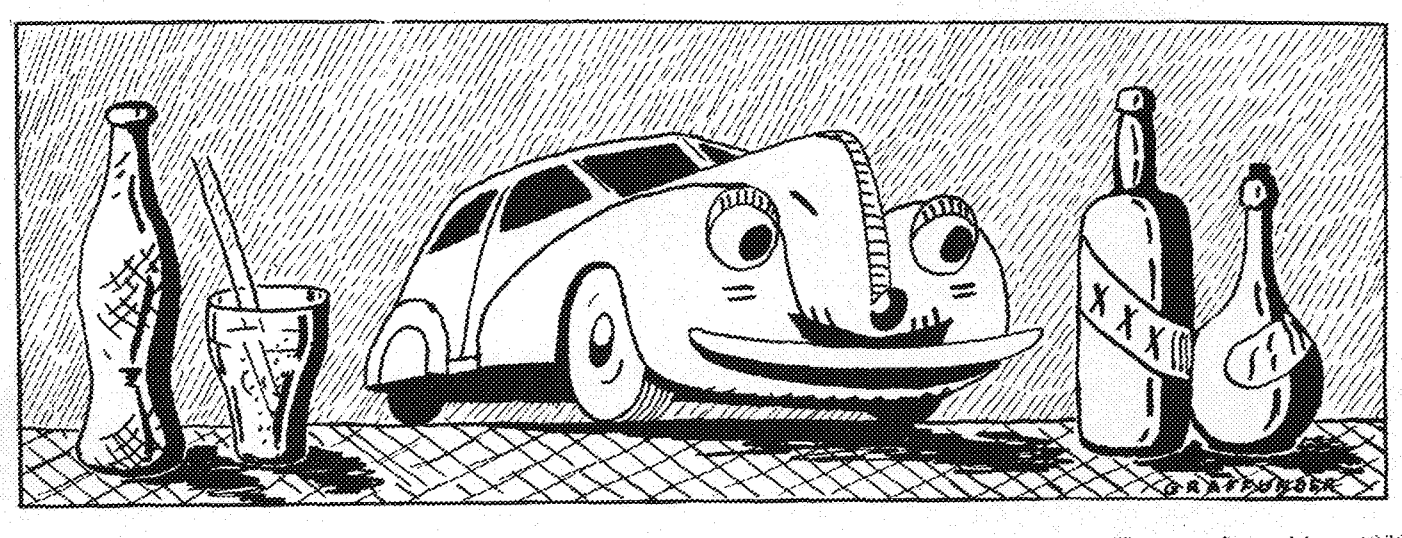
Sustaining fuels are those fuels which burn slowly and whose after effects are the controlling factor in the performance of the engine. Sustaining fuels are limited to the use of fast pace (high speed) high compression engines only.

Sustaining fuels consist of different mixtures of carbonic acid as before plus the addition of alkytane. The mixture ratio usually differs greatly with the individual engine and also the running conditions encountered. For instance, the common "Souse" type engine has been known to consume straight alkytane. However, the integrity and length of operation of this engine are doubtful. After years of observation of fast engines under various conditions, it was found that all engines of this type always had a stepped up alkytane content during periods of testing, and in general, under any conditions involving abnormal stress. However, excessively strong mixtures usually result in running the engine into the gutter, and tend to spoil the engine for operation on weaker mixtures.

The great disadvantage of the fast engine is detonations. Excessive doses of alkytane always result in excessive detonation. There was the case of a "Yearling" engine which consumed one straight quart of alkytane and detonated for a week afterwards.

III. Suggestions for Improvement

From the aforementioned statements, it can be seen that the low compression engine burning non-sustaining fuels would be best for normal operation. Everyone, however, expects extra speed and abnormal results out of his engine once in a while. Therefore, the ideal engine is an engine which is a cross between a high and a low compression engine and is capable of burning non-sustaining fuels under normal operation. During and immediately after periods of high performance and stress, the engine should be able to shift to moderate mixtures of sustaining fuels. After the period of abnormal operation has ceased, the engine should be capable of tapering off the sustaining fuels and returning to the non-sustaining fuels for normal operation.



ALUMNOTES

'31

Bob Yohe, Ch. (Ph.D.), is now working for the Procter and Gamble Company.

George Minder, E.M., one of the three members of the Minder family who are graduates of the School of Mines, stopped at the school recently. He is now in the contracting business at Fargo, North Dakota.

'32

Maurice King, Ch.E., was recently married to Ryta Fischer of New York City. Maurice is teaching applied science in the Central Commercial High School of New York City.

'35

T. J. O'Loughlin, C.E., is an engineering field draftsman in the Minnesota Department of Highways at Rochester, Minnesota. Other Civils who are working for the department in the same area are **John Healey,** at Albert Lea, and **Amos Sutton,** at Owatonna.

Sidney C. Krogsrud, Ag.E., is a junior agricultural engineer in the Soil Conservation Service at Faribault, Minnesota. He is married but there are no future engineers in the family.

Lester A. Malkerson, Ag.E., is now employed by the Northern Tire Service, Incorporated, of Minneapolis.

'36

John Stuck, Aero., is now with the Porterfield Aircraft and Engineering Corporation of Kansas City, Missouri. Also employed by the same company is **John Kirkbride,** Aero '37.

'37

Allen J. Hendry, E.E., is now with the Westinghouse Electric and Manufacturing Company in East Pittsburgh, Pa.

Arnold C. Matthies, M.E., is now with the Standard Oil Company of Louisiana in Baton Rouge, La.

Roger St. John, Arch., is working for the Union Carbide and Carbon Corporation in Niagara Falls, N. Y.

'38

Clayton Corneaby, M.E., is with the William Bros Boiler and Manufacturing Company in Minneapolis.

Erling Helland, C.E. (editor of the TECHNO-LOG last year) is now in Cambridge, Massachusetts, where he is studying on a fellowship at Massachusetts Institute of Technology.

Lloyd L. English, E.E., is now employed by the Commonwealth Edison Company of Chicago.

'39

Harold R. Larsen, Aero '38 (M.S. Aero), left recently for Troy, New York, where he will take a position with the Gurley Instrument Company of that city.

TECH NEWS

A.S.C.E. Makes Awards

The student chapter of the A.S.C.E. met on May 1 in a joint dinner meeting with the Northwest section to hear Colonel Donald Sawyer, national president from Washington. Also here with Mr. Sawyer were Mr. James Fanabee, regional vice president from Milwaukee, and Mr. Louis Ayres, director from Ann Arbor, Michigan.

A feature of the evening was the presentation of the annual awards by the Northwest section to outstanding graduating seniors. Mr. Hibbert Hill, engineer in charge of St. Anthony Falls Power Co., made the awards. Kenneth Sorenson won the first prize of initiation fees, one year's dues to the A.S.C.E., and a handbook. Clark Hook won second prize, Leslie Anderson won third. All three are members of Tau Beta Pi and Chi Epsilon.

Holtby to Present Paper

Fulton Holtby, instructor in foundry, will present a paper on a new thermocouple at the convention of the American Foundrymen's Association in Cincinnati, Ohio, May 15-18, 1939.

Banquet for Seniors

All Institute of Technology seniors are cordially invited to come to a banquet which will be given in their honor by the technical alumni association on Friday, May 19, at 6 p. m. in the Union ballroom. The main speaker will be Professor Soderberg of Massachusetts Institute of Technology.

Lingane to Leave

James B. Lingane, instructor in physical chemistry, will leave the University at the end of the year to take a position at the University of California at Berkeley, where he will teach physical chemistry.

Kolthoff to Tour Europe

Professor Kolthoff, head of the division of analytical chemistry, left on April 27 on a speaking tour which will take him to Denmark, Finland, Norway, and Sweden.

Society Award to Be Made

The Tech Commission has drawn up plans for the awarding of an attractive token to the technical society which gets the highest rating in the Institute. Points are to be awarded for social activities, meetings, field trips, athletic activities, percentage increase in membership over last year, percentage of eligibles who are members, and on several other bases. The commission will rate the societies and make the award.

There Is a Place for You

Have you ever considered working on the TECHNO-LOG? The chances are that you have. Probably, you figured you would work on the magazine, but you just never got around to doing so.

You are soon going to get a chance to find out about opportunities on the TECHNO-LOG and at the same time enjoy an evening at a TECHNO-LOG smoker. Watch for an announcement shortly.

The TECHNO-LOG organization is divided into an editorial and a business staff headed by an editor-in-chief and a business manager respectively.

Next year there will be seven associate editors working with the editor. Each of these associate editors will have a staff working with him. The opportunities in these jobs for development of qualities of leadership and the ability to work with others cannot be over-estimated. In addition, there are numerous other jobs which take less time and yet repay their holders many times.

By all means, do not make the mistake of feeling that the competition is so keen that there is no place for you on the magazine. Nothing could be farther from the truth. There *is* a place for you.

Dowdell Edits Handbook

The 1800-page handbook of the American Society for Metals has recently been published. Professor Ralph L. Dowdell of the department of metallography was the chairman of the editorial board. The Metals Handbook contains text on the casting, welding, forging, heat treating, cold working, and other treatment of metals.

Recent Honors

Following is a summary of recent awards made and their recipients. In the honorary societies only the most recent initiates are named, the others having been listed in an earlier issue.

PLUMB BOB

Homer Anderson
Leslie Anderson
Albert Arneson
Gordon Brierly
Wilson Brown
Nelson Dingle
Herbert Gaustad
Erling Hagen
Donald Lampland
Woolsey Motl
Reuben Olson
Rowland Retrum

TAU BETA PI

Spring Quarter Initiates
Donald Berkner
Charles Brearley
Samuel Callaway
Anton Chyrst
Stanford Church
Albert Diesslin
Louis Droel
Norvin Erickson
Martin Farkas
Alexander McHugh
Thomas Murphy
Hayden Pickering
David Thomas
Maurice Woxland
Essay Prize—Stanford Church

ETA KAPPA NU

Paul Wolfsberg
John Kling
Sidney Wolfenson
Max Liston
Victor Drummond
Robert Lowry
Highest honor point sophomore—Willard Weden.

PHI LAMBDA UPSILON

Juniors
Albert Diesslin
Martin Farkas

TAU BETA PI (Continued)

Seniors

C. Bradford Croston
James Geiger
Harold Haaland
Ralph Holman
Ray Douglas Johnson
Earl Lofstrom
Paul Nahinsky
Elroy Peterson
Charles Schmitz
Donald Edgar Smith

Graduates

Rugnar Almin
Gordon Bendix
Frederic Bordwell
Carl Bryan
J. Keith Lawson
Erhard Prill
Edward Scott

PI TAU SIGMA

Ralph Bowers
Raymond Flagg
Ronald Comb
John C. Miller
Bernard Sather

PI TAU SIGMA (Continued)

Evert Jernberg
Erick Schonstedt

Highest honor point sophomores—Archer Brown, first prize, M.E. handbook; Marvin Sandgren, second.

CHI EPSILON

Harry Purdy Jr.
Charles Archibald,
Gordon Anderson
Norvin Ekrem
Chester Okerlund

Highest honor point sophomore—Emmett Laursen.

COMMACINI

Kemper E. Kirkpatrick
Frederick Roth
Albert Arneson
Arthur Marshall
Robert Van Keuren

IRON WEDGE

Herbert Gaustad
Earl Farnam
Bill Johnson
Warren Waleen
Ward Simmons

GREY FRIARS

Donald Lampland
Paul Feyereisen
James Webster
Donald Reed

PRIZES

Scarab Medal (Architecture)—Robert Van Keuren.

American Institute of Architects Medal—Francis Meisch.

Alpha Alpha Gamma prize (Architecture)—George Vikre.

Institute of Aeronautical Sciences highest honor point sophomore prize—Roger Elliott.

Sigma Alpha Sigma highest honor point sophomore prize—Marius Cohn.

Tau Beta Pi prize—Arthur Dienhart.

Alpha Chi Sigma Twin City Alumni Association prize—William Stenborg.

Phi Lambda Upsilon prize—Martin Farkas.

Chemistry Faculty Prize—Donald S. Melstrom.

DuPont Fellowship—Donald Byers.

Shevlin Fellowship—Herbert Laitinen.

Hormel Fellowships—Clyde Berg, Willa Irwin.

Prize paper awards by Northwest Section of American Society of Civil Engineers—Kenneth Sorenson, first; Clark Hook, second; Leslie Anderson, third.

BLOW OFFS AND SIDE SLIPS

By Bob Wolfe, M.E. '39

Those Aeros have nothing on us. We also had a woman on our bus. Being unaware that our bus was chartered, she flagged us down a few miles outside of Milwaukee. She rode all the way into Milwaukee before she realized that she was on the wrong bus.

It took a trip like ours for many of us really to appreciate what a swell guy Professor J. J. Ryan is. This is the feeling of the whole class, Jim. We appreciate everything you did for us.

We had the same bus drivers on our trip as did the Chemicals; consequently we know a lot of gossip about their trip; but your editor, your St. Pat, and my censor (who was on the Chem trip) won't print it.

In celebration of a successful E.E. show, a group of the boys went out to celebrate, stag. After every one had been unsuccessful in getting a dance with a queen in one of the dives, Erling (Tyrone Taylor) Hagen, A.I.E.E. prexy, not only danced with her but also took her home. When he returned to the joint, he found his mates had left him. His walk home was a matter of miles.

I don't eat spinach because I don't like it, and I'm glad that I don't like it because if I liked it I would eat it and I hate the stuff!

Then there was the girl that filled her diary from lover to lover.

We wouldn't accuse "Dark Horse" Callaway of being affected by a mere 16 refills at the Schlitz Brewery, but pouring salt all over one's own head would hardly be considered the Emily Post way of acting at a dinner party.

Well, it seems that this should be a bit of a swan song to youse guys and youse gals. It's been fun, lots of fun, trying to give you little bits of interest. We sincerely hope that we have caused no hard feelings. If we have done nothing else, we are sure of this one thing, that we have pointed out the need for better columns next year. To the Ed., we apologize; maybe it's a good thing you didn't print some of those things.

PICK AND PAN

By M. A. Troxell, Met.E. '39, and H. A. Larson, E.M. '39

Only a swan song—our last column for the mag. Think of all the things we wrote, only half of which reached your eyes because of the blue pencil. It's been fun the last two years, even though it meant a lot of ribbing.

One of the Aeros who wished to display his intelligence to the surveying department put the following in his exam, "A contour line is where the surface of the earth meets the ground."

Have you heard about the clever cat that ate cheese and then breathed down a rate hole with baited breath?

Dr. Emmons explained the different items of interest about a cliff down at Minnehaha Falls the other day. One man, after listening intently, looked at the formation and remarked, "It's only a bluff."

—H. A. Larson.

By the time this column is out, I'll be pursuing the elusive job. But chuckle not, O Juniors, your time will soon come.

After the disqualification of the Gopher party by the All-University Council, I'd say my chances of being invited to the Solie household for dinner are practically nil.

Chance observation: The average campus politician would cheerfully give you the sleeves out of his vest.

'Tis Spring, and the Droppa Baga Aqua Fraternity is again rushing men. To belong to this illustrious organization one need only make a direct hit upon some heedless unfortunate. Initiates can always be detected by their skyward glances when approaching the steps of the Mines School.

What Mines Senior drank varnish remover at the Miners' Senior Banquet under the impression it was intoxicating? Note: It was.

To tell the truth, I was fiendishly planning to take a dig at a prof. or two before leaving school, but now my conscience won't let me. There are good instructors and poor instructors, but the poor ones are usually fine enough fellows personally to out-weigh their incompetence.

In conclusion, I hope you've received as much enjoyment out of reading this column as I have in writing it and as Motl has in cutting items out of it.

If you haven't enjoyed it, one of us is biased.

—M. A. Troxell

RING DOWN THE CURTAIN

on the

37th ENGINEERS DAY

by attending the

26th BRAWL

FLAME ROOM — RADISSON HOTEL

10:00—1:00 — $1.25 Per Couple

SATURDAY, MAY 13

● ● ●

THE DANSANT AND GREEN TEA

UNION BALLROOM — 3:00—5:00

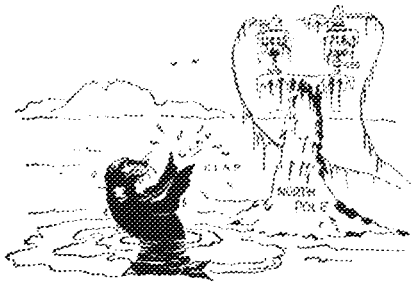
PATRICKS 25c — PATRICIAS 10c

FRIDAY, MAY 12

KEN DE VILLIERS' ORCHESTRA

PLAYING FOR BOTH DANCES

G-E Campus News

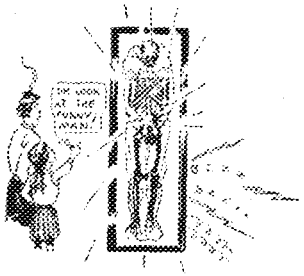


IT CUTS SOME ICE

NICODEMUS, the brown-nosed seal, playfully swam up to the North Pole, tripped the circuit-breaker and plunged Santa's workshop into darkness.

Absurd? Not as far as the successful operation of G-E outdoor air-break switches is concerned. These have been placed in a special room in the General Electric Research Laboratory at minus 20 degrees Fahrenheit, sprayed with water, and tested when coated with ice to a thickness of one and a half inches. The powerful leverages shattered the ice as easily as a walrus swallows a fish. In each case the switches opened and closed properly.

This test is just one of the many which G-E equipment must pass. And the observers, who check the operations with pitiless eye, are members of the G-E Test Course — young college men in their first year with the Company.

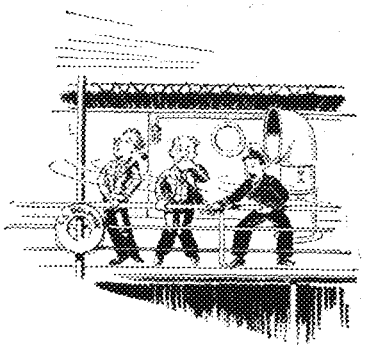


OH! MUMMY . . . !

A SKELETON in the closet—a white-robed ghost in the attic—even Ichabod Crane's headless horseman may well feel jealous of Harwa, the Egyptian mummy. For while conservative ancestors content themselves with rolling in their graves in a genteel way, Harwa is floodlighted in a golden glow in full view of the public in the G-E building at the New York World's Fair.

This unusual exhibit is designed, not to frighten women and little children out of their wits but to demonstrate one of the many uses of x-rays. By pressing a button, an x-ray machine is turned on, and an image of Harwa's skeleton appears on a fluorescent screen which moves in front of the mummy. The principle employed is the same as that by which a doctor may fluoroscope a broken bone, except that the entire body of an adult person is viewed.

Harwa lived 2800 years ago, in Egypt. From inscriptions on the coffin lid it is learned that he was overseer of storage houses on the great farming estate of one of the temples of Amen, chief god of the empire. Pathological study of the mummy by means of x-ray indicates that Harwa was probably forty years old at the time of his death. And now, nearly 3000 years later, he is in his portable grave, a citizen of ancient Egypt in the World of Tomorrow.



FLOATING POWER

THE surging waves of a stormy sea are beautiful to an artist, disconcerting to a food-loving passenger, but just another problem to an engineer. Whenever a sleek, ocean liner plows her bow through a heaving swell, her engines feel an added load, and her captain wonders if the fuel will last. So, G-E engineers built an all-electric meter that will accurately measure the power put out by the propeller of any boat, from a tiny tug to a transatlantic greyhound.

The meter is essentially a combination of two electric generators mounted a little distance away from each other on the propeller shaft, and connected to instruments which can be located at any point on the ship. The generators are so mounted that at no load the voltages generated are exactly 180 degrees apart in phase and therefore add to zero.

When a load is placed on the revolving shaft, the torque causes a small angular twist in the shaft; consequently, the two generated voltages no longer add to zero. The resultant voltage is proportional to both the shaft twist and the propeller speed, and hence the meter can be made to read directly in horsepower. The installation can easily be modified to indicate total horsepower-hours and to write an automatic log of the power delivered during the trip.

Among the G-E engineers who developed the device are A. V. Mershon, Pratt Institute '13 and Union College '15, and C. I. Hall, U. of Illinois '10.